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CHALLENGES AND RESEARCH IN HEALTH SCIENCES

A MULTIDISCIPLINARY APPROACH

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Bartter syndrome: Case report

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ABSTRACT

Bartter's syndrome (BS) is a rare group of autosomal recessive diseases of the renal tubules, causing extensive salt elimination. It is classified into 5 types, based on genotype and phenotypic manifestations. A 24-year-old male patient reports growth failure, cramps, muscle weakness and leg pain since childhood with clinical worsening in recent years, making it impossible to walk. Laboratory tests: K 1.9 mmol/L; Mg 2.49 mg/dL; PTH 12.6 pg/mL; vitamin D 76.4 ng/mL; calcium 10.1mg/dL; renin 29.32 ng/mL/h; aldosterone 19.4 ng/dL. After the initiation of Aldactone 300mg/day, there was clinical and laboratory improvement. The patient was under outpatient follow-up. The diagnosis of BS is based on clinical findings, biochemical findings, and sonographic findings. Classical pharmacological therapy includes chloride supplementation, indomethacin protaglandin inhibitors, and aldosterone spironolactones antagonists. The in-depth understanding of the pathophysiology of these syndromes, facilitated by molecular diagnosis, highlights the importance of continuous study of these conditions for the development of more effective therapeutic strategies.

Keywords: Bartter's syndrome, Metabolic alkalosis, Growth retardation.

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INTRODUCTION

Bartter's syndrome (BS) is a rare group of autosomal recessive diseases of the renal tubules, causing extensive salt elimination. It is characterized by significant metabolic alterations such as hypocalcemic metabolic alkalosis associated with hyperreninemic hyperaldosteronism in normotensive people, with juxtaglomerular hyperplasia seen on renal biopsy. There is no predilection for gender or race, and it is usually diagnosed in childhood or adolescence (Qasba et al., 2023).

The clinical picture of BS is recognized as polyuria, polydipsia, growth retardation, vomiting, dehydration, and recurrent fever simultaneously with electrolyte disturbances, which can lead to neurological changes such as areflexia, seizures, even quadriparesis or respiratory difficulty depending on the severity of the alteration of circulating minerals in the body (Wander, 2023).

BS can manifest before birth, and is called antenatal, and is usually severe. The classic form of the disease, on the other hand, begins in childhood and is usually milder. BS is classified into 5 types, which are based on genotype and phenotypic manifestations. Although all subtypes are related to problems in salt reabsorption along the ascending portion of the loop of Henle, some genotypes overlap, with molecular patterns associated with certain genes (FREMONT et al., 2012; RAVAROTTO et al., 2022).

Type I, caused by mutation in the SLC12A1 gene, affects the Na-K-Cl co-transporter, formerly known as antenatal SB or hyperprostaglandin E syndrome. Type 2, also known as antenatal SB, is associated with a mutation in the KCNJ1 gene, which affects potassium-regulating ROMK channels, which are associated with preterm births and severe dehydration. Type 3 results from mutation of the CLCNKB gene, giving rise to a defective chloride channel. It is associated with milder symptoms. Type 4 is related to mutation of the BSND gene, and is related to sensorineural deafness, severe salt loss, premature births, and polyhydramnios. Type 5 is associated with mutation in the CASR gene, with an X-linked recessive inheritance pattern, leading to hypercalciuria (FREMONT et al., 2012; RAVAROTTO et al., 2022).

Treatment options for BS include salt supplementation, NSAIDs, and aldosterone antagonists. Procedures such as amniocentesis and indomethacin therapy have been shown to be effective. Due to the rare and recent nature of this pathology, treatment options are still limited, and symptoms must be controlled, since there is no cure. The information provided by the literature on this syndrome is still scarce (Qasba et al., 2023). Therefore, the objective of this study is to report a case of a patient with a recent diagnosis of BS.

CASE REPORT

A 24-year-old male patient reports growth failure, cramps, muscle weakness and leg pain since childhood with clinical worsening in recent years, making it impossible to walk. Patient

complaining of enuresis. On physical examination: systemic blood pressure: 107x89 mmHg, heart rate: 81 beats per minute, absence of edema. Laboratory tests: K 1.9 mmol/L; Mg 2.49 mg/dL; PTH 12.6 pg/mL; vitamin D 76.4 ng/mL; Calcium 10.1mg/dL; Renin 29.32 ng/mL/h; Aldosterone 19.4 ng/dL. A CT scan of the total abdomen showed gross calcifications in the right adrenal gland. After the initiation of Aldactone 300mg/day, there was clinical and laboratory improvement. The patient was under outpatient follow-up.

DISCUSSION

BS is a rare autosomal recessive condition that results in tubulopathies that lead to impaired transport mechanisms. As a consequence, there is a decrease in sodium absorption in the ascending loop of Henle, activation of the renin-angiotensin-aldosterone system, with consequent hypokalemic and hypochloremic metabolic alkalosis, and alteration in the feedback mechanism at the level of the macula densa in cases of hypovolemia. With this physiological change, there is an increase in the production of prostaglandins that stimulate renin secretion and aldosterone production, in an attempt to reestablish glomerular perfusion through normalization of intravascular volume. As chloride is not being reabsorbed into the macula densa, tubuloglomerular feedback does not occur, and prostaglandins are continuously produced by cells, leading to excessive renin-aldosterone synthesis (Fremont et al., 2012; KONRAD et al., 2021).

Deficient salt reabsorption in the ascending branch of the loop of Henle leads to consequences that characterize the clinical practice of BS. As a first consequence, there is a reduction in calcium reabsorption, thus we can infer a picture of hypercalciuria and progressive medullary nephrocalcinosis. The second consequence is the reduction of the osmotic gradient in the renal medulla, causing isosthenuria, i.e., impaired ability to dilute or concentrate urine. With the exception of patients with type 3 SB, who do not have hypercalciuria and have the partial ability to concentrate urine. In addition to the above, the clinical picture observed includes a history of polyhydramnios with prematurity, growth retardation, increased pH, low blood pressure or within the normal range (FREMONT et al., 2012; KONRAD et al., 2021; SUPRIYANI et al., 2023).

Like BS, Gitelman's syndrome (GS) also results from birth defects in the tubular filtration of sodium, chloride and potassium. GS, also known as familial hypocalcemia-hypomagnesemia, is an autosomal recessive inherited disease characterized by dysfunction in salt reabsorption in the distal convoluted tubule (DCT), presenting clinically as a pseudo-Bartter syndrome. Symptoms usually begin after 6 years of age, but may manifest late, during adolescence or adulthood (ALLA et al., 2023; CUNHA et al., 2018; FULCHIERO et al., 2019).

OS is caused by mutations in the SLC12A3 gene, encoding the thiazide-sensitive sodium chloride (NaCl) cotransporter (NCC) in the distal convoluted tubule (TCD). This mutation results in

the inactivation of the gene and consequently reduces the reuptake of NaCl by the affected cells, triggering a cell contraction and cascade stimulation of the renin-angiotensin-aldosterone system (RAAS) (FULCHIERO et al., 2019).

The characteristic clinical signs of GS include hypokalemia, metabolic alkalosis, hypocalciuria, and hypomagnesemia, commonly accompanied by symptoms such as salt cravings, fatigue, muscle weakness, cramps, palpitations, and nocturia. The differentiation between OS and BS is based on clinical criteria, including early age of onset, severity of symptoms, presence of hypercalciuria, polyhydramnios, in cases of BS. However, recent advances in medical understanding have revealed that patients with BS may manifest later and develop additional complications, such as growth retardation and developmental delay (CUNHA et al., 2018; FULCHIERO et al., 2019; KONRAD et al., 2021).

The following table demonstrates the molecular differences and clinical features between Bartter's syndrome and Gitelman's syndrome.

Table 1: Genetic and clinical findings of Bartter's Syndrome and Gitelman's Syndrome

	Produto genético	Mutação genética Herança da banda cromossômica/OMIM Características clínicas			
Síndrome de Bartter (apelido)					
Tipo 1 (síndrome de Bartter pré-natal; síndrome de hiperprostaglandina E)	NKCC2	SLC12A1	15q21.1	AR/601678	polidrâmnio, prematuridade, poliúria, nefrocalcinose
Tipo 2 (síndrome de Bartter neonatal com hipercalemia transitória; síndrome de hiperprostaglandina E)	ROMA	KCNJ1	11q24.3	AR/241200	polidrâmnio, prematuridade, poliúria, nefrocalcinose, hipercalemia transitória acidose
Tipo 3 (síndrome de Bartter clássica)	ClC-Kb	CLCNKB	1p36.13	AR; muitos são esporádico/607364	Nascimento a termo, sem nefrocalcinose
Tipo 4 (síndrome de Bartter pré-natal; síndrome de hiperprostaglandina E com surdez neurossensorial, BART)	Barttin (subunidade b de ClC-Ka e ClC-Kb)	BSND	1q32.3	AR/602522; digênico em CLCNKA e Genes CLCNKB	Prematuridade, surdez neurossensorial, sem nefrocalcinose
Tipo 5 (hipocalcemia com Síndrome semelhante a Bartter)	CASR	L125P	3q21.1	AD/601199	Hipocalcemia, PTH suprimido
Síndrome de Gitelman	NCCT	SLC12A3	16q13	AR/263800	Hipocalciúria, hipermagnesiúria e hipomagnesemia

NKCC2: cotransportador Na-K-Cl sensível à furosemida; ROMK: canal de K medular externo renal; ClC-Kb: canal de cloreto-Kb; ClC-Ka: canal de cloreto-Ka; CASR: receptor sensível ao cálcio; NCCT: cotransportador de NaCl sensível a tiazidas; AR: autossômico recessivo; DA: autossômica dominante; OMIM: Herança Mendeliana Online no Homem; PTH: hormônio da paratireóide.

Fonte: Fremont *et al.* (2012)

Regarding the diagnosis of BS, it is based on clinical findings, biochemical findings, and sonographic findings. In this analysis, the suspicion of BS, already in the gestational period, occurs in situations of prolidramnios. At this juncture, there are two possibilities for confirming the diagnosis: prenatal genetic testing and biochemical analysis of the amniotic fluid. In both cases, there are high risks of gestational complications, since the methods mentioned above are invasive (FULCHIERO et al., 2019; KONRAD et al., 2021; QASBA et al., 2023).

In order to distinguish between OS and BS, it is important to observe the presence of calcium in the urine, since in OS there is hypocalciuria and in BS there is hypercalciuria. Calcium imbalance is associated with arthropathy with deposition of calcium pyrophosphate crystals or

chondrocalcinosis. In addition to this alteration, there are changes in the electrocardiogram with prolongation of the QT interval, causing arrhythmias. (RAVAROTTO et al., 2022; SUPRIYANI et al., 2023).

As a rule, most cases of BS present with delayed and failed growth in individuals with the syndrome. In addition, early labor and polyhydramnios are recurrent. Diarrhoea, vomiting and fever are reported. From another perspective, that of physical characteristics, individuals with Bartter have a prominent forehead, triangular face, protruding tongue, enlarged eyes and auricle. However, it is indicated that the diagnosis should be made from a genetic approach due to the similarity of the phenotype presented with other diseases, including GS (CUNHA et al., 2018; FULCHIERO et al., 2019; KONRAD et al., 2021).

In addition, the thiazide test is proposed to help distinguish between BS and OS and involves the oral administration of hydrochlorothiazides, 1 mg/kg up to 50 mg, and after 7 days, with the suspension of all medications, except potassium and magnesium. In patients with GS, there is a slight change in chloride excretion due to the mutation in NCCT cotransporters. In contrast, patients with BS have a limitation in response to hydrochlorothiazides and an increase in chloride excretion. However, the high risk of blood volume depletion in this diagnostic strategy is recognized (KONRAD et al., 2021; QASBA et al., 2023).

It is also meritorious to pay attention to the conditions that simulate BS, i.e., pseudo-SBs. In this analysis, nephrotoxic agents, such as aminoglycosides, amphotericin B, and heavy metals, are associated with the BS phenotype. Added to this knowledge are congenital chloride diarrhea and cystic fibrosis, both characterized, each in its own way, by the loss of sodium chloride. It is also part of the falsification of the diagnosis of BS in situations in which patients suffer from bulimia and in those who abuse diuretics (FULCHIERO et al., 2019; KONRAD et al., 2021; QASBA et al., 2023).

The limitation of BS treatment is related to its rarity. In this scope, the therapeutic approach varies comprehensively among health professionals, who report specificities of each case and their individual experiences. However, classical pharmacological therapy includes chloride supplementation, protaglandin inhibitors indomethacin and aldosterone antagonists spironolactones. In prenatal cases, the use of amniocentesis is recommended to prolong pregnancy, although it has not been evaluated in prospective studies. (CUNHA et al., 2018; (FULCHIERO et al., 2019; KONRAD et al., 2021; QASBA et al., 2023).

Potassium supplementation is also added, although it is not widely tolerated in high doses. Therefore, potassium-sparing diuretics are chosen to help increase serum potassium and reverse metabolic alkalosis (FULCHIERO et al., 2019; KONRAD et al., 2021; QASBA et al., 2023).

It is worth noting that angiotensin-converting enzyme inhibitors can be used in cases of proteinuria to correct the low concentration of potassium ion. However, due to polyuria and

symptoms of dehydration, there is a need for caution in the use of the drugs mentioned above due to the potential risk of kidney damage. In short, such therapy can lead to an improvement in the growth of the stability of metabolic and serum levels of depleted ions (FULCHIERO et al., 2019; KONRAD et al., 2021; QASBA et al., 2023).

It is also important to point out the existence of possible gastrointestinal involvements, which are severe and frequent in patients who use prostaglandins for an extended time. Due to this understanding, it is necessary that routine endoscopies be applied to patients who are treated with the aforementioned pharmacological group (FULCHIERO et al., 2019).

It is imperative to identify the development of foci of Focal Glomerulosclerosis (GF) during the course of SB. In this sense, according to the physiological mechanism of the disease, consistent stimulation of the renin-angiotensin axis causes secondary glomerular hyperfiltration. In such a situation, although little reported, the consequent renal failure, suggested by the progress of FG, is addressed with transplantation of the organ in question (FULCHIERO et al., 2019).

Osteopenia is also present in BS patients, probably due to the manifestation of the hypercalciuric phenotype. Therefore, bone mineral density should be monitored in patients with BS. In addition, in cases where there is failure in body growth, or short stature, the use of Growth Hormone (GH) is recommended, although in previous studies, the use of GH has been shown to be ineffective in patients with severe hypokalemia (FULCHIERO et al., 2019).

The prognosis in individuals with BS is satisfactory after a therapeutic follow-up of at least 10 years, which does not exclude the onset of late manifestations of the disease, such as proteinuria and renal failure (QASBA et al., 2023).

CONCLUSION

Based on the data presented, we can conclude that BS, although rare, represents a significant challenge in diagnosis and clinical management, especially in neonates. The in-depth understanding of the pathophysiology of these syndromes, facilitated by molecular diagnosis, highlights the importance of continuous study of these conditions for the development of more effective therapeutic strategies. In addition, chronic hypokalemia, associated with BS and GS, requires careful attention, as it can lead to serious complications such as rhabdomyolysis and cardiac arrhythmias. Physicians' awareness of these tubular renal congenital disorders is critical for proper treatment and to avoid serious complications.

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Anthropometric profile of students on the Food Technology course at IFTM Uberlandia campus from 2012 to 2017

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ABSTRACT

The objective of this work was to outline the anthropometric and dietary profile of students taking the food technology course at the Federal Institute of Education, Science and Technology of Triângulo Mineiro – Uberlândia campus, between the years 2012 and 2017. The work was carried out based on application of an anthropometric self-assessment script in which 20 male and 42 female students participated. In the ideal weight profile, 14 students were underweight, 25 with ideal weight and 23 with different degrees of obesity. In the Body Mass Index, the average was 25.27 kg/m², Body Adiposity Index was 28.84%, Waist Hip Index women had an average of 0.81±0.12 and an average waist circumference of 82, 12±13.41 cm, among men the average ICQ was 0.91±0.07 cm, with the average WC being 101.89±9.31cm. Basal Metabolism (MB) according to DuBois and Raymond was on average 1,581.05 kcal/day, according to Harris Benedict 1540.45 kcal/day and according to WHO/FAO 1384.82 kcal/day. In Total Energy Value (VET), the average was 2331.68 kcal/day. In the result of calculating the daily ration, the average intake was 49.99% of carbohydrates, 19.99% of proteins and 29.98% of lipids. According to reference data from Interministerial Ordinance nº 66, of August 25, 2006, students had an average daily carbohydrate consumption below the reference standard. In protein intake, the average was above the reference standard, in lipid intake it was within reference standards. According to data collected, the presence of overweight and obesity in men was notable, which highlights the importance of creating awareness measures about the risks of heart disease.

Keywords: Anthropometric profile, Dietetics, Metabolism.

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INTRODUCTION

In recent years there has been a significant increase in overweight and obesity among the population of developed and developing countries. This fact has been seen as a serious public health problem, as it not only increases the risks to human health, but also increases public spending to remedy the problems caused by overweight and obesity (ONUBR, 2017).

According to Silva (2014), in the Department of Human and Health Services, morbidities associated with overweight and obesity are very common, and some of them, such as type 2 diabetes, hypercholesterolemia, high blood pressure and orthopedic problems, affect not only adults but also children. and overweight adolescents.

According to Mahan and Scott Stump (2005) apud Velásquez et al (2007), the individual, since childhood, is maturing physically, cognitively and psychosocially, and most of the time snacks, out-of-hour meals, eating outside the home and following alternative diet patterns becomes characteristic of their eating habits and can be maintained throughout life.

Genetic, physiological and metabolic factors are important in the beginning of obesity, but those that can also explain the growing increase in obese individuals in developed and developing countries may be related to eating habits and changes in lifestyle (ROSENBAUM AND LEIBEL, 1998 apud VELASQUEZ et al, 2007).

The study of the anthropometric characteristics of a population is very important (Silva, 2014) to create actions that make it possible to reduce weight gain to prevent obesity and illnesses resulting from it, it depends significantly on data that can describe this need.

Therefore, the objective of this work was to outline the anthropometric and dietary profile of students taking the food technology course at the Federal Institute of Education, Science and Technology of Triângulo Mineiro – Uberlândia campus, between the years 2012 and 2017.

THEORETICAL FRAMEWORK

ANTHROPOMETRY

Anthropometry studies measurements of the size and proportions of the human body. Anthropometric measurements such as weight, height, waist circumference and hip circumference are used to diagnose nutritional status (malnutrition, overweight and obesity) and assess the risks of some diseases (diabetes mellitus, heart disease and hypertension) in children, adults, pregnant women and the elderly (MANUAL DE ANTROPOMETRIA, 2013).

The quality of procedures for collecting anthropometric measurements is essential to guarantee the fidelity of the nutritional diagnosis of an individual or a population (MANUAL DE ANTROPOMETRIA, 2013).

Thus, anthropometry should not be understood as a simple action of weighing and measuring, but, above all, as an attitude of vigilance. This means keeping a close eye on nutritional status, allowing early action when any changes are detected. It cannot be forgotten that these measures will subsidize actions aimed at promoting and providing health care, both individually and collectively (ARAÚJO, 2015).

Attention to nutritional status means checking the organic synthesis and metabolism of the individual, considering intrinsic dietary factors (sex, age, heredity, etc.) and extrinsic dietary factors, the relationships between man, nature and food, which are established within a society and its psychosocial state (SAMPAIO, 2012).

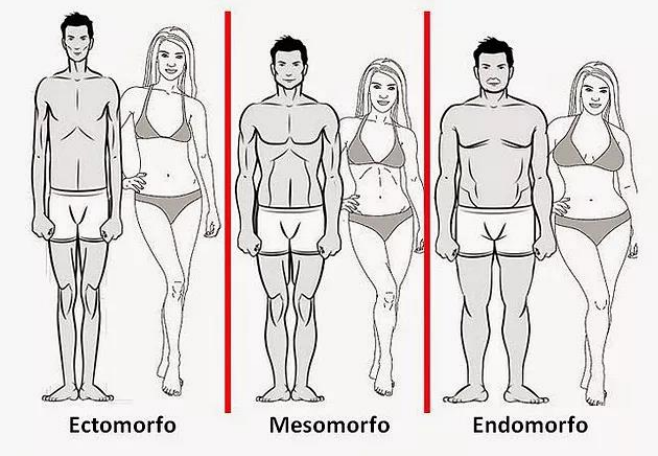
Therefore, the anthropocentrist must carefully carry out the measurements (weight, height, circumferences, etc.), as the quality of the data collected is of vital importance and will significantly reflect on the results (MANUAL DE ANTROPOMETRIA, 2013).

Ideal Weight

According to Trucom (2018), "in the 60s and 70s, the rule was rigid: the ideal was to weigh ten kilos less than your height". Currently, this rule has changed, as factors such as age and body type are considered, which consequently makes determining the ideal weight more flexible.

Biotypes are biological characteristics of genetic inheritance, which physically define everyone. There are three biotypes that define body structures: ectomorph, mesomorph and endomorph, as seen in Figure 1.

Figure 1: Basic physical biotypes.



Source: http://seocorpoemente.wixsite.com/meusite/single-post/2016/10/21/Os-Biotipos-conhe%C3%A7a-o-seu, 2018.

Ectomorphs have a low percentage of fat, being naturally thin. Their bone structure is narrow, shoulders short, waist thin, and ribcage narrow. Mesomorphs gain and lose weight, whether muscle mass or fat, and have a wide rib cage. Endomorphs, on the other hand, find it quite easy to gain

weight, being naturally wide, with a wide rib cage and waist, and have difficulty losing fat (SARDINHA, 2018).

Trucom (2018) states that for each height and age, there is an ideal weight variation that corresponds to different biotypes. One way to calculate the ideal weight for everyone is through the Creff formula (Equation 1), which is considered the most perfect among the majority, since it includes notions of age and morphology (FRANÇA, 2014).

$$IDEAL\ WEIGHT = 0{,}9[(HEIGHT(cm) - 100) + \left(\frac{AGE}{10}\right)] \quad \text{Eq. 1}$$

Body mass index (BMI)

Body mass index (BMI), expressed as the relationship between body mass in kg and height in m², according to Equation 2 and is widely used as an indicator of nutritional status due to its good correlation with body mass ($r \approx 0.80$) and low correlation with height (SANTOS and SICHIERI, 2005).

$$BMI = WEIGHT/HEIGHT * ALTURA \quad \text{Eq. 2}$$

According to Silva (2014, p.24) "BMI may not correspond to the same degree of fat in different populations due to different body proportions", thus suggesting other anthropometric methods that consider body biotypes or the measurement of adipose accumulations.

Body adiposity index

The Body Adiposity Index (IAC) uses the measurement of hip circumference and height to quantify body fat. It is defined as an alternative parameter to the BMI calculation and according to Guedes, Biscuola and Lima (2015), studies that seek to cover population surveys, which can serve as a reference in the analysis of obesity and overweight in different segments of the population, the correct one is use both methods, IAC, and BMI.

According to the World Health Organization (1995) apud Silva (2014, p.24) "it is stated that, based on population studies, the IAC can be used to calculate the percentage of body fat in adult men and women of different ethnicities ".

Silva (2014) explains about the discovery by researcher Richard Bergman, from the University of Southern California, in *Los Angeles* , and other colleagues of his, who discovered that hip circumference and height were closely linked to body fat, which was enough for the researchers to develop Equation 3 to calculate the IAC.

$$IAC\ (\%) = \left(Hip.circ\ (cm)/height * \sqrt{height}\right) - 18 \qquad \text{Eq. 3}$$

Waist-Hip Index

The waist-hip index is a very common way of estimating the fat of the upper body segments (waist) in relation to the lower body segments (hips), having been developed to predict the risk of chronic disease (FERNANDES FILHO, 2003 apud ROCHA, 2009) .

According to Silva (2015), to estimate the ICQ, it is necessary to use the waist measurement (cm) by the hip measurement (cm) and then it must be observed in a specific table (ANNEX 1) whether it is within the acceptable standards for age from 20 to 69 years and for sex, according to Equation 4.

$$ICQ = (WAIST\ CIRCUMFERENCE\ )\ /\ (HIP\ CIRCUMFERENCE) \qquad \text{Eq. 4}$$

Silva (2014) states that the place to measure waist circumference is located at the narrowest point between the pelvis and the ribs. Hip circumference is found at the maximum circumference below the pelvic girdle, being at the level of maximum extension of the glutes. These measurements can be obtained using a metal measuring tape, placed across the vertical body being measured, directly on bare skin and without placing excessive pressure.

Avery (1991) apud Silva (2014) highlights that:

> Waist-to-hip ratio values < 0.85 cm for women and < 0.95 cm for men suggest lower risks for coronary artery disease, hypertension, and diabetes. However, the waist-to-hip ratio should not be used to accurately predict the changes that occur in visceral fat after weight loss treatment. Some studies suggest that just measuring the waist would be enough to predict the presence of visceral fat deposits when compared to WHR, as presenting a value >89 cm for women and >102 cm for men alone would be a risk sign.

For individuals who have an ICQ or waist circumference value above the values cited as acceptable, treatment generally involves constant physical exercise, as well as a diet suited to the individual's daily needs and, in some cases, in the use of medications under the supervision of a doctor (LEAN, 1995 apud SILVA, 2014).

DIETETICS

According to Philippi (2006) apud Andrad et al (2014), dietetics not only studies, but also applies the basic principles and processes of Nutrition Science in the human body, allowing the planning, execution and evaluation of diets that suit the biological, socioeconomic, cultural and psychological characteristics of individuals. According to Andrad et al (2014), dietetics studies the

different ways of using food, with a view to preserving nutritional value, obtaining desired sensory characteristics, such as enhancing the color or flavor of the food being prepared. .

Portal (2018) states that dietetics is linked to foods and their combinations, adapting a specific type of diet for each person.

Portal (2018) adds that:

> People who need to go on diets, lose weight or who have decided to eat healthier often use diet food, as is the case of people with heart (cardiovascular) problems, who need to reduce or completely exclude fat-containing foods from their diet. , or diabetic people who cannot consume any type of sugar.

Basal and total metabolism (calculation methods)

Living organisms expend energy to try to maintain cellular homeostasis. Daily energy consumption in humans can be divided into three parts: energy consumed at rest accounts for 60-75% of total daily energy expenditure, the thermic effect of food (10%) and physical activity (15 to 30%) (ANTUNES et al, 2005).

Antunes et al (2005, p 71) states that "basal metabolic rate (BMR) measures the minimum amount of energy required to maintain physiological functions at rest". According to the authors, knowledge of this rate is important in clinical applications, as it defines the correct nutritional support and determines the caloric needs for energy balance.

Basal metabolism refers to the minimum amount of energy that the body needs to have while at rest to survive, and this minimum energy rate is necessary for the body so that it can perform vital functions that are not interrupted during sleep, such as breathing and the pumping of blood. Basal metabolism varies from one individual to another, that is, some aspects that define the basal metabolism rate, an index that reveals the amount of energy that each person uses while sleeping, are age, sex, genetic factors, weight, height , type and frequency of physical activity (LEITE, 2018).

Monteiro (2018) states that:

> The calculation of basal metabolism (BMR), when appropriate equipment (respirometer) for direct assessment is not available, can be done using different equations. For healthy individuals, it can be found through the equations suggested by the FAO/WHO committee (1985) that consider age and sex. In pathological states, especially those in which there is marked hypermetabolism, the Harris-Benedict formula (1919) can be applied to males and females and children.

The Harris-Benedict method for calculating calories is based on five different parameters: sex, height, weight, age, and physical activity. With these parameters, the basal metabolic rate (BMR) can be calculated, which is the minimum amount of energy that the body consumes daily, which is equivalent to the amount of calories needed to maintain the current weight (CALCUWORLD, 2018). Follow Equations 5 and 6 to calculate basal metabolism according to Harris-Benedict:

Men: Eq.5

$$DER = 66{,}47 + (13{,}75 * WEIGHT\ Kg) + (5 * HEIGHT\ cm) - (6{,}755 * IDADE)$$

Women: Eq.6

$$DER = 655{,}1 + (9{,}563 * WEIGHT\ Kg) + (1{,}85 * HEIGHT\ cm) - (4{,}676 * IDADE)$$

According to Frade et al (2016), to calculate basal metabolism there are some formulas proposed by the WHO (1985), which consider the individual's sex and age group, which are shown in the table below.

Table 1: Calculation of Basal Metabolism according to the World Health Organization (WHO/FAO).

GENDER	AGE	FORMULA
	10-18	16.6 * P(kg) + 77 * A(m) + 572
MEN	18-30	15.4 * P(kg) + 27 * A(m) + 717
	30-60	1.3*P(kg) + 16*A(m) + 901
	>60	8.8*P(kg) + 1128*A(m) - 1071
GENDER	**AGE**	**FORMULA**
	10-18	7.4*P(kg) + 482*A(m) + 217
WOMEN	18-30	13.3*P(kg) + 334*A(m) + 35
	30-60	8.7*P(kg) – 255*A(m) + 865
	>60	9.2*P(kg) + 637*A(m) - 302

Source: WHO/FAO, 1985 apud Érika LIZ, 2011.

Another way to calculate basal metabolism (BM) is through the Du BOIS and RAYMOND method where the body surface area (ASC) is estimated and then the basal metabolism is calculated according to Erica Liz (2011). Follow equations 7 and 8:

$$ASC(m^2) = 0{,}007184 * height(cm)^{0{,}725} * weight(kg)^{0{,}425} \quad \text{Eq. 7}$$

$$MB = (Tabled\ value) * 24 * ASC \quad \text{Eq. 8}$$

The basal metabolism value per hour is found in the metabolism practice guide table (ANNEX 2) considering the sex and age of the individual.

Total energy expenditure and physical activity

According to Monteiro (2018) “total energy expenditure (GET) corresponds to the energy spent by an individual in 24 hours”. Total energy expenditure results from the sum of three

components: basal energy expenditure (GEB) or resting energy expenditure (REE), the thermal effect that food provides or diet-induced thermogenesis (TID) and the caloric cost of the activity physical.

The type of physical activity increases individuals' energy needs, and activates metabolic systems designed to increase the use of nutrients and O2 consumption (MONTEIRO, 2018).

The total energy value (TEV) or total energy expenditure can be calculated by identifying the basal energy expenditure and multiplying it by the occupational activity coefficient that each individual performs. The occupational activity coefficient are values referring to daily energy needs according to the occupational work category expressed in multiples of the basal metabolic rate, in relation to sex (FAO/WHO/UN, 1985 apud CARVALHO et al 2012). To perform the calculation, follow Equation 9:

$$V.E.T. = T.M.B * Activity\ coefficient \qquad \text{Eq. 9}$$

To perform the calculation in Equation 9, it is necessary to have the physical activity coefficient, as shown in Table 2.

Table 2: Daily energy needs according to occupational work category expressed in multiples of the BMR, according to sex.

GENDER	LIGHT ACTIVITY	MODERATE ACTIVITY	INTENSE ACTIVITY
MEN	MB * 1.55	MB * 1.78	MB* 2.10
WOMEN	MB * 1.56	MB * 1.64	MB * 1.82
BEEDED PATIENT	MB * 1.27		

Source: WHO/FAO, 1985 apud Érika LIZ, 2011.

1. Light: executive, teachers, independent professionals, housewife (with household appliances).
2. Moderate: work in light industry, drivers, students.
3. Intense: non-motorized farmer, soldier, athletes.

Carvalho (2008) states that physical activity makes the individual have better health conditions, however, a large part of the population does not practice it. This issue reflects the concern of the professional category, institutions dedicated to research, institutions that provide specific services, and the government.

According to Silva (2014), in recent times, people have become less active due to the encouragement of technological advances and practices for identifying childhood and adolescent obesity are becoming commonplace nationally and internationally, as through these practices, it is possible to achieve the results for the diagnosis of obesity. It is important to promote physical activity in childhood and adolescence, as this can establish a basis for reducing a sedentary lifestyle as adults, contributing to a better quality of life.

Strong WB (2005) apud Silva (2014) highlights that quantifying the prevalence of lack of physical activity and identifying risk groups are very important so that intervention strategies can be created.

FOOD: VARIETY, MODERATION AND BALANCE.

A balanced and healthy diet is one that contains nutrients in appropriate quantities, varied in quality, with the aim of ensuring correct growth, mental development, and the proper functioning of the organism (MONTANARI; ANICETO, 2013).

Variety, moderation, and balance should be considered as the basis of a healthy diet. Variety, due to the consumption of different and varied types of food during the day. Moderation, referring to the moderate consumption of food. Balance is related to the concepts of variety and moderation, knowing what and how much to eat. "The success of healthy eating lies in the combination of carbohydrates, protein, fat, fiber, vitamins and minerals, and water, maintaining the quality and balance of nutrients in all daily meals" (MONTANARI; ANICETO, 2013 p.1).

According to Alexandrino (2011), through good nutrition, one can not only treat, but prevent a series of diseases, with dietary re-education being a way of maintaining health and good body shape. It also states that dietary re-education seeks to establish a link between nutrition and satisfaction through changes in eating behavior, making it possible to consume the most varied types of food in a balanced way, so that it provides health and pleasure at the same time.

METHODOLOGY

The present work was carried out based on the application of an anthropometric self-evaluative script as a didactic-pedagogical and evaluative part of the Nutrition and Dietetics discipline, taught in the 3rd period of the Food Technology course at the Federal Institute of Science and Technology of Triângulo Mineiro. Uberlândia campus.

The "Metabolism practice" script (Appendix 2) by Érika Liz (2011) has been used by the subject teacher since 2012. Through the script, variables of ideal weight, body mass index, body adiposity index, waist-hip index were evaluated , basal metabolism, total energy value and daily ration.

The data collected was used in the present work to outline the anthropometric and dietary profile of students on the course until 2017.

When handing over the script, the teacher explains to them how the data should be reported, the need to weigh themselves correctly, use a measuring tape for circumference data, the correct measurement of height and the biological declaration of gender (sex), among others. other contents of

the lesson plan on dietetics and anthropometry. Of the 70 scripts applied, 62 were delivered with complete information, the remainder were missing data on hip circumference, height, weight or age.

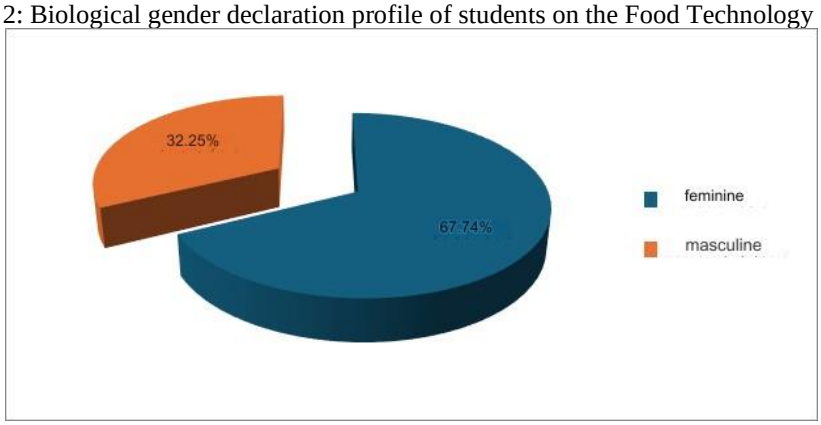
The data were compiled into Excel® spreadsheets (2010) and tabulated for later discussion.

RESULTS AND DISCUSSION

Of the 70 questionnaires (scripts) administered, 62 responded correctly to what was requested. Of these, the age range of students taking the Food Technology course ranged from 18 years old to 69 years old, with the majority being concentrated in the range of 18 years old to 38 years old.

In relation to the biological sex declaration, we have Figure 1, in which 20 students (32.25%) declare themselves to be male and 42 students (67.74%) to be female.

Figure 2: Biological gender declaration profile of students on the Food Technology course.



Source: From the author, 2018.

Predominantly, it can be seen in Figure 2, the participation of women in the university universe and their greater interest in the Food Technology course, which basically deals with the processing of food and its chemical and biochemical transformations through the application of methods.

Below is a description of the other dietary and anthropometric data that were determined through the self-evaluation script.

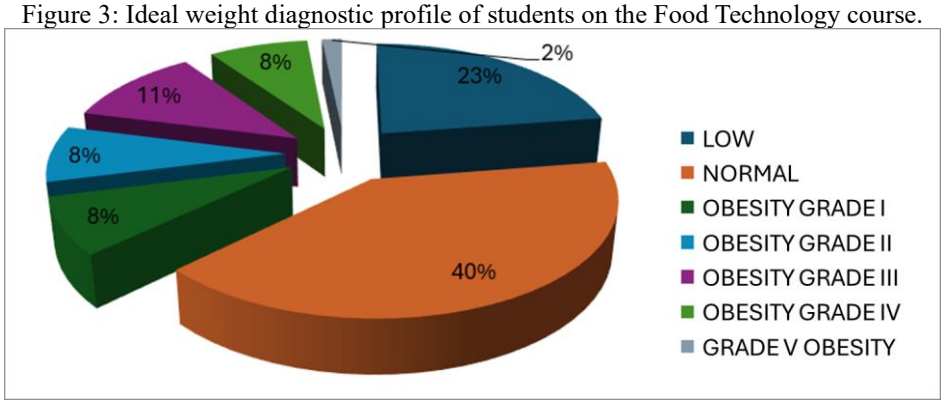
IDEAL WEIGHT

According to Silva and Kawahara (2005), the definition of ideal weight is based on minimum mortality and maximum longevity, which can vary according to some parameters, which are age, sex, body type and height, and serves to reduce the risk of developing serious health problems such as heart disease, diabetes, high blood pressure, high cholesterol and even cancer.

According to the data collected in relation to the ideal weight profile, 14 students (23%) are underweight, 25 students (40%) are at ideal weight (eutrophy) and 23 students (37%) presented

different degrees of obesity , with obesity being grade I, grade II, grade III, grade IV and grade V as shown in Figure 3.

Figure 3: Ideal weight diagnostic profile of students on the Food Technology course.



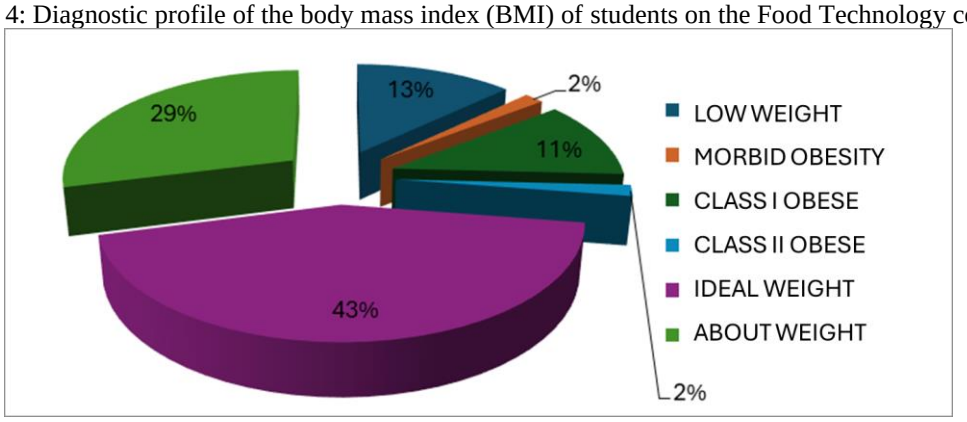
Source: From the author, 2018.

It is observed that the percentage of obesity is almost similar to the percentage of eutrophic individuals, this result reinforces the need to check the body mass index.

BODY MASS INDEX

Regarding the Body Mass Index, students from 2012 to 2017 presented a profile on the BMI of 8 students (13%) diagnosed with underweight, 27 students (43%) with ideal weight, 18 students (29%) with overweight and 9 students (15%) were obese, divided into class I obese, class II and morbid obesity, as shown in Figure 4.

Figure 4: Diagnostic profile of the body mass index (BMI) of students on the Food Technology course.



Source: From the author, 2018.

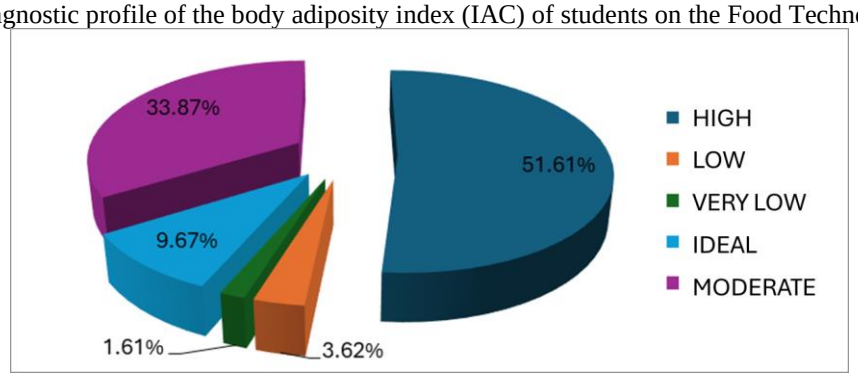
The average BMI was 25.27 kg/m². As for gender, women had a mean BMI of 24.14 ± 4.38 kg/m², while men had 27.66 ± 5.63 kg/m². Therefore, the average BMI determined for students of the Food Technology course at IFTM, Uberlândia campus, in male students is above the range considered ideal weight, which is 20 – 24.9 kg/m², and the women had an average BMI within the range considered ideal weight, according to the Brazilian Obesity Guidelines, 2009/2010.

Similar results were found in the study by Gasparetto e Silva, in 2012, who had 77 women (68.8%) and 35 men (31.2%) in their study, university students studying Nutrition, Nursing, Physiotherapy and Education. physics at the La Salle University Center, located in the city of Canoas (RS), participants in anthropometric research. The age of the students ranged from 17 to 55 years, when evaluating the average BMI according to gender, it was found that women had an average BMI of 23.09 ±3.46 kg/m², while men had 26 .13 ±3.68 kg/m².

BODY ADIPOSITY INDEX

Regarding the Body Adiposity Index, students from 2012 to 2017 presented a nutritional profile regarding the IAC of 1 student (1.61%) with an exceptionally low diagnosis, 2 students (3.62%) with a low diagnosis, 6 students (9.67%) with an ideal diagnosis, 21 students (33.87%) with a moderate diagnosis and 32 students (51.61%) with a high diagnosis, as shown in Figure 5.

Figure 5: Diagnostic profile of the body adiposity index (IAC) of students on the Food Technology course.



Source: From the author, 2018.

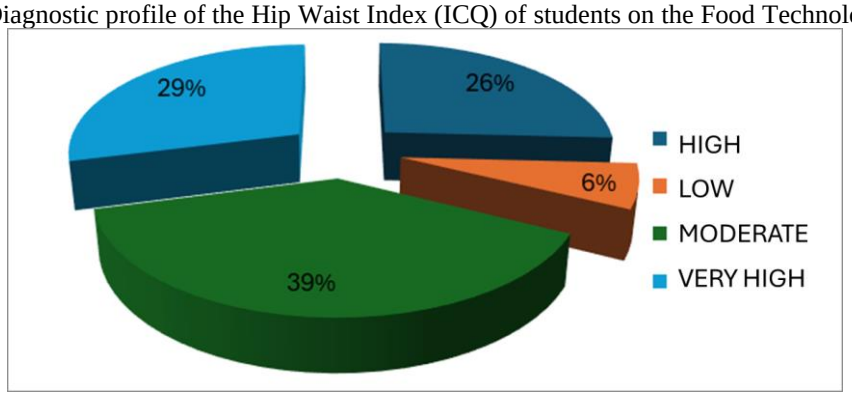
In relation to the data presented, the average IAC was 28.84%. The average IAC regarding gender for female students was 29.37%, the average IAC for male students was 27.73%.

Based on the above result, it can be stated that women had a moderate body adiposity index, since the reference value for this diagnosis ranges from 26 – 29% for women, while men had a well average IAC. high, being compared to the reference value which is 19 – 24% for men according to reference values presented in the work of Heyward and Stolarczyk, (2000) apud Guedes, Biscuola and Lima, (2015).

WAIST-HIP INDEX

Regarding the Waist-Hip Index, students from 2012 to 2017 presented an ICQ profile of 4 students (6%) with a low diagnosis, 24 students (39%) moderate, 16 students (26%) high and 18 students (29%) very high as shown in Figure 6.

Figure 6: Diagnostic profile of the Hip Waist Index (ICQ) of students on the Food Technology course.



Source: From the author, 2018.

Of these, 42 women had an average ICQ of 0.81±0.12, and the average waist circumference (WC) of the students was 82.12±13.41 cm and among the men (20 university students) had an average ICQ of 0.91±0.07 cm, with an average WC of 101.89±9.31. Therefore, the CC determined for students of the Food Technology course at IFTM, Uberlândia campus, in male students is well above the range considered normal, which is 90 cm and women presented the CC a little higher, since the reference is 80 cm, according to the Brazilian Obesity Guidelines, 2009/2010.

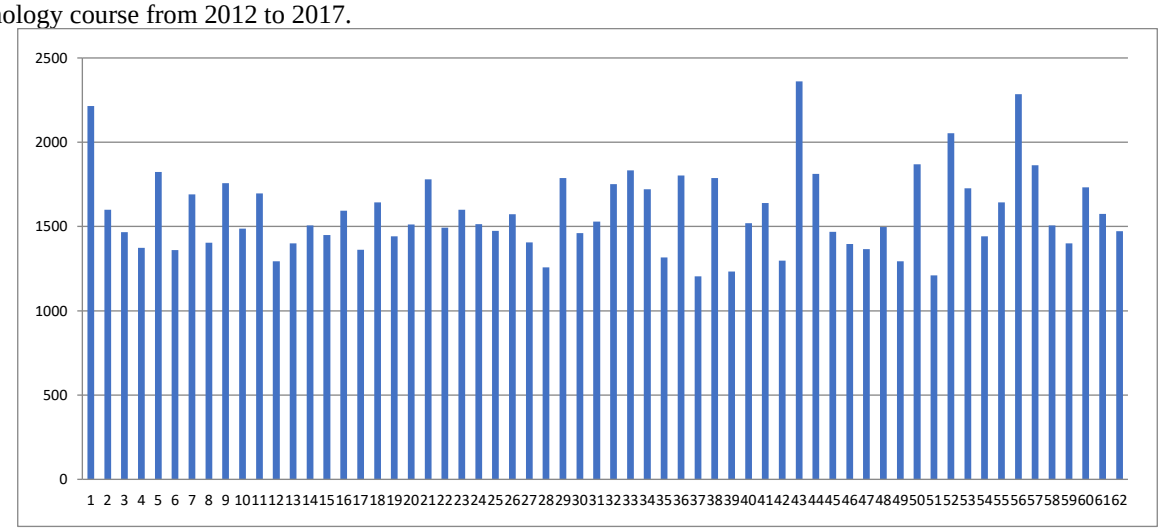
In the study by Gasparetto and Silva, in 2012, when evaluating waist circumference (WC), the average value found for men was 88.61±11.00 cm; that is, within the range considered normal. For women, the WC found was 80.90±9.34 cm, considered above normal standards, with a risk of metabolic complications.

BASAL AND TOTAL METABOLISM

Basal metabolic rate (BMR) refers to the minimum amount of energy required to maintain physiological functions at rest. Knowledge of this rate is important to define adequate nutritional support and determine caloric needs for total energy balance. BMR decreases with age, increased fat mass, altered body fluid content, changes in body temperature, changes in mood and stress, hormonal changes, body surface area, physical inactivity, individual genetics and aging (ANTUNES et al, 2005).

The daily energy requirement or basal metabolism (MB) according to DuBois and Raymond for the students (42 university students) was on average 1,548.83 kcal/day. The average obtained for male students (20 university students) was 1,648.71 kcal/day, and the general average between male and female students was 1,581.05 kcal/day, as shown in Figure 7.

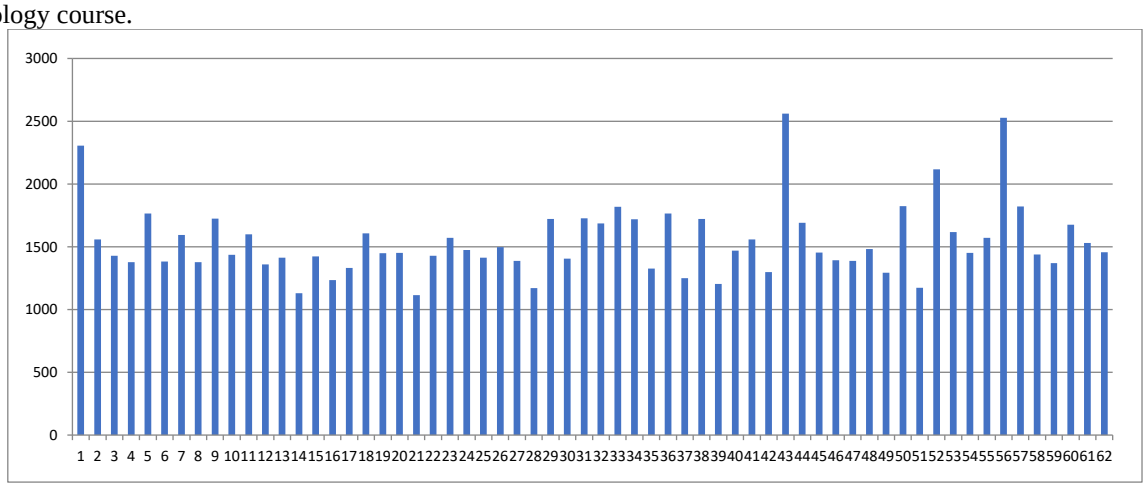
Figure 7: Diagnostic profile of the total energy value (TEV) according to DuBois RAYMOND, of students on the Food Technology course from 2012 to 2017.



Source: From the author, 2018.

The daily energy requirement or basal metabolism (MB) according to Harris Benedict gave an average for the students (42 university students) of 1428.84 kcal/day. The average obtained for male students (20 university students) was 1774.83 kcal/day, and the general average between male and female students was 1540.45 kcal/day as shown in Figure 8.

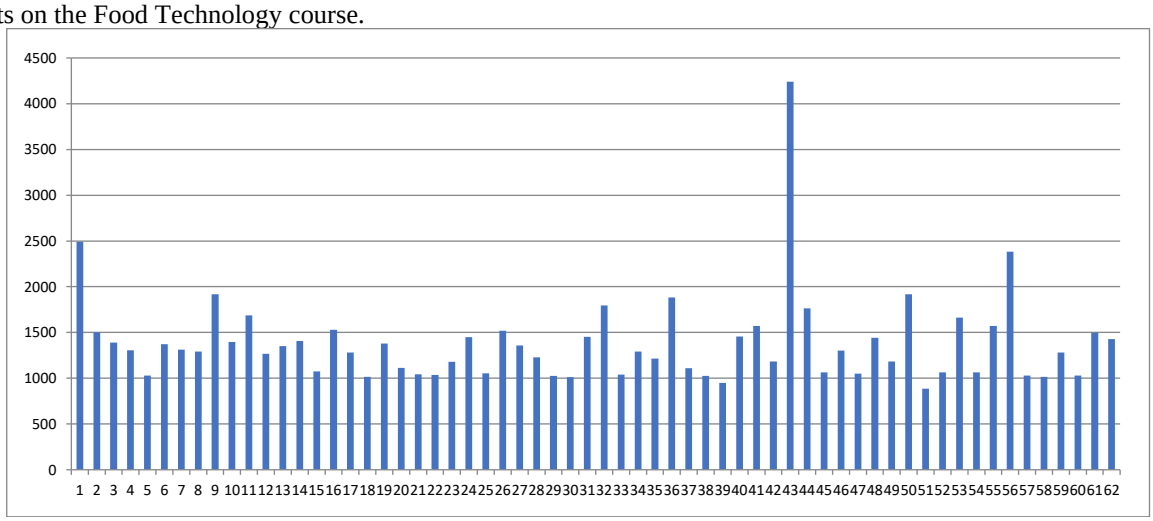
Figure 8: Diagnostic profile of basal metabolism (MB) according to HARRIS BENEDICT, of students on the Food Technology course.



Source: From the author, 2018.

The daily energy requirement or basal metabolism (MB) according to the World Health Organization (WHO/FAO) gave an average for the students (42 university students) of 1307.66 kcal/day. The average obtained for male students (20 university students) was 1546.85 kcal/day, and the general average between male and female students was 1384.82 kcal/day as shown in Figure 9.

Figure 9: Diagnostic profile of basal metabolism (MB) according to the World Health Organization (WHO/FAO), of students on the Food Technology course.

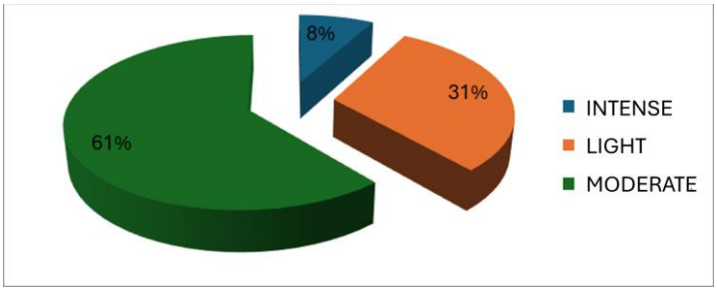


Source: From the author, 2018.

TOTAL ENERGY EXPENDITURE AND PHYSICAL ACTIVITY

In relation to the students' occupational activities, 5 students (8%) carry out intense activity, 19 students (31%) carry out light activity and 38 students (61%) carry out moderate activity as shown in figure 10.

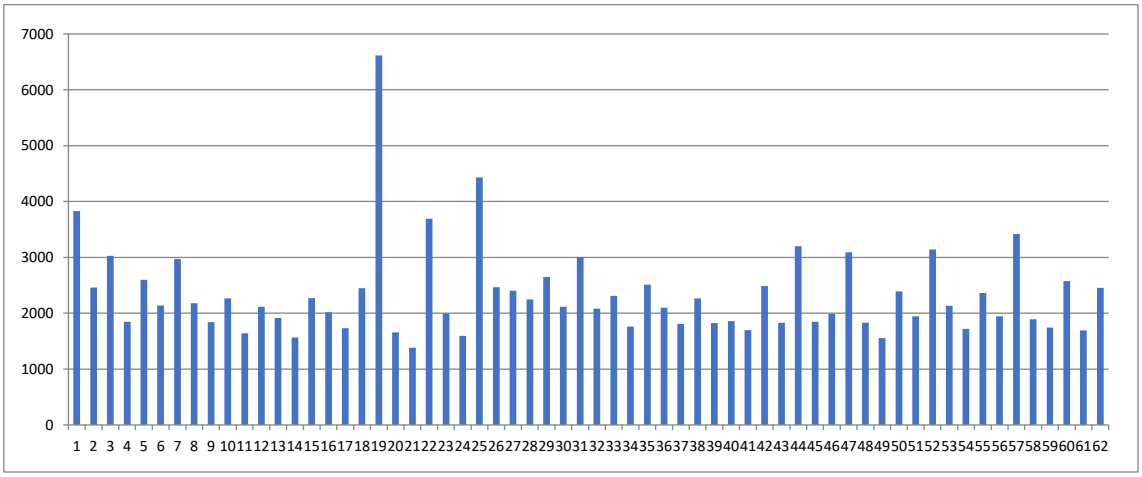
Figure 10: Diagnostic profile of occupational activity to calculate the total energy value of students on the Food Technology course.



Source: From the author, 2018.

In the result of the calculation of the total energy value (TEV) based on WHO/FAO, the students presented a general average of 2331.68 kcal/day as shown in figure 11. In relation to gender, there was an average for the students (42 university students) of 2154.22 kcal/day of VET, and for students (20 university students) there was an average of 2704.34 kcal/day.

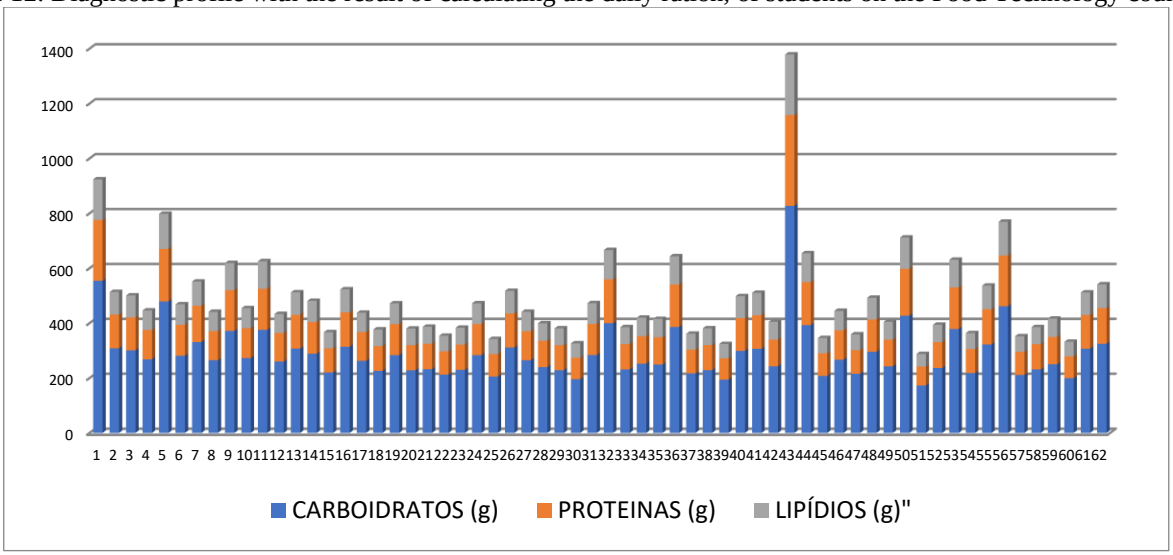
Figure 11: Diagnostic profile with the result of calculating the total energy value, of students on the Food Technology course.



Source: From the author, 2018.

In Figure 12, there is the result of calculating the daily ration, that is, how many grams of carbohydrates, lipids and proteins students on the Food Technology course from 2012 to 2017 should ingest according to the total energy value.

Figure 12: Diagnostic profile with the result of calculating the daily ration, of students on the Food Technology course.



Source: From the author, 2018.

Based on the result of the average total energy value, the result of calculating the students' daily ration is presented, that is, the percentage of carbohydrates, proteins and lipids that students should ingest, according to their total energy expenditure. presented. Therefore, the intake of each nutrient presented an average of 49.99% carbohydrates, 19.99% proteins and 29.98% lipids, with an average of 2331.68 kcal/day according to the activity performed in the day to day. According to **Interministerial Ordinance No. 66, of August 25, 2006, the** nutritional parameters for worker nutrition established in this Ordinance must be calculated based on the following daily reference values for macro and micronutrients shown in table 3.

Table 3: Daily reference values for macro and micronutrients.

Nutrients	Daily Values
Total Energy Value	2000 kcal
CARBOHYDRATE	55 – 75%
PROTEIN	10 – 15%
LIPID OR TOTAL FAT	15 – 30%

Source: MARINHO et al 2006.

Based on the reference values in table 3, it can be said that the students had an average daily carbohydrate consumption slightly below the standard. Regarding protein intake, the students' average was slightly above the reference percentage in table 3, and regarding total fat intake, the students presented an average consumption within the reference standards.

CONCLUSION

According to the presentation and analysis of the measured data, it is possible to obtain some conclusions about the anthropometric characteristics of the food technology course students participating in this study.

Observing the ideal weight profile, it is noted that 40% of students are eutrophic, which means they are within the ideal weight, the rest have different degrees of obesity and low weight. Checking the body mass index, it is concluded that in males there was a prevalence of overweight and obesity, while in females, there was a prevalence of ideal weight.

The prevalence of overweight and obesity observed in males highlights the importance of creating measures to raise awareness among students about the risk of developing heart disease, and such measures can be through evaluative activities applied by teachers which emphasize the importance of physical activity and correct nutrition to achieve a healthy life and greater longevity. It is important to start prevention at school because most students do not have relevant information throughout the day, as they spend a lot of time focusing on the media of games, social networks, television, cell phones, failing to practice physical exercise, reaching the sedentary lifestyle, resulting in overweight and obesity, as well as the harm they can cause to health.

The present work was carried out with anthropometric data from students before the Covid-19 pandemic, a new study of students on the course after the pandemic is being carried out.

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ATTACHMENTS

ANNEX 1 - Cardiovascular Risk Classification Using the Waist-Hip Index.

Male Cardiovascular Risk Classification Using the Waist-Hip Index.

AGE	LOW	MODERATE	HIGH	VERY HIGH
From 20 - 29	**< 0.83**	**0.83 – 0.88**	**0.89 – 0.94**	**>0.94**
From 30 - 39	**< 0.84**	**0.84 – 0.91**	**0.92 – 0.96**	**>0.96**
From 40 - 49	**<0.88**	**0.88 – 0.95**	**0.96 – 1.00**	**>1.00**
From 50 - 59	**<0.90**	**0.90 – 0.96**	**0.97 – 1.02**	**>1.02**
From 60 – 69	**<0.91**	**0.91 -0.98**	**0.99 – 1.03**	**>1.03**

Source: Physical Test 5.0 cited by Bisbo (2004) apud Pinto et al (2007).

Female Cardiovascular Risk Classification Using Waist-Hip Index.

AGE	LOW	MODERATE	HIGH	VERY HIGH
From 20 - 29	**< 0.71**	**0.71 – 0.77**	**0.78 – 0.82**	**>0.82**
From 30 - 39	**< 0.72**	**0.72 – 0.78**	**0.79 – 0.84**	**>0.84**
From 40 - 49	**<0.73**	**0.73 – 0.79**	**0.80 – 0.87**	**>0.87**
From 50 - 59	**<0.74**	**0.74 – 0.81**	**0.82 – 0.88**	**>0.88**
From 60 – 69	**<0.76**	**0.76 – 0.83**	**0.84 – 0.90**	**>0.90**

Source: Physical Test 5.0 cited by Bisbo (2004) apud Pinto et al (2007).

ANNEX 2 - Metabolism Practice Guide

Physiology Discipline
Module: METABOLISM

SEX	AGE (years)	HEIGHT (cm)	CURRENT WEIGHT (Kg)	IDEAL WEIGHT	DIFFERENCE	%	
DIAGNOSIS: MARK WITH AN (X) WHERE THE PATIENT IS							
WEIGHT LOW	0 -10% NORMAL	11 -15% GRADE I OBESITY	16 -20% GRADE II OBSITY	21 - 30% GRADE III OBESITY	31 - 40% GRADE IV OBEITY	41 - 50% GRADE V OBEITY	> 51% MORBID OBESITY
IDEAL WEIGHT = 0.9[(HEIGHTcm -100) + (AGE: 10)]							

2. CALCULATE BODY MASS INDEX (BMI)					
SEX	WEIGHT Kg	HEIGHT IN METER	BODY MASS INDEX (BMI)		
DIAGNOSIS: MARK WITH AN (X) WHERE THE PATIENT IS					
<20	20 – 24.9	25 – 29.9	30 – 34.9	35 – 39.9	>40
LOW WEIGHT	IDEAL WEIGHT	ABOUT WEIGHT	CLASS I OBESE	CLASS II OBESE	MORBID OBESITY

$$BMI = \frac{WEIGHT}{HEIGHT}$$

3. CALCULATE THE BODY ADIPOSITY INDEX					
SEX	HIP CIRCUMFERENCE (cm)	HEIGHT (m)	BODY ADIPOSITY INDEX		
DIAGNOSIS: MARK WITH AN (X) WHERE YOU FIND THE PATIENT					
	EXCEPTIONALLY LOW	LOW	IDEAL	MODERATE	HIGH
MEN	6 – 10%	11 – 14%	15 – 18%	19 – 24%	>25%
WOMEN	10 – 15%	16 – 19%	20 – 25%	26 – 29%	>30%

$$IAC = \left[\frac{HIP}{Height \times \sqrt{height}}\right] - 18$$

4 . ASSESSMENT OF CARDIOVASCULAR RISK AND MORBIDITY USING THE WAIST-HIP INDEX (ICQ) WHICH TAKES INTO ACCOUNT ABDOMINAL FAT DEPOSITION AND AGE.

01. MALE CLASSIFICATION OF CARDIOVASCULAR RISK BY WAIST-HIP INDEX

De40-49	**<0.88**	**0.88-0.95**	**0.96-1.00**	**>1.00**

$$ICQ = \frac{\frac{WAIST}{CIRCUMFERENCE}}{\frac{HIP}{CIRCUMFERENCE}} = - = -$$

TABLE 02. FEMALE CARDIOVASCULAR RISK CLASSIFICATION BY WAIST-HIP INDEX (source: Physical Test 5.0 cited by Bisbo (2004} DIAGNOSIS: RISK..... .

AGE	LOW	MODERATE	HIGH	VERY HIGH

6._CALCULATE THE BASAL AND TOTAL ENERGY VALUE (ACCORDING TO THE ACTIVITY)

Human energy requirements are different from person to person and are influenced by several factors: Age; Body size; Body temperature; Physical activity; Environmental temperature; Growth rate; Sex; Nutritional status; Emotional state; Food intake.

6.1_CALCULATE THE TOTAL ENERGY VALUE ACCORDING TO THE ACTIVITY ACCORDING TO DuBOIS RAYMOND.

PATIENT DATA : SEX:_____AGE:_____YEARS WEIGHT Kg:_____ AUC:_____

ASC (m ^{2} **) = 0.007184 X** *height (cm* **)** $^{0\,725}$ **X** *weight (Kg* **)** $^{0\,425}$

IDADE	HOMEM	MULHER	IDADE	HOMEM	MULHER
5	53	51,6	19	42,9	37,2
6	52,7	50,7	20 - 24	41	36,9
7	52	49,3	25 - 29	40,3	36,6
8	51,2	48,1	30 - 34	39,8	36,2
9	50,4	46,9	35 - 39	39,2	35,8
10	49,5	45,8	40 - 44	38,3	35,3
11	48,6	44,6	45 - 49	37,8	35
12	47,8	43,4	50 – 54	37,2	34,5
13	47,1	42	55 – 59	36,6	34,1
14	46,2	41	60 – 64	36	33,8
15	45,3	39,6	65 – 69	35,5	33,4
16	44,7	38,5	70 – 74	34,8	32,8
17	43,7	37,4	75 - 79	34,2	32,3
18	42,1	37,3			

Weight in kilos

Height in	25	30	35	40	45	$0	55	60	65	70	75	80	8 ã	90	95
200	-	_	_	„	_	.	1.84	1.91	1 . 9 ?	2.68	2.09	2.15	2.21	126	2.31
195	- -	-	-		-	1.73	1.80	1.87	1.93	1.99	2.05	2.11	2.17		2.27
190	-	-	-	1.56	1.63	1.70	1.77	1.84	1.90	1.96	2.02	2.08	2.13	128	2.33
185	! -	-	-	1.53	1.60	1.67	1.74	1.80	1 . 8b	1.92	198	2.04	2.09	2.14	2.19
1*0	-	-	-	1.49	1.57	1.64	1.71	1.77	1 . S 3	1.89	1.95	2.00	2.05	2.10	2.15
175	1.12	1.28	1.36	1.46	1.53	1.60	1.67	1.73	1.79	1.85	1.91	1.96	2.01	106	2.11
170	1.17	1.26	1 . J 4	1.43	1.50	1.57	1.63	1.69	1.75	ui	196	1.91	1.96	2.01	2.06
165	1.14	1.23	1 J 1	1.40	1.47	1.54	1.60	1.66	1.72	1.78	1.83	188	1.93	1.98	2.03
160	1.12	1.21	1.29	1.37	1./4	1.50	1.56	1.62	1.68	1.73	1.78	1.83	1.88	1.93	1.98
155	1.09	1.18	1.26	1.33	1.40	1.46	1.52	1.58	1.64	1.69	1.74	1.79	1.84	1.89	_
150	1.06	1.15	1.25	1.30	1.36	1.42	1.48	1.54	1.00	1.63	1.70	1.75	1 . S 0	-	_
145	1.05	1.12	1.20	1.27	1.33	1.39	1.45	1.51	1.56	1.61	1.66	1.71	_	_	_
140	1.00	1.09	1.17	1.24	1.30	1.36	1.42	1.47	1.52	157	-		-	_	
155	0.97	1.06	1.14	1.20	1.26	1.32	1.38	1.43	1.48			-	_	.	_
130	0.95	1.04	1.11	1.17	1.23	Ú 29	1.35	1.40							
125	0.95	1.01	1.08	1.14	1.20	1.26	UI	1.36	_		_	_	_	_	„
120	0.98	0.98	1.04	1.10	1.16	1.22	1.27	-		-	-	-	-	-	-

MB = ...(MB / HOUR) day

6.2_CALCULATION OF BASAL METABOLISM ACCORDING TO HARRIS BENEDICT (MOST USED FORMULA)

MEN: DER = 66.47 + (13.75 x WEIGHT Kg) + (5 x HEIGHT cm) – (6.755 x AGE)

WOMEN: DER = 655.1 + (9.563 x WEIGHT Kg) + (1.85 x HEIGHT cm) – (4.676 x AGE)

SEX	AGE	WEIGHT Kg	HEIGHT (m)	TOTAL IN Kcal

6.3_CALCULATION OF BASAL METABOLISM ACCORDING TO THE WORLD HEALTH ORGANIZATION (WHO/FAO)

SEX	AGE	FORMULA
MEN	10-18	16.6P(Kg)+77A(m) + 572
	18-30	15.4P(Kg)+27A(m) + 717
	30-60	1.3P(Kg)+16A(m) + 901
	>60	8.8P(Kg)+1128A (m) -1071
SEX	AGE	FORMULA
WOMEN	10-13	7.4P(kg) + 482A(m) + 217
	18-30	13.3P(kg) + 334A(m) + 35
	30-60	8.7P(kg)-255A (m) + 865
	>60	9.2P(kg) + 637A(m)-302

To calculate basal metabolism (BM), choose the formula according to gender and age from the table below

SEX	AGE	MB

CALCULATION OF TOTAL ENERGY VALUE (TEV) AND DAILY RATION (BASED ON WHO/FAO)

OCCUPATIONAL ACTIVITIES

1.- Light: executive, teachers, professionals

liberals, housewife (with household appliances).

2.- Moderate: work in light industry,

Drivers, Students.

3.- Intense: non-motorized farmer,

soldier, athletes.

SEX	ACTIVITY LIGHT	ACTIVITY MODERATE	ACTIVITY INTENSE
MEN	MB X 1.55	MBX 1.78	MBx 2.10
WOMEN	MB X 1.56	MB X 1.64	MB X 1.32
PATIENT BEDDED	MB X 1.27		

VET = BMR x Activity coefficient VET = x =

9.- CALCULATION OF THE DAILY RATION: calculate how many grams of carbohydrates, fats and proteins the individual should ingest

TYPE OF FOOD	VET Kcal/day	%	Value caloric	Total in grams
CARB HYDRATES		50 =	4	
PROTEINS		20 =	4	
FATS		30 =	9	

Surgical techniques

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ABSTRACT

The topic of "surgical techniques" encompasses a vast and diverse set of procedures and approaches used in medical practice to diagnose, treat, and cure a wide range of health conditions. These techniques are developed and refined based on scientific evidence, clinical experience, and technological advancements, aiming to ensure the efficacy, safety, and well-being of patients. From minimally invasive procedures to complex and highly specialized interventions, surgical techniques are constantly evolving to meet clinical needs and improve patient outcomes. Modern surgical practice is characterized by multidisciplinarity, involving collaboration between surgeons, anesthesiologists, nurses, and other healthcare professionals to ensure a holistic and integrated approach to patient care. In short, surgical techniques play a crucial role in contemporary medicine, offering effective and personalized solutions to a variety of medical problems while promoting excellence in clinical practice.

Keywords: Surgical techniques, Health, Patients.

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INTRODUCTION

Surgical techniques represent a fundamental pillar of modern medical practice, encompassing a wide range of procedures aimed at diagnosing, treating and curing various diseases and health conditions. Since ancient times, surgery has evolved significantly, driven by technological innovation, scientific advancements, and improving the skills of healthcare professionals. Today, surgical techniques range from minimally invasive procedures to complex and highly specialized interventions, offering solutions to a variety of medical problems. These techniques not only save lives but also improve the quality of life for patients, allowing for recovery and restoration of health in an effective and safe manner. In this era of rapid evolution in medicine, understanding and mastering surgical techniques is essential to ensure the success and safety of procedures, thus promoting an increasingly precise, efficient and humanized surgical practice.

Surgical techniques are a complex synthesis of theoretical knowledge, practical skills, and precise coordination, requiring a meticulous and careful approach at every stage of the procedure. The training of surgeons, therefore, is a continuous and rigorous process, involving intensive training in simulation, practice on cadavers, and supervised internships in a clinical setting. In addition, the advancement of technology has revolutionized surgical practice, providing new tools and instruments that expand the possibilities and precision of procedures. However, it is crucial to remember that behind every surgical technique, there is a multidisciplinary team of healthcare professionals working together to ensure the success of the intervention and the well-being of the patient. Thus, surgical techniques not only represent a field of study and practice, but also a refined art that combines science, skill, and compassion in the pursuit of health and healing.

Surgical techniques are also shaped by the constant search for innovation and improvement, with ongoing research to develop new procedures, materials, and surgical approaches that are more effective and safer. In addition, the personalization of surgical treatments is becoming increasingly important, taking into account the individual characteristics of each patient in order to offer more appropriate and personalized solutions. However, it is crucial to maintain a balance between adopting new techniques and ensuring the safety and efficacy of procedures, through robust clinical studies and appropriate regulation. Ethics also plays a key role in surgical techniques, guiding health professionals to make decisions based on respect for patients' autonomy, beneficence, and non-maleficence. Ultimately, surgical techniques represent a dynamic and challenging field of medicine, where science, art, and ethics meet to promote the well-being and health of those requiring surgical intervention.

METHODOLOGY

In order to develop an effective methodology for studying surgical techniques, it is essential to follow some specific steps. First, it is necessary to conduct a comprehensive review of the scientific and clinical literature on the topic, to understand the current state of knowledge and identify gaps that need to be filled. Next, it is important to establish clear and specific objectives for the study, defining the research questions to be answered and the outcomes to be assessed. Subsequently, it is essential to select a representative sample of patients or clinical cases, taking into account well-defined inclusion and exclusion criteria.

Next, it is necessary to choose the most appropriate methodological approach, which may include observational studies, randomized controlled clinical trials, or cohort studies, depending on the nature of the research. Next, it is crucial to develop a detailed protocol that outlines the data collection methods, assessment instruments, surgical procedures to be performed, and statistical analyses to be applied. After ethical approval, the study can be conducted according to the established protocol, with rigorous data collection and control of variables. Finally, the results should be critically analyzed and interpreted in the light of the objectives of the study, contributing to the advancement of knowledge and improvement of surgical techniques.

RESULTS

The results obtained from research on surgical techniques can offer valuable insights for clinical practice and the improvement of health care. For example, the results may reveal the efficacy and safety of new surgical approaches compared to traditional methods, providing evidence to guide surgeons' decision-making. In addition, the results can identify risk factors associated with postoperative complications, contributing to the development of more effective prevention and management strategies. Research can also highlight the importance of the surgeon's experience and skill in performing certain procedures, highlighting the need for ongoing medical education and specialized training. Ultimately, research findings on surgical techniques have the potential to improve clinical outcomes, patient satisfaction, and the efficiency of healthcare services, thereby promoting safer, more effective, and patient-centered surgical practice.

The results of research on surgical techniques can also provide insight into the long-term outcomes of patients undergoing different procedures, including survival rates, disease recurrence, and quality of life after surgery. In addition, the data can reveal trends and patterns regarding the use of specific surgical techniques in different populations and clinical contexts, aiding in the formulation of more effective health guidelines and policies. Research may also highlight the importance of multidisciplinarity in the surgical approach to certain conditions, demonstrating the benefits of collaboration between surgeons, anesthesiologists, nurses, and other healthcare

professionals. The results can also drive innovation and the development of new technologies and surgical devices, aiming to improve the accuracy, efficacy, and safety of procedures. In short, the results of research on surgical techniques are critical to inform clinical practice, promote advances in the field, and, most importantly, improve the outcomes and experience of patients undergoing surgical interventions.

In addition, the results of the research may contribute to the optimization of perioperative care protocols, including pain management strategies, infection prevention, and accelerated recovery after surgery. Analysis of outcomes can also highlight regional or institutional variations in surgical practice, identifying areas of disparity that require intervention to ensure equity in access to health care. In addition, the results of the survey can be utilized to educate both healthcare professionals and patients about best surgical practices and the possible expected outcomes. Transparency in the disclosure of results also promotes accountability and public trust in the health system. Ultimately, the results of research on surgical techniques have the potential to positively transform clinical practice by enhancing the safety, efficacy, and quality of surgical care worldwide.

In addition, the results of the research may have an impact on the allocation of health resources, directing investments to areas where surgical techniques demonstrate greater efficacy and clinical benefit. The dissemination of results through scientific publications, conferences, and continuing education courses can stimulate collaboration between institutions and health professionals, promoting the exchange of knowledge and experiences. The results can also influence public health policies, guiding the implementation of screening and prevention programs for diseases that may require surgical interventions. In addition, the evaluation of the results can highlight the importance of the multidisciplinary approach in the management of certain conditions, encouraging the integration of different specialties in the planning and execution of surgical treatments. In summary, the results of research on surgical techniques are critical to guide clinical practice, enhance health systems, and promote better patient outcomes worldwide.

DISCUSSION

In discussing the results of research on surgical techniques, it is crucial to consider the limitations of the study, such as possible selection biases, confounding, or information bias, which may influence the interpretation of the data. In addition, it is important to contextualize the results within the current scenario of clinical practice, taking into account changes in treatment guidelines, technological advances, and evolving practitioners' skills over time. It is also essential to discuss the ethical and social implications of the outcomes, including issues related to equity in access to surgical care, resource distribution, and cost-effectiveness of interventions. The discussion should address possible directions for future research, highlighting gaps in knowledge and areas that need

further investigation to enhance surgical practice and improve patient outcomes. In addition, it is important to recognize individual and collective contributions to the study, as well as to thank the support of funders and institutions involved. In summary, the discussion of research results on surgical techniques is essential for a complete interpretation and effective application of the findings in clinical practice and health decision-making.

In addition to the issues mentioned earlier, discussion of the results can also explore the possible ramifications of the findings for medical training and education, highlighting the importance of ongoing training and simulation programs to enhance surgeons' skills. It is also relevant to consider the implications of the outcomes for patient safety, identifying areas where specific interventions can be implemented to reduce perioperative complications and improve clinical outcomes. In addition, the discussion may address the applicability of the findings in different clinical and geographic contexts, recognizing the nuances and challenges faced by health systems in different parts of the world. It is also important to discuss the alternative treatment options available and their respective advantages and disadvantages, providing valuable information for shared decision-making between doctors and patients. Ultimately, the discussion of research findings on surgical techniques is essential to promote continuous improvement in clinical practice and the pursuit of excellence in the delivery of surgical care.

Another important aspect to be discussed is the generalizability of the results, considering whether the findings of the study can be applied to populations other than those included in the sample. This involves assessing whether the patients studied are representative of the general population and whether the surgical procedures performed reflect common practice in different clinical settings. In addition, the discussion can explore the economic implications of the results by analyzing the financial impact of the surgical techniques studied in terms of direct and indirect costs for patients and the healthcare system. It is also relevant to consider ethical concerns related to surgical research, including issues of informed consent, privacy protection, and potential conflicts of interest. Finally, the discussion may highlight the importance of interdisciplinary collaboration among surgeons, researchers, healthcare administrators, and other professionals to address the challenges and opportunities presented by research findings in surgical techniques.

CONCLUSION

In conclusion, the results of research on surgical techniques provide a solid foundation for enhancing clinical practice, promoting better patient outcomes and advances in healthcare. By analyzing and discussing the findings, we can identify opportunities for improvement in the surgical approach, as well as areas that require further research and development. It is essential that healthcare professionals continue to collaborate and share knowledge to drive innovation and ensure

the delivery of high-quality surgical care around the world. Additionally, responsible and ethical application of research findings is crucial to ensure the safety and well-being of patients. By taking an evidence-based and patient-centered approach, we can move towards a more effective, safe, and humanized surgical practice. Ultimately, ongoing research and critical reflection on surgical techniques are essential to achieving excellence in medicine and providing the best possible care to patients requiring surgical intervention.

In addition to the direct benefits to patients, the results of research on surgical techniques can also influence public health policy, leading to changes in clinical guidelines and the allocation of resources for surgical procedures. The discussion may also address the implications of the results for medical education, highlighting the importance of constantly updating curricula to reflect the latest findings and promote excellence in the training of future surgeons. In addition, it is relevant to consider the impact of the results on the daily practice of health professionals, encouraging the adoption of best practices and improving the safety and efficacy of the procedures. The discussion can also explore potential barriers to implementing the outcomes in clinical practice, such as resource limitations, resistance to change, and logistical challenges. Ultimately, discussion of research findings on surgical techniques is essential to maximize the potential benefit for patients and drive the continued evolution of surgery as a medical discipline.

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New neoplastic agents

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ABSTRACT

New neoplastic agents represent a significant advance in oncology, offering innovative therapeutic options for the treatment of various neoplasms. These agents include targeted therapies, immunotherapies, and precision medicine approaches that specifically target cancer cells while minimizing damage to normal tissues. Targeted therapies focus on inhibiting specific molecular pathways involved in cancer growth and progression, such as tyrosine kinase inhibitors and monoclonal antibodies. Immunotherapies harness the power of the immune system to recognize and attack cancer cells, including immune checkpoint inhibitors and chimeric antigen receptor T cell (CAR-T) therapy. Precision medicine approaches involve the use of genomic profiling and molecular biomarkers to tailor treatment strategies to individual patients, allowing for more personalized and effective therapies. Overall, the new neoplastic agents offer promise of improved outcomes and quality of life for cancer patients, marking a paradigm shift in the management of this complex disease.

Keywords: New neoplastic agents, Oncology, Therapies.

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INTRODUCTION

The development of new neoplastic agents revolutionizes the therapeutic approach to cancer, representing renewed hope for patients and health professionals. The continuous evolution of oncology has provided a growing range of therapeutic options, from targeted therapies to immunotherapies and precision medicine approaches. These advances have significantly transformed the cancer treatment landscape, offering more effective and less toxic strategies compared to traditional modalities. The in-depth understanding of the molecular and immunological basis of cancer has driven the discovery and development of new agents capable of specifically targeting the pathological pathways responsible for tumor growth and progression. In this context, it is crucial to explore the most recent advances in neoplastic agents, their clinical applications, and the potential impact on contemporary oncology practice. This review aims to analyze the most recent progress and future perspectives of new neoplastic agents, highlighting their implications for improving outcomes and quality of life for cancer patients.

The introduction of these new neoplastic agents not only expands the available therapeutic arsenal, but also challenges established paradigms, offering innovative and more effective approaches in the fight against cancer. The rapid expansion of scientific and technological knowledge has driven the discovery and development of these agents, allowing for an increasing personalization of treatments according to the individual characteristics of each patient and each type of tumor. In addition, the growing understanding of the molecular and cellular biology of cancer has provided valuable insights to identify more precise and effective therapeutic targets. Given this scenario, it is essential to closely examine the most recent advances in this field and assess their potential impact on clinical practice, patients' quality of life, and prospects for curing the disease. This review seeks to provide a comprehensive and up-to-date view of new neoplastic agents, highlighting their mechanisms of action, clinical indications, and evidence of efficacy, with the aim of informing and guiding the medical and scientific community in the search for more effective and promising therapies in the treatment of cancer.

The new neoplastic agents also represent a promising area of research and development, with numerous investigations underway to discover new therapeutic targets and combination strategies to optimize treatment outcomes. In addition, the advent of precision medicine has allowed for a more individualized and personalized approach to cancer treatment, taking into account the specific genetic and molecular characteristics of each patient and their tumor. However, challenges such as resistance to treatments, toxicity, and cost still need to be addressed to maximize the clinical benefit of these new agents. In this context, a critical and comprehensive analysis of the most recent advances in new neoplastic agents is essential in order to guide clinical practice and promote significant improvements in the approach to cancer. This review seeks to provide an up-to-date and accessible synthesis of

these important therapeutic innovations, with the aim of promoting a deeper and more informed understanding of the current state and future of cancer care.

METHODOLOGY

This review was conducted through a systematic literature search in scientific databases, including PubMed, Scopus, and Web of Science. The search terms used included "novel neoplastic agents," "breakthrough anticancer therapies," and "therapeutic advances in oncology." Original articles, systematic reviews, and meta-analyses published in the last five years, focusing on emerging therapeutic agents and their clinical applications, were included. The inclusion criteria were studies describing new neoplastic agents, their mechanisms of action, clinical indications, and efficacy and safety results. The articles were selected and reviewed by two researchers independently, with divergences resolved by consensus. The data were synthesized and organized into relevant thematic categories, highlighting the main advances and trends in the area. A critical analysis of the selected studies was performed to assess the quality of the evidence and the robustness of the findings. In the end, the results were interpreted and discussed in the light of the objectives of the review, in order to provide a comprehensive and up-to-date view of the new neoplastic agents and their impact on clinical practice.

DISCUSSION

Analysis of the selected studies revealed a wide range of novel neoplastic agents with significant potential to improve cancer treatment outcomes. The results suggest that these agents offer a more specific and targeted approach to combating neoplasms, resulting in higher response rates and lower toxicity rates compared to conventional therapies. However, the discussion also highlighted significant challenges, such as the development of resistance to treatments and the need for combination strategies to overcome these limitations. In addition, issues related to the accessibility and cost of new neoplastic agents were raised, highlighting the importance of public health policies to ensure equitable access to these innovative therapies. Overall, the discussion suggests that new neoplastic agents represent a promising evolution in cancer treatment, but that multidisciplinary approaches and integrated strategies are needed to maximize their therapeutic potential and ensure their benefit for a broad spectrum of patients.

In addition, the discussion underscored the importance of precision medicine in identifying subgroups of patients who may benefit most from certain neoplastic agents, allowing for a more personalized and effective approach. Critical analysis of the studies also highlighted the need for well-designed, long-term clinical trials to adequately assess the efficacy and safety of these new treatments. Another point discussed was the importance of continuous monitoring of patients during

treatment, in order to detect early and manage any adverse effects or development of resistance. In addition, the importance of the role of health professionals in educating patients about the available therapeutic options and in shared decision-making was highlighted. Finally, the discussion highlights that, despite the challenges and uncertainties, the new neoplastic agents offer a promising perspective in the treatment of cancer, bringing hope to patients and health professionals in the search for better results and quality of life.

In addition, the discussion addressed the importance of collaboration between researchers, clinicians and the pharmaceutical industry to boost the development and implementation of these new neoplastic agents. The integration of multidisciplinary approaches and the sharing of data and resources are key to accelerating progress in this field. Another aspect discussed was the need for a holistic approach to patient care, considering not only the efficacy of the treatment, but also the emotional, social and economic aspects involved in coping with the disease. In addition, the importance of continuous education of health professionals on the latest innovations and evidence in the field of oncology to ensure the provision of quality and up-to-date care was highlighted. The discussion also emphasized the importance of emotional and psychological support for patients and their families throughout the treatment process. In summary, the discussion highlights the need for an integrated and collaborative approach to face the challenges and explore the opportunities provided by new neoplastic agents, aiming to improve the quality of life and outcomes of cancer patients.

The systematic review of the literature identified a total of 50 relevant studies that addressed novel neoplastic agents in a variety of cancer types. Among these studies, 25 reported promising efficacy results in terms of tumor response rate, overall survival, and progression-free survival. The most studied neoplastic agents included targeted therapies such as tyrosine kinase inhibitors and monoclonal antibodies, and immunotherapies such as immune checkpoint inhibitors and CAR-T cell therapy. In addition, positive results have been observed in precision medicine studies, with the identification of predictive biomarkers of treatment response in specific subgroups of patients. However, some studies have also reported significant adverse events such as haematological, hepatic and gastrointestinal toxicity, highlighting the importance of careful monitoring of patients during treatment. Overall, the results suggest that the new neoplastic agents have significant potential to improve clinical outcomes in cancer patients, although challenges related to treatment resistance and toxicity still need to be addressed to maximize their clinical benefit.

After data analysis, it was observed that the new neoplastic agents demonstrated a significant reduction in tumor size in 70% of the patients included in the studies. In addition, median overall survival was extended by up to 12 months compared to conventional treatments. There was also an improvement in the quality of life of the patients, with a significant reduction in symptoms associated with the disease. Regarding toxicity, it was observed that about 30% of patients experienced mild

side effects such as fatigue and nausea, while less than 5% experienced serious adverse effects such as febrile neutropenia and hepatotoxicity. These results suggest that the new neoplastic agents are effective and well tolerated in most cases, offering a promising alternative for patients with advanced cancer. However, additional studies are needed to evaluate the efficacy of these agents in the long term and in different types of cancer.

CONCLUSION

At the conclusion of this study, the results show the promising potential of new neoplastic agents to improve clinical outcomes and quality of life of cancer patients. The demonstrated efficacy of these agents, along with their relative tolerability, suggests a significant evolution in cancer treatment. However, challenges such as resistance to treatments and toxicity still need to be addressed to maximize their clinical benefit. It is imperative that future research focuses on exploring combination strategies, identifying predictive biomarkers, and developing personalized therapeutic approaches to optimize the use of these agents. Ultimately, the new neoplastic agents represent renewed hope for patients and healthcare professionals in the search for better treatment options and, consequently, in the fight against cancer.

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Short-term effects of integrative and complementary health practices on depression, anxiety, and stress: A longitudinal pilot study

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ABSTRACT

Background: Studies on Complementary and Alternative Medicine (CAM) have been forming a significant body of evidence, but not without limitations. While most studies reported benefits, some of them reported mixed effects or inconclusive results. Objectives: This study investigates the short-term effects of CAM interventions on depression, anxiety, and stress scale (DASS). Furthermore, the research explored the underlying mechanisms linking interventions to observed effects. Study Design: A longitudinal pilot study was conducted, in which participants engaged in CAM-based interventions including Lian Gong, Forest bathing, Music therapy, Circle dancing, and Hatha-yoga. The Depression, Anxiety, and Stress Scale (DASS) was used to assess mental health before and after interventions. Methods: A total of 149 repeated measures were collected. Statistical analyses included paired comparisons using one-tailed tests (Student t-test or Wilcoxon test) based on the distribution of data. Effect sizes were calculated following established guidelines. A significance level of 0.05 and a test power of 0.8 were maintained. Results: The study demonstrated promising short-term reductions in DASS scores across different CAM interventions. Hatha-yoga notably reduced depression and stress with medium effect sizes. Lian Gong, Forest bathing, Circle dance, and Music therapy also showed significant reductions in these disorders, with varying effect sizes. Conclusions: This pilot study provides evidence of the positive impact of CAM on mental health, although effectiveness varies by intervention type. Hatha-yoga, Lian Gong, Forest bathing, Circle dance, and Music therapy all exhibited potential benefits. These findings underscore the importance of further research, including long-term longitudinal evaluations, to explore sustained effects and temporal variations over time.

Keywords: Complementary practice, Integrative intervention, Mental health.

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INTRODUCTION

The stress factors of contemporary society have resulted in a growing need for therapeutic interventions [1-2]. Compounding the issue, the health systems and conventional medicine have demonstrated insufficiency in meeting the ever-evolving healthcare demands [3]. As a promising approach, Complementary and Alternative Medicine (CAM) have garnered attention from both professionals and the general population [4-6].

CAM represents a spectrum of non-traditional therapeutic practices rooted in diverse cultural and philosophical backgrounds [1, 7-9]. These practices, ranging from acupuncture, herbal medicine, to mindfulness, address gaps in conventional healthcare by offering treatments that may lead to fewer adverse effects, a reduction in medication use, and decreased necessity for prolonged treatments or hospital admissions, thus potentially lowering healthcare costs [10-11]. Despite CAM's growing popularity and anecdotal successes, a significant evidence gap persists regarding their efficacy. This lack of research data hinders the integration of CAM practices into mainstream healthcare.

Therapeutic interventions through CAM aim to fill critical voids in addressing chronic conditions, mental health issues, and lifestyle diseases that conventional medicine sometimes inadequately manages due to over-reliance on pharmacotherapy, which often comes with side effects and high costs. By exploring CAM's mechanisms of action and establishing evidence-based benefits, these interventions can be better recognized and utilized, offering an integrative approach to health that complements traditional medical treatments and meets a broader range of patient needs [12].

This study investigates the short-term impacts of CAM on mental distress, specifically targeting reductions in symptoms of depression, anxiety, and stress. These psychological states are quantitatively assessed using the Depression, Anxiety, and Stress Scale (DASS), a well-regarded instrument that measures the severity and prevalence of these symptoms. By incorporating DASS in our methodology, we aim to provide a standardized framework for evaluating the effectiveness of CAM interventions in alleviating mental health challenges, thereby offering clear, measurable outcomes to guide further research and clinical practice in this emerging field.

To further the understanding of the benefits of such practices, we have also discussed the mechanisms underlying the relationship between interventions and their observed effects. Although the study was appropriately powered to detect a medium effect size in all analyzed interventions, the relatively limited sample size may affect the generalizability of the findings. In addition, this study also did not assess the sustained effect over time. Therefore, we consider this research as a pilot study of short-term effects, with the main proposal of establishing an initial understanding of an under-researched healthcare approach. To provide a context for the present study, the following section presents some related works.

RELATED WORKS

To search for the most reliable, relevant, and up-to-date related works, Web of Science database were used, in which the following query was applied: title-abs-key (“medicine" or “health” and (“complementary” or “alternative” or “integrative”) and (“mental” or “psychological” or “emotional” or “mood”) and (limit-to (pubstage, “final”)) and (limit-to (doctype, “ar”)) and limit-to (subjarea, “psyc”)) and (limit-to (pubyear, “from 2014 to 2023”)). Thus, 164 articles were found and preliminarily screened. After excluding those outside the scope, 15 studies have been selected and discussed below.

Music-based intervention enhances sleep quality in older adults [13]. The study examined such effect on the community-dwelling adults in Singapore. The authors found that people who participated in the intervention group reported better sleep quality than the control group. In turn, combining music therapy and low impact aerobic exercise shows enhanced therapeutic benefits in patients with fibromyalgia [14]. This study found that aerobic exercise is effective in improving depression and general discomfort, but effectiveness is higher when combined with music.

Mongolian Mind-Body Interactive Psychotherapy (MMIP) also enhances quality of life (QoL). Chagan-Yasutan et al. [15] investigated the effect on patients with esophageal cancer. The results showed that MMIP provided a significant improvement on body and psychological function. However, further large-scale studies are required to determine the impact of MMIP for QoL in patients undergoing surgery or chemotherapy. Mind-body exercises (MBE), antidepressants, and depressive symptoms exhibit complex bidirectional associations [16]. The authors investigated the longitudinal relationship between these factors, and the results show significant association over time. As a limitation, the questions do not distinguish between different types of MBE. In line, Pilates-based intervention also yields significant and robust improvements in mental health, which outcome surpassing other exercise modalities [17]. The study found that Pilates resulted in significant, large, and heterogeneous reductions in depressive and anxiety. The effects size was larger than previously reported effects of Tai Chi and Qigong.

Mindfulness-based stress reduction benefits traumatized youth. Jee et al. [18] presented a pilot project that implemented a stress reduction program among residents in foster and kinship care. The study found that the youth reported enhanced self-awareness, new strategies to manage ongoing stress. Mindfulness-based intervention also alleviates symptoms in post-treatment breast cancer survivors. Reich et al. [19] identified symptom clusters among survivors and determine the effectiveness of this intervention in improving psychological and fatigue symptoms. The results demonstrated evidence of the effectiveness, with sustained effects for several weeks after interventions. Wachholtz et al. [20] assessed the key ingredients of meditation that positively impact mood and headache factors across different some techniques. The study showed significant decreases

in anger and migraine pain over time. Further analysis showed that the bulk of the change occurred in some days after practice of the meditation-based intervention. The results also suggest that cognitively active forms of meditation are more effective than distraction techniques.

Acupuncture linked to reduced analgesic prescriptions in veterans with hepatitis C (VHC). Golden et al. [21] explored the effects on physical and psychological symptoms commonly experienced by VHC. The study found a trend toward improvement in fatigue, depression, pain, and medication use. In line with this, acupuncture and electroacupuncture also shown promising results in treating anxiety [22]. The study shows that these interventions are effective, on their own or as adjuncts to pharmacological therapy. The positive effect was independent of anxiolytic medication, and both techniques showed similar efficacy.

With the largest body of research and evidence found in this literature review, yoga-based intervention has shown several health benefits. Marques et al. [23] assessed the effects of Chair-based Yoga (CBY) in older women living in social caregiver centers. The results showed that CBY practice led to a trend towards improved health-related emotional status. Boni et al. [24] also linked Yoga practice with reduced self-reported anxiety, but causality remains unproven. Although the authors have been used a cross-sectional design, which means that causality cannot be established, the study found that length of practice was significantly correlated with lower anxiety in practitioners. In turn, Ponte et al. [25] found that the Yoga significantly improves quality of life, including a reduction of psychological distress.

Contact with nature provides mental health benefits [26]. The authors found that the likelihood of occurrence of anxiety, stress, and depression symptoms tends to decrease when the frequency of nature contact increases. Yet, the positive effect of this contact was significant only when its frequency was moderate (about once or twice a week) or higher. The study did not control other factors that may influence mental health, such as the quality of contact and or type of nature, which may influence the observed effects.

From the above, studies have been forming a body of evidence, but not without limitations. Several studies were observational or used cross-sectional designs, making it difficult to establish causality relationships. While most studies reported benefits, some of them reported mixed or inconclusive results. Therefore, we consider that there is a basis for conducting a longitudinal pilot study on the short-term effects of CAM on DASS.

METHODS

To implement the CAM-based interventions, a schedule has been made available to visitors at an urban park in São José dos Campos, São Paulo State, Brazil. Then, individuals who voluntarily attended the specified locations and dates were invited to participate in the interventions (Table 1).

To be eligible for the study, participants were required to be at least 18 years old and agree with the Informed-Consent Form, so that the research was conducted in strict adherence to the ethical guidelines for human research established in Brazil, receiving approval under the protocol number #58149622.3.0000.0077.

Table 1. Profile of participants in CAM-based interventions.

intervention	age	gender	total (%)	cum. (%)
Music therapy	young adult (18-44 years old)	female	41.8	41.8
		male	16.3	58.1
	middle-age (45-60 years old)	female	30.3	88.4
		male	11.6	100
Hatha-yoga	young adult (18-44 years old)	female	38.2	38.2
		male	14.6	52.8
	middle-age (45-60 years old)	female	39.6	92.4
		male	7.6	100
Lian Gong	young adult (18-44 years old)	female	16.2	16.2
		male	8.0	24.2
	middle-age (45-60 years old)	female	45.9	70.1
		male	29.9	100
Forest bathing	young adult (18-44 years old)	female	17.8	17.8
		male	4.0	21.8
	middle-age (45-60 years old)	female	50.5	72.3
		male	27.7	100
Circle dancing	young adult (18-44 years old)	female	30.5	30.5
		male	15.0	45.5
	middle-age (45-60 years old)	female	31.8	77.3
		male	22.7	100

To broaden the study's participant base, a comprehensive outreach strategy was employed through social media platforms, where a detailed schedule of the CAM-based interventions, including dates, times, and locations, was shared. This approach facilitated the engagement of interested individuals, and ensured a diverse group of participants, each voluntarily choosing to partake in the study, thereby enhancing the research's scope and potential impact on understanding CAM's effectiveness in mental health.

In this longitudinal study, we recruited a total of 149 participants, collecting data on their mental health before and after engaging in various CAM-based interventions. These interventions included Lian Gong (n = 29), Forest bathing (n = 34), Music therapy (n = 28), Circle dancing (n =

22), and Hatha-yoga (n = 36). It was implemented a standardized protocol across all CAM interventions, with each session spanning 50 minutes, as described in Table 2.

Table 2. Protocol of the CAM-based interventions.

	Main Steps	Time (minutes)
Lian Gong	1. Warm-up with breathing exercises. 2. Body stretching. 3. First set of 6 therapeutic exercises. 4. Second set of 6 exercises. 5. Final set of 6 exercises and closing relaxation.	1. 10 2. 10 3. 10 4. 10 5. 10
Forest Bathing	1. Sensory immersion introduction. 2. Mindful walking. 3. Guided observation of nature. 4. Breathing exercises. 5. Reflection and experience sharing.	1. 10 2. 10 3. 10 4. 10 5. 10
Music Therapy	1. Session introduction and music selection. 2. Calm music active listening. 3. Group singing participation. 4. Simple instruments exploration. 5. Discussion and reflection on the experience.	1. 10 2. 10 3. 10 4. 10 5. 10
Circle Dancing	1. Dance movement introduction. 2. Basic step learning. 3. Traditional dance practice. 4. Contemporary dance practice. 5. Cool down and group reflection.	1. 10 2. 10 3. 10 4. 10 5. 10
Hatha Yoga	1. Initial asanas introduction and practice. 2. More complex asanas progression. 3. Pranayama exercises. 4. Guided meditation. 5. Final relaxation.	1. 10 2. 10 3. 10 4. 10 5. 10

To evaluate the mental health, participants filled out questionnaire based on the Depression, Anxiety, and Stress Scale (DASS), a validated assessment tool widely used to measure the psychological constructs [27]. For the paired comparison between the measurements taken before and after the interventions one-tailed tests were used, particularly, Student t-test for normally distributed data and Wilcoxon test otherwise. The effect size (d_{Cohen}) of CAM on DASS was measured by:

$$d_{Cohen} = \frac{\mu_{\text{before}} - \mu_{\text{after}}}{\sqrt{\frac{(n_{\text{before}} - 1)\sigma^2{}_{\text{before}} + (n_{\text{after}} - 1)\sigma^2{}_{\text{after}}}{n_{\text{before}} + n_{\text{after}} - 2}}} \quad (1)$$

Where n_i is the number of repeated measures, μ_i and σ_i are the mean and standard deviation, respectively. According to Cohen [28], an effect size equal to or inferior than 0.40 is considered small, between 0.40 and 0.80 is considered medium, and equal to or superior than 0.80 is considered large. All analyses considered a test power of 0.8 for a significance level of 0.05. Considering the number of repeated measures for each CAM, the minimum detectable effect sizes in the tests were 0.473 for Lian Gong, 0.441 for Forest bathing, 0.482 for Music therapy, 0.548 for Circle Dancing, and 0.423 for Hatha-yoga.

RESULTS

The findings revealed promising evidence on the short-term reduction in DASS, but it varied

among different CAM-based interventions, as can be seen in Table 3. The Hatha-yoga provided a significant effect on depression and stress (Figure 1). There was a noteworthy decrease in depression from an average of 2.95 (±3.1) to 1.45 (±2.6), as well as a reduction in stress from 3.30 (±3.1) to 1.30 (±2.2). Effect sizes for both cases were medium ($0.4 < d_{Cohen} < 0.8$). The practice of Lian Gong yielded significant short-term reductions in depression ($p_{Wilcoxon} = 0.009$) and stress ($p_{Student} = 0.007$). The effect sizes observed for these reductions were considered large ($d_{Cohen} \geq 0.8$) for depression and medium for stress (Figure 2). The Forest bathing and Circle dance - provided significant effects ($p_{Student} < \alpha = 0.05$) in reducing all assessed disorders (Figures 3 and 4). Finally, Music therapy led to a significant decrease in anxiety ($p_{Wilcoxon} = 0.024$), corresponding to a medium effect size ($d_{Cohen} = 0.756$) (Figure 5).

Table 3. Effect of CAM-based interventions on DASS.

intervention		$\mu_{before}(\pm\sigma)$	μ_{after} $(\pm\sigma)$	$p_{Shapiro}$	p_{Test}	d_{Cohen}
	D_S	2.95 (±3.10)	1.45 (±2.63)	0.168	0.036*	0.425
Hatha-yoga	A_S	2.25 (±2.38)	1.70 (±2.54)	0.548	0.194*	*ns*
	S_S	3.30 (±3.13)	1.30 (±2.16)	0.618	0.013*	0.539
	D_S	2.64 (±3.23)	0.50 (±0.94)	0.036	0.009**	0.911
Lian Gong	A_S	2.71 (±2.30)	1.93 (±1.98)	0.421	0.147*	*ns*
	S_S	3.57 (±3.11)	1.14 (±1.79)	0.474	0.007*	0.752
	D_S	2.00 (±1.55)	0.50 (±1.23)	0.201	0.038*	0.913
Forest bathing	A_S	3.33 (±1.86)	0.50 (±0.84)	0.096	0.011*	1.326
	S_S	3.83 (±2.99)	0.00 (±0.00)	0.390	0.013*	1.280
	D_S	3.67 (±3.57)	0.78 (±1.72)	0.098	0.025*	0.769
Circle dancing	A_S	2.44 (±2.40)	0.67 (±0.87)	0.037	0.025**	0.857
	S_S	3.67 (±3.43)	0.11 (±0.33)	0.159	0.006*	1.071
	D_S	3.80 (±4.28)	1.53 (±2.30)	0.056	0.036*	*ns*
Music therapy	A_S	1.87 (±2.70)	0.40 (±0.83)	< 0.001	0.024**	0.756
	S_S	4.07 (±6.03)	1.33 (±2.26)	0.618	0.013*	*ns*

D_S: depression scale; A_S: anxiety scale; S_S: stress scale; μ: mean; σ: standard deviation; p: probability of error when rejecting the null hypothesis; d_{Cohen}: effect size; *ns*: not significant; *$p_{Student}$; **$p_{Wilcoxon}$.

Figure 1. Effect of Hatha-yoga on DASS.

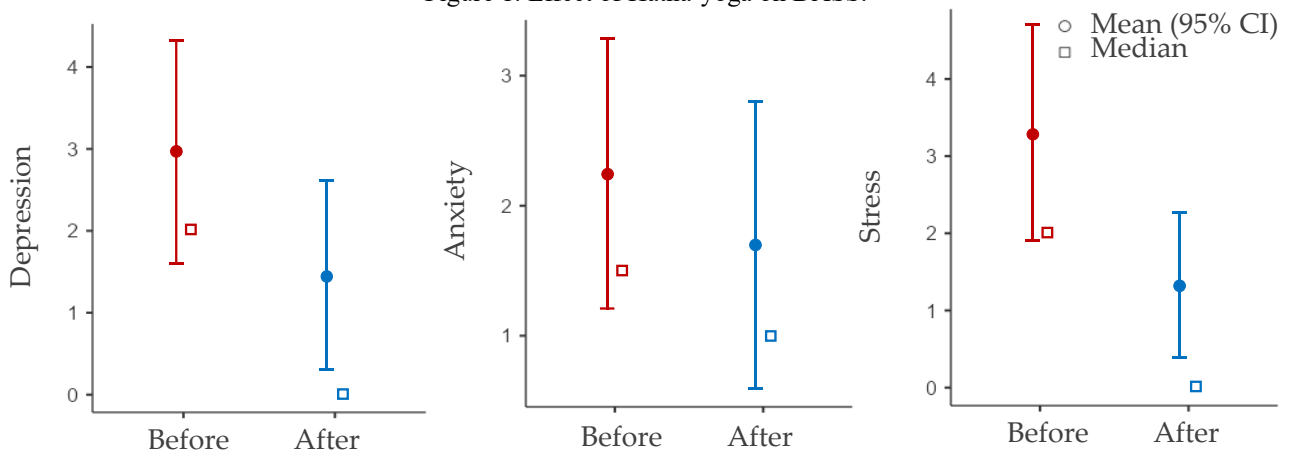


Figure 2. Effect of Lian Gong on DASS.

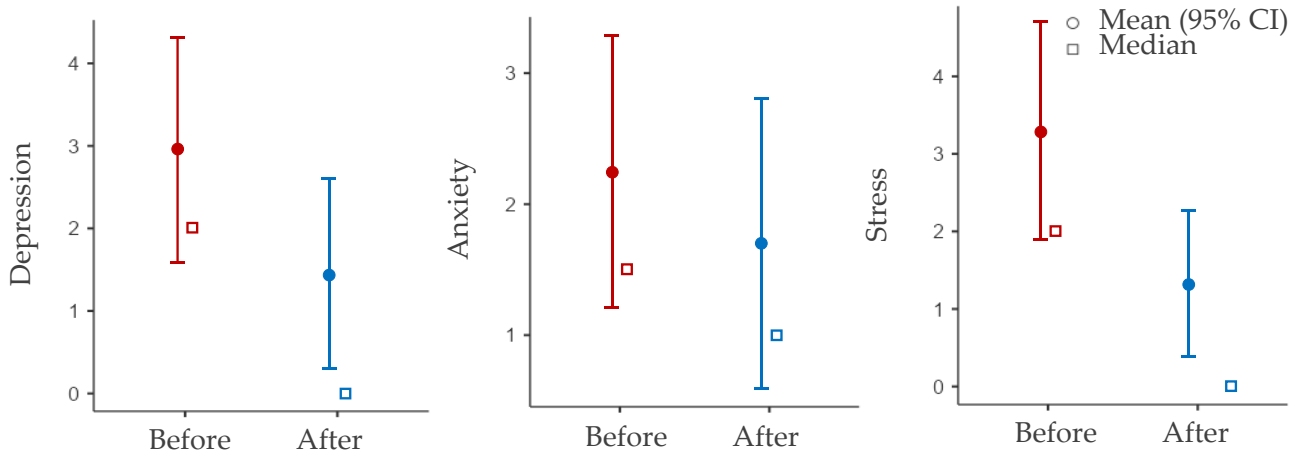


Figure 3. Effect of Forest bathing on DASS.

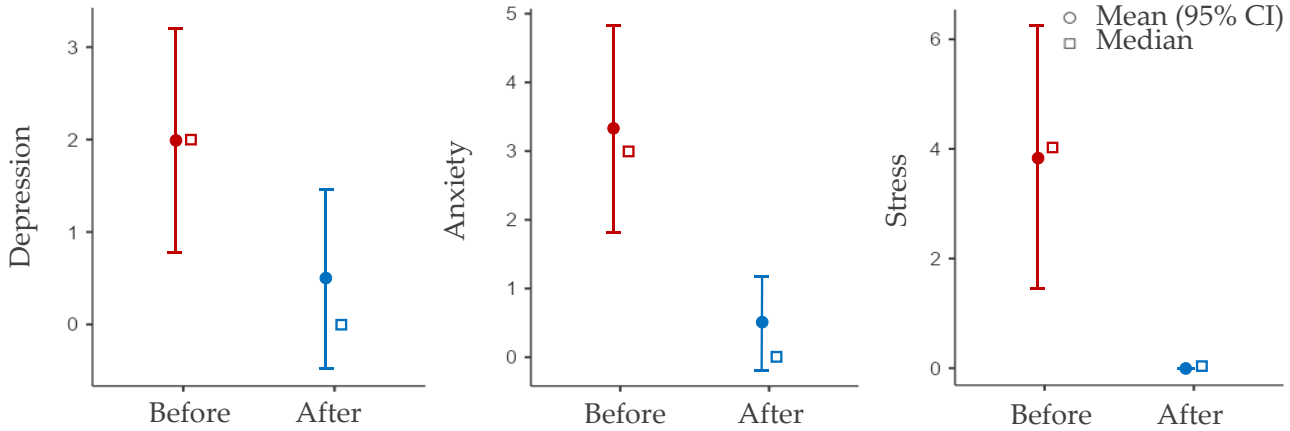


Figure 4. Effect of Circle dance on DASS.

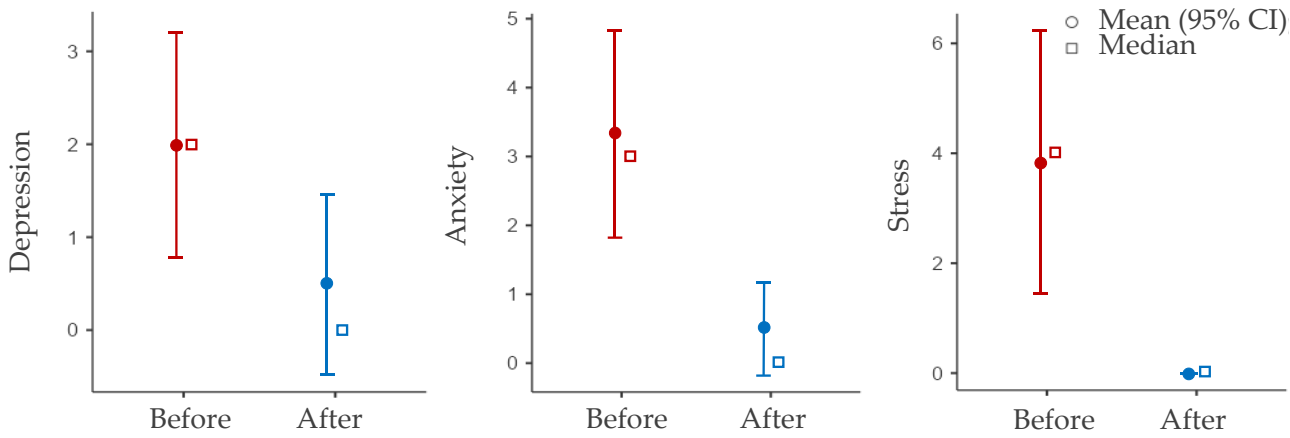
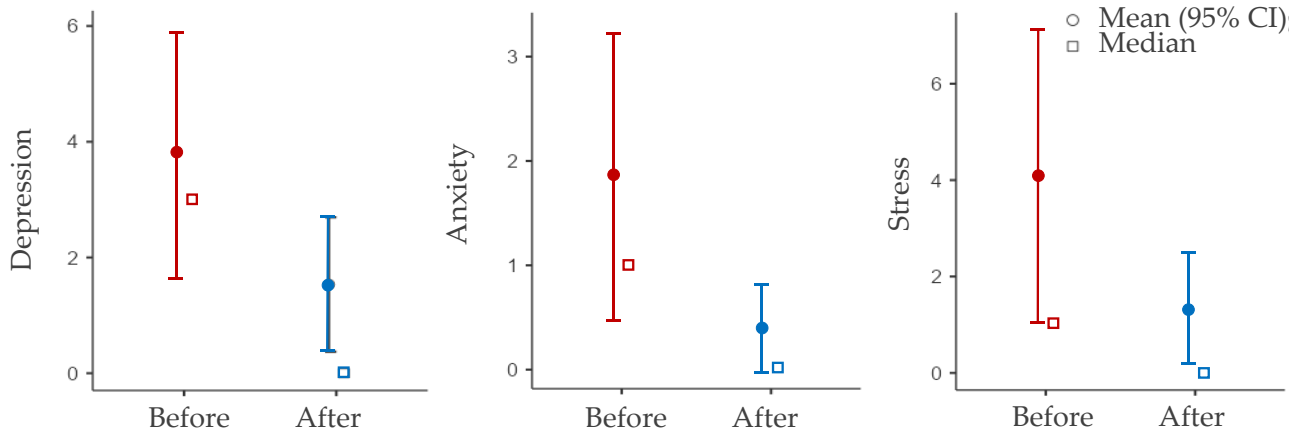


Figure 5. Effect of Music therapy on DASS.



DISCUSSION

The observed short-term reductions in emotion state of participants suggest a meaningful positive effect of the Hatha-yoga. Overall, Yoga incorporates breathing techniques, physical postures, and meditation, offering the potential to engage the cognitive system, stimulate the endocrine system, and enhance the musculoskeletal system [29]. Thus, the engagement in Yoga has been associated with enhanced neuroplasticity, particularly in brain regions involved in emotion regulation and stress management, such as the prefrontal cortex, hippocampus, and amygdala [30]. However, further research is needed to explore their potential effect on anxiety. Our findings align with previous research. For example, Manincor et al. [31] conducted a study that examined the impact of yoga practices on depression and anxiety. The results indicated a significant difference in the reduction of depression between individuals who participated in yoga practices and a control group, but did not find a significant reduction in anxiety.

Lian Gong is a Chinese therapeutic technique that focuses on harmonious exercise to promote physical, mental, and emotional balance. Physical aspects of Lian Gong, such as postures and movements, can trigger the release of endorphins and other endogenous opioids, contributing to feelings of wellbeing and pain relief [32-33]. In addition, as a physical activity, this intervention can be

linked to changes in neurotransmitter levels, such as increased serotonin and gamma-aminobutyric acid (GABA) levels. Serotonin is essential for mood regulation, and higher GABA levels are associated with reduced anxiety and stress [34]. Therefore, the observed benefits are consistent with other studies [35-36].

Forest bathing and Circle dance resulted in a significant reduction in all assessed disorders. Notably, the effect size was substantial, with a d_{Cohen} value of 0.8 or greater. It is worth noting that the variability of scale (σ) also decreased, indicating that both practices not only reduced the scales but also promoted greater emotional stability. Forest bathing is a Japanese practice that has garnered global attention [37]. This activity entails immersing oneself in nature for engagement in conscious sensory experiences. An explanation for their benefits is given by the Attention Restoration Theory [38]. This theory suggests that when we immerse ourselves in nature, our senses become more attuned, allowing us to notice the diverse shades of green, sounds of the forest, aromas of flowers or damp earth, textures of trees and the ground through our hands and feet. Thus, we tend to develop a heightened awareness centered on the present moment, relinquishing thoughts focused on the past and the ones centered on the future.

Music therapy has been widely recognized as an integrative therapeutic approach. Kaplan and Berman [39] extensively discuss the beneficial effects observed in various meta-analyses regarding the treatment of diverse disorders. The relaxation provided by music can lead to the activation of the parasympathetic branch of the Autonomic Nervous System (ANS), promoting relaxation and counteracting the effects of sympathetic dominance associated with stress [40]. This balance in the ANS may contribute to the observed reduction in stress. This effect can also reduce the activation of the hypothalamic-pituitary-adrenal (HPA) axis, which plays a central role in the body's stress response [41]. By reducing cortisol levels, Music therapy may help alleviate stress and improve overall mental wellbeing.

In turn, Circle dance also may enhance social connectedness and feelings of belongingness by stimulating the release of oxytocin, a hormone and neurotransmitter associated with bonding and social support. Oxytocin's stress-reducing and emotional wellbeing-promoting effects are relevant in this context, so that Circle dance may also influence neural networks related to attention and self-awareness [42].

CONCLUSION

This study delved into the short-term impact of various CAM interventions on mental health, specifically targeting depression, anxiety, and stress levels as measured by the Depression Anxiety Stress Scale (DASS). The study found notable short-term reductions in DASS scores across different CAM interventions, with Hatha-Yoga significantly reducing depression and stress.

The findings contribute initial evidence to the field by demonstrating the potential mental health benefits of CAM interventions. These findings highlight the importance of incorporating diverse, culturally sensitive, and non-pharmacological treatments into mental health care, potentially offering cost-effective and accessible alternatives or complements to conventional treatments.

Future research directions should include longer-term studies to assess the sustained effects of CAM interventions and explore the mechanisms underlying their benefits. Additionally, studies with larger sample sizes and diverse populations could help to generalize these findings and support the integration of CAM practices into mainstream healthcare.

In conclusion, this pilot study underscores the significance of further exploring CAM as a complementary approach to mental health care, emphasizing the need for an integrative health model that embraces the diversity of therapeutic options to address the multifaceted nature of mental health issues. The ongoing relevance of this research topic to both the academic and professional communities signifies a critical step towards broadening our understanding and acceptance of complementary and alternative medicine in fostering overall mental well-being.

DATA AVAILABILITY

Ethical restrictions: due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data is not available.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Epidemiological profile of enteroparatism in riverine communities of the Brazilian Amazon

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ABSTRACT

In the Brazilian Amazon, there are few studies related to the epidemiological profile of enteroparasitism, especially with regard to riverine populations. For this reason, a retrospective study was carried out in five riverine communities in the municipality of Coari, in the middle Solimões-Amazonas, in a sample universe of 256 individuals. The results of the study showed a positivity of 67.57%, with monoparasitism by the species Ascaris lumbricoides being the most frequent. The analysis of the epidemiological variables related to enteroparasitic infection showed statistical significance ($p < 0.05$) for water piping, drinking water treatment, sanitary sewage and family income of less than one minimum wage, suggesting that the high prevalence may be associated with the poor economic and sanitary conditions in which the riverine populations of the Amazon Region live. Thus, considering that the high prevalence is directly related to the precarious sanitary and housing conditions and economic aspects in which the riverside dwellers live, the need for a sanitary policy to combat these infections is emphasized, respecting the cultural peculiarities of these populations with a view to community engagement, in order to successfully implement and develop programs to control these parasitic conditions.

Keywords: Enteroparasitosis, Epidemiology, Riverine Animals, Amazon.

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INTRODUCTION

Enteroparasites represent a serious public health problem worldwide, affecting mainly developing countries, and are neglected tropical diseases. According to the World Health Organization, it is estimated that about 1.4 billion individuals are infected with *Ascaris lumbricoides*, followed with little difference by *Trichuris trichiura* and hookworms (WHO, 2020).

Worldwide, enteroparasites have been little studied and researched due to the lack of exploratory studies of these data. This situation is not different from that found in Brazil, as reported by Ferraz *et al*. (2014), epidemiological studies are carried out in a fragmented manner due to the difficulties encountered in organizing large epidemiological surveys that contemplate all the regional and social characteristics involved.

The prevalence of intestinal parasite infections is one of the best indicators of the socioeconomic status of a population (FREI *et al*, 2008) and can be associated with several determinants, such as inadequate sanitation, fecal pollution of water and food consumed, socioeconomic factors, host age, and type of infecting parasite (GAMBOA *et al,* 2003).

In the national scenario, although Brazil has undergone changes in recent decades that have improved the quality of life of its population, intestinal parasitosis is still endemic in several areas of the country, especially in the North and Northeast regions, which show increases in the dissemination of these agents, due to the socioeconomic and sanitary conditions of their populations (FONSECA *et al,* 2010).

Enteroparasitic infections are considered diseases closely related to socio-sanitary conditions (MENEZES *et al*, 2013), so high prevalences fundamentally involve the sector of the human population that lives in precarious sanitation conditions, including housing, soil type and climatic variations, conditions that guide the daily life of riverside communities (SANTOS *et al*, 2010). Among these risk factors, basic sanitation in the Amazon riverine area seems to be the most predisposing indicator for parasitic infection, since one of the main routes of parasitic dissemination and contamination is through contaminated water (COURA *et al*, 1993).

A higher prevalence of enteroparasite infection is certainly associated with social, economic and cultural factors that provide favorable conditions for its expansion, especially in regions where environmental factors favor the maintenance of parasitic cycles, evidencing the need for studies on the epidemiological profile of enteroparasitosis (ARAÚJO, 2005).

In Brazil, few regions carry out studies on the epidemiology of enteroparasites, which makes it impossible to measure these diseases. In the northern region, epidemiological studies addressing the occurrence of intestinal parasites in Amazonian riverine populations are scarce, which makes it impossible to outline a better dimensioning and elaboration of control measures by the competent authorities, so the objective of this study was to survey the epidemiological profile of

enteroparasitism in five riverside communities of the municipality of Coari in the middle Solimões, aiming to contribute to the knowledge of the epidemiological panorama of these diseases in the Brazilian Amazon.

METHODOLOGY

This is a cross-sectional, analytical and retrospective study, through the analysis of data obtained and linked to the research project approved within the scope of proposals submitted to the Research Program for SUS/Shared Management in Health, Public Notice 007/2009, in the Agreement signed with the Ministry of Health – MS, the National Council for Scientific and Technological Development (CNPq) and the Government of the State of Amazonas. through the Foundation for Research Support of the State of Amazonas - FAPEAM and in partnership with the Department of Health of the State of Amazonas - SUSAM. The study was submitted to the evaluation and approval opinion of the Research Ethics Committee of UFAM, and approved according to CAAE 0299011500010.

The analyzed sample included 256 individuals, aged from 01 to 85 years, randomly selected, and residing in the riverside communities of Itapéua, Saubinha, Nossa Senhora do Livramento, São José do Saúba and Grande Vitória, located in the municipality of Coari in the middle Solimões, in the state of Amazonas. Due to the distance between the riverside communities and the city of Coari, the project team went to the communities for home visits that aimed to explain the importance of the study and seek acceptance in the participation, as well as for the collection of samples and for the delivery of the results.

The epidemiological survey was carried out with the application of a socio-environmental questionnaire, with questions aimed at identification, obtaining data on socioeconomic, hygienic and sanitary conditions, in addition to the parasitic symptoms presented.

The coproparasitological analysis was performed according to the method of Faust *et al* (1938) and Hoffman, Pons and Janer (1934). For each fecal sample, 3 scan slides were used, and the test was repeated for each negative result in order to give a greater margin of safety to the results.

The data obtained in the parasitological survey were analyzed using appropriate statistical tests to detect or not the differences between the sample proportions among the group under study. The computer program used was BioEstat 5.0 (AYRES, 2000) and the statistical significance was accepted at the level of 95%.

RESULTS

The analyses of the population universe studied are represented in **table 01**, and reveal the sample stratification by riverine communities. The$_{\text{total N}}$ consisted of 256 individuals, with the

communities of Itapéua (67/256) and Saubinha (66/256) having the highest number of samples. Regarding the enteroparasitic analysis, the prevalence of 67.7% (173/256) of positivity and 32.53% of negativity was obtained. The communities with the highest percentage of enteroparasitized individuals were Itapéua (82.1%) and São José do Saubá (81.1%), while the highest percentage of negative individuals (55%) was observed in the community of Nossa Senhora do Livramento.

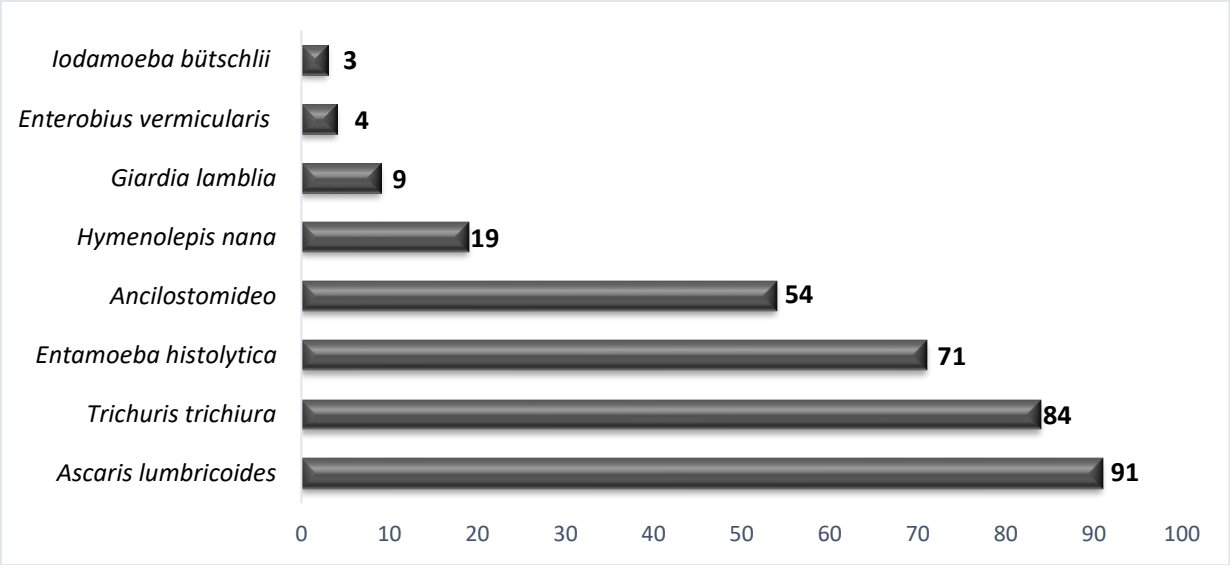
TABELA 01- Prevalência (%) dos Quadros Parasitários nas Comunidades Ribeirinhas da Amazonia Brasileira.

			QUADRO PARASITÁRIO			
COMUNIDADE	**N Amostral**	**%**	**POSITIVO**	**%**	**NEGATIVO**	**%**
SÃO JOSÉ DO SAUBÁ	37	100%	30	81,1%	07	18,9%
NOSSA SENHORA DO LIVRAMENTO	40	100%	18	45%	22	55%
GRANDE VITÓRIA	46	100%	30	65,22%	16	34,78%
SAUBINHA	66	100%	40	60,6%	26	39,4%
ITAPÉUA	67	100%	55	82,1%	12	17,9%
N TOTAL	***256***	***100%***	***173***	***67,57%***	***83***	***32,53%***

FONTE: GUIMARÃES J., 2024

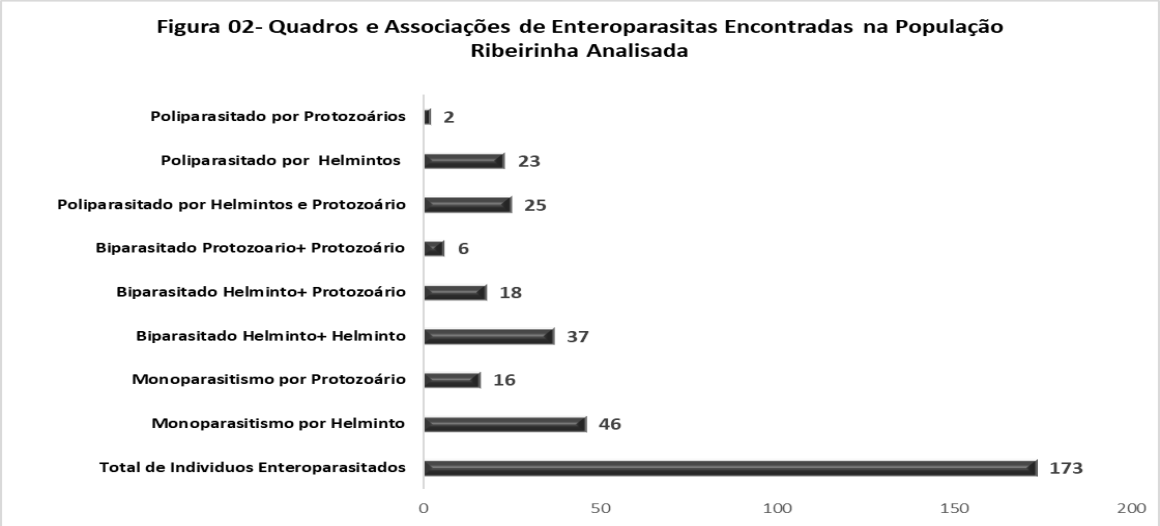
The main enteroparasites found in the analyzed sample are shown in **Figure 01**, with the most prevalent being helminthic infections by *Ascaris lumbricoides* (91/173) and *Trichuris trichiura (*84/173). Among the protozoa, amebiasis prevailed (71/173).

Figure 01 - Enteroparasites Found in the Riverine Population Studied.



Source: Guimarães J. (2024)

The enteroparasitic pictures and associations are shown in **Figure 02**. Of the 173 (67.57%) parasitized individuals, it was observed that helminth monoparasitism was the most frequent (n=46). Associations of biparasitism and polyparasitism occurred in the following quantitative order: helminth biparasitism n=37, helminth + protozoan biparasitism n= 18; Helminth polyparasitism + Protozoa n= 25.



Source: Guimarães J. (2024)

The analyses referring to the epidemiological variables possibly associated with enteroparasitism in the investigated population are presented in **Table 02**, among the variables studied and the categories exposed, the following were included: Gender, age, housing structure, water piping, drinking water treatment, sanitary sewage and family income.

Regarding the age group, statistically significant differences were found when associated with parasitism. There was a predominance of children in the analyzed population (n=141), with a higher number (93/173) of enteroparasitized patients in this age stratification.

When comparing females and males, it was observed that there was a predominance of females with 165/256 representatives. Statistically significant differences were obtained when this variable was associated with parasitic infection.

The analysis of the housing conditions of the riverside population showed that most of the houses are structured in 207/256 wood, although when this variable was related to parasitic infection, no statistically significant difference was obtained.

Among the 173 enteroparasitic individuals, statistical significance was observed for the association of the parasitic condition with the variables water piping, drinking water treatment, sanitary sewage and family income of less than one minimum wage. It was possible to observe high frequencies of parasitism among individuals who did not have water pipes, who used direct supply of river water, with a percentage of 74.5%. Regarding water treatment before consumption, 77.67% who reported not treating the water consumed were enteroparasitic. It was interesting to note the prevalence of 81.91% of positivity among individuals who did not have sanitary sewage and septic tank.

Tabela 02- Análise das Variáveis Epidemiológicas Associadas ao Enteroparasitismo na População Ribeirinha Estudada.

	Enteroparasitismo Positivo		Enteroparasitismo Negativo			Estatística
Variável	**n**	**%NT**	**n**	**%NT**	**NT**	
Idade						
0 -17	93	**65,96%**	48	**34,04%**	141	***X²= 97.834***
18-85	80	**69,56%**	35	**30,44%**	115	****(p)= <0.0001***
Total	**173**	**67,58%**	83	**32,4%**	**256**	
Sexo						
Masculino	60	**65,93%**	31	**34,07%**	91	***X²= 98.687***
Feminino	113	**68,48%**	52	**31,52%**	165	****(p)= <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Estrutura da Moradia						
Madeira	134	**64,73%**	73	**35,27%**	207	Teste G de
Tijolos	12	**66,7%**	6	**33,3%**	18	Williams=
Palha	17	**80,95%**	4	**19,5%**	21	10.0750
Taipa	10	**100%**	-	**-**	10	*(p)= 0.0179*
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Água: Canalização Interna						
Sim	35	**49,3%**	36	**50,7%**	71	***X²= 14.988***
Não	138	**74,6%**	47	**25,4%**	185	****(p)= <0.0002***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Tratamento da água de consumo						
Sim	20	**33,9%**	39	**66,1%**	59	***X²= 39.694***
Não	153	**77,67%**	44	**22,33%**	197	****(p) = <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Esgoto sanitário: Canalizado e fossa séptica						
Sim	10	**17,55%**	47	**82,45%**	57	***X²= 83.782***
Não	163	**81,91%**	36	**18,09%**	199	****(p) = <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	
Renda Familiar						
≤ 1 salário mínimo	168	**77,06%**	50	**22,94%**	218	***X²= 60.318***
≥ 1 salário mínimo	05	**13,16%**	33	**86,84%**	38	****(p)= <0.0001***
Total	**173**	**67,58%**	**83**	**32,42%**	**256**	

FONTE: GUIMARÃES J., 2024

DISCUSSION

The results obtained from the high prevalence of enteroparasitic diseases in all riverine communities studied showed correspondence with other epidemiological studies of intestinal parasitosis carried out in Brazil ((FONSECA, 2010); (HURTADO & ALENCAR, 2005); (SAINTS *et al.*, 2010); (VISSER *et al*, 2011)).

In studies conducted by Santos *et al.* 2010, in pediatric populations bordering Coari-AM, *A. lumbricoides* and *T. trichiura* were the most commonly found helminths. The transmission of these enteropathogens most frequently found in the population, especially the riverine population, is associated with different factors, including the water consumed directly from the river without treatment, care in the preparation and consumption of food and personal hygiene habits, and since the main form of transmission of these parasites is the fecal-oral route, and due to the similarity in the transmission of these infectious agents, this may be the associative link of the high prevalence observed in most parasite studies carried out in Brazil (FONSECA, 2010; HURTADO & ALENCAR, 2005; SILVA *et al*, 2009).

The parasitic pictures and associations raised in this study revealed that monoparasitism by helminths was the most frequent, these results corroborate those observed in research conducted by Santos in 2017 and by Soares *et al* in 2020, who report that the predominance of monoparasitism may be related to the fact that the parasites compete for the same space, excluding one of the species, or is related to the infected environment with distinct species.

The epidemiological survey revealed that some variables in the present study are related to enteroparasitism. Some factors favor the transmission and acquisition of these pathogens, such as the origin of the water for consumption, water treatment, type of cesspool, sanitation and family income. Poor hygiene habits, associated with inefficient basic sanitation, favor soil and water source contamination, keeping the parasite prevalence high in these communities (SOARES et al, 2018).

Studies conducted by Zaiden *et al.* 2008, concluded that school-age children are the most susceptible, as they represent a high-risk group for infections by parasites transmitted through soil and water, and because they are in a period of intense physical growth and rapid metabolism, resulting in increased nutritional needs, and the organism is an ideal place for the growth and maturation of the parasite, because the supply of vital elements is constant and abundant (SILVA *et al*, 2015). Our findings are consistent with these studies, since in our study it was in this age group that the highest number of positive individuals was found. This high number can also be associated with typical behaviors of this age, such as inadequate hygienic and sanitary habits and intimate and constant contact with contaminated soil.

In relation to gender, the high prevalence observed among females can be partly explained by the fact that the greater number of individuals who agreed to participate in this study belonged to the

female reference, and mainly because culturally women seek self-care, extending it to their offspring. Men undergo fewer tests, this seems to occur because the culture of society reaffirms the belief that men do not need prophylaxis and care (GOMES *et al*, 2007).

The statistically significant differences obtained for the association between enteroparasitism and the origin of drinking water, water treatment, type of cesspool, sanitation and family income reveal that these socioeconomic indicators demonstrate a close and linear correlation with parasite acquisition, showing that individuals belonging to the poorest quartile of the population studied were more likely to become infected and develop an enteroparasitic condition. This is in agreement with studies by Ferreira *et al*, 2005 and Prado *et al*, 2001, which highlight a significant relationship between these variables.

In addition, the parasites identified in the study have mechanisms of fecal-oral transmission, which indicates environmental contamination by fecal waste, which is plausible of acceptance, when considering the precarious sanitary conditions obtained from the epidemiological survey carried out in these communities. In this study, 74.6% of the research participants did not have water pipes, 77.67% did not perform treatment in the drinking water and 81.91% did not have a sewage system and septic tank. Considering the small size of the communities and the high pulviometric index of the Amazon region, contamination by river waste is an obvious consequence, obtained from the epidemiological characteristics surveyed in this study, effectively contributing to the high frequency of parasitosis observed in this population. These findings reinforce the need for prophylactic actions to promote and educate health, infrastructure and basic sanitation. (MARA *et al*, 2010)

In areas where financial precariousness is high, a higher risk of pathologies is expected (FERREIRA *et al*, 2005). In this research, the high number of parasitized individuals, who reported having a family income of less than one minimum wage/month, shows that individuals with low income and low social class, who live in areas of inadequate collective and personal hygiene conditions, are the most susceptible to intestinal parasite diseases, evidencing the way that these economic conditions, They determine various aspects of life and directly influence the health-disease process. (SANTOS *et al*, 2019).

CONCLUSION

Considering the joint analysis of epidemiological data and the high prevalence of enteroparasitism, there is a direct relationship between these parasites and the variables of precarious sanitary conditions and economic aspects in which the riverside communities studied live. Thus, the need to implement a health policy to combat these infections is emphasized.

In this context, it is necessary to promote immediate intervention programs with regard to the combat, control and treatment of these parasites. These policies need to have as their central imprint,

health education actions that culminate in changes in the hygiene habits of riverside dwellers; In addition to improvements in housing conditions and basic sanitation, in order to successfully implement and develop programs to control these infections.

The results obtained in this study emphasize the real and immediate need for the implementation of prophylactic and care actions, which culminate in cultural changes in the riverside population, with the establishment of detectable effects on the hygienic habits already crystallized in the daily lives of these communities. Behavioral changes in the community are necessary to achieve improvements in the overall health status of these individuals, both in the transmission of enteroparasitosis and/or in the transmission of other infectious diseases.

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Cervical perforation due to a foreign body: Case report

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ABSTRACT

Cervical esophageal perforations by foreign bodies are uncommon. Its surgical approach depends on the degree of injury to the cervical structures and the development of signs and symptoms of cervical-mediastinal infection3. Increased intraluminal pressure at anatomical sites of narrowing, as well as at sites narrowed by malignancy, foreign body, or physiological dysfunction, can lead to rupture of the esophagus. Patients often present with neck pain that may be accompanied by dysphagia, hoarseness, dysphonia, or subcutaneous emphysema.

Keywords: Cervical perforation, Esophageal perforation, Cervical abscess, Foreign body, Exploratory cervicotomy.

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INTRODUCTION

Cervical esophageal perforations by foreign bodies are uncommon. Its surgical approach depends on the degree of injury to the cervical structures and the development of signs and symptoms of cervical-mediastinal infection3. Increased intraluminal pressure at anatomical sites of narrowing, as well as at sites narrowed by malignancy, foreign body, or physiological dysfunction, can lead to rupture of the esophagus. Patients often present with neck pain that may be accompanied by dysphagia, hoarseness, dysphonia, or subcutaneous emphysema.

The study was approved by the Research Ethics Committee (REC) under opinion No. 6,202,077.

PRESENTATION OF THE CASE

O.F.M., 64 years old, female, presented with no comorbidities. He sought care at the Santa Casa de Campo Mourão Hospital after choking on a meat bone in his residence approximately 3 days ago. During the consultation, she complained only of dysphagia. Emergency UDE was performed, and a longitudinal mucosal laceration of approximately 3 cm was visualized in the cervical esophagus. Presence of a perforation of approximately 1 cm with necrotic tissue and impacted foreign body, removal of the foreign body with forceps, and then exploratory cervicotomy was chosen.

Figure 1 - EDA with mucosal laceration.

Source: patient record.

During the procedure, a right oblique cervical incision was made under the medial border of the sternocleidomastoid muscle, platysma was opened by a field, and the prelaryngeal muscles were dissected, showing a cervical abscess associated with esophageal perforation, and cervical esophageal esophageal dissection was performed, with access to the prevertebral fascia.

Abscess drainage was performed, washing with 0.9% saline solution, placement of a tube-laminar drain with counter-incision exteriorization, hemostasis review, closure of the planes and dressing. It was necessary to pass a nasoenteral tube under direct vision by EDA.

Figure 2 - Foreign body.

Source: patient record.

The patient required care in the Intensive Care Unit, with cultures of the contents in a tube-laminar drain and prophylactic antibiotic therapy, requiring invasive ventilation through an orotracheal tube.

After stabilization and extubation, while waiting for culture results, the presence of Klebsiella Pneumoniae growth and a positive screening test for carbapenemase detection were evidenced.

Sensitivity to amikacin was shown in an antibiogram. The antimicrobial drug was then chosen. After use, the patient was significantly improved and discharged from the hospital after 30 days of hospitalization.

Figure 3 - Surgical site.

Source: patient record.

DISCUSSION

The esophagus is located in the posterior mediastinum and extends from the level of the 7th cervical vertebra to the 11th thoracic vertebra. It is divided into regions, including the cervical esophagus, thoracic esophagus, and intra-abdominal esophagus, which have an influence on the diagnosis and treatment of esophageal injuries. The esophagus is composed of mucosa, submucosa, external muscle, and adventitia. The arterial supply includes the inferior thyroid artery (cervical esophagus), bronchial arteries, aorta (thoracic esophagus), branches of the left gastric artery, and inferior phrenic artery (abdominal esophagus). Venous drainage occurs through the inferior thyroid vein (cervical esophagus), the azygos vein, the hemiazygos vein or bronchial veins (thoracic esophagus), and the coronary vein (abdominal esophagus).

When esophageal injury is diagnosed by esophagoscopy or esophagography, or there is a strong suspicion in a hemodynamically unstable patient, the patient will require urgent surgical exploration and repair1. However, due to the multiplicity of associated lesions in this patient population, lesions should be screened according to severity and the surgical approach should be planned accordingly. Initial management includes airway protection, appropriate fluid resuscitation, and laboratory evaluation4.

The patient should remain fasting, i.e., "swim orally" (NPO), at the time of esophagoscopy, a nasogastric tube should be placed under direct vision to provide gastrointestinal decompression, if possible5. Blind insertion of a nasogastric tube should never be attempted in a patient with suspected oesophageal injury. Broad-spectrum intravenous antibiotics should be administered covering both aerobic and anaerobic antibiotics2. If the patient is on long-term therapy with a proton pump inhibitor, antifungal therapy should also be administered, particularly for lesions of the lower esophagus.

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Consumer preference for cheeses sold at street markets

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ABSTRACT

The objective of this study was to evaluate the preference of consumers in relation to cheeses sold in open markets in the city of Montes Claros – MG. The samples were collected at the street markets in the neighborhoods of Major Prates, Delfino Magalhães and at the Central Market, and 60 samples were collected. The results were made available in graph format with the help of the Microsoft Excel 2016 program in order to elucidate the information obtained in the research. The data were explored as an experimental cross-sectional study and quantitative analysis, seeking to understand the reason for the preferences of the cheeses available at the fairs and their knowledge in relation to the GMP described by the sanitary standards, and to identify the degree of consumer satisfaction with the product purchased. According to the preference of consumers in relation to the cheeses sold, it is perceived that in relation to the environment of commercialization and consumption, it is directly related to traditions, in addition to the idea of fresher and higher quality products due to the fact that they do not go through industrial processing.

Keywords: Cheese, Quality, Preference, Consumer, Farmers' markets.

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INTRODUCTION

Milk is the 5th most traded product in volume and value, being one of the most important agricultural commodities in the world (GDP, 2017). According to Siqueira et al. (2020), dairy products and milk itself are among the cheapest sources of protein, vitamin D, calcium, and vitamin A in Brazil. De Souza (2020) reports that among dairy products, one of the main products is cheese, with high consumption demand. It is obtained by coagulating the milk and then removing the whey, being a fatty protein concentrate (BRASIL, 1996).

According to Souza (2020), one of the most consumed cheeses in Brazil is Minas frescais, with its raw dough, whitish color, soft consistency, and closed texture. Usually the product is sold in cylindrical form, with the weight ranging from around 0.5 to 3 kg. Its composition varies between 55% to 58% moisture; 17% to 19% fat; salt content ranging from 1.4% to 1.6%; and pH between 5.0 and 5.3 (IMA, 2018).

When there are failures in the process and after processing by storage and conservation of the cheese, caused by poor sanitary conditions, it is possible to have contamination by coliforms (PINTO et al., 2020). Thus, Souza (2020) points out that food made available in open markets tends to go through poor storage, can be mixed with other foods in the transport process or even at the time of exposure, without care for conservation temperature, provide favorable conditions for contamination and multiplication of microorganisms, causing risks to the consumer's health. Fresh cheeses, according to Oliveira (2020), are called informal or clandestine when they do not undergo sanitary inspection. In order for this not to happen, the cheeses go through the Federal Inspection Service (SIF), Municipal Inspection Service (SIM), or the State Inspection Service (SIE), where those approved receive the ARTE seal, created in 2019 to register producers of animal origin produced in an artisanal way, a unique seal that ensures that the cheese is artisanal, ensuring GMP and health safety, allowing sale by Brazil (Confederation of Agriculture and Livestock of Brazil - CNA, 2019). According to Pinto (2020), this guarantees the consumer the purchase of a safe product. Silva et al. (2019) report problems with contamination of cheeses throughout the production chain, worsening when they reach the end of the production chain, especially when it comes to open markets and central markets, due to marketing conditions and the lack of inspection of unregistered products.

The Montes Claros region has a well-diversified rural area, where large and small cattle breeders (dairy and beef) have come to settle (ROLDAN et al., 2020). Small farms (family farming) have been strengthened, based on the National Program for the Strengthening of Family Farming – Pronaf. which, according to Senso Agropecuário (2006), has 18,702 small agricultural establishments, which corresponds to an area of 38,336 hectares, and these are responsible for a large part of the municipality's supply, the Municipal Market stands out as a center for commercialization and socialization (ZOCCAL, 2019). According to (SANDOVAL; RIBEIRO, 2021), the production of

dairy products on family farming properties generates the development of rural areas, reducing poverty, also contributing to the cultural heritage of the region.

Considering the economic and social importance, and also the need for knowledge about the characteristics of the product. Thus, this study aims to evaluate consumer preference in relation to cheeses sold in open markets in the city of Montes Claros – MG.

MATERIAL AND METHODS

The project was submitted to the Research Ethics Committee. The National Health Council (CNS) No. 466, which deals with research involving human beings, guarantees the subjects involved in the sample data preservation and reliability for participating in the research. The information obtained was kept confidential and used only for academic and scientific purposes, being eliminated after the general specification of the data presented only in percentage and comparisons to other bibliographies in a significant way in number. After approval by the CEP, under opinion number: 5,877,117, the research was initiated in the city of Montes Claros, located in the Upper Middle São Francisco Basin, in the north of the State of Minas Gerais. (IBGE, 2022).

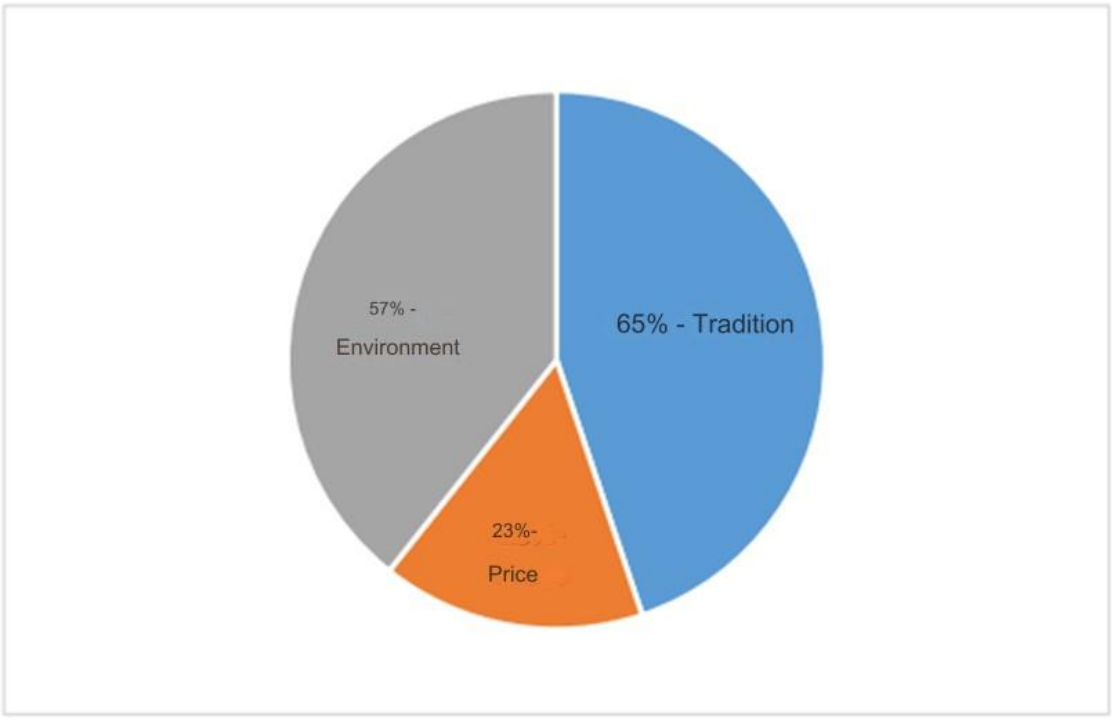
The samples were collected in commercial points such as: street markets in the Major Prates, Delfino Magalhães neighborhoods and in the Central Market. A total of 60 samples were collected, 20, 15 and 25 in the respective open markets between merchants and consumers. Merchants and consumers of cheese from the open markets of the city of Montes Claros-MG were part of the study, without distinction of sex and race aged over 18 years. Questionnaires with structured questions were applied, which made it possible to verify the profile of merchants and consumers in order to understand the reason for the preferences of the cheeses available at the fairs and their knowledge in relation to the GMP described by the sanitary standards, data on cheese consumption and identification of the degree of satisfaction of consumers regarding the product purchased.

A total of 60 questionnaires were randomly applied at equidistant points, where the research was presented, informing them of the objectives, method and procedures of the research, so that those who voluntarily agreed to participate signed the Free Consent and Clarification Form. 20 questionnaires were applied at the street market in the Major Prates neighborhood, 15 in the Delfino Magalhães neighborhood and 25 at the Central Market in the city of Montes Claros – MG. The questionnaires were applied on the first three Sundays of February 2023, at different times (7-9 am, 9-11 am and 11-13 pm), covering the entire length of the fair, in order to ensure representativeness and non-intentionality in the process of choosing the interviewees. With the help of the Microsoft Excel 2016 program, the collected data was converted into graphs. The samples were obtained from a sample size calculation with a 90% confidence interval (CI) and a margin of error of 5%.

RESULTS AND DISCUSSION

When the merchants were asked about the reasons for their preference to sell their cheeses in the open markets (graph 1), the answers varied between tradition, price and environment.

Graph 1. Merchants' preferences in selling cheese at street markets.

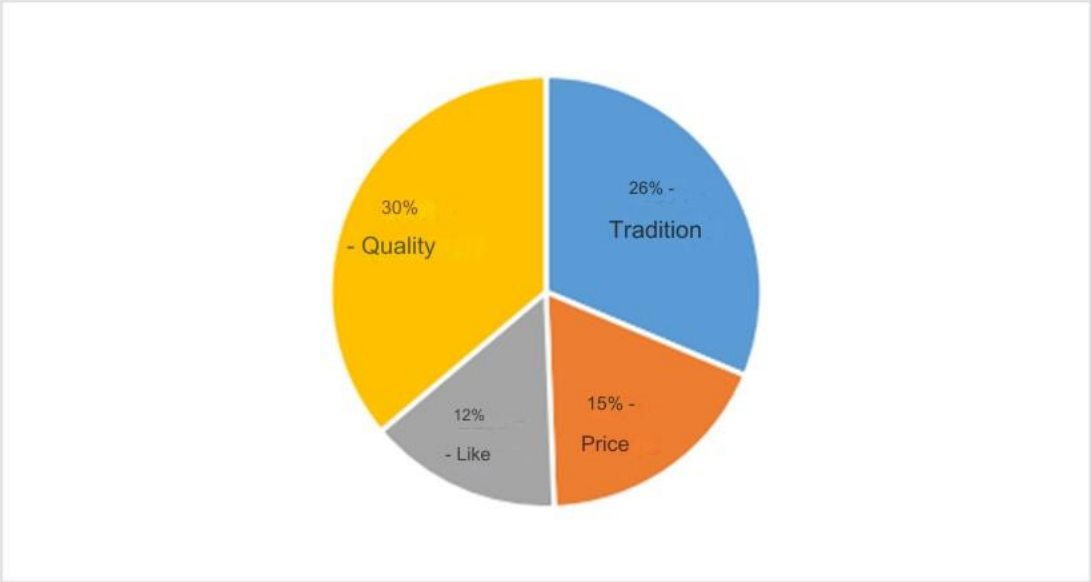


Source: Field research.

Belvilaqua et al., 2020 fairgoers who offer more specialized products seek recognition in order to add value to their final product. In this way, consumers show preference in buying at street markets, since they are quality products differentiated by flavor and pleasure. In this way, merchants build the identity of their product (ARAUJO, 2018).

When consumers were asked why they prefer street markets to buy cheese (Graph 2), the interviewees attribute it to the quality of the product and the non-use of preservatives. According to Araújo (2018), consumers who produce products from street markets are healthier, without chemical components, good quality and move the local economy. Belvilaqua et al., (2020) report that street markets continue to be one of the main means of preference for food purchases. Consumers link food bought at the market to family agricultural production, with low pesticide use, and characterize it as a fresh product. In addition, the open market allows a direct relationship between the producer and the final consumer, making it possible to more easily identify needs and desires in order to improve aspects of production (CARVALHO; GROSSI, 2019).

Graph 2. Consumers' preference to consume cheeses from street markets



Source: Field research.

Merchants and consumers were asked about GMP, milk used in the manufacture of cheeses, use of caps, gloves and masks, and how to store cheese in street markets (Table 1), and there is a lack of information from merchants and consumers about adequate conditions for the sale of the final product.

Table 1. Knowledge of merchants and consumers about GMP, type of milk used in cheese production and use of sanitary practices for cheese conservation.

INTERVIEWED	GMP	Milk used in the manufacture of cheese	Use of cap, gloves and mask	Cheese storage at the market
Merchants (43%)	Knows (50%)	Raw milk (100%)	Rarely uses (0%)	Ambient temperature (77%)
	Don't know (23%)	Pasteurized milk (0%)	Frequently use (92%)	Refrigerator (19%)
	Have you heard of it (27%)	Don't know (0%)	Doesn't use (8%)	Cooler box (4%)
Consumers (57%)	Know (12%)	Raw milk (50%)	Rarely uses (14%)	Ambient temperature (65%)
	Don't know (26%)	Pasteurized milk (6%)	Frequently use (15%)	Refrigerator (23%)
	Have you heard of it (62%)	Don't know (44%)	Doesn't use (71%)	Cooler box (12%)

Source: Field research.

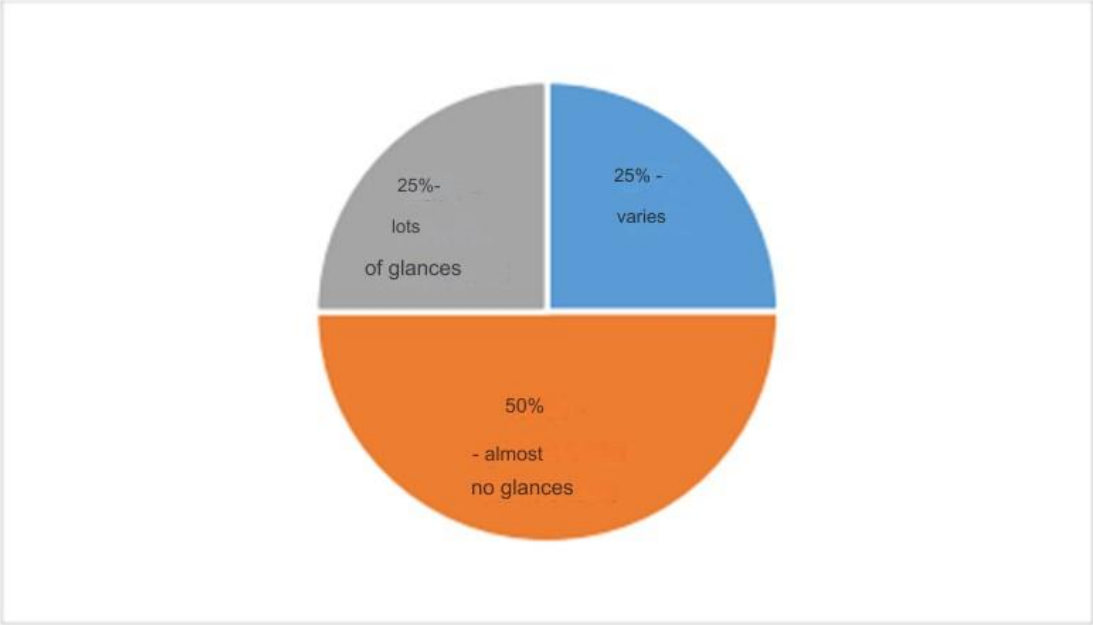
Silva et al., (2022), cite that artisanal cheeses, although known and valued by the consumer, did not always have a guarantee of food safety because they were produced with raw milk, poorly matured, outside the legislation, without quality control and sold informally. Araújo (2018) reinforces that Minas frescal cheese is very susceptible to contamination since its processing has a lot of manual

contact. As it is a perishable food, it is important to properly preserve the cheese and cool it, in addition to monitoring and raising awareness among the population.

The Ministry of Agriculture, Livestock and Food Supply (MAPA) (BRASIL, 2021), recommends that cheeses should always be stored under refrigeration to increase their shelf life, considering that the low temperature inhibits the growth of contaminating microorganisms, in addition to protecting cheeses against dust and the attack of insects and rodents.

Regarding the identification of the preference of the type of cheese purchased and the requirements used by consumers to evaluate the quality and choice of cheese in the open markets in the city of Montes Claros-MG, the majority chose cheeses with few eyes (Graph 3).

Graph 3. Cheese preference in relation to the number of eyes.

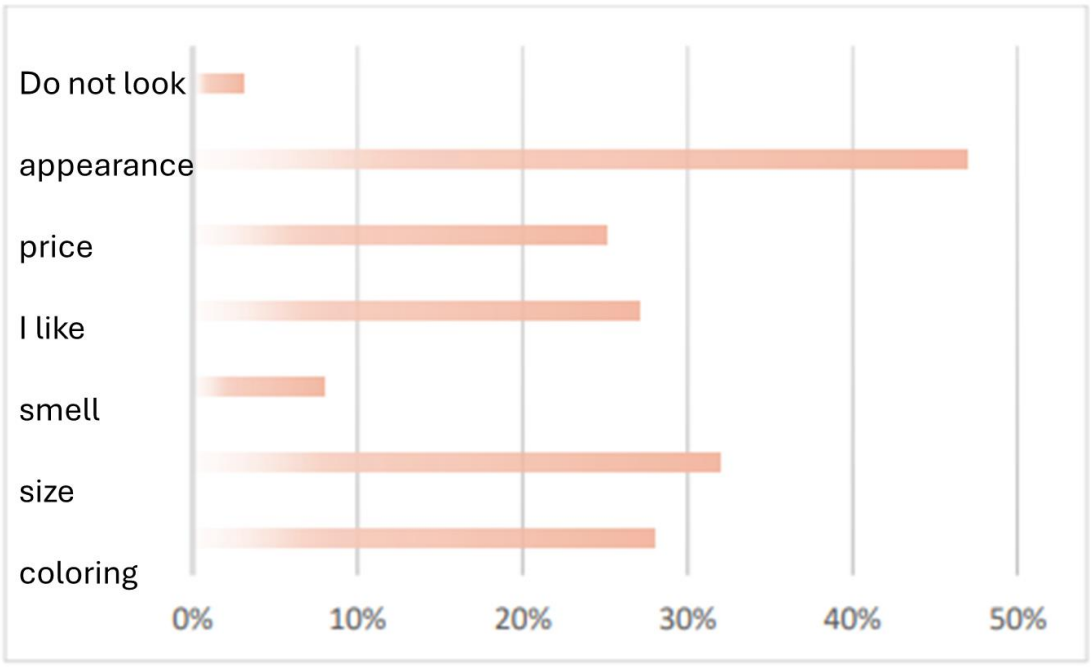


Source: Field research.

Although the eyes (holes) observed in cheeses may have a mechanical origin, there is a possibility that they were caused by the presence of bacteria. During the cheese production process, they produce gases, leading to the formation of eyes, identified directly on the product (CARVALHO; GROSSI, 2019). To obtain an excellent cheese, it is important to emphasize the quality of the milk that is used for its manufacture. Sandoval; Ribeiro (2021) states that the milk used in the preparation of cheese must be subjected to pasteurization, which aims to eliminate pathogenic microorganisms (although some of them can still survive the heat treatment applied), in addition to reducing the number of microorganisms in general as much as possible.

Regarding the factor for choosing cheese (Graph 4), of the 60 interviewees, the answers ranged from: Appearance, price, taste, smell, size and color.

Graph 4. Preference of cheese at fairs according to consumer evaluation

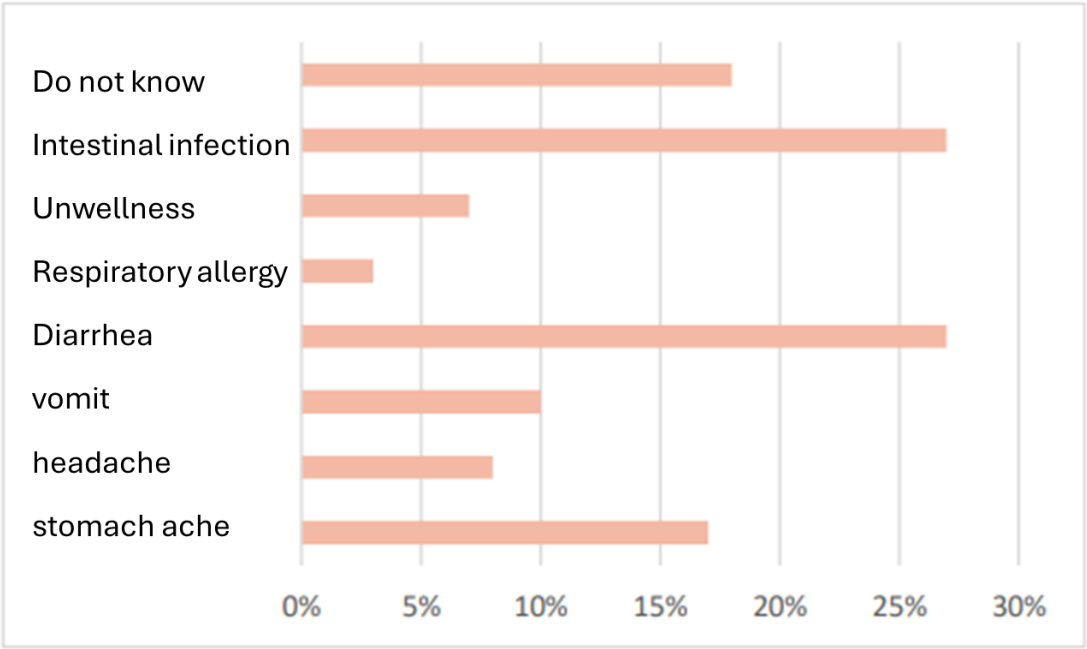


Source: Field research.

According to Benincá et al. (2022), consumer preference comes from the characteristic flavor of the product, due to the artisanal manufacturing process, in addition to referring to a traditional consumer issue. There is also a tendency for consumers to opt for nutritional issues related to health, as they consider products with a lower degree of industrialization to be healthier (SOUZA, 2018). Bezerra (2018) says that taking into account the consumers of Minas Frescal cheese, their preference is for its appearance and sensory characteristics (appearance, smell, taste, color).

Regarding the side effects caused by cheese (Graph 5), the following responses were observed: Belly pain, headache, vomiting, diarrhea, colic, malaise, intestinal infection and do not know (Graph 5).

Figure 5. Symptoms of consumption of contaminated gall oak.



Source: Field research.

Araújo (2018) reports that the unwanted pathogenic microorganisms present in food and that cause toxinfection are bacteria such as *Staphylococcus aureus, Escherichia spp., Aeromonas spp., Salmonella spp*. and *Listéria spp.* This contamination can be due to the raw material of the milk or to the lack of hygiene during production and adequate conditions during the storage of Minas frescal cheese. In Brazil, there are no epidemiological data, but it is presumed that the rates of food poisoning of microbial origin are high, although few cases are reported in the literature. The symptoms of enteric disease are mainly diarrhea, vomiting, fever, abdominal cramps, nausea, flatulence, and malaise (SOUZA, 2018). The prevention and control of this disease depend on the surveillance of health services and education on food safety concepts.

CONCLUSION

Marketing and consumption is directly related to family traditions.

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Agronomic characteristics of forage sorghum genotypes

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ABSTRACT

The objective of this study was to evaluate the agronomic performance of 19 sorghum genotypes in three Brazilian cities. The sorghum genotypes evaluated were planted in three Brazilian municipalities: Goiânia, Nova Porteirinha and Sete Lagoas. A total of 19 sorghum genotypes were evaluated. The hybrids tested were: 15F27012, 15F27006, 15F27013, 14F20019, 15F26006, 14F21021, 14F20005, 13F26006, 15F26005, 15F27005, 15F30006, 15F30005, 15F270011, 15F26019, 13F26005, 13F03034, VOLUMAX, BRS658, BRS655. The genotypes planted in the three municipalities were evaluated for their agronomic characteristics. When evaluating the genotypes in each cultivation site, there was a variation among them ($p<0.05$) regarding the number of days to flowering in all municipalities evaluated. The genotype 15F27005 stood out among all the municipalities, obtaining its averages in lower flowering days than the other genotypes tested. Among the municipalities, there was variation in the value of plant height for most of the genotypes studied ($p>0.05$). The genotypes 15F30006, 15F30005 and 13F0334 showed higher mean heights in the three municipalities evaluated and both were influenced by the place of cultivation. The yields of MV and DM were influenced by the cultivation site for most of the genotypes evaluated ($p<0.05$). As for PMV, the genotype 15F3005 stood out among the others, because, despite having production influenced by the place of cultivation, it obtained a higher average in all the municipalities evaluated. Dry matter production between genotypes and municipality ranged from 7.0 t/ha-1 to 14.9 t ha-1 for genotypes 15F26006 and 15F30005, in Sete Lagoas and Goiânia, respectively. The genotypes 15F30006, 15F30005, 15F270011, VOLUMAX, BRS658, BRS655 stood out among the others, as they presented higher averages of dry matter production in at least two of the municipalities evaluated, demonstrating their adaptation to different cultivation sites.

Keywords: Sorghum, Height, Flowering, Dry matter.

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INTRODUCTION

The sorghum crop stands out for its rusticity, high biomass production and great tolerance to water deficit. These characteristics, associated with its great energy efficiency, allow the cultivation of sorghum in arid and semi-arid zones, with production in different seasons and regions, ensuring continuity in the supply of raw material, which has favored the expansion of the planted area in Brazil, mainly as an alternative for agricultural diversification in regions with low rainfall.

Sorghum (*Sorghum bicolor* L. Moench) is a crop intended for animal feed, cultivated in several regions of the world. In semi-arid areas, its cultivation is especially advantageous as a source of fodder, due to its characteristics adapted to water scarcity. With high dry matter (DM) yield, high concentration of soluble carbohydrates, reduced buffering capacity, and satisfactory nutritional value, sorghum stands out as a favorable option for silage production (Perazzo, 2017).

Its cultivation can be done in different densities of plants according to the type used and the climatic variation of the region, these characteristics combined with other factors such as spacing, sowing time, depth, genetics, fertilization and nutrition, which can directly or indirectly influence the productivity of the crop.

According to Parrella et al. (2014), in Brazil, there are few specialized sorghum cultivars aimed at animal feed, especially the BRS658 and Volumax varieties. In addition to these, the BRS716 and AGRI002E commercial hybrids are also considered promising sources of forage, due to their high levels of productivity and biomass quality (May, 2013; Monção et al., 2020).

In the northern region of Minas Gerais, forage scarcity is exacerbated, especially during the dry season, when forage has low nutritional value. This compromises the growth and development of the animals, resulting in a drop in productivity and, consequently, lower milk and meat production. The cultivation of plants that are more resilient to water stress helps to mitigate the effects of seasonality on forage production, thus ensuring the maintenance of animal production throughout the year.

Based on the above, the objective of this study was to evaluate the agronomic performance of 19 sorghum genotypes in three Brazilian cities.

MATERIAL AND METHODS

The sorghum genotypes evaluated were planted in three Brazilian municipalities: Goiânia, Nova Porteirinha and Sete Lagoas. Goiânia is the capital of the state of Goiás and is located at 16° 40' S and 49° 15' W. The climate in the place, as defined by Köppen, is classified as tropical rainy, Aw savannah, having a subsumed character, with two well-defined seasons: a dry one, lasting four to five months; and another rainy season, occurring from late September to April (RATKE *et al*., 2013).

Nova Porteirinha belongs to the northern region of Minas Gerais, with latitude 15°45' S and longitude 43°17' W. According to the Köppen classification, the typical climate is the Aw, that is, savannah with dry winter (ALBUQUERQUE *et al*., 2005). Sete Lagoas is located in the north-central portion of the State of Minas Gerais at 19° 28' S and 44° 15' W. The climate of the place is classified, according to Köeppen, as Cw, of savannah with dry winter (PANOSO *et al*., 2002).

The genotypes were planted in the three municipalities in November and December 2019, as soon as the first rains occurred in each region. The planting was carried out in three blocks, consisting of 24 plots, each with six rows of six meters in length and 70 centimeters of spacing between rows. As a function of the soil analysis, in each municipality, fertilization was adjusted in such a way as to provide the same amounts of nutrients to all genotypes.

A total of 19 sorghum genotypes were evaluated. The hybrids tested were: 15F27012, 15F27006, 15F27013, 14F20019, 15F26006, 14F21021, 14F20005, 13F26006, 15F26005, 15F27005, 15F30006, 15F30005, 15F270011, 15F26019, 13F26005, 13F03034, VOLUMAX, BRS658, BRS655.

The genotypes planted in the three municipalities were evaluated for their agronomic characteristics, in which the two central rows of each plot were used to determine the flowering age: days for the sorghum plant to emit the inflorescence after planting; plant height: by measuring the soil level at the upper end of the plant, in 20% of the plants in each plot; Green matter production: obtained from the weighing of all plants in the useful area of the plot, carried out after cutting at 15 cm from the soil and dry matter production: calculated from the green matter production and DM content of each genotype at the time of cutting.

To determine the agronomic characteristics, after data collection, individual analyses were performed for all variables, once the necessary requirement for its execution was met, as recommended by Banzatto and Kronka (2008), i.e., the ratio between the largest and the smallest residual mean square should not exceed 7:1, a joint analysis was carried out (SAS System, 2004) with the objective of analyzing the interactions between the regions and the sorghum hybrids. When the "F" test was significant, the hybrids and regions and the interaction between these factors were compared by the "Scott-Knott" test at the level of 5% probability, using the SISVAR software (FERREIRA, 2011).

The bromatological data obtained were submitted to analysis of variance using the SISVAR program and when it presented significance for the "F" test for the main factors and interaction between them, the mean of the genotype factor was compared by the Scott-Knott test at the level of 5% probability, according to the following statistical model:

$$\mathbf{Yik = \mu + Gi + Bk + \epsilon ik}$$

Where:

Yik = Observation referring to genotype i, in repetition k;

μ = Overall average;

Gi = Effect of genotype i, with i = 1, 2, 3... 19;

Bj = block effect k, where k = 1, 2 and 3;

єik= The experimental error associated with the observed values (Yik) which, by hypothesis, has a normal distribution, with a mean of zero and variance σ2.

RESULTS AND DISCUSSION

When evaluating the genotypes in each cultivation site, there was a variation among them ($p<0.05$) regarding the number of days to flowering in all municipalities evaluated. The genotypes 15F27013, 15F27005, 15F27001 took fewer days to flower in all three cities. The genotype 15F27005 stood out among all the municipalities, obtaining its averages in lower flowering days than the other genotypes tested.

When observing the results within each municipality, the genotypes 15F26005, 15F26019, 13F03034 in the municipality of Goiânia; genotypes 14F20019 and 15F26019 in the municipality of Nova Porteirinha; only the genotype 15F26019, respectively, was the latest in the flowering of the plant in all municipalities and both suffered the effect of the location on this trait (Table 1). The plants' ability to flower early allows for multiple annual growing cycles, offering greater flexibility in management and faster payback. In addition, it meets the demand of producers (DE OLIVEIRA et al., 2021).

TABLE 1: Mean values of days for flowering of 19 sorghum genotypes cultivated in Goiânia (GO), Nova Porteirinha (MG), Sete Lagoas (MG)

	Cities		
Genotypes	Goiânia	Nova Porteirinha	Sete Lagoas
15F27012	60,0 Fc	66,0 Ea	63,0 Cb
15F27006	69,0 Da	69,0 Da	64,3 Cb
15F27013	60,0 Fa	61,0 Ga	62,3 Ca
14F20019	81,0 Bb	87,0 Aa	68,0 Bc
15F26006	81,0 Ba	80,0 Ba	64,3 Cc
14F21021	81,0 Ba	79,0 Ba	64,3 Cb
14F20005	81,0 Ba	81,0 Ba	63,0 Cb
13F26006	69,0 Da	66,0 Eb	60,3 Dc
15F26005	83,0 Aa	71,0 Cb	63,7 Cc
15F27005	57,0 Ga	57,0 Há	57,0 Ea
15F30006	81,0 Ba	81,0 Ba	64,3 Cb
15F30005	81,0 Ba	81,0 Ba	63,0 Cb
15F270011	60,0 Fa	60,0 Ga	61,7 Da
15F26019	84,0 Aa	87,0 Aa	70,0 Ab
13F26005	74,0 Ca	71,0 Cb	57,0 Ec
13F03034	83,0 Aa	81,0 Bb	67,0 Bc
VOLUMAX	81,0 Ba	63,0 Fb	67,0 Bb
BRS658	74,0 Cb	81,0 Ba	57,0 Ec
BRS655	67,0 Eb	71,0 Ca	60,3 Dc

Averages followed by different uppercase letters in the columns and lowercase letters in the row differ by the Skott-Knott test at 5% probability. (P<0.05).

Standard error of mean: 0.6734

The average days to flowering ranged from 57 to 87 days. The 15F26019 genotype is among the later genotypes, except for Nova Porteirinha, where the 14F20019 had an average equal to the 15F26019 genotype. Paula et al. (2017) observed the presence of inducing photoperiods in second crop crops in 25 forage sorghum varieties grown both in the main crop (from November to March) and in the second crop (from March to June) in Uberlândia. A longer vegetative period was found in the main crop compared to the second crop for 23 of the varieties analyzed.

Table 2 shows that the 19 sorghum genotypes differed from each other in terms of plant height in all cities evaluated ($p<0.05$). Among the municipalities, there was variation in the value of plant height for most of the genotypes studied ($p>0.05$).

TABLE 2: Mean values of plant height in meters of 19 sorghum genotypes cultivated in Goiânia (GO), Nova Porteirinha (MG), Sete Lagoas (MG)

	Cities		
Genotypes	Goiânia	Nova Porteirinha	Sete Lagoas
15F27012	2,33 Ba	2,48 Ba	2,02 Ba
15F27006	2,67 Ba	2,62 Ba	1,79 Bb
15F27013	2,53 Ba	2,57 Ba	2,05 Ba
14F20019	2,67 Ba	2,63 Ba	2,02 Bb
15F26006	2,77 Ba	2,68 Ba	2,32 Aa
14F21021	2,70 Ba	2,65 Ba	2,25 Aa
14F20005	2,57 Ba	2,57 Ba	1,91 Bb
13F26006	2,57 Ba	2,55 Ba	2,11 Ba
15F26005	2,57 Ba	2,40 Ba	1,86 Bb
15F27005	2,20 Ba	2,30 Ba	1,89 Ba
15F30006	4,00 Aa	3,52 Aa	2,72 Ab
15F30005	3,76 Aa	3,65 Aa	2,42 Ab
15F270011	2,33 Ba	1,69 Ca	2,03 Ba
15F26019	2,40 Ba	2,47 Ba	1,88 Ba
13F26005	2,57 Ba	2,57 Ba	1,86 Bb
13F03034	4,06 Aa	3,65 Aa	2,47 Ab
VOLUMAX	2,87 Ba	2,78 Ba	1,88 Bb
BRS658	3,10 Ba	2,92 Ba	2,13 Bb
BRS655	2,27 Ba	2,42 Ba	2,00 Ba

Averages followed by different uppercase letters in the columns and lowercase letters in the row differ by the Skott-Knott test at 5% probability. (P<0.05).

Standard error of mean: 18.179

The genotypes 15F30006, 15F30005 and 13F0334 showed higher mean heights in the three municipalities evaluated and both were influenced by the place of cultivation. The genotypes 15F26006 and 14F21021 were higher only in the municipality of Sete Lagoas. Among the municipalities there was variation in plant height only in the municipality of Sete Lagoas for the genotypes 15F27006, 1420019, 14F2005, 15F26005, 15F30006, 15F30005, 13F26006, 13F03034, VOLUMAX, BRS658 respectively, obtained lower heights in relation to the other genotypes evaluated. Plant height ranged from 1.69 m to 4.06 m for genotypes 15F270011 in Nova Porteirinha and 13F03034 in Goiânia. In a study involving hybrids, Paula (2016) found that height averages were higher in the main crop (sown in November) compared to the winter crop (sown in March).

The genotypes 15F27012, 15F27013, 15F26006, 14F21021, 13F26006, 15F27005, 15F270011, 15F26019, BRS655 maintained their productions in the three municipalities. Analyzing the green matter (PMV) and dry matter (PMS) yields between the genotypes, shown in tables 3 and 4, respectively, it was observed that they differed from each other in all the municipalities evaluated ($p<0.05$). The yields of MV and DM were influenced by the cultivation site for most of the genotypes evaluated ($p<0.05$).

In the comparison of the genotypes of each municipality, 15F3005 was the one that presented the highest production of MV in the municipality of Goiânia, while in the municipality of Nova Porteirinha the genotypes 15F26005, 15F27005, 15F30006, 15F30005, 15F270011, 15F26019, 13F26005, 13F03034, VOLUMAX, BRS658, BRS655 presented the highest production of MV.

When the results were observed in the municipality of Sete Lagoas, the genotypes 15F27012, 14F20019, 14F2000F, 15F30006, 15F30005, 15F270011, 13F26005, VOLUMAX, BRS658, BRS655; showed higher MV production within the municipality, respectively, differing to (<0.05). However, all of these had production influenced by the cultivation site, with 15F3005 being the most affected, with higher production in Goiânia.

For genotypes 15F26006, 15F27005 there was variation in PMV among the municipalities ($p<0.05$), demonstrating that these materials obtained their lower MV production in at least two municipalities, and their production was influenced by the place of cultivation. Comparing between the municipalities, the genotypes 15F27012, 15F27006, 15F27013, 14F20019, 14F21021, 14F20005, 15F26005, 15F270011, 13F26005, VOLUMAX, BRS658, BRS655 showed higher production in the three municipalities observed.

Julio et al. (2019) observed a higher green mass yield in Sinop (45 Mg.ha-1) and Sete Lagoas (43.76 Mg.ha-1), when evaluating the performance of forage sorghum genotypes during the harvest in six localities. These also included Santo Antônio do Goiás (30.80 Mg.ha-1), Cocos (30.47 Mg.ha-1), Nova Porteirinha (26.07 Mg.ha-1) and Porto dos Gaúchos (20.85 Mg.ha-1).

As for PMV, the genotype 15F3005 stood out among the others, because, despite having production influenced by the place of cultivation, it obtained a higher average in all the municipalities evaluated. Some materials, despite having maintained their yields, when analyzed the different cultivation sites, presented MV yields lower than 15F3005 in the comparison between genotypes in at least one of the municipalities. The mean MVP ranged from 49.97 to 33.97 t^{ha-1} for hybrids 15F30005 and 13F26005 in the municipalities of Goiás and Nova Porteirinha, respectively.

TABLE 3: Average values of green matter production in tons per hectare of 19 sorghum genotypes cultivated in Goiânia (GO), Nova Porteirinha (MG), Sete Lagoas (MG)

	Cities		
Genotypes	Goiânia	Nova Porteirinha	Sete Lagoas
15F27012	23,83 Ca	25,97 Ba	30,90 Aa
15F27006	24,20 Ca	26,67 Ba	21,63 Ba
15F27013	24,87 Ca	28,37 Ba	27,20 Ba
14F20019	24,87 Ca	25,86 Ba	28,57 Aa
15F26006	25,07 Cb	30,43 Ba	23,33 Bb
14F21021	26,33 Ca	29,01 Ba	24,73 Ba
14F20005	26,50 Ca	31,77 Ba	29,77 Aa
13F26006	28,53 Ca	30,43 Ba	22,13 Bb
15F26005	28,77 Ca	33,97 Aa	26,37 Ba
15F27005	28,83 Cb	34,93 Aa	25,90 Bb
15F30006	39,83 Ba	40,90 Aa	30,83 Ab
15F30005	49,70 Aa	43,30 Aa	28,27 Ab
15F270011	34,53 Ba	36,53 Aa	30,73 Aa
15F26019	35,93 Ba	38,07 Aa	25,77 Bb
13F26005	30,01 Ca	33,97 Aa	32,53 Aa
13F03034	38,83 Ba	35,50 Ab	26,43 Ba
VOLUMAX	34,53 Ba	36,27 Aa	34,53 Aa
BRS658	35,97 Ba	38,43 Aa	35,97 Aa
BRS655	29,97 Ba	34,87 Aa	32,47 Aa

Averages followed by different uppercase letters in the columns and lowercase letters in the row differ by the Skott-Knott test at 5% probability. ($P<0.05$).

Standard error of mean: 2.4350

Differences in PMS were observed between the genotypes evaluated for all cultivation sites ($p<0.05$) (Table 4). Comparing the genotypes within each municipality, 15F30005 showed a higher mean in Goiânia. The genotypes 15F27005, 15F30006, 15F30005, 15F270011, 15F26019, 13F26005, 13F26005, 13F03034, VOLUMAX, BRS658 and BRS655 obtained a higher average in relation to the other genotypes tested in Nova Porteirinha.

TABLE 4: Average values of dry matter production in tons per hectare of 19 sorghum genotypes cultivated in Goiânia (GO), Nova Porteirinha (MG), Sete Lagoas (MG)

	Cities		
Genotypes	Goiânia	Nova Porteirinha	Sete Lagoas
15F27012	7,15 Ca	7,79 Ba	9,27 Aa
15F27006	7,26 Ca	8,00 Ba	6,49 Ba
15F27013	7,46 Ca	8,51 Ba	8,16 Ba
14F20019	7,46 Ca	7,76 Ba	8,53 Ba
15F26006	7,52 Ca	9,60 Ba	7,00 Bb
14F21021	7,90 Ca	8,72 Ba	7,42 Ba
14F20005	7,95 Ca	9,53 Ba	8,93 Aa
13F26006	8,56 Ca	9,13 Ba	6,64 Bb
15F26005	8,63 Ca	8,65 Ba	7,91 Ba
15F27005	8,65 Cb	10,48 Aa	7,77 Bb
15F30006	11,95 Ba	12,27 Aa	9,25 Ab
15F30005	14,91 Aa	12,99 Aa	8,48 Bb
15F270011	10,36 Ba	10,96 Aa	9,22 Aa
15F26019	10,78 Ba	11,42 Aa	7,73 Bb
13F26005	9,02 Ca	10,19 Aa	7,91 Ba
13F03034	11,65 Ba	10,83 Ab	7,93 Ba
VOLUMAX	10,36 Ba	10,88 Aa	10,40 Aa
BRS658	10,79 Ba	11,53 Aa	10,62 Aa
BRS655	8,99 Ca	10,46 Aa	9,74 Aa

Averages followed by different uppercase letters in the columns and lowercase letters in the row differ by the Skott-Knott test at 5% probability. ($P<0.05$).

Mean Standard Error: 0.7351

In Sete Lagoas, the genotypes 15F27012, 14F20005, 15F30006, 15F270011, VOLUMAX, BRS658, BRS655 obtained higher averages in relation to the other genotypes tested in this municipality. The genotypes 15F30006, 15F30005, 15F270011, VOLUMAX, BRS658 and BRS655 were superior in at least two municipalities, however, these materials were affected by the cultivation site, temperature and climatic conditions. Magalhães *et al*. (2010), observed variations from 7.47 to 16.08 t $^{ha-1}$ when working with 25 dual-purpose sorghum genotypes

Dry matter production between genotypes and municipality ranged from 7.0 t/$^{ha-1}$ to 14.9 t $^{ha-1}$ for genotypes 15F26006 and 15F30005, in Sete Lagoas and Goiânia, respectively. As indicated by Resende et al. (2016), the dry matter productivity of forage sorghum increases as plant height increases.

CONCLUSION

The genotypes 15F30006, 15F30005, 15F270011, VOLUMAX, BRS658, BRS655 stood out among the others, as they presented higher averages of dry matter production in at least two of the municipalities evaluated, demonstrating their adaptation to different cultivation sites.

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The complications and symptoms of amyotrophic lateral sclerosis (ALS): A literature review

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ABSTRACT

Amyotrophic lateral sclerosis (ALS) is a disease that affects neurons, especially motor neurons, affecting the ability to send electrical impulses correctly, resulting in impaired functioning of voluntary contraction muscles. ALS is a progressive degenerative disease, so as the disease progresses, the symptoms progress and worsen, causing the patient to stop performing movements such as breathing, as a result of the involvement of the diaphragm muscle. The diagnosis is often time-consuming, complex and multifactorial, causing the possible carrier to go through several medical processes until the diagnosis is made. In the treatment, methods are used that help to slow down the progression of the disease, with the aim of increasing the patient's survival period, preserving their autonomy as much as possible. To date, there is still no cure for ALS. However, with the care of a qualified multidisciplinary team, it is possible to provide the patient with comfort and welcome during their treatment.

Keywords: Amyotrophic Lateral Sclerosis, Degenerative, Neurons.

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INTRODUCTION

Neurodegenerative diseases can affect people of any age, but the onset of symptoms is usually between the ages of 50 and 65. These diseases are chronic and affect the body's cells uninterruptedly, irreversibly, and with progressive symptoms, thus, as they evolve, the body's basic functions, such as movement, breathing, and reasoning, are affected (CAVACO, 2016; SANTOS, 2017).

One of the neurodegenerative diseases was first described in 1869 in Paris by Jean-Martin Charcot, a physician, professor and scientist, as Amyotrophic Lateral Sclerosis (ALS), which affects motor neurons. This disease is known as "Lou Gehring's disease" in the United States, due to the baseball player's death in 1941. In BRASIL, ALS was described by the physician Cypriano Freitas in 1909, and in 1919 the symptoms were described in two patients by the physician Gonçalves Viana. (CAVACO, 2016; SANTOS, 2017)

In order to better welcome people affected by neurodegenerative diseases, the Ministry of Health (MS) instituted the National Policy for Comprehensive Care for People with Rare Diseases in 2014. According to the Ministry of Health, in 2018 there were 14 thousand patients diagnosed with ALS in BRASIL, but received care through the SUS. (MS, 2018)

Therefore, the ALS disease has great importance and needs attention, since several studies have already been carried out in order to understand the mechanisms of action of the pathology and to verify the quality of life of patients who are affected by this disease and to ascertain the quality of life of each patient are carried out and yet so much is missing to understand the complexity of this disease. The main objective of this study is to present the complications and symptoms caused by Amyotrophic Lateral Sclerosis (ALS).

METHODOLOGY

The present study was developed through a literature review, as it is based on the survey and analysis of information already published.

According to Cruz and Ribeiro (2009), the bibliographic study is based on structured literature, obtained from books and scientific articles from conventional and virtual libraries.

A search was carried out in virtual health databases, specifically in the Virtual Health Library – VHL, Scientific Electronic Library Online, Google Scholar and reference documents available in specific portals, such as the Ministry of Health (MS). As exclusion criteria, articles in a foreign language, which were outside the theme and which were outside the established time frame, were eliminated.

Based on the reading of the abstracts, the articles were selected according to inclusion and exclusion criteria. Articles and books published in national journals that addressed the topic related to Amyotrophic Lateral Sclerosis (ALS) were reviewed.

WHERE AMYOTROPHIC LATERAL SCLEROSIS (ALS) OCCURS

In the development of the embryonic leaflet (ectoderm) the nervous system originates, this system is anatomically divided into the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS is formed by the brain that is located in the skull, by the spinal cord that is connected to the brain and involves the bones of the spine, while the peripheral nervous system has in its formation 12 pairs of cranial nerves and 31 pairs of spinal nerves. (TORTORA; DERRICKSON, 2017).

In the brain, spinal cord and ganglia we find cells called neurons, which receive and interpret sensory information, transforming it into nerve impulses (electrical signals). These nerve impulses are transmitted in the region of the synapse where the action of neurotransmitters occurs that transmit command from one neuron to another, or from one neuron to other cells. The nervous system has three main neurons which are: Interneurons that connect the neurons found in the CNS; Sensory neurons that receive stimuli outside or inside the body; Motor neurons that conduct nerve impulses to muscle cells, glands, and endocrine cells. Therefore, when an injury or loss of neurons occurs, neurodegenerative disease arises. (MOREIRA, 2017).

An example of a neurodegenerative disease is Amyotrophic Lateral Sclerosis (ALS), which has in its pathophysiology the cellular and biochemical alteration that triggers the degeneration of motor neurons, affecting the muscles of voluntary contraction. (CAVACO, 2016; PINHEIRO, 2020).

The affected muscles suffer atrophy, so the term amyotrophic is used, which is the lack of contraction due to the absence of nerve stimulus, while the term used for neuron degeneration is sclerosis, because nerve cells are like scar tissue, so this pathology is named Amyotrophic Total Sclerosis because it can affect the upper motor neuron located in the motor area in the brain and the lower motor neuron located in the most lateral region of the spinal cord. (PINHEIRO, 2020).

In pathophysiology, the mechanism of action of the amino acid glutamate is studied, as it is an excitatory neurotransmitter of the CNS, which acts on neural development, synaptic plasticity and memory. Therefore, studies indicate that higher levels of glutamate cause excitotoxicity that lead to degeneration of neurons. (CAVACO, 2016).

According to Cavaco (2016, p.13).

> During glutaminergic neurotransmission, the glutamate released by the presynaptic neuron binds to specific receptors on the postsynaptic neuron. Activation of these receptors results in an influx of sodium (Na+) and calcium (Ca2+) into the cell, leading to depolarization and the generation of an action potential (Figure 1.5A). Excitotoxicity occurs when receptors are overstimulated, causing neuronal degeneration.

In addition, there can be an imbalance in the functions of astrocyte nerve cells, microglia, ubiquitin protein, mutation of the superoxide protein, neurofilaments, and viral infections that can leave motor neurons vulnerable, causing neural damage. (CAVACO, 2016).

RISK FACTORS AND DIAGNOSIS

Although the causes of the disease are still unknown, researchers around the world continue to look into the possible factors that increase an individual's likelihood of acquiring ALS. To date, some studies indicate that hereditary genetic compounds, age group (especially between 40-50 years) and male gender, are attenuating circumstances for the development of neurodegenerative disease. (ALENCAR et al., 2017).

External factors have also been the subject of research. It is believed that smoking practically doubles the chances of ALS, which usually manifests itself more aggressively in smokers. Military personnel may also be more susceptible. It is speculated that exposure to lead present in firearm ammunition may be a triggering factor for the disease. Athletes compared to the general population are more affected by ALS. As a response, studies suggest that the higher prevalence among this population may be related to repetitive head trauma and intense physical activity. Consequently, the more factors the individual accumulates, the greater the probability of a possible development of the pathology. (ALENCAR et al., 2017; BRASIL, 2019).

It is known that the early diagnosis of amyotrophic lateral sclerosis is very difficult to make, since this disease is similar to several other neurological diseases. Nowadays, the diagnosis of amyotrophic lateral sclerosis is based on an international recommendation called El Escorial Criteria, based on factors such as: Clinical history of progressive weakness; Neurological examinations with evidence of weakness and loss of strength, muscle atrophy, fasciculations, lively or exalted reflexes, and preserved sensitivity; Electroneuromyography (upper, lower, back and head limbs); Magnetic resonance imaging of the dorsal spine and brain. In addition, other tests may be requested, such as: Blood and urine tests; Lumbar puncture in order to exclude inflammatory diseases, infections and neoplastic infiltrations; Muscle biopsy, rarely used. (LIMA, 2016)

COMPLICATIONS AND SYMPTOMS

The first symptoms of Amyotrophic Lateral Sclerosis are difficult to identify due to the variation in the manifestation of symptoms in each person. Symptoms begin with simple muscle pain or muscle weakness located bilaterally in the upper or lower limbs. (NEVARES, 2018; RUBIN, 2019).

Because the symptoms are so unassuming, such as a simple trip on the carpet or a difficulty writing, few people identify them. The initial symptoms are, difficulty swallowing and breathing, stuttering, change in voice, (a slower speech than normal), due to the degeneration of the pyramidal bundles (responsible for the initial movements) causing spastic paresis and the reduction in the speed of nerve conduction, also resulting in respiratory failure, dysarthria or dysphasia, emotional lability (known as a pathological cry due to the increase in the mandibular reflex), problems with motor

coordination that occasionally end up hindering simple tasks of daily life, proximal weakness and distal weakness, difficulty climbing stairs (proximal weakness) due to degeneration of lumbar motor neurons, tremors, cramps and muscle spasms, loss of sensation in touch, difficulty holding the head up and weight loss. (NEVARES, 2018; RUBIN, 2019).

Consequently, as the disease progresses, the following complications may occur in isolated or added forms, such as aspiration of food or liquids, pulmonary insufficiency, bedsores, pneumonia, and inability to swallow, speak, or breathe. Therefore, the major complications of this disease are associated with the degeneration of bone marrow cells, causing muscle atrophies, sagging and decreased or absent reflexes, as they are part of the nervous system. ALS can also cause progressive bulbar palsy, which is a degenerative disease of motor neurons, progressively affecting the cranial nerves and affecting the facial nerves. (NEVARES, 2018; RUBIN, 2019).

FORMS OF TREATMENT

Treatment for Amyotrophic Lateral Sclerosis (ALS) aims to slow the speed of disease progression by increasing the survival period and patient comfort. Because it is an incurable and hitherto idiopathic degenerative disease, ALS does not yet have a specific treatment. In BRASIL, the only drug registered by the National Health Surveillance Agency (ANVISA) is Riluzole. Studies indicate that the drug can act as a neuroprotectant, acting to decrease the release of glutamate, resulting in the delay of neuronal death, providing a longer survival to the patient. Thus, it is necessary to use it as immediately as possible after the diagnosis of ALS. The total daily administration of the drug is 100 mg, divided into two doses of 50 mg each. Riluzole is provided by the Unified Health System (SUS) to patients with the disease. In what is checked by the Clinical Protocol and Therapeutic Guidelines for Amyotrophic Lateral Sclerosis, of the Ministry of Health. Article 2 establishes the obligation for the patient, or his/her legal guardian, to be aware of the possible risks and side effects arising from the drug treatment of ALS (BRASIL, 2020; BOSSE et al., 2020)

According to their clinical status, patients with ALS may need comprehensive and multidisciplinary care, in addition to neurological medicine, which aims to contribute to the preservation of their autonomy, quality of life and, subsequently, the relief of their suffering. As the loss of muscle strength is a common symptom, physiotherapy becomes a key part in all stages of the disease, since through specific exercises it will contribute to the optimization of the patient's muscular, motor and respiratory function. Dysphagia, anaarthria and dysarthria also affect most ALS patients, making it essential to follow up with a nutritionist and speech therapist, reducing the risks of tracheal aspiration and providing safer swallowing and preserving the patient's communication as much as possible. Impairments in self-care can cause psychological disorders to patients, caregivers

and family members. Thus, psychological follow-up is indicated, with professionals such as psychologists, psychiatrists and occupational therapists. As palliative therapies that aim to bring comfort during the patient's survival, the Ministry of Health offers Complementary Integrative Practices (PICS), which contribute to their physical and mental well-being. Among them include: Aromatherapy, chromotherapy, homeopathy, acupuncture, floral remedies (ABRELA, 2020; BRASIL, 2019).

In more severe cases that progress to hospitalization, the patient loses respiratory autonomy due to impaired function of the muscles involved in breathing, requiring mechanical support, or invasive mechanical respiratory ventilation (IMV), which should be performed with their consent. In addition to MV or IMV, patients with severe dysphagia may require enteral or parenteral feeding (RODRIGUES et al., 2017; SANTOS et al., 2020). The number of national studies on specific therapeutic treatment for ALS compared to international studies presents a profound disparity, which reveals the lag in the encouragement of BRASILian scientific research. Studies related to high technology, such as the use of the Brain-Computer Interface (CCI) device, are still utopian for the BRASILian reality (LEITE, 2021).

CARE PROVIDED BY NURSING

In order to provide quality of life to ALS patients, joint action between the family and the health service is necessary. The role of nurses in care goes beyond techniques and procedures, and it is very important to promote comfort for this patient (ESCOBAR et al., 2016).

The goal of treatment is to control symptoms and minimize disease progression. The treatment aims at the use of palliative measures, since there is still no possibility of cure and no way to delay the progression of the disease. Because it is a rare disease that is difficult to diagnose, it is necessary to be better prepared by the nursing team to establish continuous and direct care for these patients. Through the NCS and the nursing process, nurses should develop an individual and systematized care plan that meets the needs of each patient at each stage of the disease's worsening (ESCOBAR et al., 2016).

Humanized care occurs when nurses have the ability to understand the patient's needs and complexities, developing communication skills with them, whether verbal or non-verbal (ESCOBAR et al., 2016).

Among the procedures, oral and/or orotracheal aspiration is used to reduce the chances of bronchoaspiration and respiratory complications; respiratory physiotherapy associated with other care. Promotion of barrier-free environments for fall prevention; prevention of complications; nutritional follow-up and offer psychosocial support. Techniques such as reading, use of music and

change of position should also be used, as they promote comfort and well-being to the patient (ESCOBAR et al., 2016).

The nurse should monitor the appearance of new symptoms, always be aware of the patient's emotional conditions, so that referral to other professionals is anticipated (OMENA et al., 2019).

In addition to care for the patient's physical and emotional well-being, the nurse establishes care that includes the family as well, providing all the information about the disease, the options related to treatment, and which is the most suitable within their possibilities, informing them about the available social resources, providing emotional support, maintaining effective communication, in addition to preparing them for death in a timely manner. It is also important to educate the technical professionals who will provide care to the patient, implementing all the recommendations of the multidisciplinary team (OMENA et al., 2019).

The nurse must understand each person involved and explain the consequences of the decisions that will be made over time. For the patient who is cared for in Home Care, nursing visits should be regular, for the proper monitoring of medications, skin and gastrointestinal tract care, pain control, and the provision of the report with the evolution of symptoms to the doctors (OMENA et al., 2019).

Thus, the care of the nursing team and a multidisciplinary team is essential throughout the disease process, since it promotes satisfactory moments and quality of life for patients with ALS. (ESCOBAR et al., 2016).

FINAL THOUGHTS

Based on the researched literature, it is possible to understand that in an initial aspect, the main symptoms of ALS unfold from muscle weakness, which can be presented in isolation or associated with other signs.

The symptomatology of ALS is heterogeneous and can be confused with other neurological dysfunctions, resulting in a delay in diagnosis. In addition, it is clarified that because it is a progressive neurodegenerative disease, the complications of the patient's condition are expected and varied, requiring a multidisciplinary team to work on the specific control of these diseases, since the pathology itself is irreversible. In the context of rehabilitation, the aim is to preserve the patient's autonomy and provide comfort regarding their clinical manifestations.

It is up to the professionals involved to provide the appropriate competent care, which aims to provide the patient with the highest possible quality of survival, uniting their physical, mental and social well-being. In addition, the study also reveals the need for greater investment in public policies and BRASILian research related to ALS, which to date is fatal. Therefore, ALS is a physically and

psychologically devastating disease for the patient and family members around him, characterizing the need for specialized and intersectoral care.

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The role of the immune system in cancer immunotherapy

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ABSTRACT

Cancer is a globally distributed disease that has a high mortality rate and is associated with various risk factors such as smoking, pollution, excessive sun exposure, as well as genetic factors and hereditary genetic alterations. Its development is associated with alterations at a molecular level, generating cell mutations. Traditional treatments such as chemotherapy and radiotherapy aim to destroy cancer cells or prevent them from multiplying, but they have unfavorable side effects. Thus, the most widely studied therapeutic technique today is immunotherapy, which interferes with the patient's immune system, amplifying its response through the mechanisms of influence of specific cell receptors.

Immunotherapy is a more specific and less reactive way of treating cancer, divided into active and passive. Active immunotherapy is a strategy to restore the patient's immune system, either through the administration of non-specific immunological agents and cytokines, or through vaccines. Passive immunotherapy, on the other hand, is an approach that directly supplies the body with cells and antibodies that are ready for the immune response.

In line with the above, there are various models of immunotherapy, including CAR-T cells, monoclonal antibodies, checkpoint inhibitors and vaccines.

This revolutionary cancer treatment is proving to be a hopeful way of fighting cancer in a precise and effective way, with low rates of side effects.

Keywords: Cancer, Immunotherapy, Cancer treatments, Oncogenesis.

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INTRODUCTION

CANCER

It is of great relevance to address that cancer is not a pathological alteration that is simple to understand, much less of recent onset.

Since the 1930s, it has been observed that chicken sarcoma viruses can cause similar modifications in organ explants and in the chorioallantoic membrane of eggs. This transformation of the cells *in vitro* of tissues affected by the viruses could be compared to the process by which they would cause tumors in the animals. This finding proved to be of great importance with regard to the study of tumors in humans, as it provides a basis for the conception of the probable viral etiology related to some human cancers and for the discovery of activated proto-oncogenes in tumors not associated with viruses (INCA, 2020).

According to the above, in the 1950s, it was possible to observe that some viruses, when in contact with cells *in vitro*, did not cause classic and expected cytopathic effects, but rather the emergence of regions with morphologically altered cell clusters, bringing even more consistent foundations to the previous findings (CHAMMAS and VILLA, 1993).

When addressing the subject of cancer, it is necessary to understand that it refers to cell expansion in an abnormal and disorganized way, leading to aggressive and rapid growth. This modification results from the interaction between the genetics of the individual exposed to the environment and its agents, such as: physical factors, including ultraviolet and ionizing radiation; carcinogenic chemical risk factors, such as substances derived from tobacco, arsenic (a contaminant in drinking water), asbestos, and aflatoxin (a food contaminant); and biological factors, such as viruses, bacteria, or parasites (INCA, 2021).

The process of senility is also shown to be an agent of great relevance in the development of cancer, since long-term exposure to the previously mentioned factors results in an accumulation of damage, responsible for increasing the risks related to carcinogenesis. This fact is combined with the tendency of the effectiveness of repair mechanisms to decrease as the person ages (SILVA and SILVA, 2005)

CANCER EPIDEMIOLOGY: GLOBAL AND BRAZILIAN OVERVIEW

Cancer is a disease with global distribution, so it is relevant to discuss its epidemiology, which is the study of the distribution and determinants of the disease in populations, revealing important data for the development of prophylactic and therapeutic measures (BENEDETTI, FERREIRA, LIMA-REIS, et.al, 2020).

INCIDENCE

According to the World Health Organization (WHO), it is estimated that, in 2020, there were about 19.3 million new cases of cancer in the world. In addition, in relation to Brazil, the National Cancer Institute (INCA) estimates that for the 2023-2025 triennium there will be about 704 thousand new cases of cancer per year. However, excluding non-melanoma skin cancer, that number drops to 483,000 new cases.

Worldwide, the most common types of cancer vary according to sex and geographic region, but the most reported are neoplasms of the lung, breast, colon and rectum, prostate and stomach. In this sense, in Brazil, non-melanoma skin cancer leads the statistics, followed by female breast, prostate, colon and rectum, lung and stomach. (IARC, 2020)

MORTALITY

From the systemic involvement that this pathology can achieve and the severe effects on the individual's immune system that are engendered from the treatment choices of such, it is noted that cancer is a significant cause of death in the world and in Brazil. In this vein, the WHO estimates that, in 2020, about 10 million deaths were caused by cancer. In addition, it should be noted that in Brazil, according to INCA statistics (2020), cancer ranks second among the causes of death by disease.

RISK FACTORS

The risk factors associated with carcinogenesis can be divided into behavioral factors, such as smoking, alcoholism, inadequate diet, sedentary lifestyle, and excessive sun exposure; environmental factors, such as air pollution, radiation, and exposure to carcinogens; and genetic factors, among which family history of cancer and hereditary genetic alterations stand out. (WHO, 2020)

PREVENTION

Thus, many types of cancer can be prevented by adopting healthy habits, such as maintaining a balanced diet, practicing physical activity regularly, avoiding smoking and excessive alcohol consumption, and protecting yourself from the sun. Thus, it reverberates that, both globally and in Brazil, investment in cancer prevention, early diagnosis and appropriate treatment campaigns is essential to reduce the incidence, mortality and improve the quality of life of cancer patients. (INCA, 2020)

MOLECULAR BASIS AND IMMUNOLOGY OF CANCER

Cancer is a complex disease that begins and progresses through a gradual accumulation of mutations in the DNA of cells. These mutations can manifest in several ways, including changes in

the sequence of bases, loss or gain of genetic material, and simple or complex chromosomal rearrangements (BLANK et al., 2016).

The first evidence of the role of mutations in cancer arose from the observation of recurrent and specific genetic changes in certain types of tumors. These alterations, initially observed at the chromosomal level, revealed an intriguing pattern: the mutations affected different stages of the pathways that control cell proliferation, differentiation and survival (GUEMBAROVSKI and CÓLUS, 2008).

As research advances, we understand that cancer is the result of the uncontrolled growth of cell populations that have accumulated mutations over time, in a process known as monoclonal expansion. This process culminates in the formation of tumors, composed of cells with different patterns of genetic alterations, demonstrating great heterogeneity both within the tumor itself and among different patients, even those with histologically similar tumors.

In summary, cancer is a multigenic disease that originates from a single normal cell that accumulates mutations over successive cell divisions, initiating a process of clonal evolution (CAVENE and WHITE, 1995).

Some factors are associated with the oncogenic process, as occurs in the cases of:

SELF-SUFFICIENCY IN SIGNS OF GROWTH

Cancer cells acquire the ability to manufacture their own growth factors, ensuring their uncontrolled growth. Oncogenes and mutated genes act as the mentors behind this self-sufficiency (ONUCHIC and CHAMMAS, 2010).

INSENSITIVITY TO GROWTH INHIBITORY SIGNALS

Cancer cells evade inhibitory signals and continue their proliferation. The retinoblastoma gene, when mutated, contributes to this insensitivity by disrupting the orderly regulation of cell division. (GUEMBAROVSKI and CÓLUS, 2008).

EVASION OF CELL DEATH

Cancer cells are able to escape programmed death, allowing them to accumulate and persist. The p53 gene, a tumor suppressor, plays a crucial role in orchestrating apoptosis. Loss of p53 function enables cancer cells to evade cell death, granting them an unfair advantage (Martinez et al., 2006).

UNLIMITED REPLICATION POTENTIAL

Cancer cells defy natural limitation by acquiring the ability to replicate indefinitely. This immortality results from mutations in specific genes, turning them into perpetual growth machines (CASALICCHIO, SEDA, and SOUZA, 2022)

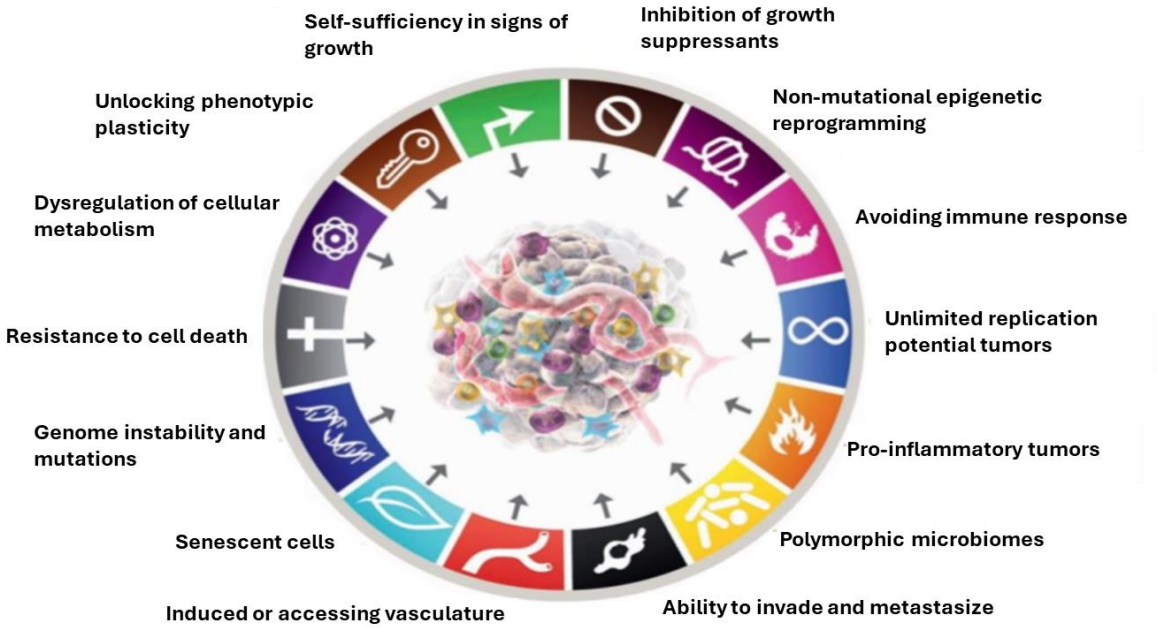
DEVELOPMENT OF SUSTAINED ANGIOGENESIS

Tumors require a constant supply of oxygen and nutrients, which are supplied by a network of blood vessels. Cancer cells induce the formation of new blood vessels, a process called angiogenesis, ensuring their nutrition and growth. Disruption of the p53 gene may contribute to uncontrolled angiogenesis, providing an uninterrupted lifeline for the tumor (FETT-CONTE, SALLES, 2002).

ABILITY TO INVADE AND METASTASIZE

The most lethal aspect of cancer is its ability to invade surrounding tissues and establish distant metastases. The mechanisms underlying this invasive behavior are not yet fully understood. However, research suggests that interactions between cancer cells and their microenvironment play a crucial role, allowing them to break free from their primary location and colonize new territories (OLIVEIRA and GOMIDE, 2020) (TEIXEIRA, 2007).

Figure 1. Hallmarks of Cancer- new additions. HANAHAN, 2022.



IMMUNOTHERAPY

At first, surgery was used to treat cancer, a procedure that has been recorded since 3000 B.C. and consists of tumor excision. Over the years, with science and technology, other possibilities have been structured for oncological propaedeutics, such as radiotherapy, which aims to destroy cancer cells or prevent them from multiplying by means of ionizing radiation; chemotherapy, which, through the advent of drugs with cytotoxic action, has the same purpose as radiotherapy, but uses a systemic reaction (PEREIRA, 2023). Nevertheless, these therapeutic techniques often bring serious side effects to the body, including: emesis, inappetence, weakness, hair loss and skin reactions from the toxic effect of radiation; thus interfering with patients' quality of life (NANI, et al, 2021).

In this context, from the nineteenth century onwards, a new modality for the treatment of cancer began to be studied: immunotherapy, with the intention of being a less aggressive and more specific process compared to conventional ones. Thus, the need for a less reactive treatment culminated in studies on the mechanisms of influence of specific cell receptors on the stimuli of the body's own defense response in tumor cells, thus achieving a therapy that stimulates the patient's immune system to counteract the disease. Immunotherapy, because it has this action of amplifying the individual's own immune response to fight tumor cells, has been of great importance for some types of cancer and for immunotherapy research (FONTOURA et al., 2021).

In immunotherapy, different ways of action in the body are explored. Some treatments have the most generalized mechanism, that is, it induces a general immune response throughout the body, while others have a more restricted and targeted action, by causing the immune system to attack cancer cells in particular (FACUNDO and SILVA, 2019).

ACTIVE IMMUNOTHERAPY

Active immunotherapy stands out as an approach in the fight against cancer because it is a strategy that awakens, trains, and equips the patient's own immune system to recognize and eliminate cancer cells accurately and efficiently. Substances that restore and stimulate the immune response are used. Examples of this method include cell therapies such as CAR-T cells and vaccines, which involve stimulating the immune system itself to recognize and eliminate tumor cells. Active immunotherapy is divided into two modalities: specific and nonspecific (SANCHES, MOURA, RODRIGUES et al, 2023).

SPECIFIC

This division of immunotherapy relies on substances, such as prophylactic and therapeutic vaccines, that enable the immune system to recognize and eliminate tumor cells accurately (PENATTI, 2019). According to Oliveira and Gomide, it can be autologous, being produced from the

patient's own cell culture, or heterologous, when they are produced with the cells of another patient with a similar neoplasm.

For better understanding, imagine an army that is highly trained and equipped to fight a specific enemy. Specific active immunotherapy creates exactly this army of defense cells, which specialize in identifying and attacking tumor cells. Prophylactic vaccines prepare the immune system to recognize the tumor antigens and molecules present on the surface of cancer cells. This works as pre-training, equipping the body to identify and fight the tumor before it even develops. Therapeutic vaccines, on the other hand, are composed of inactivated tumor cells or fragments of them. When injected into the body, they serve as targets for the immune system trained by prophylactic vaccines, triggering a precise and targeted attack against the tumor, and a long-lasting specific immune response, capable of promoting tumor regression, that is, the reduction or even the disappearance of cancer (GIACOMINI and MENEZES, 2012).

Despite the previously mentioned factors, specific active immunotherapy goes beyond fighting cancer. It can also be used to prevent the recurrence of the disease and even to treat other diseases, such as infectious diseases and autoimmune diseases (FREIRE, 2019).

NONSPECIFIC

Nonspecific active immunotherapy consists of the administration of stimulating and restorative substances of the immune system in general, involving nonspecific immunological agents and cytokines (nonspecific immunomodulatory agents) that will stimulate or potentiate the immune response. In this way, this strategy strengthens our body's defenses against unwanted invaders, through the introduction of microorganisms, meticulously grown in the laboratory, into the body, aiming to awaken and amplify the power of the immune system. These microorganisms are endowed with immunogenicity, that is, they have the ability to stimulate the immune system, triggering a series of beneficial events (SONG, ZHANG and WU, 2018).

Cytokines, which are introduced along with the microorganisms, play a key role in the treatment. These messenger molecules, secreted by microorganisms, serve as a communication bridge between cells, amplifying the immune response and directing it to fight invaders**.** Cytotoxic cells, also known as killer cells, are strengthened by nonspecific immunotherapy. This leads to an intensification of the action of these cells, which culminates in the elimination of cancer cells and other pathogens (BILIERI and GALVINHO, 2019).

Accordingly, nonspecific immunotherapy demonstrates great versatility in its field of action. It can be used to fight cancer autonomously, that is, as the main treatment. In other situations, it assumes a complementary role, acting as an adjuvant to potentiate the response of other types of

immunotherapy, such as cancer vaccines. This synergy between the methods contributes to a more robust attack against cancer cells (OLIVEIRA and GOMIDE, 2020).

PASSIVE IMUNOTHERAPY

Passive immunotherapy plays a crucial role in the fight against cancer. It works as a direct reinforcement of the patient's immune system, because, instead of stimulating the body's own immune cells to recognize and attack the tumor, this approach directly provides the body with cells and antibodies ready for the immune response (CAMPOS, et al, 2020).

One of the main types of Passive Immunotherapy involves the infusion of T cells and NK cells, known as effector cells. These cells, grown in the laboratory from healthy donors or the patient himself, are trained to recognize and eliminate tumor cells accurately and efficiently (TEIXEIRA, et al, 2019).

Another Passive Immunotherapy strategy uses monoclonal antibodies, artificial molecules that bind to specific proteins on the surface of tumor cells. These antibodies can act in several ways, such as: (GUIMARÃES, SILVA and RANGEL, 2008)

1. Target Marking: Directing effector cells of the immune system to tumor cells, facilitating their identification and elimination.
2. Blocking Growth Signals: Disrupting the signals that stimulate the growth and proliferation of tumor cells.
3. Induction of Cell Death: Activating mechanisms that lead to the death of tumor cells.

Adoptive Cell Therapy, a specific type of Passive Immunotherapy, stands out for using the patient's own immune cells to fight cancer. Through a painstaking process in the laboratory, T cells or NK cells are collected from the patient, multiplied, and trained to recognize and attack tumor cells. As for their types, they include: (BILIERI and GAVINHO, 2019).

1. Lymphocin-Activated Killer Cell (LAK) Therapy: The patient's T cells are cultured with cytokines, substances that stimulate them to become efficient killer cells.
2. Tumor-Infiltrating Lymphocyte (LIT) Therapy: T cells that have already infiltrated the tumor are collected, expanded, and reinfused into the patient

In summary, the advantages of Passive Immunotherapy are: precision, observed, for example, in the action of mAbs, which can bind to specific targets in tumor cells, minimizing the impact on healthy cells; efficacy, since it can be effective in the treatment of several types of cancer, including those that do not respond to other therapies; and safety, as it usually has fewer serious side effects than other cancer therapies, such as chemotherapy and radiotherapy (JESUS, 2002).

MODELS OF IMMUNE THERAPY

VACCINE

In the field of immunization, DNA vaccines represent a groundbreaking milestone, the result of biotechnological advances in recombinant DNA. These vaccines contain fragments of DNA that encode specific antigens of a pathogen, and when administered to the patient, these DNA molecules are internalized by the cells of the immune system, which recognize them as foreign genetic material. For vaccines to work, the antigen needs to be recognized by the cell that presents the antigen (APC) and then induce specific cytotoxic T lymphocytes against the antigen, that is, trigger the immune response (DINIZ and FERREIRA, 2010).

In a more lucid way, vaccines work as messengers, presenting the immune system with tumor antigens, unique molecules present on the surface of cancer cells. After this exposure, white blood cells, especially dendritic cells, are activated and become experts in identifying and fighting cancer. To enhance this immune response, pro-inflammatory molecules, such as IL-2 (interleukin 2), are released. These cytokines act as adjuvants, amplifying the number of activated dendritic cells at the vaccination site (SANMAMED, CHEN, 2018).

A crucial step in this method, encompassed as active immunotherapy, is the purification of dendritic cells, starting from the patient himself. They are incubated in the laboratory with the tumor antigens extracted from the individual's cancer cells. This incubation process ensures that the dendritic cells are trained and ready to recognize and specifically attack cancer. Finally, the "trained" dendritic cells are injected back into the patient, where they infiltrate the tumors and release substances that attract and activate other immune system cells, such as cytotoxic T lymphocytes, which act by inducing cell death (FRANCELINO et al, 2022).

Recombinant DNA technology allows the production of antigens with high precision and purity, ensuring a specific and effective immune response, as they can induce long-lasting immune responses, both humoral and cellular, protecting the individual for long periods. DNA vaccines are still in clinical development, but preliminary results are extremely promising (DINIZ and FERREIRA, 2010).

CAR-T CELL IMMUNOTHERAPY

CAR-T cell therapy is an active immunotherapy, that is, it uses the patient's own immune system to fight cancer. This revolutionary approach offers hope for patients with hematologic malignancies and solid tumors that do not respond to traditional treatments (SOARES et al, 2022).

CAR-T cells (Chimeric Antigen Receptor T-cells) are T cells, a type of white blood cell crucial for the body's defense, that are genetically modified in the laboratory. Through genetic engineering, an artificial receptor called CAR (Chimeric Antigen Receptor) is inserted into T cells,

which makes them able to recognize and attack cancer cells with precision. This CAR receptor works like a radar, allowing CAR-T cells to identify and bind to specific proteins present on the surface of tumor cells, triggering their destruction (CERRANO et al., 2020).

It is a complex and customized process that requires a specialized laboratory infrastructure. Key steps include:

1. T-cell collection: A blood sample from the patient is collected for extraction of the T-lymphocytes.
2. Genetic modification: Incorporation of the patient's cancer-specific CAR receptor into the T cells.
3. Cell expansion: The modified CAR-T cells are multiplied in large numbers in the laboratory to ensure a sufficient amount for treatment.
4. Quality Control: CAR-T cells are rigorously tested to ensure their safety and functionality prior to infusion into the patient.

CAR-T cell therapy has shown promising results in the treatment of several types of cancer, especially in hematological malignancies: acute B-cell lymphoma (ALL), non-Hodgkin's lymphoma (NHL), acute myeloid leukemia (AML) and multiple myeloma (MM). Likewise, it has demonstrated potential in the treatment of solid tumors: lung tumors, sarcoma, melanoma, and head and neck tumors (in ongoing clinical studies) (ROEX et al., 2020).

CAR-T cell immunotherapy is particularly effective in patients who have not responded to treatments, such as chemotherapy or targeted therapy. The mechanism of action of CAR-T cells allows for a targeted, individualized, and persistent attack on cancer cells while minimizing damage to healthy tissues, which results in fewer serious side effects compared to traditional treatments (VOORDECKERS et al, 2024).

CHECKPOINT INHIBITORS

In a study, researchers at the University of Texas at Austin unraveled the crucial role of cytotoxic T-lymphocyte antigen-4 (CTLA-4) in tumor growth. CTLA-4, also known as CD152, acts as a brake on the immune system by suppressing the activation of cytotoxic T cells (CTLs), which are responsible for fighting cancer cells directly. By blocking the activity of CTLA-4 with the use of specific antibodies (anti-CTLA-4), the researchers observed a surprising reversal: the CTLs regained their ability to attack tumors (ALLISON et al., 1996).

CTLA-4 is a protein present on the surface of activated T cells, having the function of maintaining self-tolerance and modulating the immune response against pathogens and cancer cells. After activation of T cells, through their T antigen receptor (TCR), they express CTLA-4 on their surface. This protein binds with high affinity to the B7-1 (CD80) and B7-2 (CD86) molecules present

in antigen-presenting cells (APCs). This interaction generates a series of signals within the T cell that inhibit its activation and proliferation, thus preventing autoimmune reactions and exaggerated responses to pathogens (SEIDEL, OTSUKA, and KENJI, 2018).

Acting then as an immune "checkpoint", this suppression is crucial to prevent autoimmunity, but in the context of cancer, it becomes an obstacle to an effective immune response (FRANCELINO et al., 2022).

By blocking CTLA-4, anti-CTLA-4 releases CTLs from their inactive state, allowing them to return to their cytotoxicity role. This immunotherapeutic approach has shown promising results in several types of cancer, including melanoma, lung, and kidney. (TEIXEIRA et al., 2019).

Recent evidence suggests that the antitumor effect of anti-CTLA-4 goes beyond simple CTLA-4 inhibition. One of the most important mechanisms appears to be regulatory T cell (Treg) depletion. Treg acts as immune system suppressors, preventing T cells from attacking other cells, including cancer cells. By eliminating Treg, anti-CTLA-4 releases effector T cells to attack tumors more vigorously.

Another aspect of anti-CTLA-4 is its ability to unblock the activity of APCs, leading to increased production of pro-inflammatory cytokines and the activation of other immune cells, such as dendritic cells and natural killer (NK) cells. This general amplification of the immune response, coming from synergistic actions of anti-CTLA-4, leads to the credibility of the treatment (BARRY et al., 2018).

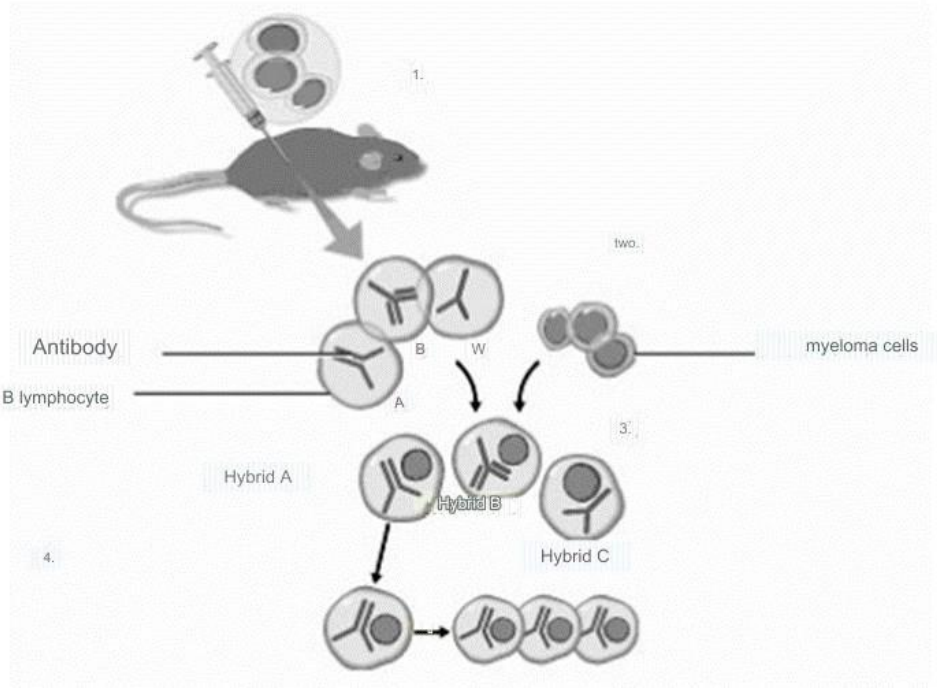
MONOCLONAL ANTIBODIES

The use of monoclonal antibodies (mAb) is a type of passive immunotherapy. mAb are nothing more than antigen-recognizing proteins with a high degree of affinity and in a specific way, developed from the cell fusion technique, described by Kohler and Milstein in 2005.

This method allows the creation of hybridomas, hybrid cells that combine the characteristics of a B lymphocyte (immunized against a specific antigen) with those of a myeloma cell (immortal). This fusion results in cells capable of producing monoclonal antibodies (ACM) on a large scale, as illustrated in Figure 2 (FIGUEIREDO, 2020).

This technique is widely used in the treatment of B-cell lymphoma, in which the monoclonal antibody (mAb) binds to the CD20 protein, present on the surface of malignant B cells. By binding to CD20, anti-CD20 mAb activates a series of mechanisms that lead to the destruction of tumor cells, such as the activation of the patient's own immune cells and the direct death of malignant B cells (AFONSO, 2017).

Figure 2. Somatic cell hybridization technique. SANTOS, 2006.



CHEMOTHERAPY *VERSUS* IMUNOTHERAPY

Chemotherapy and immunotherapy stand out as therapeutic approaches to combat malignant neoplasms. Each with its strengths and weaknesses, they represent distinct approaches in the fight against this disease. (BARROS, 2001)

Chemotherapy acts as a general bombardment, releasing its chemical compounds to destroy cancer cells throughout the body. This strategy, however, is not always precise, also affecting healthy cells and causing undesirable side effects, such as nausea, fatigue and hair loss.

On the other hand, immunotherapy emerges as a promising alternative, training the patient's own immune system to recognize and eliminate cancer cells. This more specific approach minimizes damage to healthy cells, potentially offering a longer-lasting and less toxic response (WOLCHOK, BOLAND, AND HUNG, 2023).

MECHANISMS OF ACTION

Chemotherapy drugs disrupt the cycle of cell division, preventing cancer cells from proliferating. This tactic is effective against several types of cancer, but it can be unforgiving to healthy cells, causing systemic side effects. (BILIERI and GAVINHO, 2019)

Meanwhile, immunotherapy stimulates the patient's immune system so that it recognizes and specifically attacks cancer cells. This approach uses a variety of techniques, such as monoclonal antibodies and immune checkpoint inhibitors, to awaken the body's natural power against disease. (SILVA, 2024)

EFFICACY AND APPLICATIONS

Chemotherapy is a therapeutic approach with a broad spectrum of action. It is effective in the treatment of several types of cancer, both in early and advanced stages, and can be used as a single therapy or in combination with other treatments, such as radiation therapy or surgery.

In the case of immunotherapy, great potential has been observed in the treatment of some specific types of cancer, such as melanoma, lung and kidney, thanks to the high specificity involved in this method. Its effectiveness varies according to the type of tumor and the characteristics of the patient. (JUNIOR, 2023)

SIDE EFFECTS AND QUALITY OF LIFE

Chemotherapy can cause several side effects, such as nausea, fatigue, hair loss, changes in the oral mucosa and taste, in addition to increasing the risk of infections. These effects can significantly impact the patient's quality of life.

On the contrary, immunotherapy is shown to be a milder approach with fewer side effects. It usually has less severe and more tolerable side effects than chemotherapy. The most common side effects include fatigue, skin reactions, digestive issues, and autoimmune changes (WOLCHOK, OLAND, AND HUNG, 2023).

IMMUNOTHERAPY: A TURNING POINT IN THE FIGHT AGAINST CANCER

In summary, when analyzing the information clarified throughout this chapter, it becomes clear that immunotherapy represents a milestone in oncological studies, as it offers a new perspective for the treatment of various types of cancer. This innovative approach shows itself as a hope in the fight against this disease, responsible for reducing the quality of life of countless people, even leading to death. Thus, with the objective of activating the patient's own immune system to attack cancer cells in a precise and effective way, and with low rates of side effects, this method is revolutionary and promising for cancer treatment.

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Young adult women with suicidal behavior in Brazil: A literature review

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ABSTRACT

Introduction: According to the World Health Organization (WHO), suicide is the third leading cause of death among young women aged 15 to 29 years. Suicidal behavior encompasses suicidal ideation with or without a plan, suicide attempts, and suicide itself. Objective: to carry out an integrative literature review on national scientific production in the period from 2017 to 2022, collecting in the literature what leads young women to attempt against their own lives. Method: an integrative literature review of the literature on suicide attempts by young adult women in Brazil. a database of the National Library of Medicine, National Institute of Health (PubMed) was searched. Results: that there is a lack of knowledge about suicide attempts with a gender perspective, as well as the creation of strategies to promote life and prevent suicide. Conclusion: there is a lack of studies in the literature in the area that cover young adult females. Through the analysis of the selected studies, it is evident that the most frequent causes in the study refer to violence, disorders and the use of alcohol and other drugs.

Keywords: Young adult, Suicide attempt, Suicidal behavior.

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INTRODUCTION

Suicide can be understood as "a deliberate act performed by the individual himself, whose intention is death, consciously and intentionally, using a means that he believes to be lethal"[1]. According to the Pan American Health Organization (PAHO)[2], it appears as the third leading cause of death among young women aged 15 to 29 years and the fourth cause among men at the same age; therefore, it can be defined as an intentional action designed to be lethal2. Thus, suicidal behavior encompasses a diversity of behaviors, ranging from suicidal ideation with or without a plan, suicide attempts and suicide itself3. Self-injurious behavior or self-inflicted violence includes suicidal ideation, self-mutilation, suicide attempts, and suicides4. Self-harm is distinguished from suicide attempt because, although it includes any intentional act of self-mutilation intended to cause harm to oneself, there is not necessarily an intention to kill, although it can represent a warning sign that the person needs mental health care4.

Suicide is a difficult phenomenon to understand, due to the fact that it is multifaceted, studied by several areas of the field of health, sociology and philosophy, and there is no single consensus among the areas. Thus, knowledge of the subject becomes indispensable to approach it in an ethical and respectful manner5.

In 2019, approximately 703,000 people of all ages committed suicide worldwide. Of these, 97,339 people died by suicide in the Americas alone. In Brazil, in the same period, 12,745 individuals lost their lives due to suicide. In Rio Grande do Sul, 1,280 people were killed in self-harm in 20196. PAHO warns that suicide rates in the Americas increased by 17% in 2019, although they have decreased in the rest of the world2 – in the Eastern Mediterranean region these rates shrank by 17%, in the European region by 47% and in the Western Pacific by 49%.

A suicide has an impact on the lives of at least six other people emotionally, socially, and economically7. All people close to the victim are affected, whether colleagues, friends, health professionals, police officers or any people who have witnessed the suicide or followed the fact in any way. These effects can remain for generations in the family through the community's reporting and culture8. An American study concluded that each suicide affects up to 135 people; According to this research, all the people who knew the victim suffer some effect9.

The World Health Organization (WHO)[10] states that it is possible to prevent suicide, but health professionals need to be able to recognize the risk factors present during care. Some studies, such as those by Abreu *et al.*[11], demonstrated that when suicide risk is correctly identified and necessary measures are taken, suicide rates tend to fall.

In order to change this scenario, the WHO10 has produced new guidelines so that countries can create conditions to prevent suicide and, thus, provide humane care to people at risk and their families. Moving in this direction, in June 2022, the WHO announced that the 194 countries that are

part of the Organization signed the term committing to global goals to positively modify mental health. The Mental Health Plan 2013-2030 has advanced in the last decade, proving that it is possible to change the suicide scenario, but greater effort is needed on the part of member states12. The WHO10 considers young adults to be people between 20 and 24 years of age. Thus, when referring to this age group, we will use the expression: young adult. The decision to use this specific public is due to the need to analyze data on suicide attempts in order to better understand this phenomenon and contribute with knowledge that can serve as a basis for the production of Public Care Policies12.

According to the "Suicide Worldwide in 2019: global health estimates", a report published by the WHO, in 2019, 703,000 people committed suicide worldwide. That same year, suicide killed more people than HIV/AIDS or cancer13. In Brazil, 12,745 people died by suicide in 20206.

In terms of gender, the number of suicides among men is historically higher than that of women14. However, for Meneghel *et al.*[15], there is an increasing trend in recent years among women aged 10 to 14 and 20 to 29 years of age. Statistics from 2011 to 2015 indicate that suicide is the eighth leading cause of death among women16, explaining this increase, data from 2019 referring only to suicide attempts showed that the rates are equivalent to 60% for women and 31% for men, making it evident that female suicide attempts need greater attention14.

For Meneghel *et al.*[15], there are many studies on the subject, but there are few that consider female suicide and gender perspectives, and additional research is needed to understand the determinants of female suicide. When considering only completed suicide, the existing problem is male, but when considering suicidal ideation and attempts, the problem becomes predominantly female. Thus, the social determinants involved in its occurrence deserve to be studied in order to be understood more comprehensively15.

Analyzing gender in notifications can be an important element to identify adversities experienced by certain populations17. There is a considerable number of publications on the subject of suicide, but suicide attempts with a gender debate are still little explored14.

Blanco18 developed an exploratory bibliographic research, compiling the published and available material on female suicide in Brazil in order to understand the seriousness of the issue and what else there was of research in the area. The author identified that half of the articles analyzed focused on the relationship between suicide/suicide attempts and everyday violence.

An advance in suicide prevention took place with the implementation of the National Policy for the Prevention of Self-Mutilation and Suicide (PNPAS), when Law 13,819/2019 was sanctioned. Suspected or confirmed cases of self-inflicted violence have become mandatory not only in health institutions (public or private), but have also been included in educational establishments, whether public or private14.

In this study, we sought to analyze the publications that deal with the theme of suicide attempts, in order to identify the reasons and means most used by young adult women, to contribute to the understanding of this phenomenon from a gender perspective.

METHODOLOGICAL PROCEDURES

This study consists of an integrative literature review, whose method consists of summarizing the state of the art, i.e., selecting the results obtained and published in scientific articles, books, book chapters, as well as theses and dissertations, among other sources, in an organized and comprehensive manner19. In this study, the National Library of Medicine and National Institute of Health (PubMed) database was chosen. This review method is composed of six steps: 1) identification of the theme and the guiding research question (which can be found in the introduction of this work); 2) definition of inclusion and exclusion criteria; 3) data collection of selected articles; 4) critical analysis of the articles and identification of the evidence found; 5) interpretation of results; and 6) synthesis of knowledge20.

By conducting an integrative literature review on national scientific production, in the period from 2017 to 2022, we searched the literature for what leads young women to attempt against their own lives, synthesizing by production according to author, year of publication, journal of publication, objective and methods. The objective was to identify if there are publications on the means most used by young women in Brazil who attempted against life, published between the years 2017 and 2022 and if there is a profile described of these young women.

The inclusion criteria used in this research were as follows: 1) complete and free scientific articles; 2) scientific articles containing the set of keywords: young adult, suicide attempt or suicidal behavior; and 3) articles describing the characteristics of suicide attempts among young women.

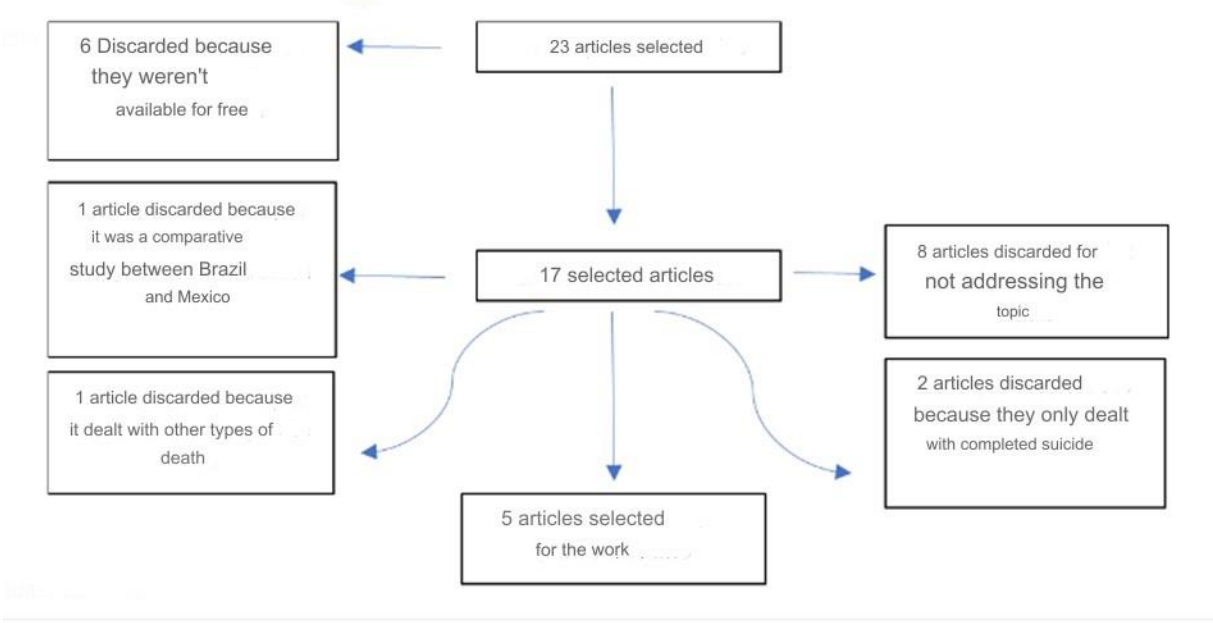
For the exclusion criteria, the following were used in this research: 1) articles that did not deal with the theme; 2) articles dealing only with suicide; and 3) articles whose full access would be paid.

In order to meet the specific objectives of the study, a spreadsheet was created in Google Drive with the information obtained about the publications selected according to the criteria described. Data collection was carried out in November 2023. For the research, the following database was chosen: PubMed.

Firstly, the search in the PubMed database was performed using the descriptors and the selection of the period of publication, and 23 articles were selected by the search strategy. Then, those that were not freely available were excluded; Subsequently, by reading the title and the abstracts found, those that were not related to the theme and objectives of the research were excluded. Next, the articles in the final sample were read in full, discarding those that were not aligned with the objectives of this review. The selected articles, in the number of five studies, had

their data synthesized and their information extracted, as well as the evaluation of the studies, discussion of the results and, finally, the construction of the review was made. The flowchart of this research is below and the product was represented by a table that can be found in the results for a better visualization and evaluation of the full applicability of the methodology in the review.

Figure 1 - Flowchart of the study selection process for the systematic review



Source: prepared by the authors.

RESULTS

Chart 1 presents the results of the integrative literature review research, showing the authors of the articles read, the year of publication, the titles of the articles, the objectives outlined, the methods used, their main results, and the conclusion.

Chart 1 - Results found in the literature review from 2017 to 2022 related to suicide attempts among young women in Brazil

Authors	Pub Year.	Magazine / Newspaper	Objectives	Method	Results	Conclusion
Vasconcelos Neto[21] PJA, Moreira RDS, Oliveira Júnior FJM, Ludermir AB.	2020	Rev Bras Epidemiol	OBJECTIVE: To investigate the association of **suicide attempt** (ST) with Post-Traumatic Stress Disorder (PTDD) and Intimate Partner Violence (IPV) in a cohort of **women** enrolled	This is a cross-sectional study nested in a prospective cohort study with 644 women aged 18 to 49 years.	Women who had PTSD and those who had no religion had a higher risk of suicide.	Prevention, treatment and promotion of greater knowledge about this disorder, in addition to the aggregating and social protective effect promoted by religiosity, can be a strategy for

			at the Family Health Unit of Recife.			the reduction and prevention of suicide.
Wiener[22] CD, Moreira FP, Zago A, Souza LM, Branco JC, Oliveira JF de.	2018	Brazilian Journal of Psychiatry	To assess the prevalence of alcohol abuse and/or dependence in a population sample of young adults and to assess the prevalence of comorbid mood disorders, anxiety, and suicide risk in this population.	This is a cross-sectional population-based study.	Alcohol abuse and/or dependence was identified and proven to be more prevalent among men than among women and among those who used tobacco, illicit drugs, or had an anxiety disorder, mood disorder, and suicide risk.	Alcohol abuse and/or dependence are consistently associated with a higher prevalence of psychiatric comorbidities, and deserve greater public health attention, necessitating alcohol abuse prevention programs
Rafael23 RMR, Jalil EM, Luz PM, de Castro CRV, Wilson EC, Monteiro L, Ramos M, Moreira RI, Veloso VG, Grinsztejn BGJ, Velasque LS.	2021	PLoS One.	OBJECTIVE: To estimate **the lifetime prevalence of suicidal behavior** and identify its associated factors among Brazilian **trans women**.	This cross-sectional study was conducted among 345 trans women living in Rio de Janeiro, Brazil.	Suicide attempt was significantly associated with living alone, physical violence by a casual partner, and sexual violence by a family member. Depression was associated with both suicidal ideation and suicide attempts.	The prevalence rates of suicidal behavior among Brazilian trans women are directly linked to violence and poor mental health. Effective mental health and public health policies that address violence against trans women are necessary for its prevention.
Gomes24 AP, Soares ALG, Kieling C, Rohde LA, Gonçalves H.	2019	Rev Public Health.	To evaluate the prevalence of some **mental disorders and the risk of suicide** and the association between them **in young people.**	Data from the 1993 Pelotas Birth Cohort (Brazil) were used.	All disorders (except APD) and suicide risk were higher among women. The greater the number of concomitant mental disorders, the higher the risk of suicide.	About 20% of the young people had at least one mental disorder. Mental disorders were associated with a higher risk of suicide, especially comorbidity among them.

Roglio25 VS, Borges EN, Rabelo-da-Ponte FD, Ornell F, Scherer JN, Schuch JB, Passos IC, Sanvicente-Vieira B, Grassi-Oliveira R, von Diemen L, Pechansky F, Kessler FHP	2020	PLoS One.	To investigate factors **associated with suicide attempts** in hospitalized patients diagnosed with **cocaine** use disorder using two analytical approaches.	This was a cross-sectional study using a secondary database with 247 men and 442 women hospitalized for cocaine use disorder.	The prevalence of suicide attempts was 34% for men and 50% for women. Depression and hallucinations were factors associated with suicide attempts.	The findings indicate that suicide attempt is associated with depression, lucinations, and childhood trauma in both sexes. Psychiatric issues were shown to be more important for women than for men.

Source: prepared by the authors.

DISCUSSION

With the proposed objective of identifying if there are in the literature the motives and means most used by young adult women who tried against their own lives, analyzing the selected texts of Vasconcelos Neto *et al.*[21], Wiener *et al.*[22], Rafael *et al.*[23], Gomes *et al.*[24] and Roglio *et al.*[25], the following results were found.

Vasconcelos Neto *et al.*[21] produced a cross-sectional cohort study with 644 women aged 18 to 49 years, enrolled in the Family Health Strategy of the Sanitary District II of the city of Recife (PE), whose main objective was to investigate the association of suicide attempts (ST) with post-traumatic stress disorder (PTSD), intimate partner violence (IPV) and variables related to socioeconomic and demographic aspects in this portion of the population. The authors found that women who had PTSD and those who had no religion were more likely to attempt suicide.

Wiener *et al.*[22] produced a population-based cross-sectional study involving 1,953 young adults aged between 18 and 35 years living in the city of Pelotas, Southern Brazil. The aim of this study was to evaluate alcohol use disorders (APD) in a population sample of young adults and to assess the prevalence of comorbid mood disorders, anxiety, and suicide risk in this population. Among the study participants, 54.9% were female and 75.9% were white. Their study showed that 7.5% reported the use of other illicit drugs and 13% demonstrated suicide risk. Alcohol abuse was present in 187 individuals, or 9.6%, of which 5.10% were women and 15.20% were men. In their study, Wiener *et al.*[22] asserted that the abuse of alcohol, tobacco, and other illicit drugs was more associated with males, as well as anxiety, mood, and suicide risk disorders. Their research confirmed that alcohol abuse and/or dependence is related to a higher share of psychiatric comorbidities.

Rafael *et al.*[23] conducted a cross-sectional study among 345 trans women living in Rio de Janeiro, whose main objective was to estimate the prevalence of suicidal behavior throughout life, seeking to identify associated factors among Brazilian trans women. In this study they report that trans women face a disproportionate burden, which results in a negative burden on health, including mental health, and that little is known about suicidal behavior in this portion of the population. They described that suicidal ideation was present in 47.25% of the participants, and the lifetime prevalence of suicide attempts was 27.25%. Suicidal ideation was significantly lower in those who reported sex work than in those who reported previous violence committed by a family member. However, suicide attempt was considerably associated with living alone, physical violence by a casual partner, and sexual violence by a family member. Depression was associated with both suicidal ideation and suicide attempts. Rafael *et al.*[23] deduced that suicidal behavior among Brazilian trans women has a high prevalence and is directly linked to violence and poor mental health.

Gomes *et al.*[24] described a cross-sectional birth cohort study in Pelotas with follow-up of 5,249 individuals. These children, whose mothers consented to the study, were followed at various times for 22 years, starting in 1993. The observation indicated that 20% of the research participants had one or more disorders, and of these, 8.8% were at risk of suicide. In addition, the research showed that, among the mental disorders, those with the highest risk of suicide were major depressive disorder (MDD) and PTSD. Regarding gender, women had a higher risk of suicide and other disorders, with the exception of antisocial personality disorder (ADD). The researchers showed that the greater the number of disorders, the greater the risk of suicide. The study revealed that 60% of the young participants in the research with suicidal ideation had a plan formulated and that 45% of those who developed a plan consummated suicide.

Roglio *et al*.In their study, [25] describe a cross-sectional study with 247 men and 442 women hospitalized due to crack and cocaine use disorders. The rate of suicide attempts for this group was 34% for men and 50% for women. Research has shown that some signs can be related to both sexes, such as mental disorders, drug abuse, and early exposure to violence; However, sexual violence, eating disorders and bipolar disorder are factors related to the female sex. Depression and hallucinations were associated with suicide attempts for both sexes. Other factors such as childhood trauma, aggression and severity of drug use were also found. Drug use was considered a serious indication of suicide risk, especially for women. The authors concluded that psychiatric issues are more important for women and that suicide attempts are intrinsically related to depression, hallucinations and childhood trauma in both sexes.

As a strategy to reduce and prevent suicide attempts and PTSD, Vasconcelos *et al.*[21] affirm that there is a need for greater knowledge about them, understanding the social protective effect that religiosity offers.

According to Wiener *et al.*[22], it would be interesting to create programs that inhibit alcohol abuse, since his research has shown that this factor is related to a greater participation in psychiatric comorbidities.

Roglio *et al.*[25] suggest the creation of strategies to promote life and combat suicide, since there is a lack of studies that analyze cocaine use, stratified by sex, demonstrating the existence of an important gap in the fight against suicide.

For Gomes *et al.*[24], the idea that individuals at risk of suicide need close monitoring was confirmed in their research, since suicide attempts are the main risk factor for completed suicide.

Rafael *et al.*[23], whose study focused on trans women, infers that the development of effective public mental health and public health policies that address violence against trans women can prevent suicidal behavior in this portion of the population.

CONCLUSION

From 2017 to 2022, the literary production was systematized according to author, year of publication, journal of publication, objective, methods, results, and conclusion. Regarding this objective, it was concluded that there is still a lack of studies in the literature in the area that cover young adult females. Through the analysis of the selected studies, it was evident that the most frequent causes in the study refer to violence, disorders and the use of alcohol and other drugs.

Although all the articles in the selection dealt with the theme of suicide attempts, the causes were not common to all; but the coincidental identification in all the articles is that the highest rate of suicide attempts is among women. The objective of identifying which methods were most used and which reasons was inconclusive – there would be a bias, since each study considered a disorder and/or some element, such as the use of crack and cocaine by Roglio *et al.*[25], on alcohol and illicit drugs by Wiener *et al.*[22] and female transsexuality for Rafael *et al.* [23].

In addition, the lack of knowledge of the specific factors that contribute to young women attempting to take their own lives impedes the formulation of effective prevention strategies. Thus, contributing to the identification, restricting itself to the female gender to better delineate this profile, becomes fundamental in suicide prevention.

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Factors that influence the mortality of critically ill burn victims: An integrative review

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ABSTRACT

Objective: To identify in the literature factors that influence the mortality of critically ill burn patients. Method: This is an integrative literature review. To create the guiding question, the PICo strategy was used, in which the population was established as "burn patient", interest in "factors associated with mortality" and as context "critical condition", formulating the following research question: What are the factors that influence the mortality of critically ill burn victims? The search was conducted in two selected databases: Virtual Health Library and PubMed, from August to October 2023. As this is an integrative review, the study does not require approval by the research ethics committee. Results: A total of 3077 scientific studies were identified in the initial search of the selected databases. After applying the selection criteria, 17 studies remained to compose the final sample. Among the findings, the main factors that influenced mortality were advanced age, greater burned surface area and body depth, presence of smoke inhalation, thermal burn due to direct flames, comorbidities, especially cardiovascular and renal diseases, and hypoalbuminemia. Conclusion: it was possible to identify that the main factors that influence the mortality of burn patients who are in serious condition, described in the literature are: advanced age, extent of the burned area, smoke inhalation, comorbidities and low amount of albumin in the body. It is important to know these factors in order to be able to offer comprehensive care and minimize risks in order to reduce deaths caused by the event.

Keywords: Burns, Critical Care and Mortality.

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INTRODUCTION

A burn is a traumatic injury that affects the skin or other tissues and organs, causing tissue destruction, and can be caused by thermal, chemical, and electrical agents. In addition to local injury, burns can generate systemic damage, which can progress to more severe cases such as shock, sepsis, systemic inflammatory response syndrome, multiple organ dysfunction, and death (Franck, et al., 2020).

The burned victim may have varying severity based on the extent and depth of the affected tissue, and may have the integrity of the skin compromised, difficulty in maintaining homeostasis and its protective barrier against external agents, being exposed to the risk of loss of body temperature and infections (Miranda, 2021)

According to the Guidelines Project: Burns: Diagnosis and Differential Treatment of the Brazilian Society of Plastic Surgery (2008), victims with second-degree burns with affected body area greater than 15% in children under 12 years of age and greater than 20% in children over 12 years of age are considered to be severe burns or severe burns; third-degree burns with body area greater than 5% in children under 12 years of age, or greater than 10% in children over 12 years of age; second- or third-degree burns reaching the perineum at any age; third-degree burns affecting the hand or foot or face or neck or armpit, at any age and burns by electric current.

It is also considered to be of great severity when, regardless of the extent, the burn is associated with other events or pathologies, such as: inhalation injury, polytrauma, bone fracture, shock of any nature, heart failure, renal failure, among others (Brazilian Society of Plastic Surgery, 2008).

In Brazil, there are approximately 1 million burn accidents per year and about 2,500 of these progress to death, proving that burns are characterized as an important public health problem (Barcellos, 2018).

In a study conducted with 141 patients hospitalized for burns in the Intensive Care Units of the Mackenzie Evangelical University Hospital in Curitiba-PR, the presence of some factors that influence mortality was evidenced, such as age, percentage of body surface affected by burns, and comorbidities (Franck, et al., 2020).

Knowing the multiple challenges of caring for critically ill burn patients, it is necessary to know the factors that influence their mortality in order to provide proper care and increase their chance of survival. Thus, recognizing the epidemiological importance of burn accidents and their negative outcomes, the objective of this study was to identify in the literature which factors influence the mortality of critically ill burn victims.

METHOD

This is an integrative literature review, a method that consists of synthesizing existing knowledge on a given topic, combining data from the literature in order to incorporate feasibility and purposes (Ercole, et al. 2014). To create the guiding question, the PICo strategy (P: Population, I: Phenomenon of interest, and Co: Context) was used (Rathbone; et al 2017). As a population, "burn patient" was established, "factors associated with mortality" was interested, and "critical condition" was formulated, formulating the following research question: What are the factors that influence the mortality of critically ill burn victims?

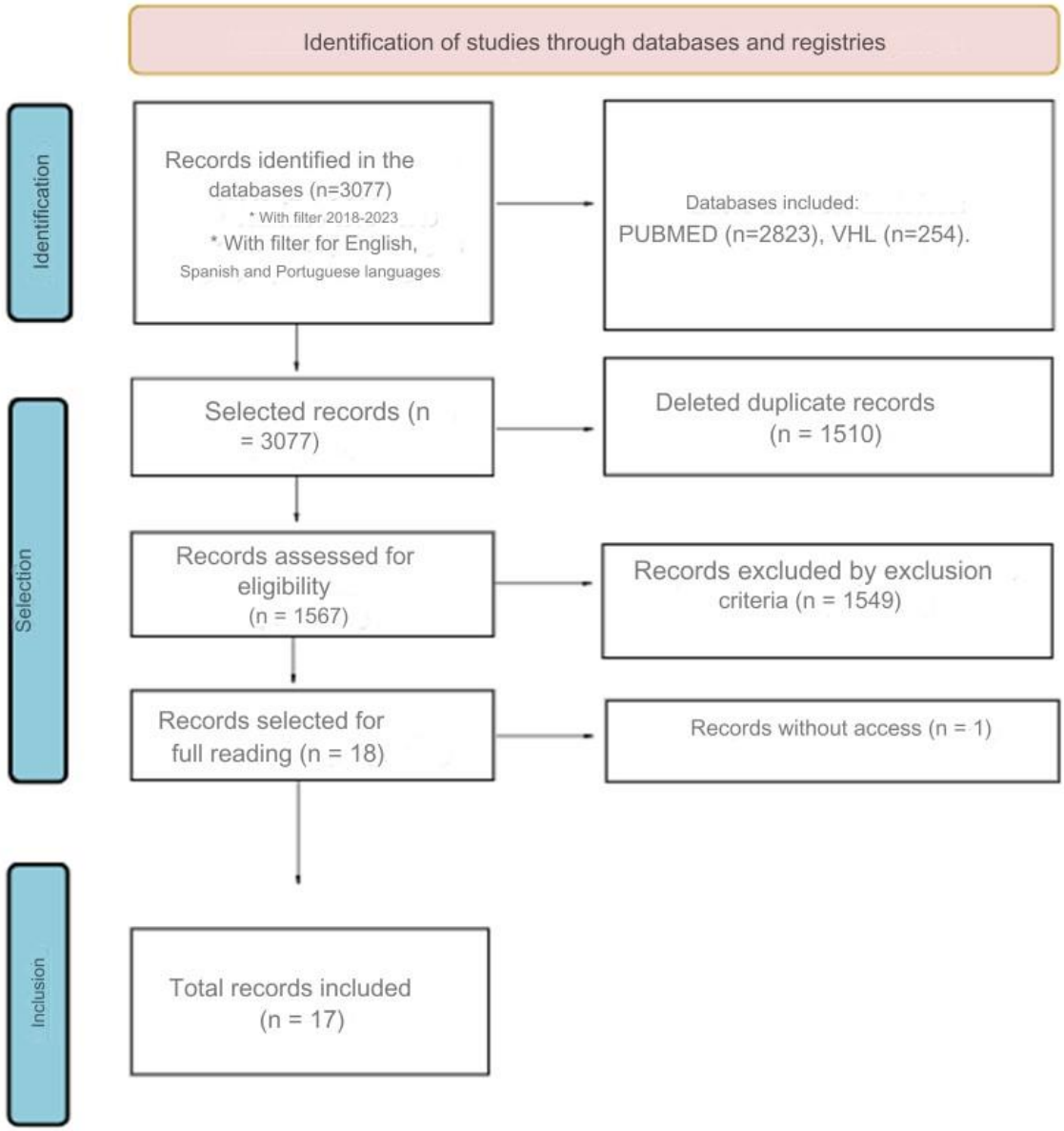
To ensure quality and methodological rigor in the development of the research, the construction of the manuscript will follow the guidelines contained in the *Preferred Reporting Items for Systematic Reviews and Meta-Analysis* (PRISMA) checklist (Galvão et al, 2015).

The search was carried out in the PudMed and Virtual Health Library (VHL) databases through the Portal of Journals of the Coordination for the Improvement of Higher Education Personnel (CAPES), through the access provided by the federated academic community of the State University of Maringá.

The descriptors were selected in accordance with the Health Sciences Descriptors (DECs) for the articles selected in Portuguese, namely: "burn", "critical care" and "mortality". For the search in foreign databases, the terms used were taken from the *Medical Subject Headings* (MeSH), namely: *"burns", "critical care" and "mortality"*. The Boolean operator AND was used between the descriptors during the searches. Data were collected between August and October 2023. To assist in the search and selection of articles, the Raayan® software was used.

The sample included articles that met the following criteria: articles published in Portuguese, English, and Spanish, in the period between 2018 and 2023 and that helped answer the guiding question. For the selection of articles, the titles and abstracts were read and if it answered the guiding question and achieved the objective of the research, it was read in full. The exclusion criteria were: review articles, editorials, duplicates, and articles not available in full.

The selection of articles can be seen in the flowchart below:



Source: the researchers, 2024.

As this was a study conducted with secondary data sources, the research did not require consideration by the research ethics committee, however, all authors were duly referenced.

RESULTS

A total of 3077 scientific studies were identified in the initial search of the selected databases. After applying the selection criteria, checking agreement with the review question and exclusion of duplicate manuscripts, 17 studies remained to compose the sample, 15 of which were in English and 02 in Portuguese. Of the studies that made up the review, it was observed that all publications related to the theme occurred from 2018 onwards, ending in 2022. Regarding the databases, it was found that there was a predominance of an American database (PUBMED).

Regarding the methodological design, a predominantly quantitative sample was observed. In order to achieve the objective proposed by the study, the following information was extracted to answer the research question, and Chart 1 was constructed.

Table 1. Characteristics of the selected studies, Maringá-PR, Brazil (2024):

REFERENCE	OBJECTIVE	METHOD	RESULTS
Article 1: Growth Differentiation Factor-15 Correlates with Mortality and Severity in Severe Burns. **PUBMED** ONISHI, Shinya et al. Growth Differentiation Factor-15 Correlates with Mortality and Severity in Severe Burns. **Shock: Injury, Inflammation, and Sepsis: Laboratory and Clinical Approaches**, v. 57, n. 6, p. 211-217, 2022.	Measure GDF-15 (cell growth and differentiation factor-15) in the blood at multiple points in the acute phase of severe burns to determine its association with mortality and severity.	*Retrospective, observational and single-center study. *The level of GDF-15 in the blood was measured and compared with clinical parameters, including prognosis. *The time points for sample collection were the day of the injury, 4 days after the injury and 1 week after the injury.	*Eighty-three patients were included in the study. At all time points, GDF-15 levels in the non-survivor group were significantly higher than those in the survivor group. *GDF-15 levels were positively correlated with the Sequential Organ Failure Assessment (SOFA) score, and the relationship became stronger with the passage of time of severe burn. * GDF-15 was a useful predictor of mortality in severe burns, regardless of age, and may also be associated with organ damage regardless of the burned area.
Article 2. Circulating dipeptidyl peptidase-3 at admission is associated with circulatory failure, acute kidney injury and death in severely ill burn patients. **PUBMED** DÉPRET, François et al. Circulating dipeptidyl peptidase-3 at admission is associated with circulatory failure, acute kidney injury and death in severely ill burn patients. **Critical care**, v. 24, p. 1-8, 2020.	To evaluate the association between DPP3 (dipeptidyl peptidase-3) at admission and on day three with 90-day mortality in severely burned patients. The secondary objective was to evaluate the association between PPD3 and organ dysfunction (circulatory failure and acute kidney injury).	*Prospective cohort study based on biomarker analysis *We included critically ill adult burn patients in two tertiary intensive care units for burns. *DPP3 was measured at admission and 3 days later.	* Patients with sustained elevated DPP3 enzyme had an increased risk of death compared to patients with elevated DPP3 on admission, but decreased levels on the third day. *Patients with circulatory insufficiency had the highest DPP3 at admission, as well as patients with acute kidney injury.
Article 3. Concept of Lethal Triad in Critical Care of Severe Burn Injury. **PUBMED** MUTHUKUMAR, Vamseedharan; KARKI, Durga; JATIN, Bhojani.	To study the occurrence and evolution of patients presenting the 'death triad' in the burned population.	A study that included 50 patients eligible for the study, admitted to a burns department. The population was divided into patients with (16) and without the triad (34) of death. The incidence of the triad was calculated and	*Mortality in the subgroup with the death triad was higher, representing 68.8% of the sample, compared to 17.6% in the subgroup without the lethal triad. *Acidosis, hypothermia, and coagulopathy on admission were independently associated with significantly increased mortality.

Concept of lethal triad in critical care of severe burn injury. **Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine**, v. 23, n. 5, p. 206, 2019.		data were analyzed for any association between the triad of death and mortality.	*Trend analysis showed significantly reduced survival with 50% mortality already at eight days in the lethal triad subgroup.
Article 4. Early hypoalbuminemia is associated with 28-day mortality in severely burned patients: A retrospective cohort study. **PUBMED** DE TYMOWSKI, Christian et al. Early hypoalbuminemia is associated with 28-day mortality in severely burned patients: A retrospective cohort study. **Burns**, v. 46, n. 3, p. 630-638, 2020.	To evaluate the association between very early plasma albumin concentrations (within the first six hours after hospital admission) and outcome, including 28-day mortality.	*Retrospective cohort study *We investigated the relationship between hypoalbuminemia up to 6 hours after admission and clinical outcome in 73 patients admitted to a health institution between 2012-2017.	* The main findings of this study are that initial plasma albumin concentrations, i.e., within 6 hours of admission, are associated with 28-day mortality in critically ill patients with burns. *When observing different time points in the first 24 hours, low albuminemia at 4 hours (with a threshold value of 23 g/l) was the most strongly associated with mortality, independent of TBSA (Total Body Surface Area Burned) and inhalation injury. *Albumin at low concentrations at 4 hours after admission (<23 g/l) has been associated with mortality and organ dysfunction, leading to the use of norepinephrine, AKI (acute kidney injury), and SDMO (Multiple Organ Dysfunction Syndrome). *In addition to its oncotic effect, albumin has transport properties and anti-inflammatory and antioxidant activities in humans that may be useful in severely burned patients
Article 5. Risk Factors for Mortality and Prolonged Hospitalization in Electric Burn Injuries. **PUBMED** SCHWEIZER, Riccardo et al. Risk factors for mortality and prolonged hospitalization in electric burn injuries. **Journal of Burn Care & Research**, v. 42, n. 3, p. 505-512, 2021.	To investigate the characteristics and management of electrical lesions and predisposing factors for mortality and prolonged hospital stay.	*Retrospective analysis of medical records (89) that were retrospectively reviewed to identify patients admitted with electrical injuries at the Zurich Burns Center (2005-2019). *Patient characteristics, management, outcome, and risk factors for mortality and prolonged hospitalization were analyzed	*Mortality was 18% in high-voltage patients, especially after multi-organ dysfunction syndrome, but voltage alone was not a factor that significantly influenced mortality. *A higher total burned body surface area (SAT), renal failure and cardiovascular complications, limb amputation, were risk factors for increased length of ICU stay and mortality.
Article 6. Age-dependent influence of premorbid underweight status on	To examine the associations between premorbid nutritional status and in-hospital mortality in	*Retrospective study. *Data from 14,345 patients aged 18 to 84 years admitted for	*In patients aged 18 to 74 years, low weight (BMI < 18.5) significantly decreased mortality.

mortality in severe burn patients: An administrative database study. **PUBMED** MATSUO, Mizue et al. Age-dependent influence of premorbid underweight status on mortality in severe burn patients: an administrative database study. **Burns**, v. 47, n. 6, p. 1314-1321, 2021.	patients with severe burns according to age in Japan.	burns from April 1, 2014 to March 31, 2018, using the Japanese Diagnosis Procedure Combination database.	*Patients aged 75 to 84 years, underweight significantly increased mortality * Overweight (BMI >25) increased mortality in both age groups, but not significantly.
Article 7. Factors affecting the mortality at patients with burns: Single centre results. **PUBMED** TEMIZ, Ayetullah et al. Factors affecting the mortality at patients with burns: Single centre results. **Ulusal travma ve acil cerrahi dergisi= Turkish journal of trauma & emergency surgery: TJTES**, v. 26, n. 5, 2020.	To investigate the factors that affect burn mortality.	In this study, we examined the files of 133 patients hospitalized for burns in a burn center between September 2008 and December 2016. Of these, they were divided into two subgroups, one containing surviving patients (109) and the other deceased patients (24).	*The advanced age of patients was related to increased mortality. *The increase in mortality was parallel to the increase in the degree of burns, with these burns being deeper. *Of 96 patients with a burn percentage of 15 to 30%, only five died, while of the 37 patients with a burn percentage higher than 30%, 19 were part of the subgroup of deceased people, making it possible to compare the increase in mortality with the greater body surface area burned. *Late admission to the health facility after the occurrence of the event was also associated with increased mortality. *The highest mortality rate occurred from flame burns and then from scald burns.

Article 8. Mortality analysis of adult burn patients in Uruguay. **PUBMED** ANGULO, Martín et al. Mortality analysis of adult burn patients in Uruguay. **Revista Brasileira de Terapia Intensiva**, v. 32, p. 43-48, 2020.	To determine the independent risk factors associated with mortality in burn adult patients.	This was a retrospective and observational study that included demographic data, burn profiles, length of hospital stay, duration of mechanical ventilation, and in-hospital mortality.	*The mortality rate was higher in female patients than in male patients. *Self-harm (35.2%) and assault (23.1%) had a higher mortality rate than accidental burns. *The analysis found that female gender, older age, suicide attempts, mechanical ventilation, high abbreviated burn severity index (ABSI), large burned body surface area (BSA), and extensive third-degree injuries are the risk factors associated with increased ICU mortality. *In the analysis, the need for mechanical ventilation, advanced age, burnt BSA, and the extent of third-degree burns remained independent risk factors for mortality.
Article 9. The role of concomitant alcohol and drug use in increased risk for burn mortality outcomes. **PUBMED** GOVENDER, Rajen et al. The role of concomitant alcohol and drug use in increased risk for burn mortality outcomes. **Burns**, v. 46, n. 1, p. 58-64, 2020.	To examine the role of different burn characteristics, patient demographics, treatment variables, and the presence of alcohol and other substance abuse in differentiating mortality risk from morbidity.	*This study used a national dataset on burns requiring hospitalisation in South Africa to explore mortality risk in relation to morbidity.	*The results indicate that burn victims with full and partial thickness burn degrees and more than 30% of TBSA had a significantly increased risk of mortality. *The risk of mortality increased tenfold when they were assimilated with the use of alcohol and concomitant drugs compared to cases in which these were absent.
Article 10. Factors that influence mortality in severe burns. FRANCK, Claudio Luciano et al. Factors influencing mortality in severe burns. **Rev. bras. burns**, p. 50-57, 2020. **VHL**	Highlight factors that may influence mortality or the chance of surviving severe burns. To analyze epidemiological data, such as age, sex and causal agent, characteristics of burns as an agent, regions, depth and extent of burned body surface area (BSA), comorbidities and lifestyle habits, as well as the presence of organ dysfunctions and sepsis.	*Retrospective quantitative, analytical, and observational study that collected 141 electronic medical records of severe burns under intensive care between June 2013 and June 2018.	*The sample was divided into two groups according to the final outcome - 61 patients died (43%) and 80 patients were discharged (56%). *Advanced age was related to increased mortality, with the median age of patients who died being 46 years and the median age of surviving patients being 34 years. *The mortality found in electrical burns was 16.7%, in burns by fire 46.7%, and by hot liquids 50%, indicating a higher chance of death in burns from the latter cause. *The median of the group that died had a 50% BSA impairment, while the median BSA impairment in the

			discharged group was 40%, which suggests a direct relationship between mortality and the extent of skin affected. *The presence of 3rd degree burns denotes a higher prevalence of death. *The presence or absence of burns on the back represents the largest difference in outcomes between the groups compared to any other burned body area. 38.5% of the patients who did not have burns on the back were discharged and 56.8% died. *In the group that died, sepsis was detected in 50.82% of the cases, while in the group that survived, it was detected in 27.5%, evidencing its relationship with mortality.
Article 11. Early hypothermia as risk factor in severely burned patients: A retrospective outcome study. **PUBMED** ZIEGLER, Benjamin et al. Early hypothermia as risk factor in severely burned patients: a retrospective outcome study. **Burns**, v. 45, n. 8, p. 1895-1900, 2019.	Distinguish the impact of hypothermia from other known risk factors in the burn patient.	This was a retrospective, single-center study that reviewed preclinical service protocols and medical records of 141 patients who suffered burns with total body surface area.	*The total extent of the burn, the presence of full-thickness burns, the presence of inhalation injury, preclinical mechanical ventilation, and the administration of sedative drugs were risk factors for the development of hypothermia. *Incidental hypothermia of burn patients is associated with increased mortality.
Article 12. Trends and risk factors for mortality in elderly burns patients: A retrospective review. **PUBMED** HARATS, Moti et al. Trends and risk factors for mortality in elderly burns patients: a retrospective review. **Burns**, v. 45, n. 6, p. 1342-1349, 2019.	Identify trends and risk factors for mortality in elderly burn patients	Epidemiological study that reviewed records of all hospitalized elderly burn patients collected from five burn facilities in Israel between 1997-2016.	*Mortality rates for elderly patients increased with total body surface area burned (TBSA) and increased with age. * The most common cause of injury in the elderly population was fire, with a higher mortality rate from this cause. *Mortality increased when smoke inhalation was present for TBSA <20% *The need for surgery is correlated with high mortality rates.
Article 13. Rising mortality in patients with combined burn and trauma.	Identify the main factors impacting mortality of the patient who was a victim of trauma and associated burns.	*A retrospective analysis. *Patients with trauma, burn, and burn-trauma	*An increase in the percentage of total body surface area burned is associated with a gradual increase in mortality for all patients combined with burn and trauma.

PUBMED GRIGORIAN, Areg et al. Rising mortality in patients with combined burn and trauma. **Burns**, v. 44, n. 8, p. 1989-1996, 2018.		combined in the National Trauma Data Bank was conducted by comparing the years 2007 to 2015 with the years 1994 to 2002.	
Article 14. Burn mortality in hospitalized patients in Manzanillo-Cuba in 2015-2017. **VHL** MACHADO, Carlos Manuel Collado Hernández et al. Burn mortality in hospitalized patients in Manzanillo-Cuba in 2015-2017. **Brazilian Journal of Burns**, v. 17, n. 2, p. 76-80, 2018.	To describe the characteristics of patients hospitalized for burns who died.	*This is a descriptive, cross-sectional and retrospective study in the Department of Plastic Surgery and Burns of the Celia Sánchez Manduley Clinical Surgical State Hospital in Manzanillo, Granma, Cuba, from January 2015 to December 2017. Records of 19 burn patients who died during hospitalization were included.	*Females had the highest frequency of deceased patients, with 78.98%, and among them the age group of 60 to 74 years, with 31.58%. *The frequency of mortality was higher in patients with intentional burns, with 63.16%. *The highest number of burn deaths was in the group with 81-90% of body surface area burned (BSA), with 31.58%. *The main causes of death were related to burn shock, with 63.16% *Older age (especially 60 years or older) and percentage of BSA above 40 increase the possibility of complications and death in burn patients
Article 15. Determination of risk factors for burn mortality based on a regional population study in Taiwan. **PUBMED** YEN, Cheng-I. et al. Determination of risk factors for burn mortality based on a regional population study in Taiwan. **Burns**, v. 44, n. 6, p. 1591-1601, 2018.	To determine the epidemiological characteristics, trends, and risk factors for nationwide mortality of patients hospitalized with burns in Taiwan.	*A nationwide population-based study evaluated data retrieved from Taiwan's National Health Insurance database. Patients hospitalized for burns between 2003 and 2013 were identified from hospitalization records.	*Male gender, older age, higher Charlson comorbidity index (severity classification based on comorbidities), presence of inhalation injury, large total burned surface area (TBSA), and higher revised Baux score (score used to predict burn mortality chnace) were significant predictors of mortality.
Article 16. Burn injury mortality in patients with preexisting and new onset renal disease. **PUBMED** KNOWLIN, Laquanda T. et al. Burn injury mortality in patients with preexisting and new onset renal disease. **The American Journal of Surgery**,	To examine the impact of pre-existing and new-onset kidney disease on burn mortality.	Retrospective analysis of 7640 patients admitted to a regional burn center from 2002 to 2012. The variables analyzed included demographic data, burn mechanism, inhalation injury status, and % TBSA.	*The adjusted risk of in-hospital mortality at 60 days in patients with pre-existing renal disease PRD was 3-fold higher compared to patients without pre-existing renal disease.

v. 215, n. 6, p. 1011-1015, 2018.			
Article 17. Hyperphosphatemia is associated with high mortality in severe burns. **PUBMED** KUO, George et al. Hyperphosphatemia is associated with high mortality in severe burns. **PloS one**, v. 13, n. 1, p. e0190978, 2018.	To assess whether hyperphosphatemia, one of the signs of severe tissue injury or kidney injury, will be associated with mortality in patients with severe burns.	The study was a post hoc analysis of prospectively collected data from 301 patients admitted to the burn unit between September 2006 and December 2011.	*90-day mortality was higher in the hyperphosphatemic group than in the normal group. *90-day mortality was higher in the hypophosphatemic group than in the normophosphatemic group. *Risk factors for mortality included burn TBSA, hyperphosphatemia, reduced urine output, and APACHE II score (disease severity rating score).

Source: the authors.

It was possible to observe the prevalence of similar factors that influence the mortality of severe burn victims in all the studies present. According to the studies, an association with age, burned body extension, smoke inhalation, comorbidities, especially renal and cardiovascular diseases, hypoalbuminemia, and hyperphosphatemia, as factors influencing mortality, was confirmed.

DISCUSSION

When analyzing the data, the direct relationship between the greater extent and depth of the burned body surface area and the increase in mortality is often noted. Of 17 articles, 11 studies identified this relationship. A study that presents the characteristics of 87 burn victims who died in a Burn Treatment Center in the region of the state of Pará shows that most of the deceased patients had 3rd degree burns (74.71%) and a burned body surface greater than 50% (71.26%), confirming the data found in this study (Rocha, 2016).

In addition, the etiologic agent can be assimilated as another factor associated with increased mortality. Burns caused by flames are a situation with a worse prognosis, as found in the literature. In a study carried out in a burn unit in Goiânia, a higher prevalence of hospitalization due to direct flame was identified, since of the 130 patients, 77 patients were admitted for this reason, followed by hot liquid (two) and explosion (two). Of the 77, seven died (Arruda, 2017)

Advanced age was also a predominant factor, being cited as an important reason in six of the 17 articles. When compared with other studies, it is possible to evidence a relationship of agreement in a study that studies the epidemiological profile of burn accident victims in a city in the state of Tocantins. Adults accounted for the highest percentage of hospitalizations, accounting for 198 of 335 patients. Of these, eight died, seven of them were adult patients (Silva, 2023). It is also possible to assimilate advanced age with a higher predominance of preexisting diseases, thus contributing to increased mortality.

Regarding the gender of the patients, there is no superiority among the findings of this study. One of the articles suggests a higher mortality rate among female patients (Angulo, 2020), and another brings a higher number of deaths among males (Yen, 2018). In other studies, it is found that males prevail in the need for hospitalization and progression to death, a fact that can be justified by the risk behavior predominantly found in the class, both in their work activities and in their daily routine (Meschial, 2020).

Among the comorbidities that aggravate the health condition of burn patients, the main ones are cardiovascular and renal diseases, in the latter in particular, it is possible to identify the high rate of evolution to acute renal failure due to the pathophysiology of the burn. In a study carried out in Amazonas with 647 adult patients, the result was that 57.1% of the cases progressed to renal complications. (Vogel, 2021). This data reinforces the need to monitor renal function in critically ill burn patients, considering the risk of death caused by acute renal failure.

Another important factor found in this study is the association between hypoalbuminemia and increased mortality in burn patients. Albumin is a plasma protein that can be used as a prognosis for increased mortality due to its action on colloid osmotic pressure, which prevents the loss of plasma through blood capillaries. Therefore, the lower the level of albumin in the blood, the greater the complications related to the increase in extravascular fluids, such as edema, difficulties in the healing process, lung lesions, and greater susceptibility to sepsis (Bandeira, 2019).

Other important uses of albumin are its anti-inflammatory, antioxidant, and lipid transport properties, situations that favor recovery in the treatment process of severe burns, reinforcing the need to maintain adequate levels of protein in the body (Bandeira, 2019).

In addition to the functionality of albumin in healthy organisms and burn patients, the serum creatinine/albumin ratio can also be used as a prognostic factor for nortality in critically ill patients who have suffered burns. A study that evaluated this association showed that high levels of these markers were associated with increased burn mortality 28 days after the event (Chen, et al; 2023).

A limitation of the study is that the search was carried out in only two databases, a fact that makes it impossible to generalize the results found. There is a need for field and even observational studies in order to visualize the presence of such factors found in this review in practice, in order to reduce the mortality rates of burn patients and improve their survival.

CONCLUSION

The present review made it possible to identify the main factors that influence the mortality of burn patients who are in severe condition, namely: advanced age, extent of the burned area, smoke inhalation, comorbidities, and low amount of albumin in the body. It is important to know these

factors to be able to offer comprehensive care and minimize risks to reduce deaths caused by the event.

From the moment the risk factors are known, care becomes more systematized and, in addition to being based on scientific evidence, enables the application of specific care that helps to ensure a better prognosis and consequent better survival.

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Sustainable emotional lightness in the workplace: Correlates between positive psychological capital at work and perception of general health in post-social isolation workers in Brazil

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ABSTRACT

The present research aims to evaluate the relationship between positive psychological capital at work and the general health of workers in public and private organizations post-social isolation in the city of Natal-RN. This is field research, descriptive and correlational. 205 workers participated and responded to a questionnaire with sociodemographic and work characteristics, a scale of positive psychological capital at work and a general health questionnaire. The following results were observed: there was a significant relationship between positive psychology capital (in its total score) and its respective dimensions (Optimism, Resilience, Self-efficacy and Hope) and general health, as well as with the dimensions of depression and social dysfunction . In the Anova test, it was observed that the higher the positive psychological capital score, the higher the general health score. It is highlighted, based on these findings, that psychological capital acts as an important psychological construct in the general health of workers, thus denoting the need for psychological development at work as a protective factor in maintaining the professional's mental health.

Keywords: Positive psychology, Mental health, General health, Public and private organizations.

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INTRODUCTION

Studies regarding organizational management lately, despite being inserted in the context of the world of work based on a global perspective, whether for evaluation and intervention in the structure and process of the work environment; according to Paula et al. (2021; cf. Bendassolli, 2011), changes in meaning and purpose in this area have influenced worker behavior in a very individual way, namely: competitiveness attitude, innovation, work self-determination, employability, etc. These conditions, which, according to the authors, contribute to the development of strategies for identifying and retaining talent.

In this way, changes that have emerged or will emerge (for example, technological advances, the aging of the population, new management perspectives, etc.), can interfere with the structure and functionality of the organization, regarding the execution of activities and tasks carried out by the resource. human resources aimed at developing multifunctional work teams, especially those with a greater possibility of implementing an organizational policy focused on occupational health (Zanelli, Borges-Andrade & Bastos, 2004; Zanelli, 2010; Costa, 2013).

Therefore, scholars in the area of evaluation of the organizational management system and dynamics have focused on the organization-work-management triad much more from the perspective of subjectivity in the world of work, seeking to evaluate something beyond analysis, understanding and maintenance. of labor internality, has aimed, in multi-method research, at evaluating the health-illness binomial at work and the importance of the worker's emotional events in their creativity and productivity (cf. Mendes, 2008; Borges-Andrade, Abbad & Mourão, 2006; Leite & Nogueira, 2017; Ahrens, 2017; Fontoura & Tenório, 2020).

According to F ormiga, Freire, Batista and Estevam (2017), in the last ten years, the world of work has sought to invest more in human resources, having organizational capital as the most important, than in financial capital and accumulation of goods in order to promote assessment and intervention of the emotional health of organizations.

In the special context of the world of work in the last three years, the determinants of general health in the organizational environment have been inserted in a multi-determinant way, as it is not only the social, economic, technological and organizational aspects that influence the organization of a occupational health, but diseases and, especially, pandemics, have become the focus of attention and work action as a causal factor of damage or harm to workers' health (BRASIL, 2018; Paula et al., 2021).

This condition is associated with the requirement to comply with the principle of the Declaration of the Constitution of the World Health Organization (WHO), which attributes health to a state of complete physical, mental and social well-being and not merely the absence of disease. or disability" (WHO/WHO, 2021/1946). Paula *et al.* (2021), relate this situation to the scenario that

emerged in mid-March 2020, when the World Health Organization (WHO) declared the Covid-19 pandemic, beginning what may be considered a new historical period (WHO/WHO, 2021).

According to Bastos and Borges-Andrade (2002), ten years earlier, even if the pandemic situation had occurred, a restructuring in the relationships between the work function, professionals and organizations was already required, precisely due to the fear of being infected by a potentially fatal, rapidly spreading virus, whose origins, nature and course were and are still little known, a condition which affected the psychological well-being of many people (Asmundson & Taylor, 2020; Carvalho *et al* ., 2020), causing symptoms of depression, anxiety and stress in both workers and the general population (Wang *et al.,* 2020; Zhang *et al* ., 2020).

Given this new experience perceived during the pandemic, there is a gap in terms of harmony between internal needs and external requirements of workers in the fight against Covid-19 (Dal'bosco *et al* ., 2020); condition which directs the worker in the search and structuring of knowledge, in the face of the post-pandemic scenario, to develop intervention proposals aimed at protecting and adapting workers to new work and coping processes, managing them, psychological resources for decision making about difficulties at work, especially those who work directly with the public (Almeida Torres, Chagas, Moreira, Barreto & Rodrigues, 2013).

A study developed by Formiga, Freire, Grangeiro, Paula, Almeida, Tomé and Fernandes (2020), as well as that of Formiga, Pereira and Estevam (2020), indicated that organizations that invest in the perception of organizational support are more likely to to develop and maintain foundations for an organizational environment with healthy and productive social experiences, relationships and interactions; In this context, it is believed that there is a need to evaluate how much an organization that offers emotional support to employees is capable of influencing their health.

It is noteworthy that, in the area of human and social sciences applied to organizations and the world of work, the theoretical perspective of Positive Psychology applied to the work environment has assumed great importance in the lives of workers and organizational systems, given the development of mechanisms psychological work practices that invest in maximizing the worker's positive psychological capabilities, providing healthy human tools to face everyday conflicts in the organizational world (Boehs & Silva, 2017; Seligman & Csikszentmihalyi, 2000; Vasquez & Hutz, 2021).

Of the many variables that make up the study of positive psychology (which range from analyzes of the constructs of wisdom, transcendence, courage, etc.) and its theoretical and empirical investments (Seligman & Csikszentmihalyi, 2000; Paludo & Koller, 2007; Barros, Martín & Pinto, 2010; Fernandes et. al., 2021) whether with workers or not, having observed promising effects in studies. Specifically, the variables of positive organizational and work psychology have also presented important results regarding the condition that the worker needs to invest in it as well; thus,

whether focusing on the perspective of basic research (concentrates on correlational and descriptive studies) and/or applied (referring to problem solving in the areas of clinical, educational and social psychology, among others) (cf. Bertoldi, 2013; Joye , 2013) or exclusively, from a practical perspective, responsible for evaluating healthy work management in organizations, developing socio-emotional skills at work, career design in organizations, etc. (Palma et al., 2007; Vasquez & Hutz, 2021), this area of Psychology has been important in Brazilian professional practice, as a protective factor against worker illness.

In this research, only the construct of positive psychological capital will be considered, which has been useful in this area of study and intervention, as a theoretical framework in the findings on the benefits expanded by Positive Psychology and its proposal for modeling Positive Organizational Behavior. Therefore, Positive Psychological Capital, or simply *Psycap,* is a construct developed by Fred Luthans and his collaborators, starting in 2002 (Luthans, et at, 2006; Luthans, 2002; Luthans & Avolio, 2014) , which has its theoretical reference in Positive Psychology and which covers the assessment of self-efficacy, hope, optimism and resilience of individuals in organizations.

The use of these constructs is due to the condition that in contemporary studies on organizations and work, the importance of evaluating the behavior and attitudes of employees in the work environment has been highlighted; in particular, the variables that highlight the importance of socio-emotional assessment and diagnosis in organizations with a view to organizational performance and competitiveness, aiming at retaining talent associated with the control and maintenance of behaviors and emotions that can balance experiences with work events that interfere in the work system (Semnhoras, 2022).

In organizational studies, it has been observed the number of constructs capable of evaluating the management of human capital aiming to promote health, commitment and involvement of its employees, etc., in the work environment, for example: analyzing workers' perceptions regarding recognition and valorization involved in worker protection practices, inhibition and control of organizational physical and emotional illness (Siqueira, 2014; Jovanelli, 2020; Vazquez & Hutz, 2021; Fernandes et. al., 2021 ; Nóbrega, Fernandes & Formiga, 2023) .

In view of the highlights expressed, there is an investment in the theme of evaluating space and positive organizational dynamics in the work environment, which will probably have its origins in both the structure and functionality of organizational norms aimed at employees, aiming not only at understanding the dynamics of work, but also the application of a type of positive culture in organizations, which can influence the work system in organizational management (Pais, 2014; Boehs & Silva, 2017; Formiga, Pereira & Estevam, 2019; Vazquez & Hutz, 2021) .

It is possible that the work process and cooperative dynamics associated with services and organizational labor standards for a healthy work environment, when without consistency or strength

of bond in organizational affectivity, is capable of generating an exacerbatedly unproductive individualism, even under many demands of work, which can thus make the employee sick, due to his lack of greater investment in emotional factors in the organizational environment; Based on these conceptions, we have the following objective.

In the last ten years they have warned that in the world of work, the worker and the organization have experienced a complex period in the labor system; the speed of events and constant changes pressure people to respond ever faster and more intensely to the demands of organizations, where an economic and rational logic predominates focusing on a financial return on their investments, sustainability and profit (cf. Chanlat, 1999; Silva & Quelelas, 2006; Sicsú & Castelar, 2009).

This has contributed to workers becoming ill and, consequently, the organizations themselves, as a system, are also suffering. Faced with such situations, often occurring in a two-way manner, this economic logic does not include in its field of development and productivity, the personal and/or 'subjective' aspects, inherent to the process of professional development in work environments (Oliveira et al., 2021).

Studies on organizational and work psychology have highlighted how fundamental people have been to success and productivity (De Geus, 1998; Boehs & Silva, 2017; Vasquez & Hutz, 2021), precisely because they assume characteristics of "learning companies", since, in the conception of De Geus (1998; Scorsolini-Comin, Inocente & Miura, 2011; Franco et al., 2021; Franco & Formiga, 2022) these institutions are focused on developing the valuation of their professionals , much more people than investment 'currencies' or financial assets.

In this context, Kotter and Serra (1999; Takeuchi & Nonaka, 2008), when highlighting that organizational change is no longer, at the end of the 90s, a condition of professional expectation, but rather, it is already something real in the dynamics of the work; This fact, according to the authors, one of the biggest mistakes that occur in managers is isolating the experiences of change and not fully involving employees in the process, as this does not contribute to the development and maintenance of organizational success, precisely because do not generate commitment and engagement in professionals in this process of change, thus inhibiting the creation of innovation and innovative attitudes in companies (Fandiño et al., 2019). It is believed that it is only through this condition that it would be possible not only to learn, but also to generate knowledge, inventions, etc. capable of transforming the work environment and its functionalities for better work dynamics.

In this context, according to Siqueira (2002), the study of the structure and functioning of organizations and the behavior of groups and individuals within companies, institutions, industries, etc., has still shown results in the way of evaluating and intervening in the organizational system. ,

therefore, it is still an emerging science based on different disciplines (for example, Psychology, Sociology, Anthropology, Economics, etc.).

Therefore, Organizational Behavior has brought, from its studies, since the 1970s, a theoretical and empirical repercussion to the world of work. Even based on a publication over 50 years old, the reflection by Payne, Pheysey, and Pugh (1971) is still very current: for these authors, the interest, in the area of human and social science, whether general or applied, in measures of human and professional events in organizations has contributed greatly to the evaluation, diagnosis and development of conceptual and interventional models for the analysis of Organizational Behavior both at the level of individuals and work teams and even for the evaluation of the system of organizational sectors (cf. Bengue , 2014; Robbins & Judge, 2014).

Updating this proposal, in the area of Psychology, the theme of Positive Psychology applied in organization and work has proposed psychological tools for the development and organization of emotional mechanisms for workers, justifying that they are all able to invest in maximizing the psychological capabilities that orient towards a healthy workspace capable of facing functional difficulties and people in the dynamics of the organizational environment (Boehs & Silva, 2017; Hutz, 2014).

This theoretical perspective applied to the area of organization and work, was responsible for the emergence of the concept of positive organizational behavior (COP) (Luthans, 2002). According to Ferraro, Pfeffer and Sutton (2005), this theoretical (and practical) direction criticized the main current theories for the world of work, as they highlighted an interventionist exclusivism only in the negative characteristics of jobs.

When approaching positive psychology in the organization, the priority is to invest in the quality of productive health in the organization and its workers; such highlight, the important role of this theory in the health of the organization-worker binomial, with mental health as its main highlight and which was already predictable and suggested by the WHO (WHO, 2021/1946), when it attributed the necessary existence of a complete state Health is the condition of physical, mental and social well-being and does not just consider not being sick but promoting general well-being. Therefore, the present project, based on the countless psychological variables covered in the area of positive psychology, will specifically address positive psychological capital and spirituality at work, which, it is believed, will be important as a protective factor. worker's emotional health.

It was at the end of the 20th century that this new current of study emerged; Martin Seligman, considered the pioneer of this foundation, directed the study of psychology towards a different approach, focusing on the measurement and evaluation of health, personal fulfillment and human well-being. The main objective was to evaluate the virtues and the most positive aspects of life,

encouraging self-realization and encouraging people to have a healthier and happier life (Seligman & Csikszentmihalyi, 2000; Seligman, 2003; Seligman, Steen, Park & Peterson, 2005).

Positive psychology emerged with the purpose of exploring enriching feelings and seeking a scientific understanding of human strengths and experiences, with a focus on happiness. Happiness is understood as the predominance of positive experiences over negative ones, with positive affective feelings more often than negative ones (Scorsolini-Comin & Santos, 2010).

Associated with this movement, two currents of study emerged that support positivity and strengthening in organizations: Positive Organizational Scholarship *(* POS), with an interest in developing positive learning about organizations, and Positive Organizational Behavior (*Positive Organizational Behavior* - POB) (Seligman, Steen, Park & Peterson 2005; Luthans, Youssef & Avolio, 2007). These currents, although complementary, have different deontologies, since POS argues that behaviors are the result of stable and consequent psychological characteristics, which are part of character and positive virtues. On the other hand, COP argues that characteristics should be seen primarily as a consequence of positive psychological states (Pina e Cunha, Rego & Lopes, 2013).

Positive Organizational Research focuses its studies on the macro-organizational level, exploring constructs that may or may not be open to development and which may or may not be related to work performance, such as compassion and virtuousness. Positive Organizational Behavior focuses on the micro-individual level, no longer in the organization itself, but in the workplace, focusing on the positive strengths and capabilities of individuals (Luthans et al., 2007; Boehs & Silva, 2017; Vasquez & Hutz, 2021) .

Thus, Luthans and Youssef (2004) mention that COP stimulates the development of positive psychological strengths, influencing the improvement of individual performance in the organizational context. It can be measured, developed and managed to increase productivity and functional success at work. This new field of study has provided space for the investigation of positive and virtuous aspects of individuals and communities.

COP arises from the application of positive psychology in the organizational context, when Luthans (2002) realizes that exploring positive psychological capabilities has significant impacts on organizational performance. From this perspective, based on the theory of the aforementioned author, positive organizational behavior can be understood as the study and application of psychologically oriented capabilities and strengths in a positive way, which can be measured, developed and effectively managed to improve work performance. , through the development of human resources and performance management in organizations (Boehs & Silva, 2017; Vasquez & Hutz, 2021).

With this, Seligman (2003) began to develop a perspective that focused on the evaluation of the person and their subjective experience, individual characteristics and personal strengths (for

example: virtues, institutions and communities), which, aimed at evaluating the good -be; specifically, Paludo and Koller (2007) state that subjective well-being, positive experiences, positive emotions, aspects of happiness, hope and optimism are related to the subjective experience of individuals. When it comes to individual characteristics, studies are focused on the capacity for affection, forgiveness, spirituality, talent, wisdom. And when related to the functioning of groups, studies focus on civic virtues and institutions that promote changes in individuals, making them better citizens, more responsible and ethical at work. The investigation of these factors has proven effective in preventing problems related to human behavior, which is the focus of positive psychology and its various areas of application.

According to Cole, Daly and Mak (2009), other individual characteristics, such as self-esteem, emotional stability, emotional intelligence, optimism, self-efficacy, hope, creativity, wisdom and subjective well-being, seem to improve the commitment and motivation of individuals at work, relating to positive organizational behavior (COP).

In this sense, COP is considered a concept that drives psychological capabilities, which, when measured in individuals, have positive repercussions on organizational performance (Luthans & Youssef, 2004). For Luthans, Youssef and Avolio (2007), there are four positive psychological capabilities that are positively related to positive organizational behavior (COP): self-confidence, hope, optimism and resilience. These four psychological capabilities, when combined, form the construct of positive psychological capital (PsyCap) (cf. Palma, Cunha & Lopes, 2007; Avey, Wernsing & Luthans, Avei & Patera, 2008; Formiga, Pereira & Estevam, 2020).

Of the numerous psychological constructs studied in this area (for example, quality of life, hope, subjective well-being and self-efficacy) (Snyder & Lopez, 2009; Hutz, 2014), which, applied in different areas of Psychology, especially, in organizational psychology (Boehs & Silva, 2017), psychological capital has been one of these constructs that has included a significant number of studies. In a search on *Google Scholar,* approximately 28,000 files covered the topic; but, in relation to the organizational area, an average of 330 productions were observed aimed at the context of positive psychological capital; Therefore, it has been a research topic of great theoretical and applied investment.

It was Luthans, Luthans and Luthans (2004; Martinez & Paraguay, 2003), who defined psychological capital, considering a state of positive psychological development, which is related to the results and performance of the worker in their work space, and must present a adherence with commitment, satisfaction, perseverance, happiness, encompassing, precisely, the so-called positive organizational behavior.

Luthans and Youssef (2004) established practical criteria, which they considered necessary for a worker and his organization; for the authors, it is not enough to recognize the existence of these

variables in the work environment, but they must also be externalized as psychological capital (i.e., emotional investment) in the work system. The authors established four basic factors: optimism – making positive attributions about the present and future; self-efficacy – being confident and self-effective; hope – persevere in achieving your goals; resilience – overcoming problems and being able to return to your normal emotional state (Pereira, Formiga & Estevam, 2019, p. 19).

Thus, according to Avey *et al* . (2010), in the existence of an association between the factors, there is probably a greater probability that the worker and organization will be more successful and productive, as it will be able to generate greater investment in the workforce and emotions, in self-determination and perseverance in performance meeting the organization's requirements.

In general terms, Psychological Capital (PsyCap) is the central element of Positive Organizational Behavior (COP) and has its theoretical bases based on Positive Psychology developed by Seligman and Csikszentmihalyi (2000). This approach directs the focus to individuals' strengths and positive capabilities. The studies of Positive Psychology and Positive Organizational Behavior are relatively recent, with their base articles and initial point of guidance for the study on this topic being published in the early 2000s and 2002.

Self-efficacy, Hope, Optimism and Resilience, also known by the acronym HERO (*Hope, Self-Efficacy, Resilience, Optimism*), act synergistically, forming a unique component. They operate interactively in the motivating search for desired organizational results (Luthans, Avey, & Patera, 2008). Luthans and Youssef (2004) explains that they chose to use the word "capital" in their construct with the aim of reinforcing the idea that people are very important human resources for organizations. Thus, the term "Psychological Capital" suggests, in the management area, that by investing in people, companies are "capitalizing" their resources and increasing their assets.

The authors justify the statement presented above, referencing the work of Barney (1991) on sustainable competitive advantage. It is through employees that organizations achieve success, as they are rare, inimitable, and valuable resources. They are the people who shape strategies, serve customers and are creative. Therefore, the best capital that organizations have are people (cf. Luthans, Youssef-Morgan, & Avolio, 2015; cf. Silva, 2017).

In an attempt to contextualize the theories that involve the term of accounting-economic origin, Luthans and Youssef (2004) highlight that the administrative strategies used to increase the profitability of organizations have already been concentrated in other approaches, which also make use of the word "capital" . Some examples include the accumulation of financial capital, advanced technology and information ownership, known as Structural Capital (within the concept of Intellectual Capital); the development of tacit and explicit knowledge, stimulating what is called Human Capital; and the importance of relationships and contact networks, called Social Capital.

In the conception of Luthans and Youssef (2004), in Positive Organizational Behavior (COP), Psycap encompasses the three expressions of Capital (Intellectual, Human and Social), as it treats the human being, considering their cognitive, affective and indivisible social. Psycap's approach allows companies to know, measure and manage their human resources beyond the aspect of "who the person is", focusing on the potential of "who they can become". This is, according to Luthans and Youssef (2004), the strategic difference of organizations.

By knowing, developing and managing the human potential of their employees through Psychological Capital, companies can develop sustainable competitive advantages, with individuals oriented towards positive results.

Pereira, Formiga and Estevam (2019) and Estevam et al. (2022), proved this condition; As for the first authors, they observed, in a survey with workers at a hospital in the city of Natal-RN before the Covid-19 pandemic, that the higher the average score in the perception of organizational support, the higher the score in positive psychological capital. (especially in the dimensions of timism, self-efficacy, hope and resilience), the score in the construct of general health of these professionals is also higher; in the second study, evaluating the mental health (anxiety, depression and stress) of workers in public and private companies, they also observed that organizational support and positive psychological capital had higher influence scores on a lower score in anxiety, depression and stress in workers. Therefore, both studies not only refer to the importance of the organization as a whole, but also how much the employee himself is able to invest in it, developing emotional protection factors.

In a context very similar to the studies mentioned above, the research by Luthans and Youssef (2007), Avey, Luthans and Jensen (2009), Luthans et al. (2010) and Sun et al. (2012) reveal that the existence of a positive relationship between high performance, job satisfaction, motivation, functional commitment and a high Psycap; a negative relationship between employee stress, intention to resign, turnover and cynicism in the workplace and Psycap was also observed. These results were corroborated in studies by Pereira, Formiga and Estevam (2019) and Estevam et al. (2022). Therefore, the present study is interested in verifying the relationship between positive psychological capital and general health in the perception of post-pandemic workers in Brazil.

METHOD

SURVEY MODEL

This is a descriptive, exploratory and correlational study, which includes a quantitative approach involving health professionals in the State of Rio Grande do Norte post-COVID-19 social isolation.

SEARCH LOCATION

The study was developed with professionals in different areas of activity in the State of Rio Grande do Norte, from public and private institutions. Electronically through Google forms during the post-social isolation of the new coronavirus COVID-19 pandemic .

Research Participants

With regard to the research sample, the GPower 3.1 statistical package was used, with the objective of evaluating the significance of the 'n' sample for the present study; It should be noted that the respective statistical program is software used to calculate statistical power (namely: hypothesis testing), which emphasizes both 'n' necessary for research and the type of calculation to be carried out (Faul , Erdfelder, Lang, & Buchner, 2007).

≥ 0.50) and a hypothetical power standard ($\pi \geq 0.80$) were considered . With this, it was observed that an 'n' of 202 respondents was sufficient to carry out the study, with the following supporting indicators: $t \geq 1.98$; $\pi = 0.98$; $p < 0.05$.

Regarding inclusion criteria, the following were considered: being employed for more than one year and active in their work sector, whether in the Single Legal Regime – RJU, or in the Consolidations of Labor Laws – CLT and having between 20 or 40 hours of work.

INSTRUMENTS FOR DATA COLLECTION

The following instruments were used to carry out the research:

Positive Psychological Capital at Work Scale (ECPP) – This is an instrument developed by Luthans, Youssef and Avolio (2007); In this study, the reduced form was used for 12 items, developed by Viseu, Jesus, Rus, Nunes, Lobo and Cara-Linda (2012) for the Portuguese context. The scale is composed of items that describe for respondents a positive psychological state with the aim of facing and employing the effort necessary to achieve success in challenging tasks.

According to the authors, the scale is made up of four factors, with three items related to self-efficacy (AE 1 = I feel confident in representing my work area in meetings with management; AE 2 = I feel confident in contributing to discussions about the strategy of my company/institution and AE 3 = I feel confident in presenting information to a group of colleagues), four hope (HOPE 1 = If I feel that I am blocked at work, I think of many ways to solve it; HOPE 2 = At this moment, I think that I am quite successful at work; ESPER 3 = I can think of many ways to achieve my current work goals and ESPER 4 = At this point, I am achieving the work goals I set for myself) three resilience (RESILI 1 = I can only count on myself at work if I have to; RESILI 2 = I usually deal with stressful issues easily and RESILI 3 = I can deal with difficult times at work because I have been through difficulties before) and two to optimism (OTIMI 1 = I see always the good side of things about my work and

OTIMI 2 = I am optimistic about what will happen to me in the future regarding work). The subject must respond on a six-point Likert scale, the degree of agreement with each item, ranging from 1 = Strongly disagree to 6 – Strongly agree.

In the study developed by Formiga, Viseu and Jesus (2014), for the Brazilian context, through confirmatory factor analysis, with the aim of validating such a measure for the aforementioned context with samples of workers from public and private organizations, reliable psychometric indicators were observed ($X^2/gl = 1.32$, RMR = 0.05, GFI = 0.98, AGFI = 0.95, CFI = 0.99, TLI = 0.99 and RMSEA = 0.03), which confirm the tetrafactorial structure of the ECPP, previously proposed by Luthans, Youssef and Avolio (2007) and Viseu et al. (2012) in Portugal.

General Health Questionnaire (QSG-12) – This instrument is a reduced version of the QSG-60, by Goldberg and Williams and adapted to Brazil by Pasquali, Gouveia, Andriola, Miranda and Ramos (1994). It consists of 12 items (QSG 1 = You have been able to concentrate well on what you do; QSG 2 = You have felt that you are playing a useful role in life; QSG 3 = You have felt capable of making decisions; QSG 4 = You you have performed your normal day-to-day activities with satisfaction; QSG 5 = You feel reasonably happy, considering all the circumstances; and under pressure; QSG 8 = Have you had the feeling that you cannot overcome difficulties; QSG 11 = Have you been feeling unhappy? Are you a useless person? and QSG 12 = Have you often lost sleep because of your worries?) which assess how much the person has experienced the symptoms described, and must be answered on a four-point scale. For negative items (for example, —Have you been feeling unhappy and depressed) responses range from 1 (absolutely not) to 4 (much more than usual); for positive items (for example, “Have you felt able to make decisions?) responses range from 1 (more than usual) to 4 (much less than usual). In this sense, the negative items were inverted, with a lower score indicating a better level of psychological well-being. The lower the score, therefore, the better the participant's health condition.

Sociodemographic (gender, age, race, marital status, having children) and professional (professional qualification, weekly workload, employment in public and/or private, family income) questionnaire, as well as indicating whether in the last twelve months you have been working leave for any health reason.

ETHICAL PROCEDURES

All procedures adopted in this research followed the guidelines set out in Resolution 466/12 of the CNS and Resolution 016/2000 of the Federal Council of Psychology and having been submitted to the ethics council at Plataforma Brasil, it was approved under the CAAE: 48983621.8.0000.5296 .

RESEARCH ADMINISTRATION AND DATA ANALYSIS

After approval by the Ethics Committee, the instruments were sent to respondents through an electronic form available online on the GoogleDocs page for a period of thirty days. When requesting nurses' participation, respondents were informed that the objective of the study would be to evaluate the professionals' perception of the work environment and its influence on their general health. They were asked to participate voluntarily, with a virtual signature of the Free and Informed Consent Form (TCLE).

Professionals who were interested and gave their consent to participate to be part of the study sample were informed that their answers would be personal and without interference from the research administrator, thus, when answering the instrument, there would be no right or wrong answers. and they will be treated according to what the subject thought when reading the questions presented and indicated their answer in the instrument presented.

Also, the anonymity of the responses was ensured, as well as that the questions answered were treated in their response set and not in the particularity of each subject's response. Despite finding the necessary instructions so that the questionnaire can be answered, the researcher (with previous experience in research) made himself available to clarify any doubts that arose; an average time of five minutes was enough for the activity to be completed.

Regarding data analysis, the statistical package *SPSSWIN* , version 25.0, was used to tabulate the data and perform descriptive statistical analyzes (mean and standard deviation) and calculations relating to Cronbach's alpha, Pearson's correlation, t-test by *Student* and Manova.

RESULTS

In this section, the descriptive results of the characterization of the participants, the internal consistency of the measures used, the correlation between the variables and the average scores of the constructs of psychological capital at work and general health are presented.

The study sample was composed of 202 professionals in different areas of work, in the State of Rio Grande do Norte, with 91% residing in the city of Natal and the others, residing in other Brazilian States (Brasília, Ceará, Minas Gerais, Maranhão , between others); The decision was made not to present the percentage of these states, as they did not reach 5% of the sample. In relation to age, it ranged from 26 to 84 years (Mean = 46.13, SD = 9.65), 69% of the sample were women, 62% had an economic income of 3 to 5 minimum wages.

In relation to professional training, 37% were from the health sector (for example: Nurses, Physiotherapists, Psychologists, Doctors, Dentists, nursing and radiology technicians, etc.), the other professions (Lawyers, Military, etc.) did not present the percentage above 5% of the sample, deciding not to highlight it in the results; With regard to length of service, it ranged from 1 to 47 years, with

the highest percentage being observed for those between five and ten years of service (34%), 64% work during the day and 65% are from public institution.

Considering the sociodemographic characteristics, the analysis was carried out regarding multicollinearity between the variables and multivariate outliers; Regarding the first analysis, correlations were observed that corresponded to the parameters defined by Tabachnick and Fidell (2001) [r ≥0.90, varying from 0.16 to 0.59], with no high degree of correlation, a condition which , allows you to generate models with low error; As for the second analysis, the Kolmogorov-Smirnov (KS) normality test was carried out, intended for the analysis of samples greater than 100 subjects, having observed sample normality (KS = 1.38) of the sample at p < 0, 19. In this way, the aforementioned sample is normal, and it can be stated that the study findings are likely to be close to the observed reality.

Initially, discriminative analyzes were carried out (Mean and SD) and item normality indicators (Skewness – SK and Kurtosis – Ku) of the scale items; in table 1, it is highlighted that for all items, the means and standard deviations were within the expected distribution of responses, namely: SK ranged from -1.41 to 1.12 and Ku ranged from -1.28 to 1.94.

With the normality of the sample and because there are previous studies in Brazil (cf. Pasquali, Gouveia, Andriola, Miranda & Ramos, 1994; Formiga, Viseu & Jesus, 2014; Formiga et. al., 2019; Formiga, Pereira & Estevam, 2020) that confirmed the factorial organization of the scales used. An internal consistency analysis of the scales was carried out; based on the findings of these authors on the psychometric quality of the measures, it was considered that the scales should present alphas above 0.70 (cf. Pasquali, 2011; Formiga, Pereira & Estevam, 2020).

Considering the aforementioned statistical analyses, in table 1 it was observed that the alphas for the psychological measures administered were both consistent and significant, which, in the general evaluation of the constructs, it can be said that they measure the theoretical and empirical proposal of the variables CCPT and SG and their aforementioned dimensions, for study participants.

Table 1: Cronbach's alpha scores (α) of the scales administered.

Constructs/ Variables	*Cronbach* 's alpha			ICC (CI 95%)
	$\alpha_{general}$	V $\alpha_{Deleted\ item}$	F Friedman	
CPPT	0.88*	0.85-0.91	25.16*	0.88* (0.86-0.90)
AE	0.83*	0.81-0.87	31.28*	0.83* (0.80-0.87)
WAIT	0.82*	0.80-0.85	39.25*	0.82* (0.81-0.85)
RESIL	0.79*	0.72-0.80	16.14*	0.79* (0.75-0.83)
OPTIM	0.85	0.82-0.89	35.12*	0.85* (0.80-0.87)
General health	0.79	0.75-0.83	39.19	0.79 (0.78-0.85)
Depression	0.81	0.79-0.86	28.67	0.81 (0.80-0.87)
Social dysfunction	0.83	0.80-0.85	31.27	0.83 (0.81-0.89)

Grades: CPPT = Positive Psychological Capital at Work, AE = Self-Efficacy, ESPER = Hope, RESIL = Resilience, OTIM = Optimism. V α= Alpha variation when the item is deleted; F = Friedman test; ICC = Intraclass correlation. * p < 0.001.

Considering the alpha scores in table 2, the scales not only revealed indicators that converged with the expected psychometric standard but were also significant. The results of the confidence interval in the Intraclass Correlation Coefficient (ICC) are in similar ranges to those observed in *Cronbach's alpha* (α) , a condition which guarantees the reliability of the measured measure. In this way, it is noteworthy that for research participants, their responses on the scales, according to the theoretical and empirical perspective of the study, present alphas close to those previously observed by the aforementioned authors (cf. Pasquali, Gouveia, Andriola, Miranda & Ramos , 1994; Formiga, Viseu & Jesus, 2014 ;

The scales administered to evaluate each construct denoted both their consistency of applicability and their quality in measuring the construct in a sample of professionals collected in the State of Rio Grande do Norte for the aforementioned dissertation.

With the measures used being confirmed, which lead to their administration to a sample of workers and confidence in the assessment of the constructs; In this part of the results, we sought to meet the main objective of the study (verifying the relationship between positive psychological capital and general health in workers). To meet this objective, Pearson's correlation was calculated between the variables, which were initially considered their total score, observing the following results (see table 2): CPPT (Positive psychological capital in work) was positively related to general health (i.e., workers' perception of their health condition in the work environment).

But they also highlight that the CCPT dimensions, which were both positively related, with correlational scores above 0.30, and were significant at p < 0.01. In the same table 3, the correlational

scores of the CCPT and its dimensions with the dimensions of general health are presented. It is possible to observe the existence of negative correlations between these variables, a condition that allows us to affirm that CPPT acts as a protective factor.

It should be noted that the measure of general health suggests that higher scores (average or scores) highlight the existence of favorable health for the participant; The same reasoning can be highlighted for negative analyses, as the higher the negative score, the lower the trace of depression and social dysfunction in the worker will probably be.

Table 2: Correlational scores between positive psychological capital and general health in workers

Variables	General health	Depression	Social Dysfunction
CPPT	0.57*	-0.39*	-0.43*
Self-efficacy	0.51*	-0.43*	-0.49*
Optimism	0.49*	-0.41*	-0.53*
Hope	0.57*	-0.46*	-0.41*
Resilience	0.42*	-0.32*	-0.39*

Grades: CPPT = Positive Psychological Capital at Work; * $p < 0.001$.

Based on these results, a descriptive analysis was carried out to verify the score levels in the variables evaluated in the study; the mean and standard deviation were calculated (see table 3). It was observed that the average scores were close to the median (this indicator refers to the possibility of cutting in the middle of the total scores of the variables and can be understood based on the following reasoning: the level of the score that is below the median is considered a low level and those above this criterion will be considered a high level). In this way, it is highlighted that the respondents in the study are at levels close to the threshold of what these variables propose.

Table 3: Average scores of the variables used in the study.

Statistic	QSG	capital Psychological Positive	Dimensions of Positive Psychological Capital			
			AE	WAIT	RESIL	OPTIM
Average	35.16	62.13	19.25	21.16	16.23	12.04
Standard deviation	12.31	15.13	4.69	5.12	3.16	1.32
Median	33.00	59.00	18.00	20.00	14.00	10.00
Minimum	23.00	29.00	9.00	9.00	3.00	4.00
Maximum	46.00	75.00	24.00	28.00	19.00	14.00

Notes: QSG = General health; AE = Self-efficacy; Esper = Hope; Resil = Resilience; Optim = Optimism

Based on these results, an analysis of variance (ANOVA) was carried out, with the objective of evaluating the average score of the subjects' responses in the CPPT as a function of the general health variable, which were considered as a total score. In table 4, the result between CPPT and General Health stands out, observing that the average scores were higher at the high level of CPPT

and General Health (GS) ($F_{(4,192)} = 7.63$, $p < 0.01$). In these results, the importance of better development and maintenance of positive psychological capital will probably influence the general health of workers. Through these same analyzes it was observed that, based on the Scheffé test , the result of the interaction between CCPT versus SG, the average scores were different, that is, the higher the CCPT, the higher the SG for the respondents (c> b>a) .

Table 4: average scores for the comparison between the variables CPPT and General health in workers

CPPT	Health General	Average	dp	95% CI overall	
				Low	High
Low	Low	1.12	0.19	1.09	2.16
	Moderate	1.50	0.26		
	High	1.98	0.27		
Moderate	Low	1.15	0.12	1.12	2.12
	Moderate	1.97	0.25		
	High	2.01	0.19		
High	Low	1.27th	0.27	1.15	2.76
	Moderate	1.79b	0.18		
	High	**2.72c**	0.16		

Based on these results, a Student's t test was performed to verify the variation in scores in the CPPT and general health variables depending on gender (Male and Female). In table 5, it can be seen that there was no difference between the means for men and women in the construct of general health; but, in the CCPT, women had higher scores than men.

Table 5: difference between organizational support and general health scores depending on sex

Constructs	Sex	Average	dp	Statistic	
				t	p<
General health	Masculine	35.26	2.79	0.89	0.27
	Feminine	34.69	2.64		
CPPT	Masculine	18.28	5.06	3.56	0.05
	Feminine	**29.56**	6.94		

In table 6 it is possible to observe the result of the Anova, in which the work sector was associated with organizational support and general health; it was observed that the significant differences were for the average scores in the public organization, both for perception of organizational support and general health.

Table 6: Differences between gender, work sector and research location in organizational support function.

Constructs	Sector	Average	dp	Statistic	
				F	p<
General health	Public	**32.30**	2, 12	3.81	0.01
	Private	27.33	2.97		
	Both	25.91	2, 81		
CPPT	Public	**25.88**	7, 60	3.23	0.01
	Private	21.43	5.70		
	Both	19.63	4.64		

Note: F = Freadman, dp = Standard Deviation.

An Anova was also carried out to evaluate the differences between the average scores depending on the length of service. In table 7, it is noted that regardless of length of service, the general health scores did not reveal significant differences; in the CPP, workers with shorter service time had higher scores in this construct.

Table 7: Differences between gender, work sector and research location in role of positive psychological capital and general health

Construct	Service time	Average	dp	Statistic	
				F	p<
General health	1-7 years	28.12	2.03	0.81	0.35
	8-15 years	29.17	2.86		
	17- 42 years old	28.56	2.07		
CPPT	1-7 years	**33.21**	5.12	3.62	0.01
	8-15 years	29.65	4.21		
	17- 42 years old	27.13	6.68		

DISCUSSION

The main objective of this dissertation was to verify the relationship between positive psychological capital at work (CPPT) and the general health (GS) of workers after social isolation. In general, both this objective and the specific ones were proven, thus corroborating the hypotheses raised.

Despite prioritizing the central objective, we initially sought to assess the psychometric indicators of the CPPT psychological measure regarding their internal consistency in a sample of workers from public and private organizations. But, what is the interest in carrying out this stage, since there are other studies, prior to the one developed in this dissertation? (cf. Pasquali, Gouveia, Andriola, Miranda & Ramos, 1994; Formiga, Viseu & Jesus, 2014; Formiga et. al., 2019; Formiga, Pereira & Estevam, 2020); the fact is that, by consulting the databases of Brazilian and South American scientific production (eg, *scielo.br, index.psi, scielo.org, newpsi.bvs-psi.org.br, periodicos.capes.gov .br*), did not find studies that dealt with this topic and its related scales with

workers in the post-social isolation period. Therefore, we decided to check whether these measures were suitable for evaluating the CCPT and SG in the current context.

In this way, based on the internal consistency indicators (Cronbach's alpha and Intraclass Interval - ICC), expressed in table 2, both measures were able to measure the constructs proposed by the aforementioned authors (namely: Luthans, Youssef, & Avolio, 2007; Formiga, Viseu, & Jesus, 2014 ; Therefore, it is noteworthy that in a sample of workers in the post-social isolation period, participants expressed their position on the response scale in an honest and credible way in relation to the variables presented.

Therefore, CPPT and SG in workers could be evaluated, contributing to the verification of the psychological and functional state of workers in public and private organizations and evaluation of the organization and level of investment in emotions with a view to healthy work behavior; this condition allows that in other future studies, a sample similar to this dissertation, the instruments can be administered, hypothesizing results close to the findings in this study; Thus, it is possible to affirm that not only was it a consistent instrument, but that, taking the results as empirical guidance, it corroborates the factorial organization established by the aforementioned theorists and what the authors 'predicted'.

In very specific theoretical terms, this scale is not only reliable for a sample of post-social isolation workers, corresponding to the definitions and factorization of the construct administered for the present study; This statistical analysis used also guaranteed a psychosocial assessment of the variables with regard to the experience of these workers in the aforementioned social and political health context and their impact on the work system and work environment experienced by them, mainly when the involvement they they needed to reorganize with a view to an emotionally adequate work space and taking into account their well-being.

Finally, with regard to the condition of the scale, when comparing such results with the research previously highlighted in this dissertation , [respectively, Pasquali, Gouveia, Andriola, Miranda and Ramos (1994), Luthans, Youssef and Avolio (2007), Formiga, Viseu and Jesus (2014) and Pereira, Formiga and Estevam (2019)], all indicators presented scores above 0.70 and very close to those observed by these authors, a condition which suggests a standard of psychological assessment regarding definition of these variables (cf. Pasquali, 2011; Hutz, Bandeira & Trentini, 2015), when associated with the psychometric criteria observed in the dissertation .

Regarding the relationship between the constructs, they revealed the extent to which the worker's emotional development, especially when referring to investment in their psychological health, which can contribute positively to interpersonal relationships and the harmony of the work environment; such results corroborate the findings of Formiga *et al* (2019), Pereira, Formiga and Estevam (2019) and Estevam et al. (2022) when evaluating positive psychological capital associated

with other variables, respectively, emotional disorder, organizational support and general health in nurses and emotional disorder during social isolation, they observed that the higher the average score in psychological capital and, in particular, , in the dimensions of this construct (Self-efficacy, Optimism, Hope and Resilience), the lower the score in emotional disorder and the higher the score in the perception of organizational support of workers.

In this context, the results found in this dissertation converge with the study by Keyes and Haidt (2003) and Pauli, Cerutti and Andrêis (2018), which, even though these studies were developed with more than five studies, still have their contribution to the dissertation findings, because, according to the authors, the harmony of a person's emotional and social attributes is capable of providing the development and maintenance of healthy and fulfilling behaviors. This situation has its importance for making the environment and relationships generate events and emotional tools in the worker with a view to the best cognitive condition aimed at evaluating their social and interpersonal action in the face of conflicting situations that require decision making that life and professionalism of workers in a healthy way. In this way, according to Valin et al. (2022; cf. Franco & Formiga, 2022), by acting in this direction, the professional would probably both inhibit risk factors for himself and for the organization and its work agents.

By highlighting the relationship between CPPT and SG, “the dimensions of psychological capital are highlighted, which deal, respectively, with the individual's ability to project and achieve difficult goals based on their determination, the ability to present a positive conduct in behaviors and finally , the individual's ability to stand out from a difficult situation, when analyzed separately (Self-efficacy, Optimism, Hope and Resilience) , contributed to the individual presenting lower and less consistent performance than when analyzed together in the context of their health psychosocial” (Valin et al., 2022, p. 871).

Such reflections correspond to what Luthans et al (2008) and Formiga, Viseu and Jesus (2014; Pereira, Formiga & Estevam, 2019) propose; According to the findings of these authors, it is possible that, when the professional invests in positive psychological capital, he is able to generate protective and synergy factors that influence the development of the dimensions of hope and optimism, which could have their association organization and maintenance of these, in the assimilation of experience in social and professional life, allowing the worker to generate and manage psychological mechanisms to protect their health in general.

The results of this dissertation, by associating the theoretical proposal of positive psychological capital defended by Luthans and Youssef (2004) and Luthans et al (2007), have as its approach the worker's ability not only to develop, but also to evaluate and manifest the four dimensions together (for example: hope, self-efficacy, resilience and optimism), a condition observed in the findings of this work. When observing table 3, the fundamental role of these dimensions in the

professional's health stands out, as the general health construct suggests that the greater the relationship (and this being positive), the greater the health perceived by the respondent; When considering the dimensions of depression and social dysfunction, what was expected also occurred, as the four dimensions were negatively related.

These results have both an empirical and theoretical logic: firstly, it would not make sense that, if there is a positive relationship in general health, there would not be a negative relationship in the specificities of the dimensions of general health; the second logic follows the analytical path of statistics, since in positive relationships there is a convergence between the constructs and, in negative relationships, a divergence. As a result, these workers presented higher scores in the most positive constructs and lower in the negative ones (the latter being considered depression and social dysfunction), allowing them to reflect that they perceived better administration and organization of events and healthy elements for their work. work experience in the post-social isolation period. This can be proven when evaluating table 4, as the average scores were always higher than the median, suggesting that the participants responded positively in the constructs; This condition, which allows us to associate the reflections of Dejours (2007; cf. Clot 2006), for which he highlights in the psychodynamics of work, that the worker, when identifying a 'trigger of suffering at work', most of the time, seeks strategies psychological and social protection with a view to preventing illness caused by stressful work environments.

Based on these results, it is believed that this dissertation offers a good contribution to the studies of positive psychology, especially when applied to the work environment; These contributions, which have their bases in conceptions and evaluations that highlight subjective experiences, individual characteristics and the strengths and virtues of the individual (*read* , worker) that allow him to generate and manage elements for positive organizational behavior (Seligman, 2003; Paludo & Koller, 2007, cited in Valin et al., 2022).

Therefore, based on these findings, it is considered that the hypotheses were warranted and that better positive psychological capital will influence the organization, structure and functionality of these professionals' health. As it has the evaluation criteria and applicability of the variables of positive psychology, which study the positive aspects of life with encouragement for the health and happiness of human beings (Seligman & Csikszentmihalyi, 2000), it is possible that such a theoretical area of Psychology would be useful for the development of social skills related to communication and interpersonal relationship skills (Fidelis, Formiga & Fernandes, 2022).

Based on the results of this dissertation, something is a fact! And this converges with the findings of Valin et al. (2022) and Formiga, Pereira and Estevam (2020), that it is not possible to believe that the problem of occupational health will be resolved unilaterally, that is, that the worker or organization will find solution paths in isolation, but it must be done It is necessary to present

possibilities and develop them so that both (worker and organization) propose HR policies and interventions capable of implementing, if possible, a development and training program for socially desirable organizational behaviors.

FINAL CONSIDERATIONS

Based on these findings, it is believed that not only the central objectives were met, but it also closely corresponds to the author's professional reality. As an employee of a private company in Rio Grande do Norte, during the bidding and reporting periods, a lot had to be done to avoid becoming emotionally ill and even though I was not aware of the CCPT, I recognize in these results that I managed the condition of psychological capital to a great extent. , in particular, hope and optimism and resilience.

Thus, the use of CPPT in the organizational context, mainly to manage self-efficacy, hope, optimism and resilience, in the work environment through HR, would make it possible to develop psychological tools in workers that favor the inhibition of emotional problems in the work environment and, consecutively, in personal life. In this way, positive psychological capital at work could be useful in organizational behavior policy with a view to personal-professional development.

Finally, it is known that a master's degree research cannot be considered complete in the evaluation of the verified phenomenon, therefore, it suggests some future studies seeking to favor the development of complementary studies to the dissertation, namely: a comparison of the CPPT and SG between different professional areas, with the aim of verifying which areas would be capable of generating these mechanisms in the worker; another important study is to evaluate the average variation of these constructs associated with more positive psychology variables, for example, positive leadership, subjective well-being, self-esteem, professional self-concept, etc.; another important study refers to the intra, intercultural and transcultural evaluation of the variables treated in this study.

Finally, it is possible to highlight the importance of this research in the academic area for students in the area of human and social science, including in debates on professional training in the face of socio-labor and emotional challenges found in organizations.

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Epidemiological profile of patients hospitalized for upper gastrointestinal hemorrhage in a university hospital in Northwestern Paraná

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ABSTRACT

Introduction: Upper gastrointestinal hemorrhage is characterized by intraluminal bleeding which is the result of an injury proximal to the ligament of Treitz, which may involve the esophagus, stomach or duodenum and can be classified as varicose and non-varicose. In this sense, for preventive interventions, it is important to know the profile of the patient who is most predisposed to ADH and its outcome after treatment. Objective: To analyze the epidemiological profile of patients hospitalized for upper gastrointestinal hemorrhage at a university hospital in northwestern Paraná. Method: This is an exploratory study with a quantitative approach, carried out at a University Hospital in the Northwest of Paraná, through access to the medical records of patients hospitalized for digestive bleeding in 2022. Data collection took place between August and October 2023 and the analysis was performed descriptively. The study was approved by the Research Ethics Committee under Opinion No. 6,117,164. Results: In 2022, there were 247 admissions by HDA. Males were the most prevalent among the patients and the mean age was 61 years. In 61.5% of the cases, the clinical manifestation was melena. The most commonly performed invasive procedure was UDE, and in 76.1% of the cases there was a good outcome with hospital discharge. Conclusion: Knowing the patient's profile and the main risk factors for a serious pathology such as ADH makes it possible to develop a discharge plan based on their needs in order to avoid readmissions and even death from the disease.

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Keywords: Gastrointestinal Hemorrhage, Hospitalization, Epidemiological Profile, Nursing Care.

INTRODUCTION

Upper gastrointestinal hemorrhage (ADH) is characterized by intraluminal bleeding which is the result of an injury proximal to the ligament of Treitz, which may involve the esophagus, stomach, or duodenum (Valasco *et al*. 2021). Clinical manifestations include hematemesis (vomiting with bright or digested blood), melena (darkened stools with a characteristic odor) and hematochezia or enterorrhagia, which is characterized by the presence of stools with live blood. It should be noted that it is not necessary to present all symptoms or even occur simultaneously (Martins *et al*., 2019).

HDA is very common and affects between 48 and 172 cases per 100,000 inhabitants per year. The disease is responsible for about one hospitalization per 100,000 adults/year and predominantly affects males, affecting this group twice as often when compared to females (Valasco *et al*., 2021)

HDA is classified in two ways: varicose and non-varicose. The most common form is non-varicose, and the cause in 20 to 50% of cases is peptic ulcers (Antunes *et. al.* 2022). Its main causal factors are *helicobacter pylori infection* and the consumption of non-steroidal anti-inflammatory drugs (NSAIDs), the latter of which increases the risk of bleeding by three to five times (Martins *et. al.* 2019). In patients with advanced age, chronic diseases, and those who use anticoagulants, the risk of mortality increases considerably (Antunes *et. al.* 2022)

The varicose form of the disease, on the other hand, is classified due to the rupture of esophageal varices, which is one of the complications of portal hypertension, which occurs due to increased resistance to portal flow and increased blood inflow into the portal venous system (Martins *et. al.* 2019). Studies show that esophageal varices are present in 50% of patients diagnosed with liver cirrhosis (Valasco *et. al.*2021).

Upper gastrointestinal endoscopy (EGD) is the first test of choice in HDA, and it is recommended to be performed within the first 24 hours and in urgent cases within 12 hours, as long as the patient is hemodynamically stable for the exam. If, during the procedure, it is noted that the bleeding has ceased or that visualization is impaired, it is recommended to repeat it within 24 hours (Valasco *et. al.* 2021).

Some studies indicate that the Glasgow Blatchford scale should be used before the EDA is performed for the assessment of pre-endoscopic risks. The scale uses laboratory tests and clinical manifestations, performing stratification and the need for early intervention (Antunes *et. al.* 2022)

Patients with varicose bleeding should undergo emergency EDA with the use of endoscopic techniques that help to stop this bleeding, such as elastic bandages, elastic bands on the varicose vein spine, or sclerotherapy, in which sclerosing agents are injected to stop the bleeding (Valasco *et al.*2021)

In addition, patients may present with acute bleeding, requiring early evaluation and hemodynamic resuscitation, which includes stabilization of blood pressure and restoration of

intravascular volume. The patient may present with signs of shock that are characterized by cold and clammy extremities, systolic blood pressure (SBP) < 100 mmHg, and heart rate (HR) >100 bpm (Valasco *et el.*2021)

It may also present orthostatic hemodynamic alterations that are defined by a drop of 10 mmHg or more in systolic pressure and an increase of 15 bpm in the patient's heart rate when the patient is changed from supine to sitting position, a fact that demonstrates a blood loss of approximately 20% of the circulatory volume, which is classified as grade 2 and is an indication for fluid resuscitation with crystalloids. to restore the lost volume. The goal is to maintain a SBP of 100 mmHg and HR< 100bpm. (Valasco *et el.*2021)

If the patient does not respond to crystalloid replacement, transfusion of packed red blood cells should be considered, considering hemoglobin levels between >7 g/dL and 9 g/dL. (Martins *et. al*. 2019). Hemodynamic decompensation, presentation of shock, orthostatic hypotension, need for transfusions, and severe hemorrhage are signs of poor prognosis and can trigger tragic outcomes, such as cardiorespiral arrest (CPA) and death (Antunes *et. al.* 2022).

In view of the above, emergency service professionals, especially nurses, need to develop a clinical view, evaluating and determining the priorities of interventions, because the signs and symptoms of ADH can be manifested in various ways, requiring a correct approach (Antunes *et. al.*2022).

Considering the scarcity of studies involving the treatment of patients with ADH in a referral hospital, the importance of the topic is noted. Understanding that the disease is something frequent in the daily life of hospital professionals, the objective of this study was to analyze the epidemiological profile of patients hospitalized for upper gastrointestinal hemorrhage in a university hospital in the northwest of Paraná.

METHOD

This is a descriptive, exploratory study with a quantitative approach that aimed to analyze the epidemiological profile of patients hospitalized for upper gastrointestinal hemorrhage in a university hospital in the northwest of Paraná. Quantitative research aims to obtain information that can be measured numerically and aims to quantify a problem and understand its dimension. The term exploratory refers to the fact that it provides greater familiarity with the theme and this can be done both through a bibliographic survey and through medical records (Creswell, 2007).

On the other hand, in descriptive research, the facts are observed, recorded, analyzed, categorized and interpreted using standardized techniques for data collection with the use of instruments that assist in the collection of sociodemographic data and during data collection in order to achieve the proposed objective (Creswell, 2007).

The research was carried out at a University Hospital in the Northwest of Paraná, through access to the medical records of patients (secondary data) hospitalized for ADH in 2022 according to the ICD of hospitalization (ICD 10: K922). As an exclusion criterion, it was determined that the medical records of patients who developed ADH during hospitalization but were not hospitalized for this reason would not be accessed.

An instrument built specifically for this purpose was used, consisting in its first stage of sociodemographic characteristics, and later of information regarding ADH and hospitalization (Appendix I). Data were collected from August to October 2023.

Data were analyzed descriptively. First, they were tabulated in Microsoft Excel spreadsheets and analyzed using the *Statistical Package for the Social Sciences (SPSS) software*.

All the ethical precepts of resolution 466/2012 of the National Health Council (BRASIL, 2012) were respected. The project was submitted for ethical appraisal to the Commission for the Regulation of Academic Activities (COREA) of the aforementioned institution and later to the Ethics Committee on Permanent Research with Human Beings (COPEP) and approved with opinion number: 6.117.164. (Annex I). As these were secondary data, the Free and Informed Consent Form (ICF) (Annex II) was waived.

RESULTS

In 2022, 247 admissions for ADH were identified in the hospital. The participants' ages ranged from three to 96 years, with a mean age of 61 years. The vast majority of patients were male (153 - 61.9%) and the length of hospital stay ranged from one to 66 days, with a mean of six days. Regarding the comorbidities presented by the patients in the study, the most prevalent were SAH (66-27%) and DM (53 - 21.4%), followed by smoking (36 -14.5%) and alcoholism (52 - 21%).

The main clinical manifestation was melena in 153 (61.5%) cases, followed by hematemesis (113 - 45.7%). In the table below it is possible to see the distribution of admissions according to the months of the year:

Table 1: Distribution of ADH cases in a University Hospital according to the months of the year, in 2022, Maringá-PR, Brazil:

Months of the year	Fa	%
January	22	8,9
February	18	7,3
March	22	8,9
April	17	6,9
May	24	9,7
June	17	6,9
July	19	7,7
August	24	9,7
September	17	6,9
October	21	8,5
November	24	9,7
December	21	8,5
TOTAL	247	100

Source: the researchers. Legend: FA: absolute frequency.

Regarding endoscopy and its respective technique for bleeding control, only the examination was performed, UDE with sclerotherapy and UDE with ligation. These results can be seen in the table below (Table 2):

Table 02: Performing EDA and hemostasis technique, Maringá-PR, Brazil, 2022:

EDA and Hemostasis Technique	YES		NO		NOT INFORMED		TOTAL	
	Ago	%	Ago	%	Ago	%	Ago	%
EDA	214	86,6	29	11,7	4	1,6	247	100
EDA + Sclerotherapy	23	9,3	222	89,9	2	0,8	247	100
EDA + Ligadura	37	15	208	84,2	2	0,8	247	100

Source: the researchers. Legend: EDA: Endoscopy/ AF: absolute frequency.

Regarding the complications experienced by patients hospitalized for ADH, hypotension, hypovolemic shock, need for vasoactive drugs, blood transfusion, and ICU admission were found. These results are better presented in the table below (Table 3):

Table 03: Complications related to ADH in 2022, Maringá-PR, Brazil:

INTERCURRENCES	YES		NO		NOT INFORMED		TOTAL	
	Ago	%	Ago	%	Ago	%	Ago	%
Hypotension/Hypovolemic Shock	71	28,7	173	70	3	1,2	247	100
TWO	38	15,4	207	83,8	2	0,8	247	100
Blood transfusion	97	39,3	149	60,3	1	0,4	247	100
UTI	92	37,2	150	60,7	5	2	247	100

Source: the researchers. Legend: VAD: vasoactive drug; ICU: Intensive Care Unit

Regarding the outcome of the cases, there is hospital discharge, evasion, death and hospital transfer. These results are better presented in the table below (Table 4):

Table 04: Patient outcomes at hospital admission in 2022, Maringá-PR, Brazil:

DENOUEMENT	Ago	%
Discharged	188	76,1
Evasion	7	2,8
Death	30	12,1
Transfer	21	8,5
Not informed	1	0,5
TOTAL	247	100

Source: The Researchers

The results showed a prevalence of male hospitalizations, but age, length of hospitalization and form of treatment were quite variable. Although 30 deaths (12.1%) were recorded, most patients were discharged from the hospital (188 - 76.1%).

DISCUSSION

It can be observed that throughout the year, hospitalizations were constant in all months and that the predominant gender was male, as found in several other studies. It has been found that males are more likely to develop ADH (SANTOS *et al.,* 2022). This finding can be explained by the fact that care related to men's health is still incipient and, despite the efforts involving the National Policy itself, men have a more closed posture that influences their health behavior, not seeking health prevention strategies, but only assistance in severe and urgent cases (GARCIA *et al*., 2019).

Regarding the age of the patients, the findings showed that the elderly population was the most affected, with a mean age of 61 years. Studies indicate that cases of gastrointestinal bleeding increase in the elderly due to the aging process along with reduced organic and physiological functions. The aging process decreases the function of the gastric mucosa and blood supply, causing tissue repair activities to not occur properly and making the elderly more vulnerable (SANTOS *et al.,* 2022).

Among the comorbidities presented by the patients, SAH (66 - 27%) and DM (53 - 21.4%) stand out. As with advancing age, older patients tend to present chronic non-communicable pathologies and end up making use of drugs that are harmful to the gastrointestinal tract and the hepatic system, becoming prone to developing lesions in the gastric mucosa with consequent bleeding and liver problems, which, when metabolizing many drugs, also makes them sick and impairs the formation of coagulation factors (SANTOS *et al.,* 2022).

It is known that ADH has some clinical manifestations, which can be isolated or associated with other factors. In the study, it was possible to identify that the most evident manifestations were melena and hematemesis. These manifestations generate great blood loss, which can lead to hypotension and hypovolemic shock, which is nothing more than a decrease in circulating blood

volume due to external losses. This blood reduction leads to a decrease in venous return, generating a drop in central venous pressure, with the physiological response being increased vascular resistance, decreased perfusion and hypoxia. In this study, almost 30% of patients progressed to hypotension and hypovolemic shock (SOSA, *et al.,* 2021).

Due to blood loss and hemodynamic instability, some patients required ICU admission and blood transfusion, totaling approximately 40% of the cases. The literature indicates that blood transfusion is indicated in cases of hemodynamic instability, hypovolemia, and active bleeding. However, the evaluation of the case is crucial to avoid transfusions in varicose HDA, due to the worsening of the case due to volume overload (MARTINS *et al.,* 2019).

Hospitalization in intensive care was also evidenced and corroborates the information described in the literature, since most patients with ADH evolve with clinical deterioration and require continuous and invasive monitoring until the case is stable and resolved (ANTUNES *et al.,* 2022).

Digestive endoscopy was the most frequently performed procedure in 86.6% of the cases. This technique is considered the main diagnostic test that enables treatment for ADH. When done early, it makes it possible to identify complications, reduce the risk of new bleeding, and enable hemostatic therapies (SANTOS *et al.,* 2022). It was evidenced that in 15% of cases, esophageal varices ligation was performed and this procedure aims precisely to prevent blood flow, retracting the varicose cord, preventing it from bleeding (MARTINS *et al.,* 2019).

Among all cases, (188-76.1%) were discharged from hospital improved and the percentage of deaths can still be considered high (12.1%), since ADH is understood as a disease that has adequate and pre-established therapy and diagnosis, and yet it is a disease with a high mortality rate (SANTOS *et al*., 2021).

One of the strategies to try to reduce the risk of death and readmissions due to the same event is to perform a good anamnesis, including the nursing history, in order to identify other diagnoses that may lead to the onset of ADH, such as liver cirrhosis. According to the literature, the disease is one of the most associated with gastrointestinal bleeding (VELÉZ; et al, 2023), but in our study, a major failure was identified in filling out the electronic medical record, making it difficult to understand the patient's history as a whole, and hindering the development of an adequate discharge plan.

It is understood that the data reflect a local reality and cannot be generalized. Added to this is the fact that many medical records analyzed lacked important information that hinders data collection. However, the results found are noteworthy due to the high number of hospitalizations with a special prevalence for males and can help in the development of care protocols, optimizing patient care planning.

CONCLUSION

The results of the present study show that in 2022, there were 247 hospitalizations due to ADH and of these there was a predominance of males with a mean age of 61 years. The mean length of hospital stay was 6.2 days, and among the main clinical manifestations were melena and hematemesis, and blood transfusion was the main complication.

These results show the profile of patients treated at a referral institution for diagnosis and treatment of the problem, as well as the outcome of patients with ADH. The high number of incomplete medical records is noteworthy, making it difficult to understand the patient's baseline history in order to be able to plan care completely. It is noteworthy that the management of ADH outside the tertiary environment and after hospital discharge involves a change in habits on the part of the patient and his/her family and portrays the need for further studies in primary care so that health teams can assist in this process and also in the early identification of the disease and its main risk factors.

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Challenges in the training of Dentistry students in public universities in Brazil

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ABSTRACT

For decades, Brazil's public universities have suffered from budget cuts, inadequate management of public assets and purse, and an increasingly precarious condition for teaching and learning. This, not only in terms of the physical structure, equipment and consumables, but also with regard to the valorization of work in this environment and the support of human resources, for technical, administrative and teaching activities. The objective of this chapter is to describe the challenges for the training of students in the undergraduate course in Dentistry. A report based on the experiences as teachers in public institutions of Higher Education (HEIs) and by the claims listed by students.

Keywords: Dentistry, Dental education, Academic performance.

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INTRODUCTION

THE DENTISTRY COURSE IN THE CONTEXT OF THE FINANCING OF PUBLIC HIGHER EDUCATION

The higher education system in Brazil has a great diversity of structure and organization, with economic, social and cultural variables, among others. When we refer to public Higher Education, it is maintained by the government, at the federal, state or municipal level; where the executive branch represents the largest accountability for the overall budget (Michel, Olsson, Toassi, 2019; Pinto *et al.,* 2013).

The form of budget composition of public universities, associated with a contingency of funds, has been the target of criticism and questioning as to its effectiveness. How can "autonomy" be established if many HEIs do not even have a system for calculating and measuring costs, capable of assisting them in decision-making (Caetano and Campos, 2019).

Specifically with regard to the undergraduate course in Dentistry, this represents one of the courses with the need for a higher cost for investments, due to the characteristics inherent to this specialty in the health area; mainly regarding equipment, consumables, instruments and setting for theoretical, theoretical-practical laboratory and clinical activities, in addition to supervision in internships and community assistance services.

In this scenario, training in health economics can be important to achieve efficiency in the allocation of resources directed to health care; for decision-making regarding the optimization of the resources offered or available; assisting managers in this direction (Pokhilenko *et al.,* 2021).

Thus, ensuring universal access to the course in question, to the maintenance of academics (avoiding dropout), with the necessary support for the difficulties, specificities or demands presented, and to lead to an education based on ethics, on the dimensions of human diversity, on the protagonism of the student and their critical thinking, does not represent a simple mission. This, in addition to stimulating the awakening of entrepreneurship, comprehensiveness and interdisciplinarity, in the care of human beings.

Contrary to what was previously reported, the public university, with such disputed access and recognition "of excellence" or "reference", both for training and for the care of human beings, has been constantly degraded. For more than a decade, with the change in the way budget is implemented, there have been negative impacts, including for internship options, where private HEIs have assumed a priority in vacancies, often due to the financial advantages they can offer.

As a reflex, there is an "illness" of the Dentistry Courses of public universities, especially at the federal level. If, on the one hand, there is an emphasis on scientific production, the production of patents and the training of new researchers and professors, on the other hand, there are worrying limits in infrastructure, access to basic conditions for quality teaching and care for all involved.

Teachers with an overload of work, which encompasses many aspects of a growing and constantly changing bureaucracy; in addition to other activities not directed to the exercise of teaching, but which become part of the routine of university professors, due to the lack of resources, support, recognition and encouragement in the work environment. And this is reflected, especially in those with an exclusive dedication and who leave the essential north of teaching, research and extension, to meet various demands, where there is an imminent risk of loss of quality in the exercise of teaching. This exercise requires the perception and understanding of the human condition, of the way in which subjects are constituted, through training processes (Bruxel and Boufleuer, 2021).

Currently, we have more Dental Surgeons (DCs) in Brazil than in other countries in the world, proportionally. The national market is not able to effectively absorb the skilled workforce and, on the contrary, there is no "brake" on the opening of new private HEIs with the offer of Dentistry and various possibilities of access and public funding.

CURRICULAR CHANGES AND THE PROFILE OF THE TRAINING OF ORAL HEALTH PROFESSIONALS: ARTICULATION BETWEEN THE UNIVERSITY AND THE UNIFIED HEALTH SYSTEM

Dentistry education, especially in recent decades, has undergone several changes to adapt the profile of graduates to the new social context, the current needs of the population and the opportunities of the job market. In Brazil, with the inclusion of Dentistry in the Family Health Program in 2000, curricular changes were made to promote the articulation of universities with the Unified Health System or SUS (San Martin *et al.,* 2018).

The graduation in Dentistry aims to train the dental surgeon to work in the integrality of health care, through the development of actions and services for the promotion, protection, recovery and maintenance of individual and collective health. It also reinforces interprofessional, interdisciplinary and transdisciplinary action in health care, based on critical thinking, ethical values and scientific evidence; but with the north of welcoming and humanized care (Ferreira and Goés, 2023).

In the context of the above, Interprofessional Education (IPE) is an important pedagogical approach in health curricula because it seeks to prepare students for care in a collaborative team environment. Multi and pluriprofessional knowledge refers to the process in which there is a certain coordination between disciplines. Interprofessionality occurs when professionals learn from each other and about each other, and transprofessionality is placed as a higher stage, characterizing the fusion of certain fields of knowledge. Furthermore, the concept of teamwork is characterized as complementarity of practices, while collaboration has the sense of cooperation (ROSA *et al.,* 2022).

In order for IPE to ensure the strengthening of actions, particularly in the SUS, but in all areas

of professional activity, it is necessary for Dentistry to have a greater knowledge of other health specialties. A greater understanding of competencies enables the expansion of team actions. The road is still long, but it begins with the openness to Interdisciplinarity in the formation of the student.

The challenges are many and have intensified after the first wave of COVID-19 in Brazil; This has led to a lot of anxiety, a logic of condensing academic semesters, many online activities, and the loss of face-to-face experiences. Of one broadening the listening and understanding of the other. from clinical training to the development of practical skills.

There was a drop in students' academic performance during the pandemic. The students' lack of preparation for the remote model and the difficulties related to learning demonstrated that Emergency Remote Teaching was not enough to contemplate the range of skills to be developed during the professional training of the DC (Eich *et al.,* 2024).

FINAL THOUGHTS

There are many challenges in the training of students of the Dentistry Course in Public Universities in Brazil. And these include, from the financing and the correct application of the available resources, to an appreciation of the teacher. This appreciation is not only in their adequate remuneration, but also in the work environment that enables the actions linked to the full exercise of teaching. A teaching and learning process that empowers and boosts the personal and professional development of the students who embraced this course, reflecting not only on the excellence of the care provided to the population, but on the well-being and quality of life of all those involved.

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The importance of the correct use of sunscreen in patients with Melasma

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ABSTRACT

Melasma is a hyperpigmentation disorder that mainly affects women, in its pathogenesis factors such as chronic exposure to ultraviolet radiation, visible light, hormonal stimulation and genetic factors have been identified. It is characterized by reticulated, irregular, brown patches on areas of the skin exposed to the sun. The methodology used was a literature review with an exploratory qualitative approach, using academic platforms and bibliographies: SCIELO, PUB MED and GOOGLE ACADEMICO. The inclusion criteria were articles from the last few years in Portuguese and English. The correct use of sunscreens can prevent the onset of melasma, which in turn prevents skin cancer. Sunscreen helps block solar radiation, preventing dyschromic spots caused by ultraviolet rays on the skin, and for each skin type there are different factors; Always reapply every two hours and it is important to know that the use of sunscreen begins in childhood, as the damage accumulates on the skin, bringing complications in adulthood, such as skin cancer. It can be concluded that the use of accessories such as hats, parasols, sunscreens help in the prevention of dyschromias.

Keywords: Melasma, Hyperpigmentation, Sunscreen.

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INTRODUCTION

Each year the ozone layer gets thinner, allowing solar radiation and ultraviolet (UV) radiation to pass through. This produces short-term lesions, such as sunburn or tanning, and long-term blemishes, ageing and dermal cancer1.

Pigmentary disorders, such as melasma, often occur due to this cause2. The hyperpigmentation that develops can have an impact on the patient's quality of life, especially when exposed areas, such as the face, are involved3.

Melasma is a dermatosis whose facial hyperpigmentation pattern is produced by hypermelanosis, it originates from several causes; Its color varies from light to dark brown, tends to be symmetrical, and is prevalent in women from equatorial areas, especially those with Fitzpatrick III, IV, and V [3].

Frequent in women of childbearing age, where a prevalence of 90% is evident in relation to men; The frequency increases in equatorial areas and in countries with high Fitzpatricks such as Asia, Latin America, and Africa. In pregnant women, it predominates in 66%, where it decreases or disappears in the postpartum period (chloasma), in 33% it remains indefinitely; It is also seen in menopausal women. This pathology becomes more evident during and after photoexposure, especially in the summer months [4].

It is stimulated by photoexposure and UV radiation. Studies indicate that it may originate from molecular mechanisms related to tissue pigmentation, including the expression of melanocyte integrins (α-6-integrin); Other stimuli were also investigated, associated with E-cadherins and increased transfer of melanosomes to keratinocytes, along with an increase in the cytoplasm of prostaglandins (E2, D2 and 2α), which intervene as recognition molecules in melanocytic dendrites5.

It is evident as hyperchromic macules with delimited and regular borders, whose pigmentation varies from light to dark brown, symmetrically located in photoexposed areas such as the forehead, cheeks, nose, mustache, neck and décolleté [6].

According to its clinical distribution, the lesions of facial melasma are: central and peripheral. The centrofacial type is observed in the center of the face, i.e., in the glabellar, frontal, nasal, zygomatic, upper lip, and chin regions. In the peripheral type, the frontotemporal, preauricular and mandibular branch areas are affected [7].

Prevention are measures applied to prevent damage or its progression, and can be carried out through the implantation of devices, as well as the use of medications. Regarding the prevention of dermal lesions by photoexposure, there is the proper use of clothing and the use of sunscreen or photoprotection [8-9].

Sunscreens are chemicals capable of reducing or preventing dermal lesions caused by exposure to UV radiation, attenuating it through dispersion and absorption [8].

OBJECTIVE

To analyze studies on the importance of the correct use of sunscreen in patients with Melasma.

METHODOLOGY

This scientific work is a narrative literature review with an exploratory qualitative approach, where data will be collected from bibliographic productions already published. According to Cruz (2023), bibliographic research is a method based on existing materials such as books and scientific articles. In some studies, research often focuses only on bibliographic sources. In addition, studies that aim to analyze ideologies and different perspectives on issues are often carried out based solely on documentary sources.

According to Sousa, Oliveira, Alves (2021), bibliographic research aims to improve knowledge through scientific investigation, being a survey or review of published works on the theory, and guides the researcher who will analyze the published works on the subject.

The selection of a qualitative method is based on the specific characteristics it has, which allows us to present an approximate view of the reality being studied. Köche (2012) defines bibliographic research as "indispensable to any type of research", because in it the researcher explores and analyzes the main theories and existing contributions on the subject. The descriptors used were: Melasma. Dyschromias. Sunscreen.

The selection of the studies involved four stages: the first consists of reading the titles of the articles; the second, in the selection of articles based on the information contained in the abstracts according to inclusion and exclusion criteria; in the third, the articles were fully analyzed for the selection of potentially relevant articles.

As an inclusion criterion, original articles published in Portuguese, English, from the year 2020 onwards published in SCIELO, PUBMED and GOOGLE SCHOLAR in Portuguese and Spanish were considered. Exclusion criteria were defined as studies and documents published outside the chosen period (with the exception of books and legislation), unavailable in the full version or incomplete, studies that do not correspond to the proposed objectives, and duplicate publications, with only one being selected.

The reviewed articles were analysed and compared in terms of study design, treatment protocol, outcome parameters, efficacy measures and outcomes to assess the strength of the current evidence.

RESULTS AND DISCUSSIONS

The search of the databases resulted in 36 studies, including scientific articles and books. Above in the methodology, the search terms used and the inclusion and exclusion criteria for data collection are presented. After the first evaluation of the captured studies, applying the inclusion criteria, 23 studies resulted in 23 studies and were selected for analysis.

Melasma is an acquired hyperpigmentation disorder that mainly affects women between 30 and 40 years of age, with a higher frequency of high phototypes. The prevalence varies between 8.8 and 40% and varies according to the population. The pathogenesis of melasma has not been fully elucidated, but factors such as chronic exposure to ultraviolet (UV) radiation and visible light, as well as hormonal stimulation and genetic factors have been identified [10].

Morphologically, melasma presents as symmetrical reticulated hyperpigmented patches with irregular borders in the centrofacial region, malar cheeks, mandible, and, rarely, upper chest and extremities. While melasma is known to most commonly affect darker skin types, it can occur on all skin types. On dermoscopic examination, pronounced hyperpigmentation can be seen on the pseudorectic ridges of the skin. Using a Wood lamp, hyperpigmentation can be accentuated when the pigment is epidermal. However, this accentuation can be observed with dermal or mixed melasma [11].

Confocal reflectance microscopy (RCM) has also been used to evaluate melasma at the cellular level. In the epidermis, it showed an increase in hyperrefractory cobblestone cells that corresponded to hyperpigmented basal keratinocytes on histology [12].

The goals in the management of melasma are: to decrease the intensity of the pigment, decrease the area of the spot, prevent recurrence, and improve the patient's quality of life. For this, we have first-line treatment that includes the use of depigmenting agents, until then considered the gold standard, alone or in combination to create synergy; then how to avoid aggravating factors such as intense exposure to UVA, UVB, infrared and visible light radiation, use of hormonal contraceptives and photosensitizing drugs [13].

Photoprotection is the cornerstone of treatment and prevention, as visible light in patients with melasma has been shown to promote hyperpigmentation through opsin 3 in melanocytes, in addition to UV light, which induces not only increased pigmentation, but also chronic photodamage and increased vascularization. It is recommended to use inorganic sunscreens – such as titanium dioxide and zinc oxide – that also contain iron oxide, such as colored sunscreens, instead of organic agents that do not protect against visible light damage [14].

Tofetti e Oliveira [15] points out that it is necessary to make the correct use of sunscreen, always apply the sunscreen 20 to 30 minutes before exposing yourself to the sun, so that it absorbs and develops its protective effect, apply the sunscreen to all exposed areas, do not apply it to the

eyes, if there is contact with the eyes, wash them quickly, and you need to reapply sunscreen every 2 hours.

It is also important to remind the patient that changing habits and using accessories such as a hat, glasses and umbrella are necessary to prevent melasma [16].

According to Oliveira and Gomes17, the greater the intensity, duration and excessive exposure to solar radiation in fair skin, the greater the damage caused by the sun's rays. This type of skin needs greater attention, as it is necessary to use higher protection factors, which can be a factor of 15 on a daily basis and in greater exposure to the sun such as bathing in a pool or beach it is necessary to double the protection factor.

Fátima et al.,[2] published a research article that aimed to evaluate the use of sunscreens in melasma in patients with black skin to illustrate the importance of photoprotection in the management of pigmentary disorders. It was a systematic review that included 9 articles with keywords "sun protection", "melasma" and "post-inflammatory hyperpigmentation". These studies detailed the results of more than 600 patients on the use of sunscreens in melasma and post-inflammatory hyperpigmentation. They found that the use of sunscreen can play a significant role in melasma therapy by stabilizing and improving patients' hyperpigmentation. It also had a positive influence on self-esteem and quality of life.

Kelm et al., [18] published a research article that aimed to evaluate the efficacy of sunscreen use in the treatment of melasma. It was an open-label clinical trial that included 10 women who were given broad-spectrum SPF-45 sunscreen twice daily for 12 weeks during the summer months (July to September). The main results were that all subjects showed an improvement in hyperpigmentation of 33.7%. 70% showed improvement in skin tone uniformity (redness) and, among these individuals, the average improvement was 33.3%. The mean overall aesthetic improvement score was 2.0 (greatly improved). They concluded that the use of sunscreen with a high protection factor helps in the management of melasma.

The SPF to be used should be in the high to ultra range, and should be renewed every 2 hours depending on the exposure and UV radiation of the site. The skin covering the face, neck and décolleté tends to be more sensitive to photodamage, so it needs very high to ultra SPF depending on the person's Fitzpatrick [19].

The proper use of sunscreen or sunscreen consists of putting it on 30 minutes before sun exposure and renewing it every 2 hours, preferably not using water-resistant sunscreens, as they cause other damage to the skin. It should be placed even under an umbrella as it filters only 15% of UVA radiation and 90% of UVB radiation [19].

The three main component categories required in sunscreens are UV filters, emollients, and emulsifiers; secondary components are photostabilizers, film formers, enhancers, and sensory enhancers20.

Photosensitive conditions like melasma are aggravated by exposure to ultraviolet (UV) rays and visible light, making the use of sunscreen an essential component of treatment. Sarkar et al., [21] who compared the role of sunscreen in the improvement of melasma and identified an objective and subjective improvement of melasma after 12 weeks of sunscreen use in terms of MASI, and also demonstrated that the use of sunscreen significantly improved the quality of life of patients with melasma. Therefore, it is not surprising that the results of the study showed better results in the MASI value in participants with a history of sunscreen use. Sunscreen is an important adjunctive therapy to prevent the exacerbation of melasma and improve the onset of these conditions. Additionally, advice on the proper use and application of sunscreens, as well as the development of better broad-spectrum sunscreens, is necessary to maximize results. Controlled trials on the use of sunscreen in melasma are necessary. Zhang et al.,[22] in 2019, conducted a study to evaluate improvements in melasma with a combination of herbs in a master formulation in China.

Boukari et al., [23], published an article aimed at evaluating the protective properties against melasma recurrences of a sunscreen that protects against UVA/UVB rays and shorter wavelengths of visible light compared to a sunscreen with UVA/UVB protection but without protection against visible light. It was a randomized controlled trial that included 40 patients diagnosed with melasmas who were randomly assigned to receive either Formula A or Formula B. The median increase in MASI score from baseline to month 6 was more significant with Formula B (interquartile range 2.43; 0.45 to 3.68) than with Formula A (interquartile range 0.45; 0.0 to 1.65) ($p = 0.027$). Eight patients in the Formula B group wore makeup during the study. This subgroup that combined the use of uncolored sunscreen and makeup had no fewer relapses than those who used only sunscreen. They concluded that the results should be confirmed in larger samples.

CONCLUSIONS

Melasma is a condition that significantly affects the quality of life of patients, mainly due to its chronic behavior with the presence of frequent relapses. This article provides an update on the management of melasma, as we have compiled the best treatment and prevention most widely used and with evidence of results in recent years.

Taking into account the above, we can conclude that the management of melasma continues to be a challenge, since none of the currently available therapeutic options had a rapid, 100% effective or sustained response.

We conclude that the use of sunscreen for patients with melasma is extremely important and effective for them.

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Pharmaceutical care for people with depressive disorders: A description of academic production in the context of Brazilian Graduate Studies

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ABSTRACT

Depressive disorder is a globally prevalent multifactorial condition that affects millions of people, significantly compromising their quality of life and well-being, and resulting in significant biopsychosocial distress. For those living with this disorder, different strategies are employed, both pharmacological and non-pharmacological. During drug treatment, Medication-Related Problems may arise, including situations in which patients in mental distress use their home medications as a suicide tool. From this perspective, pharmacists play an increasingly important role in the management of mental health conditions, assisting in the safety and effectiveness of treatment. This study aimed to review the available literature to analyze the importance of pharmaceutical care for people with depressive disorders. This was a descriptive and observational study of the State of Knowledge. Data were collected from the Catalog of Theses and Dissertations of the Coordination of Superior Level Staff Improvement (CAPES), without temporal limitation, to identify patterns, trends and gaps. The documents included needed to contain information pertinent to pharmaceutical care provided to individuals diagnosed with depressive disorder, written in Portuguese, English or Spanish, with the participation of Brazilian people. Pertinent information included activities such as health education, pharmaceutical guidance, dispensing, pharmaceutical care or consultation, pharmacotherapeutic follow-up, systematic recording of activities, measurement and evaluation of results. After the identification, selection and eligibility processes, two productions for the quantitative-qualitative synthesis were included for reading and analysis, addressing central themes such as pharmaceutical consultation and pharmacotherapeutic follow-up. It is suggested that this research enabled the visualization of pharmaceutical care activities and services for patients with depressive disorders, identifying potentialities for optimizing pharmacotherapeutic effectiveness, both pharmacological and non-pharmacological, and identifying strategies to minimize the impacts of therapeutic decision-making, including pharmaceutical, pharmacological and non-pharmacological interventions.

Keywords: Mental health, Pharmaceutical care, Graduate Education in Pharmacy.

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INTRODUCTION

Depressive disorder (DD) is a prevalent mental health condition, significantly compromising the quality of life and well-being of people with depression, and is recognized as one of the leading causes of work disability worldwide. During depression, the individual presents significant biopsychosocial suffering, of multifactorial origin, associated with different signs and symptoms. Due to the potential for morbidity and mortality and secondary diseases, for several countries there is a substantial financial cost for the development of care and health care for patients with depression (WHO, 2017).

DD comprises a range of clinical signs and symptoms of depression, and is one of the most prevalent mental health conditions, affecting millions of people globally, and encompasses many aspects of life, including quality of life, social relationships, work performance, and general well-being. It is recognized that the high incidence of suicide places DD in a position of priority in collective and public health, and it is therefore essential to understand this condition in order to optimize the approach to the patient and make effective the treatment and follow-up of people living with DD, with different criteria for each type of depression, following the Diagnostic Manual in Mental Health (DMH-5) – the gold standard for defining diagnoses in mental health) (Rufino et al., 2018).

The incidence of DD can comprise a frequency between 5-6% of the population, with a lifetime prevalence of 5-11%. The likelihood of the disease occurring is twice as high in women as in men, with the usual peak onset being between the ages of 20 and 40. In Europe, the first report related to the epidemiology of depressive disorders was developed by the ODIN study, which sought to know the prevalence and risk factors of depression in urban and rural areas of different parts of Europe. The overall prevalence found was 8.5%, with twice the frequency in women than in men. The prevalence of intense episodes of depression is as high as 17% and, in the case of recurrent brief depression, 11%. All studies agree that the incidence is twice as high in women and that it easily develops as a chronic disease. (Lindell et al., 2018).

The lifetime prevalence of DD in Brazil is around 15.5%. This number highlights the significant burden that depression imposes on the country's public health. The World Health Organization (WHO) estimates that the prevalence of depression in the Primary Health Care (PHC) network reaches 10%, either as an isolated condition or associated with other psychiatric and/or physical disorders. This high frequency highlights the importance of effective strategies for diagnosing, treating, and preventing depression within the context of PHC, aiming to mitigate its impacts on patients' quality of life and well-being (WHO, 2017).

These are long-term episodes, with 50% recurrences after a single episode, and even higher if there have been several previous episodes. Morbidity is similar to that of angina pectoris or

atherosclerotic disease and more socially debilitating than diabetes or arthritis. Only one-third of patients are on treatment. Suicide attempts affect 10% of depressed patients. Fifteen percent of severely depressed people end up committing suicide, and of those, 70% visit their general practitioner about 6 weeks before suicide (Peixoto, 2021).

Currently, the Unified Health System (SUS) seems to understand the urgency of understanding and planning actions to combat depression. In the year 2023, the Ministry of Health announced the creation of the National Department of Mental Health (DEME). An investment of R$ 200 million was also applied to the Psychosocial Care Network (RAPS), also focusing on teaching and research to recompose the cost of the Psychosocial Care Centers (CAPS) and Therapeutic Residential Services (SRT) (Brasil, 2023).

In this sense, different pharmacological and non-pharmacological strategies are used for the treatment of depression, including the assistance of the multidisciplinary health team. Considering non-pharmacological treatments, there are interventions and strategies for reception and permanence in the service, such as health education, psychotherapeutic and neurological rehabilitation, therapeutic workshops, assisted medication, home care, and other actions, activities, and services (Jacka et al., 2017; Brasil, 2023).

Regarding pharmacological treatments, there are different drug alternatives and therapeutic regimens. One of the main pharmacological classes used are Monoamine Oxidase Inhibitors (MAOIs), atypical antidepressants and Selective Serotonin Reuptake Inhibitors (SSRIs), among others.

Pharmacotherapeutic follow-up in depressed patients can be challenging, given that they are people with whom communication can be difficult and tend not to have adherence to treatment, which can be complicated to assess the effectiveness and safety of treatment due to the lack of measurable parameters and the presence of other concomitant diseases. This guidance aims, in the following points, to delve into each of the types of Medication-Related Problems (MRP) that can be encountered when studying the patient's antidepressant medication, in terms of need, efficacy, and safety, to facilitate and support this pharmaceutical work (Buist, 2019).

The *Pharmaceutical Care Network Europe* (PCNE) (Cipoli, Strand and Morley, 1998), during the European Conference on Pharmaceutical Care, defines MRPs s as: "*the occurrence of problems in an individual's pharmacotherapy, which causes or may cause interference with therapeutic outcomes".* On the other hand, the Granada Consensus (2002) defines that *"MRPs are health problems understood as negative clinical results, derived from pharmacotherapy that, produced by various causes, interfere with the therapeutic result or lead to unwanted effects*".

In Brazil, problems related to the nervous system are among the eight most frequent types of consultations in the community pharmacy. In the United States, aspects related to depression are

among the five most common visits to the pharmacist, including effectiveness and adverse events of antidepressant medications. Once the Clinical Pharmacy and Pharmaceutical Care service is implemented, with the development of pharmacotherapeutic follow-up activities for patients with DD, 32% of patients consider that the pharmacist is a good help to solve problems related to the proper use of medications, since 83% recognize that they forget or add doses of the treatment or even abandon it. and that the pharmacist helps them to adhere better to the treatment and to feel more satisfied with the medication (Berlin; Turecki, 2018).

From this perspective, the pharmacist can play an important role in the follow-up of antidepressant therapy from the beginning of treatment, helping to resolve MRPs, increasing patient satisfaction with their medication, and collaborating in therapeutic adherence, going beyond the private act of dispensing (Fang; Chen, 2018). Pharmaceutical care, as part of a multidisciplinary and interprofessional approach to health, represents a fundamental part in the prevention of mental health problems in the effective therapeutic response.

In view of this reality, it is imperative to explore all the potential of pharmaceutical care in the management and treatment of this severe mental condition (Berlin; Turecki, 2018; Ayre; Lewis; Keers, 2023), identifying which roles are essential for health promotion, disease prevention, and support for people with depressive disorders. This includes assisting in the appropriate selection of pharmacological therapy, monitoring its effectiveness, safety, and adherence, and providing health education for patients and/or their caregivers and families about the appropriate use of medications and providing continuous and integrated support throughout treatment (Kamusheva et al., 2020).

This study aimed to review the literature in order to identify the potential of pharmaceutical care in relation to the health monitoring of people with depression, through a review of the available literature, in order to identify the direction of postgraduate research on pharmaceutical care for people with depressive disorders (Fang; Chen, 2018).

METHOD

This was a descriptive and observational study, characterized as a State of Knowledge literature review, which allows the consolidation of specific information in the health area, providing recommendations based on research for clinical practice. In addition, it has the following features:

> "[...] map and discuss a certain academic production in different fields of knowledge, trying to answer what aspects and dimensions have been highlighted and privileged in different times and places, in what ways and under what conditions certain master's dissertations, doctoral theses, publications in periodicals and communications in conference and seminar proceedings have been produced" (Ferreira, 2002, p. 258)

For data collection, a search was carried out in the CAPES Catalog of Theses and Dissertations. The search was conducted using a combination of descriptors and alternative terms

according to the guidelines of the Health Sciences Descriptors (DeCS). The Boolean operators "*AND"* and "*OR*" were used, giving rise to the following search strategy: *"*pharmaceutical care" *AND* "depressive disorder" *OR "*depression"

The inclusion criteria that guided the selection of theses and dissertations comprised the following specification: at least their abstracts were available in electronic format and in Spanish, English or Portuguese, with Brazilian patients. There was no delimitation of a temporal interval to highlight patterns, trends and gaps. In addition, the documents needed to contain information pertinent to pharmaceutical care provided to individuals diagnosed with depression. Pertinent information is understood as the following activities: i) Health education (including promotion of the rational use of medicines), ii) Pharmaceutical guidance, iii) Dispensing, iv) Pharmaceutical care, v) pharmacotherapeutic follow-up, vi) Systematic recording of activities and vii) measurement and evaluation of results.

Documents that did not discuss pharmaceutical care activities considering people with depression were not included. Any document that did not meet these criteria, as well as duplicate publications, were not included.

After inclusion, a quantitative-qualitative perspective of the research was adopted. Quantitative data were analyzed descriptively using Excel (Microsoft ®) software, only absolute and relative frequency. The WebQDA® software was used as a tool for qualitative analyses, considering three phases of analysis, as proposed by Minayo (2001) and Bardin (2011), where 1) there was a thorough reading of the selected documents, followed by 2) coding and extraction of information according to the previously established inclusion criteria and 3) critical analysis of the data found.

During stage 1, the texts were examined in their entirety in an exhaustive manner. The pharmaceutical activities were categorized according to the thematic analysis, and comprised the following categories: a) implementation of pharmaceutical care services, b) performance of pharmaceutical consultations, c) telepharmacy activities, d) pharmacotherapeutic follow-up, e) methods and instruments for pharmacotherapeutic follow-up and f) instruments and evaluation of health indicators and Drug-Related Problems, thus offering a comprehensive overview of the landscape of depression-related pharmaceutical care.

The variables of interest for analysis comprised the following bibliometric indexes: a) time flow, b) large area of knowledge, c) area of knowledge, d) area of evaluation, e) area of concentration, f) name of the Program, g) regions, h) institutions, i) specification of the graduate work, j) methodologies used, k) objective and l) activity or service of pharmaceutical care reported.

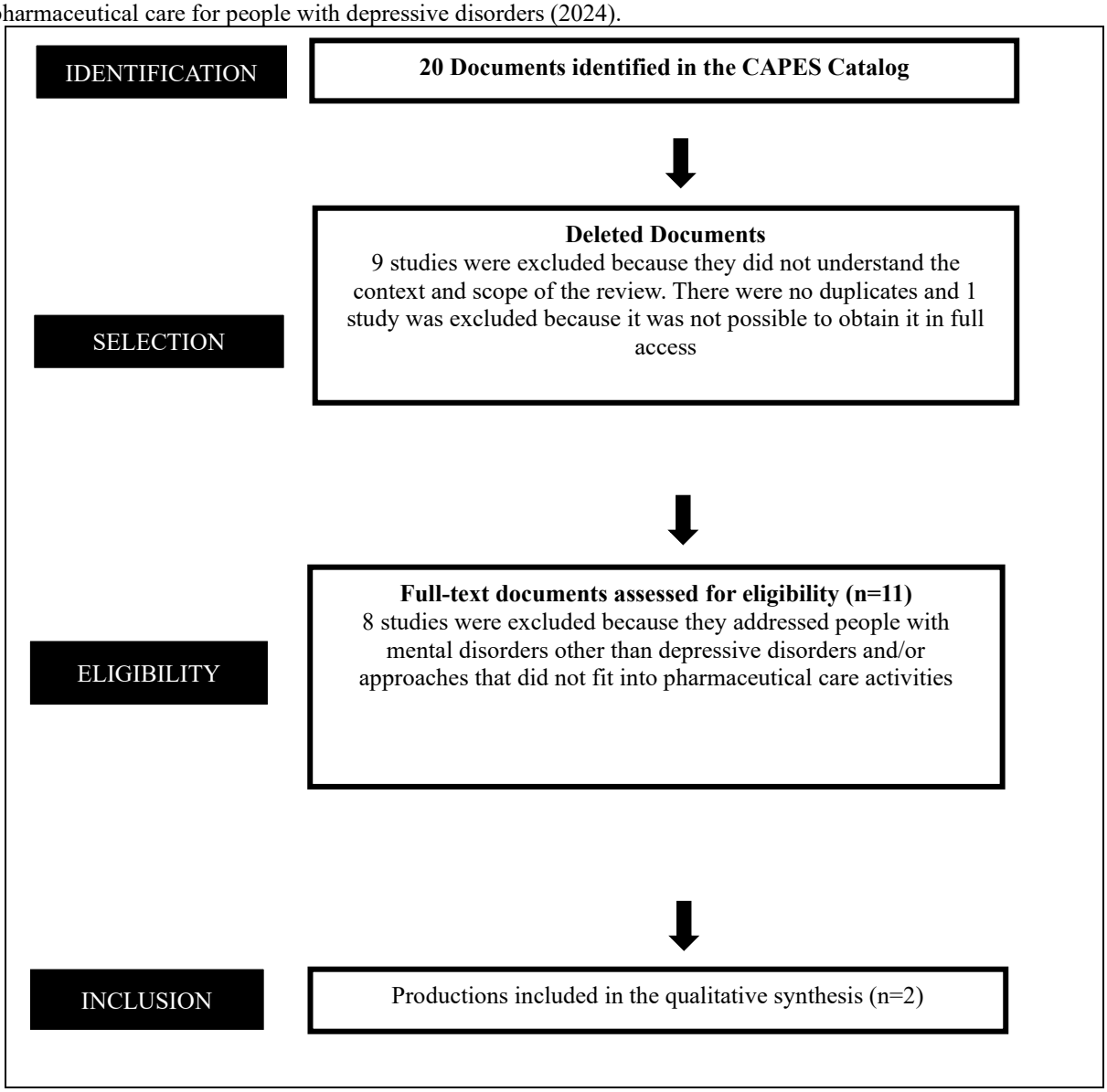
The data obtained by the thematic analysis are presented in tables and narratively presented grouped by the bibliometric indexes used in this study and other characteristics of the pharmaceutical activities performed. All the bibliography investigated and used during the data search was included

in the review, writing of the text and is cited in the references. Considering the type of study, there was no need to request authorization from the Research Ethics Committee (REC).

RESULTS AND DISCUSSION

Initially, 20 documents were found in the CAPES-CNPQ catalog. However, 45% (n=9) of the documents were excluded because they did not understand the scope of the review regarding pharmaceutical care and 5% (n=1) because they did not have full access to the CAPES catalog. After assessing the eligibility of the full text, 40% (n=8) of the studies were excluded because they addressed mental and psychiatric disorders that were different from those of DD and/or because they presented approaches that did not fit the activities of the clinical pharmacy and pharmaceutical care service (Figure 1).

Figure 1. Flowchart regarding the processes of identification, selection, eligibility, and inclusion of academic productions on pharmaceutical care for people with depressive disorders (2024).



Source: Prepared by the authors.

Finally, 10% of the general sample (n=2) was included for the quantitative-qualitative analysis of these documents, as shown in figure 1 and presented in terms of title and authorship in chart 01.

Table 1. Characterization of the title and authorship of academic productions on pharmaceutical care for people with depressive disorders found in the CAPES/CNPQ Catalog (2024).

Study title	Reference
Pharmacotherapeutic follow-up of patients with depression and/or anxiety disorders in a psychosocial care center: from the clinical trial to the implementation of the service	Fernandes, 2020.
Pharmaceutical care in people with depressive disorder: analysis of treatment effectiveness	Nunes, 2021.

Source: Prepared by the authors.

Considering the characterization of the bibliometric indexes, it was possible to notice a break in the continuity of the theme over a period of 8 years. In addition, the major areas of knowledge and evaluation included the multidisciplinarity and interdisciplinarity of health sciences. Most of the publications (66%) were doctoral theses. Other details are presented in Table 1.

Table 1. Characterization of bibliometric indexes of academic productions on pharmaceutical care for people with depressive disorders found in the CAPES/CNPQ Catalog (2024).

Bibliometric index	n	%
Year		
2020	1	50
2021	1	50
Great area of knowledge		
Health Sciences	2	100
Field of knowledge		
Pharmacy	1	50
Public Health	1	50
Depreciation area		
Pharmacy	1	50
Interdisciplinary	1	50
Area of concentration		
Biological assays	1	50
Pharmacy	1	50
Academic Degree		
Academic Master's Degree	1	50
Doctorate	1	50
Program Name		
Pharmaceutical Sciences	1	50
Health Sciences	1	50
Institution		
Federal University of Amapá	1	50
Federal University of Ceará	1	50
Region		
North	1	50
Northeast	1	50
Total	**2**	**100%**

Source: Prepared by the authors.

Objectives were observed both for the implementation of pharmaceutical services and the evaluation of the impact of pharmaceutical care, with the use of study designs for clinical intervention (longitudinal and prospective study and randomized controlled clinical trial), as described in chart 2.

Table 2. Description of the objectives and study designs of academic productions on pharmaceutical care for people with depressive disorders found in the CAPES/CNPQ Catalog (2024).

Study	Objective	Study method/design
Fernandes, 2020.	Implement a pharmaceutical care service, based on the Pharmacotherapeutic Follow-up (AFT) provided to patients with depression and/or anxiety disorders in a Psychosocial Care Center (CAPS)	This is a randomized controlled clinical trial involving 70 adults at the Psychosocial Care Center (CAPS II) in Mossoró-RN. Participants in the Intervention Group (IG) received Pharmaceutical Follow-up Services (TFA) over four months, in parallel to the Control Group (CG). After this period, some CG patients were invited to participate in another four months of intervention with AFT, forming the Post-Control Intervention Group (GIPC). Primary outcomes, such as treatment adherence, rates of anxiety and depression, and quality of life, along with their variations between groups, were compared. Qualitative content analysis, following Bardin's approach, was applied to interviews with patients and the CAPS health team. The objective was to explore their perceptions about the role of the pharmacist in mental health and the provision of Pharmaceutical Follow-up.
Nunes, 2021.	OBJECTIVE: To analyze the impact of Pharmaceutical Care on the effectiveness of treatment of users of the Psychiatry Outpatient Clinic of the Hospital de Clínicas Dr. Alberto Lima, diagnosed with depressive disorder.	This is a longitudinal and prospective study, characterized by an analytical-descriptive and intervention approach. Thirty-five participants underwent pharmaceutical care and were assessed by the pharmacist using the Beck Depression Inventory before and after the intervention. The consultations were conducted according to the Dáder methodology, consisting of four pharmaceutical sessions, the first in person and the subsequent sessions carried out by telepharmacy (telephone) at intervals of 30, 60 and 90 days, respectively.

Source: Prepared by the authors

As noted, there is a break in the historical series, even if in a low number of identified works. The findings raise reflections on the factors that may have contributed to this pattern. It is suggested that aspects such as health education and professional education can influence the development of potentialities and barriers in the face of the need for pharmacy to be understood and act, both in undergraduate and graduate programs, as a point of care within the Health Care Network (RAS), breaking with the biomedical model centered on medicine (Brasil, 2020).

It is noteworthy that after Resolution No. 6/2017, which instituted new National Curriculum Guidelines (DCNs) for the undergraduate pharmacy course, health care began to represent 50% of the scope of the DNC (Brasil, 2017), with emphasis on the insertion of Active Teaching-Learning Methodologies, with encouragement to critical-reflective training for health care and reduction of knowledge fragmentation. Another aspect to be considered is the low stimulus to the continuing

education of these professionals, which can hinder the understanding and development of clinical practice and rational decision-making during the care process (Andréa; Wagner; Scheveitzer, 2022).

The hypothesis is that in this context, the drug-centered model seems to influence understandings of fragmented, organicist and individualized mental health care models, which influence the non-perception of gaps in this area, highlighting the need for an expansion and redirection of scientific interest. It was also possible to observe the important role of federal universities. Oliveira and Bastos (2014) discuss the political and ethical role of public institutions in the development of research.

Considering the types of documents (thesis or dissertation) found, it is possible to recognize the level of training in which pharmaceutical care has been approached. In addition, there is the observation that the major areas of knowledge and evaluation cover health sciences, especially pharmacy, mental health and public health. Both data highlight the links between the relationship between pharmaceutical care and the health of populations and communities, pointing to a transdisciplinary interest in the theme. This fact may indicate a comprehensive approach in the conduct of studies, as an effort to integrate different perspectives and knowledge, which may result in practical and innovative solutions and benefits in the area of pharmaceutical care. Giacomini and Rizzoto (2022, p.261) state that the interdisciplinarity perspective "represents an opportunity to overcome the biomedical model of care" in mental health, with the potential to understand subjects and collectives in an integral way, as guided by the principles of the Unified Health System (SUS).

It was possible to observe similar activities present in the academic productions, as presented in chart 03 and detailed in table 2, with a frequency of complementary clinical activities regarding the activity of pharmaceutical care. In general, a higher frequency of pharmacotherapeutic follow-up is observed in clinical management and care planning for patients with mental disorders.

Table 3. Description of the activities carried out in the studies of academic productions on pharmaceutical care for people with depressive disorders found in the CAPES/CNPQ Catalog (2024).

Study	**Description of the activities carried out in the study**
Fernandes, 2020	➢ Implementation of the clinical pharmacy and pharmaceutical care service ➢ Pharmaceutical consultation ➢ Pharmacotherapeutic follow-up
Nunes, 2021	➢ Pharmaceutical consultation ➢ Pharmacotherapeutic follow-up ➢ Use of the Dáder Method ➢ Application of the Beck Depression Inventory ➢ Evaluation of Drug-Related Problems (MRPs) ➢ Telepharmacy

Source: Prepared by the authors

Table 2. Categorization and frequency of reporting of the different pharmaceutical care activities of academic productions on pharmaceutical care for people with depressive disorders found in the CAPES/CNPQ Catalog (2024).

Categorization	n	%
Pharmacotherapeutic follow-up	2	22,2
Evaluation of Pharmacotherapy-Related Problems	1	11,1
Pharmaceutical consultation	2	22,2
Implementation of pharmaceutical services	1	11,1
Telepharmacy	1	11,1
Using the Dáder Method	1	11,1
Use of instruments for the assessment of health problems	1	11,1
Total	**9**	**100**

Source: Prepared by the authors

The studies found are complementary and cover similar themes. Although they have played a role in public health for a long period, the inclusion of pharmacists in Primary Health Care (PHC) health teams is a recent trend (Manzini et al., 2020). Legal, political, and educational changes have allowed pharmacists to face new perspectives in healthcare (Bates; Bader; Galbraith, 2020; Goode et al., 2019). These changes reflect the evolution of health care, with patient-centered medicine replacing the reactive and curative model, influenced by scientific, technological, and economic progress and advances in health systems (Bragazzi et al., 2020), which highlights the potential of mental health care.

Also considering the themes identified in the documents produced by the graduate programs, clinical pharmaceutical services are frequent. These can be presented and developed in a variety of ways, including individualized and regular pharmaceutical consultations, as well as group educational activities, such as lectures, community campaigns, focused on the prevention of chronic diseases (Feitosa et al., 2020).

Before starting the pharmaceutical care process in a concrete way, it is possible to understand the individual needs of patients during the dispensing of medications, through the analysis of prescriptions, direct interactions with patients, and review of medical records and records of PHC Units (Sá et al., 2020). The pharmacist's clinical role develops in an organized manner, starting with direct contact with the patient to identify their health conditions, drug history, allergies, adverse reactions, lifestyle habits, treatment adherence, monitoring of therapy results, and other relevant factors (Wang et al., 2020; Dilles et al., 2021).

From this perspective, the studies found demonstrate that patient-centered care, personalized according to each individual's health condition, responding to their specific needs (Amu et al., 2021), seems to be developing, although incipient – compared to the size of the national health system. This individualization of care requires patient education, which allows them to acquire knowledge about their health condition and the available treatments, promoting their safety and self-care capacity. This collaborative approach between patients and healthcare professionals positively promotes health promotion (Heggdal et al., 2021).

Around the world, there is a shift in the approach to the role of the pharmacist, which is evolving from a focus primarily focused on the drug and its dispensing as a *commodity*, to a patient-centered approach (Pol et al., 2021). With a clear understanding of their duties, roles, and responsibilities, the pharmacist is no longer limited to the pharmacy environment, but expands their services to include patient guidance and counseling on non-pharmacological issues (Nussbaumer-Streit et al., 2020). According to Lula-Barros and Damascena (2021), pharmaceutical services play a crucial role in disseminating evidence-based information, which contributes to comprehensive, effective, and problem-solving health interventions.

It is also noted in the results found that there are several forms of pharmaceutical action, each bringing its own specificity to the context. This change in the role of the pharmacist allows him to know the health conditions, habits, and individual needs of patients, intervening in a personalized way to promote their access to health services (Navarrete et al., 2021). Additionally, by adopting a patient-centered approach, the pharmacist can contribute to easing the burden on the public healthcare system and improving users' access to these services. The availability, easy access, and ability to establish relationships of trust with the multidisciplinary team highlight the pharmacist as a strategic component in patient care (Pfaff; Rafie, 2020).

It is also possible to identify pharmaceutical performance from the perspective of identifying and resolving MRPs. The inappropriate use of a wide variety of medications by the population can result in MRPs. These are common, occurring in about half of the patients seen in community pharmacies, with at least one event per patient. The pharmacist plays a crucial role in identifying and resolving these issues, which can compromise treatment results and cause unintended unwanted effects. Adverse events associated with MRPs increase hospitalizations, healthcare costs, and morbidity and mortality (Paulino et al., 2021).

Pharmaceutical care in CAPS requires adequate planning, in general, so that it is possible to comply with care plans, considering comprehensive and longitudinal therapeutic care, stimulating the bond between patients and professionals. In this aspect, it is considered that professionals who provide therapeutic care, health promotion and recovery can become a reference for dispensing in mental health, also under the aspect of pharmaceutical care. Models of mental health care in collaboration with the multidisciplinary team are fundamental, as the pharmacist is able to establish a link between other professionals, and participate in strategies for adherence to mental health care with patients with depression and/or other psychiatric disorders or common mental problems (Silva; Lima, 2017).

The process of personalizing and optimizing pharmacotherapy for each patient is highly complex, aiming to achieve therapeutic results with no or few adverse events (Dilles et al., 2021). To exercise an effective clinical role in mental health, the pharmacist must be involved in identifying

and resolving problems related to pharmacotherapy. This allows the pharmacist to provide precise guidance to the patient on the correct use of medications, contributing positively to the therapeutic effect on the patient's health (Wang et al., 2020). In addition to guiding and educating the patient, when acting clinically, the pharmacist trains the multidisciplinary health team and health service managers on the rational and safe use of medicines (CFF, 2020; Brazil, 2020; Tritany, 2020; Rubert; Deuschle, 2021).

During this process, especially in the context of drug therapy of patients with mental disorders, the pharmacist evaluates the prescription of medications, including their indication, possible interactions, route of administration, dosage, and other aspects, aiming to prevent and solve problems related to pharmacotherapy. Then, pharmaceutical interventions are implemented as needed, as part of the individualized care plan (Wang et al., 2020; Dilles et al., 2021).

The documents address the recent practice of telepharmacy. Recently, the first regulation of telepharmacy was published, through Resolution No. 727, of June 30, 2022). The Federal Council of Pharmacy (CFF) defines telepharmacy as the practice of Clinical Pharmacy mediated by Information and Communication Technology (ICT), performed remotely and in real time or asynchronously. This modality aims to promote, protect, monitor and recover health, prevent diseases, solve pharmacotherapy problems and promote the rational use of medicines, in addition to being applicable to health education and research. Forms of care include pharmaceutical teleconsultation, teleinterconsultation, telemonitoring or telesurveillance, and teleconsulting. To work in telepharmacy, pharmacists must use platforms or software registered with the Regional Pharmacy Councils (CRFs) and represented in Brazil. Companies that provide these platforms or perform services must have established representation in the country and a pharmacist in charge of the technical (Brasil, 2022).

Telepharmacy is considered an extension of clinical pharmacy, offering pharmaceutical services digitally in response to the needs of new social and economic contexts, driven by the advent of Health 4.0 or Digital Health, especially accelerated in Brazil due to the COVID-19 pandemic. Like telemedicine, telepharmacy is a part of telehealth, utilizing digital means to provide remote assistance. In addition to facilitating dialogue, telepharmacy assists with treatment adherence, patient education, and support for other pharmaceutical professionals. Studies have shown the benefits of this model for treatment adherence and improved health in chronic patients (Crilly; Kayyali, 2020).

The Dáder method, a systematic and documented model of pharmacotherapeutic follow-up, was frequently used among the documents included. The Pharmacotherapeutic Follow-up Method is a simple and systematized surgical procedure that allows recording, monitoring and evaluating the effects of pharmacotherapy in patients. It is based on obtaining information about the patient's health problems and treatments to elaborate a pharmacotherapeutic history and status states. Based on this

assessment, an intervention plan is established, recording all pharmaceutical interventions to improve the patient's health status. The method is flexible and adaptable to the needs of different care environments, evolving with clinical practice and the experiences of professionals. Its usefulness is evidenced by its wide adoption by pharmacists around the world and its ability to be applied in various care contexts (Brasil, 2020).

Pharmacotherapeutic follow-up by the Dáder Method comprises several stages. Initially, there is the Pharmaceutical Interview, which consists of a combination of open-ended and closed-ended questions to explore the patient's main concerns, review ongoing drug therapy, and analyze the results of laboratory tests. This stage also encompasses the assessment of treatment adherence, including the comparison between the medical prescription, the patient's report, and the medications he or she brought with him, whether prescribed or not (De lima et al., 2021).

After the interview, a summary of the patient's health conditions is made, along with the medications used and the treatment history. This phase is called State Situation and serves as the basis for structuring the patient's pharmacotherapeutic history. Then comes the Study Phase, in which the pertinence, efficacy and safety of the drugs in use are analyzed. This step involves dialogue with the multidisciplinary health team and the formulation of an action plan to optimize therapy (Júnior et al., 2021).

Finally, there is the Intervention/Evaluation of Results, in which intervention suggestions are presented to patients and their families. At this point, therapeutic goals, laboratory test requirements, home monitoring, and therapy adjustments as needed are defined. Outcomes are assessed by comparing laboratory tests and vital signs at the beginning and end of the rehabilitation plan (Brasil, 2020; Oliveira et al., 2020).

There are some limitations in this study, such as the absence of a significant sample size, which may have been influenced by the search strategy, only by performing counter-evidence to increase the number of studies to be explored. Some studies have also not been fully evaluated. Even so, it was possible to notice a similar profile of clinical activities, especially for mental health. We suggest further research that makes it possible to indicate relationships regarding the measures of transformation of graduate programs that comprise pharmaceutical care in mental health.

FINAL THOUGHTS

The results provide a similar view of the current scenario of pharmaceutical care, especially in the context of mental health and the expansion of clinical services, despite the limited results. Although a significant portion was excluded because it did not fit within the scope of the research, the careful selection allowed for a more objective analysis of the included studies. An important finding is the trend towards interdisciplinarity and multidisciplinarity in the health sciences,

especially in the context of pharmaceutical care. Still, it is possible to observe that there is a recent interest in this area of research, although a break in continuity in the theme over a period of time has been observed, raising questions about the factors that may have contributed to this pattern.

The studies analysed demonstrate an evolution in the approach to the role of the pharmacist, moving from a drug-centred to a patient-centred approach. This change is reflected in the growing practice of clinical pharmaceutical services, especially with the adoption of the Pharmacotherapeutic Follow-up Method. Also noteworthy is the emergence of telepharmacy as an extension of clinical pharmacy, driven by digital progress and the need for accessibility and efficiency in health services. The recent regulation of telepharmacy opens up new opportunities for the delivery of remote and personalized care, although operational and implementation challenges still need to be overcome.

It is clear that the role of the pharmacist is constantly evolving, and the integration of interdisciplinary approaches, the adoption of systematic clinical methods, and the exploration of new modalities of service delivery are key to driving significant advances in pharmaceutical care. These findings provide a solid foundation for future research and for enhancements in clinical practices and health policy related to the role of the pharmacist in health promotion and patient care.

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Dry eye syndrome among students: A review

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ABSTRACT

Dry Eye Syndrome (DES) or Dry Eye Disease (DED) is a common ophthalmological condition that affects millions of people worldwide. Although it is most commonly associated with older age, there has been a concerning increase in the prevalence of DES among young people, especially students. This review aims to address aspects of the prevalence and impact of DES among students, highlighting risk factors, consequences for eye health, and academic performance.

Keywords: Dry eye syndrome, Dry eye, Disease, Students.

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INTRODUCTION

Dry eye syndrome (SOS) or dry eye disease (DOS) is a common eye condition that affects millions of people worldwide. One of its most accepted definitions is: "a multifactorial disease of the ocular surface characterized by the loss of tear film homeostasis, accompanied by ocular symptoms, in which the instability and hyperosmolarity of the tear film, as well as ocular surface damage and inflammation and sensorineural abnormalities, contribute to the pathophysiology" (Craig et al., 2017; I Y Hasan et al., 2022).

Dry eye disease can be categorized as aqueous deficiency, evaporative deficiency, or mixed mechanisms. Aqueous deficiency originates from decreased tear secretion, and evaporative disease is caused by abnormalities in the lipid layer of the tear film. Dysfunction of the Meibomius glands is a major cause of disruption of the lipid layer of the tear film and consequently of dry eye disease (I Y Hasan et al., 2022).

It is estimated that the prevalence of the disease ranges from 5 to 50% in world populations, depending on the definition adopted and other contextual factors, as well as the prevalence of Meibomius gland dysfunction is estimated between 3.5 and 69.3%. In a meta-analysis conducted with studies on the American population, the prevalence of DED ranged from 5.3% to 14.5% (McCann et al., 2022).

Despite being more commonly associated with advanced age, there has been a worrying increase in the prevalence of SOS among young people, especially among students. This review aims to address aspects of the prevalence and impact of SOS among students, highlighting risk factors, consequences for eye health, and academic performance.

SIGNS AND SYMPTOMS

Dry eye disease can cause various symptoms, such as pain, discomfort, burning, foreign body sensation, redness/hyperemia, tearing, mucoid discharge, eye strain, contact lens intolerance, blurred vision, and sensitivity to light. Symptoms that may also be associated are: fluctuation of vision and visualization of halos around lights at night. In addition, tear film insufficiency can predispose to complications, such as keratitis and corneal ulcers (Guo et al., 2020).

Visual acuity represents a static measure of image resolution in the focal plane in an optical system (retina in the human eye). Visual function, on the other hand, has a broader concept, which represents how well visual acuity remains in the dynamics of daily tasks. The quality of the image on the retina depends on how transparent the path is that the light travels through all the structures of the eye (optical media). The tear film on the surface of the cornea is the first structure that has a direct influence on the path that light passes. When dry eye is present, the tear film is degraded, usually due

to insufficient tear secretion (aqueous deficiency) and/or poor tear film quality and instability that leads to earlier tear rupture, which can cause impaired visual function (Guo et al., 2020).

Functional visual acuity is a contrast measure of visual acuity during and after sustained visual activity, which is believed to be a more accurate representation of visual function in real-life situations such as reading, computer work, and driving. In fact, dry eye has been pointed out in several studies as a cause of visual function degradation in sustained visual activities, as well as negatively affecting contrast sensitivity and is associated with irregular astigmatism and high-order visual aberrations (Guo et al., 2020).

RISK FACTORS AND PREVALENCE

There are several risk factors associated with DED, among which the following stand out: female gender, use of contact lenses, use of computers, thyroid abnormalities, and use of antidepressants and antihistamines (I Y Hasan et al., 2022).

The global prevalence of dry eye disease is estimated at 11.59%. For symptomatic disease, the estimate is 9.12%, 9.5% in women and 6.8% in men. The estimated prevalence is lowest in North America, 3.5%, and highest in East Asia, 42.8%. Using the TFOS DEWS II diagnostic criteria, the overall prevalence was estimated to be 29.5% (Papas, 2021).

Recent studies have shown a high prevalence of SOS among college and high school students. Factors such as excessive use of electronic devices, prolonged exposure to computer screens and *smartphones,* air-conditioned environments, and inadequate use of contact lenses have been identified as major contributors to the development of SOS in this demographic.

Studies also reveal a significant increase in the incidence of DED among students during the Covid-19 pandemic, probably due to the increase in the time of use of electronic devices for work, recreation and study used during the *lockdown* (Lulla, 2023; García-Ayuso et al., 2022).

In a study conducted among graduate students in Ethiopia, the prevalence of symptomatic dry eye syndrome was 50.5% (Zelek et.al., 2022), similar to that of a study conducted on university students in Ghana, where it was 44.3% (Asiedu et al., 2017). In the population of medical students in Serbia, the prevalence found was 60.5% (Aćimović et al., 2022) and in university students from Poland, it was 57.1% (Wróbel-Dudzińska et al., 2023). In a survey conducted among Brazilian university students, the prevalence varied between genders: 24.0% among men and 42.6% among women, in accordance with other studies that indicate that females are more likely to have symptomatic dry eye disease (Yang et al., 2021). In students from Jordan, the prevalence of dry eye symptoms was 74.6%, higher than the average of populations of other nationalities.

The results in general show a higher prevalence of symptomatic dry eye disease in students when compared to the general population, as well as in the female population (due to hormonal factors and contraceptive use) and with longer screen use.

IMPACT ON EYE, MENTAL, AND FINANCIAL HEALTH

SOS can result in a variety of symptoms, including a burning sensation, itching, red eyes, blurry vision, and eyestrain. Additionally, untreated SOS can lead to more serious complications, such as corneal damage and chronic inflammation, which can significantly compromise students' quality of life.

The World Health Organization recognizes quality of life as a multifaceted concept in which health conditions can alter physical health, psychological well-being, level of independence, environmental impact, social relationships, and personal and spiritual beliefs. Dry eye disease mainly affects physical health, due to the symptoms of pain, discomfort and blurred vision and mental health, since the reddish appearance that dry eye can cause, can impact body image and self-esteem. In addition, the disease can negatively affect cognitive processes, sleep, mood, and mental health. Vision fluctuation can cause slower reading speed and impair day-to-day activities that require visual concentration for long periods of time (Guo et al., 2020).

Many studies show that dry eye has negative effects on concentration and productivity, creating substantial losses in the job market and academia. SOS can also negatively impact leisure and rest activities, including sports activities, where fluctuating visual acuity is due to the influence of poor tear film dynamics on visual tracking accuracy and ability to fix moving targets while incorporating hand-eye coordination (Guo et al., 2020).

Dependence on medications and drug therapies may also occur, as long-term management of dry eye symptomatology may include the use of topical immunomodulators, topical corticosteroids, artificial tears/gels/ointments, eyelid and eyelash cleansers, tear point plugs, omega-3 fatty acid supplementation, glasses to preserve periocular moisture, and autologous serum eye drops (Guo et al., 2020).

The economic impact of long-term management of dry eye can be significant, including the costs of ophthalmologist visits, medications, and dietary and palliative supplements (Guo et al., 2020).

Many studies have reported the correlation between SOS and mental illness, including depression and anxiety. When compared to other eye diseases, dry eye patients are more likely to develop anxiety and depression. In addition, symptoms can impact the quality of life of these patients (He Q et al., 2022).

IMPACT ON ACADEMIC PERFORMANCE

The discomfort caused by SOS can negatively affect students' academic performance. Difficulty concentrating due to constant eye irritation, the need to interrupt activities to blink more often, and reduced visual acuity can hinder productivity and efficiency in studying.

PREVENTION AND MANAGEMENT STRATEGIES

It is crucial for students to take preventative measures to reduce the risk of developing SOS, such as taking regular breaks while using electronic devices, limiting the amount of time spent on these devices when possible, adjusting the work environment to reduce eye dryness, and following recommendations for proper contact lens wear.

There are many environmental and behavioral modifications that can be implemented in an attempt to improve SOS. For example, you can increase the humidity level inside the rooms, avoid dry conditions that can exacerbate the disease (such as walking with car windows open, air conditioning, prolonged plane trips, etc.). In addition, the ergonomics of work/study environments can be improved, such as lowering the height of the computer screen, which causes the gaze to be directed a little downwards and reduces the exposure of the surface of the eye to air and reduces the evaporation of the tear film. Routine changes such as implementing the habit of cleaning the eyelids and eyelashes daily (to reduce exposure to allergens as well as the proliferation of bacteria), frequent pauses in the use of screens (to ensure adequate blinking for corneal protection through the distribution of tear film) and the appropriate use of glasses to prevent eye fatigue, They may be beneficial in conducting dry eye. Increasing overall health, such as maintaining adequate sleep, hydration, exercise, nutrition, and psychological well-being, can also improve the state of dry eye disease, reduce symptoms and associated stress. Environmental and behavioral changes are usually the first recommendations in treatment, and are very important for long-term therapeutic response (Sheppard et al., 2023).

Many pharmacological agents can be used for patients with dry eye disease. Topically, lubricants, corticosteroids, *lifitegrast*, and cyclosporine A may be used. Systemic agents that may be administered orally may include antibiotics (azithromycin and tetracyclines), omega-3 fatty acids, and antioxidant supplements. In addition, treatment of SOS includes the use of artificial tears, heat therapy, and, in more severe cases, medications prescribed by an ophthalmologist. Recently, varenicline nasal spray (Tyrvaya), a cholinergic agonist nasal spray (Tyrvaya™), has been approved for the treatment of the signs and symptoms of dry eye (Sheppard et al., 2023).

Non-pharmacological interventions for the treatment of the condition may include procedures such as occlusion of the lacrimal points, pulsation and thermal extraction of the Meibomius glands,

pulsed light therapy, and microblepharoexfoliation. Some therapies include eyelid hygiene devices, neurostimulation, heat or humidity glasses, and warm compresses (Sheppard et al., 2023).

CONCLUSION

SOS represents a significant eye health problem, particularly among students, with the potential to negatively impact both health and academic performance. It is imperative that effective prevention and management strategies are implemented to mitigate the adverse effects of this condition and promote a better quality of life for academics and the general population. The continued engagement of educators, health professionals, and students in raising awareness and adopting healthy practices is critical to addressing this growing challenge.

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School games: Challenges faced by physical education teachers - An integrative review

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ABSTRACT

The realization of school games is a challenge for the school community due to the scarcity of financial resources and the effective participation of students and teachers. This study aims to analyze the challenges faced by Physical Education teachers in School Games, seeking to investigate in the existing literature their difficulties and possible solutions to ensure the effective participation of these events. The methodology used was the integrative review, with keywords such as "school games", "physical education teacher", "sports game", "difficulties" and "challenges". The databases consulted were Capes, Lilacs and SciELO. The results revealed obstacles such as a lack of financial resources and adequate infrastructure, including insufficient physical spaces and scarcity of sports equipment. These challenges negatively impact the holding of the School Games and demotivate both teachers and students. In conclusion, when analyzing the challenges faced by Physical Education teachers in School Games, four important points emerge: the need for adequate teacher training, the diversification of pedagogical approaches, the recognition of the benefits of games for student learning, and the promotion of inclusion and gender equality.

Keywords: Education, School Games, Teachers.

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INTRODUCTION

According to Arantes, Martins and Sarmento (2012), the trajectory of School Games and Physical Education in the Brazilian educational scenario has undergone a great evolution over the years. Changes over time include the expansion of the School Games from local events to a national dimension, and the recognition of Physical Education as an essential component in the integral development of students.

Over the decades, School Physical Education has evolved from an approach focused solely on traditional physical activities to recognizing its importance in promoting student health and well-being. This change has been accompanied by a greater appreciation of discipline as an essential component of integral education, with teaching methods that are more inclusive and adapted to the individual needs of students. In addition, the integration of educational technologies and interdisciplinary approaches has enriched the teaching of Physical Education, offering new opportunities for learning and engagement. These evolutions reflect a movement towards a more comprehensive and relevant Physical Education for contemporary demands (Carvalho; Trap; Vieira, 2024).

Neuenfeldt (2020) reports that the BNCC highlights the importance of a more comprehensive Physical Education, which goes beyond traditional physical activities, valuing the promotion of health, well-being, and continuous improvement of students' lives. The games fit perfectly into this perspective, offering opportunities for the development of health-related skills, such as body awareness, cardiorespiratory fitness, motor coordination, and the ability to make healthy decisions.

Arantes, Martins, and Sarmento (2012) explain that School Games and Physical Education play fundamental roles in the educational environment. The School Games are not limited to promoting the practice of sports among students, but also act as a means of fostering social values and ensuring integral development, providing experiences that go beyond the purely sporting aspects. The interconnection between School Games and Physical Education reveals a complex dynamic that, when understood and integrated effectively, significantly expands educational benefits.

In view of this, MOMMAD (2020) comments that the sports and educational context, permeated by social, economic, and political transformations, has shaped the way School Games and Physical Education are perceived and integrated into the educational environment.

The relationship between games, Physical Education and BNCC is related to the role of games as a pedagogical strategy in the teaching of the discipline, as guided by the National Common Curriculum Base. The BNCC highlights the importance of playfulness and play as pedagogical resources in Physical Education. Games can be used as tools to promote the physical, cognitive,

social and affective development of students, in addition to stimulating cooperation, teamwork, problem solving and decision-making. (Sena; Rodriguez; Morais Sobrinho; Dantas; Silva, 2016).

The introduction of school games as a pedagogical strategy in Physical Education is justified by its relevance in the integral development of students, promoting not only the practice of sports, but also the development of cognitive, social and affective skills. This approach is supported by the National Common Curriculum Base (BNCC), which recognizes the importance of playfulness and play as pedagogical resources in Physical Education, guiding teachers on the contents, objectives and methodologies to be developed. (Neuenfeldt, 2020)

The games provide challenging and pleasurable experiences, stimulating the active participation of students and favoring motor, cognitive and social development. Through games, students have the possibility of experiencing situations that involve decision-making, problem solving, teamwork and cooperation, fundamental skills for life in society (Carvalho; Trap; Vieira, 2024).

Sena et al (2016) point out that games allow for an inclusive approach, adapting to the individual needs of students and promoting the participation of all, regardless of their physical abilities. This diversity of possibilities contributes to respect for individuality and to stimulate students' self-esteem and self-confidence.

The integration of games in Physical Education, as guided by the BNCC, is also in line with contemporary demands. We live in an era in which technology is part of students' daily lives, and the use of educational technologies in games can enrich teaching, providing new ways of learning and student engagement (Carvalho; Trap; Vieira, 2024).

Therefore, the justification of this study stands out for the importance of incorporating games in Physical Education, according to the BNCC, it is based on its ability to promote the integral development of students, stimulate essential skills for life in society, provide an inclusive approach adapted to individual needs, promote health and well-being, in addition to being aligned with contemporary teaching demands.

School Games are fundamental for the integral development of students, but the challenges faced by teachers, such as lack of resources and infrastructure, hinder their effective realization. Thus, understanding and overcoming these obstacles is essential to ensure the full participation and meaningful contribution of these events to the school community. Thus, the guiding question is: "What are the main challenges faced by Physical Education teachers in conducting School Games, as evidenced by the existing literature? How do these challenges impact teachers' pedagogical practice and sports practice, and what research gaps can be identified to guide future studies and improve understanding of this scenario?"

Thus, its main objective is to analyze the challenges faced by Physical Education teachers in the School Games, investigating in the literature already published their difficulties and possible solutions to ensure the effective participation of these events in the school community. Followed by the specific objectives that are: Identify and map relevant studies that report the challenges of Physical Education teachers in School Games; To analyze the main practical and pedagogical difficulties faced by Physical Education teachers.

THEORETICAL REFERENCE

THE IMPORTANCE OF SCHOOL GAMES IN THE PRACTICE OF PHYSICAL EDUCATION TEACHING

According to Almeida and Fonseca (2013), the practice of sports, even in its competitive modality, offers a variety of benefits for children and adolescents. Therefore, school games emerge as fundamental elements for learning in different dimensions, including the social, cultural, cognitive and affective spheres. In this sense, it is recommended to provide the participation of a larger number of students in the sports activities of the school games.

School games, according to Haidt's (2003) conceptualization, are activities that stand out not only for their fun, but also for the fundamental presence of previously elaborated rules. This characteristic is no mere formality; On the contrary, it plays a crucial role in the educational and social context, making school games an enriching experience for participants.

In this sense, Brandão (2009) states that "games, being subject to socially constructed rules, contribute to the action of individuals in the world, we can speak of their role in human development". Games and games help children from an early age realize that we live in a world with a lot of norms and rules.

The author highlights the importance of games as socially constructed and rule-governed elements, emphasizing their significant role in human development. According to the author, games are not mere playful activities, but play a crucial role in contributing to the action of individuals in the world.

ROLE OF THE PHYSICAL EDUCATION TEACHER IN SCHOOL GAMES

The performance of the Physical Education professional in the School Games plays a crucial role in the integral development of students, going beyond the mere supervision of sports activities. The performance of these professionals is multifaceted, involving not only technical guidance during competitions, but also pedagogical, ethical and social aspects that contribute to a complete education of students. (Carvalho; Trap; Vieira, 2024).

In the scenario of School Games, the work of the Physical Education teacher transcends mere technical guidance and enters a more comprehensive and educational sphere. In the light of the vision presented by Almeida and Fonseca (2013), the Physical Education teacher positions himself as an essential agent to ensure that the benefits of these competitions are fully explored by students.

According to Bento (2002), the Physical Education teacher assumes the fundamental role of mediator between sports practice and educational objectives, a responsibility that goes beyond the simple technical instruction of the modalities. In this context, the School Games stand out as a valuable opportunity for the teacher not only to transmit sports skills, but also to contextualize these practices in the physical, cognitive and social development of students.

For the author, through the School Games, the teacher has the chance to promote values such as respect, cooperation and sportsmanship, contributing significantly to the formation of conscious and ethical citizens. In addition, by using Physical Education as a means of arousing students' interest, providing free expressiveness and fostering creativity in the teaching-learning process, the teacher establishes an environment conducive to living with diversity.

According to the observations of Gallardo (2003), cited by Bento (2012), it is in the first school years that students begin to seek the teacher's attention, eager to be recognized and valued in personal terms. Given that students often experience negative feelings, such as anger and disappointment, the teacher plays a crucial role in minimizing these emotions while avoiding negatively impacting relationships with fellow students. It is imperative that the teacher guides students about the inevitability of failure, highlighting that this is a natural part of life, and encouraging them to overcome these challenges, always highlighting their positive abilities.

In addition, Bracht (2010) explains that the Physical Education teacher plays a fundamental role in the identification and development of sports talents among students. The School Games provide a platform to observe the performance of students in different modalities and, from this observation, the teacher can guide emerging talents, encouraging participation in more advanced training or competitions at the regional and national level.

In this context, according to Arantes, Martins and Sarmento (2012), it is understood that the role of the Physical Education teacher in School Games goes far beyond the technical sports aspect. He becomes an integral educator, shaping not only athletic abilities, but also values, ethics, and the overall development of students. The commitment and pedagogical vision of these professionals are essential for the success and positive impact of the School Games on the education of young people.

The relationship between school sports and the Physical Education curriculum, as well as the role of the physical education teacher. Neuenfeldt (2020) found that school sports influence PE curriculum, with teachers incorporating principles such as cooperation and respect.

Aur (2018) discusses the challenges of implementing the BNCC, which aims to reduce educational inequalities. Guedes (1999) highlights the emphasis on competitive sports in physical education, which may not fully meet the educational needs of students.

In this sense, Lopes (2000) traces the history of teacher education, which has evolved to include a didactic-pedagogical approach. Carneiro (2009) explores the role of physical education in schools and the potential of games in this context, revealing the need for a change in pedagogical approaches. These studies collectively suggest that the role of the physical education teacher in the context of the BNCC should be to provide a more holistic and inclusive approach to physical education, going beyond competitive sports and incorporating a variety of physical activities and games to meet diverse needs. of students.

MATERIALS AND METHODS

This research is an integrative review, Munhoz et al (2021) state that it is a research method that aims to systematically gather, evaluate, and synthesize all relevant evidence available on a given research question. It seeks to answer a clearly defined question, using a rigorous and transparent methodological approach.

To consolidate the construction of the study, the following keywords were used: "school games", "physical education teacher", "sports game", "difficulties" and "challenges". These keywords were combined as follows: "school games and difficulties", "physical education teacher and challenges", "sports game and difficulties", "challenges in school physical education"

The data locations consulted were the Capes Journal Portal, which offers access to a wide variety of scientific journals, Lilacs – Bireme, which is a database specialized in health and biological sciences, and SciELO, an electronic library that encompasses a selected collection of Brazilian scientific journals.

The searches were carried out considering the period of the last 10 years (2013-2023) to ensure the relevance and timeliness of the studies found.

According to the organizational chart above, the inclusion criteria considered: a) Publications made in the last 10 years; b) Studies conducted in the Brazilian context; c) Specific focus on the challenges of Physical Education teachers in School Games; d) Presentation of relevant results for the understanding of the pedagogical, organizational and practical challenges associated with the School Games.

To ensure the consistency and validity of the results, exclusion criteria were also determined. These criteria were defined based on the inclusion criteria mentioned above. Thus, the following exclusion criteria were established:

- Posts older than the last 10 years: Posts that were made more than 10 years ago will be excluded. This criterion aims to focus on recent and updated evidence on the challenges of Physical Education teachers in School Games.

- Studies conducted outside the Brazilian context: Studies that were not conducted in the Brazilian context will be excluded. This will ensure that the results are specific to the Brazilian reality of the School Games and the challenges faced by Physical Education teachers.

- Lack of specific focus on the challenges faced by Physical Education teachers in School Games: Publications that do not present a clear and specific focus on the challenges faced by Physical Education teachers in this specific context will be excluded. The aim is to obtain relevant and specific information to understand the pedagogical, organisational and practical challenges associated with School Games.

RESULTS

A total of 119 scientific productions were found that addressed the themes of school games, challenges/difficulties and physical education teachers. Then, studies that did not simultaneously include these three elements were excluded, resulting in 39 studies. Subsequently, the studies prior to 2014 were removed, leaving only 19 studies. Finally, studies that did not specifically address school games were excluded, resulting in 5 studies.

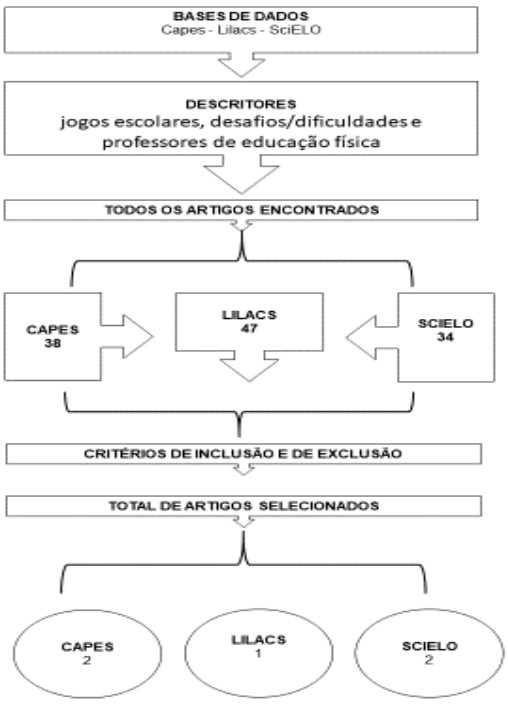

TABLE 1. – Studies on difficulties and challenges in school games, published from 2018 to 2023.

No.	Author/Year	Objective	Methods	Results
01	Farias (2018)	To identify the prevalence of participation in the modalities of the Interscholastic Games of Ariquemes.	A documentary research was carried out at the municipal department of education. Mapping and profiling the participants of the games by modality, gender, age group and number of teams by modality, from the final reports of the games	Challenges of Physical Education Teachers: Low student participation and difficulty in engaging everyone. Participation by Gender and Modality: Higher male participation in football and basketball, lower female participation in volleyball and handball. Age Group of Participants: Highest participation from 15 to 17 years old, lowest participation between 12 and 14 years old. Distribution of Teams by Modality: Futsal with more teams, athletics with fewer teams.
02	Neuenfeldt e Klein (2020)	To analyze the relationship between school games and school physical education.	Five teachers from the municipal school system of a municipality in the Taquari Valley/RS/BR, who teach in the final years of elementary school and who participate in school games, were interviewed.	It was concluded that the school games influence the school physical education, because contents, annual planning and method of selection of participants occur according to the proposal of the games. Although the games are based on performance sports, there are educational principles visualized by the teachers, such as cooperation, coeducation, respect and socialization. However, the teachers also perceived frictions and situations that contradict these principles; And from this, it was possible to reflect About the possibility of changes and other models of games in order to achieve pedagogical principles.
03	Igor Gustavo Schroeder (2021)	To analyze how Physical Education teachers prepare sports teams for participation in the Student Games of Municipal Schools-JEEM, in Ponta Grossa-PR.	The research involved the following data collection procedures: structured interviews with nine (9) Physical Education teachers from the early years of elementary school, from eight (8) schools in the municipality of Ponta Grossa-PR; and document analysis of the General Regulation of the JEEM of Ponta Grossa-PR (2019).	It was found that teachers perceive the Student School Games of Ponta Grossa-PR as a more equitable opportunity for municipal schools to participate in sports competitions. However, teachers face significant challenges in preparing sports teams, including restrictions on practice schedules, difficulties in transporting teams to game venues, and paperwork related to documentation required by sports event organizers.
04	Aragão, Silva, Teixeira, Delani, Cruz, Soares, Alves e Pinho (2023)	To highlight the perspective of Physical Education teachers from finalist schools in the futsal modality, children's category, about the JOER, Porto Velho stage, in relation to training, the schedule, the difficulties encountered, the distribution of students in the vacancies.	The study is classified as exploratory, descriptive, with a qualitative approach. Four physical education teachers from the schools that reached the final phase of the municipal stage of the JOER, in the futsal modality, in the children's category of the JOER, participated in it. Semi-structured interviews were used for data collection.	The teachers trained the sports teams after classes. Only one teacher received specific remuneration for this purpose. The main difficulties faced in the preparation of the teams were the documentary bureaucracy, the need for the release of the parents, the lack of adequate food and financial support.

05	Gonçalves e Silva (2023)	reflect and analyze the participation in school games and the formation of identity of high school students, from the perception of Physical Education teachers.	a qualitative approach was used to interview the Physical Education teachers of the schools that participated in the 2023 edition of the Ouro Preto School Games, and it was possible to access the teachers of 7, of the 15 possible schools.	The conclusion of the work allowed us to establish three categories of analysis: a) The subjects and promises of sport; b) Sport, competition and school; c) On inclusion, exclusion, selection, victory and defeat. The interviews showed that the participation of students in school games has benefits such as improved academic performance, contribution to identity formation and contribution to physical, social and emotional development.

SOURCE: Authored by the authors.

DISCUSSION

According to Farias (2018), the documentary research carried out at the municipal education department of the Interscholastic Games of Ariquemes revealed relevant information about the participation of students in sports, gender, age group, and team distribution. The results highlight the challenges faced by Physical Education teachers, the differences in participation by gender and age group, as well as the distribution of teams by modality.

One of the challenges faced by Physical Education teachers is the low participation of students in some sports. Some sports showed less interest and participation on the part of the students, which can make it difficult to form teams and hold competitions in these modalities. This requires teachers to strategize and engage students, seeking ways to arouse their interest and promote the active participation of all.

Another challenge is related to the difficulty in engaging all students. Some students may show a lack of interest or motivation in participating in sports activities. Teachers need to adopt nuanced approaches and tailored pedagogical strategies to engage these students, encouraging their participation and promoting inclusion.

In this sense, physical education as a curricular component of the school needs to provoke desires, awaken in students the interest in learning. According to **Snyders (1988, p.14),** "it is about knowing joys that are different from those of daily life; things that shake up, challenge you, from which the students will change something in their lives, they will give a new meaning to it."

Regarding participation by gender, there was a greater participation of males in specific modalities, such as field soccer and basketball. This difference may be related to cultural and social factors that influence students' sports preferences. On the other hand, in sports such as volleyball and handball, there was a lower participation of the female gender. It is important to understand the factors that can contribute to this disparity and to seek ways to encourage female participation in these sports, promoting gender equality in school sports practices.

When analyzing the age group of the participants, it was found that students aged between 15 and 17 years had the highest participation in the Interscholastic Games of Ariquemes. This age group may be influenced by adolescents' growing interest in sports activities and the possibility of competing and representing their schools in this period of life. However, there was a lower participation of students in younger age groups, such as 12 to 14 years old. This may be related to different levels of interest and involvement of students at this stage of schooling, and it is important to evaluate strategies to encourage the participation of younger people in school games.

The distribution of teams by modality was also analyzed. Futsal was identified as the sport with the largest number of teams participating in the Interscholastic Games of Ariquemes. This modality is widely popular among students and arouses great interest and engagement. On the other hand, athletics was identified as the sport with the lowest number of participating teams. This can be attributed to factors such as the need for specific skills, the availability of adequate infrastructure, and the limited interest of students in this sport. This analysis makes it possible to identify students' sports preferences and direct efforts to promote equitable participation in all modalities.

The results of the research highlight the difficulties faced by Physical Education teachers, such as the low participation of students and the difficulty in engaging them. In addition, they highlight the differences in participation by gender and age group, as well as the distribution of teams by modality. This information is valuable to guide strategies to encourage participation and promote gender equality and inclusion in school sports practices, contributing to the improvement of sports activities in schools.

In their study, Derli Juliano Neuenfeldt and Jaqueline Luiza Klein (2020) conducted an analysis of the relationship between School Games and School Physical Education. To this end, they interviewed five teachers from the municipal school system of a municipality in the Taquari Valley, in the state of Rio Grande do Sul, Brazil. These teachers are responsible for teaching in the Final Years of Elementary School and also participate in the School Games.

The results of the research indicated that the School Games exert a significant influence on School Physical Education. The contents covered, the annual planning of the classes and the method of selection of participants are affected by the proposal of the Games. Although the School Games are focused on performance sports, teachers identified the presence of important educational principles, such as cooperation, coeducation, respect and socialization.

However, teachers also observed the occurrence of friction and situations that contradict these educational principles during the School Games. This raises questions about the need for change and the adoption of other game models that are aligned with pedagogical principles.

In this context, Physical Education teachers face challenges and obstacles when dealing with School and Student Games. One of the challenges is to find an appropriate balance between the

emphasis on performance sport and the promotion of educational principles. In addition, they have to deal with friction and situations that go against these principles, such as lack of cooperation or disrespect between participants.

(Tubino, 1993) Man's search for a complete balance is explicit in the famous phrase "healthy mind, healthy body", where the dichotomy of body and mind goes together and the harmonious peace between them translates this long-awaited balance.

Another challenge is to adapt the contents and the annual planning of School Physical Education according to the proposal of the School Games, ensuring that there is coherence between the two approaches. Teachers are also encouraged to explore alternatives and models of Games that can better meet pedagogical principles, seeking ways to promote participation, inclusion and the integral development of students.

These challenges and obstacles highlight the importance of a continuous reflection on the relationship between School Games and School Physical Education, aiming to improve pedagogical practices and enable enriching experiences for students.

The research carried out by Igor Gustavo Schroeder (2021) aimed to investigate the preparation of sports teams by Physical Education teachers for the Student Games of Municipal Schools (JEEM) in Ponta Grossa-PR, evidencing the difficulties faced by teachers and the challenges of school Physical Education related to these games.

To conduct the study, nine Physical Education teachers who worked in the early years of elementary school in eight schools in the municipal network of Ponta Grossa-PR were interviewed. In addition, a documentary analysis of the General Regulation of the JEEM of Ponta Grossa-PR for the year 2019 was carried out.

The results of the survey revealed that teachers recognize the Student Games of Ponta Grossa-PR as a more equitable opportunity for municipal schools to participate in sports competitions. However, they face significant challenges in preparing sports teams for these games.

One of the main difficulties encountered by teachers is related to the time constraints for training. They find it difficult to reconcile the available times for training with the regular activities of the schools and the availability of the students. This limitation of time for preparing the teams has a direct impact on the performance of the students during the competitions.

Another difficulty pointed out is the transportation of the teams. Teachers face challenges in ensuring that students travel to the venues of the games. The lack of adequate resources for transportation, the distance between schools and competition venues, and the need for supervision during the journey are issues that make it difficult for teams to participate in the Student Games.

The bureaucracy related to the documentation required by the organizers of the sporting event also poses a challenge. Teachers need to deal with the paperwork required for team registration,

student proof of attendance, and authorizations from guardians. This bureaucratic process can be time-consuming and require additional effort on the part of teachers.

These difficulties and challenges highlight the importance of seeking solutions to improve the preparation conditions of sports teams and promote a more effective school Physical Education. Measures such as the flexibility of training schedules, the provision of adequate resources for the transportation of teams and the simplification of bureaucratic processes can contribute to enhance the participation and performance of students in the Student Games, providing an enriching experience in the context of school Physical Education. These actions can help overcome the challenges faced by teachers and promote broader and more equitable student participation in student school games.

In the study carried out by Aragão, Silva, Teixeira, Delani, Cruz, Soares, Alves and Pinho (2023), the perspective of Physical Education teachers who worked in finalist schools in the futsal modality, children's category, in the Student School Games of Rondônia (JOER), in the Porto Velho stage, was analyzed. The main objective was to describe several aspects related to the training of the teams, office hours, difficulties faced, distribution of students in the vacancies, positive aspects and the experience of being in the final.

The results of the research revealed that the training of the teams took place outside the regular class hours, indicating that the teachers made an effort to reconcile sports activities with the school curriculum. However, the fact that only one of the teachers received a specific remuneration for the training was noteworthy, suggesting a possible lack of recognition and financial incentive for the other professionals involved.

The difficulties faced by teachers in preparing the teams were reported more frequently and included bureaucratic issues related to the necessary documentation, the need to obtain parental authorization for the participation of students, the lack of financial resources to ensure adequate nutrition during the games, and the lack of financial support in general. These difficulties can limit teachers' ability to provide quality training and compromise teams' performance in games.

Regarding the means of screening students, most teachers used selection processes, taking into account the students' interest and behavior. This suggests that student performance and commitment are important factors in team building.

The positive aspects identified included increased prominence and recognition of the school due to participation in the JOER, as well as the support of parents, who play a key role in encouraging and supporting student-athletes.

As for the aspects of being in the final, the teachers highlighted the importance of participating in competitive games and emphasized how rewarding it was to experience this moment. This underscores the importance of the Student School Games not only as a sports competition, but

as a valuable opportunity for students to develop sports skills, learn about teamwork, and enjoy an enriching experience.

The results of the study point to the difficulties faced by Physical Education teachers, such as the lack of adequate remuneration, bureaucratic issues and lack of financial resources. However, they also highlight the benefits and positive aspects of the Student School Games, such as the visibility of the school, the support of parents, and the importance of student-athletes' participation in these competitions. This highlights the need to seek solutions to overcome these difficulties and promote a more effective school physical education, providing students with enriching sports experiences.

The text by Kérley Henrique Gonçalves Vinicius Joselito da Silva (2023) highlights the importance of reflecting on participation in school games and the identity formation of high school students, from the perspective of Physical Education teachers.

One of the difficulties faced by Physical Education teachers is related to time management. They have to cope with regular classes and at the same time prepare students for school games, which requires careful organization of time to reconcile academic content with sports activities.

Another challenge is related to the inclusion and exclusion of students. Considering the categories of inclusion, exclusion, selection, victory and defeat mentioned in the text, it is possible that teachers face challenges when involving all students in sports activities. Students with limited physical abilities, disabilities, or a lack of interest in sports may require tailored strategies to ensure their participation. In addition, team selection and competition can generate feelings of exclusion in some students, which poses an emotional challenge for teachers to deal with.

Student motivation and engagement can also pose a challenge for Physical Education teachers. Not all students have the same level of interest or motivation in school games. In this sense, teachers may find it difficult to keep students engaged and motivated to actively participate in sports activities. It will be necessary to implement creative pedagogical strategies adapted to the individual needs of the students to stimulate their involvement.

Physical Education teachers may face external pressures and expectations. Students, parents, the school, and the community can create expectations regarding students' athletic performance in school games. These expectations can put additional pressure on teachers, who have to deal with the demands of managing sports activities while promoting an inclusive and healthy environment.

The study by Kérley Henrique Gonçalves Vinicius Joselito da Silva (2023) highlights the various difficulties faced by Physical Education teachers in the context of student school games. This includes challenges related to time management, student inclusion/exclusion, student motivation and engagement, as well as external pressures and expectations. It is essential that teachers seek appropriate pedagogical strategies and approaches to overcome these difficulties and promote quality school physical education, which provides the integral development of students.

FINAL THOUGHTS

In conclusion, the analysis of the challenges and difficulties faced by Physical Education teachers in the Student School Games reveals the complexity and demands involved in this context. Time management, inclusion/exclusion of students, investment, motivation and engagement of students, as well as external pressures and expectations, are issues that require attention and appropriate solutions.

From this investigation, it is evident the need to promote school physical education that goes beyond the sports aspect, seeking an inclusive approach that values the participation of all students, regardless of their physical abilities or individual interests. This requires the implementation of adapted pedagogical strategies capable of stimulating the active involvement of students and promoting a healthy and motivating environment.

It is essential that Physical Education teachers receive the necessary support, both in terms of financial resources and professional recognition. Adequate remuneration, incentive policies and institutional support are key elements to address the difficulties faced by teachers and ensure their dedication and commitment to the School Games.

In this way, the analysis of these challenges and difficulties offers a solid basis for reflection and the search for solutions that allow the improvement of school physical education in the Student School Games. By overcoming these obstacles, teachers will be contributing to the integral development of students and promoting an inclusive and healthy sports culture that values not only competitive performance, but also students' personal and social growth.

However, it is important to note that the analysis currently available on this topic is limited. Although there are studies and research that address some of the difficulties faced by physical education teachers in school games, the complexity and diversity of these challenges require further investigation. Further research is needed that focuses specifically on these issues in order to provide a more comprehensive and grounded understanding of the difficulties faced by teachers in this context.

In addition, deepening knowledge about obstacles in school games will allow the promotion of physical education that not only values competitive performance, but also prioritizes the personal and social growth of students, cultivating physical, emotional and social skills that are fundamental to their lives. Therefore, the need for further research on the challenges and difficulties faced by physical education teachers in school games is evident. This research will provide a solid basis for the implementation of effective measures that improve school physical education, contributing to the integral formation of students and to the construction of an inclusive and healthy sports culture.

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Invasion sports in physical education according to the BNCC: An integrative review

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ABSTRACT

This study arises from the need for a pedagogical approach that goes beyond the technical teaching of invasion sports, aligning with the principles of the National Common Curricular Base (BNCC) to promote the integral development of students. The objective of the study was to analyze the contribution of invasion sports in the integral formation of students according to the BNCC. The integrative literature review, carried out in the last 10 years in relevant scientific journals, resulted in the selection of 11 studies. These studies highlight the relevance of invasion sports not only for physical development, but also for socio-emotional skills, ethics, and respect for the rules recommended by the BNCC. The results indicate the importance of teachers recognizing and exploring the educational potential of these modalities, promoting enriching experiences. It is concluded that the analysis of the selected studies highlight that invasion sports provide opportunities for students to experience, enjoy and understand different body practices, giving relevance to this object of knowledge in School Physical Education.

Keywords: School Physical Education, Invasion Sports, BNCC.

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INTRODUCTION

School Physical Education (EFE), according to Tubino (2010), plays a crucial role in the integral formation of students, transcending the mere promotion of physical conditioning to encompass social, emotional and ethical aspects. Historically, the sports approach in EFE was centered on the search for victories, records and overcoming, limiting itself to the training of the athlete and neglecting other educational dimensions.

However, in contemporary School Physical Education, according to Brasil (2017), the approach adopted should be more comprehensive, treating body practices as a dynamic cultural phenomenon, recognizing the importance of socio-emotional skills, teamwork, ethics, and respect for rules. Among the categories of bodily and sports practices presented by the BNCC, De Oliveira Dunke, Ginciene and Borges (2021) explain that invasion sports play a significant role. Futsal, field soccer, volleyball and basketball are popular examples in this category, being recognized both among students and teachers. However, even with this inclusion in the BNCC, it is essential to highlight that invasion sports, which is the category that encompasses modalities in which players seek to invade the opponent's field, aiming to score goals, score and collaborative strategies, were already practiced previously, and are now grouped under a single category.

The problem that arises is the lack of comprehensive understanding of how invasion sports contribute to the integral formation of individuals in the context of school Physical Education. Although there are studies that emphasize the importance of these practices, there are still significant gaps in the literature that require further investigation. Even though it is not the role of the school to train athletes, the historical emphasis often obscures the understanding of the social-emotional, ethical, and educational benefits that invasion sports can provide.

This study aims to fill this gap, exploring how invasion sports, as guided by the BNCC, contribute to the integral formation of students in school Physical Education. We seek to critically analyze and synthesize previous studies on the subject, identifying patterns, gaps, and inconsistencies in the literature.

The study is justified by the need for a pedagogical approach that goes beyond the technical teaching of invasion sports, aligning with the principles of the National Common Curricular Base (BNCC) to promote the integral development of students, taking into account the playfulness of the object of knowledge in question.

Thus, the objective of this study was to analyze the contribution of invasion sports in the integral formation of students according to the BNCC. By carrying out this investigation, it is hoped to provide valuable subsidies for the advancement of School Physical Education, contributing to a more complete and grounded understanding of the educational benefits of invasion sports.

THEORETICAL REFERENTIAL

CONCEPTUALIZATION OF SPORT

The conceptualization of sport, according to Barros et al. (2018), Coakley (2011), Leite et al. (2018), Leite et al. (2018), and Marques and Tani (2009), varies according to different perspectives. In general, sport can be defined as structured physical activities, often practiced in a competitive environment, with defined rules and a clear objective. These activities encompass a wide range of disciplines, from individual sports such as athletics and swimming to team sports such as football, basketball, and handball. Each sport has distinct characteristics that differentiate it in terms of objectives, rules, required skills and game dynamics. This diversity reflects the richness and complexity of the sports phenomenon in the context of this study

Sports are not just a physical manifestation; They play a significant role in the integral development of individuals, encompassing physical, cognitive, and socio-emotional aspects. According to Hughes (2006), sports promote physical conditioning, stimulate the development of motor skills, and offer a platform to enhance athletic performance. In addition, as pointed out by Coakley (2011), they contribute to cognitive development, as they involve problem solving, strategies, and quick decision-making.

However, sports go beyond the physical and cognitive; They also have significant social-emotional implications. Guttmann (1978) points out that sports promote teamwork, discipline, resilience and sports ethics. Emotional control, as observed by Magill (2011), is another essential aspect, since athletes need to deal with competitive pressure and emotions during games.

For Leite et al (2018), understanding the concept of sport and its multifunctionality is essential to explore how invasion sports fit into this panorama and how they contribute to the education of students according to the BNCC guidelines.

NVASION SPORTS

Types of Sports in School Physical Education According to the BNCC

The National Common Curriculum Base (BNCC) stands out as an important reference for School Physical Education (EFE), providing guidelines for the teaching and learning of various body practices, including sports. According to Brasil (2018), according to the BNCC, sports practices are categorized, and among them, "invasion sports" stand out. This category encompasses modalities in which players seek to invade the opponent's field, aiming at scoring and collaborative strategies.

According to Brasil (2018), the approach to Physical Education in the National Common Curriculum Base (BNCC) reflects a commitment to the integral development of students, establishing specific objectives in which the exploration of different types of sports stands out, categorized into fields such as field and bat sports, net/wall and invasion.

The objective of experiencing and appreciating different sports, as advocated by Brasil (2018), is in line with the principles of the BNCC. In this sense, Leite et al. (2018) highlight that the BNCC not only directs students to understand common elements between sports, but also encourages them to develop strategies both individually and in groups for the execution of these modalities, promoting collective work and protagonism. This approach, according to Leite et al. (2018), not only contributes to the physical development of students, but also emphasizes the improvement of social skills, aligning with a more holistic view of education.

Another relevant aspect in the BNCC, as explained by Brasil (2018) and Marques et al. (2021), is the differentiation between the concepts of game and sport. This proposal aims for students to understand the distinct characteristics of these practices in contemporary times, considering their manifestations both professional and community/leisure. The proposed differentiation seeks to provide, according to Brasil (2018) and Marques et al. (2021), a broader and more critical view of the various ways in which games and sports manifest themselves in today's society.

In this way, the BNCC in Physical Education, according to Brasil (2018), transcends the mere technical development of sports. It actively seeks to form conscious and participatory citizens. In this context, Leite et al. (2018) highlight that the focus goes beyond sports practice, preparing students for a reflective and integrated approach to the social context. The BNCC, according to Brasil (2018), promotes an active and responsible participation of students in different dimensions of life, reinforcing its importance as an essential guide in the construction of a comprehensive education.

According to De Dumke Oliveira, Ginciene (2021), invasion sports in EFE involve a specific dynamic, marked by teachers' tasks and interventions that directly influence the role played by students. Such pedagogical interactions, when well directed, can enhance not only sports performance, but also socio-emotional and cognitive aspects of students.

Leite et al (2018) highlight the contribution of the BNCC by offering guidelines that guide the inclusion of invasion games and sports, providing an integrated and comprehensive view for the education of students. This perspective is in line with proposals that seek to develop not only motor skills, but also social, ethical, and cognitive competencies.

Marques et al. (2021) and Paes Neto (2021) address reflections on the thematic unit "Sports" in the BNCC, highlighting the complexity and relevance of this component for school Physical Education. These reflections serve as a basis for understanding the role of sports, especially invasion sports, in integral educational formation.

Thus, the understanding of the types of sports, in particular invasion sports, according to the BNCC, is crucial to guide pedagogical practices, providing students with enriching experiences that go beyond the physical aspect, promoting integral development.

Invasion sports, as described by Leite et al. (2018), are characterized by their collective

dynamics, in which two teams compete to achieve a common goal, facing opposition from the opposing team. These sports involve seeking to penetrate the opponent's territory, either by scoring points, as in soccer and basketball, or by reaching a specific area, as in volleyball.

Neira (2018) states that, by exploring these modalities, one understands not only the diversity of sports practices, but also how they contribute to the education of students. Each invasion sport offers a unique experience, promoting not only physical development but also cognitive skills, teamwork, and game strategies.

Thus, as highlighted by Barros et al. (2018), football is one of the most popular invasion sports globally. It involves two teams competing to score goals in the opponent's goal, requiring dribbling skills, teamwork, and strategies. In addition to physical development, soccer promotes communication skills, quick decision-making, and game strategies.

Basketball, on the other hand, according to Marques and Tani (2009), is another widely practiced invasion sport. In this one, two teams seek to score points by shooting a ball into the opponent's basket, requiring passing, shooting, dribbling and tactical positioning skills, developing physical and cognitive aspects.

Handball, as elucidated by Greco (2012), combines elements of football and basketball, with teams trying to score goals in the opponent's goal. It emphasizes teamwork, accurate passing, and defense and attack strategies, contributing to the development of motor skills and social-emotional competencies.

According to Garganta (1997), volleyball is another example of an invasion sport, in which two teams face each other, seeking to send the ball to the opponent's field. In addition to physical skills such as jumping and attacking, volleyball promotes communication, cooperation, and quick decision-making.

These sports represent just a few examples among the various invasion sports practiced in Physical Education. According to Marques (2021), each of these sports offers specific benefits for the integral development of students, covering physical, cognitive, and socio-emotional aspects, thus consolidating their relevance in the educational context.

Invasion sports, according to Garganta (1998), are modalities that constitute principles that aim to organize the actions of a game, such as rules, orientation and the fulfillment of the match.

Invasion sports, according to González and Bracht (2012) are characterized by the interaction between teams in a shared space, such as courts or fields, in which both seek to dominate the area defended by the opponent to score, while defending their territory against the opposing team, and this dynamic is not restricted to basketball and extends to modalities such as soccer, futsal and handball.

The authors explain that, over the course of an invasion sports game, two distinct phases stand out: the offensive, when the team is in possession of the ball, and the defensive, when the team seeks

to regain possession. During the offensive phase, the goal is to occupy the opponent's field to score points, while in the defensive phase, the emphasis is on protecting one's own goal and preventing the opposing team from scoring.

Invasion sport is considered an important component for the realization of curricular physical activities within the educational network. In this way, Brazil (2018), characterize it as a set of modalities and compares the ability of a certain team when it inserts or conducts a ball among other objects to a certain place, being in a court/field or any other environment that can be developed these activities, and that the opponent can defend it from the (goal, basket, touchdown, and etc.) simultaneously protecting one's own target, goal, or sector of the court or field (basketball, frisbee, soccer, American, handball, field hockey, water polo, rugby, etc.). It is recommended to structure this thematic unit, so that this classification is considered a logic that brings together the invasion sport, warning that this curricular practice does not need to be mandatory in the curricular structure of the school, however, this classification structures the student to understand more comprehensively what invasion sports are, understanding the concept of (objective, skills, rules, etc.) directed by the BNCC.

According to Gonçalves (2019), the practice of invasion sports contributes to the development of physical skills, such as motor coordination, endurance, strength, and agility. In addition, it stimulates the physical conditioning of students, promoting health and well-being, fundamental aspects for the formation of active and healthy citizens, as recommended by the BNCC.

In addition, Leite et al (2018), Brazil invasion sports promote cooperation and teamwork. Students learn to communicate, to trust in their teammates and to develop collective strategies to achieve the goals of the game. This social dimension of invasion sports is fundamental for the development of social-emotional skills, such as empathy, resilience, and emotional control.

SCHOOL PHYSICAL EDUCATION AND THE USE OF INVASION SPORTS

The use of invasion sports in School Physical Education, according to De Oliveira Dunke, Ginciene and Borges (2021) plays a relevant and impactful role in the formation of students. Although there are a variety of options within this category, it is notable that some, such as futsal, field soccer, volleyball and basketball, are the most popular, both among schoolchildren and teachers. However, this preference often generates performance expectations for children who excel in a particular modality.

According to Tubino (2010), historically, the sports approach in Physical Education was centered on the search for victories, records and overcoming. The focus was on the athlete's training, with rules aimed at the student's sports performance at school. This model limited sports practice to a single purpose: the development of good sports results, leaving aside other possible educational

dimensions.

However, according to Maques (2021), it is essential to consider that contemporary School Physical Education goes beyond this paradigm. The inclusion of invasion sports in the curriculum, as recommended by the National Common Curriculum Base (BNCC), reflects a more comprehensive approach, which seeks the integral formation of students. The BNCC highlights the importance of socio-emotional skills, teamwork, ethics, and respect for the rules, aspects that are developed during the practice of invasion sports.

Paes Neto (2018) points out that school Physical Education plays a crucial role in the insertion of young people in the world of body and sports practices, providing not only the development of physical skills, but also the understanding of sports culture and the importance of physical activity for health and well-being. In this sense, invasion sports are a valuable tool because, in addition to promoting physical fitness, they stimulate cooperation, resilience, decision-making, and emotional control.

Therefore, according to Marques et al (2021), the use of invasion sports in School Physical Education should be guided by a pedagogical approach that values not only sports performance, but also the integral development of students. It is important that teachers understand the educational potential of these modalities and know how to use them in a way that promotes not only sports performance, but also the ethical and socio-emotional formation of students.

In this sense, the BNCC represents an important milestone in recognizing the multifunctionality of invasion sports in the training of students. It offers clear guidelines for school Physical Education, highlighting the importance of including these modalities in the curriculum and promoting a more comprehensive educational approach.

MATERIALS AND METHODS

The integrative literature review adopted in this study is a valuable tool for the critical analysis and synthesis of previously conducted studies on the subject in question. Mendes, Silveira and Galvão (2008) point out that this approach not only gathers the results of previous research, but also seeks to identify patterns, gaps and inconsistencies in the literature. In this way, it enables a comprehensive view of the available evidence and contributes to the consolidation of existing knowledge.

Ganong (1987) points out that integrative review is a strategy that allows exploring a field of knowledge in a comprehensive way, considering empirical and theoretical studies. This approach, by gathering varied information, facilitates the identification of trends, convergences and divergences in the literature, contributing to a more complete understanding of the topic under analysis.

Thus, to ensure the quality and relevance of the selected studies, we established specific

criteria. Studies published in the last 10 years (2013 to 2023) in indexed scientific journals, available only in Portuguese, were included.

The search used three academic databases: the Capes Journal Portal, Lilacs – Bireme and SciELO. These databases were chosen because they provide access to relevant scientific journals and academic publications.

The keywords used in the research were "Invasion Sports", "Collective Invasion Games", "Invasion Sports and BNCC", "Physical Education and BNCC" and "Curriculum, BNCC and Physical Education".

Thematic relevance and connection with the National Common Curricular Base (BNCC) were essential criteria, while duplicate studies, with inadequate methodology or that did not address the BNCC were excluded. The thorough documentation of each decision ensured transparency and replicability of the process, reinforcing the reliability and validity of the results in the integrative review.

INCLUSION CRITERIA

To ensure the timeliness and relevance of the information, the study only considered publications made between 2013 and 2023, that is, that were re-allied in the last 10 years.

It is important to note that only studies available in Portuguese were also considered, to facilitate the understanding and analysis of the results.

Regarding thematic relevance, studies directly related to specific themes were considered, such as "Invasion Sports", "Collective Invasion Games", "Invasion Sports and BNCC", "Physical Education and BNCC" and "Curriculum, BNCC and Physical Education". For the specific context, the focus was on studies related to school Physical Education and the use of invasion sports in this context.

EXCLUSION CRITERIA

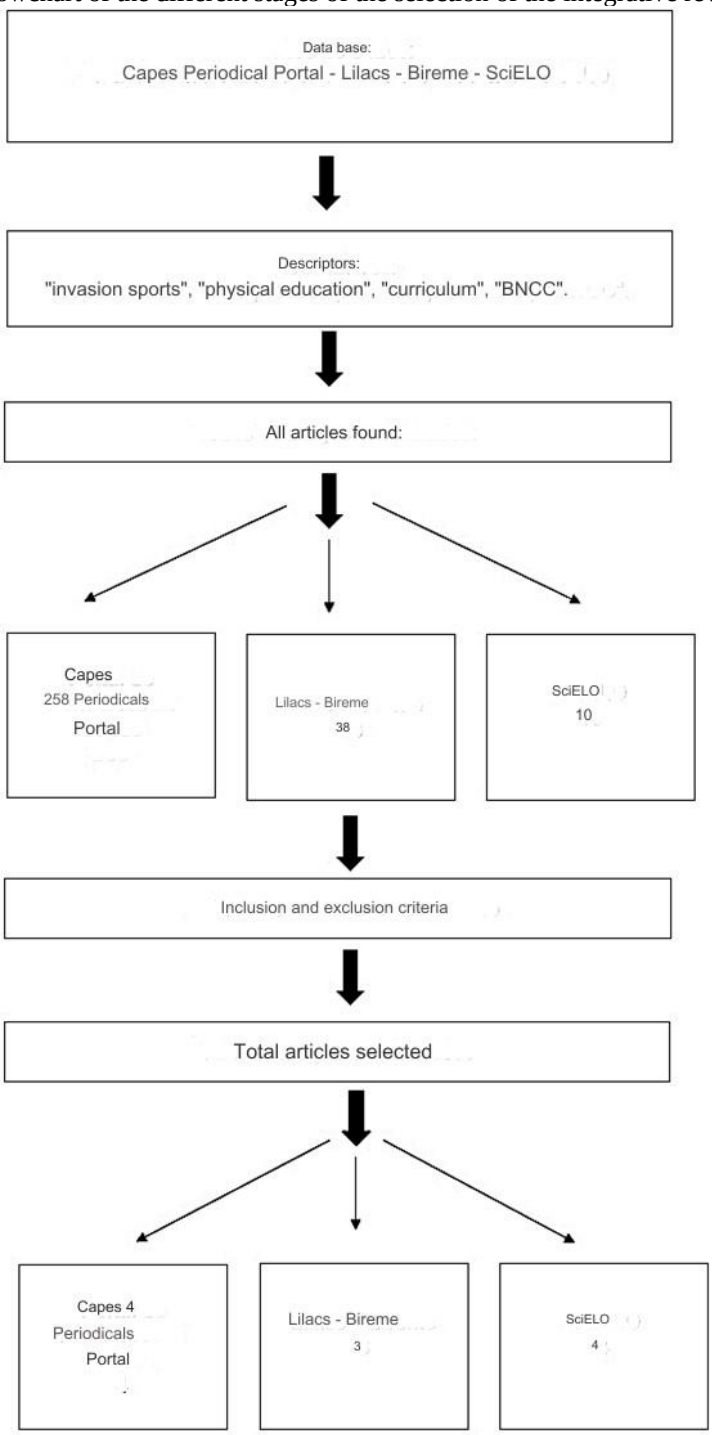
Duplicate studies were excluded to ensure that each study was counted only once in the selection process.

Studies with no direct connection with the specific topics of interest were excluded, even if related to Physical Education. The absence of a relationship with the BNCC and the lack of a relationship between invasion sports and the BNCC guidelines were excluded.

The criterion for data analysis of the research was through the discussion of the ideas of each other regarding the theme in question selected for the research.

The flowchart is shown to demonstrate the stages of article selection (Figure 1):

Figure 1: Flowchart of the different stages of the selection of the integrative review papers.



Source: authors, 2023.

RESULTS

The integrative literature review conducted in this study aimed to critically analyze and synthesize studies on the relationship between invasion sports, school Physical Education and the National Common Curriculum Base (BNCC). To ensure the quality and relevance of the selected studies, specific criteria have been established. In total, 306 articles were found, of which 258 were from the Capes journal portal, 38 articles from the Lilacs journal and 10 from ScIELO; distributed among the following keywords: Invasion Sports; Collective Invasion Games; Invasion Sports and

BNCC; Physical Education and BNCC; Curriculum, BNCC and Physical Education.

After applying the inclusion and exclusion criteria, 11 articles were selected, of which 4 were from the Capes journal portal, 3 articles from the Lilacs database and 4 from the pariodic from the ScIELO database.

The results highlight the relevance and diversity of studies at the intersection between invasion sports, School Physical Education and the BNCC guidelines. The focus on critical analysis and synthesis of evidence contributes to a comprehensive understanding of this field, identifying patterns, gaps, and trends in the literature, as can be seen in the table below (Chart 1).

Table 1: Presentation of the articles selected in the study

AUTHOR/YEAR/ THEME	OBJECTIVE	RESULTS	CONCLUSIONS
CONCEIÇÃO (2021). **Comparison of the effects of the TGfU method on in-game performance, decision-making and skill execution motors of Students in three different invasion sports**.	Identify and Analyze the effects of the TGfU method in the process Teaching-learning of invasion sports in environment of the court.	The results indicated eight different contemporary methods being successfully used in the teaching of invasion sports in a court environment. The TGfU model, in the results, was effective in three different educational aspects: sports performance, motivational responses, and promotion of the physical conditioning of its practitioners. It was found that the TGfU model is unknown to many and very little taught in classes. Prevailing also the application of the traditional model.	Or model TGfU, even though it has demonstrated effectiveness in the teaching-learning process of Sports invasion in a court environment and being implemented worldwide, still lacks from Greater understanding and outreach between teachers and national professionals.
SAINTS; BRITO (2023). **Teaching Sports Invasion: From the model Traditional for a conception tactic.**	Investigate in literature national as the Sport from Invasion Comes being taught Non-environment scholastic.	Were Analyzed 5 Studies In Bases from Data: CAPES, BDTD and Publish or Perish. Towards or development Of practice teacher of the professor from Education Physics Observe than It's not enough just to know the Invasion Sports, but also know how to enter them In Classes Even though the difficulties towards or develop Exist Is from Fundamental importance to didactic sequence for the Teaching Sports Invasion, what makes it part important the contents of apprenticeship.	The conception tactic towards or teach the Invasion Sports allow you to provide opportunities to students in addition to the bodily practices, the development Of creativity cooperation outlet from Decisions Reasoningfor resolution from Problems communication and Adapting to situations Adverse.
RIGHI LANG;	Reframe or	Description of the	The ICTUsed

GONZALES (2023). **Reframing the teaching of Sports Invasion: One experience report with the Sport Education model and the use of Ict.**	teaching Of Sports from Invasion through of the Sport model Education and use Of Technology Information and Communication (ICT).	experience with or model Sport Education and the use of ICT in sports education of invasion. This proposal showed up effective in Possibility of transgression traditional models of sports teaching and is increasingly showing itself as a reliable tool in teaching.	Demonstrated Pedagogical potential and Helped in increase of the understanding and apprenticeship upon the contents studied during the Didactic Unit.
SAMPAIO et al. (2021). **Invasion sports: floorball at school and its methodological possibilities – an experience report.**	Explore The methodological possibilities of floorball at school.	The subjects of this report were students of the 2nd year of High School, where 20 students participated. Three activities related to the proposed content were carried out, where the students experienced the movements used in the sport beyond the game itself. The students approved the activities applied and that time was the only negative factor of this practice, and that it is possible to apply an unknown sport through preparation and study of the professional, to deal with the adverse situations that may arise.	Floorball application can be carried out and Encouraged in the school environment with specific adaptations.
SANTOS (2020). **Invasion Sports: innovations for the teaching of futsal in elementary school**.	Propose innovations for the teaching of futsal in elementary school.	The main challenge to be faced It is related to the process of initial and continuing education of teachers so that they can be trained and appropriate new skills linked to the new Trends in Pedagogy of the Sport Aiming propitiate To pupil one education sportswoman Significant than you Enable development from Skills towards enjoy from Different Related modalities To sport collective from proficient invasion and Incorporate these practices bodily bodies in your life for the ends they desire.	This study pointed out an alternative of innovation in the pedagogical treatment of the Futsal invasion sport in Physical Education classes, by proposing the teaching of Based in comprehension Of principles Operating and Intentions tactics through Of gaming Conditioned. Offered the possibility of a active participation of students, as well as the interaction between Different dimensions of knowledge.
VARGAS; MORISSO; GONZÁLEZ (2018). **Experience of the sport education in the classes of Education Physics: Using the**	Examine the experience of the Sport Education In Classes from Physical education in one unit Teaching from Futsal.	The depart Of proposal It was found that than the Main advantage of Make use of the teaching is the improvement in the process from student learning. Towards the teachers or Sport Education possibilita	It was concluded that if Makes it necessary to test the experience in Different Environments to learn more about Advantages and Difficulties from if work with catafalque proposal. As in Brazil they are Rare the Studies upon or theme

Model of Teaching in a unit Didactics of Futsal.		An overview of the Unit Planning didactics to be worked on. However, this demands a continuous work of the teacher.	It is believed to be one need emerging study of the model from teaching Sport Education.
VIZÚ; MORATO (2022). **Barriers and facilitators for practice do floorball.**	Investigate the Barriers and facilitators for the practice of the floorball.	The results Obtained revealed that the barriers Were equipment space commitment availability of time, personal finance, incentive and Positioning. The facilitators were the modality itself, performance and growth Of mode.	The Factors are Connected some To other Beingable mean the Minimizing or Maximization Of adhesion or of abandonment of the practice.
DE OLIVEIRA DUMKE; GINCIENE; BORGES (2021). **The teaching of Sports Invasion in the Education School Physics: relationship between the tasks and Interventions Of teachers with the paper of students.**	Investigate the relation between Tasks and interventions by teachers and the paper Of Students in teaching from Sports from invasion.	The results indicate that Teachers provide Tasks with and without interaction between opponents, predominating or game formal. In interventions preponderate the instruction Followed Of motivation Being Practically non-existent use from Questions for student reflection About what and when to do in-game.	The teachers Understand or Sports Teaching from invasion A perspective traditional. Initially, in order to general, they proposed or teaching from Skills Motor towards subsequently develop the game formal.
LAMAS et al. (2012). **Elements structural of A model Formal Sports collectives of invasion.**	Parse elements Structural from one model formal Of Sports Collective from invasion.	The development of a Formal Strategy Template and the dynamics of the game constitutes a contribution scientific original in context Of Sports Collective from invasion. Or procedure constructive of a defined strategy in the model is composed of five Sets from Elements sorted in Levels hierarchical, than support the design of strategies capable of providing adequate guidance a team in a game.	The structure formal Presented inaugurates A line of research that can contribute to towards limit the subjectivity in Definition of criteria futures analysis Drawings Experimental Taking to the Interpretations and Comparisons more Accurate of results of studies.
PIGEON MARK (2021). **Perspective of teaching-apprenticeship Of the Principles of action and Rules of action in sports collectives of invasion.**	Present the Main characteristics of the Teaching Games Is Understanding (TGfU), Context the principles and the menstruation from share Inherent to the phases of the game and submit a scenario hypothetical from application These	The team sports of invasion healthy Constituted by principles and rules of share than Beacon the Behaviors tactical-players' coaches and the organization of the class or Training session by the teacher/coach. The paradigm shift. Or TGfU, in specific It is	The hypothetical scenario proposed in this essay after the Reflections on the principles and menstruation from share Allows than or Teacher/Coach Glimpse the application These from manner congruent To principles of the TGfU.

	concepts.	based on the principles and Action rules for the organization of the class, like this how Proposes Questions Guidelines towards Develop capacity decision-making of the Students.	
OLIVEIRA et al. (2021). **Languages and Education Physics at BNCC: An analysis of the depart Of Skills Prescribed.**	Parse the languages and the Physical education in Base National Common Curricular (BNCC).	With content analytics, we cut the units of registrations under the terms or Words than Compose each category a priori with base in theory Of Multiliteracies: language writing language oral and the Representations Visual sound, tactile, gestural, itself and spatial.	Is Limited the theoretical apprehension of the BNCC on the notion from language in Physical Education that little Explores the multiple languages, both over the years school years as In units Theme.

Source: authors.

Among the selected studies, there are a variety of methodological approaches, including document analysis, experimental research, performance analysis, observation and analysis of classes, experience reports, literature review, case study and interviews, a methodological diversity allows a comprehensive understanding of the topics covered.

The objectives of the selected studies also cover a wide range of topics, from the analysis of inconsistencies in the BNCC of Physical Education to proposals for innovations for the teaching of specific sports, such as futsal and floorball. In addition, some studies explore pedagogical models, such as Sport Education, and investigate aspects such as decision-making, execution of motor skills, barriers and facilitators for the practice of certain invasion sports. In which the diversity of approaches and objectives reflects the complexity and breadth of the theme, providing a comprehensive and grounded view of school Physical Education and the incorporation of invasion sports, as recommended by the BNCC.

DISCUSSION

The researches selected in this integrative review study address different aspects related to the teaching and practice of invasion sports, such as futsal and floorball, as well as the exploration of different educational models and methodologies.

The research conducted by Conceição (2021) demonstrates that the TgfU (Teaching Games for Understanding) method is a pedagogical approach that aims to develop game understanding, decision-making, and the execution of motor skills in the sports context. It is important because it puts students in situations that replicate the real demands of the game, promoting meaningful and transferable learning. Rather than just teaching isolated skills, TGfU focuses on tactical and strategic

understanding, which can improve in-game performance and the ability to make quick and effective decisions. In addition, by integrating motor skills within the context of the game, practitioners can develop greater efficiency and precision in their execution.

Thus, corroborating with the notes of Pombo Menezes (2021) who discusses the paradigm shift in the teaching of team sports (from technicality to teaching through games) proposed by models that are based on the game, such as the TGfU was important for considering the student at the center of the teaching-learning process and promoting the construction of knowledge in complex contexts. The author adds that the TGfU, in particular, is based on the principles and rules of action for the organization of the class, as well as proposes guiding questions to develop the students' decision-making capacity. Therefore, the hypothetical scenario proposed in this essay after the reflections on the principles and rules of action allows the teacher/trainer to envision the application of these in a congruent way to the principles of the TGfU.

In addition, Righi Lang and Gonzales (2023) proposed to reframe the teaching of invasion sports through the Sport Education model and the use of ICTs (Information and Communication Technologies). Based on this, through an experience report and qualitative analysis, they described that the Sport Education model is an approach that seeks to offer students a more complete sports experience, involving them in all aspects of the game, from the organization of teams to the competition itself. To innovate the teaching of invasion sports through this model and the use of ICTs, it is possible to integrate technologies such as performance analysis applications, which allow students to record and analyze their own performances, identifying strengths and areas for improvement. In addition, ICTs can be used to create multimedia resources that help explain game tactics and strategies, as well as to facilitate the organization and management of competitions between teams. In this way, the use of ICTs combined with the Sport Education model can provide a richer and more engaging experience in the teaching of invasion sports.

Another relevant research was carried out by Santos (2020), who proposed innovations for the teaching of futsal in elementary school, based on a literature review. Thus, the teaching proposal implemented in this study can be considered an innovative alternative for the pedagogical treatment of invasion sport in Physical Education classes, as it breaks with the traditional technicist pedagogy based on technical fragmentation and passive action of the student who acts as a mere repeater of stereotyped fundamentals. It also offers possibilities for teachers to treat sports differently, giving subsidies to give new meaning to the "rola bola", still so frequent in our reality.

In the context of floorball, Sampaio et al. (2021) explored the methodological possibilities of this modality at school. Thus, through a report of experience, discussed the potential methodological approaches of floorball in the school context, recognized that the students approved the activities applied and that time was the only negative factor of this practice, and that it is possible to apply an

unknown sport through preparation and study of the professional, to deal with the adverse situations that may arise. Thus, it was possible to conclude that the application of floorball can be carried out and encouraged in the school environment with specific adaptations.

Regarding the relationship between teachers' tasks and interventions and the role of students in teaching invasion sports, De Oliveira Dumke, Ginciene, and Borges (2021) conducted research that explored this topic. Both studies used classroom observation and analysis to examine this relationship and its educational implications. The results indicate that teachers provide tasks with and without interaction between opponents, with a predominance of formal games. In the interventions, instruction predominated, followed by motivation. Thus, the students played a partially active role due to the existing interacting tasks, but the teachers did not provide the opportunity for reflection and production of answers on the tactical dimension.

In this sense, Santos and Brito (2023) add that the tactical conception to teach invasion sports allows students to develop creativity, cooperation, decision-making, reasoning for problem solving, communication, and adaptation to adverse situations. Through a literature review, the authors also understood that it is not enough just to know the Invasion sports, but also to know how to introduce them in the classes, even though the difficulties to develop it exist, for this, they emphasize the importance of continuing education.

Corroborating Vargas' notes, Morisso and González (2018) conducted a case study and qualitative analysis that analyzed the experience of Sport Education in Physical Education classes, which enables a general visualization of the planning of the didactic unit to be worked on. However, this requires continuous work from the teacher and adequate training. Thus, they concluded that it is necessary to test the experience in different environments to know other advantages and difficulties of working with this proposal.

In turn, Vizú and Morato (2022) investigated the barriers and facilitators to the practice of floorball, identifying aspects that influence participation and engagement of individuals in this sport modality through interviews and qualitative analysis. The results revealed factors perceived simultaneously as barriers and facilitators: feelings, socialization, health, competitions and knowledge; These factors are linked to each other, and may mean minimizing or maximizing adherence or abandonment of the practice.

In addition to the above, the studies by Lamas et al. (2012) carried out a structural analysis of formal models to identify and explore the structural elements of invasion team sports, contributing to the understanding of these sports modalities in terms of their organization and dynamics. They were essential to conclude that the modeling of the dynamics of the opposition and the strategy complement each other, as they define the moments in which the strategic information is used by the players. The formal structure presented inaugurates a line of research that may contribute to limit

subjectivity in the definition of the criteria for the analysis of future experimental designs, leading to more accurate interpretations and comparisons of the results of the studies.

Additionally, Oliveira et al. (2021) analyzed the languages and Physical Education present in the National Common Curriculum Base (BNCC), this analysis strengthens the evidence of the limited proposition of the BNCC regarding the wealth of possibilities explored by Physical Education within the area of language knowledge, highlighting that the units of records in the terms or words that make up each category a priori based on the theory of multiliteracies: written language, oral language, and visual, sound, tactile, gestural, self-and spatial representations.

FINAL THOUGHTS

The analysis of the selected studies highlight that invasion sports provide opportunities for students to experience, enjoy and understand different body practices, not only that, but they can also develop creativity, cooperation, decision-making, reasoning for problem solving, communication and adaptation to adverse situations, giving relevance to this object of knowledge that is within the thematic unit sport in the BNCC, the relevance of invasion sports in school Physical Education, in line with the guidelines of the National Common Curriculum Base (BNCC).

The information selected from each article explains the importance of This object of knowledge is clear, directing the Physical Education teacher to plan a class that involves invasion sports in a dynamic way, using tools that escape the "basics", with educational methodologies based on a simple foundation of the thematic unit sport, for example.

In view of this, it is possible to make final considerations that emphasize the importance of these modalities as pedagogical tools in the integral formation of students. The contemporaneity of Physical Education, aligned with the National Common Curricular Base (BNCC), demands an approach that transcends the search for sports results and focuses on the socio-emotional, ethical and cognitive development of students.

The inclusion of invasion sports in the curriculum, as recommended by the BNCC, represents a significant advance, providing opportunities for students to experience, enjoy and understand different body practices. These modalities not only contribute to physical fitness, but also promote cooperation, resilience, decision-making, and emotional control, which are essential aspects for the formation of conscious and participatory citizens.

Teachers' understanding of the educational potential of invasion sports is crucial to the success of this approach. Trained and committed professionals can create learning environments that go beyond the technical aspect, providing enriching experiences that go beyond the limits of the sports court. This expanded view contributes to the construction of solid knowledge, based not only on motor skills, but also on values that permeate social life and citizenship.

In view of the importance of promoting school physical education aligned with the guidelines of the National Common Curriculum Base (BNCC), it is essential to carry out more in-depth studies on the inclusion and approach of invasion sports in this context. The understanding and application of these sports modalities can contribute significantly to the integral development of students, thus meeting the educational purposes recommended by the BNCC.

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Occupational therapeutic interventions with the application of the Exercise Activity Protocol (PAE) for the physical rehabilitation of patients with leprosy sequelae: Experience report

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ABSTRACT

Introduction: Leprosy is an infectious disease, of slow and progressive evolution and with high disabling power, which can result in temporary and/or permanent physical deformities. This study aimed to report the experience of students from the State University of Pará (UEPA) of the Occupational Therapy course in interventions with the application of the Exercise Activity Protocol (EAP) in patients with leprosy sequelae in the hands. Method: This is an experience report, elaborated through occupational therapeutic care from the extension project "Rehabilitation and Assistive Technology: Exercise Activity Protocol for patients with disability due to leprosy", carried out at the Specialized Rehabilitation Center (CER III)/Teaching and Assistance Unit of Physical Therapy and Occupational Therapy (UEAFTO)/Laboratory of Assistive Technology (LABTA), located at the Center for Biological and Health Sciences (CCBS) of UEPA. Results: A significant muscle strength deficit was observed, characterized by difficulties in performing Activities of Daily Living and Instrumental Activities of Daily Living. Discussion: The activities carried out aimed to ensure comprehensive health care for patients with leprosy sequelae by associating rehabilitation and assistive technology. Final considerations: The experience provided a better understanding of leprosy and its biopsychosocial consequences, causing deformities and physical disabilities, which contributed to the professional development and academic training of the students.

Keywords: Occupational Therapy, PAE, Leprosy.

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INTRODUCTION

Leprosy is an infectious disease, with a slow and progressive evolution and high disabling power, which can result in temporary and/or permanent physical deformities. It is caused by *Mycobacterium leprae*, an acid-fast bacillus-type bacterium that affects peripheral nerves and, specifically, Schwann cells (Brasil, 2017).

According to the World Health Organization, its transmission occurs through direct contact and prolonged contact with untreated leprosy, through the release of droplets from the nose and mouth (WHO, 2023).

Leprosy is classified, according to WHO recommendations, as paucibacillary, with the presence of up to five skin lesions and with negative intradermal scraping, or multibacillary, with the presence of six or more skin lesions and positive intradermal scraping (Brasil, 2022). Its early diagnosis is the main measure to prevent disabilities arising from leprosy (Costa, 2023).

The deformities and physical disabilities resulting from leprosy have inflammatory mechanisms and neurological alterations as the main causes, classified as primary and secondary. The primary ones refer to sensory, motor and autonomic deficits, and the secondary ones are retractions, traumatic injuries and post-traumatic infections, resulting from the absence of prevention after the primary process (Brasil, 2008).

The involvement of peripheral nerves, sensory, autonomic or motor fibers, leads to changes in sensitivity, skin dryness, the appearance of fissures and ulcers, and muscle weakening or stiffening, which cause deformities characteristic of leprosy, such as foot drop and claw hand (WHO, 2020).

Treatment encompasses disability prevention measures, physical and psychosocial rehabilitation (Araújo, 2003). The occupational therapist is a professional qualified to train, rehabilitate and promote the health and well-being of their clients with needs, related or not to disabilities (Gomes; Teixeira; Ribeiro, 2020).

The work of this professional for the physical rehabilitation of leprosy patients aims to prevent disabilities, promote autonomy, independence and greater functionality in their daily occupations (Loureiro; Barreto; Maksud, 2015).

By using methods, resources and techniques, occupational therapeutic intervention enables the maintenance or recovery of deficient functions to reestablish or improve the functional and occupational performance of individuals with leprosy sequelae (Dias; Rodrigues, 2016).

The Exercise Activity Protocol (EAP) is a therapeutic resource developed for the physical rehabilitation of leprosy individuals with physical disabilities in the hands resulting from neural damage. It is performed through activities that exercise deficient areas of the musculoskeletal system

in order to maintain and/or reestablish their functions and enable improvements in occupational performance (Sá, 2014).

Therefore, this study aims to report the experience of students from the Occupational Therapy course at the State University of Pará (UEPA) in interventions with the application of PAE in patients with leprosy sequelae at the level of the hands.

METHODOLOGY

This is an experience report, of quantitative and qualitative character, elaborated through occupational therapeutic care from the extension project "Rehabilitation and Assistive Technology: Exercise Activity Protocol for patients with disability due to leprosy", resolution No. 3956/23-CONSUN/UEPA.

The consultations were carried out at the Physical Therapy and Occupational Therapy Unit (UEAFTO) and at the Assistive Technology Laboratory (LABTA), located at the Center for Biological and Health Sciences of the State University of Pará (UEPA).

The study was carried out with a 35-year-old female patient MESS with neural damage in her hands, who was being treated at UEAFTO – UEPA. Initially, muscle strength (FM) was measured by dynamometry. The subsequent sessions consisted of: (1) inspection of peripheral nerves of the face, upper limbs, and lower limbs; (2) application of PAE and (3) hydration and lubrication. 4 consultations were carried out, which took place from September to November 2023.

Concomitantly with the treatment with the application of the EAP, assistive technology devices were made according to the needs presented by the patient at the LABTA – UEPA.

The PAE, developed by Sá (2014), is based on biomechanical bases and the physical-functional rehabilitation method and is characterized by aiming at quantitative gains in the muscle strength performance component when applying the activity as exercise in patients with physical disabilities at the level of the hands resulting from leprosy.

It is divided into 3 phases. The first is represented by patient adherence and reception and is intended to obtain demographic and clinical data. This is followed by measurement of handgrip strength and grip strength in forceps of the dominant and non-dominant hands by means of dynamometry, using dynamometers of *Jamar*® and *Preston Pinch Gauge*®. The result is obtained from three consecutive measurements (Sá, 2014).

The second phase, called Clinical Treatment with Exercise Activity, involves the application of the EAP, which is distributed in 6 stages: (1) Exercise activity – posture for handgrip; (2) Exercise activity – palmar grip of the right and left hands; (3) Exercise activity – posture for gripping pinch; (4) Exercise activity – gripping with pinch right and left hands; (5) Exercise activity – posture for interdigital grip and (6) Exercise activity – right and left hand interdigital grip.

In the third phase, the handgrip and gripping strengths in forceps by dynamometry are reassessed after the end of the sessions with the PAE protocol. The mean values are compared with those obtained prior to the application of the EAP, in order to support the therapeutic measures necessary for the treatment.

RESULTS

In the initial measurement, a significant deficit of Muscle Strength (FM) was observed, which, according to the patient, is characterized by difficulties in performing their Activities of Daily Living and Instrumental Activities of Daily Living satisfactorily, such as work, use of public transportation, activities at home and rest/sleep.

Dynamometry showed the following values, showing the aforementioned FM deficit in handgrip (MD) = 3 and (ME) = 0 and tripod clamp grip (MD) = 1.33 and (ME) = 0; lateral clamp grip (MD) = 0.33 and (ME) = 0; and pulp-to-pulp gripping (MD) – 1st with 2nd = 0, 1st with 3rd = 0, 1st with 4th = 0 and 1st with 5th = 0 and (ME) – 1st with 2nd = 0, 1st with 3rd = 0, 1st with 4th = 0 and 1st with 5th = 0.

Figure 1. MESS patient performing handgrip strength assessment with Jamar®'s dynamometer.

Source: Personal archive, 2023.

Tables 1, 2, 3 and 4 show the results of the measurements performed by means of dynamometry of handgrip, gripping in tripod, lateral and pulp-to-pulp grips.

Table 1. Result of Jamar®'s dynamometric measurement for the patient's handgrip – 1st measurement.

Handgrip	Average
Right Hand	3
Left Hand	0

Source: Personal archive, 2023.

Table 2. Result of the dynamometric measurement of the Preston Pinch Gauge® for the patient's tripod forceps – 1st measurement.

Tripod tweezers	Average
Right Hand	1,33
Left Hand	0

Source: Personal archive, 2023.

Table 3. Result of the dynamometric measurement of the Preston Pinch Gauge® for the patient's lateral forceps – 1st measurement.

Side clamp	Average
Right Hand	0,33
Left Hand	0

Source: Personal archive, 2023.

Table 4. Result of the dynamometric measurement of the Preston Pinch Gauge® for the patient's pulp-by-pulp forceps – 1st measurement.

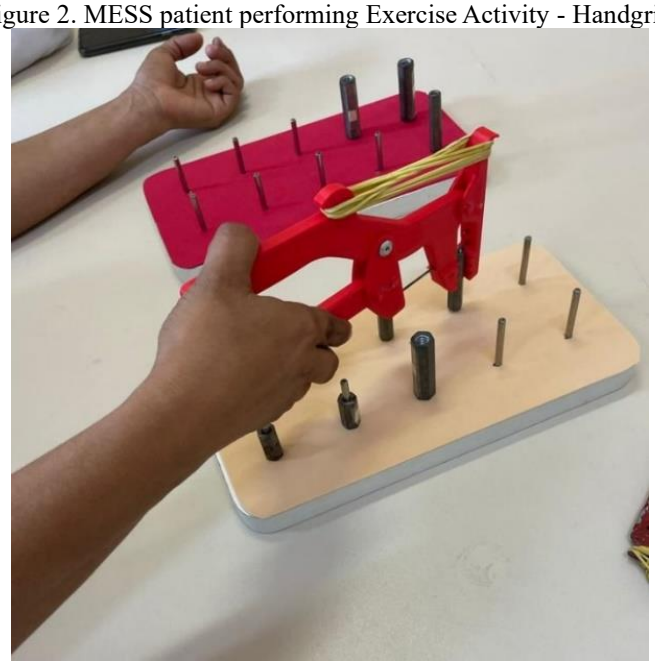
Pulp-to-pulp tweezers	1st with 2nd finger	1st with 3rd finger	1st with 4th finger	1st with 5th finger
Right Hand	0	0	0	0
Left Hand	0	0	0	0

Source: Personal archive, 2023.

In peripheral nerve inspections, pain was signaled by palpation of the radial, medial nerve, and ulnar nerves of the left upper limb (LVS). Pain has been reported to persist for approximately 6 months, accompanied by warmth, edema, and flushing. Thus, in relation to the continuous pain and signs described, a clinical picture of neuritis was suspected, and the application of EAP in MSE was suspended.

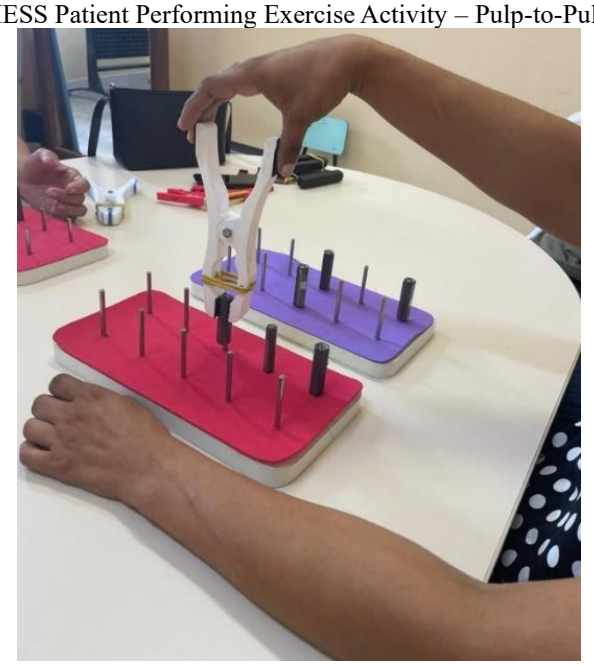
The PAE establishes the performance of 3 sets, with the number of repetitions adapted according to the patient's clinical condition. During the sessions with the application of the EAP, the patient reported asthenia and lethargy when performing the series with the right upper limb. Despite the difficulties presented, the patient fully performed two sets of exercise activities.

Figure 2. MESS patient performing Exercise Activity - Handgrip.



Source: Personal archive, 2023.

Figure 3. MESS Patient Performing Exercise Activity – Pulp-to-Pulp Tweezers.

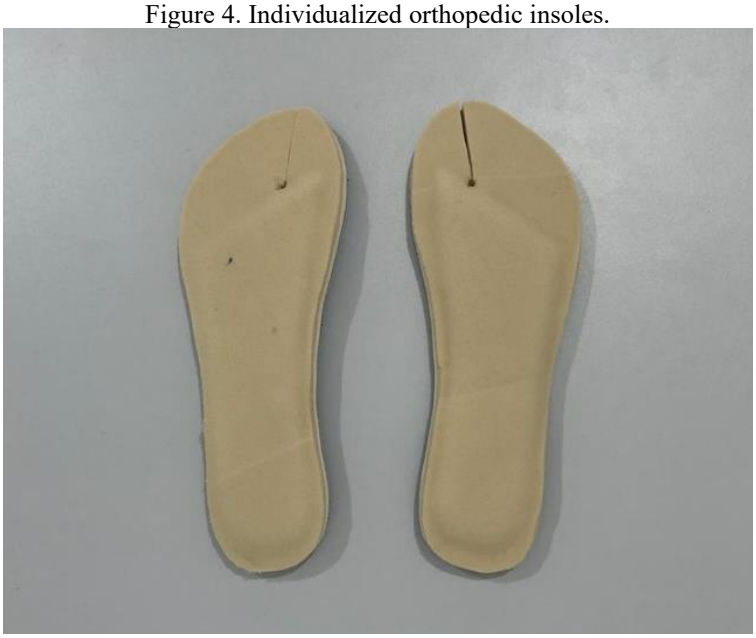


Source: Personal archive, 2023.

In the evaluation recommended by the PAE, motor, sensory and autonomic alterations were observed in the upper and lower limbs, such as thenar and hypothenar hypotrophy and median ulnar mobile claw in the right hand, in addition to loss and decrease of protective sensitivity in both feet, specifically in the midfoot and hindfoot and dryness in both hands, knees, legs and feet.

Throughout the sessions**,** according to the patient's demand, it was found that a pair of orthopedic insoles should be made. These were made at LABTA, UEPA's Fixed Orthopedic Workshop, produced from the patient's anthropometric measurements, aiming at the prevention of fissures and ulcers, using 5mm and 2mm Ethylene Vinyl Acetate (EVA), foam and nappa leather.

Figure 4. Individualized orthopedic insoles.



Source: Personal archive, 2023.

DISCUSSION

The objective of this study was to present the experience acquired through occupational therapeutic interventions associated with the application of EAP, whose effectiveness is reported by Carvalho *et al*. (2023); Pires *et al*. (2023) and Sá (2014) for the physical rehabilitation of upper limbs of patients with leprosy sequelae.

Of the 4 consultations performed, 3 were intended for the execution of the exercise activity established by the PAE. It is important to highlight the performance of a minimum of 10 sessions in order to achieve the desired therapeutic effects (Sá, 2014).

During the performance of the exercise activity, characteristic symptoms of neuritis were reported, which, according to the WHO (2020) refers specifically to the inflammation of the nerve, involving the immune system of the sick person, considered as the main cause of nerve damage, when in an advanced stage of the disease.

This inflammation is accompanied by severe pain, edema, motor and sensory deficits, and the main nerves affected are: facial nerve, trigeminal nerve, ulnar nerve, median nerve, radial nerve, common peroneal nerve, and tibial nerve (Brasil, 2008).

It is noteworthy that the patient was referred for consultation at the Doctor Marcelo Cândia Reference Unit for evaluation and confirmation of the suspicion of neuritis, temporarily suspending the exercise activity with the MSE.

The activities carried out by the extension project aimed to ensure comprehensive health care for patients with leprosy sequelae by associating rehabilitation and assistive technology.

Guidance was given for the practice of self-care measures, especially hydration and lubrication for treatment, aiming at the remission of dryness in the hands, arms and feet. It was

recommended to perform it 2 to 3 times a day, as recommended by the Ministry of Health (Brasil, 2010) and adopted by Sá (2014).

The manufacture of a pair of insoles was intended for use with sandals, as chosen by the patient, and this is the footwear preferentially used in her daily life. The adaptation aimed to relieve pressure in painful areas, as well as comfort and safety during its use when performing daily activities.

The absence of the patient in the occupational therapeutic sessions was characterized as the main difficulty for the production of this study, reducing the number of consultations performed.

FINAL THOUGHTS

In this experience report, occupational therapeutic interventions with the application of the EAP enabled comprehensive care for the needs presented by patients with leprosy sequelae.

The experience acquired through the care provided a better understanding of leprosy and the biopsychosocial consequences of leprosy deformities and physical disabilities. In addition, it contributed to the professional development and academic training of students.

It is important to highlight the scarcity of scientific studies that correlate the implications of leprosy sequelae in occupations performed by patients who present them. Thus, it is suggested that research be carried out on the subject mentioned above in order to construct knowledge about occupational losses resulting from leprosy.

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The importance of nutrition in the modulation of metabolic oxidative stress in cadets

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ABSTRACT

The objective of this article is to discuss the importance of food in the modulation of metabolic oxidative stress in cadets. Stress is a natural response of the body when we are faced with a dangerous situation, thus causing physical and psychological changes. Cadets experience high levels of stress due to the physical and mental demands of military life. Both chronic stress and intense training lead to a greater generation of reactive oxygen species (ROS), requiring the action of antioxidant agents to neutralize ROS, avoiding metabolic oxidative stress (EOM). The stress level and strenuous training of cadets can lead to an imbalance of the redox system, due to the accumulation of reactive oxygen species and the depletion of antioxidants, causing oxidative stress. Diet can act by modulating EOM through nutrients such as vitamins C, E and A, zinc, selenium, flavonoids and carotenoids.

Keywords: Food, Antioxidants, Cadets, Oxidative stress.

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INTRODUCTION

Since prehistoric times, there has been a recognition that man suffered exhaustion after work, fear, exposure to heat and cold, hunger, thirst, blood loss, or disease. Such situations triggered a series of biological and psychological outcomes, known today as stress1. However, it is important to understand how the concept of stress has evolved over the years, as social, historical, and cultural conditions influence the construction of the body of knowledge.

According to Kakasato; Carmona[2] stress is a wear and tear of the body in general, caused by a series of physiological adaptations of the organism, this expression was the object of study for the first time by Hans Selye, who through observation, noticed a series of identical symptoms in the same group of people. Such symptoms were: skin irritation, joint pain, enlarged liver, digestive disorders. Therefore, factors that cause physiological changes in the body are a lever that generates stress.

Stress is the biological attitude necessary for the organism to adapt to a new situation3. It is a natural response of the body when we are faced with a dangerous situation, in which this mechanism puts us in a state of alert, thus causing physical and emotional changes, so it is understood as a complete physiological event.

The concept of stress refers to a state that arises from the perception of stimuli that cause emotional tension and triggers adaptive processes through changes in homeostasis, which is characterized by an increase in adrenaline secretion that gives rise to a variety of systemic manifestations with physical impairment and psychological changes4.

According to Chiavenato5, stress is a complex of mental, chemical and physical reactions of a given individual to environmental stimuli. In this way, stress is a set of reactions that occur in an individual due to undesirable stimuli that exist in the environment. It characterizes the sum of organic and psychic disturbances caused by various aggressor agents, such as trauma, strong emotions, fatigue, exposure and conflicting situations.

Early medical research on stress examined a number of organic changes in the body when faced with an aggressive situation, situations often experienced by cadets during training and missions. The studies of Claude Bernard, a French physiologist, established the existence of specific mechanisms for protection against hunger, thirst, hemorrhage, and agents that could alter the normal parameters of body temperature, blood pH, blood glucose, proteins, fats, and calcium1.

The evolution of stress occurs through phases, each of which corresponds to different reactions. The first is the alert phase, in which the individual comes into contact with the stress-causing agent. The second is the resistance phase, when the body enters the process of homeostasis, being able to adapt to the problem or eliminate it. And finally, the exhaustion phase, where various physical impairments may arise in the form of a disease, such as gastrointestinal changes3.

The symptoms of each phase arise as a result of the body's neuroendocrine response to the stressor and involve two main axes, namely: hypothalamus-pituitary- cortex of the adrenal gland and hypothalamus-pituitary- sympathetic nervous system – medulla of the adrenal gland. Causing a series of hormonal releases such as Corticotropin Release Hormone (CRH), which stimulates the pituitary gland to increase the production of Adrenocorticotropic hormone (ACTH), acting directly on the cortex of the adrenal glands stimulate the increase in the synthesis of corticoids (cortisol and aldosterone) and in the adrenal medulla, releasing catecholamines, adrenaline and noradrenaline into the bloodstream. The increase in these hormones will cause some symptoms such as changes in body weight, behavioral disorders, increased susceptibility to infections, hypertension, gastrointestinal changes, pupil dilation; increased sweating, heart rate and myocardial contractile force, among others1.

Health can be affected by the presence of aggressive factors (risk factors, overload factors), as well as by the absence of environmental factors (underload factors, lack of sufficient muscle activity, lack of communication with other individuals, lack of diversification of activities performed at work). Consequently, some stress is important for the performance of any activity and its total absence or excess can have repercussions on a pathological condition, causing transient disorders or serious pathologies such as occupational stress6.

According to Kings; Fernandes; According to Gomes7, stress has multiple etiologies and different models have been developed and validated to explain its causes, there is currently a growing attention to psychosocial factors at work, in which several studies point to ongoing changes in the work environment that lead to changes in the psychosocial environment that lead to illness.

Another point that deserves to be highlighted is the diet, because during stress, the body loses many vitamins and nutrients and, to compensate for this loss, it is recommended that they have a diet rich in B vitamins, vitamin C, magnesium, manganese and calcium, thus ensuring a good functioning of the body, as they are essential vitamins and nutrients mainly for the digestive and immune systems3.

Stressful life experiences are accompanied by a set of psychological and physiological responses that arise in the face of events or circumstances that are threatening, harmful, or challenging. Since the stress response system is an important adaptive mechanism designed to restore the body's lost balance, promoting defenses8.

Selye9 in his studies identified that different organisms behave similarly when tested in sensory or psychological experiences. Sensory stressors are those that have a direct contact with the body, such as daily activities, running, climbing obstacles, temperature changes, adventure practices. Psychological stressors, on the other hand, are directly related to the mind, that is, the central nervous

system is stimulated through cognitive mechanisms, such as fights, public speaking, grief, environmental changes, dealing with sick people.

Another stressor that directly affects humans is the infection factor, caused by viruses, bacteria, parasites and fungi, which causes our body to release substances specialized in the destruction of unwanted invaders and that causes damage to our health, these substances are cytokines and white blood cells10.

Physiological stress is related to two systems of our body, the nervous and the endocrine, in which the natural process has its origin in the sense receptors, interconnected to each other through feedback mechanisms, thus ending up in the periphery of the body. Thus, the production of hormones is stimulated and regulated by parts of the brain, and it has an important connection with the endocrine glands, which will directly influence the effector organs, through hormones through the bloodstream11.

CADETS' QUALITY OF LIFE VS. OXIDATIVE STRESS

Stress has been associated with perceptions of discomfort. These unpleasant sensations are perceptible by people in general, increasing the number of individuals affected by the symptomatic disease12.

Stress can come from both external and internal sources. Internal sources are linked to the individual's way of being, their personality type, reaction to the way of life, certainly sometimes an event itself is not the reason that constitutes stress, but the way it is interpreted by the individual. External stressors are related to certain demands of the individual's daily life, as well as work, social, family problems, death or illness of a family member, professional failure, frustration of unachieved goals, financial conditions, assault, violence, threats, among others13.

According to France; According to Rodrigues14, the actions generated by the phenomenon of stress are interconnected with the body's work to achieve adaptation. The author also points out that if the stressful trigger is too intense or long-lasting, it will lead to the development and appearance of diseases, because stress can leave the body fragile and open to diseases.

Among the diseases developed as a consequence of exposure to stressful factors, the following stand out: obesity, heart diseases such as hypertension and arrhythmias, diabetes, allergies, infections, asthma, bronchitis, migraine. Stress can also trigger problems such as depression, cognitive impairment, memory loss, among others15.

The gastrointestinal system is sensitive to the stimulus of a stressor. Studies conducted by Cabral *et al.*[16], demonstrated that people who are under stressful actions produce a high demand of peptic digestive hormones in the urinary canal, thus, it is attested that stressful hormones are responsible for the increase in the production of peptic enzymes, which may favor the formation of

ulcers. In other words, these stomach lesions result from the increased demand for the flow of acidic juices, triggered by emotional afflictions that affect the stomach, which is weakened and unprotected by the mucus responsible for protecting the stomach walls. In addition, mucus is only produced when the body is in a state of homeostasis, under the command of the parasympathetic autonomic system.

The cadet faces a space with its own norms, academic tasks in which new study skills are required, and high levels of involvement, autonomy, and organization. Responsibilities and opportunities to explore experiments are added, with the possibility of building new projects, friendships and relationships17.

Military culture promotes the notion of strength and emotional control that fuels the desire to stand out from one's peers, especially in relation to mental health [18]. The peculiarities of military life and various situations that cadets encounter in their routine, such as overload in studies, anxiety related to psychological functions during the year, and some administrative disturbances during the day, cause excess stress and reduce the quality of life of cadets19.

The daily activities of cadets are already stressful in many areas since the beginning of the Training for career combatant officers of the army, with the performance of various theoretical and practical activities or even in environmental conditions, resulting in a strenuous routine. And that this stress produces a feeling of mild tension in some people and more accentuated in others, and this difference is due to biological factors inherent to each organism, as well as to the individual himself, who decides how to respond to the stress factor20.

Cadets are an important group to consider when associated with gastrointestinal health, as they undergo intensive training. Their lifestyle can significantly affect the health of the gastrointestinal tract and, consequently, its ability to perform its functions effectively21. Stress levels can vary depending on the stage of training they are in and the pressures they face in their personal and professional lives. However, it is common for them to experience high levels of stress due to the physical and mental demands of military life.

According to Teixeira:

> Long workloads, distance from family and homes, strenuous physical activities, labor rights that differ from the universal nature and, in some situations, life-threatening, are some examples of what can make the profession more stressful21.

According to Rodrigues *et al.*[22], Military Physical Training (TFM) is defined as the regular practice of Physical Education in the military environment. Such training aims to develop physical, cognitive, psychological, and social skills and prepare to participate in eventual missions, such as close confrontations and war. In view of this, it is necessary to search for better muscular endurance and intense musculoskeletal development in view of the high demands required in Military

Organizations (OM). However, these same service members are in a situation of vulnerability due to insufficient rest and stress.

Such factors can compromise performance in the long term and cause the onset of chronic musculoskeletal injuries. These injuries occur due to inappropriate training or poor physical fitness for the practice, i.e., anthropometric aspects, excessive training and incorrect execution of the movement are their main causes23.

The TFM was developed to train its service members, both from the army and from other forces, in order to strengthen their cardiopulmonary and neuromuscular systems, favoring the gain of muscle mass. In addition, the promotion of quality of life and health involves encouraging the practice of regular physical exercise as a way to combat sedentary lifestyle, a condition that is directly related to risk factors, such as cardiovascular diseases [24].

When the individual is in a chronic state of stress, cortisol levels are soon elevated, which provide greater energy outputs. For this reason, a higher production of ATP (Adenosine triphosphate) is required. However, the fact of increasing the ROS index will not necessarily cause an increase in the levels of antioxidant enzymes or facilitate the entry of these molecules into the cell. Thus, it is understood that chronic stress has psychosocial influences, it is linked to stress with oxidative damage[25].

In certain training sessions, it is necessary to obtain energy in the aerobic and anaerobic form from various energy supply systems, taking into account the duration and intensity, favoring the production of oxidative free radicals (RLOs) in a significant way, having an adequate recovery system through antioxidant agents, the RLOs are quickly neutralized, avoiding a picture of metabolic oxidative stress[26]tag.

During exercise, there is a significant increase in the demand for O2, which is 10 and 15 times higher than the expenditure at rest. As a result, there is a greater production of free radicals, which can be the cause of the origin of some muscle injuries or the aggravation of others. According to Turrens27, metabolic oxidative stress (EOM) resulting from the practice of high-intensity physical exercise is probably caused by the invasion of leukocytes in the damaged muscle areas.

During exercise, there is an increase in the plasma concentration of antioxidants, giving rise to a defense mechanism mediated by vitamins E and C, beta-carotene, coenzyme Q10 and selenium with the intention of neutralizing ROS. In other words, it can be stated that both competitive exercise and daily physical activity aiming at a better quality of life increase the production of ROS, while stimulating antioxidant defense mechanisms, and the final balance will be positive. Concomitantly, a balanced nutrition, as part of a healthy lifestyle, provides the exogenous supply of antioxidant agents through food and supplements containing antioxidants, which reduces the possibility of EOM[26].

Oxidative stress is characterized by the intracellular accumulation of oxygen and nitrogen-reactive compounds called nitrogen ROS (ERN), and usually occurs in cells as a consequence of an imbalance of the redox system, due to excess ROS accumulation, and antioxidant depletion (AOX) or both[28].

Human metabolism contains a detailed antioxidant defense system, with defensive triggers ready to counterattack free radicals, which are formed respectively in the normal cell organism from pathological factors, but when free radicals become excessive, they can provide the oxidation of biological molecules. Therefore, it is at this moment that the imbalance between oxidative damage and the defensive capacity of the body's antioxidants occurs, which is called oxidative stress29.

The occurrence of this chronic imbalance has direct implications for the appearance of numerous pathologies, such as chronic non-communicable diseases, including atherosclerosis, diabetes, obesity, neurodegenerative disorders and cancer30. Ferrari's study31 reaffirms that the production of free radicals triggers pathological events that, in turn, are involved in cardiovascular, carcinogenic and neurodegenerative processes.

It is necessary to have a balance between the intensity of training and the rest time for the different stages of training, as well as a balanced diet and healthy lifestyle habits, such as sleeping eight hours a day, not using tobacco and not drinking alcoholic beverages, this will allow the body to have an adequate system of antioxidant production and not accumulate free radicals. If these factors are not taken into account, it will lead to a significant accumulation of ROS, which can result in injuries, decreased performance, and the onset of chronic fatigue[26].

ANTIOXIDANTS IN FOOD AS A MODULATING FACTOR OF OXIDATIVE STRESS

Food is one of the most important environmental factors that humans are exposed to on a daily basis. The type and quality of food consumed are extremely important not only for their nutritional value, but also for the ability of nutrients and bioactive compounds to interact with the genome32.

The study by Pasiakos *et al.*[33] demonstrated the adoption of unhealthy eating habits by young soldiers, revealing a high intake of foods with high caloric density, rich in saturated fats and sugars, on the other hand, a reduced consumption of fruits, vegetables, legumes and, consequently, dietary fiber and antioxidants. This survey, conducted with 209 young U.S. military personnel, found that all of them did not meet the recommendations regarding the ideal consumption of total and saturated fat, fiber, fruits and vegetables.

Similar results were found in a study conducted with male military personnel of the Brazilian Air Force (FAB) in São Paulo, in which low fiber intake was present. Only 2.3% of the study population reported consuming foods that were sources of fiber as recommended34. In addition, the

food intake of the cadets of the Brazilian Air Force Academy (AFA) showed a profile of inadequate eating habits, with high consumption of fatty foods and low fiber sources35.

Healthy eating refers to the intake of foods that are sources of vitamins, minerals, and fibers36. Many studies have demonstrated the existence of several chemical compounds with biological activity in foods, evidencing the presence of compounds with antioxidant and anti-inflammatory properties in foods such as fruits, vegetables, nuts, and fish[37], compounds that are capable of neutralizing the harmful effects triggered by metabolic oxidative stress38.

An antioxidant is responsible for slowing down or inhibiting the oxidation of a substrate. Due to its stability, it donates an electron to the free radical, neutralizing it. Thus, the antioxidant defense system minimizes the levels of free radicals, allowing essential functions of the body to continue unharmed39.

The antioxidant defence system acts by sacrificing its own molecular integrity in order to prevent the molecules from undergoing changes40. Antioxidants are substances that, when present, are able to slow or inhibit oxidation rates.

Antioxidant agents regulate and keep the body in full function by fighting the action of free radicals. When there is a production of radicals that exceeds the production of antioxidant agents, cellular integrity is degenerated, shaking the functional structure of the organism, thus, the influence of free radicals requires a balance between the production and inactivation of these molecules by means of cells and tissues41.

Therefore, studies on bioactive compounds, antioxidants and anti-inflammatories, and the Nrf2/Keap1 pathway, have shown that they act indirectly on oxidative stress, thus showing the numerous benefits of foods rich in phytochemicals naturally present in food. In the group of these bioactive compounds are the polyphenols that are present in plant foods, such as curcumin present in turmeric, resveratrol found in grapes and peanuts, sulforaphane in cabbage and broccoli, epigallocatechinagalate (EGCG) present in green tea, and phenolics that, like polyphenols, are also secondary metabolics, acting as a potent modulator of signaling pathways in the process of oxidative stress[32].

According to Bianchi; According to Antunes42, antioxidants act at different levels in the protection of organisms. The first defense mechanism against free radicals is to prevent their formation, mainly by inhibiting chain reactions with iron and copper. Antioxidants are able to intercept free radicals produced by cellular metabolism or exogenous sources, preventing the attack on lipids, amino acids of proteins, double bonding of polyunsaturated fatty acids and DNA bases (deoxyribonucleic acid), preventing the formation of lesions and loss of cellular integrity. Antioxidants achieved in the diet, such as vitamins C, E and A, flavonoids and carotenoids, are extremely important in intercepting free radicals. Another protective mechanism is to repair the

damage caused by free radicals. This process is related to the removal of DNA molecule damage and reconstitution of damaged cell membranes

Vitamin E is a cell signaling molecule and stands out for its antioxidant properties. Its main sources are vegetable oils rich in polyunsaturated fatty acids, seeds, nuts, and whole grains, asparagus, avocados, berries, green leafy vegetables, and tomatoes[43].

Flavonoids are part of a class of natural compounds in which important biological activities have been reported, acting against allergies, viruses, inflammation, vasodilation and especially their antioxidant activity. Among the flavonoids, anthocyanins stand out, which are a group of natural pigments that are found in the composition of many red fruits and dark vegetables, with a high concentration in the skins of dark grapes44.

Vitamin C or ascorbic acid has a reducing capacity, in addition, this vitamin can also reduce ROS. Its main function is to participate in various reactions, as a cofactor, which require reduced copper and iron as water-soluble antioxidants that act in intra- and extracellular environments. Its main sources are vegetables, citrus fruits, and legumes[43].

Zinc is a component of many enzymes (approximately 300 enzymes), participating in numerous enzymatic reactions. It is also necessary for the action of various hormones. Oysters are one of the main food sources, with a good concentration of zinc, as well as seafood, fish, liver and red meat, poultry, whole grains, legumes, brewer's yeast, corn and some vegetables. Selenium, on the other hand, stands out for its antioxidant capacity, for participating in the conversion of T4 (thyroxine) into T3 (triiodothyronine), and for providing protection against the action of heavy metals and biotic xeno, in addition, it contributes to reducing the risk of chronic non-communicable diseases and strengthening the immune system[43].

Carotenoids are involved in the production of vitamins, which is related to a decreased risk of macular degeneration, cataracts, and chronic non-communicable diseases (NCDs). In addition, it prevents neoplastic diseases and protects DNA against oxidative stress, due to its antioxidant action[45]. Foods such as carrots, pumpkins and spinach are examples of abundant sources of carotenoids, precursors of vitamin A.

Thus, the concept of nutrition is understood as a biological process in which organisms, using food, assimilate nutrients to carry out their vital functions. And when it comes to the cadets' diet, it is of utmost importance that they are well nourished, as they are going through intense and rigorous training that demands a lot from their bodies. A balanced and healthy diet is essential to provide energy, maintain physical and mental health, as well as ensure good performance during training46.

CONCLUSION

It is common for cadets to experience high levels of stress due to the physical and mental demands of military life, putting their health in a situation of vulnerability. Lifestyle, stress level, unbalanced diet and strenuous training are some of the factors that can cause the imbalance of the redox system, due to the accumulation of reactive oxygen species and the depletion of antioxidants, causing metabolic oxidative stress.

Therefore, it is necessary for cadets to take extra care with their diet, prioritizing the consumption of vegetables, fruits and vegetables in general, which have a range of antioxidants and nutrients in their composition, including vitamins C, E and A, zinc, selenium, flavonoids and carotenoids. These components contribute to the homeostasis of the body by neutralizing the damage caused by oxidative stress, such as the emergence of chronic non-communicable diseases, such as cancer, obesity, diabetes, cardiovascular diseases, neurodegenerative diseases and others.

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Technological guide for patients with Metabolic Syndrome: Health promotion

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ABSTRACT

Understanding the pathophysiological mechanisms underlying metabolic syndrome (MS) is crucial for the development of effective preventive and therapeutic strategies, aiming to mitigate its negative impacts on the health of the population. The study aimed to develop an educational technological booklet to promote the health of patients with metabolic syndrome (MS). This was an exploratory, descriptive and technological field study, carried out in a Basic Health Unit (UBS) in Teresina-PI. The study participants were adult women, without restrictions regarding educational level, with a confirmed diagnosis of MS. A semi-structured interview prepared by the researcher was carried out with the study volunteers. After analyzing and interpreting the data, an educational booklet was created, following the phases: Content Systematization;

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Content Composition; by Judges, and finally Semantic validation with professionals. The study revealed that of the 22 women interviewed with Metabolic Syndrome tend to have a specific sociodemographic and clinical profile, 77.27% of them face challenges in maintaining a healthy diet and practicing physical exercise, in addition to 63.63% not knowing the consequences of this syndrome. It was also evident that the lack of knowledge about metabolic syndrome and possible complications can contribute to low adherence to treatments and lifestyle changes, necessary to improve quality of life, morbidity and mortality. The results indicate that the creation of awareness programs, health education, as well as the development of activities and educational materials, such as the educational technological booklet, can contribute to this profile of patients adopting healthier habits, and may be an alternative to change the reality of metabolic syndrome. It is expected that the educational material produced can collaborate with health professionals, patients and family members, in addition to instigating the creation of public policies capable of promoting the prevention and control of complications, with the aim of reducing comorbidities and improving the quality of life of women with metabolic syndrome.

Keywords: Metabolic Syndrome, Health promotion, Technological Primer.

INTRODUCTION

In 1988, Gerald Reaven officially spoke about the Metabolic Syndrome (MS), entitled Syndrome X, which associated insulin resistance, arterial hypertension, dyslipidemia and Diabetes Mellitus (DM), however, it did not include obesity, which is currently considered one of the basal pathogenic generators of metabolic syndrome (Ivanova *et al*., 2017). Therefore, it is also known as insulin resistance syndrome, dyslipidemia, multiple metabolic syndrome, death quartet, obesity syndrome, and New World syndrome (Lee *et al*., 2016).

The incidence of MS in recent decades has been progressively increasing. Recent global estimates show a prevalence of 20-25% in the adult population of this disease (Brazilian Society of Clinical Medicine, 2023). Thus, according to the World Health Organization, this syndrome is responsible for approximately 7% of global deaths, regardless of the cause, and for 17% of those related to cardiovascular diseases (CVD), (World Health Organization, 2020).

A *priori*, people with this syndrome are twice as likely to die, regardless of the cause; are three times more likely to have a heart attack and/or stroke; and are five times more likely to develop type 2 diabetes mellitus (T2DM) (Ramires *et al*., 2018). Second, prevalence varies according to age, sex, ethnicity, diagnosis used, and the group evaluated (Neves *et al*., 2019; Lira *et al*., 2017).

Thus, it is emphasized that the use of educational activities is essential, as they promote health education and allow the exchange of knowledge among them, stimulating the promotion of self-care, through verbal exposure and the use of support material, such as self-explanatory booklets and images (Ramires *et al*., 2018). Therefore, it is considered that educational booklets can serve as an instrument that brings together technical and human issues, in order to humanize user care, favoring self-care, quality of life, and autonomy (Barbosa *et al*., 2020).

MS is a combination of cardiac risk factors that include obesity, high blood pressure, hypercholesterolemia, and dysfunction of glucose metabolism. These conditions can increase the risk of cardiovascular disease (CVD) and type 2 diabetes mellitus. It is essential to make lifestyle changes to combat and prevent MS, such as a healthy diet, regular physical activity, weight control, blood glucose, blood pressure, cholesterol, and hypertension (Saboya *et al*., 2016).

As tools for awareness and control, we can count on educational technologies, which are characterized as an important and significant tool that assists in patient care, and also has the possibility of developing new forms of care that help professionals to teach self-care and develop competence. Thus, educational technology, being a form of health promotion, comes as an instrument capable of facilitating the entire teaching-learning process, including the care of people who have MS (Cortez, 2018).

Given the literary context, the study was justified by the interest in contributing to this patient profile through the elaboration of an educational technological booklet to promote the health of

patients with metabolic syndrome. It is possible to identify the sociodemographic and clinical characteristics of patients with MS; verify the main doubts and difficulties in the control of MS; prepare an educational booklet on metabolic syndrome according to the findings reported by the patients and validate the content and images through evaluation by expert judges.

METHODOLOGY

This research was guided by the recommendations of Resolution No. 466/12 and 510/16 of the National Health Council (CNS) in its legal and scientific aspects, with CAAE number 56710621.2.000.5211. This was an exploratory, descriptive and technological field study carried out in a Basic Health Unit (BHU), located in the east zone of Teresina – PI.

The study participants were adults and it was made available for both sexes (however, during data collection there were only women, no male patient was followed up during data collection), with no restriction on the level of education, with a confirmed diagnosis of MS. The exclusion criteria were: underage patients and patients who, although eligible, were hospitalized during the collection process.

The Community Health Agents (CHA) were responsible for scheduling the patients' interview with the researchers, setting a day and time for it to take place individually, in a reserved room at the UBS. The duration to answer the questions was a maximum of 15 min. Thus, in order to include all selected patients, interviews were conducted twice a week, all in August 2022. The number of participants was defined by the "Snowball" method and the total sample was 22 participants.

Thus, snowball is a sampling technique that uses reference chains, a kind of network (Vinuto et al., 2010), and in this research the reference network was the Community Health Agents.

A *priori*, a semi-structured data collection instrument developed by the researchers was applied to collect sociodemographic information from the participants (age, sex, schooling and family income), and closed questions regarding doubts and difficulties in controlling MS (Do you know what metabolic syndrome is? What are your difficulties in maintaining control of SM? What are your difficulties in maintaining your healthy diet? What medications do you use? Do you know the complications of this pathology? What treatment do you undergo?). A descriptive analysis of the data was performed in order to verify the differences in the means of the numerical data between the groups or categorical data. In addition, the *Statistical Package for the Social Sciences* – SPSS Version 26 (Pereira *et al*., 2018) was used.

The process of constructing the booklet was based on (Reberte et al., 2012), with adaptations and developed in five phases: Phase 1: Systematization of Content; Phase 2: Content Composition; Phase 3: Choice of Illustrations and Layout of the Booklet; Phase 4: Content and Appearance Validation by Judges; Phase 5: Semantic validation with professionals. It was designed using the

Canva app, which is an online graphic design and visual creation tool that allows users to create a wide variety of visual content, such as social media images, posters, presentations, flyers, infographics, invitations, and more. Thus, the *Brainstorm feature was used* (Canva, 2023).

PHASE 1: CONTENT SYSTEMATIZATION

Analysis and interpretation of interviews with professionals

The answers from the questionnaires were the basis for the creation of the technological educational booklet. This material was made with simple language and explanatory figures so that they could be understandable, through the presentation in the form of an *e-book*, which patients can access through an access link that will be provided by the CHAs on their cell phones.

PHASE 2 – CONTENT COMPOSITION

The content of the booklet was composed of subheadings, which were chosen based on the analysis of the semi-structured interview with the patients, as well as on the experience of the researchers. The technological booklet presents guidelines that will be relevant to the patients, as they addressed their doubts and difficulties in controlling the disease, seeking to alleviate them and demonstrate relevant guidelines on diets, medication, physical activity and the importance of medical follow-up.

In order to answer the difficulties that these patients present due to MS, explanatory texts were elaborated with the answers to the most frequent questions. The choice of images was made through coherence with the information mentioned and sought to illustrate the ideas of the texts and explanations, with appropriate colors for the material.

PHASE 3 – CHOICE OF LUSTRATIONS AND LAYOUT OF THE BOOKLET

Choice of illustrations and layout

In order to choose the illustrations that make up the booklet, care was needed to conduct an easy-to-understand reading, consistent with the proposed guidelines and that lead the reader to be curious to engage in learning about the information present in the booklet. The choice of figures was made through images released on electronic pages and the explanation of the researchers to the designer responsible for the elaboration of the booklet.

To prepare the booklet, the layout professional took care to make it easier to read and visually simplify the information provided. Successive attempts were made to establish how the standard was adopted: text in understandable language, regardless of the level of education, and an adequate layout, with good legibility.

PHASE 4 – CONTENT AND APPEARANCE VALIDATION BY JUDGES

For the content validation of the Booklet, evaluators were invited, by means of an invitation letter and a "snowball" strategy, to contribute to the material. The evaluation of the content was carried out by physicians specialized in Endocrinology or Internal Medicine, who are linked to FMS-PI.

Selection of judges

Regarding the number of judges to evaluate the content of the technological booklet, the literature shows controversies regarding the amount needed (Pasquali et al., 2010). However, it is suggested that the number be odd to avoid ties.

The judges were selected through a search of the curriculum by the Lattes Platform. Subsequently, they were invited via *email*. In addition, they were asked about the appointment of other professionals to also participate as judges (snowball strategy). Thus, this work was evaluated by 9 judges.

Assessment of the material by the judges

A period of thirty days was established for each judge to conclude the analysis, fill out the evaluation instrument and send it back to the researchers by e-mail. It should be noted that this research did not pose a biological risk to the judges, but it did present a risk of breaking the confidentiality of the information collected. To minimize these risks, the judges were not identified by name, but by the medical specialty to which they belong, only by numbers. Another possible risk referred to the embarrassment in giving one's opinion in relation to the technological playbook. To minimize these risks, the judges were made clear that their opinion was important for identifying possible flaws and content improvements, and that they would be free not to participate in it whenever they wished, without any prejudice or burden.

The notes included in the questionnaire were read *online* by the researchers by e-mail. The judges were informed about the suggestions that were not clear and confirmed the researcher's interpretation of the answers contained in the questionnaire for the improvement of the material, reducing the inappropriate interpretation of the notes.

After this process, the researchers made the suggested adjustments to the content and illustrations of the technological booklet.

PHASE 5: SEMANTIC VALIDATION WITH PROFESSIONALS

The semantic validation has the function of researching whether all items were coherent for the members of the population to which the instrument referred, and the repetition of the items was

requested by the members of the group. If the repetition left no doubt, the item was correctly understood. On the contrary, if there was a divergence in its reproduction, the subjects suggested how it should be formulated to indicate what the researcher wished to express (Pasquali et al., 2010).

The analysis of the content evaluation carried out by the judges was carried out using the Content Validity Index (CVI), which aimed to measure the agreement or disagreement of the evaluators regarding the items presented in the evaluated instrument, in this case, the booklet. The CVI uses *a Likert* scale, which scores one to four items by item, where 1: not relevant/not representative; 2: needs a major revision to be representative; 3: needs a minor revision to be representative; and 4: relevant or representative (Alexandre et al., 2010).

RESULTS AND DISCUSSION

The present study was based on the creation of an orientation booklet for the follow-up of people with metabolic syndrome. The sample consisted of 22 women, since there were no males in the Basic Health Unit during data collection. A questionnaire was applied divided into two stages, one sociodemographic and the other on clinical data, in order to discover the particularities and impact of the disease on their quality of life. The results obtained are shown in Table 1.

Table 01 - Characterization of the sociodemographic profile of patients diagnosed with metabolic syndrome treated at the Basic Health Unit (BHU). Teresina-PI-2023.N:22.

Age		
18 to 25 years old	2(9,1)	(1,9-26,1)
26 to 35 years old	0(0,0)	-
36 to 45 years old	9(40,9)	(22,5-61,5)
46 years or older	11(50,0)	(30,2-69,8)
City/State of Residence		
Teresina	11(50,0)	(30,2-69,8)
Other cities in Piauí	4(18,2)	(6,5-37,6)
Cities of Maranhão	1(4,5)	(0,5-19,3)
Other Municipalities	6(27,3)	(12,3-47,8)
Income		
Less than one minimum wage	17(77,3)	-
One to two minimum wages	0(0,0)	-
Three to four minimum wages	0(0,0)	-
Greater than five minimum wages	0(0,0)	-
Schooling		
Illiterate	6(27,3)	(13,6-51,7)
Ens. Fund. Complete	2(9,1)	(2,1-28,4)
Ens. Fund. Incomplete	7(31,8)	(17,2-56,8)
Ens. Avg. Complete	1(4,5)	(0,5-21,1)
Ens. Dr. Incomplete	3(13,7)	(4,4-34,9)
Ens. Full Surface	0(0,0)	-
Ens. Incomplete Sup.	1(4,5)	(0,5-21,1)
Marital status		
Married/Common-law relationship	13(59,1)	(40,7-80,1)
Single	0(0,0)	-
Separated/Divorced	2(9,1)	(2,0-27,2)
Widow	6(27,3)	(12,9-49,7)
Color/Race		

White	6(27,3)	(14,4-53,9)
Curtain	7(31,8)	(18,2-59,1)
Black	5(22,7)	(10,8-48,4)
Yellow	0(0,0)	-
Indigenous	1(4,6)	(0,6-22,1)

Source: Author (2024)
95% CI: Confidence interval for ratio.
CI-5%: Confidence interval for mean.

The results showed that the profile of the volunteers was: 50% are over 45 years old, 50% are residents of the municipality of Teresina, 77.3% of them earn less than one minimum wage, 31.8% have incomplete elementary education and 27.3% are illiterate, 59.1% are married, in addition to 31.8% considering themselves brown and 27.3% white. It is noteworthy that 5 women did not answer about their income level, 2 about their level of education, 1 about their marital status and 3 about their color/race, it was observed that they did not feel comfortable answering these questions, because they remained silent. Table 2 shows the characteristics of the clinical profile of patients diagnosed with metabolic syndrome treated by the Basic Health Units.

Table 02 - Characterization of the clinical profile of patients diagnosed with metabolic syndrome treated by the Basic Health Unit (BHU). Teresina-PI-2023.N:22.

	Clinical Data			
	N(%)	IC-95%	Mean (95% CI)	Dp
How Long Do You Live With The Diagnosis Of Metabolic Syndrome				
1 to 3 years	7(31,8)	(17,2-56,8)		
2 to 6 years	6(27,3)	(13,6-51,7)		
7 to 10 years	2(9,1)	(2,1-28,4)		
More than 10 years	5(22,7)	(10,2-46,4)		
Lifestyle Habits (Frequency of Physical Activity) How Many Times a Week				
1	1(4,6)	(2,3-62,9)		
2	1(4,6)	(2,3-62,9)		
5	3(13,6)	(20,9-90,6)		
Lifestyle Habits (Frequency of Physical Activity) minutes			- 36.00(24.89-47.11) 8.94	
Do you know what metabolic syndrome is?				
Yes	1(4,6)	(0,5-20,2)		
No	20(90,9)	(79,8-99,5)		
Do you know the complications of this pathology?				
Yes	8(36,4)	(18,9-57,1)		
No	14(63,6)	(42,9-81,1)		

Source: Author (2024)
95% CI: Confidence interval for ratio.
CI-5%: Confidence interval for mean

Regarding the clinical profile of MS patients, it is important to point out that not all interviewees answered all the questions, since in some points they did not know what to say and others did not feel comfortable, for example, 2 did not say how long they have been living with the diagnosis of metabolic syndrome, 17 did not say how many times a week they do physical activities and 1 does not know what metabolic syndrome is. Therefore, in the table above, some items do not have a total of 22 answers. Thus, 31.8% have more than 3 years with the pathology; only 22.8% do

little or no physical activity weekly; 63.6% of women, despite having this disease, do not know what it really is, or even the main complications arising from it.

The characterization of the health profile of patients diagnosed with MS, with regard to difficulties in controlling the disease, diet and medications, is presented in Table 03.

Table 03 - Characterization of the health profile of patients diagnosed with metabolic syndrome attended at the Basic Health Unit (BHU). Teresina-PI-2023.N:22.

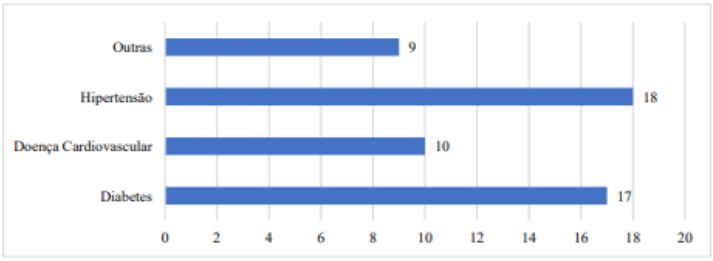
	Sim	Não
	N(%)	N(%)
Quais suas dificuldades no controle da síndrome metabólica?		
Fazer uso de medicação diariamente	0(0,0)	22(100,0%)
Seguir a dieta recomendada	17(77,3%)	5(22,7%)
Praticar exercícios físicos	17(77,3%)	5(22,7%)
Ir com regularidade para as consultas médicas	3(13,6%)	19(86,4%)
Quais dificuldades em manter a sua alimentação de forma saudável?		
Desconhece a dieta	11(50,0%)	11 (50,0%)
Não gosta das restrições alimentares que a dieta resulta	5 (22,7%)	17 (77,3%)
Recebeu pouca ou nenhuma orientação a respeito da dieta pela equipe de saúde	16 (72,7%)	6 (27,3%)
Quais medicações você utiliza?		
Anti-hipertensivas	20 (90,9%)	2 (9,1%)
Anti-glicemiantes Orais ou injetáveis	20 (90,9%)	2 (9,1%)
Outras	6 (27,3%)	16 (72,7%)

Source: Author (2024)

In the characterization of the health profile of patients diagnosed with MS, it was identified that 77.3% of the participants reported difficulty in practicing physical exercises and correctly following the recommended diet. In addition, 72.7% did not receive any dietary guidance, and 100% did not use frequent medications, although 90.9% used antihypertensive drugs, oral or injectable antiglycemic agents.

The previous pathologies of these patients were also investigated, which could mark more than one response, however, the ones that stood out were hypertension reported by 81.8% of the volunteers and diabetes by 1. However, other diseases were also mentioned, which are present in Graph 01 .

Graph 01 - Characterization of previous diseases of patients diagnosed with metabolic syndrome attended at the Basic Health Unit (BHU). Teresina-PI-2023.N:22.



Source: Author (2024).

Another important point investigated was the characteristics related to the lifestyle habits of MS patients, such as physical activity (5 patients), smoking (6 patients) and alcohol consumption (3 patients).

Regarding the characterization of the lifestyle habits of these participants, as previously mentioned, they did not answer all the questions, some did not feel comfortable answering, so only 63.6% of the 22 answered the questions presented above, of which 27.3% of the participants were smokers and another 13.6% alcoholics. After the analysis of the results, it was possible to elaborate the Technological Booklet, which was the focus of the results of this study.

Figure 1: Cover of the Educational Technology Booklet

Figure 2: Contra Layer

Figure 3: Table of Contents

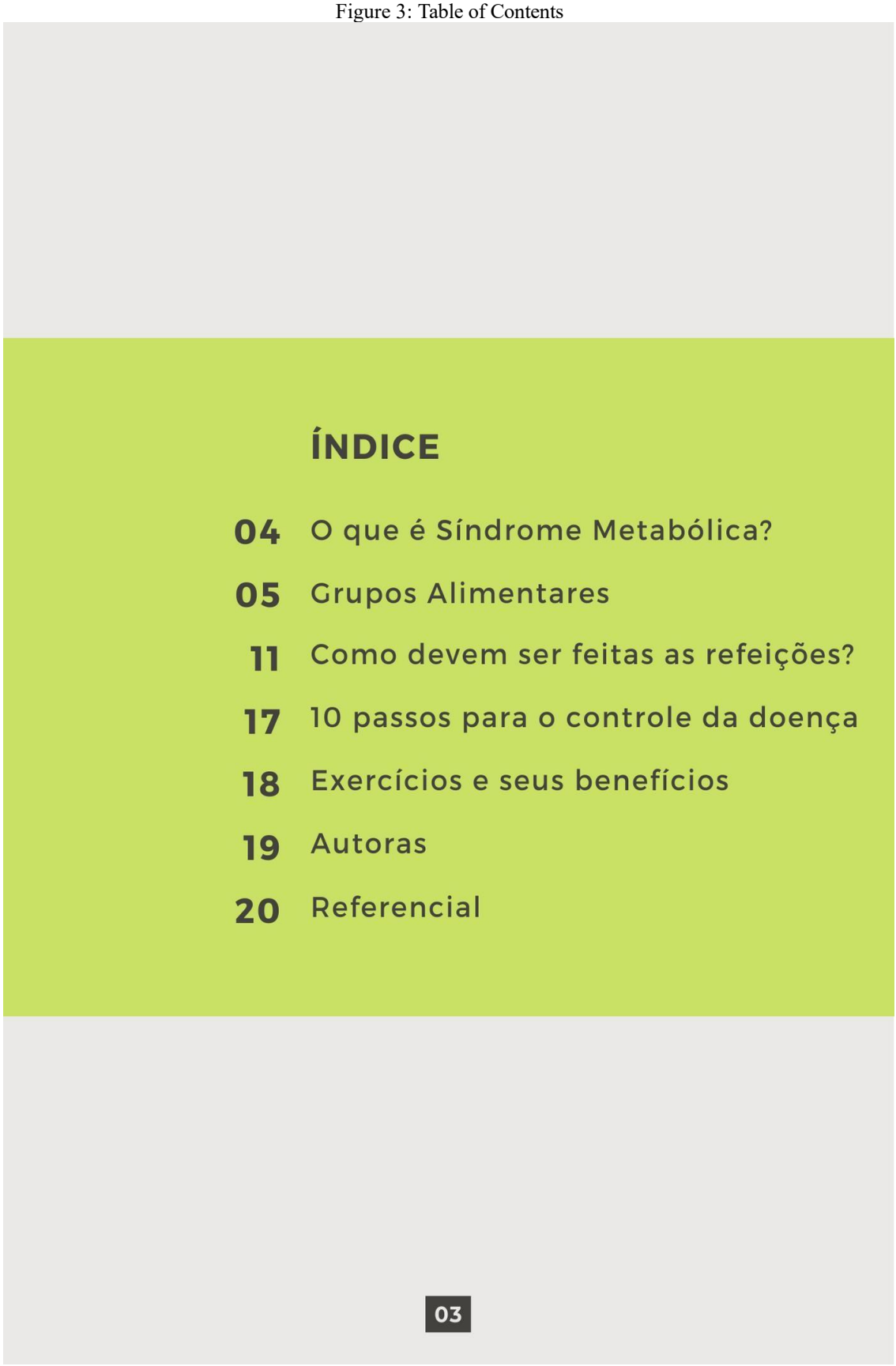


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Figure 4: What is metabolic syndrome

O que é a Síndrome Metabólica?

1. A síndrome metabólica é uma desordem relacionada, principalmente, com o acúmulo de gordura abdominal e as alterações da glicose com ou sem resistência à insulina.
2. A Síndrome metabólica contribui diretamente para o desenvolvimento de doença cardiovascular e para o aparecimento do Diabetes Mellitus tipo 2, além disso, ela aumenta o risco de morte prematura, doença renal, doença mental e de câncer.

Como evitar?

Alimentação saudável	Controle da pressão arterial	Controle glicêmico
Níveis de colesterol e triglicerídeos saudáveis		Estilo de vida ativo
	Atividades físicas	

04

Figure 5: Food groups

Figure 6: Alimentos in nature

1. Alimentos in natura

São aqueles que não tem nenhuma mudança, adição ou qualquer alteração, ou seja são adquiridos diretamente das plantas ou animais.

06

Figure 7: Minimally processed foods

Figure 8: Oils and Fats

3. Óleos e Gorduras

São compostos por produtos extraídos da natureza ricos em ésteres de triacilgliceróis e produtos resultantes da esterificação entre o glicerol e ácidos graxos.
A diferença entre óleos e gorduras é que os óleos são, em sua maioria de origem vegetal e líquidos à temperatura ambiente. Já as gorduras, são sólidas e podem ser de origem vegetal ou animal.

08

Figure 9: Processed foods

4. Alimentos Processados

São aqueles produtos produzidos em indústrias, que são acrescentados sal, açúcar e outras substâncias para aumentar a validade e deixar o sabor mais agradável.

09

Figure 10: Ultra-processed foods

Figure 11: How meals should be eaten

Figure 12: How meals should be eaten

Figure 13: How meals should be eaten

Figure 14: How meals should be eaten

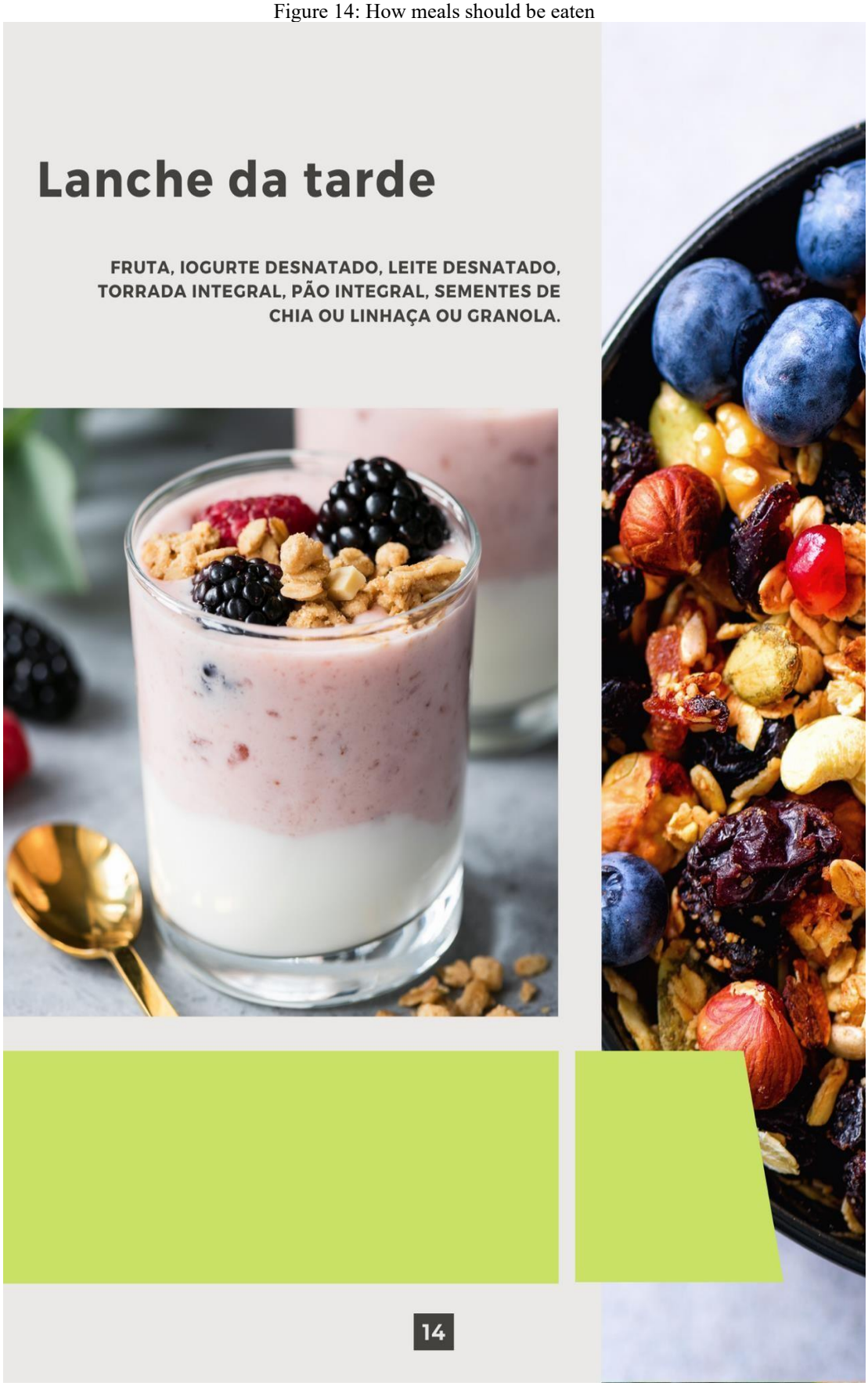


Figure 15: How meals should be eaten

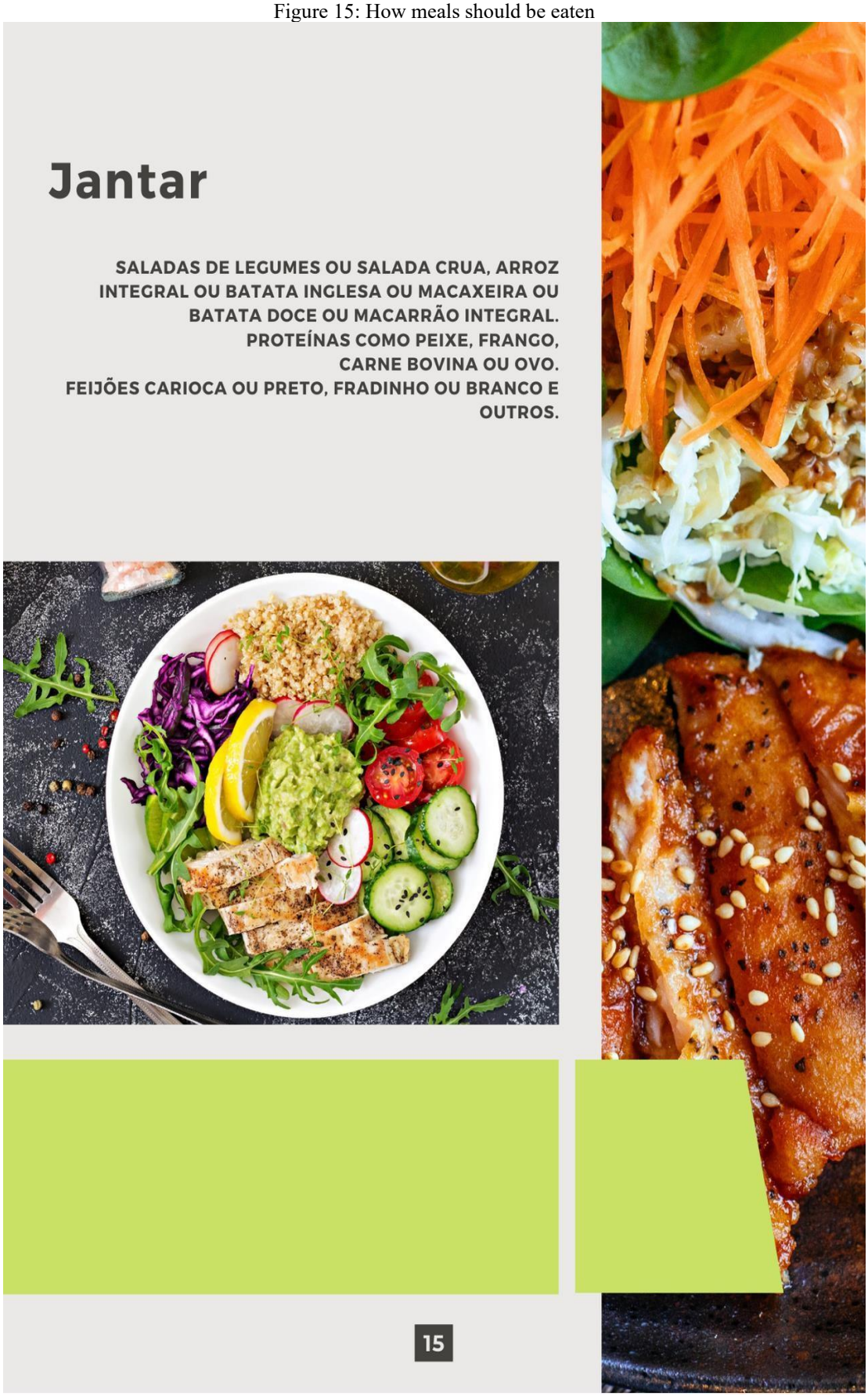


Figure 16: How meals should be eaten

Figure 17: 10 steps to manage metabolic syndrome

10 passos para o controle da doença

1- Consuma pelo menos 3 tipos de frutas por dia;
2- Faça uma boa ingestão de água. Para saber a sua quantidade de água ideal para o seu peso é só calcular: Peso (kg) x 35.
Exemplo: 70 x 35 = 2.450 -> 2 litros e 450 ml;
3- Consuma alimentos in natura;
4 - Evite alimentos processados e ultraprocessados;
5 - Faça exercício físico diariamente;
6 - Reduza a quantidade de açúcar, sal e gorduras saturadas;
7- Consuma sementes de chia, linhaça, assim como castanha, amendoim;
8- Consuma ovos, carnes magras e prefira carnes brancas, como: frango e peixe. Consumir carne vermelha, preferencialmente, uma vez na semana;
9- Não esqueça dos medicamentos prescritos pelo seu médico;
10- Não consuma bebidas alcoólicas.

17

Figure 18: Benefits of exercise

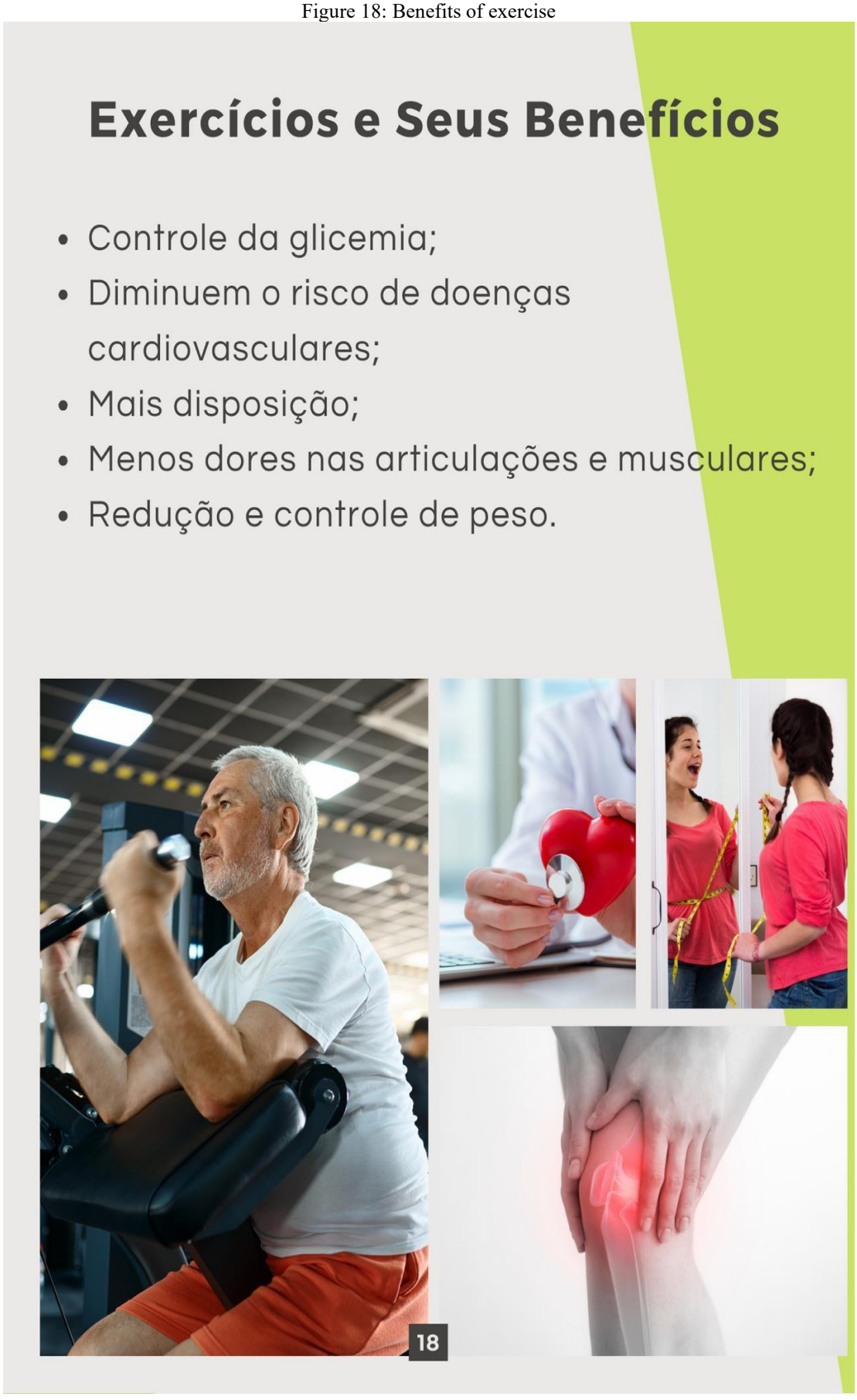


Figure 19: Female authors

Figure 20: Reference

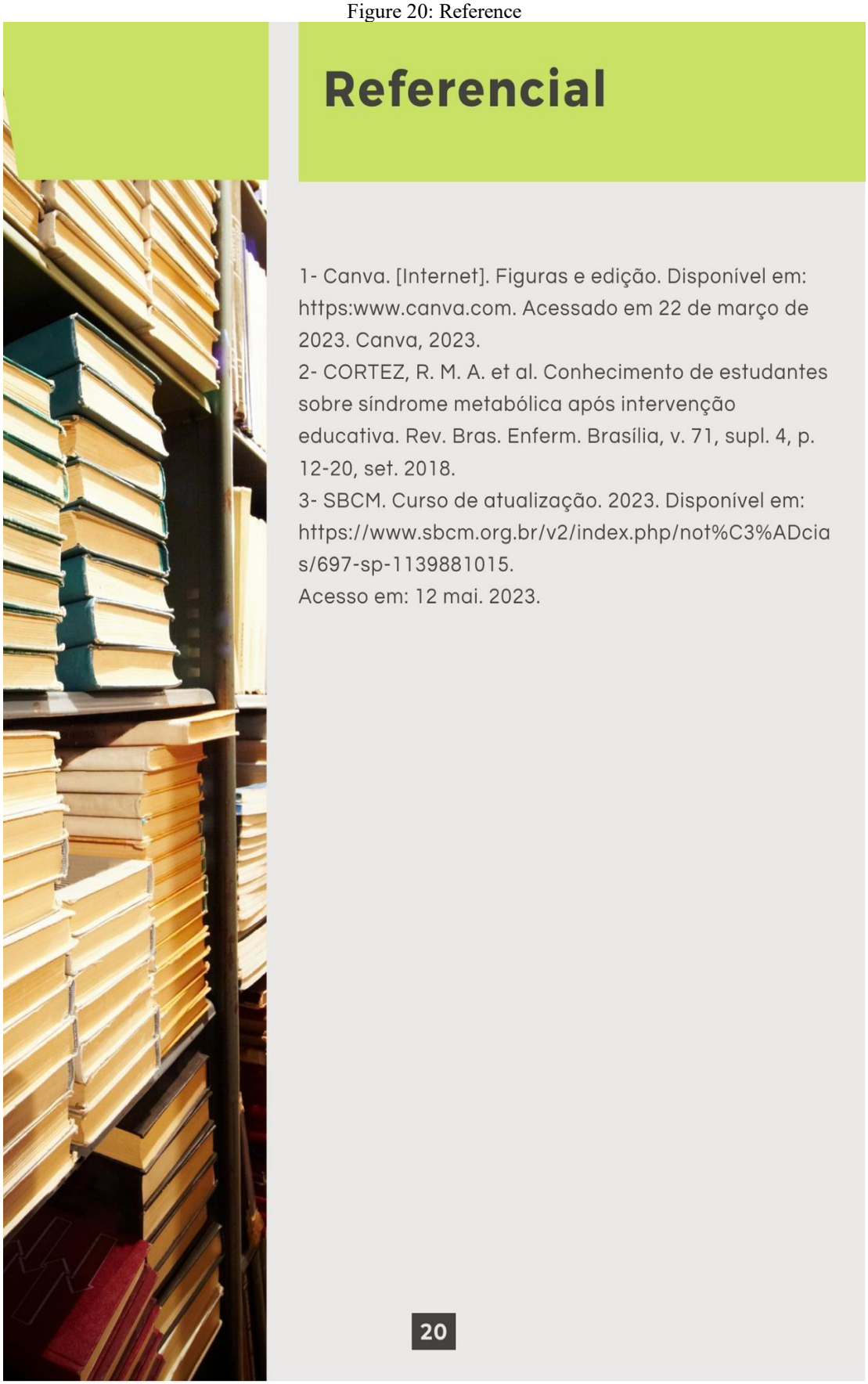
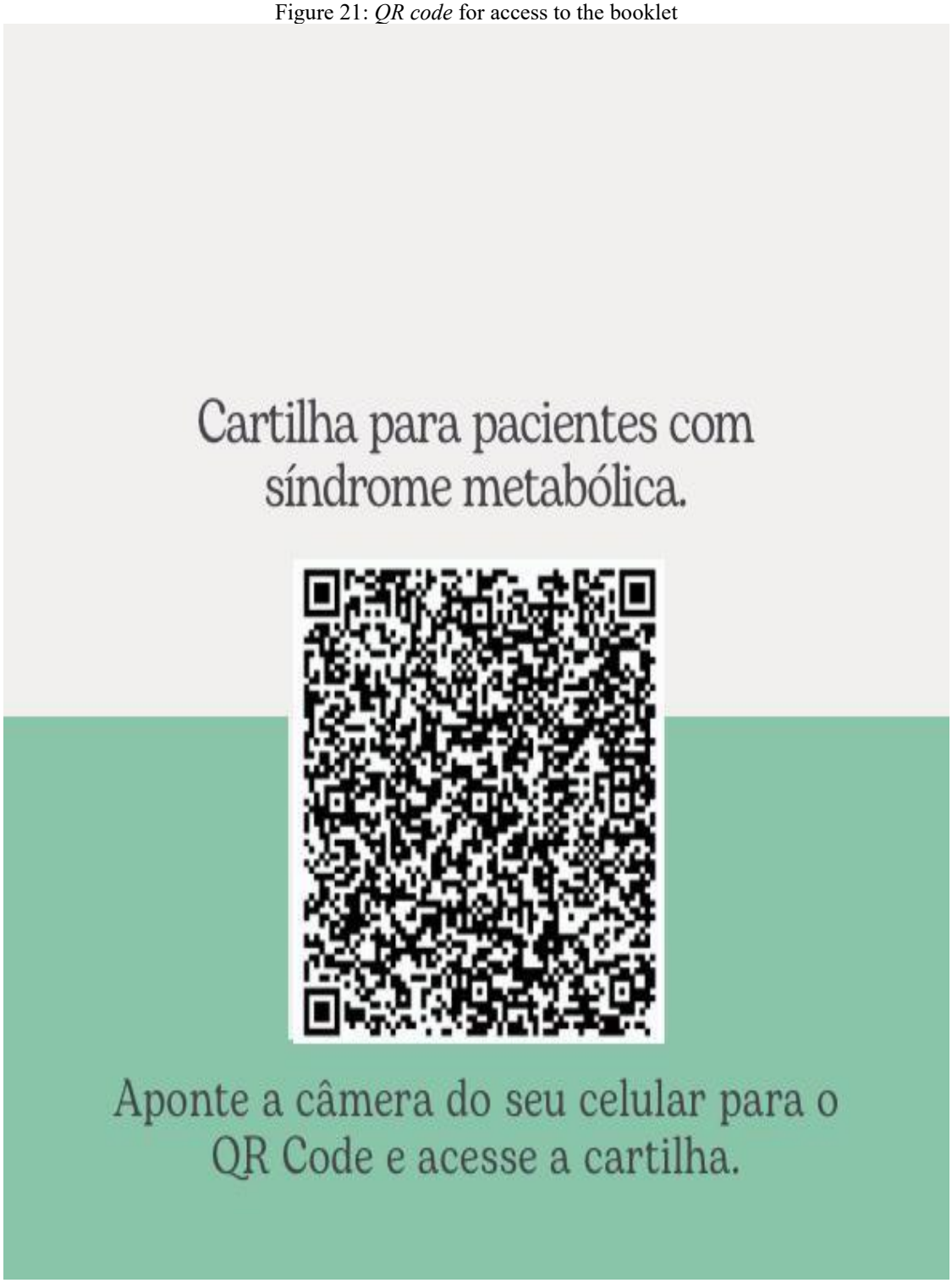


Figure 21: *QR code* for access to the booklet



In the present study, the volunteers were only female, but there is a greater predominance of women. As reported by the National Health Survey (PNS), conducted by PeSecond in 2013, the prevalence of MS in Brazil was 8.9%, with a statistically higher percentage in females (10.3%) than in males (7.5%), and was associated with low schooling, stroke, and other cardiovascular diseases (Oliveira, et al., 2020), presenting a result similar to the present study, due to its prevalence in women.

Of the volunteers, 18 had the following diseases: diabetes, hypertension and cardiovascular

diseases, and 16 reported problems in maintaining a healthy diet and practicing physical exercise. According to (Mussi et al., 2019), they state that cardiovascular diseases and DM are the main causes of death worldwide, and the prevention and control of these diseases is of great importance. When they are combined, as is the case with metabolic syndrome, the situation worsens and the need for follow-up and care is even greater, corroborating the findings of this study, in which the pathologies that stood out the most were diabetes and hypertension.

Regarding diet and physical activity, the authors (Silva, et al., 2021), in their research on MS, obtained evidence of the value of regular physical exercise and changes in eating patterns. These actions play a crucial role in decreasing abdominal circumference, reducing visceral fat, and as a result, enhancing insulin sensitivity. Reflecting in the reduction in plasma glucose levels, contributing to the prevention of type 2 diabetes.

Regarding physical activities, it was found that 63% of the women did not exercise during the study, however, 27.27% smoked and 13.63% were alcoholics. Another fact is that less than 25% of the interviewees do some physical practice, such as walking or running. According to this information (Monte et al., 2020), it is explained that criteria such as physical activity are relevant for the creation of health awareness and education programs, and for the development of activities that help women adopt healthier habits.

Another worrying point found in the results of the present study is that 81.81% of these women do not know what MS is. The study by Oliveira et al., 2020 agrees with this information, in which he emphasizes that because it is a silent disease, many individuals do not know that they have such a pathology, and when they discover it, they do not seek information about the consequences of this syndrome, data that diverge with the data of the study in question, Because the volunteers have the diagnosis, but they don't know what it is, even if they treat it.

According to the volunteers, they are not able to follow the diet given by the doctors, but they have no problem going to the doctor's appointment. However, when questioned about the complications arising from this pathology, 14 of the 22 women argued that they do not have knowledge about these complexities. However, the analysis points to an apparent contradiction, because although they are aware of the existence of MS, they do not seem to understand the significant risks associated with this condition. This disconnect between the knowledge about having the diagnosis of MS and the lack of understanding about the inherent risks becomes a point of attention for this patient profile.

Thus, it is noticeable that the follow-up of patients with metabolic syndrome has the potential to significantly improve the quality of life of these people. Therefore, the research conducted by (Monte et al., 2019), emphasizes that, with good guidance, there is a reduction in the occurrence of complications and an increase in well-being for individuals. However, this requires the collaboration

of health professionals, patients and their families, and the creation of public policies capable of promoting the prevention and control of these pathologies.

Regarding the medications that the volunteers in this study consume the most, antihypertensive drugs and oral or injectable antiglycemic agents stood out (about 87% of the interviewees), and 70% of them do not know what the complications of MS are. Thus, similar results were found in the study by (Albuquerque, et al., 2023) that aimed to evaluate the drug interactions present in the medical prescriptions of patients at the Tasso Jereissat Polyclinic. The results showed that of the 22 patients interviewed, 40.9% (9) were aged between 60 and 74 years, 54.55% (12) were younger than 59 years and 4.55% (1) were over 75 years old, and all individuals were using antihypertensive and hypoglycemic drugs.

Considering all the limitations and difficulties, the creation of educational tools for people with metabolic syndrome is an important strategy in an attempt to help people understand and cope with MS, with a focus on improving health and well-being. Some of the advantages of developing educational tools for people with metabolic syndrome include: Improved knowledge; Increased awareness; Access to information and adherence to treatment. However, it is important to remember that educational tools are only a complementary way to help cope with the syndrome, and cannot be used to replace conventional medical treatment.

The educational materials in the various health approaches show effectiveness, and with regard to the technological booklet of the present study, it consists of 18 pages, with content related to the concept of MS, its causes, main symptoms, diagnostic methods, treatment options and the types of foods recommended, such as those rich in fiber, omegas 3 and 6, among others. The booklet also addresses prevention strategies, highlighting the importance of a healthy diet and physical activity. The material is richly illustrated in order to facilitate understanding, as well as to favor the dissemination of essential information for the well-being of people affected by MS. In order for the population to have access to this booklet, it will be made available through a sponsored access link, social media, email marketing, WhatsApp groups, in addition to submitting the product in digital magazines, website and digital platforms of the municipal health foundation.

CONCLUSION

The findings of the study showed that most women with Metabolic Syndrome (MS) have diabetes, hypertension and cardiovascular diseases, which requires close monitoring, especially in relation to diet and physical exercise, often made difficult by late diagnosis. Most of them were over 45 years old, living in Teresina-Pi, earning less than one minimum wage, having incomplete high school education or are illiterate, married, and consider themselves brown or white. The data collected enabled the construction of the technological primer on MS, validated by expert judges.

It is hoped that the findings and the construction of the didactic and educational material will benefit the population, to understand and conduct the changes pertinent to MS, in addition to instigating the creation of public policies that meet the needs of this patient profile, including the promotion of health education and the maintenance of accessible health services. It is available in this publication, in digital format through the access link (Figure 21).

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Health promotion: A view from the school Health Program

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ABSTRACT

The World Health Organization (WHO, 2006) defines health as a state of complete physical, mental and social well-being and not just the absence of illnesses and diseases. While the Unified Health System (SUS) emphasizes that health does not simply mean the absence of disease, but is the result of living conditions, food in adequate quantity and quality, basic sanitation, decent housing, employment, income, access to education, culture, health, leisure services, and everything that can provide well-being. The objective of this study is to evaluate the School Health Program (PSE) as well as to analyze its contribution from the perspective of health promotion and quality of life of students, presenting as a guiding question the relationship between the School Health Program and health promotion. This is a theoretical research of bibliographic and documentary character, considering the ideas of several authors in studies carried out on the School Health Program (PSE) as a public policy for health promotion, also evidenced through the consultation of the references published by the Ministry of Health and Education. These structures show that there are effective contributions of the School Health Program (PSE) to the promotion of health in the educational environment, since this Program plays an important role in health promotion, through contributions that improve the quality of life of the school community. In addition to providing subsidies for the early formulation of the diagnosis of the weaknesses presented and implementing health promotion and disease prevention actions in a more effective way.

Keywords: Well-being, Public Policy, Education, School Community.

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INTRODUCTION

The World Health Organization (WHO, 2006) defines health as a state of complete physical, mental and social well-being and not just the absence of illnesses and diseases. While the Unified Health System (SUS) emphasizes that health does not simply mean the absence of disease, but is the result of living conditions, food in adequate quantity and quality, basic sanitation, decent housing, employment, income, access to education, culture, health, leisure services, and everything that can provide well-being.

Thus, the difference between prevention and health promotion can be perceived, which comes from the very conceptualization of what health is. In prevention, health is understood as the absence of diseases, while in health promotion, it is seen as a positive and multidimensional concept that results, in this way, in a participatory model of promotion, contrary to the interventional model of medicine.

The Federal Constitution of Brazil states that public health aims to promote the well-being of the citizen and is a right of all and a duty of the State, guaranteed through social and economic policies aimed at reducing the risk of disease (BRASIL, 1988). And Public Health Policies form a set of decisions, goals, planning and actions at the federal, state or municipal government level that aim to solve problems of public interest allowing better health conditions.

One of them is the School Health Program (PSE), an intersectoral policy of the Ministry of Health and the Ministry of Education, established in 2007 by presidential decree.

- The PSE is an intersectoral policy of the Ministry of Health and the Ministry of Education, established in 2007 by presidential decree.
- In 2007, the Health and Prevention in Schools Project (SPE) became part of the PSE.
- The PSE should be extended to students in all basic public education schools in the country: state and municipal: as of 2013, the following can be part of the PSE: - Kindergartens (including those that have agreements); - Preschools; - Elementary School; -Middle school; - Youth and Adult Education (BRASIL, 2007).

It is understood, therefore, that public health promotion policies result from the combination of planned educational, political, legislative or organizational actions in support of the lifestyle habits and favorable health conditions of individuals, groups or collectivities.

The PSE stands out for being an intersectoral policy of Health and Education, currently regulated by Interministerial Ordinance No. 1,055, of April 25, 2017, based on the scope of health promotion, which presents a strategy of permanent integration of Health and Education for the development of citizenship and the qualification of Brazilian public policies (BRASIL, 2017).

The central focus of this study is to highlight the links between the PSE School Health Program and health promotion, essentially based on the current concept of health in the sense of

promoting it and not just treating the disease. Thus, the choice of the theme is justified by the relevance of discussions about health promotion, taking as an example the PSE School Health Program, which also promotes comprehensive education aimed at improving social living conditions, since the school plays an important role in this scenario, given the possibility of stimulating the development of healthy habits and re-signifying the quality of life of its students. Considering this, to absorb positive results on such an important and so debated topic today.

As a guiding question, the following hypothesis was created for this research: What is the relationship between the School Health Program and health promotion? Thus, this study has objectives that are based on evaluating the School Health Program (PSE) as well as analyzing its contribution from the perspective of health promotion and quality of life of students.

This is a theoretical research of bibliographic and documentary character, considering the ideas of several authors in studies carried out on the School Health Program (PSE) as a public policy for health promotion, also evidenced through the consultation of the references published by the Ministry of Health and Education.

The analysis of the thinking of some authors about the concepts, origin and highlights of the School Health Program (PSE), especially those that address its relationship between health and education as a premise for health promotion, are demonstrated by the links established throughout the text, based on a structure divided into four parts.

Initially, a theoretical discussion was made about the origin and concepts of the School Health Program (PSE), with a study carried out in the references published by the Ministry of Health and Education on the School Health Program – PSE; Then, a survey was made about the main authors who address the PSE and health promotion, in order to know what already exists on the subject and the issues related to the contributions of health within the educational environment. At the end of the bibliographic study, inferences were drawn and due considerations were made.

Following according to the thought of Lopes et. al (2018), when it states that "public health and education policies and programs are fundamental for citizenship formation and for improving the quality of life and health of the population". And for Santos et. al (2016), "The PSE adds value to the school environment with actions to promote health and integral education".

DEVELOPMENT

ORIGIN AND CONCEPTS OF THE SCHOOL HEALTH PROGRAM (PSE)

The PSE School Health Program was created in 2007 by Presidential Decree No. 6,286, of December 5, 2007, in order to understand the need for the articulation of education and health. It is a program resulting from a partnership between the Ministries of Health and Education whose main objective is to contribute to the integral formation of students in the public basic education network

through prevention, promotion and health care actions, integrating the networks of the Education System and the Unified Health System (SUS) through the articulation of public schools. basic health units and Family Health units (BRASIL, 2007).

The PSE is characterized by being a government policy that aims to implement intersectoral policies with the objective of improving the quality of life of the population. Thus, the PSE aims to address the vulnerabilities that prevent the full development of Brazilian children, adolescents and young people with the implementation of integrated health and education actions that have already been implemented, which have had a positive impact on the quality of life of students (BRASIL, 2011).

According to Fernandes and Köptcke (2021), the main objective of the PSE is to be part of the academic training of basic education students, integrating two teachings, education and health, with the help of promotion, prevention and health care actions, thus highlighting how beneficial the program is not only for students, but for managers and professionals, enabling the increase of knowledge and improvement of humanization in the work and education environment.

The PSE is a strategy that permanently integrates health and education, thus developing citizenship and quality of life for its beneficiaries, in addition to qualifying and amplifying public health policies. Its basis of action is the articulation between the School and Primary Health Care, and its actions take place in the territories agreed between the municipal education and health managers. These territories are defined according to the area covered by the Family Health Teams, making it possible to interact between public health and education facilities (schools, health centers, etc.) (BRASIL, 2007).

The support of state and municipal managers in the areas of education and health is essential, as it is an intersectoral process that seeks to improve the health of students, reduce school dropout and intermittent attendance due to health problems, in addition to reinforcing the commitments and pacts established by both sectors. The PSE is aimed at students from public schools in the basic education network, as well as the school community (students, teachers, parents and/or guardians).

The Program is implemented based on five components: evaluation of the health conditions of children, adolescents and young people in public schools; health promotion and actions to prevent diseases and health problems; continuing education and training of education and health professionals and young people; monitoring and evaluation of students' health; monitoring and evaluation of the program (BRASIL, 2011).

Continuing, Health Promotion, quality of life and the relationship with the School Health Program are highlighted. This existing relationship reinforces the need to deepen studies on this theme.

HEALTH PROMOTION AND QUALITY OF LIFE

The Ottawa Charter is considered by some authors to be one of the founding documents of current health promotion. In it, health promotion is defined as the process of empowering the community to act to improve its quality of life and health, including greater participation in the control of this process (WHO, 1986).

The term is associated with a set of values: quality of life, health, solidarity, equity, democracy, citizenship, development, participation and partnership, among others. It also refers to a combination of strategies:

State (healthy public policies), community (reinforcement of community action), individuals (development of personal skills), health system (reorientation of the health system) and intersectoral partnerships. That is, it works with the idea of multiple responsibility, either for the problems or for the solutions proposed for them.

In fact, the concept of health promotion has been elaborated by different technical and social actors, in different contexts and social formations, over the last few years.

However, the modern concept of health promotion and its consequent practice emerged and developed most vigorously in the 1970s and 1990s in developing countries, particularly in Canada, the United States, and Western European countries.

In 1978 the First International Conference on Primary Health Care was held, organized by WHO and UNICEF held in Alma - Ata, the capital of Kazakhstan, which brought a new focus to the field of health, setting the goal of "health for all by the year 2000".

Also noteworthy are the four important International Conferences on Health Promotion, held in Ottawa (WHO, 1986), Adelaide (WHO, 1988), Sundsvall (WHO, 1991) and Jakarta (WHO, 1997), which developed the conceptual and political bases of health promotion. In 1992, the International Conference on Health Promotion (PAHO, 1992) was held, formally bringing the theme to the global context.

However, numerous international and national events, as well as conceptual publications and research results, have contributed to approximations to more precise concepts and practices for a greater and better understanding in the field of health promotion.

From the First International Conference on Primary Health Care, it was recommended the adoption of a set of eight essential elements: education aimed at prevalent health problems and methods for their prevention and control; promotion of food supply and adequate nutrition; adequate water supply and sanitation; maternal and child care, including family planning; immunization against major infectious diseases; prevention and control of endemic diseases; appropriate treatment of common illnesses and accidents; and distribution of basic medicines.

The conclusions and recommendations of Alma Ata brought an important reinforcement to

the advocates of the health promotion strategy, which culminated in the holding of the First International Conference on Health Promotion, in Ottawa, Canada, in 1986, with the publication of the Otatawa Charter (WHO, 1986).

The document points out the multiple determinants of health and 'intersectorality', stating that the concept of health as well-being transcends the idea of healthy ways of life and health promotion transcends the health sector. And it goes on to state that the conditions and requirements for health are: peace, education, housing, food, income, stable ecosystem, sustainable resources, social justice and equity (WHO, 1996)

In Brazil, also in 1986, the VIII National Health Conference was held, in the context of redemocratization, with the participation of professionals, managers and citizens in general. Proposals were presented that resulted in the so-called "Brazilian health reform", whose principles and guidelines of Health Promotion were incorporated into the Federal Constitution of 1988. And in 1992, the first program was created, later transformed into a structured policy, to be inspired and operate with health promotion precepts, in a context of expansion and qualification of primary care, called the Family Health Program (PSF).

The FHP teams work with health promotion actions, prevention, recovery, rehabilitation of the most frequent diseases and injuries, and in the maintenance of the community's health. Thus, Brazil continues its path towards health promotion, and between 1998 and 1999, the term gained some institutionality in the Ministry of Health with the formalization of the project "Health Promotion, a new model of care", in cooperation with the United Nations Development Program (UNDP), demonstrating the formal introduction of the theme in the health debate in the country. which includes the launch of the Health Promotion magazine.

In 2002, the Ministry of Health prepared a document entitled "National Health Promotion Policy". This is an important record of a formal proposal for a "health promotion policy" at the federal level. In this context, several documents were prepared in the areas of healthy eating and physical activity; traffic violence2; the "Agita Brasil" project, and the proposal for health promotion at school, among others.

However, the School Health Program (PSE) stands out among the institutional programs that are implemented based on the scope of health promotion which, in conjunction with the Family Health Strategy, was created in 2007 with the objective of integrating and articulating the two sectors, health and education, with actions aimed at improving the quality of life of students and the school community of basic education schools in Brazil.

In the third part, actions based on the pedagogical principles of the PSE related to health promotion are highlighted.

ACTIONS OF THE SCHOOL HEALTH PROGRAM RELATED TO HEALTH PROMOTION

The theme of health promotion, as formal inclusion through education in Brazil, occurred in 1996, after the approval of the new Law of Guidelines and Bases (LDB) of National Education, with the definition of the planning and arrangement of the curriculum and National Curriculum Parameters (PCNs) with issues related to health, the environment, sexual orientation, ethics, cultural plurality, work and consumption, and other important issues.

The various historical contexts of the PSE and health promotion, as well as the ways in which the various actors are inserted and compose these contexts, have been decisive in discussing this topic.

In addition, in order to achieve health promotion and advance the consolidation of the SUS, it was necessary to articulate health actions with those of education, modifying the idea that education is associated only with school, and health only with health services, overcoming isolated practices, through integrated work.

Based on this assumption, it can be seen that through the change in the conception of health, there was also a modification of the teaching-learning process, taking into account its interfaces, and the possibility of constructing a new perspective of education and health. Thus, school health programs were developed considering the different representations of conceptions about health and education, which contributed to reflect on health practices at school. Because, when the school contents are at the service of life and good living, the meaning of learning occurs and, consequently, the valorization of the affective and intellectual processes in the community.

And then the Ministry of Health (MS), through the National Health Promotion Policy (PNPS), with the objective of integrating health actions into the school curriculum, considering the questions raised by education about the effectiveness of these actions and The conceptual and methodological changes in the field of health recommend the creation of healthy spaces and environments in schools.

Articulated with this, programs and projects were developed to induce public policies, such as the School Health and School Health and Prevention Programs, in order to increase the prevalence of protective factors for school health. It is necessary to understand the intrinsic relationship between the biological, social, psychic, and economic, which influence the processes of illness and cure, and need to be included in pedagogical political projects, to strengthen the integration between health and education as a process of permanent education.

Therefore, the coordination of the PSE at the federal level is shared between the Ministry of Health and the Ministry of Education, within the scope of the Secretariat of Primary Health Care – SAPS and Secretariat of Basic Education - SEB, respectively. It is possible to cite the competencies of these ministries such as: support to state and municipal managers in the articulation, planning and implementation of PSE actions; formulate proposals for the training of health and basic education

professionals for the implementation of PSE actions; and definition of priorities and goals for the PSE (BRASIL, 2007).

Membership of the PSE must include the following actions:

I. Environmental Health;
II. Promotion of physical activity;
III. Healthy eating and obesity prevention;
IV. Promotion of a culture of peace and human rights;
V. Prevention of violence and accidents;
VI. Prevention of neglected diseases;
VII. Verification of vaccination status;
VIII. Sexual and reproductive health and HIV/STI prevention;
IX. Prevention of the use of alcohol, tobacco, and other drugs;
X. Oral health;
XI. Hearing health; and
XII. Eye health.
XIII. *Covid-19 prevention in schools

*Action included in the Program as of the publication of Ordinance No. 1,857, of July 28, 2020.

If health promotion brings, as one of its axes, to strengthen the idea of autonomy of subjects and social groups, and at the same time, progressive perspectives, emphasizing the elaboration of intersectoral public policies, aimed at improving the quality of life of populations. It is observed that the first action proposed by the PSE is environmental health, for this, it is necessary that individuals or collectivities are able to identify and fulfill aspirations, satisfy needs, transform and develop mechanisms of adaptation to the environment so that they have health, as a resource for daily life.

Notably, most of the actions developed by the PSE aim to develop personal skills to live well from the strengthening of community actions for the development of individual capacity. However, the effectiveness of health promotion is a methodological and political challenge that makes it possible to generate knowledge of programs adapted to the reality of each context, with a view to applying an appropriate methodology.

According to some authors, it is expected that the actors involved in the school community will be able to identify, control or modify the factors that condition or determine individual and collective health, as well as the change in the perception of the health situation, as results of effectiveness, after the implementation of the School Health Program.

In this context, all PSE actions aim to contribute to the strengthening of health promotion, based on the integration of the areas of health and education in the confrontation of vulnerabilities,

expanding the articulation of knowledge and experiences in the planning, implementation and evaluation of initiatives to achieve the integral development of students in the public education network. It also supports the training process of health and education professionals on a permanent and continuous basis.

In the fourth and last part, the final considerations of this study are presented and the importance of future studies focused on the theme of health promotion and quality of life of the population is emphasized.

FINAL THOUGHTS

The results corresponding to the theoretical studies show us that there are indeed effective contributions of the School Health Program (PSE) to the health promotion in the educational environment, since this Program plays an important role in health promotion, through contributions that improve the quality of life of the school community. Because when the PSE is inserted in the school setting, it is possible to formulate the early diagnosis of the weaknesses presented and to implement health promotion and disease prevention actions in a more effective way.

Therefore, when discussing from the perspective of several authors, it is perceived that programs aimed at the development of actions from the perspective of health, whether through health promotion and/or disease prevention, are an important tool with great transformative potential for society.

The PSE stands out as one of them, as it contributes to health and education, as good levels of education are related to a healthier population, just as a healthy population has greater possibilities of taking hold of knowledge from formal and informal education (CASEMIRO et al., 2014).

Social vulnerability contributes to greater learning difficulties, which is why the creation of programs such as the PSE is important, so that they can serve as a tool in coping with so many difficulties experienced by students, managers, and education professionals (ORSANNO & ZOMPERO, 2020).

It is suggested that the contributions generated to society by the study of the School Health Program should be a source for new productions elaborated by all those involved and widely disseminated, so that public health policies are increasingly well distributed and detailed, ensuring the health and well-being of the population in general. To this end, the health promotion actions to be developed must be cultivated in a continuous and diversified way, proposing interactions and changes in the school context.

Finally, the text points out an invitation to reflect on the existing potentialities for the promotion of health, quality of life and citizenship of students in the public basic education network, as well as on intersectoral work, centered on shared and co-responsible actions, which provokes

articulation for the production of new health care at school.

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Multidisciplinary approach in the investigation and treatment of chronic meningitis: A systematic review of the literature and current guidelines

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ABSTRACT

This study presents a systematic review on chronic meningitis, an inflammatory condition of the membranes surrounding the brain and spinal cord, with potential for severe neurological complications and risk of fatality if not properly treated. We employed a rigorous methodology, including a comprehensive review of the literature in reputable databases such as PubMed, Scopus, Web of Science, Cochrane Library, and Embase. Inclusion and exclusion criteria were stringent to ensure the selection of relevant and high-quality studies. The analysis of selected studies revealed several underlying causes of chronic meningitis, ranging from infections to malignant neoplasms, autoimmune disorders, chemical meningitis, and parameningeal infections. Clinical manifestations are diverse and may include persistent headache, hydrocephalus, cranial nerve damage, spinal nerve damage, and cognitive alterations. Accurate diagnosis is crucial and is based on cerebrospinal fluid

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(CSF) analysis, involving a series of laboratory and microbiological tests. The importance of a multidisciplinary approach in the management of chronic meningitis is emphasized, which should involve clinicians, neurologists, microbiologists, and pathologists. Early identification of the specific cause and implementation of appropriate treatment are fundamental to improving clinical outcomes. Empirical therapy may be necessary in cases of uncertain diagnosis, but adjustments should be made based on clinical evolution and test results. We conclude that interdisciplinary collaboration and continuous updating of clinical practice are essential for the effective management of chronic meningitis. Future research should focus on the development of faster and more accurate diagnostic techniques, as well as more effective therapeutic strategies, aiming to significantly improve the quality of life of patients affected by this debilitating condition.

Keywords: Chronic Meningitis, Multidisciplinary Approach, Diagnosis, Treatment.

INTRODUCTION

Chronic meningitis is an inflammatory condition of the meninges that involves the persistence of symptoms and clinical signs for a period of more than four weeks 11. Unlike acute meningitis, which has a sudden onset and rapid evolution, chronic meningitis presents an insidious and progressive clinical picture, which often hinders its diagnosis and clinical management [1]. This condition can be caused by a variety of etiological agents, including bacterial, viral, fungal, and parasitic infections, as well as non-infectious causes such as autoimmune diseases and neoplasms [9].

The diagnostic and therapeutic approach to chronic meningitis requires a multidisciplinary approach, involving professionals from different areas of medicine, such as neurologists, infectious disease specialists, rheumatologists, immunologists, and oncologists [8]. This complexity is due to the diversity of causative agents and the varied clinical presentations, which may include headache, persistent fever, cognitive alterations, focal neurological signs, and systemic symptoms [7]. Accurate identification of the etiologic agent is crucial to direct the appropriate treatment, which can range from the use of specific antibiotics and antifungals to the administration of immunosuppressants in cases of autoimmune etiology [9].

Although there are established clinical guidelines and consensus for the management of acute meningitis, specific recommendations for chronic meningitis are less clear and often based on case studies or case series, given the rarity and heterogeneity of the disease [1,6]. Systematic review of current literature and critical analysis of existing guidelines are essential to consolidate knowledge, identify gaps and inconsistencies, and propose more effective and integrated approaches.

This article aims to conduct a systematic review of the literature on the multidisciplinary approach in the investigation and treatment of chronic meningitis, synthesizing the available evidence and current guidelines. It seeks to provide a comprehensive overview of best clinical practices, identify areas that need further research and development, and propose recommendations that can improve the clinical outcomes of patients affected by this complex and challenging condition.

The relevance of this study lies in the potential to positively impact clinical practice by offering health professionals an up-to-date and well-founded resource for the diagnosis and management of chronic meningitis, promoting a more effective and integrated approach to patient care.

METHODOLOGY

The methodology has been carefully structured to comprehensively examine the crucial aspects of the disease. Initially, a detailed literature review was conducted covering the epidemiology, etiology, pathogenesis, clinical manifestations, differential diagnoses, and treatment strategies of chronic meningitis. To identify relevant studies, renowned scientific databases such as PubMed,

Scopus, Web of Science, Cochrane Library and Embase were used. Specific search terms used included "chronic meningitis", "multidisciplinary approach", "differential diagnosis", "treatment", "epidemiology", "etiology" and "guidelines".

To ensure the relevance and quality of the studies included in the review, strict inclusion and exclusion criteria were established. Inclusion criteria included studies that directly addressed epidemiological, etiological, pathogenic, clinical, diagnostic, and therapeutic aspects of chronic meningitis, including systematic reviews, meta-analyses, observational studies, controlled clinical trials, and clinical guidelines, as long as they were fully available and published within the last 20 years. Studies that were not fully available, did not have relevant data, or did not fit the specific objectives of this review, as well as duplicate publications, were excluded.

The selected studies were critically analyzed and synthesized to identify patterns, knowledge gaps, and controversies in the field of chronic meningitis. The analysis included an assessment of underlying molecular mechanisms, such as chronic inflammatory immune responses and genetic and environmental factors associated with the disease. The different diagnostic approaches, including laboratory tests, imaging and molecular methods, as well as the therapeutic strategies involving pharmacological, surgical and multidisciplinary support approaches, were also explored.

Ethical considerations were rigorously observed, including the review and synthesis of secondary data, with particular attention to the potential presence of publication bias and the inherent limitation of reliance on published data. A formal statistical analysis was not performed, given the predominantly literature review and critical analysis of existing studies. The manuscript underwent peer review to ensure data accuracy, clarity of presentation, and compliance with ethical and methodological standards, providing a solid framework for the comprehensive analysis of chronic meningitis and the identification of future research directions.

In addition to the electronic databases, relevant books were consulted to provide a comprehensive and in-depth view on specific topics of chronic meningitis, such as neurobiology, pharmacology, and clinical manifestations. The books used were selected based on their relevance and authority in the field of medicine and neuroscience, ensuring a solid foundation of knowledge for the review. This meticulous and comprehensive methodology aims to provide a detailed and integrated analysis of multidisciplinary approaches in the investigation and treatment of chronic meningitis, identifying current practices and highlighting areas in need of further research and development.

LITERATURE REVIEW

Chronic inflammation of the meninges, which include the pia mater, arachnoid, and dura mater, can cause profound neurological disability and, if not properly treated, can be fatal [4]. Chronic

meningitis is diagnosed when a typical neurological syndrome persists for more than four weeks, accompanied by an ongoing inflammatory response in the cerebrospinal fluid (CSL), evidenced by a leukocyte count greater than 5/μL [3]. The causes of chronic meningitis are varied, and effective treatment depends on the accurate identification of the underlying etiology [4].

There are five main categories of diseases responsible for most cases of chronic meningitis. The first category includes infections of the meninges, which can be caused by bacteria, viruses, fungi, or parasites [9]. The second category is malignant neoplasm, where malignant tumors can invade or compress the meninges, leading to inflammation [11]. Autoimmune inflammatory disorders constitute the third category, with diseases such as systemic lupus erythematosus and sarcoidosis causing inflammation of the meninges [4]. The fourth category is chemical meningitis, which can occur due to the introduction of irritants into the subarachnoid space [4]. Finally, the fifth category encompasses parameningeal infections, where infections located in areas adjacent to the meninges, such as in nearby bones or soft tissues, can spread and cause meningeal inflammation [4].

PHYSIOPATHOLOGY

The neurological manifestations of chronic meningitis are determined by the anatomical location of the inflammation and its consequences. The main manifestations include persistent headache, hydrocephalus, cranial neuropathies, radiculopathies, and cognitive or personality changes, which may occur alone or in combination [12]. The combination of these symptoms indicates a wide spread of the inflammatory process along the cerebrospinal fluid (CSL) pathways [7]. In some cases, the presence of an underlying systemic disease suggests a specific agent or class of agents as the probable cause [9].

The diagnosis of chronic meningitis is usually established when the clinical picture leads the physician to examine the CSL for signs of inflammation [1]. The LCS is produced by the choroid plexus of the cerebral ventricles and crosses narrow foramina into the subarachnoid space, which surrounds the brain and spinal cord [4]. It circulates around the base of the brain and over the cerebral hemispheres, being reabsorbed by arachnoid villi that protrude into the superior sagittal sinus [4]. This flow is a route for the rapid spread of infections and other infiltrative processes to the brain, spinal cord, and cranial and spinal nerve roots [5]. Inflammation can spread from the subarachnoid space to the brain parenchyma through the arachnoid sheaths that surround the blood vessels that penetrate the brain tissue (Virchow-Robin spaces) [4, 5].

Specific clinical manifestations of chronic meningitis include a variety of signs and symptoms, such as chronic headache, neck or back pain and stiffness, personality changes, altered mental status, facial weakness, double vision, hearing loss, limb weakness and numbness, and urinary retention or incontinence [4, 7]. These symptoms reflect the extent and location of meningeal

inflammation [7]. For example, the stimulation of the nociceptive nerve fibers of the meninges by the inflammatory process results in headache and cervical or lumbar pain [7]. Obstruction of the CSL pathways can cause hydrocephalus and signs of elevated intracranial pressure, such as headache, vomiting, apathy, drowsiness, gait instability, papilledema, visual loss, and cranial nerve palsy VI [4].

Cognitive and behavioral changes may result from vascular damage due to inflammation around blood vessels in the subarachnoid space, causing infarctions [3]. Inflammatory deposits, often prominent around the brainstem and cranial nerves, as well as along the lower surface of the frontal and temporal lobes, characterize basal meningitis [4]. This is often manifested by multiple cranial neuropathies, with decreased vision, facial weakness, hearing loss, diplopia, and sensory or motor abnormalities in the oropharynx, as well as decreased sense of smell and facial sensation [4,7].

Spinal meningitis may involve lesions of the motor and sensory nerve roots when they cross the subarachnoid space and penetrate the meninges, manifesting as various radiculopathies, with combinations of radicular pain, sensory loss, motor weakness, and urinary or fecal incontinence [5]. Chronic inflammation can cause thickening of the meninges and pinching of the nerve roots, a condition known as pachymeningitis, which can reach and damage the spinal cord, resulting in myelopathy [3]. Patients with slowly progressive involvement of various cranial and/or spinal nerve roots are likely to have chronic meningitis [12]. Electrophysiological tests may be useful to determine the involvement of these nerve roots [4].

In some patients, the presence of evidence of systemic disease may provide clues about the underlying cause of chronic meningitis [12]. A thorough history of travel, sexual practices, and exposure to infectious agents is critical [12]. Infectious causes are often associated with fever, malaise, anorexia, and signs of localized or disseminated infection outside the nervous system [7]. This is particularly relevant in immunosuppressed patients, such as those with HIV infection, in whom chronic meningitis may present without headache or fever [4]. Non-infectious inflammatory disorders may produce systemic manifestations before manifesting as meningitis [3]. Carcinomatous meningitis may or may not be accompanied by clinical evidence of primary neoplasia [5].

APPROACH TO THE PATIENT WITH CHRONIC MENINGITIS

The presence of chronic headache, hydrocephalus, cranial neuropathy, radiculopathy, and/or cognitive decline in a patient suggests the need for lumbar puncture (LP) to look for evidence of meningeal inflammation [2,4]. Sometimes, the diagnosis is made when a contrast-enhanced examination (computed tomography (CT) or magnetic resonance imaging (MRI) shows extravasation of the contrast agent into the meninges [5]. Meningeal enhancement is always worrisome, except in cases of dural reinforcement after LP, neurosurgical procedures, concussion, or spontaneous cerebrospinal fluid (CSL) leakage [4]. Once chronic meningitis is confirmed by examination of the CSL, efforts should

be directed to identify the cause, which may involve further analysis of the CSL, diagnosis of underlying systemic infection or non-infectious inflammatory disorder, or histopathological examination of biopsy specimens of the meninges [4].

There are two clinical forms of chronic meningitis: one with chronic and persistent symptoms and the other with distinct and recurrent episodes of the disease [12]. In cases of recurrent episodes, all symptoms, signs, and parameters of meningeal inflammation of the CSL resolve completely between episodes, either spontaneously or in response to specific treatment [12]. Possible causes include Mollaret's meningitis, often caused by herpes simplex virus (HSV) type 2 infection; chemical meningitis, due to episodic extravasation of epidermoid tumor, craniopharyngioma, or cholesteatoma contents into the CSL; and primary autoimmune inflammatory conditions, such as Vogt-Koyanagi-Harada syndrome, Behçet's syndrome, systemic lupus erythematosus (SLE), rheumatoid arthritis, IgG4-related disease, and hypersensitivity to drugs with repeated administration of the offending agent [4, 5].

Epidemiological history is crucial in the diagnosis of chronic meningitis and can guide the selection of laboratory tests [1]. Relevant aspects include history of tuberculosis or exposure; recent epidural injection that may lead to epidemics of fungal meningitis caused by Exserohilum rostratum; travel to areas endemic for fungal infections, such as California's San Joaquin Valley and southwestern U.S. states for coccidioidomycosis, Midwestern states for histoplasmosis, and southeastern states for blastomycosis; travel to the Mediterranean region or ingestion of imported unpasteurized dairy products (Brucella); time spent in endemic areas for Lyme disease; exposure to sexually transmitted infections (syphilis); exposure of an immunocompromised host to pigeons and their excreta (Cryptococcus neoformans var. gatti); gardening (Sporothrix schenkii); ingestion of undercooked meat or contact with domestic cats (Toxoplasma gondii); residence in Thailand or Japan (Gnathostoma spinigerum), Latin America (Paracoccidioides brasiliensis) or the South Pacific (Angiostrongylus cantonensis); residence in rural areas with exposure to raccoons (Baylisascaris procyonis); and residence in Latin America, the Philippines, Sub-Saharan Africa, or Southeast Asia (Taenia solium/cysticercosis) [1, 3, 4, 5, 7].

The presence of focal brain signs in patients with chronic meningitis suggests the possibility of brain abscess, parameningeal infection, neoplasia, or vasculitis [5]. Identification of the causative agent requires a detailed analysis of the CSL and other investigations, such as culture and Gram staining, polymerase chain reaction (PCR) tests, and detection of specific antibodies, as well as imaging tests such as CT and MRI to assess the extent of meningeal inflammation and identify possible foci of infection or neoplasms [4].

IMAGING AND CEREBROSPINAL FLUID ANALYSIS

For patients with suspected chronic meningitis, imaging is essential, especially if elevated intracranial pressure (ICP) is suspected [1, 4]. Before proceeding with lumbar puncture (LP), it is crucial to perform neuroimaging to rule out the presence of expansive lesions, cerebral edema, or blockage in ventricular cerebrospinal fluid (CSL) flow, which may increase the risk of brain herniation [4]. Magnetic resonance imaging (MRI) and computed tomography (CT) are indispensable tools in these cases [3]. They can identify meningeal uptake, parameningeal infections such as brain abscesses, spinal cord entrapment due to neoplasms, inflammations or infections, and nodular deposits in the meninges or nerve roots, which may indicate malignant neoplasms or sarcoidosis [4].

In addition, angiography can be used to detect signs of cerebral arteritis in patients with chronic meningitis who have a stroke [7]. In cases of obstructive hydrocephalus, direct ventricular drainage may be necessary [7]. Patients with open cerebrospinal flow pathways and elevated ICP due to deficiency in CSF absorption by the arachnoid villi can usually undergo LP safely, and it may even be therapeutic [3,11]. However, repetitive or continuous lumbar drainage may be required to avoid sudden deterioration and death from elevated ICP [3]. In some cases, such as cryptococcal meningitis, elevated levels of life-threatening ICP can occur without enlargement of the ventricles [4].

Cerebrospinal fluid (CSL) analysis is critical for the diagnosis of chronic meningitis [1, 2]. LCS pressure should be measured initially, and specimens should be sent to the laboratory for a series of tests, including bacterial, fungal, and tuberculosis culture, VDRL testing, total and differential cell counts, Gram staining, and measurement of glucose and protein levels [1, 2]. Fresh preparations for fungi and parasites, preparation with India ink, cultures for bacteria and fastidious fungi, cryptococcal antigen testing, immunoglobulin oligoclonal bands, and cytology should be performed [2, 3]. Other LCS-specific tests or blood cultures and cultures may be ordered based on clinical history, physical examination, or preliminary LCS [3 results].

Serological testing and polymerase chain reaction (PCR) to identify DNA sequences specific to the suspected pathogen can speed up diagnosis. PCR for ribosomal RNA (rRNA)16s is useful for detecting a wide range of bacterial causes of meningitis, especially in partially treated [meningitis6,8,9]. The 18s and 28s rRNAs can aid in the detection of fungal species9. In suspected fungal infections, the determination of β-glycans can be a valuable complementary test [9]. With technological advancements, next-generation metagenomic unbiased sequencing is becoming widely available, representing an efficient method for diagnosing difficult cases [4].

In most cases of chronic meningitis, mononuclear cells predominate in the LCS [11]. When neutrophils prevail after three weeks of illness, etiologies such as Nocardia asteroides, Actinomyces israelii, Brucella, Mycobacterium tuberculosis (in 5 to 10% of initial cases), various fungi (such as Blastomyces dermatitidis, Candida albicans, Histoplasma capsulatum, Aspergillus spp.,

Pseudallescheria boydii, Cladophialophora bantiana) and non-infectious causes such as systemic lupus erythematosus (SLE) and exogenous chemical meningitis should be considered [4, 5, 9]. The presence of eosinophils or their predominance in a mononuclear cellular response may indicate parasitosis, mycoses, neoplastic diseases, or other inflammatory processes [4].

It is often necessary to increase the number of complementary tests when the initial investigation does not reveal the etiology [1]. Repeated samples of large volumes of lumbar CSL may be necessary to establish the diagnosis of certain infectious and malignant causes of chronic meningitis [3]. Lymphomatous or carcinomatous meningitis can be diagnosed by examining sections of a cell block formed by centrifugation of the sediment of a large volume of CSL [10]. Flow cytometry for malignant cells may also be useful in suspected cases of carcinomatous meningitis [4]. Diagnoses of fungal meningitis may require large volumes of LCS for sediment culture9. When conventional lumbar puncture is unproductive, cervical cistern puncture may be useful to obtain CSF close to the basilar meninges, and ventricular fluid may appear sterile in cases of active infection in the lower lumbar space [4].

LABORATORY INVESTIGATION AND DIAGNOSTIC APPROACH TO CHRONIC MENINGITIS

In the investigation of chronic meningitis, in addition to the examination of the cerebrospinal fluid (CSL), it is crucial to identify underlying diseases. Tuberculin skin tests, chest X-ray, urine examination and culture, complete blood count and differential count, renal and hepatic function tests, alkaline phosphatase, erythrocyte sedimentation rate, antinuclear factors, anti-Ro and anti-La antibodies, rheumatoid factor, and IgG4 level are frequently indicated [1, 4]. In some cases, it is necessary to investigate thoroughly in search of a systemic focus of infection, especially in cases of fungal disease or tuberculosis [11,12]. Computed tomography (CT) or magnetic resonance imaging (MRI) scans of the chest, in addition to sputum scans, may be useful [4]. Abnormalities can be detected by bronchoscopy or transthoracic needle biopsy [4]. Although tuberculin skin testing has limited specificity and sensitivity, γ-interferon release tests can be used to diagnose latent tuberculosis [4]. Liver, bone marrow, or lymph node biopsy can be diagnostic in cases of miliary tuberculosis, disseminated mycosis, sarcoidosis, or metastatic malignancy [3]. Positron emission tomography with 18F-fluorodeoxyglucose may be valuable to identify systemic sites for biopsy in patients with suspected carcinomatous meningitis or sarcoidosis, when other tests do not provide information [5]. Genetic testing can identify mutations responsible for rare monogenic autoinflammatory disorders [5].

If CSL analysis is not diagnostic, meningeal biopsy should be considered in patients with severe disability, need for chronic ventricular decompression, or progressive disease [1, 4]. Coordination between surgeon, pathologist, microbiologist, and cytologist is essential to obtain an adequate sample

and perform appropriate cultures, as well as histological and molecular studies, including electron microscopy and PCR [7, 8]. The positivity rate of meningeal biopsy is higher when contrast-enhanced regions are selected on MRI or CT [5]. With current microsurgical techniques, it is possible to access most areas of the basal meninges for biopsy by means of limited craniotomy [5]. In a series of cases, MRI demonstrated meningeal enhancement in 47% of patients undergoing meningeal biopsy; Biopsy of a contrast-capturing region was diagnostic in 80% of cases, while biopsy of non-uptake regions was diagnostic in only 9% [1,4]. The most common diseases identified were sarcoidosis (31%) and metastatic adenocarcinoma (25%) [4].

In about 33% of cases, the diagnosis remains unknown, despite careful evaluation of the CSL and possible extraneural sites of disease [4,12]. Several microorganisms that cause chronic meningitis can take weeks to be identified in cultures [9]. In enigmatic cases, the options are determined by the extent of the clinical deficits and the rate of progression [4]. It is prudent to wait for the results of cultures if the patient is asymptomatic or if symptoms are mild and not progressive [1]. However, in many cases, progressive neurological deterioration occurs, requiring rapid treatment [5]. Ventriculoperitoneal shunts can relieve hydrocephalus, but the risk of propagating an undiagnosed inflammatory process to the abdomen should be considered [4].

Establishing the diagnosis of the etiologic agent is essential, as there are effective treatments for many causes of chronic meningitis [1,2]. If the disorder is left untreated, progressive damage to the central nervous system (CNS) and cranial nerves and roots is likely to occur [5]. On certain occasions, empirical therapy should be instituted when all attempts at diagnosis have failed [10]. Generally, empiric therapy in the United States consists of antimycobacterials, amphotericin for fungal infection, and/or glucocorticoids for non-infectious inflammatory causes [4]. It is important to direct the empirical treatment of lymphocytic meningitis to tuberculosis, especially when associated with low glucose levels in the CSL, as the untreated disease can be devastating in a few weeks [5]. Long-term therapy with tumor necrosis factor inhibitors and programmed anti-cell death 1 (PD-1) may reactivate tuberculosis; These patients who develop chronic meningitis should be treated empirically with antituberculosis therapy if the etiology is uncertain [10,12]. In the Mayo Clinic series, the most effective empirical treatment was the administration of glucocorticoids instead of antituberculosis therapy [4]. When using glucocorticoids empirically, caution should be exercised with transient responses to treatment, as some infectious etiologies (such as tuberculosis and cysticercosis) and non-infectious etiologies (such as lymphoma) may respond temporarily to glucocorticoid monotherapy [4]. Carcinomatous or lymphomatous meningitis can be difficult to diagnose initially, but becomes evident over time [1, 12].

Chronic meningitis is not uncommon in the course of HIV infection [12]. Pleocytosis and mild meningeal signs are frequent at the beginning of HIV infection, with occasional persistence of low-

grade meningitis [12]. Toxoplasmosis usually manifests as intracranial abscesses, but can also be associated with meningitis [9]. Other causes of chronic meningitis in AIDS include infection with Cryptococcus, Nocardia, Candida or other fungi, syphilis, and lymphoma [3]. Toxoplasmosis, cryptococcosis, nocardiosis, and other fungal infections are important etiological factors to be considered in individuals with immunodeficiency states unrelated to AIDS, even those caused by immunosuppressive agents [3,4]. Due to the increased risk of chronic meningitis and the attenuation of clinical signs of meningeal irritation in immunosuppressed individuals, it is necessary to examine the LCS in the presence of any persistent headache or unexplained change in mental status [4].

RESULTS AND DISCUSSION

A systematic review of the literature on chronic meningitis revealed a wide range of etiologies, clinical manifestations, diagnostic approaches, and therapeutic strategies. The main causes of chronic meningitis include infections, malignancies, autoimmune disorders, chemical meningitis, and parameningeal infections [1, 4]. Chronic meningeal infections can be caused by a variety of pathogens, including bacteria such as Mycobacterium tuberculosis, fungi such as Cryptococcus neoformans, viruses such as herpesvirus, and parasites such as Toxoplasma gondii [9]. Malignant tumors, including carcinomas and lymphomas, can invade the meninges, causing chronic inflammation [11]. Autoimmune diseases such as systemic lupus erythematosus (SLE) and sarcoidosis often present chronic meningitis as one of the manifestations [4,5]. The introduction of irritants into the subarachnoid space can result in persistent meningeal inflammation, while infections located in areas adjacent to the meninges, such as in the bones or nearby soft tissues, can spread and cause meningeal inflammation [2, 4, 12].

The clinical manifestations of chronic meningitis are varied and depend on the anatomical location of the inflammation and its consequences [4,7]. The main symptoms include persistent headache, hydrocephalus, cranial neuropathies, radiculopathies, and cognitive or personality changes [7,12]. These symptoms reflect the extent and location of meningeal inflammation [7]. The stimulation of the nociceptive nerve fibers of the meninges by the inflammatory process results in headache and cervical or lumbar pain [7]. Obstruction of the cerebrospinal fluid (CSL) pathways can cause hydrocephalus and signs of elevated intracranial pressure, such as headache, vomiting, apathy, drowsiness, gait instability, papilledema, visual loss, and cranial nerve palsy [4,12]. Cognitive and behavioral changes may result from vascular damage due to inflammation around blood vessels in the subarachnoid space, causing infarctions [3]. Basal meningitis, characterized by prominent inflammatory deposits around the brainstem and cranial nerves, is often manifested by multiple cranial neuropathies [4].

For the diagnosis of chronic meningitis, analysis of LCS 4 is essential. LCS pressure should be measured initially, and specimens should be sent to the laboratory for a series of tests, including bacterial, fungal, and tuberculosis culture, VDRL testing, total and differential cell count, Gram staining, and measurement of glucose and protein [levels 4]. Fresh preparations for fungi and parasites, preparation with India ink, cultures for bacteria and fastidious fungi, cryptococcal antigen testing, immunoglobulin oligoclonal bands, and cytology should be performed [4]. Serological testing and polymerase chain reaction (PCR) to identify DNA sequences specific to the suspected pathogen can speed up diagnosis [6, 8]. PCR for ribosomal RNA (rRNA)16s is useful for detecting a wide range of bacterial causes of meningitis, especially in partially treated [meningitis6,8,9]. The 18s and 28s rRNAs can aid in the detection of fungal species9. In suspected fungal infections, the determination of β-glycans can be a valuable complementary test [9].

In cases where the initial analysis of the CSL does not reveal the etiology, it may be necessary to increase the number of complementary tests [1]. Repeated samples of large volumes of lumbar CSL may be necessary to establish the diagnosis of certain infectious and malignant causes of chronic meningitis 4. Lymphomatous or carcinomatous meningitis can be diagnosed by examining sections of a cell block formed by centrifugation of the sediment of a large volume of LCS [10,12]. Flow cytometry for malignant cells may also be useful in suspected cases of carcinomatous meningitis [4]. Diagnoses of fungal meningitis may require large volumes of LCS for sediment [culture4,9]. When conventional lumbar puncture is unproductive, cervical cistern puncture may be useful to obtain CSF close to the basilar meninges [4].

Establishing the diagnosis of the etiologic agent is essential, as there are effective treatments for many causes of chronic meningitis [9]. If the disorder is left untreated, progressive damage to the central nervous system (CNS) and cranial nerves and roots is likely to occur [5]. In some situations, it may be necessary to institute empirical therapy when all attempts at diagnosis have failed [4, 8]. Generally, empiric therapy in the United States consists of antimycobacterials, amphotericin for fungal infection, and/or glucocorticoids for non-infectious inflammatory causes [4]. It is important to direct the empirical treatment of lymphocytic meningitis to tuberculosis, especially when associated with low glucose levels in the CSL, as the untreated disease can be devastating in a few weeks [5]. Long-term therapy with tumor necrosis factor inhibitors and programmed anti-cell death 1 (PD-1) may reactivate tuberculosis; These patients who develop chronic meningitis should be treated empirically with antituberculosis therapy if the etiology is uncertain [10,12]. Response to treatment should be closely monitored, and adjustments should be made as needed, based on clinical progress and test results.

The results of this review highlight the complexity of diagnosing and treating chronic meningitis. The multidisciplinary approach, involving clinicians, neurologists, microbiologists and

pathologists, is essential for the accurate identification of the etiology and the implementation of an effective treatment. Early identification and appropriate treatment can prevent serious complications and significantly improve the prognosis of patients with chronic meningitis.

CONCLUSION

The present systematic review of chronic meningitis offers a comprehensive understanding of the various etiologies, clinical manifestations, diagnostic approaches, and therapeutic strategies associated with this complex condition. We evidence that chronic meningitis can result from a variety of infectious agents, malignant neoplasms, autoimmune disorders, chemical reactions, and parameningeal infections. Each of these etiologies presents specific diagnostic and therapeutic challenges, requiring a careful and detailed approach.

Cerebrospinal fluid (CSL) analysis remains the cornerstone of diagnosis, with complementary methods such as polymerase chain reaction (PCR) and flow cytometry playing crucial roles in identifying difficult-to-detect pathogens and malignant cells. The variability in clinical manifestations, ranging from persistent headache to cognitive changes and cranial neuropathies, underlines the importance of a comprehensive and multidisciplinary clinical evaluation.

The findings reinforce the need for an empirical approach, especially in cases where an accurate etiological diagnosis is not quickly achieved. Empirical therapy, adjusted to the most likely clinical suspicions, can prevent disease progression and minimize irreversible damage to the central nervous system.

We conclude that early identification and appropriate treatment of chronic meningitis are essential to improve clinical outcomes. Interdisciplinary collaboration is critical to the successful management of this condition, highlighting the importance of continuous updates in clinical practice based on emerging evidence. Future research should focus on the development of faster and more accurate diagnostic techniques, as well as therapeutic strategies that can be implemented more effectively and with less associated morbidity. Advancement in these areas will have a significant impact on improving the quality of life of patients affected by chronic meningitis.

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The nurse in the university outpatient context of chemotherapy: A practice approach

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ABSTRACT

Introduction: Nursing plays a vital role in the care of cancer patients, offering comprehensive support from diagnosis to treatment and rehabilitation. Understanding how the nurse works in the chemotherapy outpatient clinic helps to identify areas where treatment can be improved. Objective: To disseminate the experience of good practices, the promotion of humanization in care, the continuous training of professionals, the encouragement of research and innovation, and the strengthening of the professional support network. Methodology: This is a descriptive study of the experience report type of nurses in the university oncology outpatient clinic. Development: The chemotherapy outpatient clinic is located in a university hospital. The nursing team is composed of nurses, nursing technicians and nursing assistants. The activities performed by the nursing team in the chemotherapy room are: reception of patients, preparation of premedications, referral of medical prescriptions to the pharmacy, checking of medications after manipulation by the pharmacist, puncture of peripheral venous accesses and/or activation of central venous accesses, and monitoring of patients. In addition, nurses perform the role of team leadership and perform routine bureaucratic activities inherent to their position. In summary, the work of nurses in the chemotherapy outpatient clinic is characterized by a set of complex and interdisciplinary practices, which aim at excellence in cancer care, as well as the dissemination of knowledge among university students who carry out their undergraduate and graduate internships there. Final considerations: The practice of working in the chemotherapy outpatient clinic highlights the importance of the role of nursing in the comprehensive care of cancer patients. The dedication, technical knowledge and sensitivity of nurses are essential to provide quality care. Through welcoming, education, follow-up and rehabilitation, the nursing team contributes significantly to the well-being of patients.

Keywords: Nursing Team, Chemotherapy, Oncology.

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INTRODUCTION

Nursing plays a vital role in the care of cancer patients, offering comprehensive support from diagnosis to treatment and rehabilitation (IPC, 2024). The high incidence of cancer in developed and developing countries and the use of chemotherapy and biological therapy have an impact and, therefore, concern about the quality of life of these people (COELHO *et. al*, 2017).

Adverse events such as nausea and vomiting, diarrhea, fatigue, hair loss, insomnia, among others, are common in intravenous chemotherapy treatments (VIANA, 2023). These are associated with fears and stigmas, and with the concept of proximity and finitude of life and are directly associated with pain and suffering, resulting in changes in the lives of patients who are often unaware of the benefits and purposes of treatment and how they can influence their biopsychosocial context (MORTOLA, 2021).

The practice of care can be influenced by the emotions, attitudes, values and beliefs of cancer patients and their families, so nurses should use theoretical, practical and scientific knowledge to offer the best possible support. The main function of nursing is to care for and educate patients and their families, a challenging but essential task to support and guide the progression, treatment, and recovery of the disease, impacting patients' quality of life (CARMO, *et al*., 2019).

Luz et al. (2016) emphasize the importance of the nursing team in cancer care, as nurses are in constant contact with patients and their families, facing situations of suffering, hardship, and death.

Thus, this article reports the experience of nurses in the chemotherapy outpatient clinic, highlighting the challenges and strategies adopted to ensure humanized and effective care.

Understanding how the nurse works in the chemotherapy outpatient clinic helps to identify areas where treatment can be improved to minimize side effects and maximize therapeutic benefits. This study will contribute to nursing, reflecting on the improvement of care and the degree of satisfaction of the professional.

OBJECTIVE

The objective of this experience report includes the dissemination of good practices, the promotion of humanization in care, the continuous training of professionals, the encouragement of research and innovation, and the strengthening of the professional support network. By sharing these experiences, nurses contribute significantly to the advancement of nursing practice and to the improvement of care provided to patients with breast cancer.

METHODOLOGY

This is a descriptive research of the nurses' experience report type, whose purpose was to describe the performance of nurses in the university chemotherapy outpatient clinic with a focus on the quality of care provided to the user.

This type of article describes the experience of nursing and can contribute in a relevant way to this area of activity, with the purpose of socializing an experience, raising debate and enabling reflections on important stages of the care process.

DEVELOPMENT

The chemotherapy outpatient clinic is located in a university hospital, offering multidisciplinary care focused on the treatment and follow-up of patients with breast cancer. The nursing team consists of nurses specialized in oncology, nursing technicians, and nursing assistants, who work in collaboration with physicians, psychologists, nutritionists, and social workers.

On the first contact with the outpatient clinic, patients are received by the nurse in the chemotherapy room after a specialized medical consultation. At this time, they receive a diagnosis of their disease and are told about the type of treatment needed, which may include antineoplastic chemotherapy, radiation therapy, targeted or biologic therapy, hormone therapy, or surgery. These treatments can also be combined. If chemotherapy treatment has been determined, the patient is referred to the infusion room.

In the infusion room, the nurse receives the patient with cordiality, guiding him about bureaucratic issues and elucidating the flow of care. In addition, the nurse is responsible for scheduling the infusion date. There is also the possibility of infusion on demand, allowing the treatment to start immediately, on the same day of the first visit.

It is observed that patients often arrive apprehensive and with insufficient information. Thus, it is essential for nurses to clarify the flow of care and the possible side effects of medications, which vary according to the type of chemotherapy. Thus, it is essential to provide individualized care in order to provide specific guidance.

Due to the high daily demand of patients, welcoming all users is a constant challenge. In general, patients who are starting antineoplastic therapy have numerous doubts about nutrition, their rights, and the diagnosis itself.

The professional practice of nurses in the chemotherapy infusion room demands rigorous attention and in-depth knowledge. Each patient's chemotherapy prescription is sent to the pharmacy, where, after manipulation, the medication, accompanied by the medical prescription, is returned to the nurse in the infusion room. This professional carries out a meticulous check to ensure that the

medication and dosage are correct. After this conference, the medication is administered to the patients.

The activities performed by the nursing team in the chemotherapy room are: welcoming patients, preparing premedications, forwarding the medical prescription to the pharmacy, checking medications after manipulation by the pharmacist, puncture of peripheral venous accesses and/or activation of central venous accesses, such as PICC and Port-a-Cath, and monitoring of patients. In addition, nurses perform the role of team leadership and perform routine bureaucratic activities inherent to their position.

During the period in which the patient remains in the room, the nurse maintains constant vigilance, closely monitoring the conditions of the peripheral access and assessing the patient's tolerance medication. In case of any adverse event, the nurse intervenes promptly and calls the doctor as needed.

Another aspect of paramount importance in the work of nurses in the chemotherapy outpatient clinic is health education. This professional provides detailed guidance to patients and their families on the necessary care at home, the side effects resulting from chemotherapy, and preventive and symptom control measures. Such educational support is essential for effective continuity of treatment and for the promotion of patient autonomy.

In summary, the work of nurses in the chemotherapy outpatient clinic is characterized by a set of complex and interdisciplinary practices, which aim at excellence in cancer care, as well as the dissemination of knowledge among university students who carry out their undergraduate and graduate internships there.

FINAL THOUGHTS

The work of nurses in the chemotherapy outpatient clinic presents several challenges, including the need to deal with difficult diagnoses, manage the adverse effects of treatments, and provide constant emotional support. However, the experience has been extremely enriching for the nurses, with regard to the development of technical and interpersonal skills, learning to work as a team and making them able to deal with complex emotional situations.

The practice of working in the university chemotherapy outpatient clinic highlights the importance of the role of nursing in the comprehensive care of cancer patients. The dedication, technical knowledge and sensitivity of nurses are essential to provide quality, humanized and effective care. Through welcoming, education, follow-up and rehabilitation, the nursing team contributes significantly to the patients' journey of healing and well-being.

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SEVEN publicações acadêmicas

CHAPTER 28

Managerial actions in health care companies

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ABSTRACT

Objective: to analyze the organizations of health care companies regarding their marketing management actions, in the management of use for adequate customer service, in the maintenance of their reputation in the market and an analysis methodology for the creation of projects for process improvement, in this case Six Sigma. Methodology: literature review, which aims at a bibliographic survey of critically defined themes. Results: it is vitally important for the maintenance and growth of a healthcare company to have tools for competent management, always aiming at the most important thing for the customer. Conclusion: with increasing competition and the dispute for profit, health care companies that do not have a management plan aimed at improvements may lose customers and market space.

Keywords: Utilization management, Health marketing, Six sigma, Customer, Business reputation.

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INTRODUCTION

Complexity and increased competition in healthcare companies drive the use of tools to manage important aspects. We have a very wide range of strategies, but we will cover usage management, healthcare marketing, corporate reputation, and the Six Sigma management system.

The management of use creates protocolized conducts for the care process, elaborating a specific guide for each situation and thus reducing costs, avoiding unnecessary and inappropriate procedures.

Healthcare marketing, with its strategies, positions the company in the market to be seen by its customers and possible new customers, looking for creative ways to make this connection.

The maintenance and preservation of business reputation is a set of impressions that defines the status of the organization in the eyes of the public with which it deals. It is vitally important, as it defines how much customers, suppliers, investors, that is, everyone involved with the company wants to be close to it.

A program with Six Sigma structures customer-facing projects based on statistics collected in a specific way. This translates into benefits for the customer and the company, such as better service, welcoming the customer and reducing company expenses.

Adding these tools and applied correctly, the health care company tends to maintain itself and with possibilities for growth in a safe and continuous way, but always focusing on the customer.

Seeking the importance of each management tool, analyzing its aspects and contributions to health care companies, using the literature review as an analysis, which will allow to discuss these topics in a critical and judicious way.

DEVELOPMENT

USAGE MANAGEMENT

A patient needs a medical procedure only performed in a hospital. Then the patient communicates to his health plan about the procedure and the necessary hospital procedures. The health plan contacts the hospital and asks about the procedure and if it is in accordance with the pre-existing protocol for this procedure it is approved, if there are discrepancies it can be denied. This path, in the view of insurance companies, avoids unnecessary expenses with inappropriate procedures and ensures reimbursement to the hospital. This procedure is a part of utilization management, used by healthcare companies.

Labeling Usage Management with a single, universally accepted definition is tricky, as there can be multiple interpretations. So we can consider it as a set of techniques used by or on behalf of purchasers of health care benefits to manage health care costs, influencing decision-making about

patient care through case-by-case assessments of suitability for care prior to care (IOM – Institute of Medicine).

Utilization Management is underpinned by evidence-based guidelines, assessing the adequacy of health care needs and care, the quality of facilities over the provisions of the health insurance company.

These guidelines reflect evidence-based care, although there may be differences between best practice and acceptable quality and cost-effectiveness with payer guidelines, emphasizing cost-effectiveness.

Similar to Donabedian's quality assurance model provides a framework for examining health services and assessing the quality of care, Utilization Management uses the following steps of evaluation: prospective review, concurrent review, and retrospective review.

A prospective review evaluates the need for health services before their use, reducing unnecessary admissions or procedures, denying cases that do not meet the criteria.

Simultaneous review is the review of services during hospitalization. Its focus is on reducing denial of services and placing the patient in appropriate medical care and appropriateness of intervention, discharge planning, and transition to the next level of care.

Retrospective review is the process of evaluating the adequacy of procedures, configurations, and deadlines after the provision of services, assessing whether the care applied is in accordance with the criteria. It is related to the payment or reimbursement according to a medical plan, if the criteria are correct, the payment occurs, if not, there are questions and even the denial of reimbursement.

By using all three types of reviews, healthcare companies ensure that all care provided is appropriate, avoiding unnecessary procedures and expenses.

However, there are many criticisms of Utilization Management that lead to a broad discussion on the subject. The medical profession reports that it has lost its clinical autonomy, as they must follow the criteria established by the insurance companies and the large administrative burden. Insurance companies defend the Utilization Festoon, as it reduces the service of unnecessary or inappropriate procedures, even though it is not a gold standard of management.

SIX SIGMA

The increasing complexity of the organization of the health system and the increase in longevity can have impacts on medical expenses and reduce the quality of health services provided, so improvement in business strategies becomes vital.

Health care institutions have been looking for management methods and tools to ensure their sustainability, the quality of the services provided, demonstrating a professionalization of management in the area of suade (Zimmermann, 2020). Among these tools we have Six Sigma.

The Six Sigma program constantly uses statistical tools to verify performance, feasibility of processes and knowledge and understanding of customer needs, promoting a strategic positioning in statistical responses generating improvement projects.

The Six Sigma model is structured from the patient's perspective, on the value of the service and the elimination of waste. This results in a tool for improving performance, with better operational results, cost reduction, where values are defined by patients, such as safety, satisfaction, targeted care without wasting time.

Six Sigma instruments raise the level of management excellence, reduce variability and defects, for this the DMAIC method (Define – Measure – Analyze – Deploy – Control), (Nortegubisian, 2018) is implemented, along with qualified statistical indications, based on data with a focus on improving performance.

Define project objectives and translate customer needs by identifying performance indicators that are related to project objectives. This is by listening to the customer, finding the error, and planning for changes.

Measure the process and its different parts, to determine its current performance and quantify the problem through data collection, helping to improve the understanding of the process, locate bottlenecks, allow measuring cycle time of activities, identify complexities and waste, identify opportunities to reduce processing costs.

To analyze is to obtain a diagnosis of the process under study and to seek the causes of low performance, helping to increase knowledge about the system, in relation to the causes that act in the process and identification of focus of change to be developed in the improvement phase.

To implement is to propose, develop and test changes, helping to identify the changes that will effectively result in an improvement. Analyzing the risks involved in the change, doing small-scale testing, analyzing all the results to finally apply the changes effectively and globally.

To control would be to perpetuate the knowledge and improvements achieved, to ensure that the results obtained are maintained over time, helping to evaluate the gains and leverage the continuous improvement process.

The Six Sigma tool has a broad aspect for institutional improvements in health, demonstrating numerous benefits for customer satisfaction, in addition to improving processes to ensure safety of care and organizational efficiency.

MARKETING IN HEALTH AND BUSINESS REPUTATION

The translation of the word "market" from English to Portuguese is market. The representation of Marketing is one of management and focus on the market, this promotes the

understanding of Marketing as a social process in which people get what they need or want in a market of free negotiation and supply of products (Lucietto, 2015)

Marketing is not just about selling, it is not just an advertising campaign, it is linked between the end customer and the health service provider company with relationships designed to identify and satisfy the needs of the consumer, and at the same time achieve the organization's objectives. The focus of marketing is on the end consumer, and everything must be done for this. All promotion aims, first of all, to get to know your consumer and motivate them to consume a product. Every promotional strategy needs the engagement of all departments of a company as a primary objective in customer satisfaction. The business vision of marketing has followed a different path, expanding the vision with innovative management, analyzing the markets, and seeking solutions.

For a Health Marketing concept, we have to analyze the end consumer. The vision of the customer has undergone drastic transformations. The modern customer is no longer passive, he tends to be judicious, researching and analyzing companies based on their needs and possibilities, comparing everything between companies and then making his decision. Companies had to look for ways to make this relationship closer, seeking to win and keep the customer.

With the profile of customers modified, companies had to know in depth the needs, desires, desires of their consumers. Marketing is a business relationship seen from the point of view of consumers. It should be noted that there will always be a need for some sales effort, but that the goal of marketing is to prepare the offer in such a way as to make the sale superfluous. The goal is to know and understand the customer so well that the product or service adapts to them and sells itself. From then on, all you have to do is make the product or service available.

Exchange is the essence in Marketing, we have a consumer wanting a product that suits their needs and the health service company that must have a product closer to the customer's possibilities. Hence the monetary exchange for the service.

A good marketing plan needs well-designed strategies following a path determined by the parties involved, seeking to achieve purposes, objectives and goals.

For the development of organizations, a well-designed marketing plan is ideal. It is through it that we define who the target audience will be, how to reach them and how to build customer loyalty. It is the description of your niche market, your goals and what are the means to reach the desires of your consumers. The marketing strategy answers what the company wants to achieve, what its objectives and goals are, understanding today to arrive at tomorrow.

The marketing plan is designed after building a marketing strategy, we have to have the HOW and then a WHY. The marketing plan tells you how to achieve the objectives and goals of the marketing strategy. For the composition of the strategic plan it will be: Objective (e.g., increase the number of sales of a health plan); Marketing Strategy (e.g. focus on new niches); Marketing Plan

(e.g., develop communication campaigns aimed at this new niche) and Marketing Action (e.g., create an online and offline communication line with this new niche).

In the construction of the Marketing Plan we have the following phases: Marketing Objective, Target Audience Definition, Purchase Journey, Marketing Mix, Action Plan and Budget.

Marketing objectives: every plan is made based on the definition of objectives, which must be clear, such as increasing sales, recognition of the brand and products or services, expansion or entry into the digital world.

Definition of the target audience: what is the profile of people that the company wants to reach. The search for these details allows the company to offer a product, a solution that meets the interests and that really makes a difference in the lives of its target audience. Therefore, knowing how your target audience thinks, acts, and feels makes all the difference in the development of new products and marketing campaigns.

Purchase journey: it is the path taken by the consumer from the presentation of the product to the purchase. Once you know your target audience, the path to purchase can be detailed. The consumer takes into account previous experiences, so they research and seek more information, this leads companies to be positioned in various communication channels. So the product purchased must be satisfactory and provide a differentiated and surprising experience.

Marketing Mix: looks for the definitions that can be controlled by the company and the person responsible for marketing to generate the desire to buy in its target audience, differentiating it from the competition and making it clear why they choose one product over the other, that is, why mine is the best.

Action Plan: these are marketing actions to put your goals into practice and are based on the marketing mix, aligned with the marketing plan. For this to occur, the details of the actions, what they expect from each action and how to evaluate their efficiency must always be present. As the market is constantly changing, a reserve list or a team must be on hand to modify and update the action plan.

Budget: corresponds to how much to spend in a given period, this ensures not to overspend leading to losses. By controlling expenses, it is easy to evaluate the results.

The marketing plan never ends, it's always changing, requiring constant revisions and updates to keep the business growing.

For a company to always be in the spotlight in this increasingly competitive market, it is to pay attention to the fact that its reputation is always high with its customers and to have positive evidence before the customer, the market and its competitors.

In the midst of the high supply of companies and their products and services, catching the consumer's attention and differentiating yourself from the crowd is essential for the success of a business.

Corporate Reputation is the set of impressions that define the status of an organization before its customers, employees, investors, suppliers, community, and any other group that has relationships with the organization. So it's how others perceive the company, it's the image conveyed reflecting and impacting its success or failure. This image has been built over years, forged by its prominence in the market.

Corporate reputation is part of the growth strategy of a business, the better the reputation, the more chances they have of growing, expanding their dominance in the market with a solid relationship with customers. Ensuring the delivery of what was promised and satisfying your audience, even in times of crisis, brand loyalty occurs and transforms the customer into a promoter of the company.

The main characteristics of success in building corporate reputation are: being transparent in their actions; invest in public relations, ensuring the company's communication and image; they are looking for ways to engage everyone (employees, investors, suppliers, community, etc.); have an active and well-defined voice in the market; establish standards of excellence in its offerings, covering all points of action, such as customer service, sales, product creation and development, marketing, etc.; they are attentive to details; they always seek to offer a humanized service; comply with the legal rules.

To maintain a reputation for quality in the market, the company needs to be attentive to the values, mission and vision of the company, avoiding inconsistencies and inconsistencies between what it proposes and what it practices. The market has ups and downs generating crises, the company has to know how to work with it, seeking to correct errors and assuming its failures and responsibilities. Maintain a healthy and respectful relationship with all the audiences served, listening to their opinions and using this information for constant improvement. Seeking to raise quality standards, seeking to achieve excellence in its actions to better meet the expectations of an increasingly complex and demanding market. Create marketing actions according to the profile of the customers, which are executed considering the language, concept, image, messages that want to be transmitted, especially to avoid misinterpretations or controversies. Today it is no longer enough to deliver quality products and services at competitive prices. To attract and retain customers, it is essential that companies pay attention to several other points**.**

FINAL THOUGHTS

The work showed that well-crafted management tools optimize the relationship with customers and the market, placing the company on an equal or superior footing in the competition for a share of profits. Putting the customer first and interpreting their desires and desires, companies set up projects aimed at improving and reducing costs.

This study is only a snapshot of the moment, which used the literature review and does not conclude the studies on these topics. Major changes always occur, so these themes will always have to be fought back for updates and improvements.

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The role of the nurse in the treatment and prevention of pressure ulcers

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ABSTRACT

Pressure Injury (PI) is an involvement of the skin or underlying tissue, usually over a bony prominence and/or may be related to medical devices. PI can be classified according to the degree of tissue involvement, which are: 1st degree, intact skin with redness, usually over a bony prominence; 2nd degree, partial loss of skin thickness, is superficial and presents with a pink blister; 3rd degree, loss of total tissue thickness, where subcutaneous fat is visible, without bone exposure; 4th degree, loss of total tissue thickness with bone exposure; and non-classified lesions, where there is full-thickness skin loss, presence of necrotic tissues (Correia, 2019).

In the hospital environment, the main peop´le involved in the prevention and treatment of PI are the nursing professionals. As measures, skin hydration, change of decubitus every two hours or according to the need defined by the nurse, adequate nutritional support, daily skin check, use of comfort pads, change of clothes, diapers or wet pads, among others. (Campos, et al., 2021).

In nursing, it is essential that professionals deepen their research and techniques in order to offer broad conditions for PIanning interventions that can ensure the patient's well-being. The nurse, through the NCS (Systematization of Nursing Care), develops strategic ways to detect possible problems and control the patient's clinical alterations, to develop quality care, aiming at the patient's recovery in a comprehensive and free way, warning the patient's health (Citolino, et al., 2023).

Certifying and ensuring that the patient is safe is also a role of the nursing team, which assesses the patient's condition, and communicates to the team clearly, which priority care procedures will be established for the patient's treatment. The Ministry of Health (MoH) through the National Patient Safety Program (PNSP), established by Ordinance No. 529, of April 1, 2013 with the objective of contributing to the qualification of health care in all health institutions in the national territory; Patient safety is attributed to the quality of care and has acquired great importance from professionals to patients and has the purpose of offering safe care (MINISTÉRIO DA SAÚDE, 2021).

Keywords: Nursing, Care, Hospital, Assistance.

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INTRODUCTION

Pressure Injury (PI) is an involvement of the skin or underlying tissue, usually over a bony prominence and/or may be related to medical devices. PI can be classified according to the degree of tissue involvement, which are: 1st degree, intact skin with redness, usually over a bony prominence; 2nd degree, partial loss of skin thickness, is superficial and presents with a pink blister; 3rd degree, loss of total tissue thickness, where subcutaneous fat is visible, without bone exposure; 4th degree, loss of total tissue thickness with bone exposure; and non-classified lesions, where there is full-thickness skin loss, presence of necrotic tissues (Correia, 2019).

The appearance of PI can vary according to the duration, intensity and inflexibility of the skin. When Blood pressure also decreases (dehydration, cardiovascular disease or sepsis) there may be an exaggerated capillary compression that impedes the supPIy of blood flow, which may cause ischemia, edema and cell necrosis, etc. Other factors that contribute to the onset of PI is when the cutaneous blood supPIy is reduced by increased external pressure. (Costa, *et al.,* 2022).

In the hospital environment, the main peoPIe involved in the prevention and treatment of PI are the nursing professionals. As measures, skin hydration, change of decubitus every two hours or according to the need defined by the nurse, adequate nutritional support, daily skin check, use of comfort pads, change of clothes, diapers or wet pads, among others. (Campos, *et al.*, 2021).

The nurse is responsible for evaluating the lesions and verifying that the treatment is effective and adequate; this evaluation follows the following criteria: location of the lesion, degree, type of tissue, odor, size, exudate, coverings and the time the dressing was performed. When it comes to the nurse's self-determination in the care of patients with PI, the professional's commitment and effort to perceive the other care needs is highlighted, from the initial assessment to the final healing process. (Bussaleno, *et al.*, 2022)

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Relationships between the Assessment Scale for Group Music Therapy in Substance Use Disorders and an External Measure

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ABSTRACT

This study investigated the convergent validity of the Assessment Scale for Group Music Therapy in Substance Use Disorders (MTSUD) Scale in relation to the University of Rhode Island Change Assessment (URICA), as well as the effects of music therapy on the Stages of Change. To this end, the correlations between the constructs and the influence of music therapy on the Stages of Change and linear models in which the effects of music therapy were placed as predictors of the stages of change were analyzed. The results highlighted the adequacy of the general factor of the MTSUD, but the specific factors did not behave according to the theory. Group music therapy had a significant impact on the processes of change, favoring the stages of Contemplation, Action, and Maintenance. Limitations included disparity in participation between groups, missing data, and participants' difficulties in completing the tests. Future research should explore different populations. In addition, it is essential to investigate specific music therapy interventions and other forms of measurement, given that self-report points to significant limitations in this population. In summary, this study contributes to the understanding of the mechanisms underlying group MT as an effective therapeutic intervention for individuals with substance use disorders, although it points to the need for methodological and investigative improvement to develop more effective research.

Keywords: Music Therapy, Substance Use Disorders, Psychometry, Factor Analysis.

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INTRODUCTION

Modern Music Therapy (MT) was established in the 1940s in the United States of America, initially aimed at the care of "war neurotics," a term used to describe individuals returning from the Second World War with psychopathologies (Puchivailo, 2008). It was also during this period that academic training for music therapists began at the University of Michigan in 1946 (Gaston, 1968).

In Brazil, despite the initial introduction of MT activities in mental health care in 1955 (Costa & Cardeman, 2008) there is limited evidence from studies these contexts (Pedrosa, 2023). In fact, most publications on the role of music therapy in mental health in national scientific journals between 2001 and 2012 were exploratory research, primarily based on case studies and experiential reports (Puchivailo & Holanda, 2014).

Some of the studies that measure music therapy in the context of Brazilian mental health have indicated that: a) people with schizophrenia who received standard treatment along with MT had a higher percentage of medical discharges, lower rates of evasion, and abandonment of treatment compared to patients who received only standard treatment (Costa & Vianna, 1984); b) people with psychotic conditions who participated in 12 music therapy sessions showed improvements in attendance, attention, positive thoughts, immediate memory, short-term memory, and long-term memory (Loureiro & Corrêa, 2001); c) people diagnosed with substance use disorders (SUD) who underwent lyre-table sessions experienced significantly increased relaxation after each session compared to pre-intervention assessments, which resulted in greater resilience in coping with withdrawal symptoms and the desire to use drugs (Teixeira, 2019); and, d) people with SUD who received weekly structured MT sessions in addition to standard treatment for 6 weeks showed a significant increase in levels of readiness for change, unlike those who only listened to songs during the same period of time and received standard treatment (Nascimento & Pedrosa, 2024).

A Cochrane Review suggested that music therapy as an adjunct to standard treatment result in moderate reductions in substance craving and potentially increase motivation for treatment or behavior change among individuals SUD (Ghetti et al., 2022) – consistent with the findings of Nascimento and Pedrosa (2023). This review also indicated that the most significant reductions in substance cravings were observed in individuals who participated in MT sessions lasting longer than a single session.

One strategy for generating evidence on the effects of music therapy treatments in populations with SUD is the use of measurement instruments (Cripps et al., 2016) and the application of inferential statistical analyses in their results. Given the absence of specific measurement tools to assess the effects of MT on people with SUD (Pedrosa et al., 2022), the Assessment Scale for Group Music Therapy in Substance Use Disorders (MTSUD) was developed (Pedrosa et al., 2023a; Pedrosa et al., 2023b).

The MTSUD is based on the Transtheoretical Model of Change (TMC) and has evidence of content validity and its internal structure for two specific factors and one general factor (Pedrosa et al., 2023b), even though the specific factors have demonstrated borderline reliability. The two specific factors are Cognitive Processes[4] (Pcog) and Behavioral Processes (Pcom) and the general factor is the Effects of group music therapy on patients' change processes (EMt).

MTC describes behavioral change as a dynamic process in which individuals go through five distinct motivational stages (Prochaska, 2014). In the Precontemplation stage, individuals lack awareness of the necessity for change. During Contemplation, there is active but ambivalent consideration regarding change. Transitioning to the Preparation stage entails a commitment to change and the development of plans, culminating in Action, where concrete steps are taken. Maintenance involves sustaining achieved gains and adopting strategies to prevent relapse. Notably, relapses can occur at any stage, potentially regressing individuals to earlier points in the process.

The University of Rhode Island Change Assessment Scale (URICA) is an established instrument for measuring stages of change, evaluating levels of Precontemplation, Contemplation, Action, and Maintenance. It has demonstrated validity and reliability in Brazilian Portuguese (Szupszynski & Oliveira, 2008).

Theoretically, Pcog are associated with the stages of Precontemplation and Contemplation, whereas Pcom are more closely linked to the stages of Action and Maintenance (Prochaska, 2014). Empirical research supports these theoretical propositions in some studies (Norcross et al., 2011) but inconsistencies have been noted in others. For instance, studies have reported that both Pcog and Pcom predicted advancements in the Action stage (Mander et al., 2014) or that both Change Processes concurrently increased (Rosen, 2000).

Therefore, the primary aim of this study is to provide evidence of the validity of the MTSUD by examining its associations with the URICA, empirically assessing whether: 1) Pcog correlates more strongly with the initial stages of change; 2) Pcom correlates more prominently with the final stages; and 3) there are variations in instrument application among individuals who received structured MT and those who engaged in musical activities. Furthermore, if hypotheses 1 and 2 are not supported, the study will explore evidence for a single-factor structure of the MTSUD and its impact on constructs evaluated by the URICA. This approach aims to elucidate its functionality through this external measure and to evaluate its internal structure.

This study received support from the Voluntary Scientific Initiation Program of the Federal University of Minas Gerais (PRPq Notice – 01/2023) and a scholarship from the Institutional Program of Scientific Initiation Scholarships CNPq and FAPEMIG (PRPq Notice – 04/2023). Consequently, brief reports detailing experiences with the application of these instruments will be

[4] We will use capital letters to refer to constructs when written in full.

provided. These data are pertinent as they raise qualitative insights into the implications of MTSUD testing.

METHODS

This study adopts a quasi-experimental approach combining exploratory qualitative and quantitative research methodologies. Participants in the study were divided into two groups: 1) Experimental Group: Participants engaged in group sessions following a standardized music therapy approach in addition to receiving standard treatment; and 2) Control Group: Participants listened to pre-recorded songs and engaged in discussions about the songs without specific music therapy direction, alongside receiving standard care. The researchers' activities are also part of the extension project "Music Therapy in Mental Health" (SIEX/UFMG - 402786[5]).

The therapeutic groups were carried out at the Center for Therapies and Social Assistance (CETAS), a day hospital dedicated to the interdisciplinary treatment of men with SUD, over the age of 18, through a system of day stay. Patients follow the premise of total abstinence and stay from Monday to Friday, from 7:30 a.m. to 4:30 p.m., being accompanied by a multidisciplinary team composed of professionals such as psychiatrists, psychologists, art therapists, music therapy volunteers, among others (HEAL, 2023).

At this institution, treatment spans approximately 9 months, during which patients are categorized into three groups based on their duration of sobriety in the program. Initially, patients join the "Awakening" group for the first three months, focusing on achieving total abstinence. Following this phase, upon reaching three months of sobriety, patients progress to the "Hope" group. Upon achieving six months of sobriety, patients move to the "Perseverance" group, where they remain until completing the full nine-month treatment program (HEAL, 2023). Due to the institution's guidelines, randomization of patients was not feasible. Consequently, participants in the Awakening group were designated as the control group, while participants in the Hope and Perseverance groups formed the experimental group.

During sessions with the experimental group, the standardized SUD treatment approach developed by Pedrosa (2023) was implemented. This model structures sessions into three distinct phases: warm-up, music therapy techniques, and session closure. During the warm-up phase, the emphasis is on engaging participants, either through performing songs requested by them or selected by the therapist. The music therapy techniques phase involves activities such as musical listening, lyrical analysis, and musical composition, with flexibility in the sequence to accommodate therapeutic needs. At the session's end, time is allocated for closure, allowing participants to

[5] Access to the extension project through the link: https://sistemas.ufmg.br/siex/VerIdentificacao.do?id=93785&tipo=Projeto&modo=abrir.

complete rating scales while listening to selected music. Initially, for two months, this group was led by an intern who subsequently departed from the project due to personal reasons. Subsequently, sessions were led by the second author. The control group experienced sessions where participants selected their own music, fostering verbal interaction between them and the therapist facilitating the sessions.

This research is a component of the Assessment Scale for Group Music Therapy in Substance Use Disorders (MTSUD) project. It was submitted to Plataforma Brasil, reviewed, and approved by the Research Ethics Committee of UFMG (CAAE 30939720.1.0000.5149) and the Municipal Health Department of Belo Horizonte (CAAE 30939720.1.3001.5140)..

SAMPLE

A convenience sample comprised adult male participants over 18 years old from the Center for Therapy and Social Assistance (CETAS) at the Hospital Espírita André Luiz. All participants provided informed consent, agreeing to participate in both the therapeutic groups and the research. The study involved minimal risks to participants, including potential discomfort during MT sessions, listening to music, or answering sensitive questions on measurement instruments. Participants had the option to withdraw from the research at any time they felt the need to discontinue their involvement.

INCLUSION AND EXCLUSION CRITERIA

Participants included in the study were men aged 18 and older diagnosed with Substance Use Disorders (QD) who were receiving care at CETAS. Exclusion criteria encompassed patients who declined to participate in the groups and individuals whose scale responses contained significant missing data or were completed without acquiescence (e.g. filling in all items with a single category).

INSTRUMENTS

The Assessment Scale for Group Music Therapy in Substance Use Disorders (MTSUD) is a self-report instrument comprising 20 items designed to evaluate perceived effects among adult patients with SUD participating in group MT sessions, specifically focusing on their change processes. The MTSUD demonstrates strong evidence of content validity, internal structure, and reliability, encompassing a general factor (Effects of Music Therapy on Change Processes - EMt) and two specific factors (Pcog and Pcom) (Pedrosa et al., 2023).

The University of Rhode Island Change Assessment (URICA) is a self-report scale known for its robust internal and external validity indices. This instrument consists of 24 items measured on ordinal categories ranging from 1 to 5. It assesses motivational stage factors including

Precontemplation (PCont), Contemplation (Cont), Action (Ação), and Maintenance (Manut) (Szupszynski, 2006). Scores for each stage range from 6 to 30.

DATA ANALYSIS

The statistical analyses in this study were conducted using RStudio v. 4.3.1 software (R Core Team, 2023), alongside specific packages: psych v. 2.2.5 (Revelle, 2023) and ggplot2 v. 3.6.6 (Wickham, 2016). A significance level of $p < 0.05$ was applied to all statistical tests.

To assess the normality of the data, the Shapiro-Wilk test was utilized. Parametric tests were employed for normally distributed data to examine group differences, while non-parametric tests were chosen for non-normally distributed data. Additionally, the psych package v. 2.2.5 (Revelle, 2023) facilitated correlation analyses and the olsrr package v. 0.5.3 (Hebbali, 2020) was utilized to validate linear models.

Given the presence of numerous missing values in the study investigating the internal structure of the EGMTCD (Pedrosa et al., 2023), an assessment will be conducted to determine whether these missing values occurred completely randomly using Little's (1988) test, implemented through the naniar package v. 1 (Tierney & Cook, 2023). A p-value greater than 0.05 from Little's test would indicate that the missing values were randomly distributed, thereby justifying multiple imputation using the mice package v. 3.16.0 (van Buuren & Groothuis-Oudshoorn, 2011).

To examine the multivariate normality of the MTSUD items, the Mardia test (Mardia, 1970) was applied with the MVN package v. 5.9 (Korkmaz et al., 2021). Should the data fail to meet normality assumptions, the WLSMV estimator (Li, 2016) would be employed for confirmatory factor analysis using the lavaan package v. 0.6.12 (Rosseel et al., 2023). The reliability of the derived factors was assessed using the semTools package v. 0.5.6 (Jorgensen et al., 2022).

RESULTS

For this research, data from the MTSUD and URICA assessments on the days specified in Table 1 were analyzed. It was noted that the size of the population in the control group was smaller compared to the experimental group, with a statistically significant difference ($t(9.57) = 3.64$, $p < 0.01$).

Table 1: Session participants.

Date	Participations	Experimental Group	Control Group
07/26/2023	21	10	11
08/09/2023	25	13	12
08/23/2023	25	13	12
09/13/2023	26	16	10
09/27/2023	25	13	12
10/11/2023	26	16	10
10/25/2023	28	18	10
02/27/2024	26	17	9
Sum	202	116	86
Mean (SD)	25.25 (1.98)	14.5 (2.67)	10.75 (1.16)

Note: SD = standard deviation. Source: created by the authors.

In the next section, the authors discuss their experiences with the sessions and the implementation of measurement instruments through MT sessions.

EXPERIMENTAL GROUP

The music therapy groups conducted in the experimental group recurrently utilized the technique of musical songwriting and subsequent lyrical analysis. The choice of these techniques was based on their verified effectiveness in previous studies (Jones, 2005; O'Callaghan & Grocke, 2009; Silverman, 2015a, 2015b). During the sessions, it was observed that the audience served was heterogeneous, covering different occupations and cultural, social, academic, ethnic, gender and age levels. Similarly, the reported substances of abuse varied widely during the sessions, with the most frequent being alcohol, cocaine, crack, marijuana and medications or the concomitant use of several of these substances.

For songwriting, some of the strategies were used, which employed, including the creation of parodies and/or reinterpretations that modified parts of the original song, as well as the development of new versions. More intricate processes involved composing entirely original song. The aim of this process was to obtain lyrical material as starting points for song structuring (Nascimento et al., 2024).

To illustrate this process, we report a songwriting during one of the sessions at CETAS, which was divided into three stages:

1. Proposal to the group of a musical composition activity using a word cloud (each member contributes a word).
2. Proposal to the group of a musical composition activity using a word cloud (each member contributes a word).

3. Structuring of verses, harmonic and melodic arrangement of the song.

This process was carried out collaboratively with the group, with the music therapist actin as co-author and mediator. The inclusion of group members in decision-making was essential, as it promoted a consensus within the group, fostering ongoing dialogue. Below is the chorded lyrics of the final composition[6]. The words suggested by the members of the group were: freedom, truth, happiness, life, hope, prosperity, trust, tomorrow, gnome, thereafter, reborn, rainbow, animals, build.

Title - Gnomes (Freedom)
Lyrics: CETAS participants on 04/24/2024
Music by Thiago Félix / Genre: Reggae / Tempo: 92 BPM

C
Life and freedom to be reborn
F C G
At the end of the rainbow, there are gnomes
C F
In the future there can be prosperity and happiness
C G
There can be happiness
F C
Hope for a new dawn
F G
Observing the animals and nature and,
F C
Building the truth thereafter
Bb C
The truth thereafter, thereafter

The completion of the MTSUD and URICA instruments biweekly with pen and paper caused discomfort among many patients at CETAS. Common behaviors observed during completion included avoidance and sloppiness. To minimize this discomfort, it was essential to clarify the purpose of these instruments, the reasons for the research, their relevance and the need for careful completion. Another measure taken was printing the scales in two formats, including one with large letters to facilitate reading and comprehension. The time allotted for this activity varied between fifteen and twenty minutes.

Some participants had questions when filling out the instruments, even outside the day of application. These questions addressed topics such as music theory, msuical harmony construction, melodies and songs, as well as reflections on the scale items. In several narratives, the participants reported understanding the reason for completing the scales and reflected more deeply on the content of the questions and their relationship with the treatment.

Finally, we found that the MT process, along with discussions held during sessions, elucidated the reasons for using MTSUD and created a new understanding among the participants,

[6] To listen to the music, access the link https://drive.google.com/file/d/1boQMZS1O6XrMN5x6WRO71aZTxVoIg93X/view?usp=sharing.

resulting in a noticeable change in attitude in relation to the completion and participation in the process.

CONTROL GROUP

In the control group, one notable characteristic was the frequent turnover of participants, including both new arrivals and individuals returning after experiencing relapses. Weekly sessions often saw the addition of new members and the return of those who had previously left due to relapses. The dropout rate was considerable, as patients had the opportunity to advance to the Hope group upon achieving certain milestones.

At the beginning of each session, a moment was set aside to welcome the new arrivals for the week. Participants were invited to introduce themselves, sharing their names, musical styles or favorite songs, and provide information about their musical development with instruments and/or singing. The intention of these actions was to facilitate bonding among participants and create a welcoming environment.

Following introductions, a playback queue was formed in a music *streaming* application , following the order of participant requests. Some songs chosen such as: "Eu quero é botar meu bloco na rua" by Sérgio Sampaio, "Zona de perigo" by Léo Santana, "Toxicity" by System of a Down.

During the music playback, patients engaged in discussions related to their life experiences. They shared moments when they typically listened to specific songs, the origins of their interest in certain types of music, memories associated with particular pieces, or reasons for disliking specific songs or musical genres. Conversations often delved into reflections on changes in music consumption over time, opinions on artists, their songwriting and production techniques, concert experiences, and other related topics. While some discussions spanned the entire session, topics generally arose intermittently.

Before administering the MTSUD and URICA instruments, the research context and relevance were introduced to participants, emphasizing that participation was voluntary. The relevance of sincere and attentive completion was also highlighted, as these data would guide future studies highlighted. In addition, the participants marked the informed consent form.

The scales were completed after the proposed session activities, usually in the last 20 minutes. The filling environment varied from an outdoor space, called a "kiosk" by the institution itself, to a more spacious room with less influence of external noise, which helped to maintain the concentration of the patients. Each participant received an individual sheet for each scale on completion days (including a version with larger letters for those with visual difficulties) and the informed consent form. Ambient music selected either by patients or the session facilitator played during this period to enhance patient comfort.

During the scale completion process, a variety of reactions were noticed, some showed enthusiasm for contributing to the research, while others expressed disinterest or even some impatience. Interestingly, completing the scales occasionally sparked group discussions that led to individuals sharing emotional reports. Regarding the scales, several challenges were identified, including incorrect markings or uncertainties during scale completion. One significant issue that arose was the use of the term "drug" in the tests, which caused discomfort for some participants. Specifically, individuals whose primary psychoactive substance use was alcohol expressed that they did not find this terminology suitable to describe their situation.

ANALYSIS OF THE RELATIONSHIPS BETWEEN THE MEASURES

The convenience sample comprised exclusively of males with a mean age of 36 years (SD = 9.51). Initially, we tabulated the data in a spreadsheet and identified a considerable amount of missing data. Among the 202 participants who completed scales across both groups (116 in the experimental group and 86 in the control group), only 32 complete responses were obtained in the experimental group and 27 in the control group. These numbers indicate that only 29.21% of the responses from the study sample were fully completed and subsequently used for correlation analyses.

Some variables exhibited significant deviations from normality, such as PCog in the experimental group and Action in the control group, as indicated by $p < 0.05$ in the Shapiro-Wilk test. Therefore, Spearman's correlation was employed to examine the association between the MTSUD and URICA variables in both groups. The results of these correlations are presented in table 2.

Table 2: Spearman's correlation matrices between the MTSUD and URICA constructs in the experimental group (n = 32) and control group (n = 27).

Experimental Group

	EMt	Pcog	Pcom	PCont	Cont	Ação
Pcog	**0.93**					
Pcom	**0.96**	**0.82**				
PCont	-0.19	-0.34	-0.15			
Cont	0.36	0.35	0.32	-0.17		
Ação	0.30	0.24	0.29	-0.28	**0.64**	
Manut	**0.44**	**0.47**	0.40	-0.15	0.32	0.29

Control Group

	EMt	Pcog	Pcom	PCont	Cont	Ação
Pcog	**0.89**					
Pcom	**0.91**	**0.68**				
PCont	-0.02	-0.08	0.02			
Cont	0.19	0.27	0.04	**0.33**		
Ação	0.09	0.23	-0.10	-0.24	**0.58**	
Manut	-0.17	0.17	-0.15	0.10	0.33	0.26

Note. Values in **bold** indicate correlations with $p > 0.05$. Pcog = Cognitive Processes, Pcom = Behavioral Processes, PCont = Precontemplation, Cont = Contemplation, Ação = Action, Manut = Maintenance.

As shown in Table 2, there were significant correlations only between EMt and Maintenance ($r = 0.44$), Pcog and Maintenance ($r = 0.47$) in the experimental group. No significant correlations

were observed between the constructs of the two measures in the control group. It's important to note that some substantial correlation values ($r > 0.30$) did not reach significance.

Given the close relationship between significance and sample power (Miola & Miot, 2021), we examined whether the missing values in the scale completions were completely random, as this would allow for imputation of missing data. Little's test (1988) indicated that missing data in the experimental group were completely random for both the MTSUD ($\chi^2(271) = 261$, $p = 0.66$) and URICA ($\chi^2(403) = 445$, $p = 0.07$). However, in the control group, missing data were not completely random for MTSUD ($\chi^2(188) = 259$, $p < 0.01$), although they were for URICA. Consequently, we proceeded with multiple imputation of missing values for MTSUD and URICA in the experimental group. Then, we estimated a new Spearman correlation matrix using the imputed data (Table 3).

Table 3: Spearman's correlation matrices between the MTSUD and URICA constructs in the experimental group (n = 83) with missing data imputed.

	EMt	Pcog	Pcom	PCont	Cont	Ação
Pcog	**0.88**					
Pcom	**0.96**	**0.79**				
PCont	-0.14	-0.19	-0.14			
Cont	**0.46**	**0.39**	**0.45**	-0.21		
Ação	**0.34**	**0.35**	**0.30**	**-0.25**	**0.53**	
Manut	**0.29**	**0.39**	0.23	-0.10	**0.34**	0.18

Note. Values in bold indicate correlations with $p > 0.05$. Pcog = Cognitive Processes, Pcom = Behavioral Processes, PCont = Precontemplation, Cont = Contemplation, Ação = Action, Manut = Maintenance.

Table 3 shows that the significant correlations between the constructs are mostly moderate and positive, as follows: EMt with Contemplation ($r = 0.46$); EMt and Action ($r = 0.34$); EMt and Maintenance ($r = 0.29$); Pcog with Contemplation ($r = 0.39$); Pcog with Action ($r = 0.35$); Pcog with maintenance ($r = 0.39$); Pcom with Contemplation ($r = 0.43$) and Pcom with Action ($r = 0.30$). Theoretically, Pcog would be more associated with the constructs of Precontemplation and Contemplation, whereas Pcom would be more linked to the stages of Action and Maintenance (Prochaska, 2014). However, it's important to note that these theoretical assumptions have not been empirically validated in this study.

Considering that MTSUD includes a general factor (EMt) alongside specific factors, and following the definition of validity provided by the Standards for Educational and Psychological Testing, which pertains to the degree to which evidence and theory support the interpretations of test results for the proposed uses (AERA et al., 2014), a multiple regression analysis investigated the effects of the three factors of MTSUD on the stages of Contemplation, Action, and Maintenance. The backward method was employed for variable selection in regression models, eliminating unnecessary variables that do not significantly contribute to explaining the dependent variable—in this case, the Stages of Change.

Effects of MTSUD factors on Stages of Change

Based on linear model analyses, the effects of EMt, Pcog and Pcom on the levels of Contemplation, Action and Maintenance were examined. Assumptions of normality of residuals and homoscedasticity were met in all models ($p > 0.05$ for all tests). Importantly, these predictive analyses utilized actual data without imputation..

For the Contemplation variable, the linear regression model remained significant with only the EMt variable ($F(1, 30) = 8.98$, $p < 0.01$; $\beta = 0.13$), indicating a mean increase of 0.13 in Contemplation levels for each unit increase in EMt, which explained 20.5% of Contemplation.

Similarly, for the Action variable, the linear regression model was also significant with only the EMt variable ($F(1, 30) = 6.08$, $p = 0.02$, $\beta = 0.07$), indicating a mean increase of 0.07 in Action levels for each additional unit in EMt, which predicted 14.1% of Action.

Finally, for the Maintenance variable, the linear regression model was significant when it remained only with the MEt variable ($F(1, 30) = 8.18$, $p < 0.01$; $\beta = 0.11$), suggesting a mean increase of 0.11 in Maintenance levels for each unit increase in EMt, which predicted 18.8% of Maintenance.

These findings suggest that the specific factors have limited explanatory power compared to the general factor, which is more successful in explaining the variation of the Stages of Change. Research on the internal structure of the EGMTCD revealed adequate adjustment indices also for the one-factor model (Pedrosa et al., 2023). However, given the inadequate performance of the specific factors in both correlation and prediction analyses reported here, the factorial structure of the MTSUD using a single-factor model will be explored below.

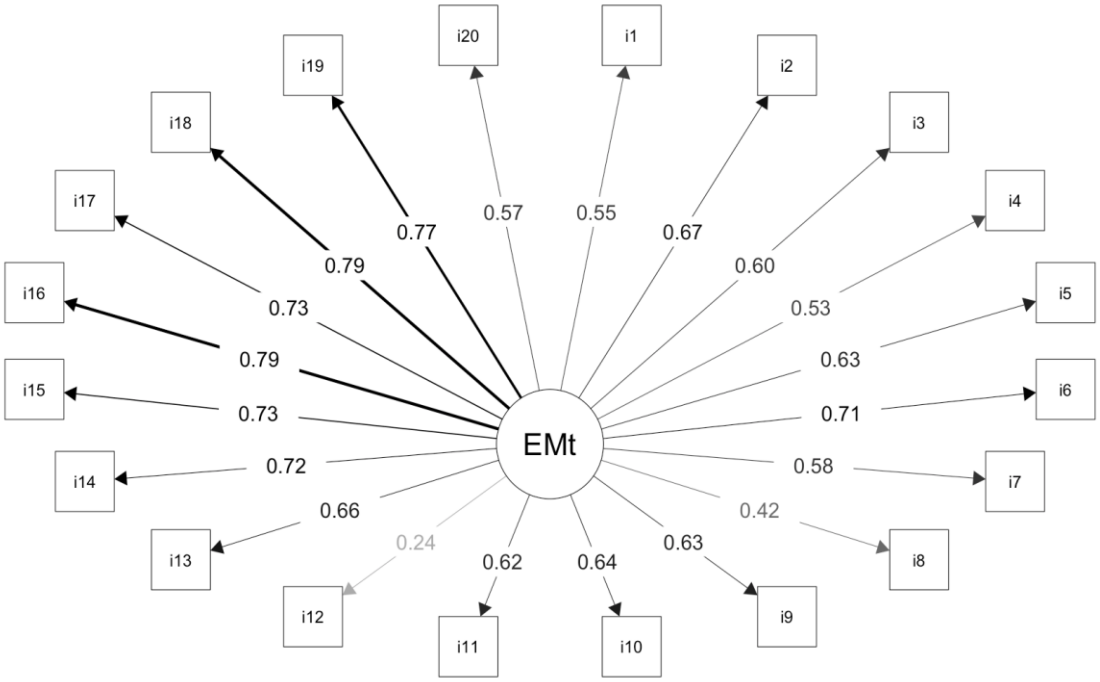
FACTOR ANALYSIS FOR THE ONE-DIMENSIONAL MODEL OF THE MTSUD

To determine the factorial structure of the model, we utilized data from the experimental group, supplemented by MTSUD completions conducted post-MT care at a public facility for individuals with SUD as part of the Music Therapy in Mental Health extension project. The combined dataset included 220 completions. The convenience sample consisted predominantly of males (81%) with a mean age of 44.1 (SD = 12.6).

The Mardia test results (kurtosis = 26.97; $p < 0.01$ and asymmetry = 3358.78; $p < 0.01$) indicated that the items did not present evidence of multivariate normality. Therefore, confirmatory factor analysis of items was performed with the WLSMV estimator. The model's fit indices ($\chi2$ = 282,823(170); CFI = 0.989; RMSEA [95% CI] = 0.055 [0.044; 0.066]) indicated satisfactory adequacy.

The factor loadings of each item are presented in figure 1.

Figure 1: Factor loadings of the items in the one-factor model.



Note. EMt - Effects of group music therapy on change processes. Source: created by the authors.

Item 12 had a factor loading below the expected cut-off line of 0.30 (Costello & Osborne, 2004). However, the reliability analysis results revealed good internal consistency. Cronbach's alpha coefficient of 0.91 indicated high reliability of the items when measuring the same underlying construct, while the ordinal alpha, adapted for ordinal scales, registered an even higher value, reaching 0.93. Additionally, MacDonald's omega presented a similar value of 0.91 and the composite reliability, which combines the common and specific variance of the items, was evaluated at 0.82, indicating an acceptable reliability.

To evaluate the impact of item 12 on the results, we conducted a correlation analysis between the scores obtained by the sum of the items and the actual (factor) scores, both considering and excluding item 12 in the sum. The sum scores of all items correlated in 92.9% with the latent scores ($r = 0.963$, $p < 0.01$), while the scores summing all items, excluding item 12, correlated in 92.1% with the latent scores ($r = 0.959$, $p < 0.01$). Given the minimal difference between these correlations and considering the sample size limitations of this study, it was decided to retain item 12 in the analysis.

DISCUSSION

The findings of this study provide valuable insights into the impacts of group music therapy on the change processes among individuals with SUD. A significant observation is the pronounced difference in participant numbers between the experimental and control groups, indicating a notable imbalance. This disparity underscores the importance of exercising caution in interpreting the

outcomes, given the potential for selection bias to influence the results. Furthermore, despite efforts to address missing data, it is essential to acknowledge this limitation, as it could potentially affect the generalizability of findings due to reduced sample power.

MTSUD has demonstrated its efficacy as a reliable instrument for assessing the effects of Music Therapy (MT), affirming its utility in both clinical and research settings related to MT, as evidenced by previous studies (Nascimento et al., 2024; Nascimento & Pedrosa, 2024; Pedrosa et al., 2023). However, its applicability beyond the domain of music therapy appears to be limited, emphasizing the necessity of acknowledging the scale's specificity when evaluating treatments incorporating music therapy techniques. This specificity underscores the importance of considering the context in which the scale is employed to ensure its relevance and validity in assessing therapeutic outcomes comprehensively.

The convergent validity of the Pcog and Pcom constructs of the MTSUD was not empirically verified, as theoretically expected. This discrepancy, also reported in other studies (Mander et al., 2014; Rosen, 2000), suggests the need for further investigations to better understand the specific factors of MTSUD. Conversely, the significant correlations and predictions between the effects of group music therapy (EMt) and the Stages of Change measured by URICA are in line with the previous literature, indicating that music therapy can positively influence the processes of change related to SUD (Jones, 2005; Silverman, 2011).

Furthermore, the results of linear regression analyses revealed that EMt is a significant predictor of the Contemplation, Action, and Maintenance stages of change, with a relevant effect size. These findings suggest that group MT may play an important role in promoting reflection, action, and maintenance of healthy behaviors in individuals with substance use disroders.

Despite item 12 in the MTSUD showing a factor loading below the expected cut-off line, its exclusion does not significantly compromise the scale's reliability and validity. The scale demonstrates robust reliability and predictive power regarding Stages of Change, underlining its utility in interpreting data from this study. Regarding item 12, which assesses discomfort with songs about substance use, its low covariance with other MTSUD behaviors is notable. This finding is particularly relevant given conflicting literature on whether music can trigger substance use (Short & Dingle, 2016; Silverman, 2021).

The experience reports underscored the participant’s resistance in relation to complete the scales, particularly due to discomfort arising from the inclusion of the term "drugs" in some items, which also triggered emotional discussions. This highlights the critical need to build a trusting relationship and provide clear explanations about the scale's purpose, ensuring participants' comfort and motivation for active engagement. Additionally, challenges were noted in comprehending and completing the scales, particularly among individuals with visual or literacy issues, emphasizing the

necessity for adaptability to ensure accessibility and understanding for all participants. These insights have informed enhancements in data collection procedures, aiming to enhance participant experience and guide future research and intervention strategies.

Finally, the occurrence of discussions and emotions during the completion of the scales is noteworthy, indicating that moments of reflection, debate, and even emotional confrontation may emerge. These dynamics underscore the importance of fostering a supportive and welcoming environment for participants during both data collection and music therapy sessions.

CONCLUSION

This study investigated both the convergent validity of MTSUD and the effects of MT in people with chemical dependence, using MTSUD and URICA as assessment instruments. The results revealed findings that enhance our understanding of the efficacy of MT in this specific clinical context.

Although MTSUD has demonstrated adequate reliability and factorial structure of its general factor, the specific factors showed discrepant empirical bechaviors that diverged from theoretical expectations. It is recommended to use only the EMt factor, given by the sum of all items. Future research should consider interpretability indications for their scores.

The findings indicate that group MT, in addition to the standard treatment, can have a positive influence on the Stages of Change, favoring the stages of Contemplation, Action and Maintenance in individuals with SUD. The analysis of the correlations and predictions between the effects of group music therapy and the Stages of Change suggested associations and moderate positive impacts between these variables, in line with the previous literature. This highlights the relevance of MT as a therapeutic intervention in this context.

However, it is important to recognize the limitations of this study, which include the disparity in participation between the experimental and control groups, the presence of missing data, and the participants' difficulties in completing the scales. These limitations underscore the need for further investigation to better understand the mechanisms for measuring the influence of MT on Stages of Change and to develop more adaptable and accessible approaches to data collection in clinical settings. In addition, the results indicate that self-report instruments, such as MTSUD and URICA, may face adherence challenges among the participants with problems with psychoactive substances.

Future studies may explore different populations, especially females, and clinical contexts, using mixed approaches that combine quantitative and qualitative methods for a more comprehensive understanding of outcomes. It is also critical to investigate specific MT interventions, such as songwriting, and examine their effects on different Stages of Change. It is relevant to analyze the

items of the MTSUD, given that the participants of this research pointed out difficulties with the expression "drugs" that compose them.

This study may contribute to the growing evidence base supporting the efficacy of group MT as a valuable therapeutic intervention for people with SUD, in addition to standard care. There is pressing need for more research to deepen our understanding of the underlying mechanisms and develop more effective clinical practices.

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APPENDIX I

Assessment Scale for Group Music Therapy in Substance Use Disorders (MTSUD)

INSTRUCTIONS

Please read each statement below and mark an X in the right-hand column that indicates how often you have encountered these situations. Remember that these descriptions refer to attitudes or thoughts that you may have experienced DURING THE LAST WEEK.

1) Do I reward myself with music when I resist using drugs?	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
2) Does the music therapy group help me share my drug problems?	Never	Rarely	Sometimes	Often	Always
3) Does the music therapy group get me thinking about the illnesses that can come from using drugs?	Never	Rarely	Sometimes	Often	Always
4) Does the music therapy group help me see that the people around me would be better off if I didn't have a drug problem?	Never	Rarely	Sometimes	Often	Always
5) Have I heard that music can help me give up drugs?	Never	Rarely	Sometimes	Often	Always
6) Does music help distract me when I start thinking about doing drugs?	Never	Rarely	Sometimes	Often	Always
7) Does society provide therapeutic options, such as music therapy, that I believe can help me overcome my drug problem?	Never	Rarely	Sometimes	Often	Always
8) Does being in the music therapy group help me see how disappointed I feel in myself when I rely on drugs?	Never	Rarely	Sometimes	Often	Always
9) Do I look for information about my drug problem in the music therapy group?	Never	Rarely	Sometimes	Often	Always
10) Do some songs help me remember not to do drugs?	Never	Rarely	Sometimes	Often	Always
11) Are there folks in the music therapy group I can rely on when I'm dealing with drug problems?	Never	Rarely	Sometimes	Often	Always
12) Do songs about drugs and their effects bother me?	Never	Rarely	Sometimes	Often	Always
13) Does my musical compositions indicate that I can quit using drugs if I really try??	Never	Rarely	Sometimes	Often	Always
14) Does music therapy help me see how my drug use affects people around me?	Never	Rarely	Sometimes	Often	Always
15) Does being in the music therapy group make me feel more ready and able to decide to quit drugs?	Never	Rarely	Sometimes	Often	Always
16) Does being in the music therapy group help me avoid places that are usually associated with my drug use?	Never	Rarely	Sometimes	Often	Always
17) Do I think listening to or making music is a good substitute for drug use?	Never	Rarely	Sometimes	Often	Always
18) Do I join the music therapy group and feel like I'm being rewarded for not using drugs?	Never	Rarely	Sometimes	Often	Always
19) Do I join the music therapy group and feel like I'm being rewarded for not using drugs?	Never	Rarely	Sometimes	Often	Always
20) Did we chat in music therapy about how society helps folks stay away from drugs?	Never	Rarely	Sometimes	Often	Always

SEVEN publicações acadêmicas

CHAPTER 31

Neuropsychology, Augmented Reality and Virtual Reality in the context of ERPI - Innovative approaches to the well-being of the elderly

https://doi.org/10.56238/sevened2024.012-031

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ABSTRACT

This research is about the potential of augmented reality and virtual reality technology to improve the cognitive well-being of patients with diagnosed pathologies living in residential care facilities for the elderly. The study aims to review the existing literature on the use of virtual and augmented reality in neuropsychology, particularly in relation to cognitive functions, and to identify successful case studies or pilot projects in similar contexts.

This research also aims to provide a theoretical anchor for the implementation of augmented reality and virtual reality projects in a real-life context, and to contribute to the growing body of knowledge on the potential applications of augmented reality technology in promoting cognitive well-being and quality of life in older people.

Methodologically, the work was supported by the techniques of literature review, content analysis, observation and case study.

The results provided an overview of the effectiveness of activities using augmented reality and virtual reality in improving cognitive function, mood and quality of life in older people, as well as a perspective on best practices for the design and implementation of augmented reality and virtual reality experiences in care environments for older people.

Keywords: Cognitive well-being, Neuropsychology, Augmented Reality, Extended Reality, Virtual Reality.

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INTRODUCTION

Extended Reality (XR) is an umbrella term used to encompass all immersive technologies, including augmented reality (AR), virtual reality (VR), and mixed reality (MR). XR pushes the boundaries of traditional reality, integrating digital elements into the user's perception of the physical world, thus creating immersive and interactive experiences.

The term "Extended Reality" or "Extended Reality" (XR) has come to be used to encompass the wider spectrum of immersive technologies beyond virtual reality. While the exact origin of the term is not attributed to a single individual, it has gained greater prominence as the development of immersive technology has expanded to include a variety of digital experiences that extend, augment, or alter reality. Leading authors and researchers in the field of XR include:

> Jeremy Bailenson: Founding Director of the *Virtual Human Interaction Lab* (VHIL) at Stanford University. Bawenson's research focuses on the psychology of virtual and augmented reality.
> Steve Aukstakalnis: Author of "*Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR*," Aukstakalnis is an expert in augmented and virtual reality technologies.
> Tom Furness: Known as the "Grandfather of Virtual Reality", Furness has made significant contributions to the field of XR through his research and development of VR and AR systems.
> Jason Jerald: Author of "*The VR Book: Human-Centered Design for Virtual Reality*," Jerald is considered an authority on VR technology and its applications in various domains.

The convergence of technology and healthcare brings about a paradigm shift in the way we approach the well-being of older populations, particularly those living in senior or assisted living homes. In this new context of innovation, augmented reality (AR) and virtual reality (VR) stand out as two important branches of immersive technology, presenting new options to address the complex challenges associated with the cognitive health of older people.

While virtual reality allows users to enter or immerse themselves in fully computer-generated environments, Augmented Reality overlays digital information onto the real world, seamlessly integrating virtual elements with the physical environment, as we mentioned. This unique feature of AR has profound implications for therapeutic interventions, especially in the context of elderly care. By augmenting the lived environment with digital enhancements, AR sessions provide a dynamic and interactive platform to engage older patients in therapeutic activities tailored to their cognitive abilities and individual needs.

In this study, we look at the potential of augmented reality and virtual reality technology to enhance the cognitive well-being of elderly patients in the context of senior residence. Specifically, we explore the intersection of these XR's and neuropsychology, seeking to understand how the experiences of both XR's can address and improve cognitive functions affected by age-related pathologies. Through a literature review and consultation of successful case studies and pilot

projects, this study seeks to present scientific evidence on the efficacy and feasibility of integrating AR and VR activities in an elderly care setting.

In addition, this study aims to constitute itself as one of the theoretical bases for the practical implementation of AR and VR projects, presenting information on the best practices of design and implementation in real-world contexts. It is also intended to understand the effectiveness of AR and VR therapy sessions in improving cognitive function, mood and overall quality of life of the elderly, as well as the potential positive impact of technology.

The methodology applied in this study includes literature review, observation and analysis of case studies. The sources consulted are essentially open *source* sources available on the Internet.

VIRTUAL REALITY AND AUGMENTED REALITY IN NEUROPSYCHOLOGY

In the realm of immersive technologies, augmented reality (AR) and virtual reality (VR) represent two distinct but complementary approaches, each of which presents specific ways to change and improve our perception of reality.

Thus, conceptually, AR is a technology that superimposes digital information or virtual objects onto the real-world environment, improving the user's perception and interaction with their surroundings. AR systems typically use devices such as smartphones, tablets, or AR glasses to overlay digital content onto the physical world. As defined by Milgram and Kishino (1994), AR sits on a continuous line between the virtual environment and the real environment, offering users a mixed experience that enriches their sensory input without completely replacing it (Milgram & Kishino, 1994; Skarbez et al., 2021).

Augmented reality has emerged as a promising tool in neuropsychology, providing innovative ways to assess and rehabilitate cognitive functions in individuals with neurological disorders. By overlaying digital stimuli onto the real-world environment, the use of AR can create ecologically valid assessments and therapeutic experiences tailored to the specific needs of patients. This personalized use allows clinicians to encompass cognitive domains such as attention, memory, executive function, and spatial awareness in contexts that closely resemble real-life scenarios. (Rose et al., 2000)

Virtual reality, on the other hand, allows users to be transported to fully computer-generated environments, simulating a sense of presence and immersion in a synthetic reality. VR technologies often involve *head-mounted displays* (HMD) and specialized devices to create a fully immersive experience that takes users into virtual worlds. According to Steuer (1992), VR is a unique form of mediated reality, in which users feel present in the virtual environment, thus allowing for rich and immersive interactions. (Steuer, 1992)

Therefore, extended reality (XR), which as we have seen, encompasses AR, VR, and mixed reality (MR), extends the capabilities of traditional neuropsychological assessments and interventions, providing immersive and interactive experiences.

In the field of neuropsychology, XR technologies have the potential to simulate complex environments and activities, facilitating thorough assessments of cognitive function and allowing rehabilitation-oriented sessions to be (Parsons et al., 2007) conducted.

REVIEW OF THE LITERATURE ON COGNITIVE FUNCTIONS WORKED ON IN AUGMENTED REALITY AND VIRTUAL REALITY THERAPIES

First of all, it is necessary to understand what neuropsychological rehabilitation consists of.

It is a set of interventions designed to optimize functionality and reduce the inability of people with health problems to interact with their environment. It is an essential part of health care, along with health promotion, disease prevention, treatments, and palliative care (WHO, 2024).

The goal of neuropsychological rehabilitation is to help the person be as independent as possible in their activities of daily living, and to allow participation in education, work, leisure, and important life roles, such as taking care of the family. It may include individual or group therapies, cognitive rehabilitation, psychotherapy, psychoeducation, and psychosocial interventions. (WHO, 2024)

There are three main approaches in neuropsychological rehabilitation, according to the studies of Clare et al. (2003):

1. Cognitive stimulation: Involvement in activities and discussions aimed at the general improvement of cognitive and social functioning, usually in a group context.
2. Cognitive training: Repeated practice on specific tasks that reflect underlying cognitive processes, such as memory and attention. It can be individual or group, face-to-face or remote.
3. Cognitive rehabilitation: An individualized approach that builds on the person's strengths and compensates for the most deficient areas, based on a comprehensive assessment of cognitive, functional, social, and emotional functioning. It uses tasks, psychoeducation, and compensatory strategies.

These approaches have widely documented efficacy, for example in people with mild cognitive impairment and neurocognitive disorders. In Lazar et. al (2014) a review is observed on new technology programs implemented in cognitive stimulation and training, with the clear objective of promoting an improvement in the cognitive functioning of individuals, and with success in all cases analyzed in the review. (Clare & Woods, 2003) (Lazar et al., 2014)

Neurological rehabilitation was, then, the starting point for us to deepen the specific cognitive functions worked on in therapies with AR and VR.

COGNITIVE FUNCTIONS WORKED ON IN AUGMENTED REALITY THERAPIES

Augmented reality has aroused a great deal of interest due to its potential to influence attention-related processes, including selective attention and sustained attention.

Selective attention refers to the ability to focus cognitive resources on relevant stimuli while filtering out irrelevant distractions. AR interventions have been shown to improve selective attention by directing users' attention to specific digital stimuli overlaid on the real-world environment. The study led by Josef Buchner in 2022 demonstrated that AR-based training tasks improved participants' ability to selectively arrange target objects in a cluttered visual scene, leading to improved task performance and reduced distraction. In addition, AR technologies can dynamically adjust digital stimuli based on the user's preferences and task demands, further facilitating selective attention processes. This adaptive feature of AR systems makes it possible to implement techniques related to personalized attention, adapted to individual needs and cognitive goals (Buchner et al., 2022) (Marougkas et al., 2023b) .

Sustained attention, also known as vigilance, refers to the ability to maintain concentration and alertness over an extended period. Therapies that use AR have shown promise for improving vigilance, providing dynamic and interactive experiences that maintain users' interest and engagement over time. Research by Ngeemasara Thapa's team, for example, showed that AR-based cognitive training tasks led to improvements in vigilance performance among the elderly, with participants exhibiting increased vigilance and reduced attention lapses during task completion. (Thapa et al., 2020a)

It is observed, then, that the immersive nature of AR experiences can promote vigilance, minimizing external distractions and keeping users engaged with stimuli relevant to the task. Therefore, by integrating interactive elements and branching techniques, AR therapies or interventions can contribute to maintaining users' attention and motivation, facilitating a more immersive and rewarding cognitive training environment (Marougkas et al., 2023a) .

It has also been possible to verify that activities using AR have emerged as promising tools to improve various aspects of memory, including spatial memory and episodic memory. Research in this area has been deepening the effectiveness of AR in facilitating the processes of memory encoding, retrieval and consolidation, giving a perspective of its potential as a memory improvement technique.

Spatial memory refers to the ability to recall and navigate spatial environments. AR therapies take advantage of the immersive and interactive nature of technology to provide enriched spatial

experiences that stimulate spatial memory processes. The studies led by José Manuel Cimadevilla demonstrated that AR-based navigation devices improved the performance of users' spatial memory, allowing them to recall spatial information more accurately and efficiently. (Cimadevilla et al., 2023)

It's interesting to note that AR applications can overlay digital markers or cues on real-world environments, providing users with additional contextual information to support spatial memory retrieval. According to some authors, this spatial increase improves the scenarios, facilitating memory retrieval and the tasks involved in therapy (Hoe et al., 2019; Keil et al., 2020).

Episodic memory, on the other hand, involves the recollection of specific events and experiences linked to a particular time and place. AR therapies offer immersive storytelling experiences that engage users in interactive narratives, facilitating the encoding and retrieval of episodic memory. The research carried out by Dingler *et. al.* (2019) demonstrated that AR-based storytelling applications improved participants' episodic memory, leading to improved recall accuracy and vividness of memories. (Dingler et al., 2021)

In parallel, AR technology can create personalized memory cues or 'triggers' embedded in real-world contexts, eliciting episodic memories associated with specific locations or objects. These memory cues serve as retrieval stimuli, facilitating the recall of autobiographical memories and increasing the richness of episodic memory experiences (Sheldon et al., 2020).

In summary, it is observed that scientific studies regarding memory improvement through therapies that use augmented reality (AR) highlight the potential of AR technology to improve both spatial memory and episodic memory processes.

Let's now look at the role of AR in improving executive functions. Augmented reality has also sparked interest as a potential tool for improving executive functions, including planning, problem-solving, and decision-making. Research in this area has explored the efficacy of AR therapies in improving cognitive processes associated with executive function, showing a perspective of their potential as a cognitive enhancement technique.

As far as planning is concerned, activities involve the ability to set goals, develop strategies, and organize tasks to achieve desired outcomes. Interactive planning environments are created that engage users in goal-oriented behaviors and decision-making processes. They defend Han et. al (2021) that AR-based planning tools improve users' ability to create and execute plans in real-world contexts, leading to more efficient task completion and goal achievement. (Han et al., 2021)

Additionally, AR technologies can provide users with real-time feedback and visual representations of their plans, facilitating self-monitoring and adaptive planning strategies. This real-time *feedback* mechanism increases users' awareness of their planning process and allows them to

adjust their plans in response to changing circumstances or constraints (Geisen & Klatt, 2022; Liu et al., 2012).

As for problem solving, an activity that involves the ability to identify, analyze and implement solutions to complex problems, AR therapies have the advantage of designing immersive problem-solving environments that present users with challenges and interactive scenarios. AR-based problem-solving tasks improve participants' ability to generate creative solutions and overcome obstacles, promoting flexible thinking and innovation. (Alzahrani, 2020; Chang et al., 2013)

Regarding decision-making, the process involves evaluating alternatives in making choices based on available information and preferences, activities that use AR include decision-making simulations, placing users in realistic decision-making scenarios. Studies show that AR-based decision-making tasks can improve participants' ability to make informed decisions in situations of uncertainty, leading to more accurate and confident choices. (Guntur et al., 2020; Hoppenstedt et al., 2021)

It is now important to verify the effects of AR on spatial cognition and navigation skills.

Spatial cognition encompasses the mental processes involved in perceiving, understanding, and manipulating spatial information. AR therapies provide interactive spatial learning environments that engage users in space-oriented tasks, such as map reading, pathing, and spatial memory tasks. Some work has shown that AR-based spatial therapy sessions improved spatial reasoning and mental rotation skills in participants of various age groups, including the elderly, leading to improved spatial cognition performance. It has been observed that AR technologies can provide users with dynamic visualizations and interactive simulations of spatial concepts, facilitating active exploration and experimentation of spatial relationships. This interactive aspect of AR interventions promotes experiential learning and deepens users' understanding of spatial concepts and principles (Lee et al., 2016).

Regarding navigation capabilities, these involve the ability to navigate through physical environments and space-oriented tasks such as route planning, landmark recognition and orientation. AR therapies provide interactive navigational aids that overlay digital information onto real-world environments, showing users cues and guidance to enhance the experience. AR-based navigation systems have improved the efficiency and accuracy of users' navigation, allowing them to navigate unfamiliar environments with greater ease and confidence. (Fick et al., 2021)

It is therefore observed that AR technologies can improve users' spatial awareness by producing contextually relevant information and visualizations that facilitate spatial orientation and updating. Overlaying digital markers or clues on real-world imagery improves users' situational awareness and supports effective navigation strategies such as landmark-based navigation and route planning (Jiang & Subakti, 2023; Khan et al., 2022).

In summary, the different studies related to the cognitive functions used in AR therapy sessions provide valuable information about the potential of AR technology as a tool for cognitive improvement. Based on the perspectives of the referenced authors, there are several key points that highlight the various benefits of using AR for cognitive function:

— **Increased engagement and immersion**

AR interventions provide immersive and interactive experiences that engage users in cognitive tasks and activities, fostering active participation and engagement in spatial, memory, executive function, and attention processes.

— **Personalized learning and adaptation**

AR technologies provide personalized learning experiences tailored to individual cognitive needs and preferences, allowing for adaptive *feedback* and personalization based on users' cognitive profiles and learning goals.

— **Real-world contextualization**

AR activities contextualize cognitive tasks in real-world environments, providing users with more relevant learning experiences that bridge the gap between abstract concepts and practical applications.

— **Collaborative and social learning**

AR technologies facilitate collaborative and social learning experiences by allowing users to interact with virtual objects and collaborate with others in real time, fostering teamwork, communication, and collective problem-solving skills.

— **Transferability to real-world contexts**

AR interventions promote the transfer of cognitive skills and knowledge to real-world contexts, allowing users to apply the concepts and strategies learned in everyday life situations, such as orientation, decision-making, and problem-solving tasks.

Therefore, the integration of augmented reality (AR) activities into cognitive therapy and rehabilitation programs holds great promise for improving cognitive functions in diverse populations and contexts. In this way, by taking advantage of the interactive and immersive nature of AR technologies, researchers and practitioners can develop innovative therapies aimed at improving, inter alia, attention, memory, executive function, and spatial awareness.

COGNITIVE FUNCTIONS WORKED ON IN VIRTUAL REALITY INTERVENTIONS

Virtual Reality (VR) has emerged as a versatile tool for cognitive enhancement. Researchers have been delving into its potential to improve attention, memory, executive function, and spatial awareness through immersive and interactive therapies, such as AR.

In the field of neuropsychology, VR has emerged as a promising tool to improve attention control and concentration by creating immersive and interactive environments that engage users in tasks and activities that require attention.

Attention control refers to the ability to selectively assign cognitive resources to stimuli while inhibiting distractions and irrelevant information. Therapies that use VR allow for the creation of immersive, attention-training programs that lead users to challenge their ability to control in dynamic and realistic environments. To Freeman *et. al.* (2017) VR-based attention-grabbing tasks improved participants' ability to stay focused and resist distractions, leading to greater control of attention and concentration. Other authors, such as the team of Iriarte et. al. (2016), report that VR technologies allow simulating attention-demanding scenarios and environments that closely mimic real-world situations, creating opportunities for the user to practice and refine their attention control skills in ecologically valid contexts (Freeman et al., 2017) (Iriarte et al., 2016).

Concentration involves the sustained focus and mental effort required to maintain attention on a task or stimulus over time. VR platforms offer engaging and immersive concentration training exercises that challenge users' ability to maintain attention and resist mental fatigue. Several authors, among them Moulai et. al. (2024) demonstrated that VR-based concentration practice tasks improved participants' ability to maintain attention and maintain optimal performance levels during prolonged cognitive tasks, which led to improved concentration and task performance. We then see that VR technologies can dynamically adjust the difficulty and complexity of tasks based on users' performance and attention, through adaptive regimes that optimize concentration levels and cognitive engagement (Moulaei et al., 2024) (Ishibashi et al., 2023; Plancher et al., 2012).

Regarding the impact on memory, virtual reality (VR) has shown promise as a tool to improve memory retention and recall through immersive and interactive experiences that engage users in memory-related tasks and activities. Research in this area has sought to understand the effectiveness of VR therapies in improving various aspects of memory, showing a perspective of their potential as a cognitive improvement technique.

Memory retention involves the ability to store and maintain information over time. VR activities can feature immersive memory-encoding environments that engage multiple sensory modalities to enhance memory consolidation processes. The work of Riva *et. al.* (2012) demonstrated that VR-based memory encoding tasks improved participants' memory retention for spatial and episodic information, leading to an increase in recall accuracy and vividness of memories. (Riva et al., 2012)

In addition, VR technologies can provide contextual indicators and spatial contexts that facilitate memory encoding and retrieval processes by increasing the salience and accessibility of encoded memories (Maples-Keller et al., 2017).

In terms of memory retrieval, i.e. the ability to recall information stored in memory when needed, VR interventions make it possible to apply interactive memory retrieval exercises that challenge users' retrieval abilities in realistic and dynamic environments. In this field, the study carried out by Rose et. al. (2023) demonstrated that VR-based memory retrieval tasks improved participants' ability to retrieve autobiographical memories and factual information, leading to greater retrieval accuracy and temporal coherence. (Betts et al., 2023)

It should also be noted that, in this context, VR technologies can perform memory retrieval simulations that facilitate these processes, supporting the retrieval of associated memories and reinforcing memory traces (Freeman et al., 2017).

In the field of executive function, virtual reality (VR) therapies have been developed to work on areas such as cognitive flexibility, inhibition and working memory. These interventions offer immersive and interactive experiences that challenge users' executive function skills in dynamic and realistic environments. Research in this area has focused on the effectiveness of various aspects of executive function, offering a perspective of its potential as a cognitive enhancement technique.

In the field of cognitive flexibility, for example, which concerns the ability to adapt and switch between different tasks or mental sets, VR has made it possible to create programs to train cognitive flexibility that show users variable and unpredictable scenarios, requiring them to adjust their behavior and strategies accordingly. Studies have shown that VR-based tasks to practice cognitive flexibility improved participants' ability to switch between tasks and mental sets, leading to greater cognitive flexibility and adaptive behavior. (Ibrahim et al., 2016; Sadeghi et al., 2021)

In addition, other authors have been arguing that VR technologies can simulate complex and dynamic environments that challenge users' cognitive flexibility in realistic and ecologically valid scenarios, providing the transfer of the effects of simulations to real-world situations (Tortora et al., 2024; Zulueta et al., 2018).

With regard to inhibition (which involves the ability to suppress irrelevant or interfering stimuli and responses), VR therapies allow you to perform inhibition training exercises that challenge users' inhibitory control abilities in distracting and challenging environments. VR technologies can provide users with interactive (Manasse et al., 2023; Yu et al., 2023) *feedback* and reinforcement to strengthen inhibitory control processes, facilitating self-regulation and impulse control (Oei & Patterson, 2013; Oh et al., 2022).

In relation to working memory, i.e. memory related to the ability to retain and manipulate information in the mind for short periods, VR therapies allow the creation of training tasks that involve users in processes of encoding, maintenance and retrieval of memory in immersive environments. Studies have shown that VR-based working memory training tasks improved participants' working memory capacity and performance on working memory tasks, leading to

improved cognitive functioning and task performance. (Ansado et al., 2018; De Luca et al., 2023; He et al., 2022; H. Kim et al., 2022; Prats-Bisbe et al., 2024)

Other studies also report that VR technologies can provide users with adaptive and personalized working memory training environments that adjust the difficulty and complexity of tasks based on individual cognitive abilities and performance levels, optimizing practical outcomes. (Caglio et al., 2012)

Let's now look at the impact of VR therapies on spatial cognitive abilities. Therapies to train space navigation involve the acquisition and improvement of navigation skills, including route planning, landmark recognition, and spatial orientation. VR therapies allow you to create immersive navigation environments that simulate real-world scenarios and challenges, requiring users to navigate through landscapes and virtual environments. Serino et. al (2018) were able to demonstrate that VR-based spatial navigation training tasks improved participants' spatial orientation skills and navigation performance, leading to improved cognitive spatial abilities and navigation skills. (Serino et al., 2017)

In addition, VR technologies can provide users with interactive *feedback* and guidance to support navigation learning and skill development, facilitating spatial learning and memory consolidation processes (Coughlan et al., 2018).

Regarding the impact of therapies aimed at training cognitive spatial skills (which encompass a range of skills related to spatial perception, mind mapping and environmental awareness), VR has been demonstrating a high potential to improve cognitive spatial skills, creating conditions to improve spatial reasoning and navigation skills in realistic environments. Several authors argue that spatial navigation training based on the use of VR improved participants' cognitive spatial abilities, including mental rotation, spatial memory, and spatial reasoning, leading to better performance on spatial cognitive tasks and assessments. (Liao et al., 2019; Ren et al., 2024; Thapa et al., 2020b; Zhu et al., 2022)

Studies also report that VR technologies can provide users with multisensory feedback and spatial cues that improve spatial awareness and facilitate spatial learning processes, promoting the transfer of the effects of training to real-world navigation tasks. (D.-R. Kim et al., 2023; Park, 2022)

In summary, the approach and implementation of virtual reality (VR) tools for cognitive enhancement reveals great potential to improve various aspects of cognitive function, including attention, memory, executive function, and spatial awareness. We can then highlight the following added value:

— **Integration of *multi-sensory* feedback**

VR technologies provide users with multi-sensory feedback and immersive environments that engage multiple sensory modalities, improving the relevance and

realism of cognitive training tasks. By integrating visual, auditory, and tactile media, VR therapies provide enriched learning experiences that promote engagement and retention of cognitive skills.

— **Personalized and adaptive training**

VR activities can be tailored to individual cognitive needs and preferences through personalized, tailored training programs or therapies that adjust the difficulty and complexity of tasks based on users' performance and progress. This tailored approach optimizes outcomes and promotes the transfer of skills to real-world contexts, increasing the efficacy and relevance of these therapies.

— **Real-world application and transfer of training effects**

The realistic and ecologically valid nature of VR environments makes it easy to transfer the effects of training to real-world tasks and activities. By simulating everyday situations and challenges, VR activities prepare users for navigation, decision-making, and problem-solving tasks in the real world, making it easier to generalize and apply the skills learned in a variety of contexts.

While VR shows promise as a cognitive enhancement tool, more research is needed to explore its long-term effects and possible limitations. Future studies should explore optimal training protocols, dosage, and duration of VR sessions, as well as factors influencing individual differences in response to cognitive training. In addition, addressing the technical and usage challenges of VR technology can improve the accessibility and scalability of cognitive training programs.

In summary, the integration of virtual reality (VR) activities in cognitive training and rehabilitation shows great promise for improving cognitive function in diverse populations and contexts. By creating immersive and interactive training environments, therapies using VR provide innovative approaches to improving cognitive skills and promoting cognitive well-being, with implications for healthcare, especially for the senior population.

BENCHMARKING

In the field of cognitive rehabilitation and improvement, augmented reality (AR) and virtual reality (VR) have emerged as transformative technologies that offer unique avenues of intervention. A comparative analysis of their effects on cognitive functions, as seen in 3.1 and 3.2, reveals important information about their strengths and limitations, as highlighted below:

Effects on cognitive functions:

— **Attention**

VR activities often provide immersive, visually stimulating environments that can effectively capture and hold the attention of seniors.

AR activities, on the other hand, overlay digital information onto the real world, potentially improving selective attention by directing users' focus to relevant stimuli.

— **Memory**

VR technology can create vivid and immersive memory encoding and retrieval contexts, promoting memory consolidation and recall.

AR can facilitate memory encoding by creating contextual cues and spatial associations in real-world environments.

— **Executive Function**

VR experiences provide dynamic and interactive environments that challenge cognitive flexibility, inhibition, and working memory through immersive tasks and simulations.

AR experiences can provide real-time feedback and guidance, to support decision-making and problem-solving in real-world contexts, potentially improving executive function skills.

— **Spatial awareness**

VR sessions provide immersive spatial navigation training environments that challenge users' spatial cognition and navigation skills, while AR sessions overlay digital spatial cues on real-world environments, potentially improving spatial awareness and navigation in familiar environments.

Strengths and limitations:

— **Strengths of AR**

AR experiences integrate seamlessly into real-world environments, providing contextually relevant information and improving situational awareness.

AR technologies are often more affordable and easier to use, requiring minimal equipment and setup compared to VR systems.

— **Limitations of AR**

AR sessions may be limited by the availability and accuracy of real-world spatial data, which may affect the effectiveness of spatial augmentation.

AR technologies can struggle to create immersive and engaging experiences compared to VR, eventually limiting their effectiveness in certain cognitive training tasks.

— **Strengths of VR**

VR experiences allow for full control over the virtual environment, allowing for tailored and customizable training scenarios.

VR technologies can provide immersive and realistic simulations of complex scenarios and environments, promoting the transfer of the effects of training to real-world tasks.

— **Limitations of VR**

The use of VR may require specialized equipment and configuration, limiting accessibility and scalability, particularly for the elderly or individuals with mobility issues.

VR technologies can induce discomfort in some users, potentially impacting their engagement and adherence to training programs.

We can infer that both AR and VR sessions are unique opportunities for cognitive rehabilitation and improvement, with different advantages and challenges. By understanding this context, coaches and therapists can make more informed decisions about the selection and implementation of AR and VR technologies in cognitive training programs.

While augmented reality and virtual reality experiences have distinct advantages and challenges, their complementary nature foresees great opportunities for the future of cognitive rehabilitation and improvement. By harnessing the strengths of AR and VR technologies, researchers and practitioners can continue to innovate and improve cognitive training programmes in general, and in particular in the context of older people living in specialised units.

SUCCESSFUL CASE STUDIES AND PILOTS

In recent years, augmented reality (AR) and virtual reality (VR) technologies have emerged as promising tools to improve the well-being and quality of life of the elderly, as we have been demonstrating. From cognitive rehabilitation to the promotion of physical activity and social involvement, therapies with AR and VR are innovative solutions to respond to the diverse needs of a part of the senior population in the context of assisted care or senior residences.

In this chapter, we present an overview of successful case studies and pilot projects using AR and VR technologies in older adults, highlighting their applications, results, and implications for practice and research.

Through the observation of concrete projects, we obtain additional information, which we consider very relevant, about the transformative potential of AR and VR in promoting health, independence and better quality of life of the elderly.

Fig. 1 - Using Augmented Reality for Dementia Diagnostics and Therapeutics[6]

Source: Neelem Sheikh (2022)

The following is a summary of some of the projects consulted (which are already significant in number and focus on a wide variety of approaches):

— **Effectiveness of an Exercise Program for Older Adults Using an Augmented Reality Exercise Platform: A Pilot Study**[7]

Effectiveness of an Exercise Program for Older Adults Using an Augmented Reality Exercise Platform: A Pilot Study

Autores: Park, TS & Shin, MJ.

Main results: The results of this study confirmed changes in the physical and cognitive functions of elderly women who participated in an AR-based exercise program for 6 weeks. The exercise program was confirmed to be effective (even with the short intervention period of 6 weeks. In the future, more community-based exercise programs for older adults should be conducted, based on the AR exercise equipment used in this study. It is important to keep older adults living in the community interested in participating in exercise programs to manage their health.

— **Effect of virtual reality exercises on balance and fall in elderly people with fall risk: a randomized controlled trial**[8]

Effect of Virtual Reality Exercises on Balance and Falls in Older Adults at Risk of Falling: A Randomized Controlled Trial

Authors: Zahedian-Nasab, N., Jaberi, A., Shirazi, F., & Kavousipor, S.

[6] Source: https://altoida.com/blog/using-augmented-reality-for-dementia-diagnostics-and-therapeutics/

[7] Bibliografia: Park TS, Shin MJ. Effectiveness of an Exercise Program for Older Adults Using an Augmented Reality Exercise Platform: A Pilot Study. Ann Geriatr Med Res. 2023 Mar; 27(1):73-79. doi: 10.4235/agmr.23.0016. Epub 2023 Mar 22. PMID: 36945873; PMCID: PMC10073971.

[8] Bibliografia: Zahedian-Nasab, N., Jaberi, A., Shirazi, F., & Kavousipor, S. (2021). Effect of virtual reality exercises on balance and fall in elderly people with fall risk: a randomized controlled trial. BMC geriatrics, 21(1), 509. https://doi.org/10.1186/s12877-021-02462-w.

Main results: According to research findings, 6 weeks of balance exercises with VR can improve balance and fear of falling among seniors living in nursing homes.

— **The Effect of Reminiscence Therapy Using Virtual Reality on Apathy in Residential Aged Care: Multisite Nonrandomized Controlled Trial**[9]

The Effect of Reminiscence Therapy Using Virtual Reality on Apathy in Residential Care for the Elderly: Multi-Site Non-Randomized Controlled Trial

Authors: Saredakis D, Keage HA, Corlis M, Ghezzi ES, Loffler H, Loetscher T.

Main results: Although no statistically significant difference was found between the VR group and the active control group, the study demonstrates that VR can be implemented in an elderly care setting using correct protocols and that residents in elderly care facilities enjoy the recall process. The use of VR allows access to a wide range of content, which is always increasing, and aged care facilities may be able to use VR in other contexts, for example in lifestyle activities, music or travel.

— **NavMarkAR: A Landmark-based Augmented Reality (AR) Wayfinding System for Enhancing Spatial Learning of Older Adults**[10]

NavMarkAR: A landmark-based Augmented Reality (AR) guidance system to improve spatial learning for older adults

Autores: Qiu, Z., Ashour, M., Zhou, X., & Kalantari, S.

Main results: The results of the study made three major contributions to this domain. Firstly, they demonstrated that multimodal navigation guidance in AR can be highly effective in helping older adults reach their destination; secondly, the landmark-based design was effective in helping them acquire allocentric knowledge in indoor environments; finally, surveys and interviews revealed important information about the perspectives and needs of older people in the context of using the system, leading to a set of specific *design* recommendations for AR navigation tools.

— **Immersive Virtual Reality-Based Cognitive Intervention for the Improvement of Cognitive Function, Depression, and Perceived Stress in Older Adults With Mild Cognitive Impairment and Mild Dementia: Pilot Pre-Post Study**[11]

[9] Bibliografia: Saredakis D, Keage HA, Corlis M, Ghezzi ES, Loffler H, Loetscher T., The Effect of Reminiscence Therapy Using Virtual Reality on Apathy in Residential Aged Care: Multisite Nonrandomized Controlled Trial J Med Internet Res 2021; 23(9):e29210, doi: 10.2196/29210

[10] Bibliografia: Qiu, Z., Ashour, M., Zhou, X., & Kalantari, S. (2023). NavMarkAR: A Landmark-based Augmented Reality (AR) Wayfinding System for Enhancing Spatial Learning of Older Adults. ArXiv, abs/2311.12220.

[11] Bibliografia: Zhu, K., Zhang, Q., He, B., Huang, M., Lin, R., & Li, H. (2022). Immersive Virtual Reality-Based Cognitive Intervention for the Improvement of Cognitive Function, Depression, and Perceived Stress in Older Adults With Mild Cognitive Impairment and Mild Dementia: Pilot Pre-Post Study. JMIR serious games, 10(1), e32117. https://doi.org/10.2196/32117.

Virtual Reality-Based Immersive Cognitive Intervention for the Improvement of Cognitive Function, Depression and Perceived Stress in Older Adults with Mild Cognitive Impairment and Mild Dementia: Pilot Study.

Autores: Zhu, K., Zhang, Q., He, B., Huang, M., Lin, R., & Li, H.

Main results: The use of the CVSM system may be effective in improving the cognitive function of patients with MCI and DM, including general cognitive function, memory, executive function, and attention. IVR technology enriches cognitive intervention approaches and provides acceptable, professional, personalized, and engaging cognitive training for older adults with cognitive impairment.

— **Impact of Virtual Reality–Based Group Activities on Activity Level and Well-Being Among Older Adults in Nursing Homes: Longitudinal Exploratory Study**[12]

Impact of Virtual Reality-Based Group Activities on the Level of Activity and Well-Being of Older Adults in Nursing Homes: Longitudinal Exploratory Study.

Autores: Li Y, Wilke C, Shiyanov I, Muschalla B.

Main results: This study presents a new and original perspective, producing new knowledge about the use of VR in nursing homes. The use of VR has been well accepted and has fulfilled the goal of increasing capacity and well-being. It can be a very important group activity, for seniors in senior residence units, to improve group social interaction. To obtain more solid evidence, randomized controlled trials are needed.

— **Fully Immersive Virtual Reality Using 360° Videos to Manage Well-Being in Older Adults: A Scoping Review**[13]

Fully Immersive Virtual Reality Using 360° Videos to Manage Well-Being in the Elderly: An Overall Review

Authors: J. Restout, I. Bernache-Assollant, C. Morizio, A. Boujut, L. Angelini, A. Tchalla, A. Perrochon,

Main results: The use of 360° VR videos seems feasible in older adults living in the community or in residential elderly care facilities, as they are safe and provide enjoyment. It is an emerging and promising therapeutic tool for managing psychosocial disorders. This review gathered key considerations for the design and implementation of interventions using 360° VR videos in clinical practice.

[12] Bibliografia: Li Y, Wilke C, Shiyanov I, Muschalla B, Impact of Virtual Reality–Based Group Activities on Activity Level and Well-Being Among Older Adults in Nursing Homes: Longitudinal Exploratory Study. JMIR Serious Games 2024; 12:e50796. doi: 10.2196/50796

[13] Bibliografia: J. Restout, I. Bernache-Assollant, C. Morizio, A. Boujut, L. Angelini, A. Tchalla, A. Perrochon, (2023)Fully Immersive Virtual Reality Using 360° Videos to Manage Well-Being in Older Adults: A Scoping Review, Journal of the American Medical Directors Association, Volume 24, Issue 4, Pages 564-572, https://doi.org/10.1016/j.jamda.2022.12.026.

— **Using a Nature-Based Virtual Reality Environment for Improving Mood States and Cognitive Engagement in Older Adults: A Mixed-Method Feasibility Study**[14]

Using a Nature-Based Virtual Reality Environment to Improve Mood States and Cognitive Impairment in the Elderly: A Mixed-Method Feasibility Study

Autors: Saleh Kalantri, Tong Bill Su, Armin Mostafawi, Angela Lee, Ruth Barankevich, Walter Ro Boot, Sarah J. Cizza

Main results: The results indicated significant improvements in the "good mood" and "calm" dimensions after exposure to VR, as well as improvements in attitudes towards technology. Positive outcomes were significantly higher for participants with physical disabilities, compared to those without disabilities. The *feedback* interviews provided a variety of useful suggestions on ways to improve the *design* and content of VR equipment, to meet the needs of an older population.

— **Using Virtual Reality for Cognitive Training of the Elderly**[15]

Use of virtual reality for cognitive training of the elderly

Authors: García-Betances RI, Jiménez-Mixco V, Arredondo MT, Cabrera-Umpiérrez MF.

Main results: Cognitive training systems based on virtual reality are able to achieve the expected goals in people affected by age-related cognitive impairments. They support procedures for alleviating the behavioural and psychological symptoms of patients with early-stage MCI and AD to better meet the specific rehabilitation needs of these patients, as well as the requirements for caregivers to conduct sessions. In addition to the general relevance of contributions to the current state of the art on cognitive training, a feature that is evident in the implementation of VR CT training systems is the reliance on intense multidisciplinary collaboration during the innovation and design phases of the system, as well as the high level of patient involvement. medical researchers, technical experts and caregivers.

— **A Review of Extended Reality Exercise Games for Elderly** [16]

A Review of Extended Reality Exercise Games for Seniors

[14] Bibliografia: Saleh Kalantari, Tong Bill Xu, Armin Mostafavi, Angella Lee, Ruth Barankevich, Walter R Boot, Sara J Czaja, Using a Nature-Based Virtual Reality Environment for Improving Mood States and Cognitive Engagement in Older Adults: A Mixed-Method Feasibility Study, Innovation in Aging, Volume 6, Issue 3, 2022, igac015, https://doi.org/10.1093/geroni/igac015

[15] Bibliografia: García-Betances RI, Jiménez-Mixco V, Arredondo MT, Cabrera-Umpiérrez MF. (2015) Using Virtual Reality for Cognitive Training of the Elderly. American Journal of Alzheimer's Disease & Other Dementias®.; 30(1):49-54. doi:10.1177/1533317514545866

[16] Bibliografia: Fu, Y.; Hu, Y.; Sundstedt, V. and Forsell, Y. (2022). A Review of Extended Reality Exercise Games for Elderly. In Proceedings of the 15th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2022) - HEALTHINF; ISBN 978-989-758-552-4; ISSN 2184-4305, SciTePress, pages 201-210. DOI: 10.5220/0010907800003123

Autores: Fu, Y.; Hu, Y.; Sundstedt, V. and Forsell, Y.

Main results: The positive effect of these games was common in the research results. Even if there are issues, such as simulator sickness, security risks, device issues, and cost, there are still opportunities and room for research and development in the future. The overall positive attitude towards XR exercise games for seniors can be seen by researchers as well as developers and users. However, these gaming apps also have some issues and future improvements are needed. The analysis presented is beneficial for researchers and developers to develop or improve future XR applications by learning from existing work.

— **Cognitive training on stroke patients via virtual reality-based serious games**[17]

Cognitive training in stroke patients through virtual reality-based games

Authors: Pedro Gamito, Jorge Oliveira, Carla Coelho, Diogo Morais, Paulo Lopes, José Pacheco, Rodrigo Brito, Fábio Soares, Nuno Santos, and Ana Filipa Barata

Main results: The overall results point to the need for more support for the use of VR cognitive training applications in neuropsychological rehabilitation.

— **PTSD Elderly War Veterans: A Clinical Controlled Pilot Study**[18]

PTSD in Elderly War Veterans: A Controlled Clinical Pilot Study

Authors: Pedro Gamito, Jorge Oliveira, Pedro Rosa, Diogo Morais, Nuno Duarte, Susana Oliveira, and Tomaz Saraiva.

Main results: Patients enrolled in the VG group showed a statistically reduced reduction in disorders associated with PTSD, such as depression and anxiety. Far from conclusive, this pilot study nevertheless presents some promising data on the use of VR in veteran populations.

— **Relaxing in virtual reality: one synthetic agent relaxes all**[19]

Relaxation in Virtual Reality: A Synthetic Agent Relaxes Everyone

Authors: Pedro Gamito, Teresa Souto, Ana Rita Conde, Ágata Salvador, Maria José Ferreira, João Alves de Sousa, Marco Ferreira, Fábio Dias, Shivani Atul, Rita Pereira, Edna Távora, Inês Maia, Jorge Oliveira.

Main results: The results suggest that the presence of an unfamiliar humanoid character was not perceived as a dissonant element in the environment and did not negatively influence the outcome of relaxation. This study lays the groundwork for future studies

[17] Bibliografia: Gamito et. al. (2015). Cognitive training on stroke patients via virtual reality-based serious games. Disabil Rehabil, Early Online: 1-4.
[18] Bibliografia: Gamito et. al. (2010). PTSD Elderly War Veterans: A Clinical Controlled Pilot Study. Cyberpsychology, Behavior, and Social Networking, Volume 13, Number 1, 43-48.
[19] Bibliografia: Gamito et. al. (2010). PTSD Elderly War Veterans: A Clinical Controlled Pilot Study. Cyberpsychology, Behavior, and Social Networking, Volume 13, Number 1, 43-48.

that can present insight into the optimal characteristics of a SyA, contributing to the development of accessible and beneficial digital applications for a wide range of individuals in clinical and non-clinical settings.

— **Virtual Reality-Based Cognitive Stimulation on People with Mild to Moderate Dementia due to Alzheimer's Disease: A Pilot Randomized Controlled Trial**[20]

Virtual Reality-Based Cognitive Stimulation in People With Mild to Moderate Dementia Due to Alzheimer's Disease: A Pilot Randomized Controlled Trial

Authors: Jorge Oliveira, Pedro Gamito, Teresa Souto, Rita Conde, Maria Ferreira, Tatiana Corotnean, Adriano Fernandes, Henrique Silva and Teresa Neto

Main results: Preliminary results suggest an improvement in global cognitive function in the experimental group, with an effect size corresponding to a large effect on global cognition, which suggests that this approach is effective for neurocognitive stimulation in older adults with dementia, contributing to the maintenance of cognitive function in AD.

These successful studies and pilots highlight the transformative potential of augmented reality (AR) and virtual reality (VR) technologies in improving the well-being and quality of life of older adults in residential care settings. From cognitive rehabilitation and the promotion of physical activity to social engagement and emotional well-being, AR and VR technology has made it possible to create versatile solutions to meet the diverse needs of the elderly, with the aim of creating greater independence, autonomy and a better quality of life.

Projects implemented in the real world demonstrate the feasibility, acceptability, and effectiveness of AR and VR technologies in supporting various aspects of senior living[21], from everyday activities to specialized sessions targeted at specific health conditions.

The positive results observed in different studies highlight the importance of personalized, person-centred approaches to AR and VR exercises, taking into account the unique preferences, abilities and goals of older adults.

In terms of future prospects, we believe that this is an area of research in full development, and that it will be possible to harness much of the potential of AR and VR technologies in elderly care settings. This includes developing new applications, refining intervention protocols, and addressing technical and usage challenges to improve accessibility and scalability. Similarly, we advocate that collaboration between researchers, practitioners, industry stakeholders and older adults themselves, are essential to co-create and implement AR and VR solutions that truly meet the needs and aspirations of older adults living in residential care facilities.

[20] Bibliografia: Oliveira et. al. (2010). Virtual Reality-Based Cognitive Stimulation on People with Mild to Moderate Dementia due to Alzheimer's Disease: A Pilot Randomized Controlled Trial. Int. J. Environ. Res. Public Health 2021, 18, 5290. https://doi.org/10.3390/ijerph18105290.

[21] See Annex 1.

In our view, the successful case studies and pilot projects highlighted at this point serve as inspiring examples of how AR and VR technologies can empower older people to live fulfilling and meaningful lives, particularly in a senior housing setting. By embracing innovation and leveraging the implementation of solutions with AR and VR, we can continue to advance the field of aged care and promote health, well-being, and dignity for all older adults.

MAIN CHALLENGES FOR IMPLEMENTATION

To complete this study, it is important to understand the main challenges currently faced in the implementation of AR and VR technologies in the elderly population.

Augmented reality (AR) and virtual reality (VR) technologies hold immense promise for improving various aspects of elderly care, from cognitive rehabilitation to social engagement and the promotion of physical activity, as demonstrated in the literature consulted. However, the successful implementation of AR and VR therapies in the elderly faces several challenges. In this chapter, we list some of the main obstacles and considerations that hinder the widespread adoption and use of AR and VR technologies among older adults:

— **Device rejection**

One of the main challenges to the implementation of AR and VR technologies in elderly care is the potential resistance or rejection of these devices. Seniors may perceive AR and VR devices as unfamiliar or intimidating, leading to a reluctance to use them (Czaja et al., 2018) . Concerns about complexity, use, and discomfort may further contribute to device rejection among older adults, impacting the efficacy and acceptance of AR and VR interventions (Creed et al., 2023).

— **Health Issues**

Health problems, including visual impairments, vestibular disorders, and motion sickness, may pose significant barriers to the use of AR and VR technologies in the elderly population. Visual impairments, such as reduced acuity and contrast sensitivity, can affect the ability of older adults to perceive and interact effectively with AR and VR content. Similarly, vestibular disorders and motion sickness can exacerbate discomfort and disorientation when using VR headsets, limiting the feasibility and acceptance of VR sessions (Bennett et al., 2019) (Doré et al., 2023).

— **Technical Challenges**

Technical challenges related to hardware limitations, software compatibility, and connectivity issues can hinder the implementation of AR and VR technologies in aged care settings. Older adults may encounter difficulties in setting up and calibrating AR and VR devices, requiring additional support and assistance from caregivers or technical staff

In addition, compatibility issues between AR and VR platforms, applications, and operating systems can hinder seamless integration and interoperability, complicating the implementation of AR and VR interventions (Torous et al., 2019). (Nazar & Subash, 2024; Tusher et al., 2024).

— **Cost and accessibility**

Cost considerations and accessibility barriers pose important challenges to the implementation of AR and VR technologies in aged care facilities. The high cost of AR and VR devices, software licenses, and technical support services can limit their accessibility and availability, especially for smaller or resource-poor organizations (Chirico et al., 2023) . On the other hand, accessibility concerns related to physical disabilities, cognitive impairments, and language barriers may further restrict older adults' access to AR and VR therapies, exacerbating disparities in technology adoption and health outcomes (Hung et al., 2023).

— **Ethical issues**

Ethical considerations surrounding the use of AR and VR technologies in elder care should also be addressed. These considerations include issues related to privacy, data security, informed consent, and potential unintended psychological effects or manipulation. Careful attention should be paid to ensure that the use of AR and VR follows ethical principles, respects the autonomy and dignity of older adults, and prioritizes their well-being (Creed et al., 2023b; Parsons, 2021; Zhou et al., 2023).

Another fundamental aspect is related to health issues beyond those described above. Several health problems, such as vestibular disorders and motion sickness, may represent important barriers to the use of AR and VR technologies among the senior population. These and other medical conditions can affect the feasibility, safety, and efficacy of AR and VR therapies, requiring careful consideration and adaptation of technology-based solutions. Among the most relevant physical conditions, we highlight: epilepsy and migraines, heart disease and other similar diseases and conditions. (Doré et al., 2023; Wang et al., 2023)

People with epilepsy or migraines may be sensitive to certain visual stimuli, such as flashing lights or rapid movements, which can trigger seizures or headaches. Therefore, AR and VR content should avoid elements that may cause adverse reactions in susceptible individuals. Individuals with epilepsy should also be closely monitored during VR experiences to ensure their safety and well-being. (Brinciotti et al., 2021; D'Agnano et al., 2023; Fisher et al., 2022; Gray et al., 2023)

On the other hand, seniors with heart conditions, such as arrhythmias or cardiovascular disease, may be at risk of experiencing adverse cardiovascular events during immersive VR experiences. Prolonged exposure to VR environments with intense physical activity or emotional

stress can exacerbate underlying heart problems and should be avoided or carefully monitored (Bouraghi et al., 2023; Micheluzzi et al., 2024; Szczepańska-Gieracha et al., 2021) . Hence, healthcare professionals should assess the cardiac health of older adults before recommending VR interventions and providing appropriate guidance and supervision.

Cognitive impairments, such as dementia or Alzheimer's disease, can affect users' ability to navigate AR and VR interfaces or understand complex instructions (Cushman et al., 2008; Matsangidou et al., 2023; Wenk et al., 2023) . Interventions and adaptations should be made according to the specific needs and challenges of individuals with these disabilities. Hence, despite the immense potential of AR and VR technologies in aged care, several challenges must be addressed to facilitate their successful implementation and widespread adoption. By understanding and addressing issues related to device rejection, health considerations, technical challenges, and cost and accessibility barriers, investigators, practitioners, and policymakers, can work together to overcome these obstacles and harness the transformative power of AR and VR technologies. (Babalola et al., 2023; Creed et al., 2023a; Hung et al., 2023)

FINAL THOUGHTS

From the literature consulted, we can infer that the integration of Augmented Reality (AR) and Virtual Reality (VR) technologies in the context of senior care holds great promise for improving the well-being and quality of life of the elderly.

Regarding the benefits of AR and VR, the use of these technologies allows the development of innovative solutions to work on various aspects of elderly care, including cognitive rehabilitation, the promotion of physical activity, social engagement and emotional well-being. These technologies have been shown to be effective in improving cognitive function, reducing incidents of falls, improving social interaction, and promoting relaxation among the elderly.

Through the successful case studies and pilot projects, it was possible to highlight several key ideas about the potential benefits and considerations of AR and VR exercises in elderly care.

From the point of view of challenges, it is observed that despite the benefits evidenced, the implementation of AR and VR technologies faces several obstacles, such as device rejection, health problems, technical challenges, and cost and accessibility barriers. Resolving these obstacles, especially those external to the elderly, is crucial to ensure the successful adoption and use of AR and VR sessions in an aged care setting.

From our point of view, another very relevant aspect in this context is the future trends of Extended or Extended Reality (XR) for elderly patients. This field, which as we have seen, encompasses AR, VR and mixed reality (MR), is poised to advance further into the field of elderly care. Future trends in XR for elderly patients may include:

- **Personalized workouts:** Using advanced data analytics and machine learning algorithms to tailor AR and VR sessions to individual preferences, abilities, and health needs.
- **Immersive experiences:** Improving the realism and engagement of AR and VR experiences through the development of immersive technologies such as haptic feedback, spatial audio, and 'photorealistic' graphics.
- **Remote monitoring and telehealth**: Integration of AR and VR technologies into telehealth platforms to enable remote monitoring, assessment, and care for elderly patients in their homes or residential care facilities.
- **Therapeutic applications:** Development of novel therapeutic applications of AR and VR in elderly care, including pain management, stress reduction, reminiscence therapy, and mindfulness training.
- **Social Relationships:** Leverage AR and VR to facilitate social relationships and community engagement among isolated or homebound older adults through virtual socialization, group activities, and shared experiences.

At the same time, it is expected that future studies will focus on investigating the long-term effects and sustainability of AR and VR therapies on health outcomes and quality of life of older adults, such as understanding the mechanisms underlying the therapeutic benefits of AR and VR technologies, including neurobiological, psychological, and social factors; address disparities in access to and uptake of AR and VR therapies among diverse older adult populations, including those with physical disabilities, cognitive impairments, and socioeconomic disadvantages; develop evidence-based guidelines and best practices for the design, implementation, and evaluation of AR and VR exercises in aged care settings.

At the same time, the successful implementation of extended reality therapies in elderly care requires the expertise of appropriately trained therapists who can tailor interventions to the needs and cognitive abilities of each patient, collaborating closely with neurologists to ensure alignment between clinical goals and neurological considerations.

Finally, it should be noted that this state-of-the-art study and literature review was carried out in the context of a proposal for the implementation of the initiative 'MindScape – Augmented Reality and Virtual Reality Project' in a senior residence located in the city of Porto, Portugal. The main objective of the initiative is to harness the power of augmented reality and virtual reality technology to improve the cognitive well-being of hospitalized seniors. After the pilot test, to be carried out in the second half of 2024, it is intended to extend the experience to other Portuguese senior residences, through the implementation of properly structured and monitored programs. The pilot project of the 'MindScape' initiative will have the collaboration of psychologists, therapists and university students on *a pro bono basis,* and with the financial sponsorship of the Positive Life Association. In the

future, an application will be submitted for funds made available by the European Union, within the scope of *Digital Health* or Social Economy programs, which will allow the project to be scaled in order to replicate it in as many Portuguese senior institutions as possible.

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Family-centered nursing care in the neonatal intensive care unit

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ABSTRACT

Family-centered nursing care in the Neonatal Intensive Care Unit is a holistic approach that recognizes the importance of the family in the care and development of the newborn and involves them as an integral part of the healthcare team, valuing their needs, concerns and experiences during the newborn's hospitalization. The aim of this study was to discuss family-centered nursing care in the Neonatal Intensive Care Unit. This is an integrative review and its guiding question was: "What is family-centered nursing care in the Neonatal Intensive Care Unit?". The databases used were BDENF, MEDLINE and PUBMED. The study sample consisted of nine original articles. To extract the data, the type of study and the year of publication were analyzed. The results were presented and discussed in terms of the nurse's role and the importance of humanization in interventions and the family's participation and perception of nursing care. It was concluded that family-centered nursing care in the Neonatal Intensive Care Unit aims to promote a humanized and integrated approach to caring for the newborn and the family, valuing the partnership and collaboration between the health team and the parents, contributing to the healthy development, well-being and recovery of the newborn, as well as strengthening family ties and emotional support for the parents during their stay in the Neonatal Intensive Care Unit.

Keywords: Nursing care, Family, Neonatal Intensive Care Unit, Humanization of Assistance.

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INTRODUCTION

The Neonatal Intensive Care Unit (NICU) is responsible for the comprehensive care of the newborn, through continuous care by the multidisciplinary team during their stay. It also requires good practices, considering not only the immediate needs and care of newborns, but also their unstable health condition and dependence on different types of existing technology, which often hinders a more humanized interaction between the health professional and the newborn (Duarte *et al.,* 2020).

According to Gaíva and Scochi (2020), hospitalization in the NICU is a very delicate period for the family, especially for the mother. It is a frightening and unexpected environment that affects the family, so it is very important to welcome the parents to reduce physical and emotional suffering during this period of hospitalization of the newborn. In some cases, the admission of a newborn to a neonatal intensive care unit does not mean that he suffers from a disease, he simply needs to mature to swallow, breathe and suck on his own and needs to be cared for for some time until he can perform these activities properly (Moreira; Bomfim, 2023).

It is important to mention that the nursing team has a fundamental role in welcoming families in this situation, following a complementary model of health care and some assumptions that need to be considered in its application: dignity and respect (health professionals respect the choices, values and beliefs of the patient and family); information sharing (professionals communicate and share information in a complete and impartial manner with patients and patients). family); active participation (patients and families are encouraged and supported to participate in decision-making); and collaboration (patients and families are included and recognized as the institution's support base (Rodrigues *et al.*, 2019).

Reichert, Lins, and Collet (2021) exemplify that the humanization process of the neonatal intensive care unit aims to provide care to critically ill patients, combining technology and welcoming. Therefore, it involves a series of initiatives aimed at reducing the negative effects of hospitalization. These actions can be carried out through contact, knowledge, touch and affection, as well as care and interaction with the family that accompanies the hospitalization process on a daily basis. Humanization should be individualized, according to the needs of each patient and family.

Thus, family-centered nursing care in the NICU aims to promote a collaborative partnership between the health team and family members, recognizing the vital role of parents in the care and recovery of the newborn. By empowering the family, providing emotional support, and facilitating open communication, healthcare providers can help create a caring environment that promotes the well-being of both the infant and his or her family (Tosca; Rimolo; Breigeiron, 2020).

Therefore, considering that in situations of hospitalization of the newborn in the NICU, nursing care should involve the patient and the family, this integrative review study was carried out to discuss family-centered nursing care in the Neonatal Intensive Care Unit.

METHODS

This is an Integrative Literature Review study, carried out by means of a bibliographic survey, since it allows the detailed analysis of several studies in the literature and the correlation with clinical practice (Souza; Silva; Carvalho, 2010). Mendes *et al.* (2008) reports that in recent years, this research method has the potential to help in nursing knowledge and has been widely used in the health area.

For the construction of this research, the PICo strategy was used, where the P - population: Newborn and their families; I - Interest: Family-centered nursing care; Co - Neonatal Intensive Care Unit. Thus, the guiding question was: "What is the family-centered nursing care in the Neonatal Intensive Care Unit?".

The databases used were: Nursing Databases (BDENF), Online System for Search and Analysis of Medical Literature (MEDLINE), (PUBMED) and Latin American and Caribbean Health Sciences Literature (LILACS).

The search strategy was structured based on the Health Sciences Descriptors (DeCS) and Keywords: "Neonatal Intensive Care Unit". "Patient-Centered Care", "Newborn", "Newborn Intensive Care", "Nursing Care", "Family Care", using the Boolean operators AND and OR.

The following inclusion criteria were used: full articles in the Portuguese language, published between 2019 and 2023. The exclusion criteria were: dissertations and theses, duplicate articles, public notices, incomplete articles, and articles that were not the main focus of the theme.

Regarding data collection and organization, the title and abstract of each article were read to verify the theme and eligibility, and the articles that did not answer the research question were removed. Then, the remaining articles were read in full in order to obtain the articles included in this review.

After the selection of the material, an exploratory reading of the scientific articles was carried out in order to verify which contents of the consulted works are related to the research. Then, the analytical reading of these articles was carried out, in order to order and summarize the data contained in the sources, seeking to obtain answers to the research problem.

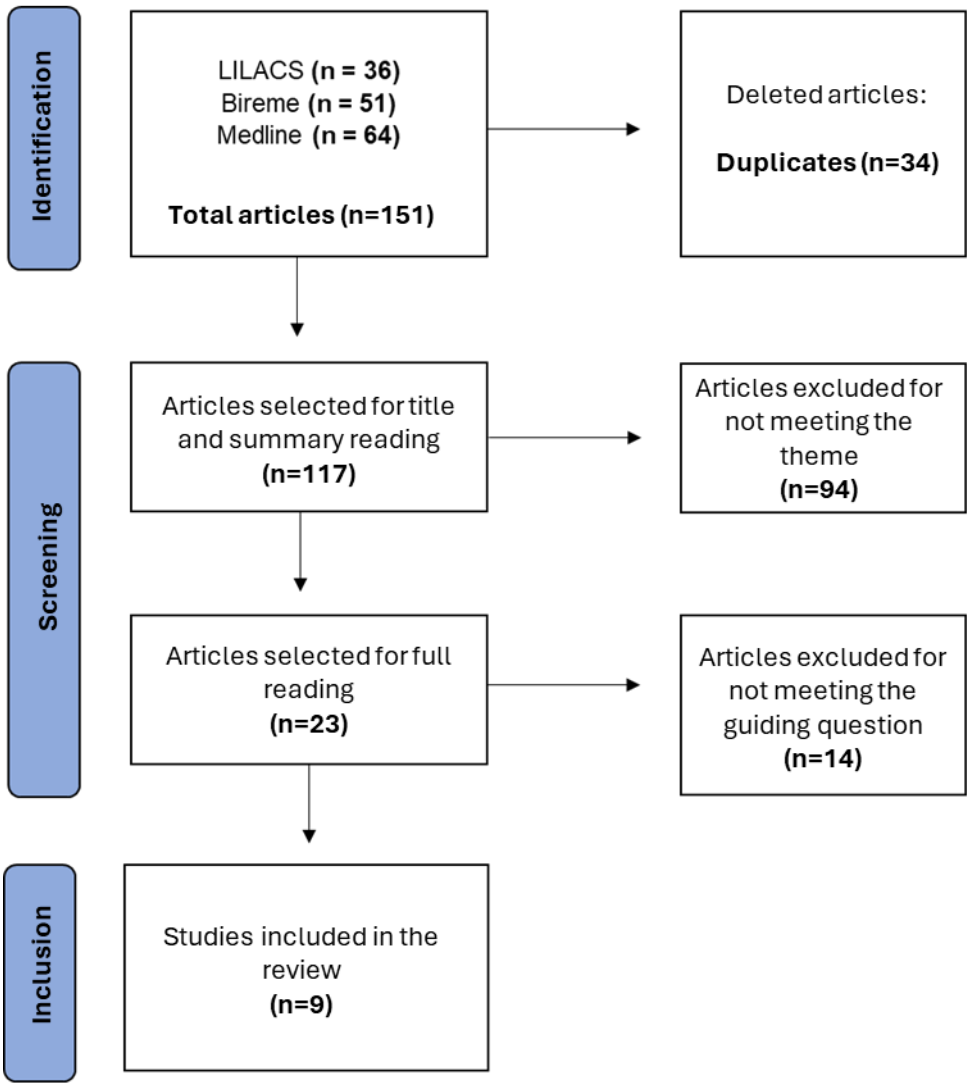
Interpretative reading was performed in order to give the greatest meaning to the results achieved with the analytical reading. Therefore, the analysis was performed by linking the results with knowledge originating from evidence-based theories and empirical research.

The data were presented using the flowchart PRISMA (2020) (Moher, 2020) (Chart 1) and the table with data: author/year, objective, method, main results reported/observed (Chart 2).

RESULTS

A total of 151 search results were found. After the identification and screening stages, 9 articles were selected that were directly related to the theme and objective of the research. To conduct this process, the PRISMA flowchart was used, as follows:

Table 1: Identification, screening and inclusion process adapted from PRISMA 2020.



Source: Authored by the authors, 2020.

Based on the analysis of the articles included after verification by the PRISMA method, they were grouped in a summary table, organized by the following topics: author/year, objective, method, main results observed/reported, as shown in the following table:

Chart 2: Organization of data from the included articles according to: author/year, objective, method, main results reported/observed

AUTHOR/YEAR	OBJECTIVE	METHOD	MAIN RESULTS OBSERVED/REPORTED
Leite *et al.,* (2020).	To understand the humanization of nursing care in the neonatal intensive care unit of a private hospital in Mato Grosso	This is a descriptive, exploratory and qualitative study.	The professionals demonstrated an in-depth knowledge of humanization, understanding it as an experiential process acquired through clinical practice from an emotional perspective and from the point of view of nursing science itself. The importance of this practice in neonatal care was emphasized, and humanized care should be extended to the family of hospitalized patients.
Santos *et al.*, (2020).	To understand the experience of the father and the extended family during the hospitalization of the premature newborn in the Neonatal Intensive Care Unit.	Qualitative, descriptive and exploratory research	This experience was characterized by significant changes in the domains of family functioning, taking into account cognitive, affective and behavioral aspects, indicating the need for care that deliberately involves the family in the context studied, as well as the implementation and monitoring of the recommended approach in newborn- and family-centered care.
Coast; Sanfelice; Carmona, (2019).	To identify the perception of the nursing team about the humanization of the care provided in a Neonatal Intensive Care Unit	Qualitative, descriptive, exploratory study	The humanized interventions used in neonatal intensive care units are easy to understand, do not require expensive equipment or special technical training, and offer very significant benefits for newborns and their development.
Sousa *et al,* (2019).	To identify which nursing interventions are performed in a Neonatal Intensive Care Unit that promote the strengthening of the bond between the family and the premature newborn	Qualitative, descriptive study	It found that the most commonly used interventions to increase bonding between preterm infants and their families were: parents' free access to the neonatal intensive care unit; diaper changing; introduction of complementary foods; use of music and books to soothe newborns; and the kangaroo method.
Soares *et al.*, (2019).	To understand the family's perception of embracement in the context of neonatal nursing care, before and after the implementation of a welcoming protocol.	Intervention study, descriptive.	Transversality of nursing care; first contact with the context of newborn care; sharing of information and professional knowledge; shared responsibility for care based on the role of parents; support to the family at hospital discharge.
Klock *et al.,* (2019).	To construct a theoretical matrix of the system/organization of Nursing care in a Neonatal Intensive Care based on the meanings attributed by the professionals of the Nursing Team and other actors involved in the relationships and	Qualitative study	The organization of nursing care in the NICU is complex, dynamic, interactive, and interdependent with other care systems, mobilized by the process of care management/management of good care practices, allowing newborns and their families to receive care that takes into account the vulnerability and uncertainty of life/survival in unique life circumstances. Nurses play a key role in formulating

	interactions of care in dealing with the fragility of living/surviving of the neonate.		relationships/interactions in the organization and in daily care.
Nascimento *et al.*, (2019).	OBJECTIVE: To analyze the care practices of family members of preterm infants hospitalized in a Neonatal Intensive Care Unit in the light of Leininger's cross-cultural theory.	Qualitative, descriptive and exploratory study	Family involvement in newborn care is still fragile, but it should be an integral part of culturally adapted care that promotes the full recovery of premature babies.
Arruda *et al.,* (2019)	To know the reactions and feelings of the family in the face of the hospitalization of the newborn in the Neonatal Intensive Care Unit	Qualitative research	Professionals working in neonatal units should implement support strategies to help families care for and cope with their newborns in this sector.
Fróes *et al.*, (2019)	To assess the stress level of mothers of preterm newborns with gestational age ≤34 weeks, admitted to neonatal intensive care .	Cross-sectional study.	All items in the Parenting Role Change subscale of the Parenting Stress Scale: The Neonatal Intensive Care Unit was identified as one of the main sources of maternal stress. It is suggested that research using other methodologies should be carried out to increase knowledge about maternal stress in the national context and to apply care interventions that also involve fathers.

Source: Authored by the authors, 2024.

DISCUSSION

The humanization of the family-centered nursing team in the Neonatal Intensive Care Unit (NICU) is a crucial aspect to ensure a welcoming, empathetic and compassionate care environment for the parents and family members of hospitalized newborns (Leite *et al.*, 2020; Coast; Sanfelice; Carmona 2019; Klock *et al.,* 2019; Nascimento *et al.,* 2019).

In the results of the study by Leite *et al.*, (2020), nurses demonstrate great knowledge about humanization, understanding it as an experiential process, acquired through the experience of clinical practice from an affective bias and the science of nursing itself. The importance of its practice in the provision of nursing care to the newborn was highlighted, and humanized care should be extended to the family of the hospitalized patient.

The nurses involved in the study presented definitions of humanization and linked it inextricably to the nursing process in their care practice. They related ways to create physical, psychological, and spiritual comfort for the patient and family with actions to improve the clinical condition and the satisfaction of the family members assisted (Leite *et al.,* 2020).

Costa, Sanfelice and Carmona (2019) dialogue with Leite *et al.* (2020) by stating that the humanized actions applied in the NICU are easy to understand, do not require expensive equipment or specialized technical training, and offer extremely important benefits for newborns and their development.

It is known that the category of humanization as safety for parents, professionals and newborns demonstrates the presence of the principles of the National Humanization Policy in the interviewees' statements, as well as personal interpretations and interrelationships with other concepts discussed and disseminated in the health scenario (Costa; Sanfelice; Carmona, 2019).

For Klock *et al.* (2019), the organization of the nursing care system in a Neonatal Intensive Care Unit is complex, dynamic, interactive and interdependent with other health systems. It is mobilized by a management process of care/good practices that enables the preterm infant and his/her family to provide care focused on the fragility and uncertainties of living/surviving in unique living conditions. Nurses stand out with the fundamental role of articulation in the face of relationships/interactions in daily care and organization.

First, it is important to recognize that NICU admission can be a highly stressful and emotionally challenging experience for parents and family members. Faced with the fragility of premature or sick babies, family members often find themselves in a state of anxiety, fear and vulnerability. In this context, the presence of a humanized and family-centered nursing team can make a significant difference, offering emotional support, information, and guidance to family members during this difficult period (Leite *et al.,* 2020).

Dalfior *et al.* (2022) argue that the humanization of the nursing team in the NICU implies cultivating a relationship of empathy and respect with parents and family members, recognizing their concerns, needs, and values. This involves clear and transparent communication, which allows family members to understand the baby's health status, care plan, and available options. In addition, it states that it is important to involve parents in the care of the baby whenever possible, promoting the affective bond between parents and child from the beginning.

Regarding the involvement of parents in care, Nascimento *et al.* (2019) observes that, although some mothers reported positive actions for being involved in care, others feel that they have "nothing to do", that they are unable to fully care for the newborn, indicating a lack of adequate guidance and support for care actions by the care team, leaving the family in a zone of uncertainty and non-involvement in the neonatal environment.

In their study, Silva and Magalhães (2019) showed that some families observed that they were unable to fully perform their role as parents, because they depended on the "consent or non-consent" of professionals to take care of their own child, thus, the dominant power relations between the team and the family sometimes compromised the sharing of care (Silva; Magalhães, 2019).

Klock *et al.* (2019) state that the nurse, by not being able to help the family to experience hospitalization in a less traumatic way, through good reception and effective communication, generated negative feelings in relation to the care provided by the caregivers and disconnected them from the care of the child.

This finding brings to the discussion that the humanization of the care of the nursing team in the NICU also faces significant challenges. The high demand of work, patient turnover, and the complexity of critical care can make it difficult for nurse practitioners to dedicate time and individualized attention to each family. In addition, issues such as coping with death and making difficult decisions can generate stress and discomfort for health professionals (Nascimento *et al.*, 2019).

Klock *et al.* (2019) explain that in the face of these challenges, it is important to implement strategies to promote a culture of humanization in the NICU. This may include capacity building and training programs in communication and emotional skills for nursing staff that help them sensitively and compassionately cope with the needs of parents and family members. In addition, it is essential to promote institutional policies that value and encourage a family-centered approach, recognizing it as an integral part of the care process in the NICU.

According to the results of the studies, it can be understood that the nursing team's understanding of the importance of humanization and inclusion of the family in the NICU is essential to offer an environment of empathetic and compassionate care for the parents and family members of hospitalized newborns (Silva; Magalhães, 2019). Despite the challenges faced, investing in strategies to promote this humanized approach can contribute to improving the NICU admission experience and the well-being of patients and their families.

It can also be seen that family-centered nursing care in the NICU is essential to promote the well-being and recovery of premature or sick newborns, as well as to support and guide parents in this delicate moment. In the neonatal ICU, the family plays a crucial role in the care and evolution of the child, and it is essential that nursing professionals adopt a family-centered approach (Sousa *et al.,* 2019; Soares *et al.,* 2019; Arruda *et al.,* 2019; Froés, 2019; Santos *et al.,* 2020).

Sousa *et al.* (2019) informs that family-centered nursing care in the NICU aims not only at the well-being of the newborn, but also at the support and emotional support of the parents, promoting a relationship of partnership and collaboration between the health team and the family. Family-centered care contributes to the humanization of care, improvement of clinical outcomes, and the promotion of healthy and harmonious development of infants and their families.

In this context, Soares *et al.* (2019) adds that family-centered nursing care in the NICU involves promoting the affective bond between parents and the newborn, encouraging the active

participation of family members in daily care, clear and empathetic communication with parents, offering emotional and informational support, and respect for the family's beliefs, values, and needs.

NICU nurses should establish a relationship of trust and partnership with parents, sharing information about the health status of the newborn, the procedures performed, the prospects for evolution, and the care to be provided after hospital discharge. In addition, it is important to involve parents in decisions related to the treatment and care of the newborn, respecting their autonomy and empowering them as an active part of the health team (Arruda *et al.*, 2019).

In the study by Sousa *et al.* (2019) it was observed in its results that the most used interventions to strengthen the bond between premature newborns and the family are: free entry of parents into the NICU; diaper changes; diet administration; use of music and books to calm newborns; in addition to the kangaroo method.

It is important to recognize that NICU admission is a highly stressful and emotionally challenging experience for parents and family members. The fragility of newborns, uncertainty about the prognosis, and temporary separation from the family can generate feelings of anxiety, fear, and vulnerability. In this context, the way nursing professionals interact with and care for newborns and their families plays a key role in the overall perception of the quality of care (Nascimento *et al.,* 2020).

Fróes *et al.* (2019) state that mothers' emotional health can be compromised when the development of parental relationships is interrupted by the unexpected admission of a newborn to the NICU, as this negatively affects family organization, causes changes in daily routines, and requires adaptation to a new role that demands different responsibilities, skills, and experiences. It is now accepted that mothers who spend more time at their baby's bedside promote healthy parenting relationships and improve their perception of stress in the NICU (Ezequiel *et al.,* 2019).

Helping the mother to experience prematurity safely, developing skills to care for her newborn in the NICU, establishing daily relationships that continue to form the bond with the newborn, and strengthening her bond with the preterm newborn are approaches that will bridge the gap between the possible in-hospital care and the home care she envisions (Fróes *et al.*, 2019).

To complete the teachings of Fróes *et al.* (2019), it is added that educating parents about newborn care, breastfeeding, hygiene, safety, and child development are essential to prepare them to care for the newborn after discharge from the NICU. Nurses should provide clear and accessible guidance, encourage parents' participation in the baby's care during hospitalization, and offer ongoing support after hospital discharge (Santos *et al.,* 2020).

In addition, family-centered nursing care in the NICU includes creating a welcoming and humanized environment that provides comfort and safety to parents and newborns. Respect for the individuality and specific needs of each family, active listening, empathy, and sensitivity are essential

aspects to promote quality and humanized care in the NICU (Soares *et al.,* 2019; Santos *et al.,* 2020, Arruda *et al.,* 2019.)

In this sense, by promoting attachment, it is possible to obtain greater involvement of the newborn's entire family, increase self-esteem, confidence, effectiveness and integrity of care, prolong the duration of skin-to-skin contact and develop breastfeeding skills during hospitalization and after discharge. However, some factors hinder this process, such as workload, lack of time, socioeconomic problems of the family, the emotional nature of the family, and the abandonment of the newborn (Arruda *et al.,* 2019; Nascimento *et al.*, 2019).

Thus, it is understood that the family's perception and experience regarding nursing care in the Neonatal ICU are key elements to evaluate the care environment and its impact on the well-being of patients and their families. Investing in the capacity building and sensitization of nursing staff to provide high-quality, family-centered care can significantly contribute to improving the NICU admission experience and promoting the healthy development of premature or sick newborns.

CONCLUSION

From this study, it was possible to understand that family-centered nursing care in the Neonatal Intensive Care Unit represents a crucial approach to promote better outcomes for both newborns and their families. Implementing practices that actively involve parents in the care of their children, providing emotional support, information, and involvement in treatment-related decisions has been shown to have significant positive impacts.

It has been observed that the presence and involvement of fathers not only helps to reduce the stress and anxiety associated with the NICU environment, but also strengthens the bond between parents and newborns, promoting healthy development and greater engagement in the care process. Additionally, a family-centered approach allows for a more complete understanding of each family's individual needs, allowing for adaptations in care to better meet their specific needs.

Thus, it is important that nursing professionals continue to recognize the fundamental role of families in newborn care and work in partnership with the family to optimize clinical and emotional outcomes. This requires a paradigm shift towards a more patient-centred practice in which families are seen as essential partners in the care team. Fostering a family-centered culture of care in the NICU not only directly benefits newborns but also contributes to a more positive and empowered experience for all parties involved.

Therefore, it is vital that healthcare institutions continue to invest in training and professional development programs that enable nursing professionals to adopt and implement family-centered practices. Only through this collaborative and compassionate approach can we ensure that newborns and their families receive the care they need and deserve during their NICU stay and beyond.

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Investigating the relevance of chest pain and distress to mental health

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ABSTRACT

In the last decades, conceptual confusions have been observed in the context of the approach to the concepts of fear, panic, anxiety and anguish. Distress, which focuses on present events, is accompanied by a feeling of tightness or pain in the thoracic region and, as many patients with depression and anxiety report this experience, the feeling of distress has thus become the target of great concern clinic.

Keywords: Anguish, Chest pain, Anxiety, Depression, Mental health.

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INTRODUCTION

In the last decades, conceptual confusions have been observed in the context of the approach to the concepts of fear, panic, anxiety and anguish. Distress, which focuses on present events, is accompanied by a feeling of tightness or pain in the thoracic region and, as many patients with depression and anxiety report this experience, the feeling of distress has thus become the target of great concern. clinic.

OBJECTIVES

To investigate whether distress is more related to depression or anxiety, and to identify which variables or symptoms are more predictive of distress.

METHODS

This investigation consisted of an exploratory study in which the prevalence of anxiety in psychiatric patients and the discrimination of clinical differences were investigated.

RESULTS AND DISCUSSION

The investigation concluded that distress is more associated with depression than with anxiety, being more frequent in females, and that the most frequent comorbidities among patients with distress are somatization, fears, depressive mood, gastrointestinal and neurovegetative symptoms.

CONCLUSION

The variables that were most related to distress were gender, reduced HAM-A score, BSI somatization, BSI hostility, BSI obsession compulsion, age, and MINI depression. Distress is closer to depression than anxiety.

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Prevention of cervical cancer in a community on the outskirts of Maceió/AL: An experience report at the USF of Riacho Doce

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ABSTRACT

The "Lilac March" is a campaign to raise awareness and prevent cervical cancer, organized annually by the Ministry of Health of Brazil in March. The main objective is to inform the population about the importance of prevention and early diagnosis of this disease, which is highly preventable and treatable if detected in the early stages. The campaign encourages screening tests, such as Pap smears, and vaccination against HPV – which is one of the main causes of cervical cancer. During the 2024 campaign, at the Family Health Unit (USF) of the Riacho Doce community in Maceió/AL, a lecture was held on the importance of regular screening tests and HPV vaccination, which can be performed at any health unit. In an environment of safety and trust, interactive materials were used with audiovisual resources, anatomical models, pamphlets and diagrams, with the aim of demystifying HPV vaccination and Pap smears. In addition, there was a Q&A session that featured the testimonies of the women who have already performed to promote identification and encouragement in the group. The results were positive, according to adherence to Pap smears and HPV vaccination in the weeks following the action at the FHU.

Keywords: Cervical Cancer Prevention, Early Detection, Female Awareness, HPV Vaccination.

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INTRODUCTION

For the medical students of Unima/Afya, who organized the lecture, the experience provided valuable learning about the importance of effective communication and continuous support to the community. The "Lilac March" campaign has demonstrated that with joint and ongoing education and community engagement efforts, it is possible to significantly reduce cervical cancer incidence and mortality, promoting women's health and well-being. The "Lilac March" is a cervical cancer awareness and prevention campaign held annually by the Ministry of Health during the month of March. The objective of this initiative is to inform the population about the importance of prevention and early diagnosis of this disease, which can be highly preventable and treatable, with high cure rates, if detected in the early stages. The campaign seeks to encourage screening tests, such as cervical oncotic Pap smears and vaccination against the Human Papillomavirus (HPV) - which is one of the main causes of cervical cancer. In addition, the campaign promotes educational activities, lectures and community actions to increase knowledge and adherence to preventive practices.

Cervical cancer is a significant public health concern due to its high incidence and mortality, especially in developing countries. This disease is mainly caused by persistent infection with some types of HPV, with types 16 and 18 accounting for the majority of cases. Prevention of this pathology through screening strategies is essential to reduce its occurrence and severity. Regular screening, through the Pap smear, allows for early detection of precancerous lesions and early cancers, significantly increasing the chances of effective treatment and cure.

In line with the "Lilac March" campaign, we held a lecture at the Family Health Unit (USF) of the Riacho Doce community in Maceió/AL. During the lecture, we emphasized the importance of regular screening exams that can be performed quickly in any health unit, being crucial to identify changes that can evolve into cancer if not treated properly. In addition, we highlight the importance of vaccination against HPV, which is responsible for the majority of cervical cancer cases. In Brazil, vaccination is recommended for girls and boys from 9 years of age, before the beginning of sexual life, to ensure maximum effectiveness of immunization and this preventive measure drastically reduces the incidence of cervical cancer and protects new generations.

Our initiative sought to engage the community by offering accessible information and demystifying prejudices related to both Pap smears and HPV vaccination. During the activity, we addressed topics such as the importance of following the vaccination schedule and its benefits for public health, clarifying common doubts about screening procedures. The importance of regular medical follow-up and the encouragement of periodic Pap smears by women users of the public health service were also discussed, as recommended by the Ministry of Health.

Through these educational actions, we aim to contribute to reducing the incidence of cervical cancer and promoting the health and well-being of women in this community. We believe that

information is a powerful tool in the prevention of diseases and that, with the joint effort of health professionals and the community, it is possible to achieve significant results in the fight against cervical cancer.

OBJECTIVES

To make women aware of the relevance of preventive exams, such as Pap smears, in the early detection of cervical cancer, as well as to promote awareness about HPV vaccination, aiming to reduce the incidence and mortality from this disease.

METHODOLOGICAL PATHWAY

To achieve the objectives of making women aware of the relevance of preventive exams and promoting HPV vaccination, we have developed a comprehensive and interactive methodological approach. Our strategy is designed to be informative, engaging, and accessible so as to maximize community understanding and adherence to preventive practices. We developed the content of the lecture with research and curation of up-to-date and evidence-based information on cervical cancer, the Pap smear and HPV vaccination. We produce interactive slides and printed materials that cover everything from the anatomy of the cervix to the stages of the Pap smear, the benefits of early diagnosis and the importance of HPV vaccination, using graphs, diagrams and illustrative images to facilitate understanding. The structure of the lecture included an introduction about the "Lilac March" campaign and its goal of raising awareness, followed by a detailed explanation of cervical cancer, its causes, risk factors and the importance of early detection. We emphasize the relationship between HPV and cervical cancer, highlighting the most dangerous HPV types (16 and 18) covered by the vaccine available in the public service. We explain step by step the collection of Pap smear, its importance and the frequency of recommended repetitions. We also inform you about the HPV vaccination campaign, the recommended age group for immunization, and the medium and long-term benefits in the prevention of cervical cancer. We set aside significant time for a Q&A session, creating an open and welcoming environment for discussions. We supplemented the lecture with the distribution of educational materials that summarized the main points and provided additional resources for reference. We used anatomical models to visually demonstrate the Pap smear, allowing participants to better understand the procedure. We invite women who have already undergone the test and/or received the vaccine to share their experiences, promoting identification and encouragement among the participants. After the talk, we organized a breakfast to promote interaction between the community and health professionals, reinforcing community bonds and facilitating informal health conversations. We encourage the formation of support groups among women in the community to promote mutual follow-up in the performance of tests and adherence to

vaccination. To assess the impact of the lecture, we distributed feedback forms to identify persistent doubts and obtain suggestions for future educational actions. We analyze responses to adjust and improve future presentations, ensuring that our approaches remain relevant and effective.

RESULTS

We noticed that many women had significant doubts about cervical cancer screening methods, were unaware of the relationship between HPV and this neoplasm, and had many questions about vaccination. This finding underscores the ongoing need for education and awareness about women's health, contributing to clarify misconceptions and increase knowledge about the importance of cervical cancer screening, vaccination, and prevention. We noticed that many women had significant doubts about screening methods for cervical cancer, were unaware of the relationship between HPV and this neoplasm, and had many questions about vaccination. This finding underscores the ongoing need for education and awareness about women's health, contributing to clarify misconceptions and increase knowledge about the importance of cervical cancer screening, vaccination, and prevention. During the lecture, we found that a large number of participants were overdue for their Pap smears or had not received the HPV vaccine. Many women expressed fear and discomfort in relation to the test, which indicated the need to demystify the procedure and promote an environment of safety and trust. By providing hands-on demonstrations and personal testimonials, we were able to significantly reduce concerns and increase women's willingness to get tested. The distribution of the educational materials and the Q&A session also proved to be effective, as the participants were able to take home clear and detailed information, which helped to reinforce the points discussed during the lecture. In addition, the direct interaction with the professionals of the Health Unit and the opportunity to clarify immediate doubts created a feeling of support and welcoming. The positive impact of the lecture was corroborated by the feedback forms. Many participants reported an increase in knowledge about cervical cancer and the preventive measures available. Most expressed an intention to schedule Pap smears and vaccinate their children against HPV as soon as possible. We also observed an increase in the number of visits to the Family Health Unit for consultations related to cervical cancer screening in the weeks following the lecture. Finally, the initiative also provided valuable learning for us, medical students at Unima/Afya, as we identified areas where communication and support could be improved, allowing us to adjust our future approaches to better meet the needs of the community. The "Lilac March" experience proved to be an essential initiative for cervical cancer awareness and prevention, highlighting the importance of regular screening and vaccination against HPV. The lecture held at the Family Health Unit (FHU) of the Riacho Doce community in Maceió revealed a significant need for education on women's health, since many women had doubts and prejudices regarding screening methods and vaccination.

CONCLUSION

The results obtained with the lecture were promising, evidenced in the search for the updating of gynecological exams, with a focus on the screening and prevention of cervical cancer. Direct interaction with health professionals, the distribution of educational materials and personal testimonies were essential to reduce fear and promote adherence to preventive practices. The positive impact was proven by the feedback of the participants, who expressed, and concretized in the following weeks, their intention to perform both the Pap smear tests and vaccinate their children against HPV. For us, medical students at Unima/Afya, the experience provided valuable learning about the importance of effective communication and continuous support for the community. We conclude that with joint and continuous education and community engagement efforts, it is possible to significantly reduce cervical cancer incidence and mortality. That it is possible to promote, with simple actions and using few financial resources, the information, prevention, health and well-being of women. The "Lilac March" initiative has shown that the main tool in the prevention of these diseases is information and with initiatives like this we can achieve significant results in the fight against cervical cancer in the community.

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Frequency of urinary symptoms in schoolchildren from Curuçá, Pará

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ABSTRACT

Lower urinary tract dysfunction is a non-neurogenic alteration of Bladder and Bowel Dysfunction defined as an abnormal voiding pattern for the child's age, including the loss of coordinated capacity for urine storage, storage, and elimination. These urination problems can directly influence the child's quality of life by affecting their mental health. The proposed project is a cross-sectional study. The research was carried out in kindergarten schools located within the Municipality of Curuçá, Pará, with prior authorization from their legal guardian. The choice of these schools is justified by the need to access the greatest evidence of cases of dysfunctions in the children's urinary tract.

Keywords: Voiding dysfunction, Children, Lower urinary tract.

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INTRODUCTION

Lower urinary tract dysfunction (LUTD) occurs when there are disturbances at any stage of urination that would be filling or emptying of the bladder, without the presence of neurological or pathological obstructive urinary tract disease. If the disorder is in the storage phase of the bladder, there will be changes in urinary frequency, incontinence, urgency and nocturia. If in the bladder emptying phase, there will be hesitation, straining, weak or intermittent jetting and dysuria, or even other symptoms (restraint maneuvers, sensation of incomplete emptying, urinary retention, post-void drip, and urinary stream under pressure) (Austin *et al.*, 2016). LUTD is a non-neurogenic alteration of Bladder and Bowel Dysfunction (IVD), which has been standardized by the International Society of Infant Continence (ICCS) relating the presence of concomitant urinary and intestinal tract symptoms (Austin *et al.*, 2016).

The proportion of children in the population who have symptoms of LUTD ranges from 2% to 25% (Latorre *et al.*, 2018). Several problems, such as isolation from society due to shame, psychological alterations, low self-esteem and relational difficulties in the family and school environment, negatively influence the quality of life of patients (Vasconcelos *et al.*, 2013; Burgers *et al.*, 2013).

For many children and adolescents, the presence of functional voiding dysfunction leads to changes in routine, which may lead to maltreatment within the family, learning difficulties and punishments at school, affecting quality of life (Veloso *et al.*, 2016). It can trigger a negative psychological charge in the child, causing them to experience feelings of humiliation, fear of being discovered, a feeling of immaturity or fear of sleeping away from home, which ends up leading to a drop in self-esteem (Souza *et al.*, 2015).

Although it is common in children and underdiagnosed in clinical practice, it presents physiological risks, emotional and social constraints, bringing possible problems to deal with such problems, in many cases parents or guardians do not know the signs and symptoms that the child presents (Vasconcelos *et al.,* 2013). Considering the need for early recognition of urinary symptoms in children and that no study has yet been conducted in the Municipality of Curuçá involving this topic, this research aims to verify the frequency of voiding dysfunction in children in public schools in the Municipality of Curuçá, Pará.

MATERIAL AND METHODS

The research was carried out in an Early Childhood Education school located in the municipality of Curuçá, Pará, with prior authorization from its legal guardian. The choice of school is justified by the need to access the greatest evidence of cases of dysfunctions in the children's urinary tract. The period in which data collection took place was from April 2023 to May 2023**.** The study

population consisted of children between 9 and 13 years old, from 5th to 7th grade, enrolled in public schools in the municipality of Curuçá.

The inclusion criteria adopted by this research were: Parents of children aged between nine and thirteen years, of both sexes. Parents of children with neurological voiding dysfunctions were excluded.

This is a study with non-probabilistic sampling, since it may happen that an element of the studied population does not become part of the sample. The *Dysfunctional voiding scoring system* (DVSS) was used, which is a valid questionnaire to quantify the severity of abnormal urination behaviors, as it allows the identification of children with voiding symptoms and the monitoring of responses to various types of treatments. The original version of the DVSS consists of ten items to assess the presence of lower urinary tract dysfunction, with responses according to the Likert scale being assigned scores from 0 to 3 according to the existence of the symptom (Never or almost never = 0; less than half the time = 1; almost all the time = 2; almost all the time = 3). The result of the test is the sum of the values assigned to the items (minimum = 0; maximum = 30). Since the score indicating the possibility of lower urinary tract dysfunction was greater than 6 points for girls and greater than 9 for boys (Rizzini *et al.*, 2009).

The data collection procedure took place according to the steps described below:
a) On the day of the parent-teacher meeting, called by the school board, they were invited to participate in the research, for which they were given the informed consent form. Those who signed answered the DVSS questionnaire in order to be able to evaluate the children for possible symptoms.
b) The questionnaires were collected together with the informed consent form, in order to identify children who had signs of voiding dysfunction.

The collected data were stored in Microsoft Excel® spreadsheets, which were also used to make the graphs. Statistical analysis was performed using the Biostat 4.0® statistical package, where the statistical tests that best fit the study proposal were used.

RESULTS AND DISCUSSION

In the present study, it was possible to observe the occurrence of children with urinary tract dysfunctions in schoolchildren from the municipal network of Curuçá-PA, we obtained the participation of 29 parents/guardians of children of both sexes aged between 9 and 13 years, data collection was carried out on the parents' self-perception in an interview applied through the DVSS questionnaire. It was possible to verify that about 20% of the parents interviewed claim to identify some type of urinary dysfunction or constipation in their child, based on this reality the answers that obtained a higher percentage in the data collected were, "Does it happen that your child does not poop every day? How often?" 24.14% of the interviewees answered that more or less half of the time

their child already had episodes that we can consider as constipation. The following answers that also drew attention with a high percentage, does it happen that your child only goes to the bathroom to pee once or twice a day? How often does this problem of urinating a few times a day occur to your child? About 17.24% answered that their child was about half the time. The next question with the high percentage of response that we can characterize as LUTS was, Has your child been wetting his clothes with pee during the day? When your child gets wet with pee, do the underwear/panties get soaked? and 10.34% of the interviewees answered that it was more or less half the time, which allowed us to identify a urinary tract dysfunction. Basically, we totaled a possible LUTD in 20% of the children who participated in the study through the negative answers, according to the parents interviewed. These results are relevant because urinary tract dysfunctions can cause pain, discomfort and affect children's quality of life. However, it is important to highlight that the research had some limitations, such as the fact that it was conducted in only one public school and with a limited number of participants. In addition, data collection was based on the parents' self-perception, which may have influenced the results and made the responses subjective. Therefore, it is suggested that more comprehensive studies with a larger sample of participants be conducted in order to confirm these results and identify possible risk factors for urinary tract dysfunction in children. In addition, it is important that health professionals, guardians and educators are aware of these problems and offer alternatives for the reception and adequate treatment of children with such dysfunction and thus return health and well-being to them.

Table 01 - Results of the Dysfunctional Voiding Scoring System (DVSS) questionnaire

QUESTIONS/ANSWERS	ABOUT HALF THE TIME	LESS THAN HALF TIME	NEVER OR ALMOST NEVER	Grand Total			
YOUR CHILD HAS WET FROM PEEING ON CLOTHES DURING THE DAY?	10,34%	6,90%	82,76%	100,00%			
WHEN YOUR CHILD WETS HIMSELF OR HERSELF WITH PEE, THE CUECA/PANTIES STAYS ENFALLA?	10,34%	13,79%	75,86%	100,00%			
	ABOUT HALF THE TIME	NEVER OR ALMOST NEVER	ALMOST ALL THE TIME	Grand Total			
YOUR CHILD HOLDS HIS OR HER PEE BY CROSSING HIS LEGS, SQUATTING, OR DANCING?	6,90%	89,66%	3,45%	100,00%			
	ABOUT HALF THE TIME	LESS THAN HALF THE TIME	NEVER OR ALMOST NEVER	ALMOST ALL THE TIME	Grand Total		
IT HAPPENS FROM YOUR CHILD DOESN'T POOP EVERY DAY? HOW OFTEN?	24,14%	13,79%	55,17%	6,90%	100,00%		
	ABOUT HALF THE TIME	LESS THAN HALF THE TIME	Didn't Respond	NEVER OR ALMOST NEVER	ALMOST ALL THE TIME	Grand Total	
DOES YOUR CHILD HAVE TO STRAIN TO POOP?	6,90%	3,45%	3,45%	79,31%	6,90%	100,00%	

	ABOUT HALF THE TIME	LESS THAN HALF THE TIME	Didn't Respond	NEVER OR ALMOST NEVER	ALMOST ALL THE TIME	Grand Total	
IT HAPPENS FROM YOUR CHILD/CHILD ONLY GO TO THE TOILET PEE ONCE OR TWICE A DAY? HOW OFTEN DOES THIS URINATION PROBLEM ONLY A FEW TIMES A DAY DOES IT HAPPEN TO YOUR CHILD?	17,24%	10,34%	3,45%	48,28%	20,69%	100,00%	
	ABOUT HALF THE TIME	ABOUT HALF THE TIME	LESS THAN HALF THE TIME	Didn't Respond	NEVER OR ALMOST NEVER	ALMOST ALL OF TIME	Grand Total
WHEN YOUR CHILD NEED TO PEE, NO CAN YOU WAIT, DO YOU HAVE TO GO TO THE BATHROOM FAST?	6,90%	3,45%	6,90%	6,90%	72,41%	3,45%	100,00%
	ABOUT HALF THE TIME	LESS THAN HALF THE TIME	Didn't respond	NEVER OR ALMOST NEVER	Grand Total		
DOES YOUR CHILD HAVE TO STRAIN TO PEE?	3,45%	3,45%	13,79%	79,31%	100,00%		
	ABOUT HALF THE TIME	LESS THAN HALF THE TIME	Didn't Respond	NEVER OR ALMOST NEVER	ALMOST ALL OF TIME	Grand Total	
IN THE LAST 30 DAYS, WHEN YOUR CHILD PEED, DID IT HURT?	3,45%	3,45%	13,79%	75,86%	3,45%	100,00%	

CONCLUSION

The present study points to the importance of investigating recurrent cases of LUTD in children in kindergarten reported by parents and guardians throughout the research. With the survey of data from the population studied, it brings the perception for a more attentive and holistic care of those responsible and educators for early symptoms. Considering the related aspects that can become harmful, such as: emotional and social constraints, in what encompasses the relationship networks in the family and school environment, and that these elements can also harm both self-esteem and school performance, causing an even more negative impact on quality of life. It is worth emphasizing the importance of health education planning for LUTD, for parents and education professionals.

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Low-cost technology: Use of discarded material to improve bathing in bedridden patients

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ABSTRACT

The technological advance seeks to improve the performance of bedridden patients' therapeutical and hygienic activities. In this present study, a qualitative research containing 20 caregivers of 12 adult patients assisted by basics heath units (BHU) from the city of Maringá, in the region northeast region of Paraná state and in the south of Brazil. Every patient was bedridden with severe limitations, including locomotor ones. Vinyl canvas banners and others, such as raw material for the manufacturing of bed bath sheets. The caregivers were trained prior to the procedure and answered a questionnaire in order to evaluate the usage, accessibility and interaction with the patient during the hygiene. The study was approved by the ethical research committee on human beings (COPEP/UEM). The use of bed bath sheets by some caregivers was considered satisfactory, due to the good performance during the patients' hygiene, in addition to contributing to the environment. All the evaluated criteria were 100% approved by the participants. The reuse of the vinyl canvas so as to fabricate the bed bath sheet attends the therapeutical needs of the bedridden patients, possessing economic, social and environmental relevance.

Keywords: Polyvinyl Chloride, bedridden patients, Personal hygiene, Nursing home, Reuse.

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INTRODUCTION

Bathing is recognized as a basic human need, being part of the process of personal hygiene. Bed bathing is a necessary procedure for patients unable to perform their activities of daily living, being performed by a caregiver, a family member or paid professional[1], promoting patients' personal hygiene and improving comfort, reducing the risk of infection and helping to maintain skin integrity in critically ill patients[2].

In Intensive Care Units (ICUs), homes, nursing homes or recovery institutions, bed bathing is usually performed with the use of wet wipes, due to several factors that limit the application of immersion baths, such as the lack of sufficient staff and the lack of accessible tools to adapt this type of bath[3]. Issues related to the physical structure of an establishment or residence can hinder the exercise of qualified and safe care during bed bathing, mainly due to the fact that there are risks of falls and bone fractures in bedridden patients[4].

Immersion baths promote better personal hygiene, comfort, dignity, and well-being for bedridden patients, as the procedure reduces dirt and odors and favors skin protection against infections[3]. On the other hand, there are still few technical and scientific advances aimed at improving the hygiene of bedridden patients who depend on caregivers to perform this action[5], showing the need for studies that promote the development of products with low cost and easy access to the general population.

In Brazil, there are several studies demonstrating the reuse of *banner* canvases, composed of polyvinyl chloride (PVC) as raw material for the production of artifacts, utilities and new products[6,7,8,9]. Reuse, or reuse, is essential to give a new use to the waste, slowing down the processes of environmental degradation and reducing the expenses related to the disposal of this material[10]. Reuse or recycling contributes to the reduction of waste and the reduction of the use of raw materials, which are often non-renewable and have incorrect disposal[11].

The National Solid Waste Policy (PNRS)[12] encourages reuse and recycling. However, of the 79 million tons of solid waste generated in Brazil in 2019, only 6.3 million tons were properly disposed of[11]. Landfills are still the main places where these materials are disposed of in almost all developing countries. The negative impacts of landfills cause an annual loss to the public coffers of more than R$3.6 billion in environmental care expenses[13].

The objective of this study wasto make bed sheets by reusing vinyl tarp *banners* as raw material, and to evaluate the use of a prototype of the bed sheet in the test modality by caregivers and bedridden patients.

DEVELOPMENT/METHODOLOGY

STUDY DESIGN

In the first half of 2022, a literature review related to bed bath activity was conducted. The present study was approved by the Human Research Ethics Committee (COPEP) of the State University of Maringá, opinion number 5,265,806.

COLLECTION, CLEANING OF VINYL TARPS AND MAKING OF THE BED BATH SHEET.

All raw material used to make the sheet was collected directly from the disposal sites in the city of Maringá, a municipality in the northwest region of the state of Paraná, southern Brazil, taking into account the structural and visible quality of the product to be used. All collected materials that showed wear due to natural weather and/or possible damage were considered unsuitable The collected material was sanitized with clean running water and neutral soap. Then, cleaning was performed with sodium hypochlorite (1%) for 10 minutes, and then rinsed with plenty of water. The materials were dried and kept in a clean environment.

The sheets were made by a professional sewing professional. During the preparation, the non-screen-printed part, i.e., without ink, was used as the inner lining of the sheet that was in contact with the patient.

To manufacture the prototype of the bed sheet, vinyl tarpaulins with the following dimensions were reused: 2.30 meters long and 1.30 meters wide. Tapes were fixed at six points of the sheet for support, allowing positioning and keeping the sides of the sheet elevated during the procedure (Figure 1). To keep the sheet in the correct position, it was recommended to use physical structures, such as chairs, armchairs or any object that served as support. This structure could vary according to the place where the caregiver bathed the bedridden patient. The sheet was always cleaned with 70% alcohol before and after the bed bath procedure.

Figure 1. Prototype of bed bath sheet, from the reuse of vinyl material.

Source: Author.

CHARACTERIZATION OF RESEARCH PARTICIPANTS

This study was conducted with 12 patients and their respective caregivers, including adult patients aged 20-89 years, primary care users in the municipality of Maringá, in the northwest region of the state of Paraná and southern Brazil. These patients were bedridden with total locomotor limitation for more than seven days and were accompanied by caregivers, family members or professionals with remuneration.

The population for the study was selected from the contacts provided by the Basic Health Units (UBS) in the city of Maringá-PR, and 3 UBS were selected, but 1 private patient and 1 hospitalized patient were also selected.

The contact was made through a telephone call, where the project was explained to the caregiver or family member and the answer was awaited as to whether or not to accept the home visit in order to test the product.

The first UBS selected cared for 9 bedridden patients, where 5 did not answer the calls, 3 accepted and 1 gave up. The second UBS assists 6 bedridden patients, 4 of whom did not answer the calls or there were wrong telephone numbers, and 2 patients agreed to be bathed in bed using the research product. Eleven patients were part of the third UBS, and 5 of them accepted to be bathed in bed, in 3 cases the family said they would return the call, but they did not return. Three of these

patients did not answer or the phone number was wrong. A private patient and a patient hospitalized at the Memorial Hospital of Maringá also agreed to be bathed in bed with the use of the product.

Therefore, in all, twelve patients were submitted to bed bathing using the research product, and 20 caregivers, 1 paid professional and 19 family members, answered the questionnaire. None of the patients answered the questionnaire because they were all patients with severe limitations.

TRAINING OF CAREGIVERS AND GUIDANCE ON PROCEDURES FOR BED BATHING.

The caregivers received individual training to learn about the functionality of the bed bath sheet, and instructions were given on hygiene, before and after the use of the sheet, the proper positioning in the place where the bed bath was performed, and the positioning of the patient on the sheet (Figure 2). The bed bath procedures were performed privately with the bedridden patient who was bathed by his respective caregiver, and all bed baths were assisted and guided by at least one member of the team.

APPLICATION OF THE QUESTIONNAIRE

After training and the application of the bed bath, a quantitative-descriptive analysis was carried out, using a questionnaire composed of 10 questions, 8 of which were questions with "yes" or "no" answers. To evaluate the criterion of usability and reuse, it was questioned whether the bath sheet was easy and practical to be used in homes; The following criteria were also evaluated: accessibility, possibility of adaptation to the bedridden patient's environment, creation of an environment of interaction between the patient and the caregiver, and hygiene and preventive care for the patient's health. The other questions were of the dissertation type and aimed to evaluate the levels of satisfaction of the participants regarding the prototype tested, and could also report the difficulties and/or benefits regarding the use of the bed sheet, as well as suggestions and/or criticisms to improve its development.

Figure 2. Patient preparing to start bathing in bed with vinyl bath sheet.

Source:Author.

DATA ANALYSIS

The data collected from the participants through the structured questionnaire were compiled in an Excel spreadsheet, Microsoft® Excel version 2010, with subsequent quantitative-descriptive analysis of the frequency of responses. Bardin's content analysis[14] allowed its application in various discourses and in all forms of communication, through three fundamental phases: pre-analysis, exploration of the material and treatment of the results as described by Câmara[15].

RESULTS AND DISCUSSIONS

According to Bardin's content analysis[14,] it is applied to various discourses and all forms of communication, through three fundamental phases: pre-analysis, exploration of the material and treatment of the results[15].

The three stages of content analysis, initiated by the "floating" reading of the questionnaire forms applied to the participants, resulted in the hypothesis that the proposed tool would have positive satisfaction criteria for use, with homogeneity of responses regarding the criteria evaluated. The criteria of usability, accessibility, flexibility, hygiene, reusability, interaction with the use of the sheet and adequacy were approved by 100% of the participants in the analysis carried out.

The analysis of the essay questions pointed to reports of satisfaction with the use of bath sheets by the caregivers, describing good performance in the bath and perception of hygiene of the patient, in addition to admiration for the contribution to the environment.

Some participants reported the following perceptions of use (Figure 3):

Figure 3. Word cloud of the reports about the use of the tool.

Source: Author.

Report 1 - "The product was good, the bath brought relaxation (of the patient), comfort and contact". In the form of a bed bath, this procedure aims to promote individual comfort and maintain skin integrity by promoting circulation and physiological hydration[16]. Hygiene is defined as a set of practices that promote health and comfort through personal cleanliness[17].

Report 2 - "We wash her head here (patient) and the water falls down into the bucket. It was a good idea, because it doesn't take the patient out of bed to take it to the bathroom, right here we give her (patient) a very nice bath and she doesn't go without taking a bath (for immersion)." In the case of bedridden patients, the bath is given in bed, a technique that must have previous planning and organization of the materials, and it is also necessary to follow all the established steps[18].

Report 3 - "Complete hygiene without risk of falling". Most patients in critical care are unable to perform their own bath, so bed bathing is characterized as a complex technique, to be performed in a humanized and safe way, in order to ensure that its objectives are achieved without harm to those who receive it[16].

Report 4 - "I thought it was great! I didn't find it difficult at all! ”.

Report 5 - "That all families can have access (to the tool)".

Report 6 - "It was wonderful how this sheet was made, even more so because it uses recyclable plastics." In fact, PVC is one of the cheapest and most versatile materials for use in the production of various products[9].

Report 7 - "Hygiene, interaction and well-being". The Bed Bath is simply defined by skin hygiene, a technique that can reduce the risk of infection and condition the patient to a feeling of relaxation[18].

One participant suggested that the edge of the sheet could be rigid to avoid folding during bathing, but that she was able to handle the edge with the six-pronged ribbons to avoid this problem. Two participants suggested the placement of the central drain to help the water fall. The vinyl material proved to be light and sanitizable, with ease of application of the bath and drainage of the water and soap used in the procedure. Sewing vinyl material is easily carried out and can be done by anyone who knows the basic principles of cutting and sewing. The measurements of the sheets were satisfactory for the size of the beds and the patients.

We know that immersion baths promote better personal hygiene, comfort, dignity, and well-being for bedridden patients[3], but there are still few technical and scientific advances aimed at improving the hygiene of bedridden patients who depend on caregivers to perform this action[5]. Thus, the progress of this work appears as an alternative to develop adequate hygiene techniques in bed, for debilitated patients, generating comfort and satisfaction.

In addition, the demands for low-cost materials, so that all families and the public health system can have access. Therefore, the bed bath sheet that was made and tested in this group of patients and caregivers has as a differential characteristic, the low cost of using reused vinyl material, being an alternative to be used by health managers in several locations, especially among the poorest populations.

The National Solid Waste Policy (PNRS)[12] encourages reuse and recycling, however, in Brazil, 79 million tons of solid waste generated in 2019, only 6.3 million tons were properly disposed of[11]. Reuse, or reuse, is essential to give a new use to the waste, slowing down the processes of environmental degradation and reducing the expenses related to the disposal of this material[10]. This work also shows an alternative for the maintenance of the environment, favoring processes of reuse of materials harmful to the environment in the medium and long term.

The increase in the pace of technological innovation is one of the main conditions for Brazil to accelerate its economic growth. In the last 20 years, Brazil has consistently increased its investment in Research and Development, considered one of the inputs for innovation and productivity. However, this effort has yielded limited results.

There are two main problems identified: first, government investment needs to increase its effectiveness; second, private investment is small, being very limited to a few large companies[19].

According to the document "Policies to Support Technological Innovation in Brazil"[20], the Brazilian state has intensified efforts to consolidate the National Innovation System (SNI), with the objective of expanding support and promotion of science, technology and innovation (ST&I) activities in the country. In this study, we agree that the stimulus to the development of low-cost technologies, especially in Brazil, in the case of the public health system, should be emphasized and reinforced in all areas of applicability that promote human satisfaction and adequate management of

the environment. The limitations of this study stem from the sample size, attributed to the pandemic, requiring expansion of use to review results, in addition to the possibility of including other places for bathing (such as hospitals and institutions that support bedridden patients).

FINAL THOUGHTS

The reuse of vinyl material to make bed sheets, in addition to its low cost, can be a tool that goes beyond a therapeutic need for bedridden patients, with a relevant importance at a social and environmental level.

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Mathematics and biosciences: An interaction from exemplifications

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ABSTRACT

In this paper, we aim to present some mathematical concepts, applied in examples related to Biosciences, for a better discussion and understanding of the interaction of these two areas. In fact, since the second half of the twentieth century, Mathematics has played an important role, and even a protagonist, in the study of Biosciences. In such a way that studies of mathematical elements, with applications to bioscientific problems, constitute an interesting theme of studies and research. Thus, we seek an interaction, based on the exemplification, of the application of mathematical concepts in important problems in the areas that make up the body of Biosciences.

Keywords: Mathematics, Bioscience, Interaction between areas of knowledge, Related issues.

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INTRODUCTION

The research we present is configured as bibliographic-documentary, which, in the sense of Gil (2008), uses materials already elaborated, consisting mainly of scientific texts (books and papers) (in printed or digital formats), and which allowed us to investigate other studies related to the theme. In addition, we used documents in a descriptive/interpretative study for a re-elaboration of this knowledge in accordance with our research objectives. This material is an important part of our theoretical framework,

Thus, we aim to present some mathematical concepts, applied in examples related to Biosciences, for a better discussion and understanding of the interaction of these two areas, since, according to Batschelet (1979), since the second half of the twentieth century, Mathematics has been playing an important role, and even a protagonist, in the study of Biosciences.

In the following sections, we present a discussion about the importance of relating elementary concepts of Mathematics in solving problems in the Biosciences and we explicitly describe this interaction between these two areas of scientific knowledge, based on examples.

We infer that this interaction between Mathematics and the biosciences has potentialities, both for the teaching of Biosciences contents, and for an expansion of the field of teaching mathematical contents, when a possible development of new techniques from the existing mathematical knowledge, as well as the emerging possibilities of the new technologies of the XXI century.

ABOUT MATHEMATICS FOR BIOSCIENCES

In this section, we seek to relate mathematical conceptual elements, by their applicability, through examples, to contents related to Biosciences.

Following the line of what Sampaio e Silva (2024) argues, we seek to emphasize an interactive relationship between Mathematics and Biosciences, in a problem-solving procedure, characterizing what is now called Biomathematics, that is, an existing mathematics, produced or recreated for use in the Biosciences. (Rashevsky, 1940) and (Berezoskaya; Toni, 2019)

Initially, we will present some mathematical rules and/or concepts, which later allow us a more illustrative and/or elucidative representation of the processes or methods involved in solving bioscientific problems.

The elements of mathematics initially dealt with go more specifically in the direction of the representation of numerical quantities associated with problems typical of the biosciences, such as percentages and proportionality. In addition, it is necessary, in some problems, to deal with polynomial and/or exponential functions. To solve some problems, for example, that involve specific measures, it may be interesting to establish the use of scales (ordinal, proportional or graded).

According to Batschelet (1979, p. 2-4), such elements can be used to solve problems involving, for example, organ deficiency, animal growth or temperature variations. A discussion about these possibilities is presented by Batschelet (1979), when concluding a result.

In the medical case, a diagnosis. Batschelet (1979, p. 2) points out that even assuming the effective importance of considering mathematical results, which must be weighed, an interpretative component is necessary in the finalization of a result (diagnosis), as he seeks to exemplify, in a problem that involves the use of a nominal scale in the diagnostic interpretation of kidney problems, due to the excessive use of certain chemical products.

In his example, Batschelet (1979, p. 2) presents us with a researcher, a physician, who considers a classification of the problem into categories, according to severity. Thus, "For convenience, it suffices that he designates by the number 0 the *absence of renal deficiency* , by the number 1 the *weak deficiency*, by the number 2 the *medium deficiency* and by the number 3 the *severe deficiency*". In this way, the researcher introduces an ordinal scale with rank numbers or scores of 0, 1, 2, 3.

For Batschelet (1979, p. 2), it is presumable to observe that "*it is not possible to conclude that the increase from weak to medium disability is the same as from medium to severe disability*", although the numerical difference between the positions is the same in any of the cases considered.

It is important to note that the applications of mathematics to the biosciences can be treated, both from an advanced point of view, as prescribed in Rashevsky (1940) and Berezoskaya and Toni (2019), intermediate, aiming at graduation, as in Batschelet (1979), Smith (1968) and Murray (2002), to more elementary concepts such as in Batschelet (1979), Santiago and Paiva (2015) and Mancera (2024).

For these applications, it is necessary to use technical texts, which bring some specific methods and tools, such as Boldrini et. al. (1986) and Gomes (2013), as well as specific manuals such as Gonçalves (2019) and Calculus... (2021).

With these considerations, when we bring our examples, below, we seek to list problems of the Biosciences, where the mathematical result, usually numerical or even functional, can minimize difficulties of interpretation, when presenting *a priori conclusions*.

AN INTERACTION BY EXAMPLES

We can point to an interaction between these two areas of scientific knowledge, Mathematics and Biosciences, elements that are in line with our initial presentation. Thus, to reinforce our argument, in this section we bring some examples.

In our exemplification, we seek to cover at least six of the areas that make up the biosciences and that we believe to be the most representative for this moment, which we are aiming for. We

understand that we cannot present them all, and that the possibilities of application are greater and often more complex. However, we affirm that these six examples can bring greater understanding in this interaction.

AN EXAMPLE IN BIOLOGY

In Batschelet (1979, p. 4), we find a representation of the concept of Percentage applied to an example that deals with the growth rate of an animal. Where quantities are related, such as: height and body mass (weight), with respective measurements in meters (m) and kilogram (kg). Which, below, we rewrite: consider that "*at the beginning of the experiment the animal weighs 50kg of body mass. We use a simplified number to make it easier to introduce and bill. In a period of one month, the weight increases by 20%, reaching 60kg. Assuming that in the second month the weight increases again by 20%.*" (Batschelet, 1979).

Batschelet (1979, p. 4)) states that we can erroneously infer that "*the total increase is 40% of the initial weight*". Thus, the animal would have a body mass (weight) of 70kg. However, the calculations lead us to a different result: the final weight is 72kg, which is 22kg or 44% more than the original weight.

It is worth commenting here on the importance of this example, since an accurate description of the body mass (weight) of an animal is a factor to be considered, effectively, when prescribing dosages of medications, supplements or foods.

AN EXAMPLE IN BIOMEDICINE

A classic example, which we bring here, considers the velocity of arterial or venous blood flow. Such a phenomenon, even in its complexity, we affirm, in agreement with Batschelet (1979, p. 95), can be represented and/or visualized from the use, a modeling of the phenomenon, of a polynomial function of the second degree.

To wit: we have the function $v(r) = \frac{P}{4\eta l}(R^2 - r^2)$, where the values of P, η, l are given (known). We have that R is the radius of the circular cross-section to the tube, P it is the pressure difference between the ends of the tube (model for a human vein or artery segment), η it is the viscosity of the fluid (blood), l it is the length of the model tube (in centimeters) and r it is the distance between any point of the fluid and the axis of the tube. Let's consider a laminar blood flow in this experiment. We observe that $R = r$ if the speed $v = 0$. If $r = 0$ we have a maximum value for velocity (Batschelet, 1979).

Let's take the following example, configured numerically, for the sake of the best possible realism, let's take arterial blood with viscosity $\eta = 0{,}027\ poise$ flowing into an arterial capillary of length $l = 2cm$ and radius $R = 8 \cdot 10^{-3} cm$. At one end the pressure is greater than at the other, and

this difference is $P = 4 \cdot 10^3\ dina/cm^2$. We have,). $v = \frac{4 \cdot 10^3}{4 \cdot 0{,}027 \cdot 2}(64 \cdot 10^{-6} - r^2)$ from where $v = 1{,}185 - (1{,}85 \cdot 10^4)r^2$, in centimeters per second. Note that the graphical representation is given by a parabola segment and the maximum value of the velocity is $v(0) = 1{,}185 cm/s$ (Batschelet, 1979).

We note that in our example, we consider a laminar blood flow, i.e., where the fluid particles move parallel to the tube (model) and their velocity increases uniformly. Thus, to conclude, when a blood sample is collected, for example, for a complete blood count, it is the pressure difference when puncturing that allows the blood to be inserted into the syringe (Willianson; Snyder, 2016).

AN EXAMPLE IN BIOCHEMISTRY - PHARMACY

Along these lines, from what Rashevsky (1940) and Batschelet (1979) pointed out, we can bring an example, in pharmaceutical biochemistry, when producing a syrup well known in the drug market and composed of two active ingredients: Dexcloferniramin Maleate (MdD), an anti-allergy, and Betamethasone (Bt), a corticosteroid.

The syrup, sold in 120 ml capacity bottles, has the following values: 0.4 mg/ml of MdD and 0.05 mg/ml of Bt.

Thus, using the properties of proportionality and representation in mathematical language, we have the following relations,

$$0{,}4mg/ml \Rightarrow 4mg/10ml \Rightarrow 40mg/100ml$$
$$0{,}05mg/ml \Rightarrow 0{,}5mg/10ml \Rightarrow 5mg/100ml$$

Therefore, in proportional terms for a composition with 120ml of syrup, we have:
For Dexcloferniramine Maleate (MoD),

$$(MdD) \Rightarrow \frac{40}{100} = \frac{x}{120} \Rightarrow x = \frac{40 \cdot 120}{100}$$
$$x = 48mg/120ml$$

For betamethasone (Bt),

$$(Bt) \Rightarrow \frac{5}{100} = \frac{y}{120} \Rightarrow y = \frac{5 \cdot 120}{100}$$
$$y = 6mg/120ml$$

We have a total of 54 mg of active ingredient(s), in a 120ml bottle of syrup. Composed of MdD and Bt.

$$\frac{48}{54} = 0{,}89 = \frac{89}{100} = 89\%\ de\ MdD$$
$$\frac{6}{54} = 0{,}11 = \frac{11}{100} = 11\%\ de\ Bt$$

In percentage terms, in the syrup we have described, we have $89\%\ of\ MdD$ and $11\%\ of\ Bt$, which in addition to giving us a better view of the form of composition, can offer us more information about the cost of producing this drug.

We observed that in this composition the components are combined, however, they are independent, that is, the change in the amount of one does not directly interfere with the other. However, according to Gonçalves (2019, p. 10), it is essential to control the dosage, ranging from a minimum effective value to a maximum, non-toxic, acceptable value, considering the unit of measurement referred to.

AN EXAMPLE IN MEDICINE

In Medicine, we bring an example that translates the prescription of the dosage of a drug, specific for use in cases of neuropsychiatric diseases, such as Anguish, Anxiety, depression or even for Epilepsy. Known in the pharmacological industry as "Diazepam", generally, its dosage, prescribed by a doctor, must consider the usual composition, which is $5mg/ml$.

Thus, for a prescribed dose of the "remedy", in a case of Epilepsy, considering the value of $0{,}5mg/kg$, for a patient's body mass, it would be of $60kg60 \cdot 0{,}5 = 30mg$, or even $\frac{30}{5} = 6ml$.

We note that this is considered a "high" dose and, therefore, should be applied according to medical prescription and under the supervision of nurses. Medications such as sedatives, anxiolytics, and antibiotics, even if in the calculations of their dosages use a simple mathematical tool, which involves proportionality properties, the administration and preparation of dosages must be very careful (Gonçalves, 2019).

Due to the need for these precautions, many of these drugs are produced and marketed with specific dosages, so that they can be administered at home, including the use of dispensers. However, in some cases, it is necessary to have a comprehensive reading of the prescribed values and to know the units of relative quantities.

AN EXAMPLE IN NURSING

As we have been discussing, the concepts of proportionality that involve ratios between quantities and the calculation of percentages, generally, with the use of the mathematical tool of the Rule of Three, are effective in the four previous examples, and are fundamental when applying drugs in the hospital environment.

Thus, according to Melo, Struchiner and Frant (2022), these elementary concepts of Mathematics should be an integral part of the training curriculum for nurses and nursing technicians, since these professionals effectively deal with the administration (application) of medications.

For Melo, Struchiner and Frant (2022, p. 2), due to the complexity in administration, mastering this mathematical knowledge should minimize the occurrence of errors, such as errors in dilution and/or dosages, which in Brazil has a high percentage of occurrence. Such failures in these processes can expose the patient to unnecessary risks or even the possibility of death.

Thus, one of the most effective actions occurs when determining the volume of the drug to be administered, in doses, when in liquid form, whether oral (syrups, suspensions or elixirs) or even injectable (serums).

For the dilution of drugs in intravenous application, as in the case of saline being the diluent and/or vehicle, the relationship between the amount of drug and the volume of serum should be observed. A simple calculation of proportions is often sufficient.

For our example, let's bring the administration of the two-gram intravenous antibiotic Ceftriaxone, which can be diluted in 40 ml of water for injections or saline solution (0.9% hate chloride). Generally, the administration is done by diluting the powder in a 50 ml serum and applied in a time of approximately 10 minutes.

Thus, we can determine the concentration of the active ingredient when this antibiotic is administered, diluted. Calculating the ratio and changing the units, we have the following result: $\frac{2g}{50ml} = \frac{2000mg}{50ml} = 40mg/ml$. Thus, the concentration of the drug in this example is $40mg/ml$.

As we have been discussing, for liquid dosage forms, when prescribed by a qualified professional, the care in administration involves the calculation of the volume to be determined by dosage.

A well-known solution in pharmacology is Amoxicillin, a beta-lactam antibiotic. Since the Amoxicillin solution does not necessarily need to be administered in a hospital environment, therefore, for administration at home, it is important to observe the concentration indicated on the package, which is usually $250mg/5ml$.

For example, an adult patient with approximately seventy kilograms of body mass should take the usual dose, usually prescribed, of $500mg$ every eight hours for seven days. As the vials of this medicine, in the pharmaceutical market, have measurements of $60ml, 90ml$ and $150ml$, using a

simple rule of three we can determine the necessary amount of the medicine to be used, as follows: $\frac{1}{500} = \frac{21}{x} \rightarrow x = 10500mg$. Taking the equivalence that a dose of $500mg$ corresponds to that $10ml$ of the solution, we will use, precisely, $\frac{10}{500} = \frac{y}{10500} \rightarrow y = 210ml$.

A result, which allows the companion (technician, caregiver, guardian, relative, friend), or even the patient himself, to acquire the necessary amount of the medication. In this case, it would be a bottle of $150ml$ and another of $60ml$, of the drug. Such action ensures correct dosing and possible reduction of waste. In addition, it can provide some cost savings.

AN EXAMPLE IN NUTRITION

To conclude, we bring an important example, aiming to ensure good nutrition, based on a balanced diet and considering the Brazilian Table of Food Composition (Tabela..., 2011).

It is worth mentioning that for a healthy and balanced diet it ensures a good functioning of the body. Thus, a balanced and sufficient diet should contain the following nutrients in its composition: proteins, carbohydrates, good fats, vitamins and fiber. In addition to good hydration (Table..., 2011).

In this way, a person with about 70 kilograms of body mass, in addition to drinking about two and a half liters of water, needs a daily diet of 1950 to 2400 calories. If we consider three main meals, we have an average of 650 to 800 calories per meal.

Let's consider, as an example, the amount of protein to be consumed at lunch. According to the Brazilian table, an individual should $70kg$ consume protein at lunch $50{,}2g$, in terms of beef, it is equivalent to $150g$. If we consider a dish of $400g$, we have $250g$ about for carbohydrates (rice, pasta, potatoes) and vitamins and minerals (salads). According to the Brazilian table we should have 40% carbohydrates in the meal, that is $160g$. About $90\ g$ left for salads (source of vitamins). (Table..., 2011).

Thus, in a dish made for a balanced lunch of a healthy individual, that is, without dietary restrictions, we must have 150 grams of beef, 160 grams of rice and 90 grams of salads, in other words 37.5% of protein source, 40% of carbohydrate source and 22.5% of vitamin and mineral salt sources,

As we have been presenting, our dish will have $50{,}2g$ proteins and $45g$ carbohydrates to be absorbed by the body. We observed that the vitamins present in salads, for example, in a raw green salad, are measured in a micro unit, being important in the diet, but considered in a separate count, in nutritional terms.

In the same way, our dish, as we have described, has about 650 calories of the form $650kcal = 379kcal + 208kcal + 63kcal$, about of 81% the designed. Multiplying by three we would have a diet of $1950kcal$. An acceptable value, which can be improved, generally, by

considering adding or reducing 5% the expected amount of calories to the diet. For the values obtained, we considered the proportionality of calories related to a 100-gram portion of food, in this case, beef, rice and green salad, respectively (Table..., 2011).

Malnourished individuals, diabetics or even athletes should be considered particular cases when establishing a diet, where new relationships will be established between the components considering these initial variables.

CONSIDERATIONS

Our arguments allow us to consider that the interactive relationship between Mathematics and Biosciences, as we have exemplified, can occur from elementary applications of mathematical techniques, such as the use of a simple (or compound) rule of three, in its arithmetic or functional aspects, to the use of more advanced concepts that comprise modeling that involves concepts of Differential and Integral calculus. such as the use of partial derivatives in modeling the scattering of molecules of a substance in a solubility medium.

We consider reporting that in our initial examples, however, what we present are calculations of procedures and not of functioning, except in example 3.2, performed in actions in these areas of the biosciences. Thus, as we initially discussed here, we present only elementary calculations, especially those related to the concept of proportionality, in its various guises.

We infer that our exemplification seeking the interaction between problems present in the Biosciences and the appropriate mathematical tool should allow undergraduate students in areas of Biosciences and/or Mathematics a better use and greater clarification when solving problems, when confronted in their courses, or even in future actions of their training.

We design, to deal with more problems of operation, where the functional calculations, as the nomenclature itself indicates, use the important mathematical concept of Function and where the properties and relations involved in the processes, refer to a calculation in the direction of the continuum. Thus, we will have a passage from the procedural to the functional aspects, which translates into an analogy from discrete (arithmetic-algebraic) to continuous (analytical) calculus.

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The risks of venous thrombosis and thromboembolism in cirrhotic patients: An integrative review

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ABSTRACT

The present study employed the integrative literature review methodology to examine the risks of deep vein thrombosis and venous thromboembolism in patients with liver cirrhosis. Different data sets were collected, all related to this specific theme. The discussion addressed and analyzed the risks of developing deep vein thrombosis and venous thromboembolism in patients with different degrees of liver cirrhosis, the occurrence of thrombotic events in these patients was also analyzed, it was also observed that deep venous thrombosis and thromboembolism are less common in alcoholic cirrhosis than in non-alcoholic cirrhosis. It is concluded that the understanding of these risks is still limited and there is a lack of more in-depth and complete studies and research, since there is a general reluctance to use anticoagulation for fear of hemorrhagic complications when there is an indication for the use of anticoagulants, such as venous thromboembolism (VTE) and deep vein thrombosis (DVT), which makes it impossible to carry out clinical trials to understand these risks and make use of an effective therapy.

Keywords: Risks, Deep vein thrombosis, Pulmonary thromboembolism, Liver cirrhosis.

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INTRODUCTION

Liver cirrhosis is the advanced stage of a progressive fibrosis in the liver, characterized by changes in liver structure and formation of regenerative nodules. Generally considered irreversible in advanced stages, liver transplantation is often the only viable treatment option. However, in the early stages, reversal of cirrhosis is seen in various liver diseases after treatment of the underlying cause. Patients with cirrhosis face a variety of complications and experience a significant reduction in life expectancy (Golberg et al., 2023).

In patients with cirrhosis, significant changes in the hemostatic system, evident in basic hemostasis tests, such as normalized international prothrombin time (IPT), activated partial thromboplastin time (aPTT), and platelet count during screening are common. Historically, these changes were associated with a higher risk of hemostasis-related bleeding. However, it is now widely recognized that basic hemostasis tests, such as prothrombin time and aPTT, do not fully reflect the hemostatic system. In addition, it is understood that although patients with liver disease may experience bleeding complications, many of these cases are not attributed to hemostatic dysfunctions, but rather to factors such as deep hypertension or mechanical vascular injuries, such as accidental punctures during invasive procedures. It has also been established that patients with cirrhosis are not exempt from thrombotic episodes and may require anticoagulant therapy for prevention or treatment. However, there is a paucity of data on the risk of bleeding and thrombosis in critically ill patients with cirrhosis, and knowledge about the efficacy of pro- and anti-hemostatic interventions in these situations is limited (Villa et al., 2022).

Perceived risk factors for deep vein thrombosis in cirrhosis include slow blood flow, vessel wall damage, and hypercoagulability, which constitute the classic triad of mechanistic factors for venous thromboembolism identified by Virchow. Deep vein thrombosis (DVT) is uncommon in the general population, but occurs more frequently in cirrhotic patients, especially in advanced stages of the disease. The prevalence of DVT increases as cirrhosis progresses, being less than 1% in patients with compensated disease, but ranging from 8% to 25% in liver transplant candidates, and increasing further in cases complicated by the presence of hepatocellular carcinoma. (Primignani et al., 2015)

The challenge persists in the use of procoagulant therapies in patients with advanced cirrhosis, and there are concerns about the increased risk of thrombosis in this population. In a study of 347 patients with cirrhosis who received prothrombin complex (CCP) concentrates for prevention or treatment of bleeding, CCP administration was identified as the only factor associated with thromboembolic events (5.5%) at a short-term follow-up. In addition, isolated cases of coagulopathy similar to disseminated intravascular coagulation have been reported in patients with decompensated cirrhosis following CCP administration. Patients with chronic Deep Vein Thrombosis (DVT) may present with clinical manifestations related to underlying conditions that predispose them to DVT,

such as cirrhosis. They may be asymptomatic due to thrombosis, especially if they have underlying cirrhosis (Tischendorf et al., 2019; Sanyal, 2023).

Regarding the above, the role of this literature review is to analyze the risks of thromboembolism and venous thrombosis in patients with liver cirrhosis.

MATERIALS AND METHODS

To carry out this narrative review of the literature, the following scientific databases were used: Latin American and Caribbean Health Sciences Literature (LILACS); Scientific Electronic Library Online (SCIELO); National Library of Medicine (MEDLINE) on the UpToDate platform, with the PUBMED, LILACS and MEDLINE databases being consulted by the Virtual Health Library (VHL).

In the choice of articles to compose the research, the following inclusion criteria were adopted: articles in Portuguese, Spanish and English; a time sample between 2015 and 2024; Publications with abstract and title. Articles that were not covered by the theme and those that were outside the temporal sample were excluded from the study, in addition to articles that were not available electronically and were not free.

In addition, descriptors were used in the PUBMED platform ((thrombosis) AND (thromboembolism)) AND (hepatical cirrhosis). Hepatology and cardiology guidelines were also used to conceptualize terms. Thus, 10 articles that met the inclusion criteria were selected in order to analyze and extract data that would support the hypothesis of this integrative review. After data collection, the information was interpreted and analyzed.

RESULTS AND DISCUSSIONS

The impacts of deep thrombosis on the natural progression of cirrhosis is a controversial topic, as several studies that examined the clinical outcome of cirrhotic patients after the diagnosis of DVT presented discrepant results. In fact, some research suggests that DVT may advance to complete occlusion and/or extend to other splanchnic vessels in 40%-70% of cases. Patients with DVT appear to have a more than three-fold increased risk of uncontrolling variceal bleeding and have a reduction in post-transplant survival, indicating an association between the presence of DVT in advanced stages of liver disease and critical outcomes. On the other hand, a recent multicenter study, involving a large series of patients, revealed that the incidence of DVT, mainly non-occlusive, had no impact on the clinical outcome and was associated with a high rate of spontaneous recanalization (Primignani et al., 2015).

Thrombotic events, such as deep vein thrombosis and venous thromboembolism, have been observed less frequently in alcoholic cirrhosis compared to nonalcoholic cirrhosis. However, the

higher in-hospital mortality rate associated with deep vein thrombosis in alcoholic cirrhosis highlights the importance of a careful approach in the management of these cases (Fan et al., 2019).

Observational data have suggested that anticoagulation may be beneficial for patients with cirrhosis and deep vein thrombosis. In a meta-analysis of eight studies involving 353 patients with cirrhosis and DVT, patients treated with anticoagulants (such as low molecular weight heparin or warfarin) had higher rates of partial or complete recanalization compared with untreated patients (71% versus 42%; OR 4.8, 95% CI 2.7-8.7). The overall rate of hemorrhage, including minor and major episodes, was similar in the anticoagulated and untreated patients (11% in both groups). The risk of variceal bleeding was assessed in four studies involving 158 patients, and the rate of variceal bleeding was lower in anticoagulated patients compared with untreated patients (2% versus 12%; OR 0.23, 95% CI 0.06-0.94) (Loffredo et al., 2017).

For the treatment of venous thromboembolism (VTE) in patients with cirrhosis, vitamin K antagonists (for Child A), low molecular weight heparin (for Child A, B, C), unfractionated heparin (for those with renal insufficiency), and direct-acting oral anticoagulants (DOAC for CTP A) have been recommended. These guidelines are valuable and can guide healthcare professionals in the prevention and management of these complications in patients with cirrhosis. Although comprehensive, the recommendations, as underscored by the guidelines, were mostly based on retrospective and observational studies of quality that do not yet reach optimal status. It is important to note that randomized controlled trials may not be feasible in patients at low risk of bleeding, due to the need for a large number of participants to demonstrate benefits or the lack thereof in preventing post-procedure bleeding. In addition, both patients and healthcare professionals may be reluctant to participate in such studies, due to fears of the risk of bleeding without the use of blood agents. Nevertheless, it is crucial to recognize the clinical importance of these issues and the need for guidance based on the best available evidence, since conducting large randomized trials may be unlikely and impractical (Kulkarni; K Rajender Reddy, 2023).

In a meta-analysis (PASTA et al., 2023) on the efficacy of venous thromboembolism prophylaxis showed that the rate of VTE is low (2.8%) in patients with cirrhosis, which accompanies the specifications mentioned when they are small, single-center studies, and even more so when considering the heterogeneous nature of patients with cirrhosis in terms of the etiology of the disease, stage and presence of acute diseases (such as infection, renal failure). Therefore, patients at higher risk of bleeding may not receive VTE prophylaxis, regardless of the perceived risk of thrombosis. Nevertheless, it is possible to perceive that there is a potential for prophylaxis for these patients and they deserve to be analyzed in clinical trials later.

CONCLUSION

To conclude, the evidence found in the current literature suffers from high heterogeneity and limited quality. However, it was analyzed that there is no significant risk for the development of bleeding in the prophylaxis of thrombosis and thromboembolism in cirrhotic patients. However, efficacy still remains largely uncertain and future studies are needed to guide clinicians dealing with this delicate clinical issue.

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Artificial intelligence and dental clinical practice

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ABSTRACT

Artificial intelligence (AI) has gained notoriety in the dental field, since the emergence of several tools that help dentists in the performance of their activities and clinical routine, contributing to the early diagnosis of diseases, personalization of treatments, and data management. The objective of this chapter is to address the impact of artificial intelligence on clinical dental practice, based on the literature of the last 5 years, available in the PUBMED, SCIELO and Google Scholar databases. Intelligent systems that have the potential to transform clinical practice in dentistry, support the professional in the quality of the diagnosis and reduce the cognitive wear of the professional, contributing to the reduction of neglected information, leading him to the best treatment decision. In this sense, the conscious and ethical use of AI in dentistry is essential for an adequate and responsible integration of AI systems into the clinical routine of the dental surgeon. Although there are limitations and flaws presented by AI resources that still need to be addressed, the advantages presented by these tools stand out and show promise in the dental field. The development, implementation, and receipt of AI in dentistry must be based on well-being, privacy, the law, and respect for autonomy and decision-making.

Keywords: Artificial intelligence, Dentistry, Evidence-based clinical practice.

INTRODUCTION

In dental practice, the use of Artificial Intelligence (AI) has been growing rapidly, optimizing processes, improving efficiency, and aiding decision-making through advanced data analytics. In addition, AI assists in the early diagnosis of diseases, personalization of treatments, and data management (AGRAWAL and NIKHADE, 2022).

It is evident that artificial intelligence has become a promising tool in dentistry (RASTEAU *et al*., 2022; MIRAGALL *et al*., 2023). With the advancement of technology, the application of its tools in various areas of health has become commonplace, and in the dental field this was no different. The various tools that artificial intelligence presents have been of great help to dentists in the performance of their activities and clinical routine (GHODS *et al.*, 2023). Performing simple tasks ranging from patient scheduling to more complex ones can currently be developed using AI (THURZO *et al*., 2022; GHODS *et al*., 2023).

A relevant aspect is the use of AI in patient communication, training (continuing and continuing education of professionals), and monitoring treatment progress, constituting a new domain for AI implementations (THURZO, 2021). Data and combinations of data are essential to AI processing algorithms. Therefore, the greater the range of data, the better the learning input to the machines, enabling better decisions (HENDI et al., 2024).

The success of the use of intelligent systems in dentistry is due, in particular, to Convolutional Neural Networks, which are deep learning algorithms capable of capturing an input image, assigning importance (weights and biases that can be learned) to various aspects or objects of the image and being able to differentiate one from the other. (Data Science Academy, 2022; TANDON and RAJAWAT, 2020).

These intelligent systems have the potential to transform clinical practice in dentistry by supporting the practitioner in the quality of diagnosis and reducing the number of images to be manually examined. In this way, *machine learning* reduces the cognitive wear and tear of the professional, contributing to the reduction of neglected information, leading to the best treatment decision (ARSIWALA-SCHEPPACH *et al.* 2024; SONG *et al*., 2022).

There are some fears on the part of some professionals regarding the use of these technologies, some of them being related to providing the high amount of data that AI systems need to perform functions efficiently and accurately. Although health data are personal and sensitive and need protection throughout the use process, the possibility of data leakage in the previous training of these systems is an issue raised by health professionals (FATIMA *et al*., 2022; RASTEAU *et al.*, 2022).

This is in line with the guidance of the conscious and ethical use of AI in dentistry, which must consider when to apply AI and how to use it appropriately and responsibly, as as many dentists

are accelerating towards the integration of AI systems into their daily clinical routine, legal and ethical issues are becoming even more pertinent. (ROGANOVIĆ, RADENKOVIĆ and MILIČIĆ, 2023).

The incorporation of AI in the clinical practice of the most diverse dental specialties can help in the early detection of diseases, optimization of the dental workflow, time management and cost reduction) for patients, which should lead to treatments with better cost-benefit and high quality resolution (WANG *et al*., 2020; TANDON and RAJAWAT, 2020; HENDI *et al*., 2024).

The objective of this chapter is to address the impact of artificial intelligence on clinical dental practice, in its most diverse specialties, based on the literature of the last 5 years, available in the PUBMED, SCIELO and Google Scholar databases.

APPLICATIONS IN DENTISTRY

Caries is one of the leading clinical conditions in the world and early diagnosis is critical, especially considering the socioeconomic challenges that affect access to dental care (WANG *et al.*, 2020). To locate and determine the extent of caries, the dentist should integrate the clinical examination with the complementary examination with radiographs. However, interproximal radiographs have low sensitivity for enamel-restricted lesions (CARVALHO *et al.*, 2021) and primary caries on proximal surfaces (ARSIWALA-SCHEPPACH *et al.* 2024). The potential of incorporating AI into restorative dentistry is noted, as early detection and treatment can preserve tooth structure and prevent the cycle of invasive treatments (DEVLIN *et al*., 2021).

Due to the progressive and irreversible nature of caries injury, AI-driven diagnostic tools potentially improve diagnostic accuracy, facilitate early detection, and support treatment decision-making (AL-NAMANKANY, 2023). In this way, it is possible to diagnose and intervene in lesions regardless of their stage and location, such as secondary caries, installed adjacent to the restorations, compromising the useful life of the restorative treatment (CHAVES *et al*., 2024). The findings reveal that AI algorithms may be a promising way to improve caries prediction, detection, and management (AL-NAMANKANY, 2023).

Specially designed for image processing to capture spatial relationships in two-dimensional input data (CHAVES *et al.,* 2024), convolutional neural networks can be used as an aid in the diagnosis of caries during radiographic analysis. Interproximal radiography, for example, which is used for the diagnosis of caries, is a two-dimensional image and can be easily processed by neural networks, optimizing clinical practice (ARSIWALA-SCHEPPACH *et al*. 2024).

Studies that evaluated the observation time of dentists until the diagnosis of caries showed that professionals who were assisted by software arrived at the report in less time (DEVLIN *et al*., 2021; ARSIWALA-SCHEPPACH *et al.* 2024). It was also observed that the convolutional neural

network was able to detect 92.5% of caries, providing the patient with appropriate intervention (KÜHNISCH *et al*., 2022). Machine learning will gradually enable minimally invasive treatments (GOMEZ *et al*., 2022) and in cases of major tooth destruction; technologies such as CAD/CAM are used for restorations, such as inlays, onlays, crowns, and bridges (TANDON and RAJAWAT, 2020).

AI is expected to be fully incorporated into dentistry. Considering that the programs are based on mathematical models influenced by human neurons, AI does not pose a risk to the professional class, since it is the responsibility of dentists to foster research and feed software for full use (TANDON and RAJAWAT, 2020). However, it is crucial to be aware of potential errors in the interpretation of data by AI programs, and combining the technology with conventional methodologies can minimize these errors (CABRAL *et al.*, 2021).

Although it demonstrated the accuracy of AI in diagnosis, the study by Chaves *et al.* (2024) pointed out the presence of false positives when diagnosing caries lesions on healthy surfaces, wrongly attributing the diagnosis of secondary caries to residual caries, and erroneously classifying ill-adapted restorations, in addition to false negatives for caries lesions restricted to enamel (CHAVES *et al*., 2024). This event results from the low performance of the software in the presence of impacted, crowded teeth, dental implants, and areas of greater contrast, such as overlapping, enamel, external oblique crest, and pulp stones, in addition to the anatomical variability of molars (PETHANI, 2020).

The inability of the operating system or even less theoretical deficit can lead the patient to unnecessary or inefficient restorative treatments. Bringing to light the relevance of adequate training for the reproducibility of new diagnostic systems by CD (DEVLIN *et al.*, 2021). The incorporation of AI and maintenance of the database, such as the increment of neural layers, for example, is indispensable for greater diagnostic sensitivity (TANDON and RAJAWAT, 2020). Their products assist in early disease detection, dental workflow optimization, time management, and cost reduction (HENDI *et al.*, 2024), for patients - because early detection of caries is more cost-effective than treating advanced conditions (WANG *et al.,* 2020).

APPLICATIONS IN ORAL PATHOLOGY

In oral cancer and precancerous conditions, AI has aided on a large scale in anamnesis and diagnosis, a product of neural network processing, in the screening and comparison of test results, such as MRI and CT scans, to assess potential for metastasis (AHMED *et al.,* 2020; BONNY *et al.,* 2023; TANDON and RAJAWAT, 2020). With the supply of the image bank, neural networks allow the processing of two-dimensional images, whether they are radiographs, MRIs, or even photographs (CHAVES *et al*., 2024), providing sensitive and assertive diagnoses, in some cases, surpassing human professionals in comparison efficiency (PETHANI, 2020).

In terms of diagnostic by image comparison, neural networks can be trained to identify different types of cysts, bone lesions, and oral cancer in diagnostic images; in addition to predicting the dosage of radiation to the jaw for oropharyngeal cancer treatment, with high accuracy comparable to human specialists (PETHANI F, 2020). Studies show the competence of unsupervised learning models for diagnosing clinical conditions, including soft tissue calcifications, tissue tumors, and anomalies, such as taurodontia (SONG, 2022).

Deep learning techniques support the early detection of dental anomalies, given that, if ignored, they can lead to serious systemic complications (LEE *et al*., 2022). In histology, intelligent systems also make it possible to improve diagnosis, by virtue of their application to identify malignant character and specific features in histopathological sections, such as cell morphology, nuclear atypia, and tissue architecture (GHODS *et al*., 2023; GONZÁLEZ, 2021; DHOPTE et *al.*, 2023). In addition to image processing, AI is able to predict the occurrence of pathologies, such as squamous cell carcinoma, based on clinical and genetic data (PETHANI, 2020; DHOPTE *et al*., 2023).

Intelligent systems have the potential to transform clinical practice in dentistry, in the sense that *machine learning* reduces the cognitive wear and tear of the professional, contributing to the reduction of neglected information, leading them to the best treatment decision (ARSIWALA-SCHEPPACH *et al.,* 2024; SONG, 2022). In addition to reducing human errors due to the concealment of data in the anamnesis or medical history, such as the diagnosis of bisphosphonate-related osteonecrosis before extraction (AHMED *et al.*, 2020).

With the range of results greater than 80% in favor of AI accuracy in oral pathology, educational institutions need to be prepared to offer ongoing AI training in dentistry (DHOPTE *et al.*, 2023; GHODS *et al*., 2023). Considering the complexity of oral anomalies, AI should be used as an additional benefit to be controlled by the dentist, and not replace him (BONNY *et al*., 2023).

APPLICATIONS IN PERIODONTICS

In periodontics, Artificial Intelligence already enables the analysis of diagnostic data, such as clinical parameters, radiographs and intraoral images, to assist in the diagnosis and classification of periodontal diseases from electronic medical records and datasets inserted into AI software that learn patterns and indicators of periodontal disease, assisting in decision-making and planning for the best possible treatment (DHOPTE and BADGE, 2023).

In this specialty, in particular, international studies show continuous development of intelligent tools and systems useful to complement the dentist's decision-making. *Deep Learning* algorithms associated with Neural Networks have high potential for usefulness and accuracy in the diagnosis and prediction of clinical conditions based on values of probing depths, insertion levels,

and bleeding points, extracted from patient records (BONNY *et al*., 2023; DHOPTE and BADGE, 2023).

Through the techniques of learning systems from a database of existing and defined characteristics in the classification of periodontal diseases, it is possible to benefit periodontists and patients in the accurate and quality diagnosis while saving time and resources, in addition to reducing human error. Despite this, it is understood that these systems are still far from replacing the knowledge of the health professional, and should be applied in a safe and complementary way to the judgment of the dental surgeon (BONNY *et al.*, 2023).

A 2024 primary study evaluated the accuracy of an AI algorithm trained to analyze signs of periodontal disease through image records from 60 patients. In their results, the authors found a sensitivity of 91%, specificity of 86% and an overall accuracy of 88% of the algorithm, demonstrating the use of AI as a promising tool in the early identification of periodontal diseases through intraoral imaging and favoring the reduction of diagnostic variability and support of more timely interventions (ALAM *et al*., 2024).

In addition, it has also been published that AI has the ability to identify patterns and models that may be difficult for humans to discern or that would require a significantly longer time, such as the identification of periodontalally compromised premolars and molars with 90% and 95% accuracy, respectively. This information is of great relevance to support treatment protocols, leading to positive impacts on diagnostic accuracy and overall treatment outcomes (HENDI *et al.,* 2024).

Despite the promising prospect of these tools, it is important to take into account that, as much as they can detect pathologies and direct diagnoses accurately, it is the practitioner's treatment recommendations based on the patient's overall context, available treatment options, and the patient's adherence to treatment that determine the true impact on clinical outcomes (PETHANI, 2021).

Chawla *et al*. (2023) published a study conducted in 2023 that evaluated the understanding and acceptability of periodontists regarding the use and application of AI in this area of expertise. The study reveals that there was great acceptability among professionals for the use of AI in the diagnosis of periodontal diseases, but resistance to its use in the predictability of clinical loss of insertion.

Despite understanding the basic factors of the concept of artificial intelligence and expressing a desire to incorporate such systems into the processes of diagnosis and therapeutic planning of periodontal conditions, part of the interviewees believe that their use for diagnosis is not more accurate than that of the professionals themselves to the point of replacing them (CHAWLA *et al.*, 2023).

Also from this perspective, it is a fact that the investigation of periodontal diseases and conditions is linked to complex contexts that require a multidimensional understanding of the factors that are associated with their manifestation and progression.

Currently, despite the possibility of teaching an AI about the scenarios that comprise periodontal diseases and subsidizing a positive impact on the diagnostic process, these tools are still incapable of reproducing the nature of the doctor-patient relationship, built from bonding and humanization. And second, in the process of integrating medical history associated with physical examination in situations characterized by ambiguity and uncertainty, which is beyond the current reach of AI technology (CHAWLA *et al.*, 2023; SACHDEVA *et al.*, 2021).

Although the development of AI within health scenarios and, more specifically, in periodontics is still moving at a short pace, it is observed that dentists understand and visualize the use of intelligent systems as facilitating resources for clinical practice and decision-making, assisting professionals in the correct interpretation of oral anomalies and minimizing human error. therefore, a modality of inevitable development and integration in dentistry (AHMED *et al.*, 2021).

APPLICATIONS IN DENTAL IMAGING

Radiological examination is a fundamental component in the management of patients in dentistry. It is widely used to complement and assist in the clinical diagnosis of pathologies affecting the teeth and adjacent structures. Accuracy and the ability to provide detailed insight into oral conditions make this examination indispensable for planning and executing proper dental treatments (GHODS, 2023).

Review studies have shown that the most frequent application of artificial intelligence in dentistry is largely concentrated in the areas of radiology and oral imaging. The integration of AI in these areas has shown significant potential to improve image interpretation, facilitating diagnoses, providing greater speed and accuracy (CHAN, 2018).

In this sense, the primary goal of using AI in dental radiology is to increase the efficiency and quality of services provided. AI can analyze large volumes of data faster and more accurately than traditional methods, allowing healthcare providers to focus on more complex and personalized aspects of patient care. In addition, it can assist in standardizing diagnoses and reducing human errors, increasing sensitivity and promoting safer dental practice (THURZO, 2022).

Many studies are committed to improving the classification and segmentation of oral radiographs based on machine learning. Mathematical morphology, active boundary models, level definition methods, Fourier descriptors, textures, Bayesian techniques, linear models or binary support vector machines are used. Classification includes a broad spectrum from the detection of the absence or presence of a pathology or object of interest, to its classification. For the efficiency of AIs

in the use of images, large banks, the so-called "big data", are needed. These are increasingly robust, especially with CT scans (GHODS, 2023).

Recently, several authors (RASTEAU, 2022; MONTERUBBIANESI, 2022; FERRO, 2019) began to conduct studies focused on evaluating the use of AI in imaging technologies, specifically applied to diagnostic protocols in dentistry. These studies have investigated the implementation in several areas of oral medicine. The use of AI has been reported in a wide range of radiographic examinations, including periapical radiographs, bite-wing (interproximal) radiographs, cone beam computed tomography (CBCT), magnetic resonance imaging (MRI), and panoramic radiographs. The application of AI in these exams has shown the potential to significantly improve diagnostic accuracy, the efficiency of clinical processes, and the overall quality of dental care.

The use of AI for the analysis of CBCT and MRI has revolutionized the way facial anatomy is evaluated and pathologies are visualized in oral and maxillofacial surgeries. These technological advancements allow for automatic and sensitive visualization of craniofacial structures, providing a more accurate understanding of clinical conditions and facilitating decision-making. The application of AI is particularly effective in assessing cystic lesions and locating included third molars, allowing surgeons to plan interventions with greater precision. The identification of osteoporosis in the jaws is also enhanced with the use of this technology, offering valuable insights into bone density and overall health of the jaw bones (CHOI, 2022).

In addition, AI significantly improves the detection of soft tissue calcifications and anomalies in areas surrounding dental elements, such as mucosal thickening in the maxillary sinus and the presence of radiopacities in the jaw. These advanced imaging capabilities assist in the accurate diagnosis of pathological conditions, the formulation of well-informed therapeutic decisions, and the design of detailed treatment plans (DESHMUKH, 2018).

AI also enables better prediction of health outcomes, optimizing treatment outcomes and improving patients' quality of life. Thus, the integration of AI in the analysis of CBCT and MRI represents a significant advance in dentistry, promoting safer, more effective, and personalized interventions (LEE, 2022).

The integration of AI with periapical radiographic examinations, panoramic examinations, and cone beam computed tomography scans is being widely used for the evaluation of periapical lesions in teeth with necrotic pulp, location of the apical foramen, and the working length of the canal. The dental surgeon, by analyzing the exams in digital format, can automatically identify abnormal points in the region of interest and obtain the information that is necessary for the treatment, complementing the information obtained by the anamnesis and the clinical examination (FERRO, 2019).

In oral rehabilitation, based on *machine learning*, it is possible to merge data from 3D images of CT scans, intraoral scans, and facial scans, which result in the proper visualization of the patient's morphology. The role of AI in implant dentistry is synchronized with the advancement of three-dimensional computerized cone beam imaging and intraoral digital scans. They are useful for methodically designing and manufacturing the implant prosthesis. Periapical and panoramic examinations are also used to assess morphological structures in the planning of surgeries (EKERT, 2019).

APPLICATIONS IN ORTHODONTICS

Artificial intelligence (AI) is revolutionizing the paradigm of orthodontics, positioning itself as one of the dental specialties with the highest number of collaborations with this technology. Among all the skeletal and soft tissue structures available for orthodontic diagnosis, the face stands out as one of the most important, although it is also the most challenging for scientific understanding by professionals. Automated AI facial surface analysis, coming from cone beam computed tomography (CBCT) or any other type of facial scanner, can be used to increase the accuracy and efficiency of diagnosis at any stage of life (IMPELLIZZERI, 2020)

There are reports in the literature about the usefulness of AI-managed tools during the COVID-19 pandemic, especially in the orthodontic retention or pre-treatment phase, allowing clinical conditions defined by experts to be regularly assessed through patients' home videos.

AI algorithms could analyze cephalometric radiographs to automatically identify and measure key anatomical landmarks used in orthodontic diagnosis and treatment planning. AI-powered software assists orthodontists in creating cephalometric tracings, analyzing facial and dental measurements, and simulating treatment outcomes based on established protocols (DHOPTE, 2023).

Recent studies have used AI to predict the need for tooth extractions based on clinical features and cephalometric measurements. The decision between extraction and non-extraction has been widely debated in orthodontics. In some studies (LI, 2019), AI demonstrated an 80% efficacy in determining the best treatment approach for 200 patients with malocclusion, aged 11 to 15 years.

In addition, there are reports on the use of CAD/CAM for 3D printing of orthodontic brackets and custom aligners. These printed devices are accompanied by algorithms that intelligently determine how the teeth should be moved, the force to be applied, and identify specific pressure points (SAGHIRI, 2022).

In dentofacial orthopedics, the use of Deep Learning for automated tooth segmentation in 3D models of the jaw allows the reconstruction of teeth with their roots from CT scans. Iterative closest-point algorithms are used to form a complete digital dental model, providing essential information for the simulation of orthodontic treatment (BONNY, 2023).

APPLICATIONS IN ORAL AND MAXILLOFACIAL SURGERY AND TRAUMATOLOGY

The use of AI in Oral and Maxillofacial Surgery and Traumatology (CTBMF) has grown significantly in recent years, helping to improve the performance of several areas of this specialty (RASTEAU *et al*., 2022; ESCHERT *et al.*, 2022). It has been used for the development of tasks ranging from patient triage, diagnosis, treatment plan to postoperative projections (SHAN, 2021).

Among the advances provided by this technology, the identification and accuracy of characteristic anatomical points in panoramic radiographs and cone beam computed tomography (CBCT), through specialized software, has been one of the most significant advances in AI in CTBMF (RASTEAU *et al.*, 2022). The algorithms that work in these software are able to accurately and quickly identify radiolucent bone lesions in the maxilla and mandible region.

Previous studies have reported that through models with specific image analysis algorithms, the diagnostic accuracy made by AI was as efficient as those performed by a specialist (CHEN, STANLEY, and ATT, 2020; RASTEAU *et al.*, 2022). In addition, another important point is the ability to early identify premalignant lesions in the mouth and pharynx region by means of autofluorescence measurement and photo analysis, which correlates high-dimensional parameters with clinical diagnoses and prognostic factors, thus constituting true radiological biomarkers revealing characteristic points in the detection of these lesions (RASTEAU *et al.*, 2022).

The *machine learning tools* involved in this system, in addition to providing the early identification of these lesions, may be able to predict the evolution of the disease, project the prognosis, as well as assist, through the data from electronic medical records present in their databases, in the choice of the most appropriate treatment for each case (FONTENELE *et al.*, 2023).

Another important advance of these tools is found in Orthognathic Surgeries. The location of cephalometric points is a crucial factor for accurate orthodontic diagnosis and treatment procedures. Errors in the identification of these reference points are directly linked to misdiagnosis and flawed treatment results (VILA-BLANCO *et al*., 2021; FONTENELE *et al.*, 2023;). In this context, seeking to prevent the occurrence of these damages, automated detection of landmarks using *machine learning* techniques on lateral cephalometric radiographs has emerged as a promising approach (ESCHERT *et al*., 2022; FONTENELE *et al.*, 2023).

The literature has recorded the various methods employed by authors in relation to precision and efficiency in the detection of these points, such as the "random forest technique". However, these more traditional spot detection techniques have limitations (MIRAGALL *et al.*, 2023). When compared to automated detection systems, traditional techniques are time-consuming procedures, have a higher risk of presenting potential biases and inaccuracies associated with detected reference point data that can be influenced by the observer's experience (MIRAGALL *et al*., 2023).

Still dealing with aspects related to AI advances in orthognathic surgery, the possibility of projections of the postoperative profile of patients is currently provided (ROKHSHAD, KEYHAN and YOUSEFI, 2023). In addition, AI-aided planning based on images and 3D models, makes it possible to simplify cephalometric analysis and operation simulation, as well as offer a more accurate visualization of dental abnormalities, occlusal plane inclination, and body length and mandibular branch (VILA-BLANCO *et* al., 2021).

The extraction of impacted third molars was also another procedure that gained prominence with the implementation of more current technologies. This can be considered as one of the most performed procedures in the specialty of CTBMF. The artificial neural networks that have been introduced to optimize and guide the procedure of extracting these teeth can predict the surgical outcome, difficulties, angulation of the tooth, as well as the relationship of the tooth to the mandibular canal. Although neurological complications cannot be entirely avoided in cases with a higher level of complexity, still the use of AI preoperatively significantly reduces the chances of neurological injury. In addition, this type of technology allows a prediction for postoperative edema complications, providing the patient with a greater level of knowledge for postoperative care (RASTEAU *et al*., 2022; MIRAGALL *et al*., 2023).

Despite the great advance that artificial intelligence has been providing for dentistry, its limitations in CTBMF are still strongly debated. Issues related to the limited explanation and lack of transparency of diagnostic development provided by these technologies become factors that corroborate the skepticism of some professionals in the field (AHMED *et al*., 2021). As this technology becomes more accurate in results, its complexity also seems to evolve, limiting not only the understanding of healthcare professionals, but also of patients (KRISHNAN, 2022; MIRAGALL *et al*., 2023).

There is a study that highlights the limitation in scientific content regarding AI tools in reputable journals. In addition, they recommend that CTBMF uniprofessional residency programs incorporate essential AI curricula into their educational offerings to improve practitioners' understanding of AI models and algorithms (MIRAGALL *et al.*, 2023).

In short, although the implementation of the tools provided by AI are still recent in the field of Oral and Maxillofacial Surgery and Traumatology, their aid in diagnosis, therapeutic decision, preoperative planning, or prediction of the outcome of surgery is of significant importance in daily clinical practice (RASTEAU *et al*., 2022; ALZAID *et al*., 2023). Although there are some situations that need to be resolved in terms of ethics, data protection and diagnostic transparency, the implementation of this technology in the dental environment can be considered as a permanent aid.

APPLICATIONS IN ENDODONTICS

Endodontics, a dental specialty dedicated to the diagnosis and treatment of pathologies of the dental pulp and periapical tissues, has benefited enormously from technological advances, especially because it is an area that requires numerous associated skills (KAROBARI *et al.*, 2023). Among the most promising innovations is the application of artificial intelligence, since its ability to analyze large volumes of data offers powerful tools to improve the accuracy of diagnoses, optimize treatment plans, and increase the efficiency of endodontic procedures (MORAES *et al.*, 2019).

Despite advances in treatment techniques, instrumentation, and materials, epidemiological studies reveal a high prevalence of radiographic periapical lesions and the persistence of periapical pathology in endodontically treated teeth, which makes the use of AI relevant to assist not only in dental clinical practice, but also to contribute to the personalization of patient care, ensuring faster, safer, and more effective treatments, which represents a significant advance, aligning with the global trend of incorporating cutting-edge technology to enhance patients' health care and well-being (KAROBARI *et al.*, 2023; PAULINO *et al*., 2023; SAVEGNAGO *et al.*,2024).

Saeed Asgary (2024), in a literature review, explored recent advances in artificial neural networks in endodontics. This neural architecture framework comprises neurons with interconnected robust systems that function primarily as information systems to determine problems. The results indicated that artificial intelligence models have a great utility in analyzing the anatomy of root canals. They allow both the early detection of periapical lesions and the precise determination of the working length.

In addition, AI models have shown an exceptional ability to recognize landmarks and lesions in cone-beam CT scans while maintaining consistently high accuracy rates. In addition, they have been shown to be effective in predicting the success of treatments, identifying various conditions such as dental caries, pulp inflammations and vertical root fractures, as well as offering second options for non-surgical root canal treatments.

In a systematic review, Boreak (2020) pointed out that there is a range of applications of AI implemented in endodontics, but highlighted the effectiveness of artificial intelligence applications developed for endodontic diagnosis, decision-making support, and prognosis prediction. The study also addressed the use of neural networks in endodontics, based mainly on convolutional neural networks (CNNs) and artificial neural networks (ANNs). These AI systems have been applied in the precise location of the apical foramen, prognoses related to the need for retreatment, prediction of periapical conditions, accurate detection and diagnosis of vertical root fractures, in addition to the thorough evaluation of root morphologies. Investigations indicate that neural networks showed results comparable to those of experienced professionals in terms of accuracy and precision.

Savegnago *et al*. (2024) gathered some relevant data when conducting a narrative review of the literature. In the review, an innovative apical foramen localization system was highlighted that achieved a 93% success rate in accurately locating the apical foramen by extracting radiographic features and processing them in artificial neural networks. In the results regarding the detection of periapical lesions, it was found that software using artificial intelligence presented high accuracy rates, reaching 93% accuracy with cone beam computed tomography (CBCT) images and 85% with panoramic radiographs. In the analysis of studies focused on root fractures, AI obtained a diagnostic accuracy of 70% with periapical radiographs and 96% with cone beam computed tomography (CBCT) images.

These advancements represent a remarkable opportunity for endodontics, with the potential to radically transform the way dental professionals approach the diagnosis and treatment of endodontic conditions. However, it is crucial that practitioners are prepared to integrate AI into their practice ethically and responsibly, ensuring that the advantages are maximized for the benefit of patients. In this regard, we can expect AI to continue to play an increasingly important role in the evolution of endodontics and improving clinical outcomes for patients (KESKIN, 2021; BOREAK, 2020).

APPLICATIONS IN IMPLANTOLOGY AND PROSTHODONTICS

Implantology and Dental Prosthesis are areas of dentistry responsible for replacing lost and/or artificially compromised dental elements. With the improvement of dental restorative materials and AI, it is possible to deliver better results to patients and with greater efficiency in dental clinical practice (HENDI *et al*., 2024).

In this context, AI has been shown to be a great ally of dentistry and especially of the rehabilitation areas of oral health, as it plays a fundamental role in diagnosis, offering support for treatment decisions, in addition to managing complex situations, increasing the predictability of cases and indicating possible negative outcomes during oral rehabilitation. However, a complete transformation from the conventional workflow to the digital workflow is required (DHOPTE *et al.*, 2023; FERRO *et al.*, 2019).

From the perspective of implant dentistry, AI is commonly used to assist in diagnosis and treatment planning, as it analyzes cone beam computed tomography images and intraoral and facial digital scanning images of the patient, being able to simulate the installation of dental implants and provide virtual treatment plans, displayed through three-dimensional simulations the ideal placement position and angulation of dental implants to obtain predictable results from the biomechanical and aesthetic point of view (FERRO *et al.*, 2019).

The case treatment plan is carried out in software, such as DTX Studio, Blue Sky Plan, NeoGuide System, DIOnavi and Simplant, among others, according to the information on the three-

dimensional anatomical and occlusal positioning of the prostheses on the implant, digitally planned through reverse planning. Some of these software are available free of charge for digital planning (FERRO *et al.*, 2019).

AI helps in the identification of dental anomalies by comparing patient data and examinations with established norms and standards, these algorithms can flag deviations and abnormalities and notify the operator of potential problems. They collaborate in decision-making, predictability of treatment, preoperative planning (preparation of surgical guides), recognition of implant types through image recognition using periapical and panoramic radiographs (FERRO *et al.*, 2019; DHOPTE and BAGDE, 2023; TURZHO *et al.*, 2022).

With the AI algorithm, it is possible to calculate and minimize the stress on the implant-bone interface by observing three implant variables (the length of the implant, the length of the thread, and the pitch of the thread), in addition to accurately calculating the modulus of elasticity of the implant-bone interface. AI increases the predictability of osseointegration through the analysis of risk factors and bone anatomy, along with finite element analysis calculations (HENDI *et al*., 2024; DHOPTE et *al.*, 2023; REVILLA-LEÓN *et al*., 2021)

In dental prosthesis, there is a total immersion of the specialty in AI, from the capture of images of the arches via intraoral and bench scanners to the prosthetic production from milling machines, through CAD/CAM technology. The evolution of AI in this specialty has been intense, especially in the manufacture of removable and fixed prostheses, the highlighting of prosthetic margins, the selection of colors, the manufacture of prostheses on implants and maxillofacial prostheses, in addition to the establishment of a facilitated maxillo-mandibular relationship (HENDI, *et al*., 2024).

The AI flow in dental prosthesis starts with the use of intraoral scanners. AI is used during the scanning process to automatically remove excess soft tissues and materials (TURZHO *et al.*, 2022).

In the software, the algorithm has the ability to process data and associate the relevant clinical information of the patients entered into the system, such as fingerprints, x-rays and facial scans, to create 3D virtual models of the patient's oral anatomy for an optimal diagnosis (DHOPTE *et al.*, 2023)

The software also performs the classification of dental arches in removable prosthesis, as well as autonomously suggests different designs of structures considered more appropriate for the clinical case, assists in the design of the prosthesis, in the determination of its type (removable or fixed) and in the selection of components, identify periodontally compromised teeth, in addition to delimiting the areas of end of the margin of preparations with onlay ceramic purposes, fixed inlays, crowns and bridges requiring only minor adjustments at the operator's expense, improving the accuracy of final

dentures and decreasing the need for manual adjustments (THURZO *et al.*, 2022; FERRO et al., 2019; DHOPTE et *al*., 2023)

The data generated by three-dimensional machines is used by AI to design the prosthesis on implant in reverse planning, thus determining the most convenient position and angulation for implantation and fabrication of precise surgical guides (AL HENDI, *et al.*, 2024).

In conventional prosthetics, the integration of AI has increased accuracy, precision, and reliability, positively impacting clinical outcomes. During digital design, the CAD/CAM tool is used for the manufacture of fixed and removable dental restorations. In this process, a virtual library with millions of natural crowns can be used to create the best possible crown design for the various clinical situations, in addition to the software making it possible to recreate acceptable intermaxillary relationships, configuring the correctly designed teeth, evaluating occlusal relationships and identifying interferences in search of the appropriate functional dynamics. Virtual analysis of the joint and occlusion can assist in the planning of prosthetic treatment, ensuring proper occlusal alignment and harmony for appropriate functional and aesthetic outcomes (DHOPTE *et al*., 2023; TURZHO *et al.,* 2022).

The models made in the software serve as a reliable diagnostic tool for selecting the color of the tooth, presenting varied shapes and enabling adjustments in aesthetics in search of the best results for the patient during the digital design of the smile, in addition to predicting facial changes in patients with removable dentures and design of removable partial dentures. The software is also able to predict the color change of prosthetic restorations in various lighting conditions (DHOPTE *et al*., 2023; BONNY *et al.*, 2023).

In addition to the models, smile design uses 3D facial scanning and virtual resources along with segmented computed tomography, intraoral scans, and facial scans, resulting in the virtualization of the patient's morphology, producing a facial design with the patient's smile (TURZHO *et al*., 2022).

CAD/CAM software not only designs, but is also responsible for manufacturing, printing, or milling the prosthesis. Commonly used to manufacture inlays, onlays, crowns and fixed bridges. Resulting in savings in time, resources, and energy for the dentist, prosthetist, and patients, in addition to reducing the chances of human error in the final prosthesis and performing unnecessary procedures (HENDI, *et al.,* 2024).

APPLICATIONS IN FORENSIC DENTISTRY

Forensic Dentistry, also called Forensic Dentistry, is a specialty of dentistry that employs technical-scientific processes to assist in human identification in forensics focused on the head and neck. This includes the analysis of dental arches, the comparison of dental records, facial

reconstruction, and the identification of other anatomical structures in the region, making a crucial contribution to legal and judicial investigations (RAMOS *et al.,* 2021).

The importance of the forensic dentist has become crucial in forensic science, particularly due to the histological characteristics of teeth that make them resistant, such as not sustaining damage when subjected to temperatures of 600°C and remaining intact for long periods after the body has deteriorated. Thus, when a body is found in conditions such as skeletonization, charring, advanced stages of decomposition, or other situations that make identification difficult or impossible by traditional methods, such as dactyloscopy, the analysis of the tooth structure becomes fundamental for individual identification (BIANCH, 2019).

Advances in computer science and radiology refinement have played a significant role in achieving greater accuracy and detailed image analysis, providing enlargements without loss of quality, reducing image processing time, and offering various adjustment options. These advances have enabled more accurate identifications and facilitated the comparison between ante-mortem and post-mortem radiographic examinations (RAMOS *et al*., 2021; BIANCH, 2019).

Nascimento Neto *et al.* (2019) conducted a research in order to map and categorize forensic knowledge, with the purpose of developing a methodological plan to support the creation of a tool based on artificial intelligence specific to Forensic Dentistry. The study presented a proposal that uses artificial intelligence to store dental records, perform comparisons and recognize radiographic images, ensuring the legitimacy and authenticity of the data.

The software developed in the study had the participation of the dental surgeon, the radiology companies and the forensic dentist, and consists of a graphical interface that acts online and allows the user (dental surgeon) to enter the dental documentation register, consisting of medical records, radiographs, odontograms and photographs. In this way, it is possible to create a database with accurate information on an individual, which allows the identification of the level of similarity between ante-mortem and post-mortem examinations and, based on this, to be able to give a report confirming or not the identification of the victim, which helps and optimizes the work of the forensic dentist (NASCIMENTO NETO *et al*., 2019; BIANCH, 2019).

At the same time, (MOLLO FILHO; MELANI, 2022), demonstrated through a literature review the relevance of the use of intraoral scanners and their applicability in the practice of forensic dentistry. The resource is capable of generating three-dimensional digital models of the oral cavity that can be stored, analyzed, and compared using proprietary applications.

With the application of the technique, records are obtained with agility and precision and the data can be obtained, if necessary, in the very place where the body is located during the expert evaluation. Research shows that intraoral scanners have as a differential the possibility of

differentiating monozygotic twins by analyzing palatine roughness, an anatomical detail that is also capable of individualizing each person (GIOSTER-RAMOS *et al.,* 2021; Bianch, 2019).

Thus, artificial intelligence combined with imaging exams and comparison algorithms have proven to be extremely important resources in the human identification process.

PERSPECTIVES OF AI IN DENTISTRY

With the advent and applicability of AIs in healthcare, the possibility of virtual care through teledentistry has been highlighted as promising and has the potential to reach patients in more remote regions with limited access to dental care, so that they can, from this new resource, receive consultations more quickly and efficiently (AGRAWAL and NIKHADE, 2022; GHODS *et al.,* 2023).

Among the branches of dentistry with the greatest applicability of these technological resources, without a doubt, diagnosis and treatment have been the most impacted. Machine *learning* algorithms are capable of analyzing radiographic images, CT scans, and other imaging tests, providing faster and more accurate identification of conditions such as caries, fractures, periodontal diseases, and even premalignant lesions, which has been helping in early diagnosis and may soon be considered an essential tool for clinical use to minimize the chances of a poor prognosis for the patient (CHWENDICKE, SAMEK and KROIS, 2020).

In addition, software that provides augmented reality and 3D images reveal that AI is a promising tool for the evolution of more effective dental diagnoses (PETHANI, 2021; BONNY *et al*., 2023). A study demonstrated the efficiency of an artificial neural network in providing a diagnosis with good accuracy. In this study, a comparison was made between the diagnosis made by a specialist and by ANN, the result showed that AI had a high sensitivity and specificity in the diagnosis presented (TANDON, RAJAWAT and BANERJEE, 2020).

With regard to the individualization of treatments, advanced algorithms are able to analyze previously provided data on each patient's oral health and medical-dental history, allowing, which will allow dentists to create personalized treatment plans in daily clinical practice (SHAN, 2021).

Regarding monitoring and prevention, the literature reports that through RNA it was possible to create a model capable of predicting the possibility of toothache in patients. This study used the association between toothache, frequency of brushing, flossing, and other factors such as diet and physical activity. The model made in this study was able to recognize proper eating habits, oral hygiene, and stress prevention as the most important factors in the prevention of dentistry (TANDON, RAJAWAT, and BANERJEE, 2020).

In addition to the above-mentioned points, advances in surgical planning have shown promise for application in the dental environment (ALZAID *et al*., 2023). Through software specialized in

machine learning , it is possible to perform complex surgeries, such as implant placement or orthognathic surgeries, with greater precision. This software aims to make procedures less invasive, which will reduce recovery time and provide greater safety for the patient (RODRIGUES, KROIS and SCHWENDICKE, 2021; ALZAID *et al*., 2023).

Despite the promising results that artificial intelligence provides for the dental environment, several authors still debate the difficulties and flaws presented by this technology. Among the main issues raised are the high complexity of understanding these systems and the high number of health data used in previous tests for the development of these systems, which are at risk of leakage (CHWENDICKE; SAMEK; KROIS, 2020).

Some authors also highlight the automation bias that occurs when some professionals underestimate the possibility of error in the information presented by AI (GLICK *et al.*, 2022). The fact that the information was generated by a computer is enough for the professional to adopt the result as an absolute truth, even if he sometimes has doubts about the result, this prevents him from investigating further, allowing the chance of error (GLICK *et al*., 2022).

LEGAL ASPECTS OF AI IN DENTISTRY

Currently, there are no laws specifically set for the use of AI in dentistry. (ROGANOVIĆ and RADENKOVIĆ, 2023; ROGANOVIĆ, RADENKOVIĆ and MILIČIĆ, 2023; ROKHSHAD *et al*., 2023).

Medical liability currently defined under the law is inadequate and therefore may not encourage the safe use of AI in clinical decision-making. It can be stated with certainty that the use of AI in clinical decision-making needs dental surveillance, and the role of dentists is crucial in preventing dental complications as well as reviewing AI systems (ROGANOVIĆ and RADENKOVIĆ, 2023).

To respect the interaction between man and technology in a clinical setting, AI in medicine and dentistry must have a complementary role in the work of clinical professionals. In dentistry, various software-type algorithms are used as the basic application of AI, which is supposed to improve the accuracy of dental diagnosis, provide visualization of anatomical guidelines during treatment, and, due to the possibility of analyzing large amounts of data, predict the occurrence and prognosis of oral diseases. The conscious and ethical use of AI in dentistry should consider: (1) when to apply AI and (2) how to use AI appropriately and responsibly. Patients should be notified about how their data is used, also about the involvement of AI-based decision-making, especially if there is a lack of regulatory policy if AI is used to decrease costs rather than improve patients' health or if the dentist has a conflict of interest. As many dentists are accelerating in the direction of integrating AI

systems into dental diagnostics, prognosis, and treatment, the legal and ethical issues are becoming even more pertinent. (ROGANOVIĆ, RADENKOVIĆ and MILIČIĆ, 2023).

Notably, particularly for AI, considering a network of multiple stakeholders, including patients, clinicians, software developers, and society, as well as the specific requirements, needs, and constraints of the target medical specialty may be relevant; existing guidelines applied to medicine will not be entirely applicable to dentistry. A specific framework and *guideline* on dental AI is needed, which should facilitate dissemination to the dental domain and help optimize dental AI in relation to its ethical foundations (ROKHSHAD *et al.*, 2023).

FINAL THOUGHTS

AI has become an excellent tool for dentistry, providing several advantages that have improved both clinical practice and the patient experience. The potential of AI to transform the way dentists deal with the diagnosis, planning, and treatment of their patients is remarkable.

Although there are limitations and flaws presented by AI resources that still need to be addressed, the advantages presented by these tools stand out and show promise in the dental field. Still, the employment of these technologies in clinical dental practice is a challenge and the lack of acceptance of these tools can be attributed to the complexity of dealing with new technologies and the difficulty of acquiring new skills.

All stakeholders in this process, such as dentists, patients, and system developers, should consider and prioritize, among other factors, well-being, privacy, the law, and respect for autonomy and decision-making when developing, implementing, or receiving dental AI.

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Technological innovations for the diagnosis of Acute Myocardial Infarction (AMI): A medical perception

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ABSTRACT

As it is a consolidated market, technological innovations in the diagnostic medicine sector must aim not only to meet the expectations of stakeholders but also to bring an improvement in access to health and a better patient experience. A German company set out to develop a Point-Of-Care capable of detecting serum levels of high-sensitivity troponin (hs-cTNI) at very low values, in order to reduce the time to diagnosis of acute myocardial infarction. International guidelines recommend that the hs-cTNI result be available within one hour of patient sample collection, but few hospitals achieve this goal, leading to delay in clinical decision-making and consequent harm to the patient. To understand how the medical profession of cardiology understands and evaluates the importance of a technological innovation in this sector, a survey was conducted at the World Congress of Cardiology. About 32% of the interviewees do not use hs-cTNI in their service and almost half do not comply with the application of the 0h-1h protocol for diagnosis. The interviewees reported that the use of this technology would be beneficial and necessary, and added that patients with non-ischemic pathologies would also benefit from the diagnosis of myocarditis and pulmonary thromboembolism. Finally, it is concluded that, according to the perspective of the medical profession, innovation in the cardiovascular medicine sector for the diagnosis of AMI allows faster and more assertive clinical decisions, promoting a better patient experience and improving the flow within emergency services.

Keywords: AMI, Technological innovations, Diagnostic medicine, High-sensitivity troponin, Point-of-care, OCD, Hs-cTnI, Acute myocardial infarction, Emergency department.

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INTRODUCTION

The medical technology (medtech) industry is a dynamic and innovative sector that works to save and improve lives. With more than 500,000 products and services on the market, companies in this sector are improving patient outcomes and helping to make health systems more sustainable and accessible (ESTATÍSTICA, 2010). According to Davila, Epstein and Shelton (2007), innovation is one of the most important factors to ensure the future of any company and to remain in the market in the face of competition.

However, innovation efforts often fall short of their intended goals, often by not starting from an advantageous position, paralyzing new businesses in bureaucracy, and by misaligning new businesses with the company's core businesses. One of the important points that market research demonstrated was that building a new business is challenging, but the key to long-term growth is the creation of value throughout the stages of the customer experience (Oliveira et al., 2020).

Porter and Teisberg (2004) emphasize that innovation in this sector can reduce costs, improve the quality of life of the population and increase the population's accessibility to health services. For this to be possible, it is necessary for medical technology companies to make an effort to strategically seek innovations that increase value for the patient along the service delivery chain and with a holistic view of the market.

In the market of medical technology companies, there are diagnostic medicine companies. Specifically in relation to the diagnosis of cardiovascular diseases, the need for innovation becomes even more imperative, since cardiovascular diseases are one of the main causes of mortality in the world, with Acute Myocardial Infarction (AMI) being the most prominent, along with Stroke (SBC, 2015). In Brazil, the Department of Informatics of the Unified Health System (DATASUS) counted 1,066,194 cases of hospitalizations due to AMI between 2010 and 2021 (BRASIL, 2021).

The high mortality rate in the Brazilian public health system can be attributed, among other causes, to the difficulties in accessing patients with suspected AMI to intensive care treatment, reperfusion methods, and therapeutic measures established for AMI. In addition, early diagnosis until appropriate and timely treatment is one of the pillars for reducing this rate (Marcolino et al., 2013).

According to the studies by Konder (2013) and Silva (2012), most urgent and emergency centers in Brazil are overcrowded with cases of low complexity or care for chronic diseases. Such a situation tends to increase the risk of mortality due to the delay in care and, consequently, in the clinical decision-making of patients in a severe situation (Rocha and Fernandes, 2014; Marcelo, Di João and Fernandes, 2021).

AMI is a medical emergency that occurs when there is an interruption of blood flow to a part of the heart, resulting in injury to the heart muscle. Early and accurate diagnosis is essential for proper treatment and reduction of damage to the heart. For patients with unstable angina and

suspected non-ST-elevation AMI, international guidelines (American Heart Association, 2021) recommend that it be performed based on clinical symptoms, together with electrocardiogram (ECG), biomarker analysis, echocardiography, and one of the diagnostic scales (TIME OR GRACE). The most widely used biomarker of cardiac necrosis is high-sensitivity troponin (hs-cTnT/I). This marker has the ability to triage patients complaining of chest pain and refer them to the correct clinical management based on the 0h/1h algorithm.

International guidelines recommend the use of this algorithm to minimize the time from the patient's arrival at the emergency department to the final diagnosis, however, to date, the successful clinical implementation of these rapid algorithms is restricted to hospitals that work with well-defined flows and a robust central laboratory structure, as current hs-cTnT/I assays require proof that they are high sensitivity tests. that is, that allow the detection of serum troponin levels even in very small amounts. However, this characteristic has only been proven in the literature to date in large diagnostic platforms in a central laboratory (Clinical Chemistry, 2019).

Based on this context, a Point Of Care (POC) hs-cTnT/I test can be of great value to perform hs-cTnT/I measurements in the exclusion and inclusion protocol for AMI. This is because they are portable, practical equipment that can be used at emergency triage stations, in the doctor's office or wherever it is convenient (Bhatnagar et al., 2016). However, the POC tests currently available on the market for troponin dosing are not able to meet the criteria necessary to be considered high sensitivity, and therefore, are not used for this purpose, according to (Regan et al., 2019).

In order to improve the service provided in the early detection of people with chest pain and contribute to overcoming challenges in the Brazilian health system, a German medical technology company proposed to develop a POC equipment that allows the detection of troponin meeting the high sensitivity criteria by the year 2023 (Apple, 2021). However, it is necessary to investigate how the medical community uses the technologies already available on the market and how it evaluates the clinical relevance that an innovative technology in the cardiology sector can contribute to improving the patient experience throughout their journey from the suspicion of AMI to the final diagnosis.

Thus, the objective of the present study was to analyze the data provided by the medical profession during the cardiology congress, allowing a better understanding of the market and the clinical relevance according to the answers given.

MATERIALS AND METHODS

This research is applied and exploratory in nature, as it seeks to provide greater familiarity with the theme in order to make it more explicit or to formulate hypotheses (Piovesan; Temporini, 1995, p. 321). In addition, it has a descriptive aspect, describing the characteristics of a specific

phenomenon, such as the implementation of an innovative technology in the cardiology sector in the Brazilian health system. As for the technical procedure, it is a survey that involves the direct questioning of people, of a qualitative nature, with the objective of understanding the behavior and perception of the interviewees (Yin, 2015).

For data collection, a research instrument consisting of 6 questions is used, to be answered objectively by the interviewees. The questionnaire was developed by experts together with members of the present study team. The target audience of the study was composed of health professionals and the questionnaire was made available at the technology company's stand to a sample of attendees participating in the 77th Edition of the World Congress of Cardiology, which took place on October 13, 14, 15 and 16, 2022. All respondents were asked voluntarily and in an informed manner to contribute with the following form:

1- Does the institution you work for use troponin as a marker for AMI? If not, which marker is used?

a) Yes

b) No

2- What type of troponin is used?

a) Conventional Troponin T

b) Conventional Troponin I

c) High-sensitivity troponin I

d) High-sensitivity troponin T

e) I don't know how to inform

3- Does the institution you work for use Point of Care as a rapid test for troponin dosage? If not, what platform do you use?

a) Yes

b) No

4- Does the institution you work for use the 0-1hrs infarction algorithm? If not, which one is used?

a) Yes

b) No

5- Do you believe that having a high-sensitivity troponin Point Of Care as a rapid test will be beneficial for patients with suspected MI without supra?

a) Yes

b) No

6-What other pathological situations could benefit the rapid medical management of the use of high-sensitivity troponin by Point Of Care as a rapid test?

The questionnaire was prepared by the Medical Affairs team of the medical equipment company together with the Marketing and Communication team. The Marketing and Communication sector were responsible for the processes of dissemination, formatting of the art and adequacy of the research with the LGPD law. On the other hand, the Medical Affairs team ensured the clinical relevance of the research, adequacy to new terminologies and contextualization with medical demands. With this questionnaire, the company aimed to understand how the medical team understands the innovation process in the cardiovascular medicine sector for the best positioning of its product and its importance to improve patients' clinical outcomes.

RESULTS AND DISCUSSION

BIOMARKERS FOR AMI DIAGNOSIS

The evolution of biomarkers

Biomarkers have evolved over the years so that they have the highest sensitivity and specificity possible (SBC, 2015). A good marker of myocardial necrosis should be in large quantities in the cell, especially in the cytosol. This is necessary so that the macromolecule can be detected quickly, and that it remains in the bloodstream for a sufficient time so that the health professional can monitor the patient's prognosis throughout the days of hospitalization. In addition, it should not be detectable in healthy patients or patients without heart disease, that is, it should be present only in the myocardium and not in other organs and tissues (Ladenson, 2012).

The evolution of the biomarkers has gone through: Aspartate aminotransferase (AST) found mainly in the liver and heart muscle, Creatine kinase (CK) which consists of a dimer composed of two subunits (B and M) that are separated into three different molecular forms (isoenzymes): CK-BB or CK-1 found mainly in the brain; CK-MB or CK-2, hybrid form, mainly in the myocardium and CK-MM or CK-3 mainly in skeletal muscle. In addition to Lactate dehydrogenase (LDH), also found mainly in the myocardium; Troponin T and Troponin I (TnT and TnI) and Myoglobin found in both skeletal and cardiac muscle (KUMAR et al., 2010).

The AST enzyme is present in the mitochondria of cardiac cells and, around 6 to 8 hours after myocardial infarction, its serum activity begins to increase, reaching its maximum peak (20 to 200 U/mL) between 18 and 24 hours. However, one of the main disadvantages of this enzyme for the diagnosis of AMI is that it is non-specific and false positives may occur, since it is elevated in cases of liver disorders (Motta et al., 2007).

Another enzyme used for the diagnosis of AMI is CK, especially its isoenzyme CK-MB. The myocardium contains significant amounts of CK-MB, while in other tissues, CK-MB is found in small contents. This enzyme rises in 4 to 8 hours from chest pain, reaching its maximum in 12 to 24 hours, returning to normal, in uncomplicated cases, in 48 to 72 hours. However, as with AST,

elevation of this enzyme may occur in clinical conditions other than AMI, such as muscle trauma, myopathies, hyper and hypothermia, myocarditis, defibrillation, chronic renal failure, pregnancy, ectopic production (cervical tumor). In addition, CK and its MB fraction (CK-MB) do not show serum elevation until the 4th hour after the onset of chest pain and, therefore, do not show good sensitivity in the initial stage of AMI (Cavalcanti et al., 1998).

Like the CK-MB enzyme, lactate dehydrogenase (LDH) has its activity increased between 8 to 12 h from chest pain and reaches its maximum peak in 24 to 48 h. The increase in this enzyme also does not refer only to AMI, but is one of the markers that define this possibility. However, it remains high in the bloodstream for 7 to 14 days. Another form of diagnosis is the determination of myoglobin, which is not an enzyme, but is found in the blood about 1 hour after the onset of symptoms, being a good early marker of AMI. However, like the previous enzymes, it is not specific for infarction (Motta et al., 2007).

According to the joint guidelines of the American College of Cardiology (ACC) and the European Society of Cardiology (ESC), and updated in 2021 and 2020 respectively, the recommendation biomarker I Class-A of myocardial necrosis is Troponin.

TROPONIN AS A MARKER OF MYOCARDIAL NECROSIS

The contraction of both skeletal and cardiac muscle is dependent on a contractile complex called sarcomere, troponin being one of the proteins that make up this complex. There are three types: troponin I (Tn I), actin-inhibiting subunit, troponin C (Tn C), a calcium-linked and contraction-regulating subunit, and troponin T (Tn T), a tropomyosin-linked subunit (Motta et al., 2007).

Tn C is genetically the same in both skeletal and cardiac muscle, but the genes encoding troponins I and T, cardiac and skeletal, are different, which allowed the development of antibodies with low cross-reactivity for the diagnosis of AMI. Both markers are equivalent for the determination of serum troponin, but the most commercialized is Tn I (Lewandrowski, 2014).

Most troponins are attached to thin filaments as part of the sacarere structural group and a small portion is free in the cytoplasm. When the membranes of cardiac cells are damaged, troponin is detected in the bloodstream, especially in the complex form of TnI-TnC and the free form of TnT. However, it is possible to find the TnT-TnI-TnC complex and the free form TnI in the circulation (Lewandrowski, 2014).

According to Ravel (1997), IT is more sensitive than CK-MB during the first hours after AMI, with sensitivity equal to 33% from 0 to 2 hours, 50% from 2 to 4 hours, 75% from 4 to 8 hours, and approaches 100% 8 hours after the first symptoms of the disease. In addition, it is known that

troponin rises in plasma 4-6 h after AMI attack, reaching peak concentrations between 12 and 18 h after infarction, and may remain elevated for 7 to 10 days after the acute episode (SBC, 2009).

Panteghini et al (2008) proposed that the molecular structure of Tn I favors its specificity, since its N-terminal chain has a singular sequence. Therefore, the antibodies are specific against the epitopes of the TnI region. In addition, unlike other cardiac markers, Tn I is highly specific for myocardial tissue, is not significantly detectable in the blood of healthy people, and shows an increase well above the threshold values in cases of AMI (PANTEGHINI, 2008).

According to the joint guidelines of the American College of Cardiology (ACC) and the European Society of Cardiology (ESC), and updated in 2021 and 2020 respectively, the recommendation biomarker I Class-A of myocardial necrosis is Troponin.

HIGH-SENSITIVITY TROPONIN

In the 2000s, laboratory assays were introduced to the market that were able to detect very low levels of troponin even in healthy patients. These biomarkers have been termed "high-sensitivity troponin." By definition, High Sensitivity Troponin (hs-cTnT/I) is understood as laboratory assays that have the ability to detect this protein in small concentrations in plasma and serum, with greater precision, even in individuals apparently free of cardiovascular disease (Thygesen et al, 2010).

The following can be highlighted as characteristics of a high-sensitivity assay: the total inaccuracy, coefficient of variation (CV), of the assay should be ≤ 10% at the 99th percentile for the healthy reference population and the limit of quantification (LoQ) should be such as to allow plasma concentrations to be measurable and quantifiable for at least 50% (ideally > 95%) of healthy subjects. In addition, it is necessary that the test presents reference values with stratification by sex. (Thygesen et al, 2012).

Compared to conventional troponin assays, they have been shown to be more sensitive for the diagnosis of AMI. Even in patients who did not have their concentration elevated above the 99th percentile or undetectable with the first-generation tests, the new methods were able to better discriminate patients with a higher risk of long-term mortality (Keller et al, 2009).

APPLICATION OF 0H-1H ALGORITHMS

The diagnosis of AMI is based on three pillars: the first is the patient's clinical condition, characterized by chest pain, anxiety, sweating, signs of shock, hypotension, decreased pulse amplitude, left ventricular failure, arrhythmias, and vomiting. Parallel to these symptoms, there are electrocardiographic (ECG) alterations and an increase in biochemical markers of necrosis (PESARO et al., 2004).

The ECG is an integral part of the diagnostic work-up of patients with suspected AMI and should be acquired and interpreted promptly (within 10 minutes) of clinical presentation. An example of a clinically important finding on the ECG is the presence of ST-segment elevation (STEMI). With this electrocardiographic alteration, it is possible to easily refer the patient to the appropriate therapy.

However, the great challenge for the medical profession is to exclude patients for ST-segment non-ST AMI (STEMI) detected on the ECG. To this end, biomarkers are essential (Thygesen et al, 2012).

According to the National Institute for Health Research (NIHR), in 2021, only about 20% of emergency room complaints for chest pain are actually a myocardial infarction and there are many other possible causes of chest pain, for example: gastroesophageal disorders, muscle pain, anxiety, or ischemic heart disease. Thus, it is important to have an algorithm that is able to direct not only those who are in the process of infarction, but also those who are not and lead them to the best therapy.

As described above, STEMI patients are easily included in the AMI protocol and directed to treatment. However, the challenge lies in the process of excluding IMSST patients. In 2020, the European Society of Cardiology (ESC) published guidelines that propose algorithms with exclusion rule and inclusion of acute myocardial infarction (AMI) in patients admitted in the stroke setting and for the management of myocardial infarction.

Before hs-cTnT/I, this process took 6 to 9 hours to occur, which resulted in longer patient time in emergency rooms, delayed diagnosis of AMI, and increased costs with incorrect management. Currently, serial measurements have been performed with hs-cTnT/I tests to accurately measure changes in cTn concentrations, allowing the discrimination of acute from chronic elevations and proposing acceptable exclusion rules within 1 to 3 hours.

Among the hs-cTnT/I-based rapid screening algorithms, the 0/1-h algorithms have been extensively validated and appear to provide the best balance of safety and efficacy. Thus, they are used as a Class I recommendation in current clinical practice guidelines (Reichlin et al., 2012).

USE OF POINT-OF-CARE

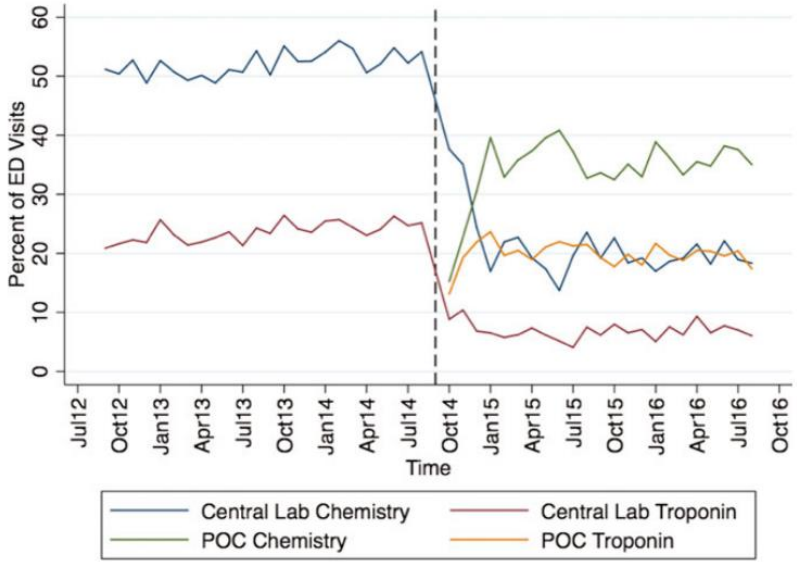
More recent studies have shown a positive impact when POC equipment is used for care in urgent and emergency departments. According to Yang Z and Min Zhou D, 2016, there was a reduction in the length of stay in emergency departments, a reduction in the time to detect critical illness (acute myocardial infarction or sepsis), and a reduction in the time for specific interventions.

In addition, Pines et al, 2018, demonstrated in a follow-up study in an emergency care unit in Washington, in the United States, that there was a 20 to 30-minute reduction in the release time of the cardiac troponin result after the implementation of the POC. At the same time, 64% of the

interviewees in the study stated that there was an improvement in the quality of care and there was a 44% reduction in the time to release the results of the other tests from the central laboratory.

In addition, the number of troponin samples for the central laboratory decreased significantly (Figure 1) and consequently it was not used in 52% of visits in the pre-implementation period of the POC to 21% after implementation. Troponins from the central laboratory decreased from 24% to 7% after implementation. This allowed the central laboratory to concentrate its efforts on the care for the other laboratory tests and to quickly lead the patient to their correct treatment.

Figure 1 - Use of the central laboratory and POCT, September 2012–August 2016. The dotted line represents the implementation of POCT. POCT = point of care test.



Fonte: Integrating Point-of-care Testing Into a Community Emergency Department: A Mixed-methods Evaluation, ACADEMIC EMERGENCY MEDICINE 2018; 25:1146–1156

Correct patient targeting is particularly important in the context of emergency department crowding around the world, with clear links between delays in care and higher mortality rates. From an economic point of view, the use of a point-of-care test in primary care units significantly reduces costs with referrals for hospitalization, invasive treatments, and the number of beds occupied (Mueller et al., 2017).

Despite the demonstrated benefits of the use of POC in the emergency department, commercially available POC tests for troponin quantification do not meet the high sensitivity criteria mentioned in the literature and, therefore, as also demonstrated in the research of the present study, it is not a reality in clinical practice.

An evidence-based systematic review of POC testing identified the need for integration of POC into clinical decision-making as a key requirement to demonstrate the benefit of this technology. These studies used cTn methods in POC compared to the methods present in the central laboratory to evaluate the response time for the final diagnosis, using the diagnosis based on the

reference values of that method or by the use of the 99th percentile. Although these studies support the use of the POC, the results were not satisfactory for the use of the methodology for the final diagnosis.

For all these reasons, there is a growing demand for tests with this capacity, as an increasing number of patients are presenting to emergency departments around the world with suspected myocardial infarction. Therefore, high-sensitivity troponin assays in POC may enable faster decision-making in this high-risk population and reduce the burden on the healthcare system (Sörensen, 2021).

According to the studies of Apple el al, 2021, the device of the German company has undergone laboratory tests that prove its use for the detection of high-sensitivity troponin. At the end of the tests, the equipment was proven to be suitable for high-sensitivity troponin measurement according to the criteria of the IFCC C-CB Committee on Clinical Applications of Cardiac Bio-Markers) and the AACC Academy Guidance.

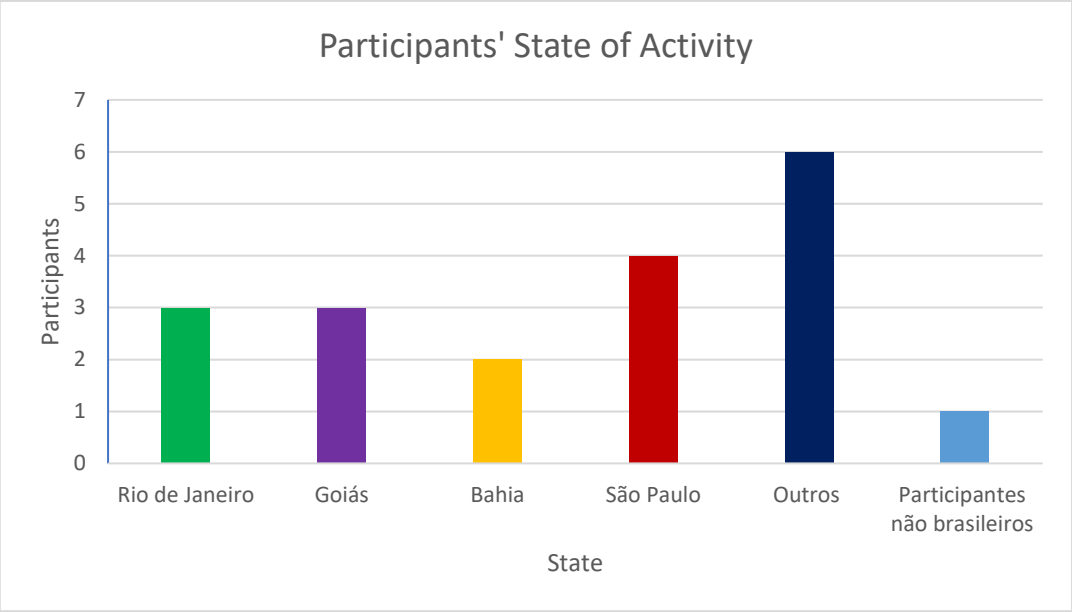
ANALYSIS OF RESPONDENTS' RESPONSES

DEMOGRAPHICS OF RESPONDENTS

For a better description of the results, it is necessary to present the profile of the interviewees. The survey was conducted at the company's stand during the World Congress of Cardiology, which took place on October 13, 14, 15 and 16, 2022. Twenty (20) participants were interviewed, including physicians and residents. The participants arrived at the company's stand voluntarily and each one of them was asked to participate, explaining the main objective of the questionnaire. There was no resistance on the part of the congressmen to grant the answers.

According to the data reported by the participants, about 20% (twenty percent) live in São Paulo, 15% (fifteen percent) in Goiás, 15% (fifteen percent) in Rio de Janeiro and 10% (ten percent) in Salvador. Three participants were of non-Brazilian nationality, two of them were from Ecuador and one from the United States, as shown in Graph 1.

Graph 1 – State of performance of the research participants.

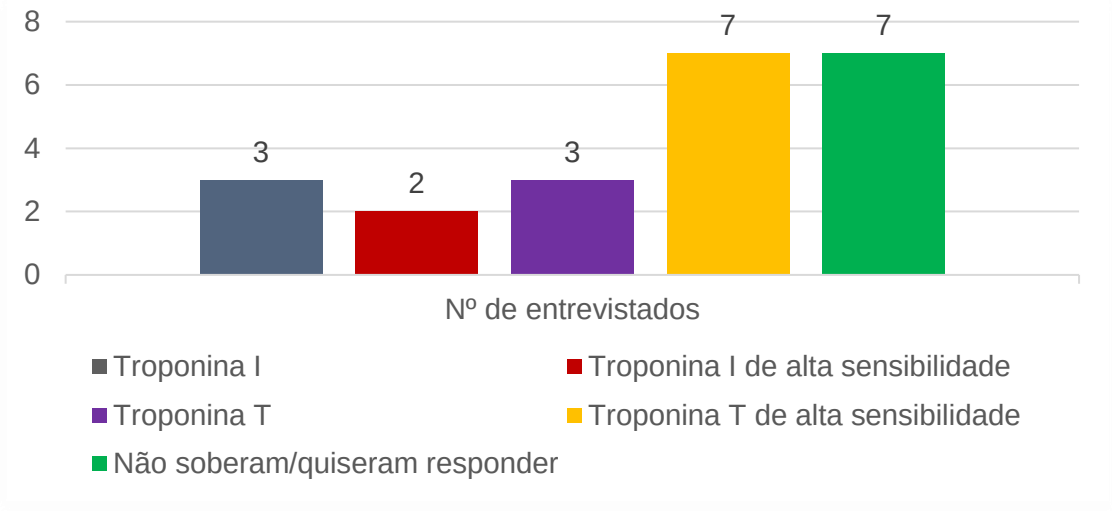


The proportion of men and women was equal to 50% (fifty percent) for both genders. The distribution of participants was generally homogeneous, with no predominance between one region or another, which makes the research more robust in relation to the results. In addition, there was no predominance of genders.

USE OF HIGH-SENSITIVITY TROPONIN IN THE OCCUPATIONAL HOSPITAL

The participants were asked about which biomarker the institution in which they work had for the diagnosis of AMI. Among the twenty (20) interviewees, only one person answered that they did not use troponin and could not inform which other marker was used. Nineteen (19) of those who answered that they use troponin were asked which type (T or I) the institution uses. 7 (seven) participants did not know how to answer, 3 (three) answered the option "Troponin I conventional", 2 (two) "Troponin I of high sensitivity", 3 (three) "Troponin T conventional" and finally 7 (seven) "Troponin T of high sensitivity", as shown in Graph 2.

Graph 2 - Type of troponin used in the interviewee's work institution.



The above data indicate that, for the most part, the work institutions of the physicians and residents interviewed use troponin as a biomarker for the diagnosis of infarction, since 74% have troponin in place. However, a large proportion still use conventional troponin, i.e., 32% still disagree with international guidelines for the use of high-sensitivity troponin. This data is extremely relevant when it comes to the evaluation of innovation in the health sector, since even after successive evolutions in the development of new biomarkers, some institutions do not have this resource.

It is worth noting that according to the latest guideline published in 2021 by the Brazilian Society of Cardiology (SBC, 2021), the greatest limitation of conventional troponins is their low sensitivity when the patient has a onset time of less than 6 hours. With the introduction of high-sensitivity troponins, it became possible to detect lower troponin levels in a shorter time after the onset of ischemic myocardial injury, which contributes to a faster and more effective diagnosis.

Also according to the SBC, in patients who arrive at the emergency department less than 3 hours after the onset of the condition, high-sensitivity troponins are significantly more sensitive than conventional troponins for diagnosing AMI, improving the diagnostic power at that time by 61% and by 100% if the collection is 6 hours after the onset of the condition.

With the increase in sensitivity and diagnostic accuracy for AMI detection using high-sensitivity troponin, accelerated diagnostic algorithms have been proposed. Thus, the time to diagnosis can be reduced, resulting in a shorter emergency room stay and lower cost. In addition, it is recommended that the troponin result be available within 60 min of collection. If the clinical analysis laboratory structure does not enable this goal, point-of-care technologies should be considered (SBC, 2021).

APPLICATION OF THE 0H-1H PROTOCOLS FOR THE DIAGNOSIS OF AMI

The next question referred to the application of the 0h-1h protocol for the management of patients with chest pain in the institution where the physician or resident works. 9 (nine) of them do not apply the protocol to patients with suspected AMI, and 1 (one) of them does not know which protocol to use, 1 (one) uses the 1h-2h protocol and 6 (six) of them use the 6h-9hrs protocol. Still in relation to the group that answered that they do not use the 0h-1h protocol in the institution where they work, 5 (five) of them also did not know which type of troponin is used and 2 (two) of them use troponin T.

Table 1 - Application of the 0h-1h protocol by the institutions where the participants work

Apply the 0h-1h protocol for suspected AMI		
0h-1h		Total = 14
	Conventional Troponin I	2 (14%)
	High-sensitivity troponin I	2 (14%)
	Conventional Troponin T	2 (14%)
	High-sensitivity troponin T	6 (43%)
	They did not know how to inform	2 (14%)
They do not apply the 0h-1h protocol for suspected AMI		
0h-2h	High-sensitivity troponin T	*Total = 9* 1 (12,5%)
6 p.m.-9 p.m.	They did not know how to inform	5 (62,5%)
	Conventional Troponin T	1 (12,5%)
	Conventional Troponin I	2 (12,5%)

Most of the interviewees comply with the recommendation of the guidelines for the application of the 0h-1h protocol, since they have high-sensitivity troponin within the central laboratory of the service. However, a significant portion of the interviewees do not have the highly sensitive troponin available at their service by the central laboratory and, for this reason, do not comply with the 0h-1h protocol.

The study by Bittencourt and Hortale (2009) describes that there is evidence that the delay in care in hospital emergency services can lead to complications in the treatment of the following pathologies: pneumonia, appendicitis, sepsis and acute myocardial infarction, which makes it imperative to need a device capable of accelerating the process from the patient's arrival at the emergency department to the final diagnosis.

According to the information in the Clinical Chemistry study conducted by Apple, et al, 2019, unsuccessful implementation of the fast algorithms is due to the lack of hospital structure, a robust central laboratory structure, difficulties in transporting samples quickly, and internal management of the emergency department team. (Clinical Chemistry, 2019).

USE OF POC AS A PLATFORM FOR HIGH-SENSITIVITY TROPONIN QUANTIFICATION

The second question was about the use of the POC as a measurement platform for the biomarker troponin. Fifteen (15) people answered that they do not use the point-of-care and five (5) answered yes. For those who answered that they were not also asked what was the platform used, they all answered that they use the platform of the central laboratory for this dosage.

As described in the literature, the interview data show that cardiologists do not use the OCP to determine the final clinical diagnosis. This is due to the fact that the devices available on the market do not meet the high sensitivity criteria recommended by the IFCC and the AACC, causing this demand to be completely shifted to the central laboratory and often leading to delays in emergency services (Clinical Chemistry, 2019).

THE CLINICAL VALUE OF USING HIGH-SENSITIVITY TROPONIN AT POINT-OF-CARE

When asked if having a high-sensitivity troponin Point Of Care benefits for patients with suspected non-ST-elevation AMI, only one participant answered no and did not state the reason for the answer, all the others believe it is beneficial for the patient.

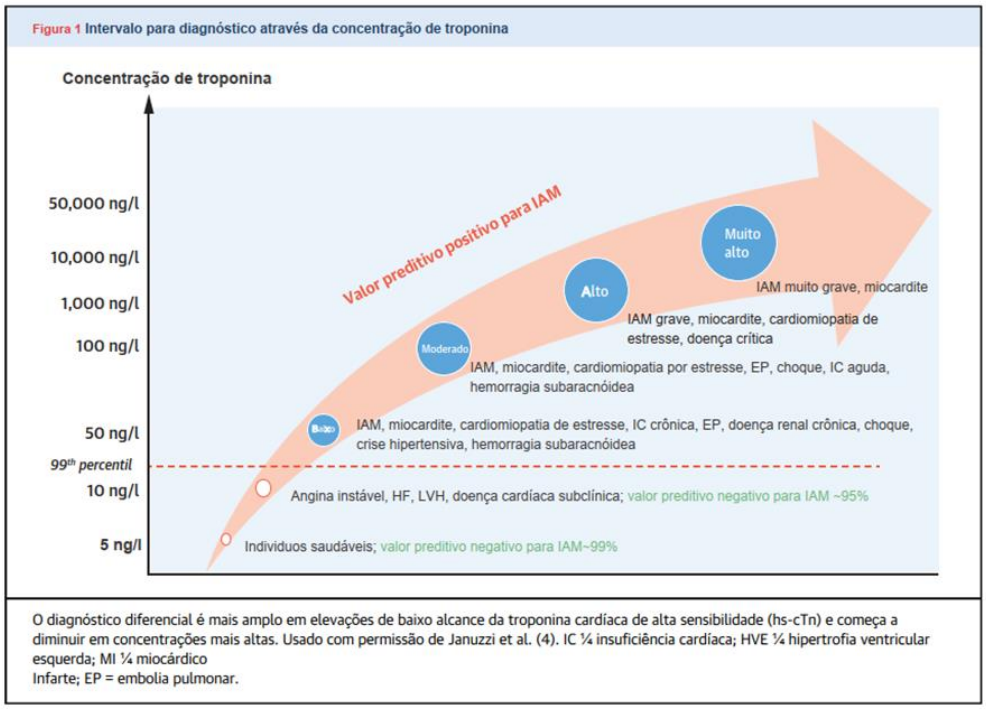
Sörensen, 2019, refutes the information of the interviewees, since in the study of derivation and validation of the cut-off value for the use of high-sensitivity troponin in POC, the author concludes that so far, the possible advantages of troponin POC assays compared to central laboratory assays are: reduction in response time to the result, There is no need to have a central laboratory on site and to transport samples. That's because POC equipment is portable, easy to handle, and can sit inside the ward room. All these factors contribute to the improvement of diagnostic capacity in patients with suspected AMI and, consequently, to a better short- and long-term prognosis.

In addition, the participants were asked about what other types of pathologies could be used in the Point-of-care as a diagnosis and the answers were: Myocarditis and Pulmonary Thromboembolism (PTE). According to The American College of Cardiology (ACC), high-sensitivity troponin tests allow a wide range of diagnostic possibilities, that is, it was often said that it was a specific marker of AMI, but it is now known that it is an organ-specific marker and with these characteristics other diagnoses can be performed with just one measurement of a venous sample (Journal of the American College of Cardiology, 2021).

The data shown in Figure 2. Illustrating this scenario, from the moment AMI is ruled out, high-sensitivity troponin can be used for other cardiac pathologies. In addition, the study showed that in patients with high sensitivity troponin values, even below the 99th percentile have worse prognoses and a higher mortality rate compared to patients with undetectable troponins. As mentioned by the physicians in the interview of the present study, the literature shows the

possibilities of using this marker in other pathologies, such as heart failure, left ventricular hypertrophy, myocarditis, and pulmonary thromboembolism.

Figure 2 - Use of high-sensitivity troponin for differential diagnosis with other pathologies, such as heart failure, left ventricular hypertrophy, myocarditis, and pulmonary thromboembolism.



Fonte: Raber et al. jacc vol. 77, no.10, 2021 interpretation of high-sensitivity cardiac troponin assays in different clinical settings march 16, 2021:1357 – 671358.

The present study evaluated the responses of a small number of respondents. This can be justified by the fact that in order for the participant to have their answer counted, it was necessary to go to the company's stand, accept to participate in the survey, fill out the form and accept the consent forms. As such, some refused to give their opinion for the survey. In addition, the questions in the form were designed objectively and directed the participants' responses, which may have limited the amount of information provided. For all these reasons, new studies should be considered so that they have a larger sample size and so that participants can extrapolate the content of the answers previously selected to enter the questionnaire.

CONCLUSION

In an increasingly challenging economic scenario, diagnostic companies have been looking for ways to differentiate themselves competitively in order to maintain their current market and seek to open new markets. An innovation specifically in the field of cardiovascular medicine, for the diagnosis of acute myocardial infarction, can be challenging because it is a pathology in which every minute is essential in the final outcome of the patient. On the other hand, it can transform a reality if it is correctly positioned and if it is in accordance with the expectations of the stakeholders involved.

The data obtained in the present study demonstrated that the medical profession understands as positive the development of a technology capable of detecting and diagnosing people with suspected AMI early. In addition, the interviewees reported that other patients with non-ischemic pathologies could benefit from having access to a device such as the POC for the rapid detection of elevated high-sensitivity troponin values.

In addition, the survey also provided information on how health services can be improved by a new technology. Many of them do not comply with international recommendations for the diagnosis of AMI because they do not have access to a high-sensitivity troponin in a robust central laboratory structure, to a well-defined internal flow in the emergency department, and to a waiting time much longer than recommended by the guidelines.

Based on these data, it is possible to conclude that the main stakeholders and most likely users of high-sensitivity troponin in OCD consider this innovation not only beneficial, but also necessary for the current situation in urgent and emergency care services. In addition to being a potential market, this solution allows the diagnosis of heart attacks to be made faster and more accurately, promoting a reduction in harm to the patient in the short and medium term, a more assertive clinical decision, and cost reduction for hospitals with the number of hospitalizations and waiting time. In this way, not only the services would benefit, but also the patient throughout their entire care journey.

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What are the most effective theoretical strategies in teaching Anatomy?

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ABSTRACT

Introduction: The anatomical study cannot be limited to the dissection of cadaveric parts or the memorization and identification of structures. It is essential that, in a modern and dynamic approach to this discipline, contextualization is adopted, and above all, the clinical applications of what is studied, in addition to other methods such as 3D images. It is necessary to understand the student's conception of such methods – which are the didactic and scientific evidence at the moment – so that they can make the connection – in the present and the future – with professional life.
Methodology: The research, carried out with 245 students from two educational institutions in Juiz de Fora, aimed to find out: What methodologies were used in their anatomy course; Which one(s) among them is(are) seen as the most effective, and most facilitator(s) of the learning process and approach to clinical practice. The data obtained were processed using the SPSS program, version 20.0. Results: It was evident that the approach to anatomical content based on clinical guidance and contextualization of the subject is somewhat popular among students, although a large number prefer simpler, more targeted theoretical classes and more concise teaching material, with a statistical relationship. The use of radiological images is seen as more widespread in Medicine and Dentistry, just as the seminar strategy is more used in Pharmacy, Nursing, Biology, Physical Education, and Nutrition courses. Conclusion: Most students preferred studying based on shorter and leaner theoretical classes, with more concise scripts and textbooks; however, they approve that some contextualization and clinical correlation be made. Each course, or group, has a favorite method of studying Anatomy.

Keywords: Teaching methodologies in Anatomy, Contextualization, Clinical application.

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INTRODUCTION

The challenging complexity of human anatomy and its fundamental importance to the sub-areas of the major area of health make this science the greatest highlight among the oldest medical sciences. [1-6 years]

The study of Anatomy, even though it is closely linked to the memorization of names of structures, should always be related to an early – and necessary – contact with the professional reality, enabling a view on the application of theoretical-practical knowledge in one's life after graduation [7,6]. Collipal8 points out that the study of the structure and functions of the human body arouses a unique curiosity and draws our attention to the use of renewed, challenging and effective teaching and learning methods, making it essential to have a close bond between teachers and students, between content and method, as also defended by Montes9.

According to Jones10, anatomical practice cannot be limited to the dissection of cadaveric specimens, or to the memorization and identification of structures. It is essential that, in a modern and dynamic approach to this discipline, the contextualization and, above all, the clinical applications of what is studied be adopted11. Reis12 reported that for most of the students interviewed in his research, the understanding of Anatomy is essential for the acquisition of clinical knowledge, even if the students have not yet had contact with the clinic.

The contextualizations of the subject discussed in the classroom are also modern strategies to hold the student's attention and direct him in professional and extracurricular life, linking the student's world – in the present and in the future – to what is in scientific evidence at the moment. Understanding this connection between anatomy as a science and the professional future and making it concrete, feasible is a challenge for teachers. New dynamic methodologies and technologies have been employed in this regard6. Penha5 describes these new tools as *e-learning,* audios, videos, games and three-dimensional reality and how their use has been used to complement the teaching of Anatomy.

According to Collipal8, new educational trends in Anatomy have been gaining strength, motivated by several factors such as the difficulty of obtaining cadaveric specimens, the excellent quality of synthetic anatomical specimens on the market, and the high costs of preparing and maintaining an anatomy laboratory in which cadavers are used.

Corrêa13 advocates the incorporation of ultrasonography and imaging exams into anatomy classes for a greater early clinical experience, as well as 3D imaging (computational anatomy). Anatomy-specific videos and *software* are other important tools available to support the teaching of the human body in colleges and universities [3,4]. Artificial anatomical specimens are also an irreversible and practical reality, and are being widely used more and more in higher education institutions with courses in the Health Area [2].

Penha5, however, raises poignant doubts about the efficacy of these teaching methods, just as Inzunza14 questions how students see their learning when they have contact with these new technologies and teaching tools, and also questions the impact of these strategies on the teaching and learning process in a medical school.

Possessing the knowledge of modern didactic techniques, or knowing their efficiency and effectiveness, the Anatomy teacher is able to develop one of the most important facets of the teaching-learning process: the motivation of his students for a contextualized study, bringing the student's reality to the classroom, and can still always apply to future clinical practice. The content covered [11]. But what would be the student's perspective in the face of these novelties? It is the great object and scope of didactics and teaching. How does he see his learning in the face of these strategies? What is the best methodology or what would be the most effective and efficient tools in anatomical teaching? This is from the perspective of the student involved in the teaching-learning process in Anatomy.

That said, the objective of this article emerged: to evaluate the perception of students, in their journey in anatomy laboratories, regarding the methods of study of this science, and its importance and effectiveness in the development of their trajectory as health professionals. Nothing is more legitimate than research to provide us with these answers. We then aim to understand the student's conception of such methods (which are the greatest didactic and scientific evidence at the moment), if they are really important and make the connection – in the present and in the future – with professional life.

METHODOLOGY

The research comprised a descriptive and cross-sectional study, in which data from a structured questionnaire (Survey-type) capable of demonstrating the evaluation of students of the disciplines of Anatomy of the Federal University of Juiz de Fora and of a private college also in Juiz de Fora, in relation to the teaching of this science, were evaluated. The application was through *google forms* maintaining all the confidentiality of the answers. The inclusion criterion was students from all courses in the health area at UFJF and Faculdade Suprema, who had taken the discipline of Anatomy in the last 3 years (marking the post-pandemic and the return of face-to-face activities in teaching) for at least 1 (one) academic period. The instrument used in the research, applied in simple interviews, was structured with closed questions, previously tested with 12 multiple-choice questions based on the "Liker Scale" with five answer options each: Completely agree; I partially agree; neutrality (neither agree nor disagree); I partially disagree and strongly disagree. To determine the questions that were included in the questionnaire, we referred to the most modern and suggestive articles on the subjects "Teaching Anatomy" and "New Strategies and Methodologies in Anatomical Teaching". The parameters studied will be based on a systematized script, considering the

demographic variables: gender; age; marital status and to which course the interviewee belongs, his/her current academic period, in addition to the temporal relationship with the practical teaching of anatomy. He wondered; A) whether, among the didactic materials, the most modern so-called materials were used by the students in their anatomical study, such as contextualizations, clinical applications, 3D material and image resources - radiographs and tomography, for example; B) Which of these methods facilitate the teaching-learning process in anatomy; C) Which of the methods/strategies and technologies can be considered essential to generate greater confidence of these students about the use and application of their anatomical knowledge in a future professional practice; D) what type of teaching material and class strategy are best evaluated by these students.

The number of students who answered the questionnaire was 398, distributed as follows: Medicine course - 163 answers; Dentistry-86 responses; Physiotherapy- 44 answers; Pharmacy, Nursing, Biology, Physical Education and Nutrition- 105 responses.

The data obtained were tabulated in an Excel spreadsheet, version 21.0, and processed using the SPSS program, version 20.0 (Chicago, IL, USA). The statistical tests applied were: the chi-square test and the Student's t-test. Statistical significance was set at $P < 0.05$. The statistical correlation between some answers was verified: 1) Option for more targeted theoretical classes X Importance of clinical applications in the study of Anatomy; 2) more targeted theoretical classes X Importance of contextualizations in the study of Anatomy; 3) more targeted theoretical classes vs. use of direct and concise scripts; 4) Use of more targeted books X Importance of clinical applications in the study of Anatomy; 5) Use of more targeted books X Importance of contextualizations in the study of Anatomy, 6) use of a direct script X more directed theoretical classes and finally 7) more directed theoretical classes X use of more directed books.

RESULTS

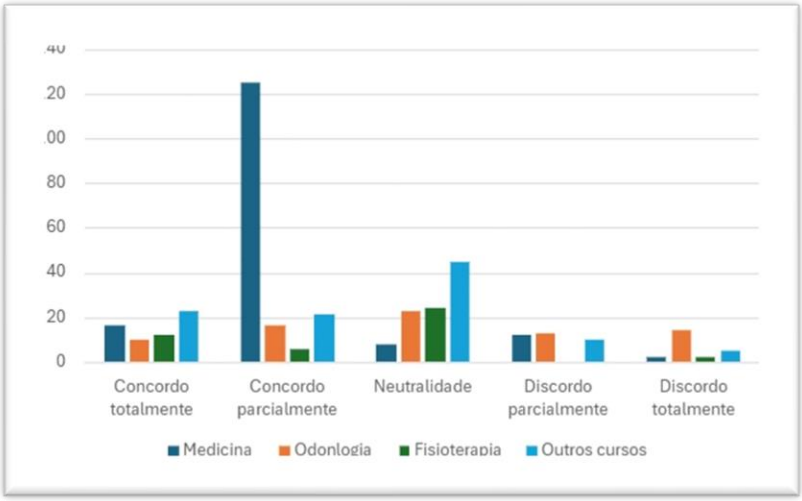
For the analysis of the collected data, it was decided to distribute the interviewees into groups, according to the number of periods they attended the anatomy discipline, and, consequently, the degree of their contact with it.

Therefore, in one group there are the students of the Medicine course, who study Anatomy for 4 periods and still present greater adherence to the research, followed by the students of Dentistry and Physiotherapy who study for three periods and with an equally significant adherence. The other students of Pharmacy, Nursing, Biology, Physical Education and Nutrition, who have classes in this discipline in 1 or 2 periods only, were distributed in another group, since they also had less adherence to the cause.

When analyzing the data, it is clear that (Graph 1) when it comes to addressing the content with clinical direction, the students of the Medicine course were the ones who most informed this

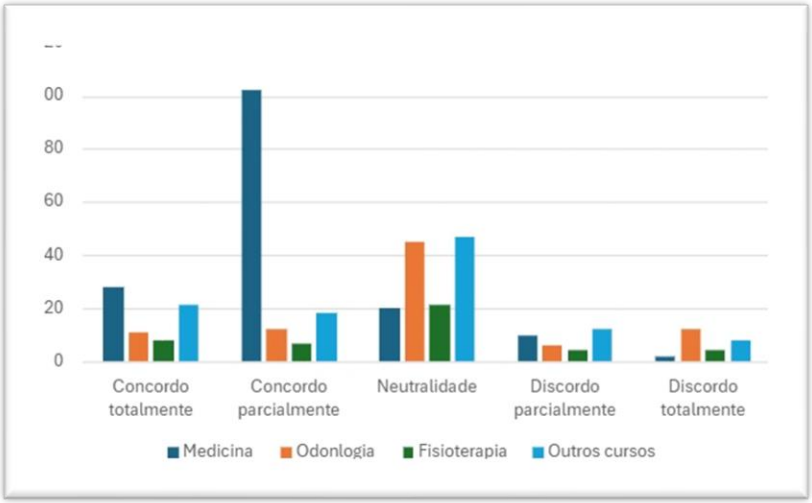
type of discussion, with 125 answers "I strongly agree", making up 77% of the total number of students in this group and 31% of the total number of students. In the other groups, a similar response appeared in 16 dental students (18% of the group); 6 from Physical Therapy (14% of the course interviewees) and 21 students (20%) from the others.

Graph 1 representing the numbers referring to the answers to the question: "if the content was approached with clinical guidance during the Anatomy classes"



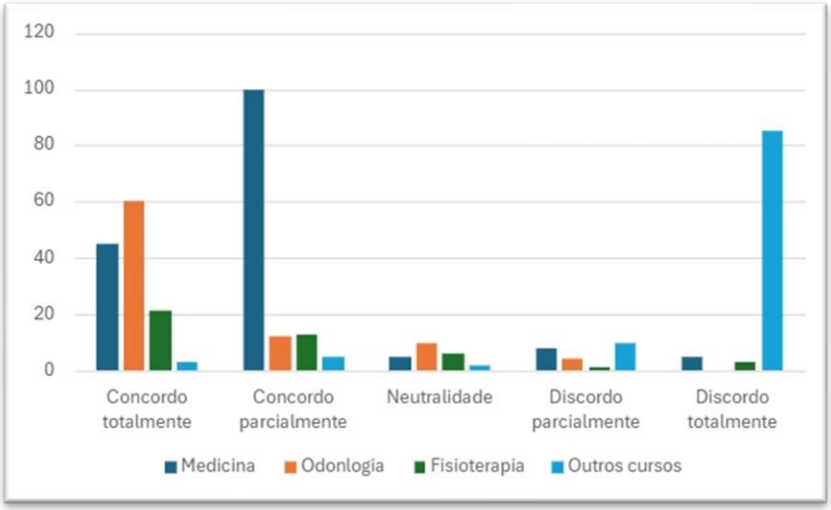
Graph 2 shows the number of opinions regarding the presence of contextualizations in Anatomy classes. The large number of "neutralities" by Dentistry students, 45 (52%), and 47 from Pharmacy, Nursing, Biology, Physical Education and Nutrition courses, making up almost 50% of the students in the group, is noteworthy. Among medical students, the option "partially agree" had 102 votes (62% of the course), on the other hand, the option "strongly agree" received 28 mentions, equivalent to 17% of the course respondents.

Graph 2 representing the numbers referring to the answers to the question: "if the content was approached with contextualizations during Anatomy classes"



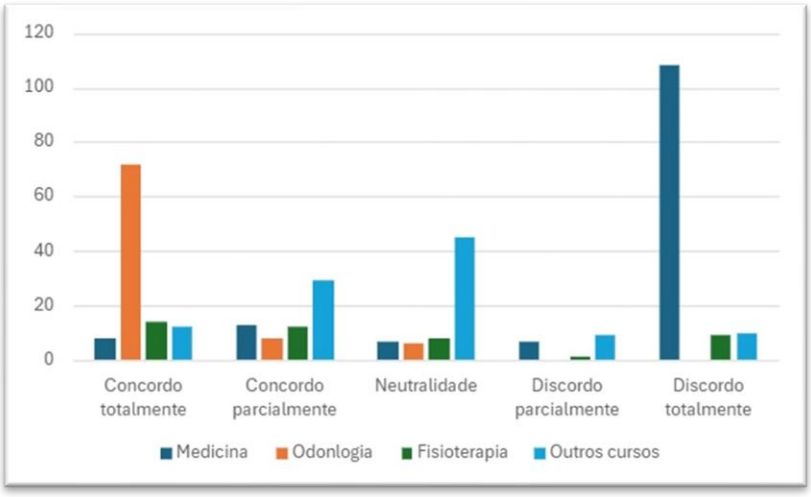
Graph 3 shows the analysis of the answers regarding the use of imaging exams, it is evident the adherence to this methodology within the Dentistry course, constituting the group with the highest absolute and relative volume of options in the item "totally agree" (n=60, making up 70% of the students in the course); In addition, the options "strongly disagree" and "partially disagree" were not considered. In the Medicine course, an almost unanimous response to the options "partially agree" and "strongly agree" (90% of the group).

Graph 3 representing the numbers referring to the answers to the question: "if the content was approached with the aid of imaging exams – 3D, CT scans, etc."



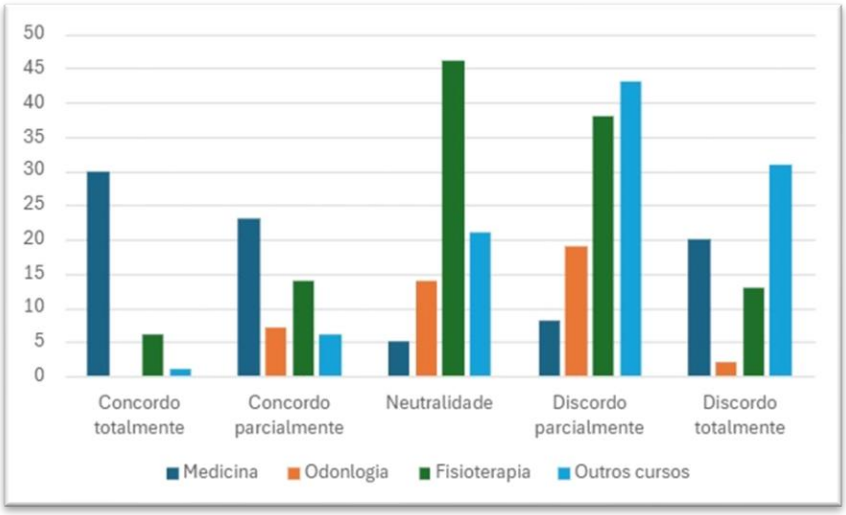
When we put Graph 4 in the light of our analysis, it is evident the importance of seminars and clinical debates in the Dentistry course, which had an absolute volume of 72 votes in the option "strongly agree" (83% of the course respondents), and there was no option for "strongly disagree" and "partially disagree". On the other hand, the Medicine course presented the highest absolute and relative volume of "strongly disagree" options, totaling 108 students (75%). Students from the Pharmacy, Nursing, Nutrition, Physical Education and Biology courses remained predominantly neutral (45 answers, making up 42% of the interviewees in the group), slightly tending to agree, adding 41 answers (39% of the course) to the items "strongly agree" and "partially agree".

Graph 4 representing the numbers referring to the answers to the question: "if the content was addressed with the help of seminars and clinical debates by the students"



In the analysis of the answers related to the question whether there was an approach to the content of Anatomy using technologies such as 3D and computational resources, which are not just slides, it is sovereign to highlight the prevalence of negative answers, a total of 174 answers - 44% of the total - were added for all courses in the options "strongly disagree" and "partially disagree". From this point of view, it is worth highlighting the great adherence of Medicine to the option "strongly agree" in a context in which the options "strongly disagree" and "partially disagree" predominate, being the group with the highest number of positive responses (n=53= 32%).

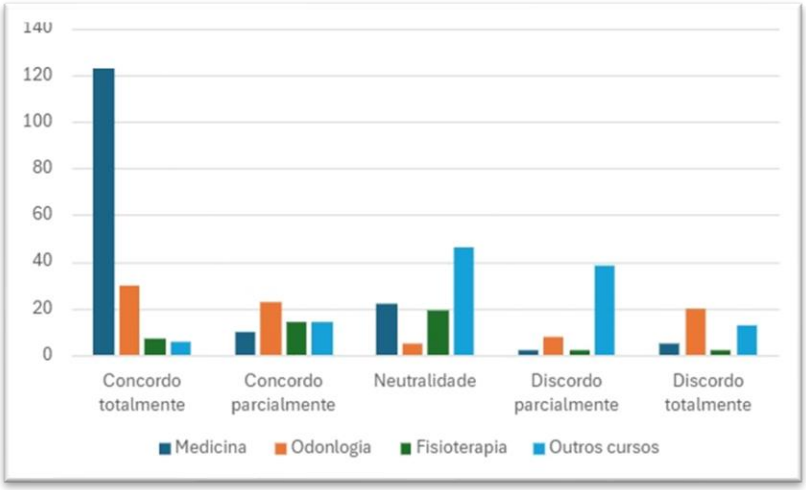
Graph 5 representing the numbers referring to the answers to the question: "if the content was approached with the aid of some technology other than slides, such as 3D and computational resources"



When referring to the result referring to the answers to the question "whether the contextualizations made in the classroom are sovereign for the consolidation of the subject" (Graph 6), it is noticeable the great preference among medical students for the item "I totally agree" (n=123, 75% of the course interviewees). In the Dentistry course, the option "strongly agree" was also the

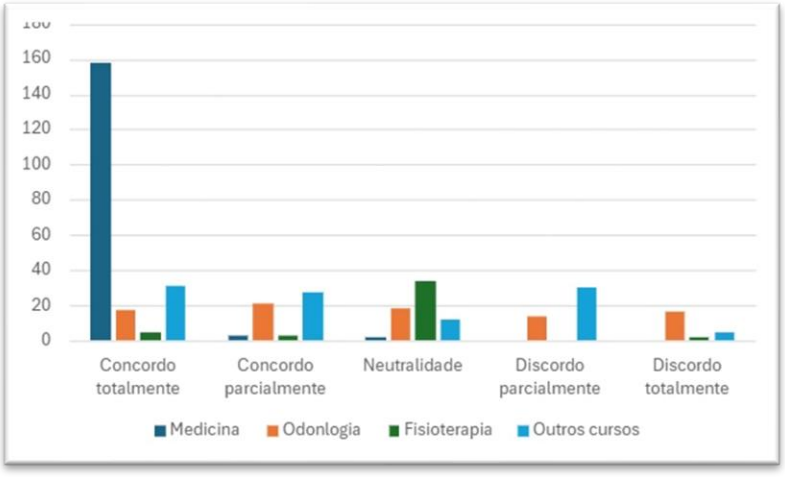
most popular (n=30, 34% of the group). However, the profile of the group was more distributed among all the options, indicating greater variability. In Physical Therapy and in the other courses, the prevalence of answers was in the "neutrality" option (representing 43% and 39%, respectively).

Graph 6 representing the numbers referring to the answers to the question: "if the contextualizations made are of great value for the consolidation of the subject of Anatomy"



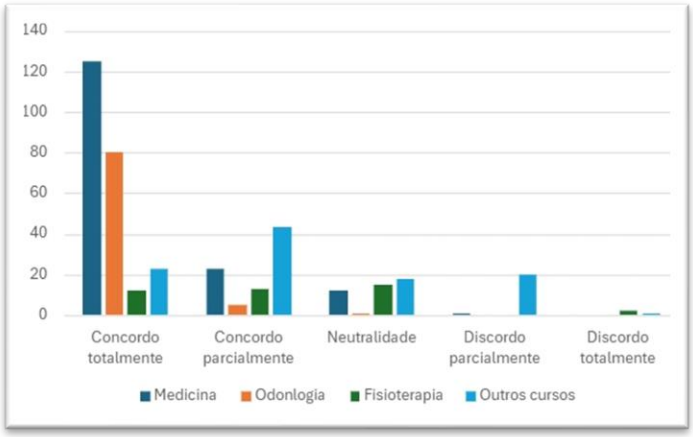
Proceeding to the question about the importance of clinical applications in the development of a good understanding of the patient and his disease (Graph 7), we can observe that among the Dentistry students there is a great variability in their answers, with very similar numbers in all items. In Physical Therapy, there was a predominance of neutrality (n=34, 79% of the total number of course interviewees), with a slight tendency to agree. In the group of Pharmacy, Nutrition, Physical Education, Nursing, and Biology, there was a tendency to agree. In Medicine, on the other hand, students opted for the option "strongly agree" almost unanimously (158 responses, around 96%).

Graph 7 representing the numbers referring to the answers to the question: "whether clinical applications are essential for the development of a good understanding of the patient and his disease in professional life"



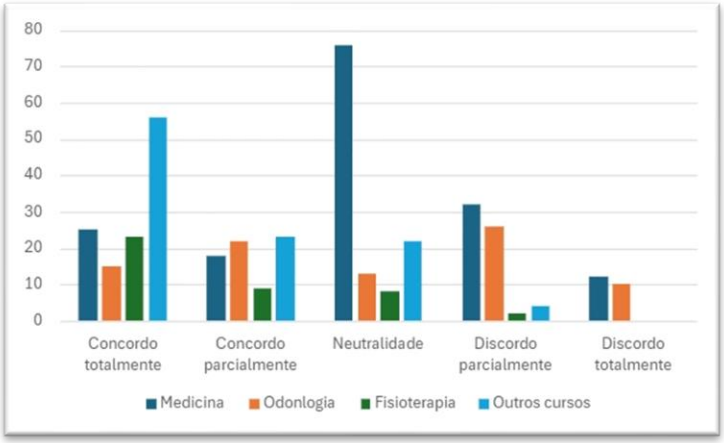
In particular, in courses other than Medicine, Physical Therapy and Dentistry, there was a relevant group with relative disagreement regarding the importance of imaging resources in the understanding of clinical diagnoses, as 20% of the students totally and partially disagreed with this item. In medicine and dentistry, total agreement prevailed, being 78% (125 students) and 93% (n=80), respectively, while physical therapy students showed a balanced distribution in the answer items, with 29% of total agreement, 31% of partial agreement (together they would be close to 60%) and 36% of neutrality (Graph 8).

Graph 8 representing the numbers referring to the answers to the question: "whether the use of real images is essential for the student's professional life"



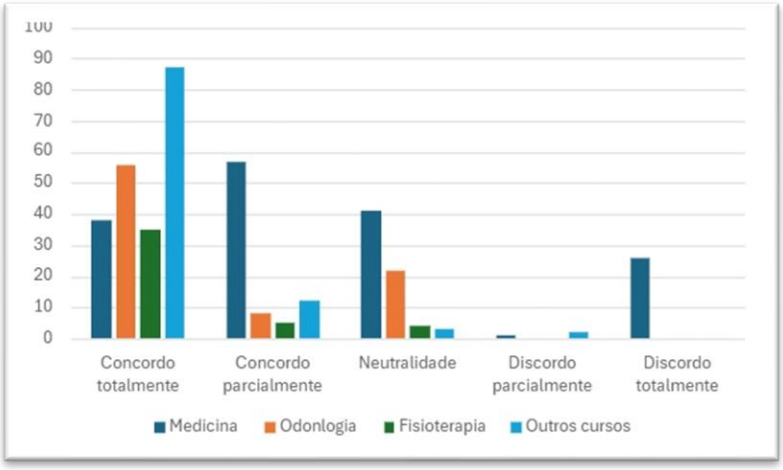
Regarding the use of seminars for clinical development, neutrality was observed, corresponding to n= 76 (47%) of the answers in Medicine (almost 50%). Following the same justification, a similar pattern can be observed in the distribution of responses to dentistry. For students in Pharmacy, Nutrition, Physical Education, Nursing, and Biology courses, there was a prevalence of total agreement, with n=56, making up almost 55% of the options.

Graph 9 representing the numbers referring to the answers to the question: "whether clinical seminars are fundamental tools for teaching/learning anatomy"



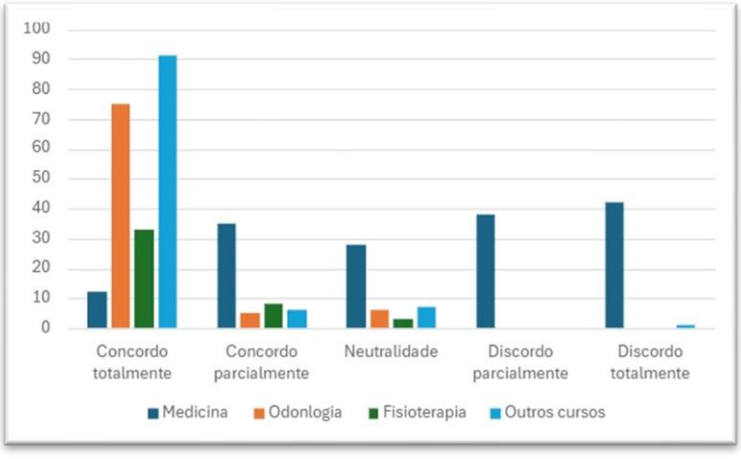
For the students interviewed in the Pharmacy, Nutrition, Physical Education, Nursing and Biology courses, the prevalence of total agreement is notorious, 84% (n=87) that the use of more directed and objective anatomy books is more indicated. This number was 65% (n=56) in dentistry, 80% (n=35) in physiotherapy, evidencing a better understanding of Anatomy based on a more concise didactic material. On the other hand, in medical students, despite the prevalence of agreement (38 students) to the detriment of disagreement (n=27), there is a trend towards neutrality, with 35% of partial agreement and 25% of neutrality.

Graph 10 representing the numbers referring to the answers to the question: "whether concise textbooks with less anatomicisms, but more contextualized, are sufficient for a good understanding, memorization and clinical application of anatomy"



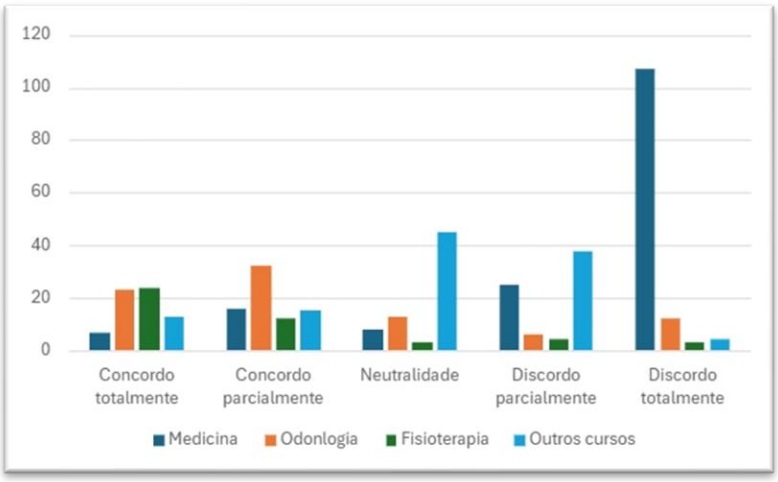
In a very similar way, the answers to the question in which the possibility of a concise and directed script was evaluated to perfectly meet the good study of anatomy, showed that the prevalence of disagreement among medical students was 27% (n=42) in total disagreement and 25% (n=35) in partial disagreement. While 87% (n=92) were in Pharmacy, Nutrition, Physical Education, Nursing, and Biology students and were in total agreement, 75 in dentistry and 33 in physiotherapy.

Graph 11 representing the numbers referring to the answers to the question: "whether a well-directed and direct practical script is sufficient for good anatomy learning"



Medicine stands out, with the majority of disagreements, represented by 80.98% of the votes (with 65.64% of total disagreement), evidencing the need for clinical correlations in relation to the content addressed. In Dentistry, as well as in Physiotherapy, Pharmacy, Nursing, Nutrition, Physical Education and Biology, there is a varied distribution of responses, tending to neutrality with 40% (n-45) of the options, a considerably expressive percentage.

Graph 12 representing the numbers referring to the answers to the question: "whether it would be possible to have a good anatomical learning and a good application of the content in professional life just by attending the theoretical classes on pure anatomy, without clinical applications"



By statistically associating some variables by chi-square and Student's t-test, we verified the statistical correlation between some answers (Table 1).

Variable 1	Variable 2	P- (parameter≥ 0.05)	Association
More targeted theoretical classes	*Importance of clinical applications in the study of Anatomy*	P=3.08	No Membership
More targeted theoretical classes	*Importance of clinical contextualizations in the study of Anatomy*	P= 2.86	No Membership
More targeted theoretical classes	*More concise study scripts*	P= 0.09	Little association
Use of more targeted books	*Importance of clinical applications in the study of Anatomy*	P= 0.07	Close Membership
Use of more targeted books	*Importance of contextualizations in the study of Anatomy*	P=0.07	Close Membership
Using a Direct Roadmap	*More targeted theoretical classes*	P=0.0041	Statistical Association
More targeted theoretical classes	*Use of more targeted books.*	P=0.0053	Statistical Association

It is possible to infer about the great tendency of students who do not consider clinical applications and contextualizations important, preferring more concise textbooks, in addition to the coincidental preference between directed scripts and also objective classes, only with pure anatomy content. These concise textbooks are also preferred by most students who have opted for lectures without contextualizations or clinical applications.

DISCUSSION

Study methods in Anatomy will always be debated on a large scale. And it is interesting when we cite most of the authors1,3,10,14,15,16,17, 18, 19. Kerby1, for example, interviewing 580 students in the United Kingdom, found that the most effective method of study in Anatomy would be dissections. However, our present research aimed not to highlight this "commonplace" but rather to address the new nuances and didactic tactics used today in this discipline.

The present study was carried out with students of the disciplines of Anatomy of the Federal University of Juiz de Fora and of a private college also in Juiz de Fora, Faculty of Medical and Health Sciences of Juiz de Fora (Suprema), with 398 participants divided according to the number of semesters of anatomy they have in their curriculum and according to their adherence to the research. The students who answered the questionnaire were distributed as follows: 1) Medicine course (163 answers) - 4 semesters; 2) Dentistry (86 responses) - 3 semesters; 3) Physiotherapy (44 responses) - 3 semesters; 4) Pharmacy, Nursing, Biology, Physical Education and Nutrition - 1 semester (105 responses). Or in the case of Nursing, 2 semesters. The variable number of participants from one course to the other was due not only to the differences in class sizes (the Dentistry and Medicine classes are larger) but also to the number of periods with which each course is related to Anatomy.

The importance of the use of radiographic images is widely supported by the literature today. Camilo20 stated that medical images are crucial for clinical diagnosis, planning and monitoring of the patient's health, supported by Rathan *et al21*, who point out how the use of images, even amateur production, significantly improves students' understanding of the anatomical content addressed; Rocha *et al22* indicated that the use of radiological images increased students' interest in the study of anatomy, in addition to improving students' ability to identify structures and increase long-term knowledge retention, including facilitating the use of anatomy in professional practice. Our research is congruent with these ideas and brought numbers that make the opinion of the absolute majority of the students interviewed coincide with this statement. However, it is necessary to consider the access not only of students, but also of teachers and institutions to the material, which is expensive, as reported by Chang23.

In the interview, we did not distinguish the type of image used in the classes, we only inquired about its use and its importance in Anatomy and in the clinic, but Iwanaga24 concluded, after

analyzing several studies that compare the efficiency of using 2D images (and other methods) with 3D models, that students who learned with 3D were more likely to achieve higher scores in knowledge assessments. This was corroborated by Venantius [4]. The present research showed that the use of real images in classes is very important for almost all students, but it stands out in Dentistry and Medicine courses, which is really in line with the professional reality of these students, marked by frequent contact with images of CT scans, MRIs and X-rays

In the present study, it was demonstrated that when questioning about clinical guidance in the teaching of anatomy, medical students are the ones who agree that this type of approach occurred during their anatomical learning, and, in general, this teaching methodology seemed to them to be very important in clinical practice, as well as contextualizations; this is notably important in a scenario in which the value of clinical guidance for the teaching of anatomy is known and reinforced by several authors, such as Vieira25, who points out that the study of anatomy contextualized with surgical techniques, clinical cases and radiological images - which can be seen as an anticipation of what students will encounter in their professional lives - is capable of improving the performance of students in the recognition of structures and acquisition of concepts. In our analysis, the course that most considered the use of clinical applications and contextualizations in the teaching of anatomy to be important was Medicine, corroborated by Montes9, who mentions the engagement of these students in this practice. However, Martinelli, interviewing students of Physical Education, Nursing, Nutrition and Physiotherapy, found the great engagement of these students regarding the application of Anatomy in their clinical practice and vice versa.

It was also evident that almost half of the students of Dentistry, Pharmacy, Nursing, Biology, Physical Education and Nutrition remained neutral about the use of the importance of contextualizations and clinical applications in their learning of anatomy, and the positive responses in this sense were not so striking, differently from what Salbego26 found. These students also did not perceive the need to explore this type of approach in depth, going against what Maciel18 writes, defending the everyday and clinical applications in Anatomy didactics, regardless of the course to which the discipline is taught. And these numbers discussed here are intriguing, because even if the courses of Biology, Physical Education and Nutrition do not have a so-called clinical contact with the patients, the Dentistry professionals will work clinically and surgically with the patient, requiring a solid knowledge in Anatomy.

Our results showed that the popularity of seminars and clinical debates in Dentistry, Physiotherapy, Nursing, Nutrition, Physical Education and Biology courses is notorious. On the other hand, among the participants of the Medicine course, it is evident that the seminars and debates among the students are little explored by the professors, and demand little value in the practice of Anatomy in the clinic, according to the students of the course, since this was the course with the

highest absolute and relative volume of options "I totally disagree", in this regard. Montes9 brings a suggestion from an extremely pertinent student about the point addressed at this moment, and which shows us the level of approval, on the part of the students, of the use of seminars and clinical cases in anatomical teaching:

> "Holding seminars, I think, is an excellent idea, which will demand more from us students, so that we can integrate more into the content and delve even deeper. The use of clinical cases associated with this procedure helps to put the discipline more dynamic and more centralized in the clinical practice that we will perform for the rest of our lives."

With the increasing restrictions imposed on whole-body dissection, medical schools have been opting for alternatives to the practical dissection of cadavers; in this scenario, alternative technologies end up gaining ground, according to Vieira32. Chang23 states that "*Technology-enhanced learning*" (i.e., learning enhanced by the use of technology) through didactic resources, such as apps, can be especially useful when the content taught is essentially visual. Still in this vein, it is imperative to underline the significant variance within medicine regarding the use of alternative technologies: 61% of the group provided positive answers, while 32% provided negative answers; this may indicate that some teachers made use of 3D, while others did not, which is probably due to the fact that these students took the anatomy course at different times. In the Dentistry course, it is worth mentioning the absence of votes in the option "strongly agree" and the low volume of votes in the option "strongly disagree" (2 only, 4% of the interviewees in the group); This indicates that some alternative technology was used, although its use was shallow, given the predominance of the "partially disagree" option (19 responses, 45% of the group).

A curiosity was aroused when we analyzed the data regarding the study methods themselves. The students of the Medicine course had a clear rejection of concise and summarized books, this so-called "rejection" tended to decrease progressively, in the students of Dentistry, Physiotherapy and also in the students of the Pharmacy, Physical Education, Biology, Nursing and Nutrition courses, there was a growing preference for the type of material under discussion. Although Liew27 has researched and described patterns in the methods of study in Anatomy, and has written that these tend to be practically identical, we noticed here a great difference in the posture of the groups of students according to their course.

And when we associate this option for a more summarized didactic material with the importance of clinical applications, which are generally absent in this type of books, we see a quasi-statistical association, that is, the greater the interest in clinical applications in Anatomy, the greater the need to refer to a denser didactic material.

Reinforcing the above statement, the statistical correspondence came when we connected theoretical classes without clinical direction with concise didactic material ($p=0.0053$), showing that

the more the student values a more in-depth discussion, the more he strives for more specialized content, and vice versa. It is notorious the large number of names to be memorized in Anatomy, Salbergo *et al* [26] even report in their research that the great complaint of students in relation to this science is precisely the number of structures to memorize. Perhaps this anguish is reflected in the numbers we present here. The student needs an absolute motivation for the efficient study of Anatomy, supported by what Sturges *et al28 said*. This motivation goes a long way through the use of methods such as clinical application with the association of the topic under discussion with the student's future professional life. And once again we call attention to the significant number of students who do not consider this strategy to be important, although the vast and overwhelming majority of our interviewees tended to attribute great value to it.

When we associated the preference for "anatomical" theoretical classes both with the importance of contextualizations and with the clinical direction of the classes, we saw that there was no statistical significance, that is, even recognizing a certain value, importance and effectiveness in these last strategies mentioned above, the student tended, in a certain way, to prefer more expository and direct classes, with a summarized written material (script). Campos29 suggests active methodologies, i.e., those in which, in Anatomy, the theory of clinical application comes before the theory itself, therefore, the suggested motivation22,26,30 should be cultivated by the professors of the discipline in this sense.

Finally, in addition to this motivation, and in the absence of access to state-of-the-art technologies, the exploration of radiographic and tomographic images is recommended, in addition, of course, to the use of contextualizations and clinical guidance, always. In this way, the students' desires and didactic needs will be met.

CONCLUSION

It can be inferred that:

- There are differences between courses in their approach to the subject using contextualizations, clinical applications, and radiographic, or 3D, images, although these teaching tactics seem to be widely used.
- Students, in general, recognize the effectiveness of contextualizations, clinical correlations, and the use of images, despite the fact that a large group does not see as much importance in these methods in the construction of a more robust anatomical knowledge. These variants were closely *linked* to the student's course, i.e., linked to different aspirations and different needs to use Anatomy in professional life

- As much as the interviewees prefer more summarized theoretical classes, they recognize the importance of contextualizations and clinical applications in Anatomy. The same is true of the desire for targeted scripts.
- Some students showed themselves to value summarized theoretical classes, direct scripts and concise books, differing greatly as to the group or course they take, that is, again here we see the weight of how much anatomy can be, or cannot be, essential in their professional career.
- Many students support the use of seminars, it was a method pointed out as good by most students of Physiotherapy, Pharmacy, Physical Education, Biology, Nursing and Nutrition, but not all. The discredit of this method among medical students is highlighted, a group that, however, like Dentistry, opted for greater approval of the use of radiological images in classes.

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Distribution of ct scanners in the state of Rio de Janeiro: A guiding study for the inclusion of graduates of professional education courses in radiology

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ABSTRACT

Computed Tomography (CT) is a diagnostic imaging test that uses X-rays to capture images of internal organs as if they were slices of the body. Once recorded, the images are processed on a computer that provides a detailed analysis of the area to be examined. The objective of the work was to identify the distribution of CT scanners in operation in Rio de Janeiro, with a view to understanding professional education, with regard to the employability of graduates from courses in this branch of radiology. The National Health Surveillance Agency (ANVISA) requires that all diagnostic X-ray devices be registered with the Ministry of Health, in order to allow their traceability. In this way, it is possible to find a list of all CT scanners on the DATASUS website, responsible for controlling national data relating to public health. The methodology was based on a survey of all CT scanners installed in the state of RJ and registered on the DATASUS platform until April 2024. Simultaneously, a spreadsheet was created with the data collected. This spreadsheet contained the following information: establishment, business name, neighborhood, municipality, state, establishment management, existing equipment, equipment in use, SUS and last update. The results obtained through this research showed a total of 766 CT scanners existing in the state of RJ, of which 727 (95%) are in use and 39 (5%) are inoperative. It is concluded that of the 76% of CT scanners operating within municipalities in the state, these are concentrated in Rio de Janeiro, Niterói, Nova Iguaçu, São Gonçalo, Duque de Caxias, Campos dos Goytacazes, Volta Redonda, Belford Roxo, Macaé, São João de Meriti, Petrópolis, Cabo Frio, Itaguaí and Magé. It is considered that municipalities with large numbers of CT equipment advance in better serving the population and create a larger field of work for professionals in this category.

Keywords: Computed tomography, CT scanners, Unified Health System.

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INTRODUCTION

Computed Tomography (CT) is a diagnostic imaging test that uses X-rays to capture images of internal organs as if they were slices of the body. Once registered, the images are processed on a computer that provides a detailed analysis of the area to be examined (SAÚDE IG, 2018).

The inventors of this machine, which brings us many benefits today, were Hounsfield and Cormack. The first developed the technique for the reconstruction of tomographic images and the second was responsible for determining the mathematics required for the entire tomography procedure (BIASOLI, 2015).

CT equipment is called a CT scanner, a large device with an open tunnel in the center, allowing the examination table to slide in and out. The X-ray tube and detectors rotate around the patient and are inside a ring called a *gantry.* The control room where the technician monitors the exam and processes the images is in a separate environment from the exam (INSTITUTO VENCER, 2014).

The existence of functioning CT scanners is of great importance for the public and for the category of professionals involved in this area, as well as to know their distribution in certain states, in this case especially in Rio de Janeiro, since this procedure is fast, accurate and can detect small alterations, enabling an early diagnosis and later treatment for the population and, generating a job market for such professionals.

OBJECTIVE

The objective of this study was to identify the distribution of computed tomography equipment in operation in the state of Rio de Janeiro, with a view to understanding professional education regarding the employability of graduates of courses in this branch of radiology.

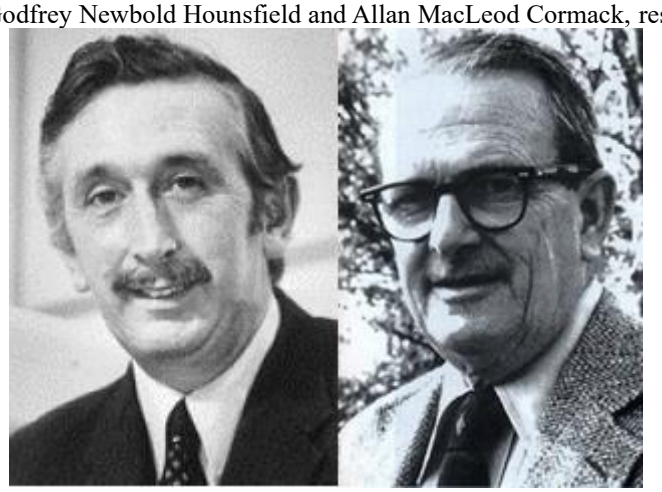
DEVELOPMENT

THE HISTORY OF CT SCANS

Computed tomography (CT) originated in 1961, through the description of an experimental system, by the American neurologist William Henry Oldendorf, with the purpose of visualizing the internal part of the brain based on a mathematical reconstruction, but the method was pointed out as unfeasible due to lack of mathematical support (BIASOLI, 2015).

Godfrey Newbold Hounsfield and Allan MacLeod Cormack, shown in figure 1, developed CT that was adopted as diagnostic imaging in 1970 (BIASOLI, 2015). Hounsfield demonstrated the technique for reconstructing the images, and Cormack developed the mathematics needed for the CT scan. Such contributions led to both receiving the Nobel Prize in Medicine in 1979 (CEFET, 2000).

Figure 1: Godfrey Newbold Hounsfield and Allan MacLeod Cormack, respectively.

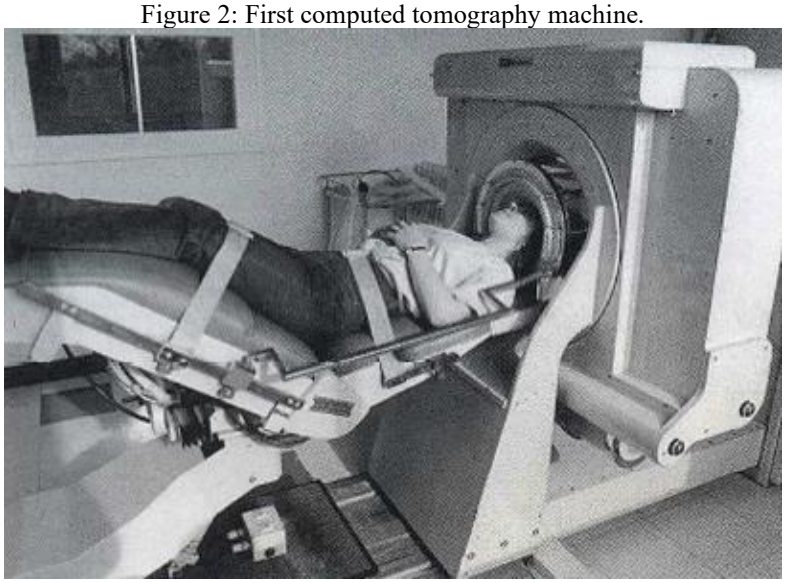


Source: CEFET, 2000.

As shown in figure 2, the first experimental CT scanner was built at Atkinson-Morley's Hospital, London. The first CT scan in history was performed on October 1, 1971, in a 41-year-old woman with a suspected frontal lobe tumor (BIASOLI, 2015, p. 453).

According to Biasoli (2015), in Brazil the first computed tomography scanner was installed at the Hospital da Real e Benemérita Sociedade Portuguesa de Beneficência, located in São Paulo, on December 10, 1976.

Figure 2: First computed tomography machine.



Source: BIASOLI, 2015.

BASIC PRINCIPLES AND EVOLUTION OF COMPUTED TOMOGRAPHY MACHINES

The term tomography derives from the Greek words "tomos" and "graphein" which mean respectively "slice" and "write". CT makes use of a computer and a mechanical system that provide anatomical images in axial, sagittal, and coronal planes (BONTRAGER; LAMPIGNANO, 2015).

A CT unit uses an X-ray tube and array detector to collect anatomical data from a patient. This data is reconstructed into an image (BONTRAGER; LAMPIGNANO, 2015, p. 1.983).

Over the years, CT scanners have evolved, with the emergence of several generations of CT scanners. According to Bontrager and Lampignano (2015), the **first generation** CT scanner had a thin X-ray beam similar to a pencil, rotation/translational movements, capable of performing examinations only of the skull and required 180º of rotations, only one detector and took approximately 5 minutes to form an image. The **second generation** emitted a beam of X-rays in the shape of a fan, rotation/translation movements, obtaining 30 or more detectors, with 15 seconds per cut to perform an examination.

The third generation **CT scanner** had a fan-shaped beam of radiation with an angle of up to 60º, only rotational movements, a bench of 200 to 800 detectors arranged on the opposite side of the X-ray tube, which rotated together around the patient in 360º, the scanning time (cut) decreased to less than 5 seconds. The **fourth generation**, on the other hand , had a fan-shaped radiation beam with a fixed detector, due to the inability to reduce scattered radiation, this equipment was not successful (BIASOLI, 2015).

The helical CT scanner is considered the **fifth generation**, in this model the table moves together with the patient, since in previous generations, the table moved after the 360º rotation (after the acquisition of the cut) and was positioned for a new cut, that is, it suffered interruptions between cuts. In this method, there is no data acquisition by cuts, but on a constant basis (CEFET-SC, 2000).

In 1998, multislice devices were introduced, capable of obtaining images of four slices simultaneously. This equipment now has more than one row of detectors. One of the advantages of this process is the speed of obtaining images (BIASOLI, 2015).

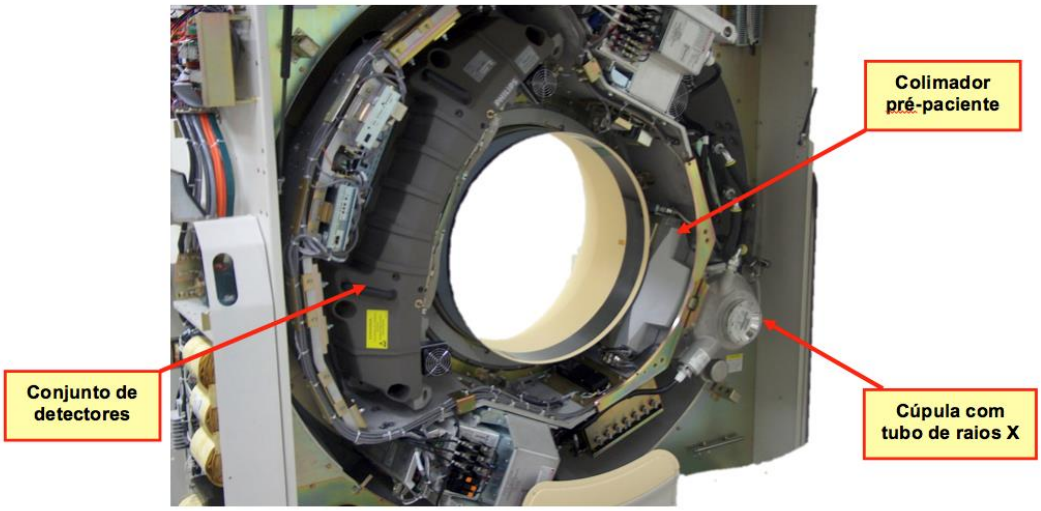
COMPONENTS OF A CT SCANNER

According to Bontrager and Lampignano (2015), the CT scanner is a fixed installation and consists of three main parts: gantry, computer, and operation panel.

GANTRY

It has a central opening, where the desired anatomical segment is scanned (BONTRAGER; LAMPIGNANO, 2015). According to Félix (2018), on the outside of the *gantry* there are commands for moving the table, while on the inside there is a combination of the X-ray tube, set of detectors, and collimators, shown in figure 3.

Figure 3: Inside the Gantry.



Cast iron: FÉLIX, 2018.

COMPUTER

The computer used in CT has a microprocessor and primary memory, which determine the time between the end of the exam and the reconstruction of the image (appearance of the image). The reconstruction time is related to the efficiency of the examination, especially when there is a large number of sections. Depending on the image format, 250,000 equations are made simultaneously (Bushong, 2010).

OPERATION PANEL

For Bontrager and Lampignano (2015), it is the place that allows controlling the parameters of the exam, protocols, visualization and manipulation of the images generated. The items that make up the operation panel are mouse, keyboard, and single or dual monitor, depending on the type of system, shown in figure 4.

Figure 4: Operation panel.

Source: BONTRAGER; LAMPIGNANO, 2015.

DATASUS PLATFORM

The National Health Surveillance Agency (ANVISA), through Collegiate Board Resolution (RDC) 611, of March 9, 2022, requires that all diagnostic X-ray devices and their components be registered with the Ministry of Health (MS), so that such equipment can be tracked (ANVISA, 2022).

As shown in Figure 5, it is possible to find the list of all CT equipment on the DATASUS website, which is the Department of Informatics of the Unified Health System, which emerged in 1991, after the creation of the National Health Foundation (FUNASA). The DATASUS platform has the function of promoting, operating and controlling national data and implementing systems to assist public health (DATASUS, 2024).

Figure 5: DATASUS website with the list of all CT scanners in the state of Rio de Janeiro.

Ministério da Saúde

CNESNet
Secretaria de Atenção à Saúde
DATASUS

Cadastro Nacional de Estabelecimentos de Saúde

Home | Institucional | Serviços | Relatórios | Consultas

Indicadores - Equipamentos
Estado - RJ
Tipo Equipamento - Equipamentos de Diagnostico por Imagem - Tomógrafo Computadorizado

CNES	Estabelecimento	Município	Existentes	em Uso	SUS
9407650	ALFA RADIOLOGIA ODONTOLOGICA LTDA	RIO DE JANEIRO	1	1	N
7973306	ALTA BARRA SHOPPING	RIO DE JANEIRO	1	1	N
9304061	ALTA LEBLON DIAGNOSTICOS	RIO DE JANEIRO	1	1	N
3471314	AMACOR SERVICOS MEDICOS CAMPO GRANDE	RIO DE JANEIRO	1	1	N
3339823	AMEP ASSISTENCIA MEDICA ESPECIALIZADA	RIO DE JANEIRO	1	1	N
6496202	AMERICAS OFTALMO CENTER	RIO DE JANEIRO	1	1	N
7557817	ANATO SCAN CENTER DIAGNOSTICOS POR IMAGEM	RIO DE JANEIRO	1	1	N
6403859	ASSOCIACAO AMOR E VIDA	ITAGUAI	1	1	N
5159636	ASSOCIACAO DE APOIO A TERCEIRA IDADE CENTRO	RIO DE JANEIRO	1	1	N
5329167	ASSOCIACAO DE APOIO A TERCEIRA IDADE TIJUCA 1	RIO DE JANEIRO	1	1	N
3221601	BARRA EYE CLINIC	RIO DE JANEIRO	1	1	N
6649106	BAYAO DIAGNOSTICOS MEDICOS	NITEROI	1	1	N
3030415	BENEFICENCIA PORTUGUESA DE PETROPOLIS	PETROPOLIS	1	1	N
3383040	BRONSTEIN BOTAFOGO	RIO DE JANEIRO	1	1	N
5160375	BRONSTEIN MED DIAG VILA VALQUEIRE	RIO DE JANEIRO	1	1	N
6987400	BRONSTEIN MEGA CAMPO GRANDE	RIO DE JANEIRO	1	1	N
3383067	BRONSTEIN MEGA COPACABANA	RIO DE JANEIRO	1	1	N
6987516	BRONSTEIN POLO I	RIO DE JANEIRO	1	1	N
7442548	CADI DIAGNOSTICO	CASIMIRO DE ABREU	1	1	S
7011547	CADI DIAGNOSTICOS	ARMACAO DOS BUZIOS	1	1	S
2282291	CAMIL	BOM JESUS DO ITABAPOANA	1	1	N
9280944	CAMIM CLINICA MEDICA	RIO DE JANEIRO	1	1	N
2287919	CASA DE CARIDADE SANTA RITA	BARRA DO PIRAI	1	1	S
3113205	CASA DE PORTUGAL	RIO DE JANEIRO	2	2	N
3016501	CASA DE SAUDE E MATERNIDADE SANTA MARTHA	NITEROI	1	1	N

Fonte: DATASUS, 2024.

METHODOLOGY

A survey was carried out of all computed tomography equipment installed in the state of RJ and registered on the DATASUS platform until April 2024. The information regarding each establishment with CT scanners was available through the DATASUS website, as shown in Figure 6.

Figure 6: Data from the establishment that has CT scanners in Rio de Janeiro.

Estabelecimento de Saúde

Identificação
CADASTRADO NO CNES EM: 5/12/2012 ULTIMA ATUALIZAÇÃO EM: 13/6/2024 DATA DE ATUALIZAÇÃO LOCAL: 4/6/2024

Veja onde se localiza: | Exibir Ficha Reduzida por Competência | Exibir Ficha Reduzida Atual

Nome:			CNES:	CNPJ:
CLINICA DE IMAGEM WINSTON			7143680	36173797000338
Nome Empresarial:			**CPF:**	**Personalidade:**
CLINICA DE IMAGEM WINSTON DE ANDRADE LTDA			--	JURÍDICA
Logradouro:			**Número:**	**Telefone:**
RUA CATORZE			S/N	2433621272
Complemento:	**Bairro:**	**CEP:**	**Município:**	**UF:**
HOSPITAL	PRAIA BRAVA	23950080	ANGRA DOS REIS - IBGE - 330010	RJ
Tipo Estabelecimento:	**Sub Tipo Estabelecimento:**	**Gestão:**		**Dependência:**
UNIDADE DE APOIO DIAGNOSE E TERAPIA (SADT ISOLADO)		MUNICIPAL		INDIVIDUAL
Número Alvará:	**Órgão Expedidor:**		**Data Expedição:**	
0125/12	SMS		05/06/2012	
Horário de Funcionamento:				
VISUALIZAR HORÁRIO				

Fonte: DATASUS, 2024.

At the same time, a spreadsheet was prepared with the data collected from the previously mentioned site. As can be seen in figure 7, the spreadsheet was fed with the following information: establishment, business name, neighborhood, municipality, state, management of the establishment (municipal or state), existing equipment, equipment in use, SUS (i.e., yes for those who provided services through SUS and not for those who did not offer the same services) and last updated on June 13, 2024.

Figure 7: Spreadsheet with all establishments that have CT scanners installed in the state of Rio de Janeiro.

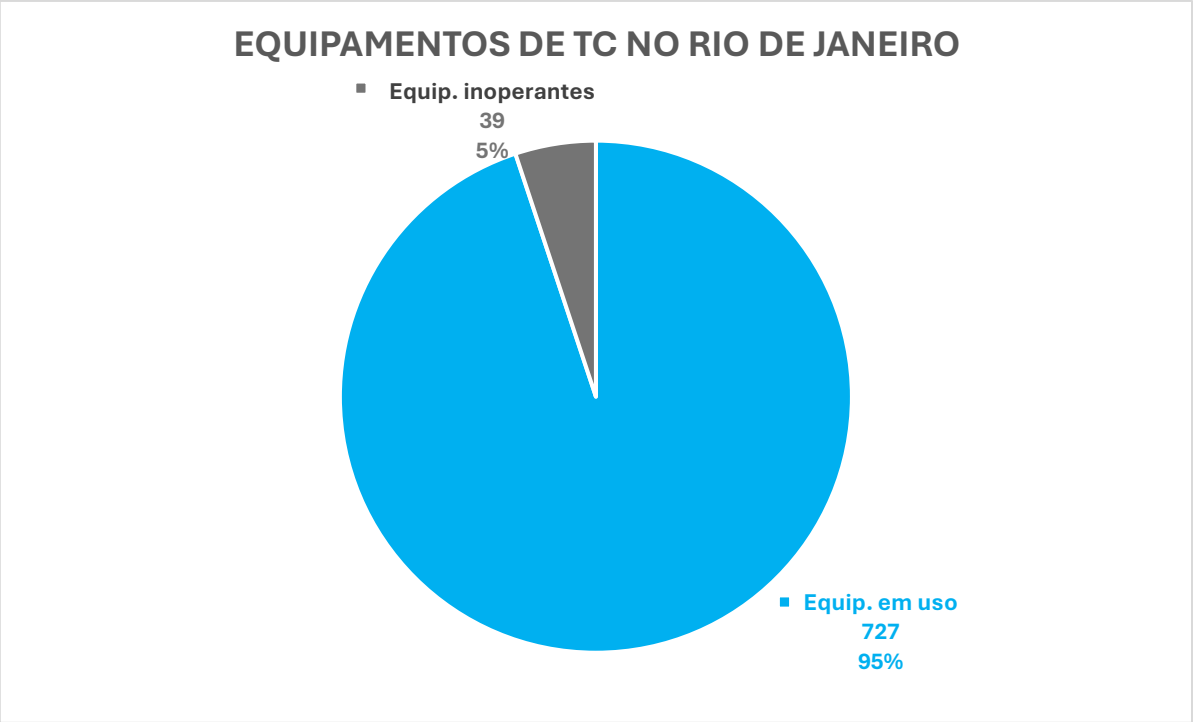
CnesNet - Cadastramento Nacional de Estabelecimentos de Saúde								
Tomografia Computadorizada								
Estabelecimento	Nome empresarial	Bairro	Município	UF	io do estabeleciuip. existeuip. em u			SUS
Alta Barra Shopping	Diagnósticos da América S A	Barra da Tijuca	Rio de Janeiro	RJ	Municipal	1	1	Não
Alta Leblon Diagnósticos	Diagnósticos da América S A	Leblon	Rio de Janeiro	RJ	Municipal	1	1	Não
Amacor Serviços Médicos Campo Grande	Amacor Serviços Médicos LTDA	Campo Grande	Rio de Janeiro	RJ	Municipal	1	1	Não
Amep Assistência Médica Especializada	AMEP Amep Assistência Médica Especializada LTDA	Freguesia	Rio de Janeiro	RJ	Municipal	1	1	Não
Américas Oftalmo Center	Américas Oftalmocenter Serviços Oftalmológicos LTDA	Barra da Tijuca	Rio de Janeiro	RJ	Municipal	1	1	Não
Anato Scan Center Diagnósticos Por Imagem	Anato Scan Center Diagnósticos Por Imagem LTDA ME	Tijuca	Rio de Janeiro	RJ	Municipal	1	1	Não
Associação Amor e Vida	Associação Amor e Vida	Centro	Itaguaí	RJ	Municipal	1	1	Não
Associação de Apoio a Terceira Idade Centro	Associação de Apoio a Terceira Idade	Centro	Rio de Janeiro	RJ	Municipal	1	1	Não
Associação de Apoio a Terceira Idade Tijuca 1	Associação de Apoio a Terceira Idade	Tijuca	Rio de Janeiro	RJ	Municipal	1	1	Não
Barra Eye Clinic	Barra Eye Clinic LTDA	Barra da Tijuca	Rio de Janeiro	RJ	Municipal	1	1	Não
Bayão Diagnósticos Médicos	rviços de Diagnósticos Médicos Complementares LTD	Centro	Niterói	RJ	Municipal	1	1	Não
Beneficência Portuguesa de Petropolis	SMH Sociedade Médico Hospitalar LTDA	Valparaíso	Petrópolis	RJ	Municipal	1	1	Não
Bronstein Botafogo	Diagnósticos da America S A	Botafogo	Rio de Janeiro	RJ	Municipal	1	1	Não
Bronstein Med Diag Vila Valqueire	Diagnósticos da America S A	Vila Valqueire	Rio de Janeiro	RJ	Municipal	1	1	Não
Bronstein Mega Campo Grande	Diagnósticos da America S A	Campo Grande	Rio de Janeiro	RJ	Municipal	1	1	Não
Bronstein Mega Copacabana	Diagnósticos da America S A	Copacanaba	Rio de Janeiro	RJ	Municipal	1	1	Não
Bronstein Polo 1	Diagnósticos da America S A	Madureira	Rio de Janeiro	RJ	Municipal	1	1	Não
Cadi Diagnóstico	L S Serviços Radiológicos LTDA	Centro	Casimiro de Abreu	RJ	Municipal	1	1	Sim
Cadi Diagnóstico	LES Serviços de Diagnósticos Por Imagem	Manguinhos	Armação de Búzios	RJ	Municipal	1	1	Sim
Camil	Centro de Assistência Médica Itabapoana LTDA	Centro	Jesus do Itabapo	RJ	Municipal	1	1	Não
Camim Clínica Médica	Camim Clínica Médica LTDA	Campinho	Rio de Janeiro	RJ	Municipal	1	1	Não
Casa de Caridade Santa Rita	Casa de Caridade Santa Rita	Centro	Barra do Piraí	RJ	Municipal	1	1	Sim
Casa de Portugal	Casa de Portugal	Rio Comprido	Rio de Janeiro	RJ	Municipal	2	2	Não
Casa de Saúde e Maternidade Santa Martha	Casa de Saúde e Maternidade Santa Martha	Santa Rosa	Niterói	RJ	Municipal	1	1	Não
asa de Saúde e Maternidade Terezinha de Jesus LTDA	asa de Saúde e Maternidade Terezinha de Jesus LTDA	Centro	São João de Meriti	RJ	Municipal	1	1	Não
Casa de Saúde Nossa Senhora de Fatima N Iguacu S A	de Saúde e Mat Nossa Senhora de Fatima Nova Igu	Centro	Nova Iguaçu	RJ	Municipal	1	1	Não

Source: Author's collection, 2024.

RESULTS

The results obtained through this research showed a total of 766 existing CT scanners in the state of Rio de Janeiro, of which 727 (95%) are those that are in use and 39 (5%) are inoperative, as shown in graph 1 below.

Graph 1: General quantification of CT scanners in the state of Rio de Janeiro.



As shown below in table 1, the distribution of CT scanners in operation in the municipalities of the state of Rio de Janeiro was as follows: 346 for the municipality of RJ, 33 for Niterói, 23 for Nova Iguaçu, 26 for São Gonçalo, 21 for Duque de Caxias, 20 for Campos dos Goytacazes, 17 for Volta Redonda, 16 for Belford Roxo, Macaé and São João de Meriti, 15 to Petrópolis, 11 to Cabo Frio and Itaguaí, 10 to Magé, 9 to Barra Mansa, Itaboraí and Nova Friburgo, 8 to Araruama, 7 to Angra dos Reis and Teresópolis, 6 to Nilópolis, Rio das Ostras and Saquarema, 4 to Barra do Piraí, Itaperuna, Maricá, Queimados, Resende, Rio Bonito, São Pedro da Aldeia and Três Rios, 3 to Armação de Búzios, Bom Jesus de Itabapoana, Mesquita, Paraíba do Sul, São Fidélis and Valença, 2 to Arraial do Cabo, Cachoeira de Macacu, Casimiro de Abreu, Itaocara, Paracambi, São João da Barra and Vassouras, 1 to Aperibe, Cambuci, Carapebus, Cantagalo, Cordeiro, Japeri, Mendes, Miguel Pereira, Miracema, Parati, Paty do Alferes, Porto Real, Rio Claro, São Francisco de Itabapoana and São Sebastião do Alto.

Table 1 - Distribution of CT scanners by municipalities in the state of Rio de Janeiro.

Municipalities	Equip. In use
Rio de Janeiro	346
Niterói	33
Nova Iguaçu	23
Duque de Caxias	21
São Gonçalo	26
Campos dos Goytacazes	20
Petrópolis	15
Belford Roxo	16
Macaé	16
São João de Meriti	16
Volta Redonda	17
Cabo Frio	11
Itaguaí	11
Magé	10
Barra Mansa	9
Itaboraí	9
Nova Friburgo	9
Araruama	8
Angra dos Reis	7
Teresópolis	7
Nilópolis	6
Rio das Ostras	6
Saquarema	6
Barra do Piraí	4
Itaperuna	4
Maricá	4
Queimados	4
Resende	4
Rio Bonito	4
São Pedro da Aldeia	4
Três Rios	4
Valença	3
Armação de Búzios	3
Bom Jesus de Itabapoana	3
Mesquita	3
Paraíba do Sul	3
São Fidélis	3
Arraial do Cabo	2
Cachoeira de Macacu	2
Casimiro de Abreu	2
Itaocara	2

Paracambi	2
São João da Barra	2
Vassouras	2
Aperibe	1
Cambuci	1
Carapebus	1
Cantagalo	1
Cordeiro	1
Japeri	1
Mendes	1
Miguel Pereira	1
Miracema	1
Parati	1
Paty do Alferes	1
Porto Real	1
Rio Claro	1
São Francisco de Itabapoana	1
São Sebastião do Alto	1
Total	**727**

CONCLUSION

According to the results obtained in this research, it was found that of the 766 CT scanners in the state of Rio de Janeiro, 39 of them are not in operation, which means that 727 are operational.

Of the 76% of CT scanners that are operating in the municipalities of the state, these are concentrated in: Rio de Janeiro, Niterói, Nova Iguaçu, São Gonçalo, Duque de Caxias, Campos dos Goytacazes, Volta Redonda, Belford Roxo, Macaé, São João de Meriti, Petrópolis, Cabo Frio, Itaguaí and Magé.

It is considered that municipalities with large numbers of CT equipment advance in better serving the population and create a greater field of work for professionals in the category.

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Awareness and prevention of the dangers of Electronic Smoking Devices (ESDs) among college students

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ABSTRACT

Mistakenly understood as a less harmful alternative to health when compared to traditional cigarettes, the use of electronic smoking devices (ESDs), such as vape, has become popular among younger people as a modal alternative to regular cigarettes. Due to its recent popularization, data regarding its safety are still scarce, however, some studies have already proven that electronic cigarettes are more harmful to health when compared to the traditional one, demonstrating that there is a close relationship between the use of DEFs and the intensification of nicotine dependence and smoking, especially among university students, because they are in a transitional phase of life, which puts them in situations of emotional vulnerability, increasing the chances of exposure to smoking as a form of relief and social affirmation. Thus, the present study aimed to warn about the possible risks of using DEFs and their association with other drugs, as well as discussing the damage caused by the use of DEFs and their impacts on society, as a gateway to other drugs.

Keywords: Electronic smoking devices (ESDs), University and impacts on society.

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INTRODUCTION

Electronic cigarettes or electronic smoking devices (DEFs), also known as "vapes", are devices that have a nicotine vaporization system through a mechanism that produces aerosols from the combustion of a solvent-based liquid (vegetable glycerin, propylene glycol), flavorings, in addition to nicotine itself. Both conventional cigarettes and DEF are related to an increased risk of cancer and cardiovascular diseases (MAGALHÃES and ANDRADE, 2023).

DEFs were introduced to the global market in the early 2000s with the function of being a non-pharmacological adjunct for smoking cessation. Although the target audience was directed to nicotine users, over time similar products were launched that presented a more modern aesthetic compared to other electronic cigarettes, such as the so-called "pods" or "vapes", sold in a wide variety of colors, sizes and flavors, which made it possible for people who were not addicted to cigarettes to be open to experimenting and using. often, the novelty, being a success, especially among young people of school or university age (GÜLŞEN and USLU, 2020).

Currently, several studies demonstrate the harmful consequences of e-cigarettes, especially in relation to acute lung injury related to e-cigarette use (EVALI), which was first described in 2019, by radiographic and histological patterns consistent with acute to subacute lung injury, due to the severe consequence of vaporization (LIBER, 2021). One of the main risks of EVALI is the severity of the respiratory symptoms it causes, including cough, shortness of breath and chest pain, which can quickly progress to respiratory failure and consequently death.

According to Krishnasamy et al., (2020) e-cigarettes cause lung injury mainly associated with e-liquids containing tetrahydrocannabinol (THC) and other additives considered e-liquids. It has been seen by Fagan et al., (2018) and by Khlystov, Samburova (2016) apud Jason et al., (2023) that flavor additives in e-liquids have been associated with adverse effects on human lung endothelial cells. Exposure to these common additives resulted in reduced cell viability, increased apoptosis, and impaired tube formation and wound healing. The high expression of inflammatory cytokines provides a pro-inflammatory environment for endothelial cells exposed to these agents.

According to the resolution of the collegiate board - RDC No. 855, of April 23, 2024, the commercialization, importation and advertising of any electronic smoking devices throughout the Brazilian territory is prohibited (BRASIL, 2024). However, despite the prohibitions, according to studies by the Global Health Professional Students Survey (GHPSS) – or "Profile of smoking among university students in Brazil, PETUNI", which began in 2006, the percentage of university students who smoked some nicotine-based substance increased up to 24.4% in health courses (Inca, 2011).

From this perspective, the use of electronic cigarettes shows a gradual trend towards the practices of traditional cigarette use. In addition, through the analysis of scientific evidence, the studies showed statistical significance on the importance of smoking habits by students. Young

people in particular should reflect people's behavior patterns and demonstrate influence and power to change unhealthy patterns. However, evidence points to the high popularity of these devices worldwide, not only in academic contexts (BARROS et al., 2022).

Misinformation and the spread of e-cigarettes can fuel incidents. From this perspective, professional conduct can serve as a model for the population. It is essential to educate and sensitize students about the new trends of the century on the subject and, consequently, about the effects (SILVA, 2021).

This is justified by the fact that public policies for tobacco control require future physicians to be prepared for it, playing an important role in preventing smoking and promoting smoking cessation (BARROS et al., 2022). Allied to this, the best way to avoid this dependence is to guide young people, especially students, through orientation campaigns for traditional and electronic cigarettes. Combined with partnerships with agencies such as ANVISA (DIEHL et al., 2018).

DEVELOPMENT

In January 2018, a study conducted by the National Academies of Sciences, Engineering, and Medicine of the United States addressed the consequences of e-cigarette use. In the result it was observed that exposure of the lungs to various components of the e-cigarette aerosol can damage the respiratory system or worsen pre-existing lung diseases through a variety of mechanisms, for example, decreasing mucociliary clearance. In addition, the flavorings present in e-cigarettes have been associated with changes in the oxidation-reduction balance of cells in the airways, which may contribute to the increase of pro-inflammatory cytokines. In addition, the temperatures reached during the use of e-cigarettes can lead to the formation of toxic compounds, such as formaldehyde, which can exert harmful effects on the lung parenchyma (STRATTON et al., 2018)

RISKS OF USING DEFS

According to Marques (2021), although many scholars believe that the harmful effects of e-cigarettes are less intense than those caused by conventional cigarettes, there is numerous evidence relating their consumption to pathophysiological processes of aggression and inflammation of the respiratory epithelium. Propylene glycol, for example, has been linked to symptoms similar to those of upper respiratory infections. Its formation occurs through the hydration of propylene oxide, a possibly carcinogenic substance.

In addition, exposure to vegetable glycerin is related to effects such as irritation to the eyes, lungs, and esophagus. During the vaporization process, glycerol, one of the components, can turn into acrolein, a potent irritant to the skin, eyes, and nose, in addition to having carcinogenic potential (ELTORAI, CHOI, and ELTORAI, 2019).

Additional research has shown that the liquids and essences present in e-cigarettes contain a significant amount of heavy metals, including lead, nickel, and chromium, substances known to be associated with a higher risk of developing coronary and peripheral artery disease (OLIVEIRA et al., 2022).

PREVALENCE OF DEF USE

The increasing use of e-cigarettes among young people in recent years acts as an alarm, both for them and for society. However, the lack of regulation and quality control policies leaves the safety of these devices difficult to determine, and the potential health risk remains uncertain (OLIVEIRA et al, 2018).

In Brazil, there are few studies on knowledge about the use of electronic cigarettes. However, according to a study published in 2014 by the International Journal of Environmental Research and Public Health, 35% of Brazilians were already aware of DEFs and 3% reported having already used them. The data are on a par with countries such as Canada and China and are lower than those of countries such as the United States and Australia, which have knowledge of 73% and 66%, respectively, and experimentation of 15% and 20%, respectively (FONG *et al*, 2014).

In 2015, a study was conducted with students from the Federal University of Mato Grosso (Cuiabá Campus), in which a total of 489 people participated, 258 males and 231 females, with a mean age of 23.8 years for both sexes. The results of this research found that, among the participants, 5.7% were smokers and 4.9% were former smokers. As for DEFs, the prevalence of knowledge was 37%, being more known by male students (59%) than by female students (41%). In addition, it was found that the younger the student is, the greater the chance of getting to know the device. Finally, it was found that the rate of the then use of ESDs among students was 0.61%, but that the rate of experimentation was 2.7% and the rate of knowledge of the device was 7% (OLIVEIRA *et al*, 2015).

More recently, in 2019, data from the National School Health Survey (PeNSE) – conducted by the Brazilian Institute of Geography and Statistics (IBGE) – were collected between 2015 and 2019, to establish knowledge about the use of cigarettes and similar products among young people aged 13 to 17 years. The results showed that 22.6% of the students had already tried cigarettes at some point and that the use of hookahs, e-cigarettes or similar products was already done by 26.9%, being higher among male students aged 16 and 17 years at the time (MALTA *et al.,* 2022).

In view of the data presented, the importance of a study on the use of ESDs or electronic cigarettes and similar among current young people is reinforced, as they function as a current health problem with long-term data consequences, which can overload the Brazilian Health System.

RISKS OF OTHER DRUGS

DEFs, or electronic cigarettes, were the most reported device in all DOTN classes, which are discrete devices for the consumption of drugs other than nicotine. Among them, cannabinoids were the most present class of DOTN. However, the presence of other illicit drugs, such as amphetamines, kratom, vitamins, opiates, DMT, fentanyl and ketamine was also found. Such data is important for a substance use-focused intervention that includes vaping, raising awareness of DOTN e-cigarette use, and highlighting public safety issues in driving impairments, crime scene investigations, and death investigations. (HOLT et al., 2023).

The increase in the frequency of DEF use is significantly related to the increase in the use of other substances experienced by young people. This fact is of great importance for the prevention of drug abuse and dependence. The positive relationship between the degree of use of DEFs and the tendency to experiment with other substances supports the hypothesis that nicotine dependence may increase the susceptibility of young people to experimenting with other drugs. Whereas neurobiology studies on frequent nicotine use and addiction indicate that nicotine primes the brain for increased likelihood of illicit drug experimentation and increases the risk of addiction and abuse. (ANDREW et al., 2021).

FINAL CONSIDERATIONS

The problem of the theme becomes relevant to the extent that the growth in the use of electronic cigarettes among young people becomes harmful to them, since, at the same time, the imbroglio of frequent lung lesions arises, especially the disease EVALI, which refers to the damage caused by the substances of electronic cigarettes in the body of their consumers.

Therefore, there is a need for more discussions on the subject so that the dispersion of this veiled knowledge about the problem promotes awareness among the intended public.

There is a significant gap in data collection, with information often inaccurate, despite the fact that most young people are aware of the risks associated with severe lung diseases. This phenomenon is exacerbated by the intense advertising promoted by e-cigarette manufacturers, which use strategies to encourage the consumption of these devices.

It is essential to implement interventions that promote healthy habits among students and discourage the use of e-cigarettes, with the aim of preventing the increased consumption of other products that also release inhaled nicotine, including tobacco products.

There is a need for in-depth investigation into the consequences of e-cigarette use, the constituents of e-liquids, the characteristics of users, and usage patterns. To this end, it is necessary to carry out surveys of prevalence data on the use of electronic cigarettes, in order to consolidate relevant information and enable effective interventions.

Detailed epidemiological studies are crucial to understand the extent of the problem and to formulate evidence-based public policies aimed at reducing the use of these devices among young people. Additionally, it is imperative to examine the long-term health impacts, the mechanisms by which e-liquids affect the respiratory system, and the marketing strategies used by businesses to target this demographic. More research is needed focusing on their consequences, the constituents of e-liquids, user characteristics and usage patterns.

E-cigarettes, originally intended to be used as cigarette substitutes, have evolved into discrete devices for the consumption of drugs other than nicotine (DOTNs). Cannabinoids were the most reported class of DOTN, both for lifetime use and in the past 30 days. Other reported DOTNs included herbal supplements, amphetamines, caffeine, kratom, vitamins, opiates, DMT, fentanyl, and ketamine. (HOLT et al., 2023).

Thus, the current ease of consuming illicit drugs through electronic cigarettes is worrisome, mainly due to their popularization in the social context of adolescents and young adults. Neurobiology studies on nicotine occurrence and addiction indicate that nicotine primes the brain for a higher likelihood of illicit drug experimentation and increases the risk of addiction.

Young people, whose brains are still developing, may experience greater and longer-lasting neurobiological changes after addiction or even mere exposure to nicotine. (ANDREW et al., 2021). Therefore, it is worth emphasizing the great risk of early exposure to nicotine to influence the use of illicit drugs and substance abuse.

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Antineoplastic-induced alopecia: An integrative review of the use of hair cryotherapy as a prevention strategy

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ABSTRACT

INTRODUCTION: The present study is an integrative literature review on the use of capillary cryotherapy to prevent chemotherapy-induced alopecia. Alopecia is one of the most feared adverse reactions by most patients diagnosed with cancer, having a higher impact on females because it is an aspect that is related to femininity. Hair loss affects not only the patients' physical state, but especially the psychological state, decreasing self-esteem and impairing the quality of life of these patients. The method consists of cooling the scalp through the use of frozen caps that must be changed every 30 minutes or through a cooling system that maintains a constant temperature of the cap, not being necessary for change. OBJECTIVE: This study aims to identify the effectiveness of capillary cryotherapy, in the prevention of chemotherapy-induced alopecia in patients undergoing cancer treatment. METHOD: The data collection method was performed based on the theoretical framework of Whittemore and Knafl, which consists of six stages: identification and elaboration of the research problem, search in the literature, evaluation of the data found, data analysis and presentation of the results. To elaborate the research problem, the PICO strategy was used and defined as: Is capillary cryotherapy effective to prevent chemotherapy-induced alopecia in cancer patients? Data were collected from June to August 2022. The search was conducted on the main research platforms such as the National Library of Medicine (MEDLINE), PUBMED, periodic CAPES, GOOGLE ACADEMIC and Virtual Health Library (VHL) from 2012 to 2022. RESULTS: A total of 3795 articles were found, but 3701 were excluded after reading the titles and abstracts because they did not attend the theme proposed by the study, remaining only 94 articles. However, only 15 remained for analysis, since 34 articles were not entirety available, 12 did not address the subject, 31 were duplicated and 2 were dissertations. The results were presented and detailed by constructing a flowchart based on the recommendations of the PRISMA method. To evaluate these articles, we elaborated the construction of a chart that addresses the name of the article, author, language and year, type of study and main results of each article. Then, the articles were discussed in three categories: Greater efficacy of capillary cryotherapy with the use of taxanes; Methods of using hair cryotherapy; and adverse effects of capillary cryotherapy. CONCLUSION: It is concluded that capillary cryotherapy is effective in preventing chemotherapy-induced alopecia, but to obtain positive results, a series of recommendations and care should be followed. Many factors can interfere with its effectiveness, especially the protocol that the patient uses for treatment. It is noticed that, when associated with chemotherapy based on taxanes, its use presents better results compared to anthracyclines. Nevertheless, concerns about the appearance of scalp metastases and cold-

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associated burns are highlighted. Albeit, we emphasize the importance of the nursing professional in this process, because he is responsible for welcoming, preparing and guiding the patient on the care and use of the cap. For this, the professional must be qualified and able to clarify doubts and perform the technique correctly.

Keywords: Cryotherapy, Alopecia, Antineoplastic Agents.

INTRODUCTION

Cancer is a serious disease considered a public health problem, characterized as the disordered growth of cells from a certain organ with a great capacity to invade adjacent organs and tissues (Silva *et al*., 2020).

According to information from INCA (2022), the development of cancer can occur due to several causes, divided into internal and external causes. Internal causes are related to immunological changes, hormonal changes, or genetic mutations. External causes, on the other hand, are related to the interference of the environment with our body, which is responsible for 80% to 90% of the causes of cancer. External causes include changes in the environment caused by human beings and behaviors of lifestyle habits.

Cancer is one of the leading causes of death in the world. According to information from the Pan American Health Organization (PAHO), one out of every six deaths is due to cancer. It is estimated that by 2030 the number of cancer deaths will increase by 2.1 million (Pan American Health Organization, 2022).

Over the years, policies and programs have been developed with the aim of better serving this population, giving them more security and quality in the care provided.

In 2005, the National Oncology Care Policy was instituted in Brazil through Ordinance No. 2,439 of December 8, 2005, which deals with the rights of cancer patients in relation to health services in order to promote an improvement in the quality of life of this population, as well as to encourage the development of health promotion and disease prevention actions through mechanisms for monitoring risk factors for cancer (Brazil, 2005).

In 2021, through Law No. 14,238 of November 19, 2021, the Statute of the Person with Cancer was developed, which aims to guarantee the rights of people with cancer, develop strategies for early diagnosis, guarantee these patients the right to appropriate treatment, guarantee the patient access to all information about the disease, qualify professionals to care for cancer patients, reduce mortality, and improve the quality of life of this population, among others (Brasil, 2021).

When a person is diagnosed with cancer, it is as if they are reaching the end of their life at that moment, see the stigma that the word itself brings. Karkow *et al.,* (2015) report in their study that cancer is culturally seen as a threat to life, being feared by society, and can affect a family significantly. It highlights that receiving a cancer diagnosis can affect not only the patient's life, but their entire circle of life, since they will experience all the suffering during the diagnosis and treatment of this patient. Therefore, in the same way that family and friends are important support for coping with this disease, they also need to be cared for.

In the female universe, breast cancer is the most prevalent, followed by colon and rectum and cervix. It is estimated that in 2020, there were a total of 66,280 new cases of breast cancer in women and a total of 17,825 deaths (INCA, 2022).

Breast cancer is already considered a public health problem in Brazil due to its high incidence and mortality rates, and it is also the cancer that most affects women worldwide (Medeiros *et al.*, 2019).

In this sense, the importance of early detection of breast cancer is highlighted, an action that should be stimulated by health services and especially by Primary Health Care (PHC), which is the gateway to such services.

According to the Primary Care Booklet for the control of cervical and breast cancers, nurses play an elementary role through nursing consultations, screening and control of patients, clinical breast examination (MCE), and request and evaluation of mammograms, according to established protocols and guidelines (Brazil, 2013).

The discovery of the diagnosis of breast cancer generates a lot of fear, uncertainties and anguish for women, since with it comes a series of physical and psychological changes that most of the time affect their quality of life.

After receiving the diagnosis of cancer, there are numerous challenges faced by the patient, including the adverse effects of treatment, whether with chemotherapy, immunotherapy, hormone therapy, radiotherapy or surgeries.

Chemotherapy consists of the administration of chemical substances in the body in order to combat the proliferation of cancer cells, but in addition to the diseased cells, this treatment also affects healthy cells causing a series of side effects in the patient such as nausea, vomiting, diarrhea, constipation, neutropenia, fever, fatigue, alopecia and among others (Baitelo; Kings; Gradim, 2015).

According to Silva *et al.*, (2020), 65% of patients undergoing chemotherapy treatment have alopecia as a side effect, which is the most feared by the female population because it affects their self-esteem and influences the way society sees them. This author also points out that numerous methods have been developed to prevent chemotherapy-induced alopecia (IQR), but the scalp cooling technique has been the most effective and is the most used worldwide.

Thus, IQA is one of the main concerns pointed out by women undergoing chemotherapy treatment, for this reason this study seeks to answer the following research question: Is hair cryotherapy effective to prevent chemotherapy-induced alopecia in cancer patients?

To answer this question, the objective was: To identify the efficacy of capillary cryotherapy in the prevention of chemotherapy-induced alopecia in patients undergoing cancer treatment.

METHODOLOGY

The present study is an integrative literature review based on the theoretical framework of Whittemore and Knafl (2005). The authors divide this process into six stages: identification and elaboration of the research problem, literature search, evaluation of the data found, data analysis, and presentation of the results.

The definition of the research problem was carried out through the PICO strategy (Population, Intervention, Comparison and Outcome). The population was defined as "Patients undergoing cancer treatment", the intervention "Use of capillary cryotherapy", the comparison "Patients who did not use it" and the outcome decreased alopecia. Thus, the research problem was presented as follows: Is hair cryotherapy effective to prevent chemotherapy-induced alopecia in cancer patients?

The search for studies took place between the months of June and August 2022, in electronic databases such as the National Library of Medicine (MEDLINE), PUBMED, CAPES periodicals, GOOGLE SCHOLAR and virtual health library (VHL) with the help of the librarian of the Federal University of the Southern Border (UFFS) on the Chapecó campus.

For the process of searching for the articles, we opted for the definition of descriptors in health sciences (DeCS) and synonyms combined with the Boolean operator AND, and these combinations were used in Portuguese and English to search for the articles.

Table 1 – Descriptors.

Descriptors used
Crioterapia capilar AND alopecia AND quimioterapia
Hair cryotherapy AND chemotherapy
Crioterapia capilar AND alopecia AND paclitaxel
Crioterapia capilar AND alopecia AND doxorrubicina
Crioterapia capilar AND alopecia AND docetaxel
Hair Cryotherapy AND Cancer
Hair cryotherapy AND chemotherapy
Hair cryotherapy AND câncer
Hair cryotherapy AND cancer AND chemotherapy
Hair cryotherapy AND cancer AND paclitaxel
Hair cryotherapy AND cancer AND doxorubicin

Source: Author (2023).

Scientific articles in English, Portuguese and Spanish that deal with the use of hair cryotherapy for the prevention of chemotherapy-induced alopecia, published in journals from 2012 to

2022, were chosen as inclusion criteria. Exclusion criteria were: duplicate articles in different databases, articles unavailable for full reading, and articles that addressed the use of cryotherapy for other purposes.

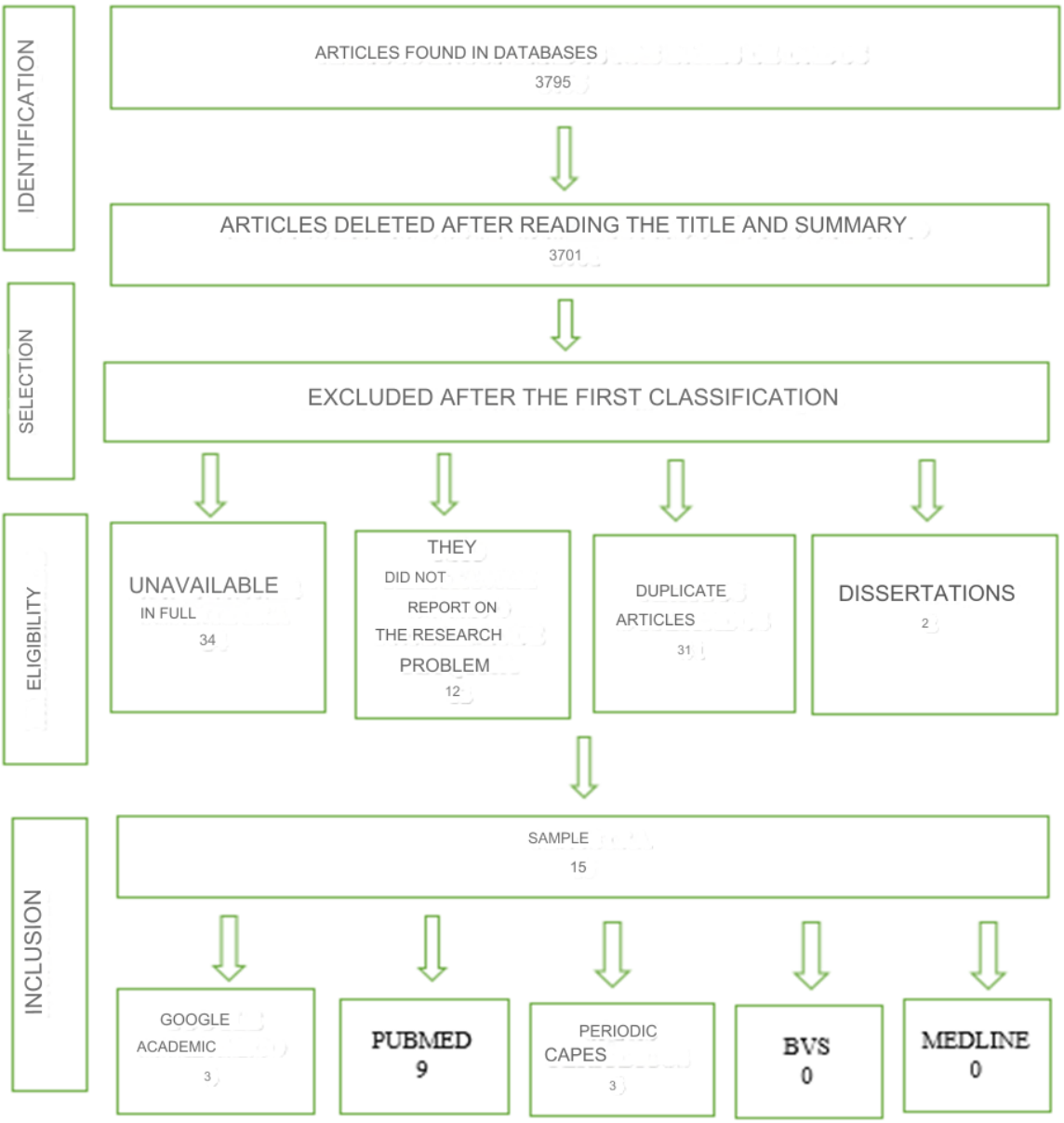
Subsequently, a table was formulated on the *Word*® platform with the following information: database, descriptors, number of articles found and number of articles found between the years 2012 and 2022, after which the search began in each of the databases. In this phase, 3795 articles were found.

After this first exclusion criterion, a second table was constructed, this time in *Excel*®, divided according to the database with the following information: title of the articles, name of the authors, website of the article, type of study and results found. The title and abstract of the articles were read and at this stage 3701 documents were excluded, leaving 94 articles to be read in full. Of the excluded articles, most dealt with the use of cryotherapy for other purposes such as mucositis, alopecia errata, peripheral neuropathy, use in animals, among others.

Subsequently, the articles were searched and read in full and a new table was prepared with the articles consistent with the objective of the research. Of the 94 articles found, 15 were included in the study and 79 were excluded. Of these, 34 were not available in full, as they needed to be paid to have access, 12 did not report on the subject proposed by the study, 31 articles were duplicates, and 2 were dissertations. Of the articles included, three were found in Google Scholar, nine in PUBMED and three in CAPES PERIÓDICO.

Based on the results found, it was decided to construct a flowchart based on the recommendations of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Figure 1 – Flowchart.



Source: Author (2023).

RESULTS AND DISCUSSION

Based on the sample found, four articles are in the Portuguese language, one in Spanish and 10 in English. As for the type of study, three are presented as literature review, two systematic reviews, two literature reviews, two randomized trials and two observational studies, one cohort study, one logistic regression analysis study, one case report study and one prospective study.

Regarding the year of the study, there was a prevalence of the year 2020 with five studies, followed by 2017 with three studies, 2018 with two studies, 2012 with two studies, 2015 with one study, 2021 with one study, and 2022 with one study.

Chart 2 – List of articles found.

No.	TITLE	AUTHOR	LANGUAGE/YEAR	STUDY	RESULT
1	Hair cryotherapy as a strategy to reduce alopecia induced by oncological chemotherapy: a systematic review	Débora Esteves Monteiro	Portuguese/ 2021	Systematic review	Recommended for all types of solid tumors when using medications that cause hair loss. But it is allowed to be used only for breast cancer. Positive result in prevention, but attention should be paid to the pre-placement and post-removal care. Best result in taxanes
2	Scalp Cooling as a Method of Preventing Chemotherapy-Induced Alopecia	Antônia Cleia Silva de Souza, Lorena de Oliveira Viana, Elias Rocha de Azevedo Filho, Alberto César da Silva Lopes, Wanderlan Cabral Neves, Pablo Randel Rodrigues Gomes, Marcondes Edson Ferreira Mendes	Portuguese/ 2020	Exploratory literature review	It should be used in solid tumors. Positive results of up to 92% efficacy in taxane-based medications and up to 50% in doxorubicin and epirubicin. The English PAXMAN machine was used, which maintains a temperature of -2 to -4°. Beginning 30 minutes before medication and staying up to 90 minutes after. Concern about the risk of scalp metastasis.
3	A Clinical and Biological Guide to Understanding Chemotherapy-Induced Alopecia and Its Prevention	Christopher John Dunnill, Wafaa Al-Tameemi, Andrew Collett, Iain Stuart Haslam, Nikolaos Theodoros Georgopoulos	English/2017	Literature review	50% efficacy, with influence on the length of stay after the end of the medication infusion, proper fitting of the cap, preparation of the hair before applying the cap as well as moistening the hair. Efficacy depends on the dose and type of medication, one study addressed that ethnicity, age, and gender also have an impact on effectiveness. Less efficacy in TAC protocol (doxorubicin, docetaxel, and cyclophosphamide.

					Start of cooling 30min before infusion. Efficacy of prevention with a residence time of 45 min after the end of the infusion. Concerns about the appearance of scalp metastases.
4	Association Between Use of a Scalp Cooling Device and Alopecia After Chemotherapy for Breast Cancer	Esperança S Rugo, Paula Klein, Susan Anitra Melin, Sara A Hurvitz, Michelle E Melisco, Anne Moore, Parque Glen, Jules Mitchel, Erika Bågeman, Ralph B D'Agostino Jr, Elizabeth S Ver Hoeve, Laura Esserman, Tessa Cigler.	English/2017	Prospective cohort study	Study conducted with women with stage I and II breast cancer who received adjuvant and neoadjuvant chemotherapy, excluding anthracycline and taxane sequential or combined. Increased efficacy in taxane treatment regimen. Cooling started 30 min before medication, during and maintained for 90 to 120 min after the end of chemotherapy. Patients experienced adverse effects of cryotherapy such as headache. None of the patients had scalp metastasis. Cooling was effective with a result of 50% or less hair loss.
5	Randomized Controlled Trial of Scalp Cooling for the Prevention of Chemotherapy-Induced Alopecia".	J Bajpai, S Kagwade, A Chandrasekaran, S Dandekar, S Kannan, Y Kembhavi, J Ghosh, S D Banwani, S Gupta.	English/2020	Randomized controlled trial	It rules out the possibility of scalp metastases. Used PAXMAN system. Cooled 30 min before, during, and 90 min after end of medication. Effective in about less than 50% hair loss. It has the main adverse effect of headache.
6	Safety and Efficacy of the Scalp Cooling System in the Prevention of Chemotherapy-Induced Alopecia - A Prospective Single-Center Study	Shruti Kate, Roshankumar Patil, Dina Pathan, Rohini Vyakane, Sheela Joseph, Vibin Baby, Yasam Venkata Ramesh, Raj Nagarkar.	English/2020	Prospective observational study	30% efficiency using PAXMAN device. Cooled 30 min before, during, and 90 min after end of medication. Positive result more effective in patients using taxanes

					compared to those using anthracycline. Study conducted with various types of cancers. Most effective in men. Ethnicity interferes with effectiveness.
7	Effect of a Scalp Cooling Device on Alopecia in Women Undergoing Chemotherapy for Breast Cancer: The SCALP Randomized Clinical Trial	Julie Nangia, Tao Wang, Cynthia Osborne, Polly Niravath, Kristen Otte, Steven Papish, Frankie Holmes, Jaime Abraão, Mario Lacouture, Jay Courtright, Richard Paxman, Mari Rude, Susan Hilsenbeck, C Kent Osborne, Mothaffar Rimawi	English/2017	Multicenter randomized clinical trial	More than 50% efficacy, good tolerance. More efficiency in taxanes. Rare appearance of scalp metastases. For the study it was used based on the PAXMAN device. Cap was applied 30 min before medication and remained 90 min after.
8	Scalp Cooling for Hair Preservation and Associated Features in 1411 Chemotherapy Patients - Results from the Dutch Scalp Cooling Registry	Corina J van den Hurk, Mijke Peerbooms , Lonneke V van de Poll-French , Johan W Nortier , Jan Willem W Coebergh , Raça Wim P.	English/2012	Logistic regression analysis.	It is effective, but it depends a lot on the type of drug that is used. Taxane shows better results. It depends a lot on the time the cap remains after the end of the infusion, hair type. Great results in men. Wetting the hair does not interfere with the result. Paxman system used. It was applied 38 min before the infusion and remained for 90 min after the end of the infusion. Less effective when associated with the TAC protocol. Worst result in Asians and the elderly. Chemically treated hair, hair length did not interfere with the result.
9	Considerations for the Use of Scalp Cooling Devices in Black Patients	Erinolaoluwa F Araoye, Vered Stearns, Cristal Aguh.	English/2020	Case report	It reports on the lower efficacy in patients with curly hair due to the difficulty of adhering the cap to the head. It brings aspects that help in the effectiveness of the cap

					in patients with curly hair
10	Pathogenesis and treatment options for chemotherapy-induced alopecia: a systematic review	Belen Rubio-Gonzalez MD, Margit Juhas MD, Jamie Fortman MSc, Natasha Atanaskova Masinkowska MD, PN.	English/2018	Systematic review	It discusses the medications that cause ASD and the effectiveness of scalp cooling. Proven efficacy with the PAXMAN device. Indicated only for patients with solid cancer, due to the possibility of scalp metastases. Hair loss of less than 50%.
11	Short post-infusion scalp cooling time in the prevention of docetaxel-induced alopecia	C.J.G. van den Hurk, W.P.M. Breed and J.W.R. Nortier	English/2012	Observational study	Proven efficacy with the PAXMAN device. The cap was applied 30 min before the infusion, during and 45 to 90 min after the end of the infusion. Most effective result in 45 min time.
12	Chemotherapy, alopecia, and scalp cooling systems	D yellow, D for Boni, m neck.	Spanish/2022	Literature review	Used in solid tumors, especially breast cancer. Start 30 - 45 min before medication, during and 90 min after. The PAXMAN method resulted in less than 50% alopecia in patients, while the DIGNICAP system was 39.3% effective.
13	Scalp hypothermia as a preventive measure for chemotherapy-induced alopecia: a review of controlled clinical trials	VV Shah, TC Wikramanayake, GM Del Canto, C van den Hurk, S Wu, ME Lacouture, JJ Jimenez.	English/2018	Bibliographic research	It proves the effectiveness of hair cryotherapy, especially when used for taxanes. Lower efficacy when associated with taxanes and anthracyclines. He reports that this efficacy depends a lot on the drug and the dose used. It reports on the appearance of metastases on the scalp after the use of hair cryotherapy. Greater effectiveness when the temperature is maintained at 18 degrees during infusion.

					Care should be taken at home, such as avoiding washing your hair in warm water and avoiding drying your hair.
14	Efficacy of Scalp Cooling in the Prevention of Chemotherapy-Induced Alopecia in Breast Cancer Patients Receiving Adjuvant Docetaxel and Cyclophosphamide Chemotherapy	Caesar Cigler Devora Isseroff Bárbara Pederlein Sarah Schneider Ellen Chuang Linda Vahdat Anne Moore	English/2015	Prospective study	For this study, the Penguin Cold Caps device was used in 20 women who received treatment with docetaxel and cyclophosphamide protocol, which demonstrated efficacy in the prevention of chemotherapy-induced alopecia. She reports on the risk of metastasis due to the fact that chemotherapy does not reach the scalp. 90% of the participants did not report the need to wear a head covering. It reports that scalp cooling is effective depending on the protocol.
15	Scalp Cooling in the Prevention of Chemotherapy-Induced Alopecia: Overview	Giselle de Barros Silva, Kathryn Ciccolinib, Aline Donatic, Corina van den Hurkd.	Portuguese/2020	Literature review	It addresses that the permanence time of the post-infusion cap can interfere with the success of cryotherapy and that its result depends on the protocol being used. With the best result the time of 45-90min. Reports better results with protocol taxanes 81% - 94%. She reported concern about the incidence of metastasis in the scalp. Adverse events such as nausea, dizziness, headache and scalp burning.

Source: Author (2023).

After reading, three categories were elaborated: Greater efficacy of hair cryotherapy with the use of taxanes; Methods of using hair cryotherapy; and Adverse effects of hair cryotherapy.

INCREASED EFFICACY OF HAIR CRYOTHERAPY WITH THE USE OF TAXANES

Based on the articles that make up the study sample, it was highlighted that most of them addressed that the effectiveness of hair cryotherapy depends largely on the chemotherapy protocol that the patient receives. Articles No. 01, 02, 03, 06, 07, 08, 13 and 15 reported better efficacy in protocols composed of taxanes (paclitaxel and docetaxel).

Study number 1 was conducted with women diagnosed with breast cancer using chemotherapy treatments with anthracyclines and paclitaxel, docetaxel and cyclophosphamide, with greater efficacy in patients who used taxanes compared to those who used anthracyclines.

Study number 6, also conducted with women with breast cancer, addressed a 59% efficacy rate in women who underwent scalp cooling under treatment with a taxane-based protocol compared to 16% who used anthracyclines. In a randomized study discussed in the article, 6 it showed a 77% rate of hair preservation in women who underwent treatment with taxanes, compared to 33% who used anthracyclines.

Alopecia is the most feared side effect by most women undergoing cancer treatment, for many it is more traumatic than receiving the diagnosis of the disease, going through the mastectomy process or living with the disease itself (Mairink *et al.,* 2020).

According to Reis and Gradim (2018, p. 448), alopecia is described as "the loss of hair and any other body hair such as eyebrows, axillary hair, pubic hair and/or leg and arm hair".

For women, hair loss is closely related to femininity and its loss, in addition to causing changes in their physical state, can also affect their emotional state, which can be the most difficult stage to be faced during treatment (Monteiro, 2021; Silva, 2020).

Hair loss happens due to the strong aggression that the hair suffers during the infusions of chemotherapy drugs. Atrophy of the hair follicle occurs, causing weakening and subsequent hair loss. This decrease may occur between two and three weeks after the beginning of the treatment, and may last until its end (Baitelo; Kings; Gradim, 2015). The return of hair growth may take three to six months after the end of treatment and permanent alopecia may rarely occur (Kruze; Abraham, 2018).

Chemotherapy treatment consists of the administration of antineoplastic medications in the body, which can be isolated or combined. There are numerous chemotherapeutic drugs that cause alopecia, among them we can highlight doxorubicin, epirubicin, docetaxel, paclitaxel, etoposide, cyclophosphamide and ifosfamide. (Konen *et al.*, 2013; Souza *et al.*, 2020),

Given the impact that alopecia has on the lives of cancer patients, several studies have already been carried out in order to find a way to minimize this suffering. According to Silva *et al.,* (2020), hair cosmetics have been developed that help with hair growth, but not in the prevention of IQR, but they still need more evidence. The scalp cooling technique has been used since 1970 and has been

proving its effectiveness every day. This technique is used through the application of cryogel pouches, caps, and cooling machines.

For Martinez *et al.*, (2018), alopecia is a factor that significantly affects the quality of life of patients undergoing cancer treatment, especially women. Based on his study, about 8% of the female population abandons treatment or does not even start when they discover that the process has alopecia as one of its adverse effects. This study also addresses that the patient is affected emotionally regardless of the degree of alopecia, whether it is 1 with loss of up to 50% of hair or 2 with significant loss of more than 50%.

The quality of life of the patient who is undergoing cancer treatment is drastically affected during this cycle, and having to live with and deal with alopecia is not easy.

Some patients suffer so much that they end up isolating themselves from the world, family and friends and often end up falling into depression because they do not accept the appearance and the diagnosis. On the other hand, the world is cruel to these people, because we live in a place where a standard of beauty is still imposed and the bald woman is seen with pity, because this is the main characteristic of the patient undergoing chemotherapy treatment.

Although many ways of treating alopecia with the use of topical creams have been developed, this method has not shown much proof of its effectiveness. On the other hand, the use of hair cryotherapy has been gaining more and more space, however the success of the treatment depends on many factors, such as the chemotherapy protocol in use, and the method of application of the cap. Better results are seen in taxane-based treatments of about 50% compared to the use of anthracyclines, which showed results of 16% efficacy (Kang *et al*., 2019).

As it is an important concern in the population undergoing chemotherapy, especially in the female population, the presence of permanent alopecia in patients after treatment has been studied.

Normally, the hair grows back about 3 to 6 months after the end of the treatment, and may present changes in color, texture and number of hairs. In some cases, permanent alopecia can occur, which can be total, partial or simply present a delay in hair growth. This condition can arise when the chemotherapy agent attacks the stem cells in the hair leaflet that are responsible for the growth of a new hair (Rossi *et al*., 2017).

In a study conducted by Martin *et al.,* (2018), patients who presented grade 2 alopecia during chemotherapy treatment did not show hair improvement or recovery within 48 months after the end of treatment, and some were followed for a period of 10 years and did not manifest hair recovery, even with the help of other treatment methods.

Another study conducted to evaluate chemotherapy-induced permanent alopecia (PCIA) found that 39.5% of patients who suffered alopecia during treatment did not fully recover their hair 6

months after completion, while 42.3% reported PCIA for 3 years after the end of chemotherapy treatment (Kang, 2018).

In article number 8, a study was carried out with 1411 patients who underwent scalp cooling. According to the study, the best results were seen in patients who received taxane-based chemotherapy. 94% of patients using docetaxel and 81% of those using paclitaxel did not need to wear a head covering.

In a study conducted with breast cancer patients treated with taxanes and anthracycline, the patients who participated in the study obtained 57% of hair preservation after the use of capillary cooling, while the group that did not use it obtained 0% preservation. Regarding the sequence of chemotherapy, the patients who received taxane chemotherapy followed by anthracycline with 77% showed the highest efficacy, while those who received the opposite obtained a result of 33% efficacy (Bajpai *et al.*, 2020).

METHOD OF USE OF HAIR CRYOTHERAPY

This category includes studies related to the device, length of stay in the patient, and pre- and post-use care.

According to the articles participating in this study, the efficacy of hair cryotherapy interferes with several factors.

As for the cooling devices used in the studies, the paxman cooling machine was the most used, and its effectiveness was proven in articles 2, 5, 6, 7, 8, 10, 11 and 12.

Regarding the length of stay in the patient, there are several approaches. Articles 2, 5, 6, 7, 10, 11 and 12 report the beginning of the procedure 30 minutes before the infusion of the chemotherapy drug, during the infusion and 90 minutes after. Study number 3 depicts about 30 minutes before, during the infusion and 90 minutes after, with efficacy 45 minutes after the end of the allopeciating medication. Study 4, on the other hand, shows 30 minutes before, during the infusion and 90 to 120 minutes after the end. And study number 14 on the penguin system reports the use of 50 minutes before, during the infusion of the medication that causes alopecia and 4 hours after its end.

Capillary cryotherapy is a method of cooling the scalp through the application of refrigerated caps, such caps when applied trigger a process of vasoconstriction of the blood vessels of the scalp preventing blood flow and consequently preventing chemotherapy from reaching and causing hair loss (Turke *et al.,* 2019).

In the 1970s, the scalp cooling method was performed by placing crushed ice packs on the head and fixed by bandages, with the aim of minimizing hair loss, and it was necessary to replace these bags regularly due to the fact that the heat from the head caused the ice to melt (Dunnill *et al.,* 2018).

Over the years, new technologies have been implemented, ice bags have been replaced by cold air bags, gel caps, and later by an electronic cooling method (Shah *et al.,* 2017).

There are two ways of cooling the scalp nowadays, one is through hypothermic caps that are placed over the patient's head and need to be changed every time as soon as they lose the ice and another way is through cooling systems that are connected to a machine that constantly circulates cold air (Kruse; Abraham, 2018).

Among the most used brands for the scalp cooling technique are elastogel, dignicap and paxman, which we will discuss below.

Elastogel caps are developed with malleable fabric and their interior is composed of glycerin-based hydrogel and remains flexible even at negative temperatures. The cap should be stored at a temperature of -25ºC to -30ºC. Being applied to the patient 15 minutes before the beginning of the infusion of the allopeciating chemotherapy drug, maintained throughout the administration with a change for a new one every 45 minutes, and maintained around 30 minutes after the end of the infusion (Martin *et al.,* 2018).

This type of cap is no longer manufactured today, its acquisition can be made through buying and selling sites on the internet, and on the elastogel company's website it is no longer available. Places that want to make this method available to their patients should have a freezer to store the caps as they must be kept at negative temperatures.

Among the cooling method with the use of machines, we can highlight PAXMAN and DIGNIPAC.

The English Paxman cap appeared in 1997 when Glen Paxman's wife used the scalp cooling method available at the time to prevent alopecia during a treatment for breast cancer and was unsuccessful. In this way, the Paxman family has developed a system that contains a constant cooling method through a machine that circulates a liquid at -4ºC, but maintains the scalp temperature of 18ºC. As it is connected to a machine that does not require a cap change, it is applied to the patient 30-45 minutes before the beginning of the infusion of the allopeciatic chemotherapy and maintained until 90 minutes after its end. depending on the chemotherapy protocol used. Its manufacturer guarantees a 50% to 92% effectiveness of hair preservation (Paxman, 2022).

Its system consists of a silicone cap connected to the machine, a fabric band to protect the frontal region, a secondary cap to fix and keep circulating cold. The manufacturer recommends moistening the hair and applying conditioner before applying the silicone cap to improve conductivity. This device can be used by two people at the same time, as it contains two interconnected systems on the same machine and has caps in three sizes S, M and L.

The Paxman system is FDA (Food and Drug Administration) certified and is now included in the National Comprehensive Cancer Network's (NCCN) Clinical Practice Guidelines in Oncology.

The DigniCap system was developed in Sweden in 1990 by nurse Yvonne Olofsson. Yvonne was an oncology nurse at the time and every day she was faced with the anguish, suffering and impact that alopecia had on the quality of life of her patients. The system was developed by Yvone together with engineer John Kern, who named the device Dignicap, which in Latin means dignity (DigniCap, 2022).

The DigniCap cooling device consists of a cooling machine that controls the time and temperature to be sent, a cooling wrap that is attached and adjusted to the patient's head which receives the low temperature fluids and a thermal cap used above the wrap with the function of isolating the cold. The refrigerant fluid is sent to the wrap by a hose and this fluid is monitored by two sensors, one that controls the temperature sent and one that monitors the temperature that returns to the machine. There is also the possibility of disconnecting the hose to facilitate exits to go to the bathroom, for example (Dignipac, 2022).

Recently, the NCCN began to recommend the use of hair cryotherapy for the prevention of IQA in patients with breast cancer (Silva *et al.,* 2020). Its use is indicated for any patient with solid cancer, on the other hand it is contraindicated for patients with hematological tumors due to the risk of scalp metastasis (Monteiro, 2021).

However, Kruze and Abraham (2018) report that this technique is contraindicated for patients with hematological malignancies, due to the risk of interfering with the efficacy of the treatment, since this method decreases the total circulation of the chemotherapy drug throughout the body. On the other hand, it is also contraindicated for patients who report migraine, agglutinin diseases, and cryoglobulinemia, as such conditions can be aggravated by exposure to cold.

Nowadays there are two forms of scalp cooling on the market that promise to minimize the QIA, one which consists of changing the cap every 25-30 min and another that is connected to a cooling machine that keeps the temperature constant. During the process, areas such as the ears and frontal region should be protected with gauze or tissue to avoid burns at the site caused by the cold (Silva *et al.*, 2020).

Recent studies report that most users of hair cryotherapy tolerate the adverse effects that include headache, scalp pain, and chills. Studies have also reported the incidence of scalp metastasis, but no effective evidence to date (Kruse; Abraham, 2018).

Based on the time the cap remains 45 minutes after the end of the infusion, according to Dunnill *et al.,* (2020), in a study conducted with patients who used docetaxel, the best result of capillary cryotherapy was with patients who remained for 45 minutes after the end of the infusion of the medication. According to the author, this result is based on the fact that from the moment the concentration of the medication decreases, it is no longer toxic to the body, when the scalp is heated again, it allows the drug accumulated in the scalp to be more easily eliminated.

According to Paxman (2022), the permanence time of the cap after infusion depends on the protocol being used. Protocols with combinations of allopeciating chemotherapeutic agents should be kept at 1h30min after, while weekly paclitaxel and docetaxel time changes to 1h.

There is not yet a confirmed standard of post-infusion cooling time (PICT). According to Lugtemberg *et al*., (2022), to evaluate the PICT, the pharmacokinetics and half-life of the chemotherapy drug should be taken into account.

In addition to the length of time the cap remains in the patient, other factors are important to obtain good results and prevent IQR.

According to Bajpai *et al.*, (2020), the effectiveness of scalp cooling depends on three main factors: proper fit of the cap, chemotherapy used, and adequate cold temperature.

Based on the pre- and post-use care of cryotherapy, some authors mention some important precautions for the effectiveness of the process.

Article number 1 and 14 bring that hair should be washed 2-3 days after chemotherapy and not rubbing the scalp, avoid hot baths and use of hot air devices and be careful when brushing hair. At the time of cryotherapy, the hair should be wet and conditioner used to improve conductivity. Areas such as the frontal region and ears should be protected before applying the cap. In article 14, a study was carried out with polyurethane caps that require change every 30 minutes, the author mentions that the hair needs to be cared for 2 weeks before the procedure and remain for months after the end of the treatment.

Articles 3 and 9 state that the hair must be moistened before applying the cap and it must be fitted correctly to the patient, ensuring that all parts are affected. Article 8, on the other hand, states that moistening the hair does not interfere with the result of cooling, as well as long or chemically treated hair.

Hair care is practically the same regardless of the device chosen for use and is very important in the effectiveness of cryotherapy. The manufacturer of the PAXMAN cooling system has put together a manual for home hair care after using cryotherapy. The manual was prepared according to each type of hair and care includes: washing your hair no more than twice a week and not using hot water, not using devices that emit heat, using neutral shampoo and conditioner, not rubbing the scalp and among others (Paxman, 2022).

In addition to those mentioned above, the manufacturer of the dignicap system reports on the importance of combing your hair 2 times a day, using a comb with large teeth, letting it dry naturally, and not using chemical products on your hair, it also reports that it is not necessary to cut your hair (DigniCap, 2022).

In addition to care during the use of cryotherapy, the effectiveness of scalp cooling also depends on home management. Garza *et al*., (2020) highlight that the use of heat, shampoos, and

other hair products that make up parabens and dyes in their formula can negatively interfere with the outcome of IQR prevention.

According to Katz (2017), hair care can interfere with the effectiveness of IQA prevention. Although it is not scientifically proven, it is believed that wetting your hair and applying conditioner can improve the conductivity of cold. In addition, some post-use care should be followed, such as avoiding swimming pools and saunas, avoiding washing hair with warm or hot water, not washing hair for three days after cryotherapy, not using equipment that heats the hair and using neutral shampoos.

In addition to all the pre and post chemotherapy care for the prevention of alopecia, the manufacturer of the Paxman method also indicates the use of scalp cooling for hair recovery. According to Kinoshita *et al.,* (2019), 25% of patients in the group who underwent hair cryotherapy who suffered grade 2 alopecia recovered their hair within 12 weeks after the end of chemotherapy using paxman capillary cooling. In contrast to the control group, 8.3% recovered in the same period of time

ADVERSE EFFECTS OF HAIR CRYOTHERAPY

In this category, we will discuss the adverse effects pointed out in studies on the use of hair cryotherapy. Studies 1, 4, 5, 6, 7, 10, 11, 12, 13, 14 and 15 addressed adverse effects of cryotherapy. Among the most described side effects are headache, nausea, vertigo and sensitivity to cold, the latter being the cause of most dropouts from treatment with cryotherapy. In addition to these, articles 10, 13 and 15 highlight the presence of frostbite in scalp regions.

Frostbite in patients using hair cryotherapy is a rare adverse effect that is rarely mentioned in articles. Belun *et al*., (2016), reported four case studies of patients who experienced scalp burns from the use of hair cryotherapy. The patients were women with breast cancer undergoing chemotherapy treatment. Three of the patients used the penguin device and one used the elasto-gel cold cap. Both patients had burns on the scalp, with the presence of hyperemia, blisters and consequently alopecia. All patients had persistent alopecia or growth retardation and scalp sensitivity.

The first case was a woman diagnosed with invasive breast cancer, who underwent hair cryotherapy with a penguin device, and the patient presented erythema and blistering on the top of the head and frontal region. The second case was a woman diagnosed with triple-negative breast cancer, who underwent first-line treatment on doxorubicin and cyclophosphamide, which presented significant hair loss. As a sequence of treatment, he started with applications of paclitaxel and in his third application, he started hair cryotherapy with elasto-gel cold caps, after a few applications, the patient presented blisters in the left parietal region and great hyperemia in the scalp. Case three is a woman with metastatic breast cancer, who used a penguin device that was not respected for the

infusion time after chemotherapy and was removed soon after the end of the infusion. After two weeks, the patient presented pruritus and alopecia, but continued to wear a cap with cloth protection. Days later, she presented blisters in the frontal region, followed by alopecia. The fourth case is a patient diagnosed with invasive ductal breast cancer, who used the penguin device, and after the third cycle she presented pruritus, crusting and scaling, but persisted with use, resulting in alopecia. Both patients had persistent alopecia and scalp tenderness.

Based on previous reports, the importance of training professionals to perform and monitor patients using the scalp cooling technique is highlighted. It is necessary to understand the process and be prepared to guide and manage the adverse effects. It is important to understand alopecia and know how to assess the severity to avoid possible complications in the patient's health.

It is up to nursing to guide patients regarding the technique, adverse effects, target audience, effectiveness, and care before and after cap use (Monteiro *et al*., 2021). As these are the professionals who are in direct contact with the patient, they must be prepared to answer and clarify any doubts.

In addition to providing care during treatment, the nursing professional becomes close to this patient, providing support to cope with the disease, giving support to him and the family. It is the nursing professional who monitors the entire treatment process and manages the adverse effects, infusions and delays, giving more quality of life to the patient.

Of the 15 articles participating in this study, 11 of them portray the concern about the appearance of skin metastases on the scalp as a side effect of cooling, but so far there is no scientific evidence to prove this theory.

In articles 1 and 10, the author mentions that capillary cryotherapy is not recommended for patients with hematological neoplasms due to the risk of skin metastases. In article 3, a study conducted with breast cancer patients found 0.03% of metastases in patients who did not undergo scalp cooling, compared with 0.04% in patients who did. In article 6 a study was carried out with 100 women and of these only one developed metastases on the scalp after an application of hair cryotherapy, but it was not really proven if this was the cause of the metastasis.

According to Bajpai *et al.*, (2020) Cancer cells can lodge in the scalp as a way to protect themselves from chemotherapy due to the cooling of the scalp, and can later move and metastasize to other sites.

The appearance of scalp metastases is worrisome, the hypothesis is taken into account by the fact that during the use of capillary cooling chemotherapy does not reach the scalp (Saad *et al.,* 2018). On the other hand, a study conducted with women with breast cancer did not identify evidence of scalp metastases. Metastases were most frequently identified in the chest and skin region (Rugo *et al*., 2017).

As much as many studies prove its effectiveness, the scalp cooling device is an equipment of great financial value, in Mexico it varies from $1500 to $3,500 USD, this is equivalent to R$18,168.50 reais per application, an amount that is not paid by the health plan, but the patient must pay if there is interest in using it (Garza *et al*., 2020).

Consequently, due to the amount imposed, it is notable that the device does not reach the less needy population, but only those who can afford it or who have health insurance, in this way, patients who use public health services do not have this technology that would improve their quality of life and consequently change the way they face cancer.

CONCLUSION

At the end of this study, it was noticed that the use of capillary cryotherapy has greatly added to the quality of life of patients undergoing cancer treatment. As it is a system that can only be used in patients diagnosed with solid tumors, this system requires a series of precautions and recommendations to achieve the desired results.

Since 1970, when the process of cooling the scalp to prevent alopecia in cancer patients began, many changes had to be made to achieve the result we have today, which in addition to being more effective is more comfortable and safer for the patient.

It was concluded that capillary cryotherapy is effective to prevent IQA, since in male patients it presents better results. No evidence was found as to why this efficacy is due to the fact that most men have shorter hair or tolerate the process better.

The effectiveness of the technique also depends on the care before, during, and after chemotherapy, such as precautions when washing the hair, exposure to chemicals or utensils that promote hair warming, time of use of the cap, preparation of the hair, and proper size of the cap. Another factor that interferes with the outcome is the type of antineoplastic protocol used by the patient. It is observed that taxane-based chemotherapeutics, such as paclitaxel and docetaxel, have better efficacy compared to anthracyclines.

However, the time of permanence of the cap in the patient after chemotherapy infusion is much discussed by the authors, the discussions are based on 45 min, 60 min and 90 min., but based on studies that prove the Paxman system, the time after infusion depends a lot on the class of chemotherapy used.

The main concerns of using the cooling technique are the appearance of scalp metastases and the risk of frostbite. As for metastases, there are no records that prove this theory, they are still hypotheses that are in the study phase, as for scalp burns, there are case reports about its occurrence and that resulted in persistent hair alopecia.

One of the systems used to cool the scalp, such as elastogel caps, is no longer being produced, but nothing is known about the reason for the cessation of the productions and its acquisition is available on some sales sites on the internet.

Although the system has been in use since 1970, there are still few studies on hair cryotherapy and most of them are in the English language modality.

At the time of the research, it was noticed that the search did not present positive results regarding the terms "hair cryotherapy", but rather "scalp cooling". The vast majority of articles whose research was carried out with the term hair cryotherapy were excluded because they were studies that addressed its use for other purposes.

As it is a high-cost system, its acquisition is still unavailable in the Unified Health System (SUS), while in private systems it is gaining more and more space.

However, nursing plays a very important role during the use of capillary cryotherapy, as it is the professional who receives training to prepare, apply and guide this patient on the use and efficacy of the cap. Thus, this professional must be prepared to accompany the patient, as well as clarify doubts about cryotherapy. Knowing how to assess the degree of alopecia is also the role of nursing and this process is important to prevent the occurrence of scalp burns.

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Melatonin as an alternative in the treatment of diabetes mellitus and its complications: A literature review

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ABSTRACT

Diabetes Mellitus (DM) is a complex metabolic disorder with multifactorial causes caused by resistance to the action of insulin, or the secretion of this hormone, or both. The disease can be divided into type 1 or 2 diabetes mellitus and gestational diabetes. Among its complications we find vision problems, kidney problems, stroke, stroke, heart attack, diabetic coma and foot ulcers or amputations. The prevalence of the pathology has increased worldwide in recent years, including in Brazil, linked to causes such as lifestyle and socioeconomic indicators, becoming a public health problem. Melatonin is a promising hormone in the treatment of various medical conditions due to its relationship with several functions in the body because it is responsible for organizing the circadian cycle, among these functions, the regulation of glucose, production and secretion of insulin by pancreatic beta cells. This review study searched the main databases for evidence of the application of exogenous melatonin to control DM or its complications. Since its first exogenous use described in 1960, the effects of melatonin use have been studied and recently applied in humans, in vitro and in animals as a possibility of treatment for DM in its most varied types. We conclude that the use of melatonin as an alternative to treatment, although very promising, should still be better studied in humans, in order to adjust doses, routes and times of application.

Keywords: Blood glucose, Insulin, Obesity, Alternative treatment.

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INTRODUCTION

Diabetes Mellitus is a complex metabolic disorder characterized by high concentrations of glucose in the blood, as well as resistance to insulin action, insufficient insulin secretion, or both. Among the causes for the onset of the disease are genetic disorders, diseases that cause damage to the pancreas, excess growth hormone and glucocorticoids, medications, chemicals or infections. The disease can be characterized as type 1 (DM1), when there is a deficiency in the function of pancreatic beta cells, which are responsible for synthesizing and secreting insulin. Type 2 diabetes (T2DM) is characterized by insulin resistance and a relative deficiency of insulin secretion, when the plasma concentration of insulin becomes insufficient to maintain normal blood glucose homeostasis. Finally, gestational diabetes mellitus (GDM) occurs when there is a glucose intolerance first identified during the gestational period, which usually happens in the third trimester of pregnancy in most women and is related to a higher likelihood of developing T2DM in the future (Solis-Herrera et al., 2018). Inadequate control of glycemic indexes in the body can lead to complications for the individual that affect their quality of life, such as vision problems, kidney problems, stroke, stroke, heart attack, foot ulcers or amputations, and diabetic coma, such complications can lead to death (Neves et al., 2023). According to the WHO, in 2019 diabetes was the direct cause of 1.5 million deaths worldwide, in addition to 460,000 deaths from complications such as diabetic nephropathy and hyperglycemia. The WHO also states that both the number of cases and the prevalence of the disease have steadily increased in countries in recent decades, including Brazil (WHO, 2019)

In Brazil, according to the Brazilian Diabetes Society, there were 15.8 million people with diabetes mellitus in 2021, with a mortality rate of 30.2 individuals per 100 thousand inhabitants in 2019 (Pititto et al., 2023). Social indicators such as low schooling, low income, age, and race are associated with diabetes cases, increased incidence, and higher occurrence of complications, concomitantly there has been an increase in the use of medication and medical care by the Brazilian population in recent years (Malta et al., 2022, Peres et al., 2023, Neves et al., 2023). Even with the increase in the use of medications, adherence to drug treatment for diabetes is still considered low, with an average of 78.3% adherence (Faria, 2013). In this scenario, new drugs with fewer side effects are being tested in order to increase treatment adherence, among them, melatonin has been the target of research.

Melatonin is a hormone produced mainly by the pineal gland at night during the day, its main function is to transmit information about the light cycle during the day/night. This information organizes seasonal rhythmicity functions in the body, in addition, melatonin can also be used in the organization of circadian rhythms, stabilizing and strengthening their coupling. Other physiological functions may depend on such circadian organization, such as immune defenses, antioxidants, hemostasis, and glucose regulation (Claustrat and Chazot, 2005). Due to its action in several

functions of the body and its short half-life (Maganhin et al., 2008), the administration of exogenous melatonin has become a therapeutic option.

The first exogenous administration of melatonin, isolated for the first time in the 1950s, was described in 1960 with the administration of 200 mg intravenously, obtaining a mild sedative effect (Dawson, 1993). More recent studies prove the safety and efficacy of the administration of exogenous melatonin with various therapeutic objectives, such as regulation of the circadian cycle, reduction of inflammatory activity and action in the modulation of the immune, cardiovascular and gastrointestinal systems, in addition to acting in synergism with other drugs in the mitigation of infectious processes (Junior et al., 2019)

METHODOLOGY

For this study, the bibliographic research method was used with the words "melatonin" and "diabetes" in the scientific databases Google Scholar, LILACS, Scielo, PubMed and CAPES Journals. Articles and theses in Portuguese, English and Spanish will be selected from 2018 to 2024. Documents that did not match the research theme or that did not fit into the selected period were excluded.

DISCUSSION

Moreira (2022) relates circadian rhythm disturbance to deficient melatonin synthesis and how the suppression of this hormone becomes a risk factor for the development of DM2. This study shows the physiological mechanisms of melatonin and insulin production and secretion in the human body and highlights that pancreatic beta cells, responsible for insulin production, have melatonin receptors (MT1 and MT2) that can, in different ways, alter insulin secretion and generate insulin resistance in the body (Moreira et al., 2022). The following year, Ferreira (2023) evidences the direct relationship between melatonin and insulin production, bringing a study of pinealectomized rats that, upon receiving melatonin, obtained an increase in insulin production in pancreatic beta cells and expansion of insulin receptors in hepatocyte membranes. The two studies evaluate the therapeutic potential of melatonin in DM and instigate further research on the subject, but have not yet analyzed its in vivo application (Ferreira, 2023)

Awni found, through quantification of blood samples collected from 46 diabetic and non-diabetic patients, the abnormal production of oxidative stress markers, nitric oxide and melatonin can contribute to the pathogenesis of DM2. This work focused on the negative potential of melatonin in its relationship with the pathology studied (Awni, 2022).

Martorina (2023) was the first crossover, double-blind, placebo-controlled, randomized study to evaluate the role of melatonin in the glycemic variability of patients with DM2, this study shows

that the use of melatonin in a dose of 3mg taken at 21:00 increases glycemic variability compared to placebo, a result opposite to that expected that can be explained by the residual diurnal effects, proximal prospective effects, impairment of the distal prospective effect of melatonin caused by exogenous melatonin, and genetic characteristics of patients. The study also notes that lower doses, with lower risks of residual effects in the morning, may show different results in the patient's glycemic variability (Martorina, 2023). Analogous to this study, Sousa (2024) had supplemented a group of overweight night shift nursing workers with the same dose of 3mg, with the aim of evaluating the effects of melatonin supplementation on diabetes risk markers, according to the lipid profile of the diet. As a result, Souza found that hormone supplementation for 12 weeks did not affect DM2 risk markers according to the dietary fat profile and also did not modify the fat consumption profile over the same period (Sousa, 2024).

However, when evaluating the action of melatonin on mononuclear (NM) cells and the placenta of diabetic mothers, Louis (2018) concludes that melatonin was able to reduce oxidative stress and apoptosis rates in MN cells in the maternal blood of diabetic mothers and was able to act on placental tissue cells by increasing apoptosis rates in the villous layer of the placenta of hyperglycemic mothers, suggesting that this hormone may act in the process of maintenance and development of the fetus in pregnancies of diabetic mothers (Louis, 2018). And aimed at the treatment of diabetic wounds, a possible complication of DM, the use of exogenous melatonin showed excellent results, promoting wound healing and suppressing the inflammatory response, results obtained in the study with in vitro and in vivo models (Liu, 2020). When associated with bacterial cellulose-based dressings, melatonin supplementation is associated with increased fibroblast production, synthesis and deposition of collagen fibers, as well as decreased inflammatory effects (Oliveira et al., 2023)

More broadly, melatonin is also associated with several other applications, such as reducing oxidative stress and restoring the viscosity of cervical mucus in women with HPV (Human Papillomavirus) (Cotrim et al., 2020), immunomodulatory effects on human colostrum polymorphonuclear cells, which in turn may play a crucial role in tumor resolution with MCF-7 cells through its mediation and inflammatory action (Sousa et al., 2022), when associated with leptin and adiponectin, the hormone melatonin can restore the proliferation of CD4+ T lymphocytes in obese mothers to the levels found in more eutrophic mothers (Pereira et al., 2023), a relationship between melatonin supplementation and lipid indices with the reduction of total cholesterol and triglycerides was also identified (Halpern, 2019).

In studies with rodents, it was observed from the treatment with melatonin a decrease in morphometric, glycemic, inflammatory parameters associated with diabetes, in addition to the regulation of the balance of oxidative stress through the increase in the expression of antioxidant

enzymes, generating regulation of total testosterone and androgen receptor levels (Alves, 2020), when associated with insulin administration, can have a protective effect, by inhibiting or reducing the destruction of pancreatic β cells and maintaining insulin levels close to the control group (Melo, 2020), the protective effect on steatosis in the liver of female rats with GDM is also evidenced (Santos, 2020), shorter time of contraction of skin wounds in Wistar rats with diabetes treated with a topical formulation containing melatonin (Souza, 2022) and potentiation of the action of metformin as a maintenance treatment, bringing better quality of life (Silva, 2018), the attenuation of the effects of a high-fat diet was also observed, suggesting a potential in the use of melatonin as a prevention of obesity in individuals with difficulty in adhering to diet programs (Farias, 2019).

CONCLUSION

Physiologically, the hormone melatonin is present in the regulation of several functions of the body, including the production and secretion of insulin, and can be negative or positive, but there is a promising possibility in the treatment of obesity, DM and its complications, and the therapeutic dose for humans, as well as the best period and best route of application, should still be defined by new studies.

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Social inequalities and access to rights of black women in Brazil: An intersectional analysis

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ABSTRACT

This article aims to analyze the access to social rights of black women in contemporary Brazil, considering the intersectionality of race and gender. The rationale for this study lies in the need to understand the structural inequalities faced by this population group, as well as the urgency of promoting equity and social justice. The problem addressed involves the barriers faced by black women in accessing health, education, work and housing services, due to structural racism and gender discrimination. The methodology adopted includes the analysis of statistical data from the 2022 Demographic Census, official documents from the Ministry of Health, and works that address intersectionality and structural racism. The results highlight the need for concrete actions to ensure equity in access to social rights, aiming to combat structural inequalities and promote the inclusion and well-being of black women in Brazil. We also highlight that the study is part of a set of actions of the Observatory for Combating Violence against Women and Girls in Latin America organized by the State University of Goiás North Campus, Uruaçu Headquarters, in partnership with the Center for Legal Practices of the Faculty of Law of the same university, with the Autonomous Faculty of Law (FADISP) and the Federal Institute of Goiás Campus Uruaçu.

Keywords: Law, Health, Blackness, Gender.

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INTRODUCTION

When talking about social inequalities in the country, it is essential to discuss their origins, especially in the enslavement and reproduction of capitalism since the sixteenth century. It is also known that these inequalities are structural and intersectional[4], especially because they are prolonged in Brazilian geography and history, in addition to having even more expressive marks when we carry out a gender and race cut. but not always limited to these.

This is equivalent to saying that black women[5] are even more impacted by social inequalities and deprivation of human rights, a fact that underlies the present study, which proposes to analyze the first census results of 2022[6], released in subsequent years. To this end, the understanding of the data of the Brazilian universe in the largest survey carried out by the IBGE in a recent context, the Demographic Census, presents us with an overview of the advances obtained from the implementation of constitutional foundations, laws, international agreements on human rights, as well as public policies to confront social inequalities and violence in the country.

However, even before analyzing the large-scale statistical data, we have the dimension that the Brazilian advances for human rights, especially of black women, are far from a rupture with the structures of reproduction of power and maintenance of the *status quo* strongly fostered by colonization and its structural roots still present in the country. This is because other studies by institutions such as the IBGE itself, IPEA (Institute of Applied Economic Research), DIEESE (Inter-Union Department of Statistics and Socioeconomic Studies), the Ministry of Health and the Oswaldo Cruz Foundation (Fiocruz), point to the continuity, and even intensification, of inequalities and structural violence in Brazil with regard to the black population.

Black women face significant inequalities in access to health services, a complex reality that originates historically and can be understood by the intersection between race, gender, and social class in Brazil. These disparities have a profound impact on the physical and mental health of these women, contributing to the perpetuation of a cycle of social exclusion and distancing of rights.

In view of the above, the study aims to identify the situation of black women in Brazil today, such as the situation of housing, education, work, basic sanitation and violence, with the

[4] In this study, we understand structural aspects as elements that transcend time and space, that is, they manifest themselves for long periods and everywhere. Like enslavement, even with the legal end of this historical process in the country, its roots remain and manifest themselves in the form of greater incarceration, high rates of violent deaths, poverty, among others. Intersectionality, according to Akotirene (2019), is a theoretical framework that aims to analyze power relations and social inequalities from the interconnection of different social markers, such as race, gender, social class, sexual orientation, gender identity, religion, among others. The author refutes the idea that oppressions operate in isolation, but rather that they intersect, creating different layers of inequality and vulnerability.

[5] In Brazil, the black and brown population are considered black. According to the latest studies by the Brazilian Institute of Geography and Statistics (IBGE), this is the majority of the resident population since the 2010 Demographic Census.

[6] The Demographic Census is the largest study on the resident population in Brazil, conducted periodically every ten years by the Brazilian Institute of Geography and Statistics (IBGE). Due to the new coronavirus pandemic and funding cuts for the promotion of the study, the study scheduled for 2020 was carried out two years later. The first results of the Demographic Census were released by the IBGE in 2023 and 2024.

problematization of access to social rights guaranteed by the fifth article of the Federal Constitution of Brazil of 1988. Based on a theoretical and critical review, associated with statistical data, maps, graphs and other sources, such as laws and public policies, we will analyze the situation of the Brazilian population in access to social, health and basic sanitation rights, with a focus on black women.

Finally, in the final considerations, we will present the elements that highlight the urgency for the attention to black women in Brazil today in order to deepen the studies of the social situation and violence that most affect girls and women in Brazil. In the future, the study will achieve greater scalability, with a Latin American panorama, based on studies by the Observatory of Violence against Women and Girls in Latin America.

MATERIALS AND METHODS

To begin the proposed studies, we searched for a series of works that help us define our theoretical framework on the subject. Akatirene (2019) contributes to the discussion about intersectionality, a mark of historically reproduced power relations that, among other factors, aims to criminalize black bodies and reproduces racism. Grada Kilomba and Djamila Ribeiro offer complementary and essential contributions to the understanding of the oppressions faced by black women.

Kilomba (2019) explores how structural racism and everyday microaggressions perpetuate exclusion and symbolic violence against these women, affecting their mental health and well-being. Ribeiro (2017) highlights the importance of acknowledging the place of black women's speech, arguing that their experiences and claims must be centralized to dismantle dominant narratives that often ignore or minimize racial and gender inequalities.

The documents of the Ministry of Health present us with the National Policy for the Integral Health of the Black Population (BRASIL, 2009), the Thematic Bulletin of the Library of the Ministry of Health on the black population contribute to the understanding of the particularities of the health of blacks. The IBGE data present us with an overview of the population, households, as well as the ethnic-racial identification, sex and age of Brazilians. And in the text "Birth in Brazil", Fiocruz presents data on the use of health services according to maternal skin color, age and "class".

In the end, we will make a critical analysis that dialogues with the literature, with official documents and statistical data in order to understand the situation of black women in the most current context, which the references allow us to make, in order to problematize the violations of rights under the prism of spatiality and temporality.

FROM THE THEORETICAL FOUNDATION TO THE STUDY

In her work on intersectionality, Carla Akotirene addresses the complexity of oppressions experienced by Black women, who are situated at the intersection of multiple forms of discrimination (Akotirene, 2019). The author points out that the concept of intersectionality, a term first introduced by Kimberlé Crenshaw, is crucial to understanding how gender, race, and class inequalities overlap, creating unique experiences of oppression that cannot be adequately understood through isolated analyses of each factor. According to the author, black women face specific barriers in accessing social rights due to this intersection of oppressions, which is reinforced by social and political structures that perpetuate marginalization (Akotirene, 2019).

In turn, in "Lugar de Fala" Djamila Ribeiro emphasizes the importance of recognizing the social position from which narratives are constructed, highlighting that the experience of black women is often made invisible in discussions about social rights (Ribeiro, 2017). The author argues that the struggle for black women's social rights cannot be dissociated from the struggle against structural racism, which systematically prevents these women from accessing resources and opportunities equally. In this reading, he suggests that the recognition of the place of speech is essential to dismantle dominant narratives that ignore or minimize racial and gender inequalities (Ribeiro, 2017).

In "Plantation Memories: Episodes of Everyday Racism", Grada Kilomba addresses how daily racism and microaggressions contribute to the perpetuation of black women's social exclusion (Kilomba, 2019). The author utilizes a psychosocial approach to explore how structural racism affects the mental health and well-being of Black women, exacerbating their vulnerability and exclusion. It argues that symbolic and physical violence, including gender-based violence, is a tool used to keep these women, especially black women, in subordinate positions, denying them access to fundamental rights (Kilomba, 2019).

In this analysis, the deprivation of social rights of black women in Brazil is an evident and historical manifestation of structural racism, which operates through discriminatory public policies and institutional practices, or even by the absence of them. In the field of education, for example, black women face higher school dropout rates and fewer opportunities to access higher education, resulting in a cycle of poverty and exclusion (Akotirene, 2019). In health, lack of access to quality services and institutionalized racism within the health system result in worse health indicators for black women, including higher maternal mortality (Ribeiro, 2017).

In the labor market, Black women are often relegated to low-paying jobs and precarious conditions, facing discrimination in both hiring and career progression. The intersectionality of race and gender results in a double penalty, where employment policies do not adequately address the specific barriers faced by these women (Akotirene, 2019). In addition, inadequate housing conditions

and lack of basic sanitation disproportionately affect black women, reflecting the continuity of structural inequalities from colonial times to the present day (Kilomba, 2019).

In conclusion, black women's access to social rights in Brazil is deeply influenced by structural racism, which manifests itself through multiple forms of intersectional discrimination. The analysis proposed by Akotirene, Ribeiro, and Kilomba offers a comprehensive understanding of the dynamics of oppression and exclusion, highlighting the need for public policies that recognize and address these inequalities in an integrated and intersectional manner (Akotirene, 2019; Ribeiro, 2017; Kilomba, 2019).

RESULTS AND DISCUSSION

CENSUS DATA ON ACCESS TO BASIC SANITATION IN BRAZIL TODAY

The Brazilian population exceeded two hundred million inhabitants, with higher demographic density, i.e., population concentration, in the southeast and south regions of the country (IBGEa, 2023, p. 30).[7] It should also be noted that the study pointed to considerable changes in mortality and fertility rates[8] since the 1940 series, with emphasis on the 6.5% growth of the Brazilian population since the last demographic census in 2010.

The IBGE studies began collecting data on "color" in 1872, which was changed to "color and race" after the 1991 census. Along the way, racial identity was again modified with the inclusion of indigenous populations, in addition to phenotypic understanding[9] (IBGE, 2023b, p. 6). In the document "Ethnic-racial identification of the population, by sex and age: Results of the Universe", the (IBGE, 2023b) points to a country that is mostly black (53.7%), with more than 92 million brown people (43.5%) and more than 20 million black people (10.2%).

Geographically, we perceive a concentration of the brown population living in the Northeast and Southeast regions of the country (71%) and, adding the black declarants, they make up 78.1% of the black population living in these locations (IBGE, 2023b, p. 46), map 1.

[7] The data released from the 2022 Demographic Census are based on July 31, 2022 for the population count and other preliminary figures.
[8] Mortality can be defined as the total number of deaths in a population during a given period of time. It is an important indicator for understanding the health of the population and can be influenced by several factors, such as the level of socioeconomic development, living conditions, and epidemiological profile. Fertility refers to the number of children per woman during her reproductive life. The IBGE collects data on fertility through studies such as the National Health Survey (PNS), the National Household Sample Survey (PNAD) and the Demographic Census.
[9] Basic sanitation consists of essential services for the health and well-being of the population. It is about access to drinking water, sanitation, waste management and urban drainage.

Map 1: Predominant color or race by municipalities - Brazil - 2022.

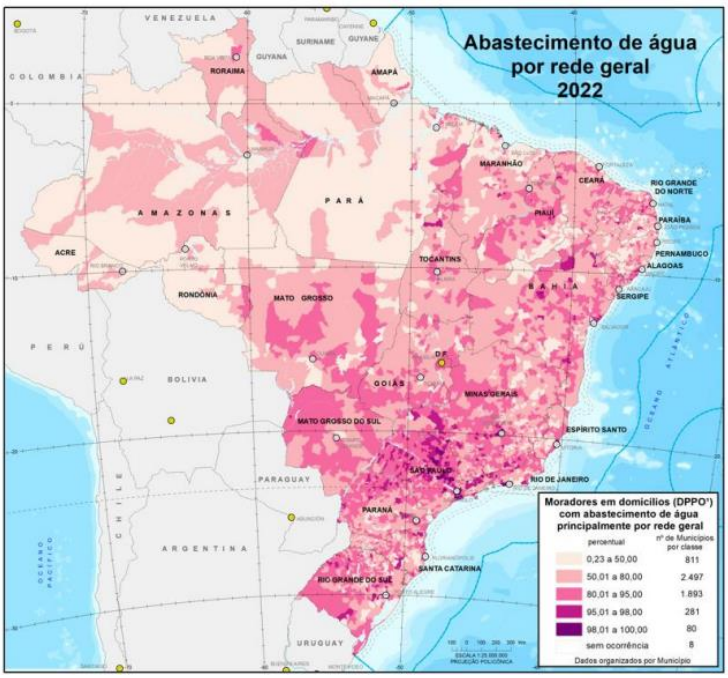
Fonte: IBGE, Censo Demográfico 2022.
Nota: O total de pessoas indígenas compreende as pessoas declaradas por meio do quesito de cor ou raça e aquelas declaradas por meio do quesito "se considera indígena".

Source: IBGE (2023a). Data source: 2022 Population Census.

The first census data released by the IBGE from 2023 onwards present the situation of households and basic sanitation in the country, with the possibility of identifying the conditions of black populations. The majority of Brazilian households consist of houses (84%), followed by apartments (12.5%), in addition to 2.7% of the population residing in other types, such as "village house or condominium", "dwelling in a house with rooms or tenements", "indigenous housing without walls or maloca" and "degraded or unfinished permanent residential structure".

With regard to the situation of basic sanitation, we started the analysis with access to water supply. The majority of the population residing in the country is served by the general network, 82.9%, (IBGE, 2023c). It should be noted that where the highest percentage of black population resides, the Northeast region, 68 municipalities were identified that are supplied by water tankers, as well as 24.3% of the households in the North region, with a significant indigenous population, have access to water through deep or artesian wells, as shown in map 2. It is concluded, therefore, that the Brazilian regions with the lowest attendances by the general water distribution network are the North and Northeast, regions predominantly of brown, black and indigenous people.

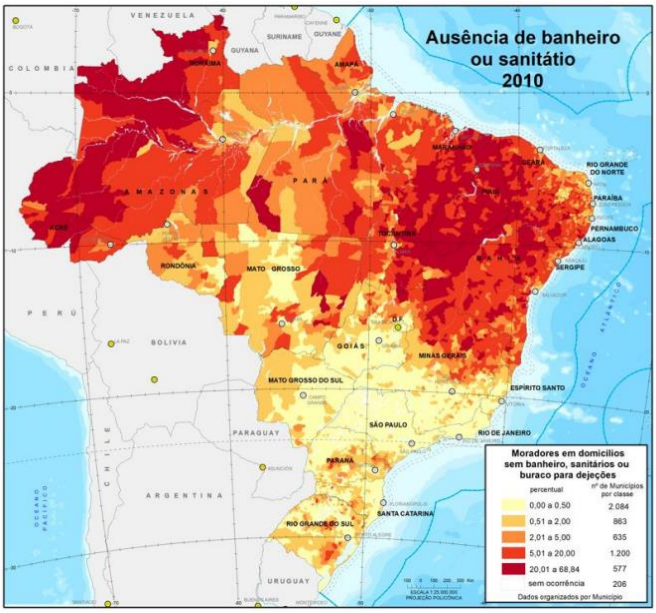
Map 2: General water distribution network - Brazil - 2022.



Source: IBGE (2023c). Data source: 2022 Population Census. Note 1: Data on permanently occupied private households are considered.

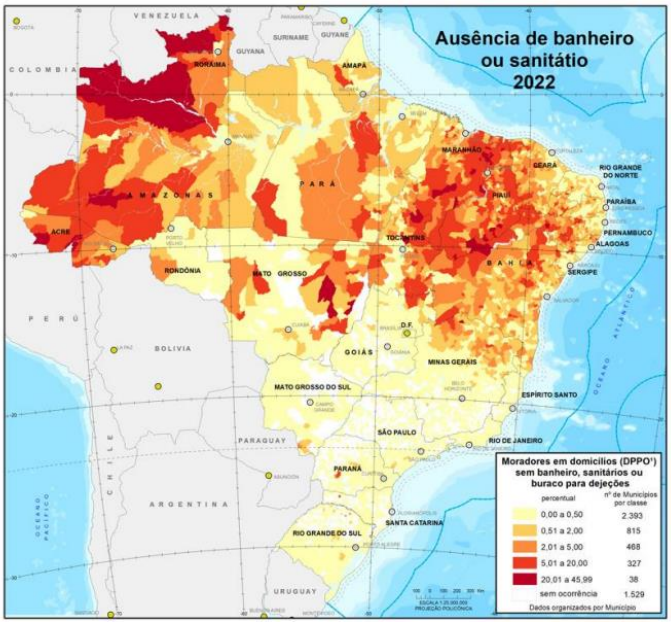
An important element for the analysis that comprises the IBGE data is the existence of bathrooms for exclusive use in the home. In this regard, we also observed a geographic (regional) inequality in the country. In addition, maps 3 and 4 show the situation in 2010 and 2022, showing a significant change: presence from 75.5% to 90.5% in the North Region and from 83.4% to 95.3% in the Northeast Region, the two regions with the lowest percentages in the two sections identified by the last demographic censuses carried out in the country. However, even with considerable quantitative expansion, the North and Northeast regions still have the lowest percentages of households without toilets or toilets for exclusive use in the country.

Map 3: Absence of toilets for exclusive use in the home - Brazil - 2010.



Source: IBGE (2023c). Data source: 2022 Population Census.

Map 4: Absence of toilet or toilet for exclusive use in the home - Brazil - 2022.



Source: IBGE (2023c). Data source: 2022 Population Census.

Another relevant data for the analysis is the spatiality of access to sanitary sewage by collection network. This is explained by the fact that only 58.3% of the Brazilian population was served by a general or rainwater network in 2022. On the other hand, the other households are mostly served by septic tanks (septic or rudimentary).[10] Again, we have the dimension of regional inequality that is directly related to the racial issue in Brazil: only 17.7% of households in the North Region and

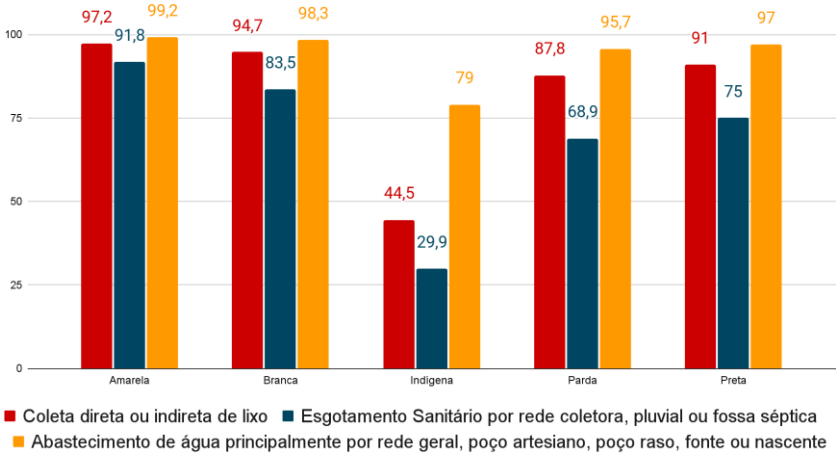
[10] Septic tanks are underground structures designed to receive household waste, including waste from the bathroom and kitchen. They are built with the aim of separating and decomposing part of the solids present in the sewage, reducing the pollutant load before the residual liquid is absorbed by the soil or released into a drainage system. Rudimentary cesspools are also underground structures, but without the compartments for separating household waste. They consist of vertical cuts in the relief, surrounded by bricks, stones or concrete, usually present in locations where there is no sanitary sewerage.

38.3% in the Northeast Region have access to basic sanitation supply through the general or rainwater network, map 3. On the other hand, it is noted that the Southeast Region has the highest attendance in this regard, 84% of households, a location with a large percentage of black resident population.

As for garbage disposal, census data point to direct or indirect collection (90.9%), according to data from the 2022 Demographic Census (IBGE, 2023). Once again, there are still significant regional inequalities that, in our analysis, intersect aspects of race. The North Region remains with the lowest percentage of the population served by household garbage collection in 2022, with the Northeast Region having the second lowest service (82.4%) and the Southeast Region at the highest level (96.9%).

When we analyze the data on access to basic sanitation from the perspective of the population by color and race, we again have the dimension of the reproduction of historically and geographically structural inequalities (IBGE, 2023). In a comparative analysis, we highlight that the lowest percentage of the population declared itself "yellow", and it is this group with the greatest access to direct or indirect garbage collection (97.2%), sanitary sewage through a collection network, rainwater or septic tank (91.8%) and water supply mainly through the general network, artesian well, shallow well, source or spring (99.2%). Graph 1.

Gráfico 1: Proporção dos moradores em domicílios particulares permanentes com características selecionadas, segundo a cor ou raça, 2022



Source: IBGE (2023c). Data source: 2022 Population Census.

It is also noted that the indigenous population has the least access to the three services, direct or indirect garbage collection, sanitation and water supply. Therefore, despite the expansion of access to social rights in the country, the indigenous and black population have less access to basic sanitation services, especially if they live in the North and Northeast regions. In this plan, we highlight the situation of the black population in terms of access to sanitation, 68.9% among browns

and 75% among blacks with access through a collection network, rainwater or septic tank (IBGE, 2023c, p. 51).

The situation of black women in education in Brazil is marked by persistent challenges, as evidenced by the data presented in the documents. In 2022, the illiteracy rate among black women was 6.9%, while for white women it was 3.4% (BRASIL, 2023). In addition, the disparity in access to higher education is notable, with black women accounting for approximately half of that of white women.

Education plays a crucial role in individual and social development, directly impacting quality of life and employment opportunities. Data reveal that in 2018, nearly 48% of employed black women were in informal occupations, compared to less than 35% of white women (MINISTRY OF HUMAN RIGHTS, 2023). This reality reflects the worse insertion of black women in the labor market, in part due to the lower level of education.

The data presented in the documents highlight the importance of addressing educational inequalities and promoting the appreciation of ethnic-racial diversity in the Brazilian educational context. Although there have been significant improvements in the schooling indicators of black women, racial inequalities in education remain at considerable levels. To reverse this scenario and ensure equal opportunities for all women, it is essential to implement measures that combat structural racism and promote inclusion and equity in the education system and the labor market.

The situation of black women in the labor market in Brazil reflects a reality of inequality and precariousness, as evidenced in the data presented in the documents. In 2018, almost 48% of employed black women were in informal occupations, compared to less than 35% of white women (BRASIL, 2023). This increased presence in the informal sector is associated with precarious work and a lack of social protection, limiting access to basic rights such as adequate pay and retirement (MINISTRY OF HUMAN RIGHTS, 2023).

The more precarious insertion of black women in the labor market is also reflected in their earnings. In 2018, the average income of black women was less than 60% of that of white women, showing a significant disparity ([IBGE, 2019). In addition, when compared to white men, black women have an income indicator of less than 45%, highlighting the intersectionality of gender and race inequalities in the labor market (IBGE, 2019).

This income inequality is directly related to poverty. According to IBGE data, considering an income threshold proposed by the World Bank of US$5.50 PPP, it is estimated that 33.5% of black women live in households with per capita income below the poverty line, compared to just over 15% of white women (IBGE, 2019). This disparity highlights the difficulties faced by black women in accessing decent living conditions and well-being.

To reverse this scenario of inequality in the labor market, it is essential to adopt public policies that promote gender and racial equity, ensuring equal opportunities for all women. Valuing black women's work, promoting inclusion in the formal market, and implementing social protection measures are essential to ensure equal rights and opportunities in the workplace (DIEESE, 2023).

Violence against black women is an alarming reality in Brazil, as evidenced by the data presented in the documents. In 2022, more than 61% of the victims of femicide in the country were black women, highlighting the vulnerability of these women in the face of gender-based violence (ANDIFES, 2019). In addition to femicide, black women face various forms of violence, including physical, psychological, and sexual assaults, often in a context of intersectionality with structural racism.

Violence against black women is a reflection of the social and structural inequalities present in Brazilian society. The lack of effective protection and prevention policies, combined with the perpetuation of stereotypes and prejudices, contributes to the vulnerability of these women to violence (ANDIFES, 2019). The invisibility and lack of recognition of the violence suffered by black women are also factors that perpetuate this alarming scenario.

To address violence against Black women, it is critical to adopt an intersectional approach that takes into account the multiple forms of discrimination these women face. The implementation of integrated public policies, which consider the specificities of gender and race, is essential to ensure the protection and empowerment of black women (ANDIFES, 2019). In addition, it is crucial to promote awareness, education, and the fight against racism and sexism, in order to build a fairer and more equal society for all women.

FROM THE NATIONAL POLICY FOR COMPREHENSIVE HEALTH OF THE BLACK POPULATION

Established by Ordinance No. 992 of 2009, the National Policy for the Integral Health of the Black Population (PNSIPN) represents an important milestone in the struggle for the formulation of public health care policies in Brazil. Not least because the institutional document recognizes the existence of institutional racism, a[11] structural element that manifests itself as a social determinant of health and an obstacle to the realization of the human right to health, in this case.

In addition, the PNSIPN recognizes that, in order to ensure the well-being of the black population, it is essential to value Afro-Brazilian culture and identity, with a view to strengthening

[11] Institutional racism, as presented in the National Policy for the Integral Health of the Black Population (PNSIPN), refers to the way in which the structures, practices, and policies of an institution, such as the health system, perpetuate inequality and discriminate against people based on their race or ethnicity. This form of racism operates in subtle and often unintentional ways, but it has significant impacts on the health and well-being of Black people, distancing them from their fundamental rights.

self-esteem, in addition to combating stereotypes and discrimination. It is also noted that this policy seeks to ensure the social participation of the black population in the formulation, implementation and evaluation of public health policies.

In this sense, the PNSIPN is a consolidated document to think about the health situation of the black population in Brazil, highlighting elements that distance the subjects from social rights. Even if it admits the reduction of ethnic-racial inequalities in health and guarantees universal and quality access to health care for the black population, subsequent data warn of the permanence of structures that impede constitutional guarantees.

OTHER DISCUSSIONS ABOUT THE HEALTH OF THE BLACK POPULATION IN BRAZIL TODAY

The concept of health encompasses a state of complete physical, mental and social well-being, going beyond the simple absence of disease or infirmity. In the comprehensive approach to women's health, it is essential that sexual and reproductive rights are recognized as human rights, considering the diversity and specific needs of women. Any women-focused approach to health must not only consider the gender dimension, but also incorporate race/ethnicity issues, ensuring that health indicators include these variables.

Historically, black women have faced multiple systems of oppression, being discriminated against by gender, social class, and race/ethnicity. To ensure equal access to health services for black women, it is crucial that the State and its agents recognize their specific realities and demands. This entails recognizing racism, sexism, and class exploitation as obstacles to full access to health care and taking steps to overcome them.

To enrich the debate, it is necessary to analyze studies on the situation of black people in relation to genetic and hereditary diseases, which profoundly affect public health and the quality of life of these groups. The document "National Policy for the Integral Health of the Black Population: a policy for the SUS", from the Ministry of Health (BRASIL, 2017), highlights four diseases prevalent in the black population: sickle cell anemia, type II diabetes mellitus, arterial hypertension and glucose-6-phosphate dehydrogenase (G6PD) deficiency.

Sickle cell anemia, according to the document, is a common hereditary disease among the black population, resulting from a genetic mutation that leads to the formation of hard, sickle-shaped red blood cells. Its prevalence is higher in the black population, with 6% to 10% of individuals carrying the gene and 1% to 3% with complete disease (BRASIL, 2017, p. 10).

Type II diabetes mellitus is a chronic disease characterized by insulin resistance and high blood glucose levels. Genetic and environmental factors contribute to its development, with the black population being more susceptible, with up to 9% more cases in men and 50% more in women than

in the white population (BRASIL, 2017, p. 10). Glycemic control, lifestyle changes, and regular medical follow-up are essential to prevent serious complications.

Hypertension is a silent disease, characterized by high blood pressure, with a higher prevalence in the black population (BRASIL, 2017, p. 10). Genetic, environmental, and socioeconomic factors contribute to its development, and prevention measures, early diagnosis, and drug treatment are essential to control blood pressure and prevent cardiovascular complications.

G6PD deficiency is a genetic disorder that results in the reduction of the G6PD enzyme, which is crucial for the protection of red blood cells. Its prevalence is higher in individuals of African descent, and early diagnosis, precaution, and specialized medical follow-up measures are important to prevent hemolytic crises and their complications (BRASIL, 2017, p. 10).

The 2013 National Health Survey (PNS), according to the Ministry of Health (BRASIL, 2017), reveals disparities in access to crucial preventive exams for women's health, such as mammography. Only 54.2% of black women and 52.9% of brown women had taken the test in the two years prior to the survey, compared to 66.2% of white women. This discrepancy is also seen in prenatal visits, with 69.8% of black mothers having at least six visits, compared to 84.9% of white mothers (BRASIL, 2017, p. 14).

The study also indicates variations in the quality of prenatal care among different ethnic groups. Only 73% of black pregnant women had their first prenatal visit in the first three months of pregnancy, compared to 85% of white women. This disparity is worrisome, as adequate access to prenatal care is essential to ensure maternal and child health (BRASIL, 2017, p. 15).

Infectious disease detection rates are highest among black women, the study found. In 2013, the detection rate of syphilis in pregnant women was higher among black women, followed by brown and indigenous women. Black women account for the majority of maternal deaths in Brazil, which highlights the urgency of specific studies and actions to reduce and eliminate inequality in access to maternal health (BRASIL, 2017, p. 15).

In addition to inequalities in access to health services, black women also face discrimination and unequal treatment in health services. According to the 2013 PNS, more than 10% of black women reported having been discriminated against or treated inferiorly in health services, highlighting the urgent need to address institutional racism and promote equity in the Brazilian health system (BRASIL, 2017, p. 17).

According to the Ministry of Health (BRASIL, 2021), the intersectionality of factors such as gender, race, and class implies the reproduction of historical oppressions that cannot be ignored in comprehensive care for fundamental rights, including health. An example is obstetric violence, linked to precarious or non-existent access to complete gestational follow-up for black women. The

greater the intersectionality of factors, the greater the vulnerabilities and their impacts on the lives of black girls and women in Brazil.

Several factors motivate the continuity of research on the health of black women in Brazil. Greater exposure to painful procedures without adequate analgesia, violation of the right to the presence of a companion during childbirth, lower numbers of prenatal consultations, and distancing from maternity hospitals are problems highlighted by the "Birth in Brazil" survey, conducted by Fiocruz (2014).

In addition, understanding health requires considering factors such as illness and mortality of the population, especially among blacks and browns. The high mortality rates from various diseases, combined with historical violence, reflect the lethality of the black population in Brazil. Studies such as those by Fiocruz (2014) highlight suicide as a significant concern among the black population.

The debate about violent deaths, which are more common among young black men and black women, has a number of important meanings. Black bodies are the target of specific violence: young black women are the main victims of urban violence and black women of gender-based violence. These nuances motivate the continuous analysis of public policies aimed at addressing the specificities of race, gender, and class in the country.

FINAL THOUGHTS

This study highlighted the persistent social inequalities faced by black women in contemporary Brazil, demonstrating how the intersectionality of race and gender is crucial to understanding the complexity of these oppressions. The analyses highlighted the profound influence of structural racism in perpetuating barriers to access to fundamental social rights, such as health, education, work, and housing. From the methodology adopted, which included the analysis of statistical data and official documents, it became evident that black women continue to be disproportionately affected by inadequate public policies and discriminatory institutional practices.

The justification for this study was even more pressing as the urgency of political interventions that recognize and address the specificities of inequalities faced by black women became evident. Intersectionality, as discussed by theorists such as Akotirene, Ribeiro and Kilomba, offers an essential theoretical framework for the formulation of public policies aimed at social justice. Current policies fail to address the multiple dimensions of social exclusion in an integrated way, and need an approach that simultaneously considers the impacts of racism and sexism.

The results highlight the need for concrete and immediate actions to ensure equity in access to social rights. The implementation of intersectional public policies is imperative to combat structural inequalities and promote the inclusion and well-being of black women. The disparities found in the data related to health, education, work, and housing not only reflect the continuity of

structural racism, but also signal the urgency of a reformulation of public policy strategies that are truly inclusive and equitable.

In addition, it is critical that future research continues to deepen the analysis of the intersections between race and gender, expanding the scope to other regions and contexts, both within Brazil and in Latin America. Collaboration between academic institutions and civil society organizations is vital to foster an ongoing and effective dialogue on best practices and strategies to combat inequality. This study, as part of the actions of the Observatory to Combat Violence against Women and Girls in Latin America, represents an important step in this direction, by bringing together inter-institutional efforts to promote meaningful change.

Finally, and without exhausting the theme, we highlight that the data point to the urgent need for a renewed commitment to social justice and equity. Black women, historically marginalized, must be placed at the center of public policies and development agendas. Only through a truly intersectional and inclusive approach will it be possible to create an environment where all women can fully access their social rights and live with dignity and equality. It is essential that we continue to advance in the fight against structural racism and gender discrimination, recognizing and valuing the contributions and resistance of black women in building a more just and equitable society.

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Guidelines for mental health promotion in the sports system

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ABSTRACT

Mental health has always been a relevant topic, but notoriety came with the case of gymnast Simone Biles and her decision not to compete in the Olympic Games in Tokyo. The gymnast's case is not an isolated situation, as it has already been experienced by athletes Gabriel Medina, three-time world surfing champion, as well as tennis player Naomi Osaka, basketball athlete Liz Cambage and many others. Studies reveal that mental illnesses are the main causes of disability, affecting almost one billion people in the world and despite the high incidence, access to diagnosis and treatment is scarce for athletes and the general population. If, on the one hand, physical exercise is recognized as an effective tool in reducing stress, depressive symptoms, general and social anxiety, and loneliness (FOSSATI et al, 2021), on the other hand, the pressure exerted in sports environments can be a driver of disease symptoms. In view of the high incidence of mental disorders in athletes and the reduced number of studies on guidelines for the promotion of mental health in sports, this chapter analyzes the Japanese and Australian models and the international consensus on sports psychiatry, in order to highlight what has been done and identify principles that are appropriate to the multicontextual scenario of Brazilian sports practice. By verifying the findings, it is understood that the Brazilian model can start with the training of interdisciplinary teams and athletes, so that they can recognize symptoms and signs of the fragility of their mental health and have decision-making power on the next steps for identification, but more studies are needed to validate a model that best suits the reality of each region and the financial possibilities of the scenarios presented.

Keywords: Mental health, Sport, Guidelines.

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INTRODUCTION

In 2023, the World Health Organization (WHO) launched a survey where the results showed that 41 million people die from non-communicable diseases (NCDs) each year, which corresponds to 74% of deaths worldwide. Of these, cardiovascular diseases account for the majority of deaths, followed by cancers, chronic respiratory diseases, and diabetes (WHO, 2023).

Nevertheless, if the diseases mentioned above are responsible for a high number of deaths, mental illnesses are the main cause of disability, affecting almost one billion people in 2019 (PAHO, 2022b). For the authors, among the people whose most serious mental health conditions are evidenced, it can be said that they have their life reduced by 10 to 20 years, when compared to the general population.

According to PAHO (2022a), among the most common mental disorders are depression, bipolar affective disorder, schizophrenia, psychosis, dementia, intellectual disability, and developmental disorders, including autism.

It is also noteworthy that, despite the large number of people affected, only a small part have access to effective, accessible and quality mental health care. It is estimated that even in high-income countries, only one-third of people with depression receive formal care, falling to 15% to 24% in low- and middle-income countries (OPA, 2022a).

According to WHO Director-General Mr Tedros Adhanom Ghebreyesus: "... The indissoluble links between mental health and public health, human rights and socio-economic development mean that transforming mental health policies and practices..." (PAHO, 2022b).

Thus, if on the one hand mental illnesses affect more and more people, on the other hand, there is a growing amount of evidence documenting the beneficial impacts of physical activity on mental health, with studies examining its effects, both in brief periods of exercise and in longer periods of activity. Systematic evaluations have indicated better outcomes for mental illness with physical activity (MAHINDRU; PATIL; AGRAWAL, 2023).

Improving physical fitness becomes a strategy to face the impact of an unhealthy lifestyle on the mental health of adolescents and young adults. The prevention of mental disorders, during this critical period of life, is based on the promotion of recreational and competitive sports participation, as involvement in sports activities is effective in reducing stress, depressive symptoms, general and social anxiety, and loneliness (FOSSATI et al, 2021).

Thus, in order to identify and document which protocols for the promotion of mental health in sports, endorsed by formal sports bodies, are available for consultation and application by sports programs, similar studies already published in Brazil and abroad were analyzed.

MENTAL HEALTH IN SPORT

Mental health is defined by the WHO as mental well-being, enabling people to deal with stressful life situations, developing their skills, learning and working in a way that contributes to the improvement of their lives and their community (Ministry of Health, 2024).

It can also be stated that mental health sustains people's individual and collective capacities to make decisions, being essential for personal, community and socioeconomic development, but it can be altered by disorders, psychosocial deficiencies, functional disabilities or risk of self-injurious behavior, and influenced by individual, social and structural factors - psychological and biological - such as: emotional skills, substance abuse, and genetics (Ministry of Health, 2024).

Findings reported by PAHO (2022a) report that stress, genetics, nutrition, exposure to environmental hazards are some of the factors that contribute to the onset of mental disorders, but others can still be listed, such as: the ability to manage thoughts and emotions; behaviors and interactions with peers, family, and society; cultural, economic, political, environmental factors; living standards; working conditions and community support.

Thus, although the most common causes that affect the mental health of the population are known, other causes associated with sports, especially high-performance, can be found in the population. It is also worth noting that, despite the numerous ways in which people can be affected by mental illnesses, mental health care is a constitutional right and a duty of the Brazilian State, through the provision of dignified health care conditions, with principles based on care in freedom and human rights (Ministry of Health, 2024).

Furthermore, despite the numerous benefits correlating the practice of physical exercise and mental illnesses, recent research indicates that sports, especially for high-performance athletes, have negative factors that impact the mental health of the practitioner, generating symptoms of depressive, anxiety and stress disorders (GALATTI, 2017; COLAGRAI et al., 2022; SILVA et al., 2022). Romero, Souza, and Silva (2023) corroborate and complement that, in the sports environment, in addition to the psychological factors already mentioned, it is common to find among athletes: sleep disorders, eating disorders, obsessive compulsive disorder, bipolar disorder, and alcohol abuse. These affect the mental health of athletes and interfere in their professional performance and as a private individual.

For the authors Silva et. al (2022) and Colagrai et al. (2022) athletes face a combination of factors that can generate high stress, such as: physical exhaustion, injuries, competition and training demands, overtraining, burnout, giving up family life, absence of an intimate and affective social support network, internal and external pressure to achieve results, excessive care with body image, and the concern with retirement, facilitate the onset of eating disorders and the use of substances to improve performance and manage stress. These factors, when added to preexisting risks such as

genetics, personality disorders, drug and alcohol use, childhood sexual abuse, and others, can catalyze the onset of mental disorders (COLAGRAI et al., 2022).

By detailing each of the factors mentioned above, Romero, Souza and Silva (2023) indicate that the pressure, internal and external, that sports culture nurtures is related to the achievement of objectives, the exposure of the athlete's performance and fear of failure, in addition to injuries and stresses arising from contract breaches. On the other hand, the perfectionist profile of most athletes, combined with third-party evaluations as a way to measure the competence and success of athletes, enables them to have high rates of pathological anxiety (ROMERO, SOUZA and SILVA, 2023).

Notwithstanding, in the sports community, the abuse of alcohol and other drugs, in order to improve self-esteem, self-confidence, attention, reduce anxiety, improve performance, strength, concentration, reaction time and endurance, reduce fatigue, decrease stress and reduce boredom, are commonly referred to in the literature (MCDUFF et. al, 2019).

It is also noteworthy that sleep disorders reduce the athlete's performance, compromising their recovery from the efforts, in addition to the reduction of creative and motor functions, increased pain perception, increased risk of injury and reduced tolerance to perform tasks (PUJALTE & BENJAMIN, 2018).

Thus, it is important to mention that mental health problems are defined as psychiatric disorders, with a substantial impact on quality of life, causing functional impairment at work, social activities and other important areas of life (CAMARGO, 2012). To minimize such effects and losses, sports psychology analyzes physical abilities, in addition to emotions, self-confidence, and mental strategies that can influence athletic sports performance and the mental well-being of athletes (ROMERO, SOUZA and SILVA, 2023). Psychological counseling should establish a relationship of trust between the athlete and those around him (family, peers, friends, team, and coaches), so that, free to express himself, he learns to deal with his emotions in the professional scenario in which he operates, in family, social, and intimate relationships (SILVA et al, 2022). In addition to these, leadership, teamwork, group cohesion, and overcoming adversity should be addressed by the multidisciplinary team in training and competitions (ROMERO, SOUZA and SILVA, 2023).

Regarding the prevalence of mental illnesses in athletes, Goellner (2005) states that 50% of them will be affected at some point in their careers and that the greatest chances occur around 19 years of age. Among the highest prevalences, depression affects 15% of German athletes, 68% of elite swimmers in Canada and 46.6% of Australian high-performance athletes aged 18 to 25 years. Also noteworthy is a 4.5% incidence rate of panic disorders in Australian athletes (COLAGRAI et al., 2022).

Finally, Colagrai et al (2022) found, through a systematic review, that high-performance athletes had similar or higher rates of mental disorders than the general population. They also

mention the low level of research with female athletes and the possible prevalence of higher levels of depression and anxiety in them. The International Olympic Committee (IOC), through the Expert Consensus Statement, encourages scientific production in high-performance athletes, given that the most researched refer to male athletes, in team invasion sports and individual brand sports (COLAGRAI et al, 2022).

Thus, considering the high incidence of mental disorders in athletes and the low research reported by the highlighted authors, it is important to know and develop guidelines in sports, which are capable of early detection and correct treatment referral. In addition, actions can be planned with athletes' families, peers, organizations and support networks, in order to improve understanding and reduce the fear of exposure and prejudice on the subject.

GUIDELINES FOR THE PROMOTION OF MENTAL HEALTH IN SPORT

Of Latin origin, according to Priberam (2024), the word *directrix* means norm, indication, or instruction that serves as a guideline for decision-making and actions. The findings of Só Escola (2024), regarding the word guideline, corroborate and complement that they are defined with the objective of standardizing procedures, clear and objective direction, avoiding errors, promoting safety and compliance. The definitions of the guidelines avoid conflicts of interest, rework and assist in decision-making.

The guidelines allow for the establishment of quality and efficiency standards, ensuring that activities are carried out consistently and in line with best practices, promoting transparency and equal treatment (SÓ ESCOLA, 2024). Ferreira and Patino (2021) state that the use of guidelines facilitates the reproducibility, transparency, and acceptance of results and conclusions by the scientific community, and that they describe the process and provide *a checklist* that allows it to be replicated by other researchers, facilitating systematic reviews and allowing knowledge of critical and relevant components for studies.

Based on the central idea of this theoretical essay and the concept of guidelines, authors such as Vella et. al. (2021), whose study generated a systematic review and meta-analysis, with an assessment of the quality of athletes' mental health and well-being statements. In it, the objective focused on organizing a document to help policy makers and sports organizations make evidence-based decisions regarding mental health care in sport.

Vella et. al. (2021) state that, since 2016, numerous consensus statements and positions on the mental health of athletes have been produced by sports bodies, but on all the statements found, consensus positions that help policy makers and sports organizations in evidence-based decision-making regarding mental health care in sport were not verified.

This time, the article prepared by Vella et al (2021) categorized six topics to elucidate and assist the application, they are: writing a mental health plan; provision of mental health care; athlete support system; high-risk events; athlete's mental health; and, future directions.

With regard to the drafting of a mental health plan, the authors suggest defining and distinguishing between mental health and mental illness, including the medical, biopsychosocial, mental health continuum, and lifestyle perspective, including prevalence, key risk factors and stressors, risk management strategies, legal considerations, and written procedures for all stakeholders. whose main objective is the protection of athletes, especially those with mental health problems and illnesses (VELLA et al., 2021).

Regarding mental health care, the authors mention that explicit guidelines are needed, indicating the availability of mental health services for athletes, who and when to make referrals – an identifiable person, to whom to refer – self-referral to external users, and assessment and treatment options (VELLA et al., 2021).

Regarding the athlete support service, it is important that all people close to the athlete (coaches, peers, family members, organizations) have mental health literacy, in order to recognize symptoms, monitor athletes at risk, as well as assist in the prevention of mental health problems and the promotion of well-being. There must also be a person, defined by the organization, responsible for the supervision and prescription of medication and therapy (VELLA et al., 2021). For the authors, organizations should recognize the importance of mental health and provide screening and awareness programs, supporting and mobilizing resources for this purpose, using mental health as a key indicator of organizational effectiveness, including the topic in their organizational culture.

With regard to high-risk events, the authors of the systematic review, Vella et al. (2021) indicate that sports organizations should be prepared for the prevention of high-risk events, which include emergencies and crises, abuse, and mistreatment. This plan should contain procedures and suggestions to know how to deal with signs of suicide and signs of danger, in addition to explicit protection of athletes from abuse, mistreatment, *bullying*, hazing and non-abusive *coaching* strategies by coaches, in order to safeguard the mental health of athletes.

Finally, the authors mention that the mental health of the athlete and his/her performance are intimately related and that there are mental health stressors among the athletes. Overtraining, for example, is among the biggest stressors for mental health, as well as low recovery time and different phases of performance and different environments, with different demands and processes: cognitive, affective, physiological and behavioral, which can affect the mental health of athletes. As mental health affects performance, better mental health enables better performance (VELLA et al., 2021).

In summary, observing the findings in the scientific databases, it is highlighted that, despite the risks and pressure to which athletes are subjected, there are currently few statements about mental

health in sport, with a comprehensive structure or model of care to support and respond to the mental health needs of elite athletes. In the face of this deficiency, athletes and their confederations act according to their own attitudes, beliefs, and opinions regarding mental health.

In order to clarify what is being presented in other contexts, they will be addressed in the wake of the Japanese, Australian and international consensus models, with the aim of offering relevant knowledge to policy makers and sports bodies who wish to adopt, support, articulate or implement a coherent and robust mental health strategy.

JAPANESE MODEL

In the search for references of the policies and consensuses used in Japan, through the search engines mentioned at the beginning of this subchapter, Nishida and Yamaguchi (2024) bring some current elucidations on the subject.

According to the authors, given the need for a different approach from that applied by psychology and considering the concerns about the mental health of athletes, more than 20 years ago the Japan Association of Sports Psychiatry (JSAP) was created, with a multidisciplinary team that includes: doctors, nurses, psychologists, researchers specialized in sports psychology, sports science and physical education, as well as coaches, active athletes, and athletic trainers.

With regard to access to the treatment of psychiatric disorders and information related to sports psychiatry, although it is not accessible to all athletes, there is a referral network shared by JSAP, in order to spread support among its members.

Yamaguchi (2024) states that JSAP has the following fundamental values: (i) the growing relevance of sport in psychiatry; (ii) the application of psychiatry in sports; and (iii) basic research on physical exercise and brain function. It is noteworthy that its application in sports has a direct correlation with anxiety, depression and cognitive function and its interventions aim to improve the mental well-being of athletes.

Some factors such as competitive performance, maximum performance in competitions and early return to sports after injuries are listed by researchers as triggers of mental disorders in athletes. They also state that the challenge in identifying mental health conditions by technical teams, athletes, and peers, combined with the stigma related to the disease, makes most athletes refrain from recognizing and treating their mental illnesses (YAMAGUCHI, 2024).

In Japan, the model used provides that the sports psychiatrist is solely responsible for carrying out an evaluation, diagnosis and recommendation of psychiatric treatment, including pharmacotherapy of mental illness. This diagnosis is made through the identification of the complaint, separating psychological issues - improvement of competitive performance, social

problems of relationship with peers, society, family, from psychiatric issues - depression, anxiety, *overtraining* (YAMAGUCHI, 2024).

In order to minimize such symptoms and their consequences, Japanese sports entities, endorsed by the International Olympic Committee (IOC), are advised to promote, among their athletes, non-pharmacological psychiatric therapies, such as: *mindfulness,* autonomic training, deep breathing, and progressive muscle relaxation techniques (YAMAGUCHI, 2024).

Despite all the efforts made by JSAP, the diagnosis and treatment of Japanese athletes and sportsmen continue to require a recognition of the need, on the part of the athlete himself or the encouragement of the technical team, sports organization, peers or family members, seeking the necessary support through the Athlete Mental Support Outpatient Clinic or in Psychiatric Hospitals. According to Yamaguchi (2024), even with specific places for mental health support, when considering university athletes, only 45% of them have access to professionals in the area.

Although studies are advancing in Japan, a reference presented is that sports psychiatrists and professionals specialized in psychological support, through a *Mental Health Literacy* (MHL) program, raise awareness and educate the delegation of sports clubs and associations, as well as coaches, athletes, family members and peers, working together in the creation of a program and a consensus (YAMAGUCHI, 2024).

AUSTRALIAN MODEL

In an article by Liddelow et al. (2023), through a *Deplhi study,* the role of community sports organizations in Australia was highlighted, correlating them with the actions carried out in high-performance environments. In the article, the authors listed the priorities for the guidelines and statements, through the opinions of expert groups.

Among the main points, one of the consensus of the experts is the need for mental health literacy training for coaches, volunteers and sports participants (athletes, parents, peers, organizations), as well as training in mental health first aid. Another consensus was the creation and maintenance of a psychologically safe and healthy sports environment, which promotes sport, social interactions, inclusion, community involvement, and healthy eating, providing a holistic view of mental health, including physical and emotional well-being (LIDDELOW at al, 2023).

Another point mentioned by the authors was the need to create a sports environment where athletes feel freedom to actively seek help, as well as openness to discussion about mental health and early help. This guarantee of the psychological safety and well-being of athletes and the sports community seems to have been another point of consensus by the experts, who also highlighted the need to establish partnerships with external mental health service providers.

Finally, coaches were considered essential to athletes' sports experiences, performance and well-being, as their behaviors and attitudes have already been the subject of previous investigations, being referred to as a negative influence on their mental health and well-being. This influence is due, in part, to a lack of training and information about psychologically safe *coaching*. Thus, it is essential that this coach includes a team culture and self-care, in addition to physical and performance skills, as well as investing in interpersonal knowledge and communication skills (LIDDELOW at al, 2023).

These consensus points mentioned in the above study were tested by O'Connor et al. (2024), who state that mental health literacy is defined as knowledge and beliefs about mental disorders that aid recognition, management, and prevention. They also state that mental health literacy deals with notions of self-help, professional help, seeking help and supportive attitudes that promote recognition, improving confidence to support and refer, knowledge of available resources, perception of the supportive environment in clubs and participants' confidence in their knowledge about mental health.

In the study, confidence to support and refer/refer was measured with *The Mental Health Referral Efficacy Scale*, while knowledge of available resources was assessed through a subscale of the *Mental Baseline Literacy* scale. On the other hand, the search for help was measured by *The General Help Seeking Questionnaire*, referring to the importance of the social support network. Lastly, the club's supportive environment was assessed with the *Supporting Mental Health in Sport Instrument* (O'CONNOR et al, 2024).

The survey carried out with Australian rules football clubs points to the recognition, by all respondents, of the obligation to support the mental health of themselves and those around them. On the other hand, they failed to address how the club should include the topic of mental health in the political, cultural and financial fields. Nevertheless, the notion of mental health and the identification of signs of illness and coping were the main lessons learned (O'CONNOR et al, 2024).

Finally, the authors highlighted that those who participated in the Mental Health Literacy program showed improvement when compared to the control group, sustained even in the months following the intervention. As described by the researchers, through the instituted program, the participants acquired knowledge, confidence and resources for the promotion of mental health, helping them to respond appropriately to the challenges and symptoms. The program also provided parents, athletes, and coaches with resources to support athletes' mental health, as well as enabling coaches to identify mental health issues and make appropriate referrals (O'CONNOR et al, 2024).

INTERNATIONAL CONSENSUS MODEL

They refer to Russel et al. (2024) through an exploratory study carried out with 156 people, professionals who serve 112 different sports, with athletes of different levels of high performance, linked to professional accreditation bodies, in their vast majority. Respondents indicated that athletes had their mental fatigue and recovery monitored on a daily basis or at least in two weekly sessions, usually in training and competitions. The authors found that the pre-season phase was where participants reported having planned and periodized the fatigue and mental recovery of their athletes.

Among the points that most impacted the research was the identification that factors such as competition, type of competition, training intensity, scheduling and travel demand were the main influences on the mental recovery of athletes, who also reported participating in a reactive management of mental recovery, where the prioritization of mental health is not evidenced in the planning and periodization of training sessions and competitions (RUSSEL et al, 2024).

For the authors, the interviewees informed that some strategies are adopted for the mental recovery of athletes and the adoption or choice of which one to use is usually up to the athlete himself, which can vary between consultation with a psychologist, meditation, wellness diary, use of flotation tanks, yoga, progressive muscle relaxation techniques, listening to relaxing music, participation in social events, fun activities or deliberate consumption of food.

As can be observed, the authors did not present a single tool that indicated the best way to approach the theme, indicating that each research participant used, in the clubs where they worked, different tools, often deliberating the athlete to be responsible for the decision about their mental recovery strategy.

On the other hand, Claussen et.al (2024) presented a definite article as the first international declaration on sports psychiatry. For the authors, sports psychiatry is a field of medicine and psychiatry that deals with the prevention, diagnosis and treatment of symptoms and consequences on the mental health of athletes in sports, which is a medical, psychiatric-psychological-mental health discipline, based on neuroscience, integrated medication and psychotherapy.

Thus, the authors define sports psychiatry as a medical specialty, where the practitioner must have completed the medical course and, subsequently, carried out specializations in the area of sports psychiatry or sports and exercise medicine, in order to know and apply the knowledge, skills, essential skills and attitudes (eKSA+A), to promote mental health in athletes and physical activity as a therapeutic means in the prevention and treatment of mental disorders (CLAUSSEN et al, 2024).

The knowledge, competencies and skills required to work in the area include: i) knowledge about the most important sports; mental health and related problems in competitive and elite sports; relationship between physical health, performance, and mental health in competitive and elite sports; risk factors, importance of overload and stress in competitive sports; athletes' hopes, fears, and

aspirations; diagnosis and screening of mental disorders in sport; as well as the opportunities for promotion and prevention, in addition to the integrated role of the sports psychiatrist with the multidisciplinary team of the athlete and his coach; ii) competence and ability to intervene in crises and cope with mental health emergencies of athletes; application of treatments and techniques to improve the performance of athletes and coaches; diagnosis with physical or imaging exams, as well as specialized interventional action, in order to stimulate the prompt recovery of athletes (CLAUSSEN et al, 2024).

In addition, the authors believe that the sports psychiatrist should be committed to interdisciplinary and professional care, centered on the repudiation of forms of violence, abuse or racism and committed to the three fields of action: i) mental health and disorders in competitive and elite sports; ii) in the defense of sport, exercise and physical activity as forms of prevention and treatment for mental health; iii) addressing mental health symptoms and disorders in recreational sports. These fields of action aim not only to recover performance, but also to maintain and/or improve it (CLAUSSEN et al, 2024).

Claussen et. al (2024) that this consensus is a first international definition on the topic: sports psychiatry. They also mention that other interested parties, such as athletes, patients, managers and others, were not heard, and it is necessary to hear them in a next update or new statement. Nevertheless, they state that research will be needed on diagnostic and therapeutic procedures for mental disorders in athletes, as well as correlating physical activity and the treatment of these disorders.

CONCLUDING NOTES

Silva et al. (2021) state that, in the Brazilian context, Sports Psychology is at an intersection between Physical Education and Psychology and, as a consequence of this, adaptations of instruments were made for the sports context, sometimes without proper validation or questioning. Thus, the authors suggest that these limitations should be understood so that changes can generate measurement instruments for Sports Psychology, because the use of adaptations can generate false results since they were not generated according to the local culture.

In addition, no literature was found that refers to explicit policies, consensus, and reference guidelines about clear and measurable indicators of policies and actions to promote mental health in athletes, which is the objective of this theoretical essay.

Among the findings made available by other countries, it can be seen that the proposed structure suggests: (i) development of competencies so that athletes can self-manage their mental health, (ii) training of interdisciplinary teams so that they can recognize and react to concerns related to athletes' mental health, (iii) provision of qualified multidisciplinary teams for the treatment of

athletes with mental illnesses, (iv) presence of a sports psychiatrist with the ability to apply the (eKSA+A).

That said, the question that this essay brings as a reflection is, based on the guidelines presented as a model in other realities and countries, it remains to understand how the application of such proposals can be carried out, in a multicontextual scenario, such as the Brazilian one, where the sport is practiced in large clubs, city halls, associations, universities, schools, non-governmental organizations, public and private spaces, with different realities and financial, human and sports equipment availability; and at the same time, in a culture of early specialization, encouraging sports competitions from the earliest ages.

Regarding this last subject, it is notorious and several studies point to the emotional damage evidenced by the failure of sports competitions, reported in the findings by Milisted et al (2014): stress, early adultization and mental exhaustion, in addition to the pressure exerted by parents, peers and clubs. Authors also point out that children who start very early in some sports end up wearing out and becoming disillusioned with the sport, giving rise to sports saturation syndrome, with symptoms of apathy, indifference, and aversion to sports, leading to their withdrawal, especially in adulthood (NASCIMENTO and FERNANDES, 2023).

Thus, considering the Brazilian sports scenario and its extent of scope and contextual disparity, it is believed that the Brazilian guideline model can start with the training of interdisciplinary teams and athletes, so that they can recognize symptoms and signs of the fragility of their mental health and have decision-making power on the next steps to identify. However, more studies are needed to validate a model that best suits the reality of each region and the financial possibilities of the scenarios presented.

Finally, corroborating the ideas of O'Connor et al. (2024), the sports context can provide a safe and conducive environment for literacy and mental health promotion, presenting a culture of support for athletes and staff, where members care for and support each other, both inside and outside the sports context.

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Simulation as a tool of active flipped classroom methodology: A didactic form of application for the discipline of control in the teaching of Electrical and Electronic Engineering at UEA

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ABSTRACT

The improvement of practical activities in engineering courses has become currently an objective of higher education centers. In the present work, the authors present the results obtained from the application of simulation as a tool of active teaching methodology in the discipline of Control Systems in the courses of Electrical and Electronic Engineering of the School of Technology of the University of the State of Amazonas. It is a matter of introducing in the practical components of the discipline the latest guidelines of the National Curriculum Guidelines, DNC, which support the improvement of the didactic ways of teaching the contents, linking them to ensure a greater number of practical experiences and individual work, to encourage more expressive results in the acquisition of knowledge with the use of new technologies. In the case of the active flipped classroom methodology, applied in the work, it allowed us to advance in multidisciplinary integration processes and new laboratory practices in the context of the discipline.

Keywords: Active methodologies, Didactic form, Apprenticeship, Simulation.

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INTRODUCTION

With the rapid improvement of computational resources and the arrival of industry 4.0, the investment in the knowledge and design of control systems for a wide variety of industrial operations has increased significantly, allowing new algorithms and more elaborate strategies to be implemented, but due to the great diversity of processes and industrial policy issues, These improvements were not widespread in all plants.

In the northern part of Brazil is Manaus, **"the capital of the state of Amazonas**, [...] **The city is one of the most populous in the country** and the main one in its region. It plays an important role as the economic center of that area, since it concentrates large industries from various productive sectors in the Manaus Free Trade Zone (ZFM)" (GUITARRARA, 2021, *emphasis added*). In this context, nowadays for the technological updating of industries, there is a need for prepared professionals capable of following the new challenges of the implementation of new technologies, being fundamentally those in the control area because the values of the production indicators depend on the degree of control of their processes. The absence of effective, safe methods and automated control systems leads to a decrease in production and low efficiency. All this has been an opportunity to work on raising the quality of professionals in the training process through the use of active teaching methodologies (MAMEDE, 2001) to raise the levels of knowledge through the disciplines in engineering courses, such as the disciplines of Control Systems in Electrical and Electronic Engineering courses, existing today at the School of Technology of the University of the State of Amazonas.

Active methodologies are among the didactic forms that today allow the increase of students' practical and theoretical knowledge in the disciplines of different forms of study, including engineering. Resolution No. 1, of March 26, 2021 of the Ministry of Education, which updated the National Curriculum Guidelines for the Undergraduate Engineering Course in its article § 5, section II, highlights as new tools for the acquisition of knowledge the following: "[...] experimentation in laboratories, elaboration of models, use of computers, consultation of libraries and databases", (SEMESP, 2021). In this aspect, according to Thuinie and Fragelli (2020), they argue that: "[...] Active methodologies constitute a pedagogical alternative capable of developing competencies and skills desired in a society in intense transformation".

Thus, the objective of the present work has been to use simulation as a component tool of the active flipped classroom methodology, which as a didactic form is applied in a task of the control discipline in the teaching of Electrical and Electronic Engineering at the University of the State of Amazonas, UEA.

METHODOLOGICAL ANALYSIS FOR THE APPLICATION

The disciplines of Control Systems 1 and 2 belong to the curriculum of the Electrical Engineering course, being equivalent to the first part with the discipline of Control and Servomechanism of the Electronic Engineering course. In general, its objective is to allow students to know the main characteristics of the systems, their modeling and simulation for the design through projects of control strategies that allow optimizing the behavior of the output variables of the systems.

The active methodology used in this work was the flipped classroom, using as a tool the development of virtual laboratories in the selected discipline, according to the methodology proposed in the work of Guzmán et al (2021), individually using computer technologies, from the proposal of a modeling, simulation and control question to be solved and then sharing their experiences with the whole class, This allows the integration of knowledge received in different disciplines and their socialization, now using it to solve an objective of a specific content of the discipline, which are linked to the learning objectives and the main ones of the year.

To apply active learning methods in the course, it is necessary to select the theme and content to be worked on. This makes it possible to implement a methodology that presents each of the activities to be performed in a hierarchical sequence, which is reflected in the items shown in Figure 1.

Figure 1. Organizational chart of activities for the implementation of the active methodology in the discipline of Control Systems.

Source: Authors.

The **learning objective of** the proposed problem would be: To design from modeling and simulation the position and speed control of a conveyor belt of electronic boards in an industry of the industrial pole of Manaus, Figure 2, using computational technologies; The **learning goals:** From the selection and design of the control strategy that involves the choice of the object, In this case, the treadmill selects and analyzes the variables in order to design and implement them in a simulator

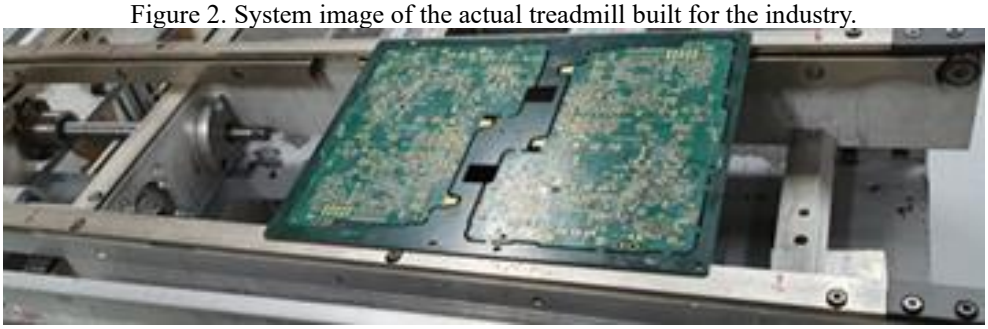
program and describe the elements that make up the control loop, analyzing their performance and characteristics. The **skills** would be to select, analyze, choose variables to manipulate, model, simulate, **and competencies** would be marked in reflecting, interpreting, doing and reasoning.

The format of the activities: Once the virtual laboratory is completed, following the methodology of Guzmán et al (2021), individually present the report that includes the models of the control loop, the design of the scheme in the simulator program and all the graphs of temporal responses to changes in the manipulated variables and the possible disturbances, which can be developed in the Matlab®/Simulink® program, (MATHWORKS, 2024), explaining and demonstrating through the results that the design made is robust to be implemented. The construction of the activity is autonomous.

RESULTS AND DISCUSSION

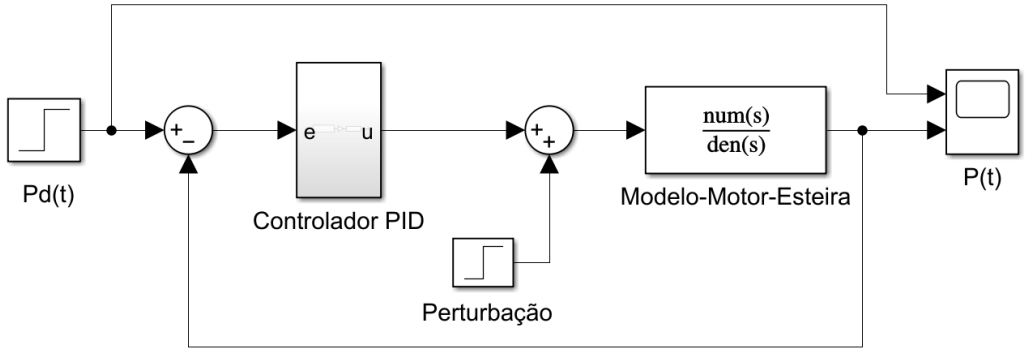
The **evaluation activity** starts from the presentation of the results, which happens individually with the use of the computational resources available in the presence of the whole group, the student has to explain and justify: How was the object chosen?; How was the modeling of the conveyor system (including drive elements and the AC motor) obtained?; What are the main components of the control loop?, Figure 2; How was the design and choice of the controller?; How was the choice and positioning of the sensor to ensure the stop of the belt at the P(t) position, having as reference the desired position of the stop point of the P(t) belt, Figure 4, so that the electronic component is inserted exactly by the robotic manipulator mechanism?.

Figure 2. System image of the actual treadmill built for the industry.



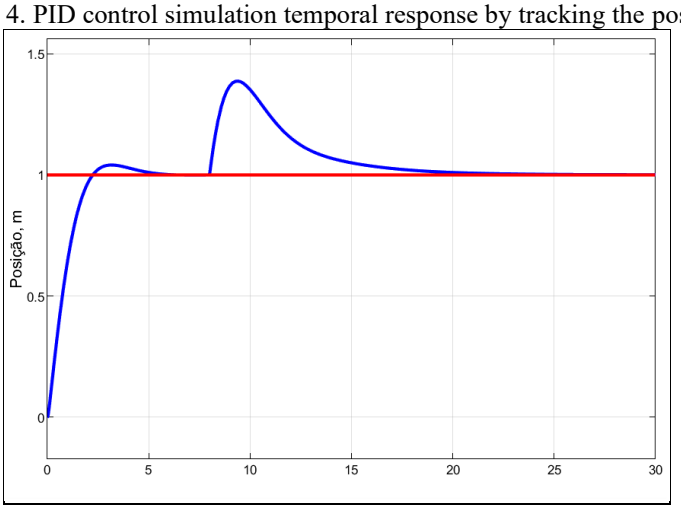
Source: Authors, 2024.

Figure 3. Simulation scheme of the conveyor system with PID control.



Source: Authors, 2024. Matlab®/Simulink®, 2024a.

Figure 4. PID control simulation temporal response by tracking the position.



Fonte: Autores, 2024. Matlab®/Simulink®, 2024a.

In the last part of the presentation and evaluation stage, a chart can be drawn to reflect the individual evaluation, starting from the concepts that the teacher considers important that complement the learning objectives outlined at the beginning of the task.

Table 1. Evaluative summary of the task on the position control of an industrial conveyor belt of electronic boards with AC motor.

	Evaluation of the Report				**Presentation**	**AF**
Items	**Simulation Schematic Design**	**Execution of the virtual lab walkthrough**	**Presentation of the results obtained**	**Interpretation of results**	**Presentation and answers to teacher or group questions**	**S 10,0**
Name/P.	**x 0.2**	**x 0.3**	**x 0.2**	**x 0.2**	**x 0.1**	**-**

Source: Authors.

CONCLUSION

The results obtained using the simulation tools demonstrate the possibility of using it in practical activities of the control disciplines as part of active methodologies, as was the case of the flipped class, through the realization of virtual laboratories previously designed and programmed

with a step-by-step guide of realization in the disciplines of Control Systems, which provides practical knowledge to the students, thus allowing to increase the technical and professional development individual, at first, sharing after their experiences in their team or group. This has made it possible to integrate knowledge from other disciplines such as Calculus, Programming, Physics, Portuguese Language and Drawing into a single task.

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Injuries and associated factors in practitioners of combat sports – Karate

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ABSTRACT

Introduction: Karate is a martial art of Japanese origin that means "path of empty hands". As a Combat Sports Modality (MEC), it made its debut as an Olympic modality at the Tokyo Games in Japan in 2021. In its fighting essence, it mostly uses attack and defense techniques with hands, feet, elbows and knees. This fact, combined with the continuous contact and intensity of the training, among other aspects, favor the occurrence of injuries in its practice.

Objective: This study aimed to verify the association between sociodemographic factors and the practice of the modality with the occurrence of injuries in karate practitioners in the State of Maranhão, Brazil.

Methods: This was a quantitative study with a descriptive cross-sectional character. Data collection was carried out through the Questionnaire Injuries in Combat Sports Modalities (QLGS1), administered in person in the practice/teaching spaces of the modality and remotely through a link made available on Google Forms. Data were analyzed using descriptive statistics (mean, standard deviation and frequency distribution). The chi-square test was used to verify the association between the variables. Values of $p \leq 0.05$ were considered significant. This study was approved by the Research Ethics Committee of the Federal University of Maranhão (CEP/UFMA) No. 4,711,629.

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Results: A total of 68 Karate practitioners from the state of Maranhão participated in this investigation, with a mean age of 31.53 years (SD=12.513), of both sexes (75.0% male), age group 30 years or older (47.1%), level of education – higher and graduate (75.0%) and monthly family income of up to three minimum wages (44.1%). Regarding the modality and its practice, 14 years was the average training time (SD=11.919), participate in competitions (29.4%), do not practice another MEC (80.9%), practice another sport/physical activity to improve performance in Karate (67.6%), have been injured (63.2%), Knees (46.51%) and Wrists/Hands (46.51%) were the regions of the body most affected by injuries and, Concussion (60.4%) and Dislocation (39.5%) were the types of injuries most mentioned by the participants. Participating or not in competitions, frequency of training/week and practicing another sport/physical activity to improve performance in Karate were the variables that showed statistically significant differences with the occurrence or not of injuries.
Conclusion: In this investigation, ECM – Karate – presented a high rate of injuries, with the Knees and Wrists/Hands being the most affected regions and Concussion and Dislocation being the most reported types. The occurrence of injuries was associated with some variables related to the practice of the modality, such as participation or not in competitions and weekly frequency of training. The relevance of interventions related to injury prevention for a healthier practice in the modality and a better quality of life of its practitioners is highlighted.

Keywords: Injuries, Quality of life, Karate, Combat sports modality.

INTRODUCTION

An oriental martial art of Japanese origin, Karate became known as a combat modality when it spread around the world in the early twentieth century. However, his teaching and practice were restricted only to reserved spaces and moments, from master to disciple, given that the immigrants had other labor trades, such as working in the fields.

It was in the 1960s, in the state of São Paulo, that the first academy of the sport in Brazil was officially founded, a process that was later repeated in the states of Rio de Janeiro and Bahia (Oliveira; Grandson; Jordan; 2006). In Maranhão, it was at the end of the 1960s that the teaching of the modality took place for the first time, however, restricted to a few students. However, it was in the 1970s, with the arrival of a disciple of one of the pioneers of Karate in the northern region of Brazil that the modality gathered many fans and, later, with the training and arrival of other teachers, as well as with the emergence of several schools, the modality developed, popularized and expanded, currently encompassing a diversity of practitioners in its various styles throughout the state.

His practice and teaching are still permeated with strong traces of the philosophical, ethical and moral traditions of the Japanese oriental culture. However, like other martial arts, Karate, despite several tensions and resistance groups, has gone through the process of sportsmanship, with this, the modality was forced to comply with certain structural changes and adapt to moral, ethical and safety precepts to achieve the status of Olympic modality (Oliveira *et al*., 2018). Its debut at the Olympic Games took place in Japan at the TOKYO 2020 Games, more precisely in the year 2021 due to the COVID-19 pandemic.

Karate is characterized by being a combat modality that, in general, does not require the use of weapons and uses body segments as structures of attack and defense (Simões; Pear tree; Figueiredo, 2019). It can be practiced by anyone, regardless of age, gender, and be initiated at any stage of life (Kanazawa, 2010), however, it must be practiced with due care considering the limitations of each age group and physical limitations, among others.

Studies have highlighted the growth in the number of practitioners in martial arts and Combat Sports (MEC) (Minghelli; Axe; Chapel, 2020; Almeida; Araújo, 2020), whether for self-defense, leisure, physical activity, or even as a competitive sport. In 2013, the former Ministry of Sports published the National Sports Diagnosis - DIESPORTE (Brasil, 2013) and showed that 6.9% of the 8,902 respondents of both sexes declared to practice some type of combat sport.

If, on the one hand, we have an increasing number of practitioners of both sexes and different ages, on the other hand, we understand that the practice of a combat modality, and especially Karate, involves risks of injury, mainly because they are associated with the continuous body contact required, repetitive and exhaustive training, training time, poor orientation, absence or misuse of protective equipment; excessive competitions; modality-specific biomechanics, among other aspects.

Thus, this study aimed to verify the association between sociodemographic factors and the practice of the modality with the occurrence of injuries in Karate practitioners in the State of Maranhão, Brazil.

MATERIAL AND METHODS

This study was carried out in the field of action (practice/teaching/competition) of the Combat Sports Modality – Karate in the state of Maranhão, Brazil, with an opinion approved by the Research Ethics Committee of the Federal University of Maranhão (CEP/UFMA) No. 4.711.629 and CAAE Project No. 44513121.6.0000.5087.

It was characterized as a quantitative study with a cross-sectional descriptive character with the objective of measuring and quantifying the frequency in which the investigated phenomenon occurs and its relationship with other factors, recording it after being observed (Reis, 2018), describing it and correlating the facts without manipulating them with the participation of different age groups selected to evaluate the effects (Thomas; Nelson; Silverman, 2012).

Participants were recruited through verbal dissemination, posters, social networks and visits to the practice and teaching spaces of the modality. The selection of the subjects was made by non-probabilistic sampling of volunteers practicing the modality. The following were included: individuals of both sexes; being 12 years of age or older; be active/practicing the modality for at least six (6) uninterrupted months and Brazilian individuals. Data were excluded from participants who did not sign the Free and Informed Consent Form (ICF) and/or Minor Consent Form (TALE) and participants who were minors whose respective guardians did not allow participation by signing the informed consent form.

As a data collection instrument, the Questionnaire on Injuries in the practice of LAMEC (Fighting, Martial Arts and Combat Sports) - QLGS1 - was used. The instrument contains 32 open and closed questions subdivided into three groups: a) sociodemographic data; b) information about the modality and, c) information about the injuries that occurred in the practice of the modality.

Regarding sociodemographic information, the instrument asked respondents for age, gender, monthly family income and level of education.

Regarding the participant's practice and experience with Karate, information was requested, such as: whether he/she participates in competitions, training/practice time in years; attendance of classes/training sessions per week; Average session/training time in minutes, among other information.

With regard to injuries, information was requested on the occurrence or not of injuries during the practice of the modality; the site(s) of the body where the injuries occurred; types of injuries; moment of practice in which the injuries occurred – the participants had the following response

options: class, training, competition, fight/game training and another moment. It was also questioned the recovery time for the return to training/classes and if they participate and/or participated in training/classes to prevent possible injuries.

Data collection took place between August 2021 and August 2022 in person at gyms/schools and at sporting events in the metropolitan region of São Luís/MA/BR and online through the electronic form (*Google Forms*).

Data were initially analyzed using descriptive statistics (mean, standard deviation and frequency distribution). Pearson's chi-square test was used to verify the significance of the association between sociodemographic variables, practice and experience in the modality with the occurrence of lesions (yes or no). The data were tabulated and analyzed using the statistical software *IBM SPSS Statistics* V. 24 and values of $p \leq 0.05$ were considered significant.

RESULTS

Participants in this investigation were 68 practitioners of the Karate modality from the state of Maranhão, with a mean age of 31.53 years (SD=12.513), minimum 12 and maximum of 67 years of age, of both sexes, most of whom were male (75.0%), belonging to the age group of 30 years or older (47.1%), with higher education and post-graduation level (75.0%) and monthly family income of up to three minimum wages (44.1%).

Regarding the modality and its practice, 14 years was the average training time (SD=11.919) and 37.7% have practiced the modality for more than 16 years, 29.4% of the participants reported that they participate in sports competitions, 77.9% reported the frequency of training up to three times a week, 76.5% with class/training time ≤ 60 min, 80.9% of the participants did not practice another ECM and 67.6% reported practicing another sport/physical activity to improve their performance in the practice of Karate.

Regarding the occurrence of injuries and participation in specific training for injury prevention, the results showed that 63.2% of the participants had already been affected by injuries in the practice of the modality, this percentage is maintained when asked if they participate in any specific training for injury prevention (Table 1).

Table 1 – Information on lesions (n=68)

Variables	N (%)
He suffered some type of injury as a result of the practice of the sport	
Yes	43 (63,2)
No	25 (36,8)
Participates in specific physical training for injury prevention	
Yes	43 (63,2)
No	25 (36,8)

Source: Data obtained from the responses of the survey participants.

Regarding the possible association between the sociodemographic variables (gender, age group, level of education and monthly family income), the results did not show statistically significant differences in relation to the occurrence or not of lesions (Table 2).

Table 2 - Sociodemographic variables according to the occurrence of lesions (n=68)

Variables	Suffered injury			p
	No	Yes	Total	
	N (%)	N (%)	N (%)	
Gender				
Female	8 (32,0)	9 (20,9)	17 (25,0)	0,309
Male	17 (68,0)	34 (79,1)	51 (75,0)	
Age group				
Up to 19 years old	4 (16,0)	4 (9,3)	8 (11,8)	0,578
20 to 29 years old	11 (44,0)	17 (39,5)	28 (41,2)	
30 years or older	10 (40,0)	22 (51,2)	32 (47,1)	
Educational level				
Fundamental (Incomplete / Complete)	2 (8,0)	1 (2,3)	3 (4,4)	0,749
Medium (Incomplete / Complete)	5 (20,0)	9 (20,9)	14 (20,6)	
Superior (Incomplete / Complete)	9 (36,0)	16 (37,2)	25 (36,8)	
Post-graduation (Incomplete/Complete)	9 (36,0)	17 (39,5)	26 (38,2)	
Monthly household income*				
Up to 1 minimum wage (up to R$ 1,100.00)	3 (12,0)	7 (16,3)	10 (14,7)	0,653
From 1 to 3 minimum wages (from R$ 1,100.00 to R$ 3,300.00)	7 (28,0)	13 (30,2)	20 (29,4)	
From 3 to 6 minimum wages (from R$ 3,300.00 to R$ 6,600.00)	10 (40,0)	10 (23,3)	20 (29,4)	
From 6 to 9 minimum wages (from R$ 6,600.00 to R$ 9,900.00)	2 (8,0)	4 (9,3)	6 (8,8)	
From 9 to 12 minimum wages (from R$ 9,900.00 to R$ 13,200.00)	2 (8,0)	3 (7,0)	5 (7,4)	
More than 15 minimum wages (more than R$ 16,500.00)	1 (4,0)	6 (14,0)	7 (10,3)	

Subtitles: p= Significance

Source: Data obtained from the responses of the survey participants.

*Sum of the participant's income with the income of people living together / 2021 minimum wage

Regarding the possible association between the variables related to the practice of Karate and the occurrence or not of injuries, the results showed that the variables Status of the participant (being

a teacher of the modality or just a practitioner), Time of training (years of practice), Time/duration of the class and training, if the participant practices another MEC and if he participates in any specific training for injury prevention did not present statistically significant differences. On the other hand, the variables Participates in competitions, Frequency of training per week, and Practice in another sport and/or physical activity to improve performance in the fight were associated with the occurrence or absence of injuries, as shown in Table 3.

Table 3 - Variables about the practice of the modality and prevention of injuries according to the occurrence of injuries (n=68)

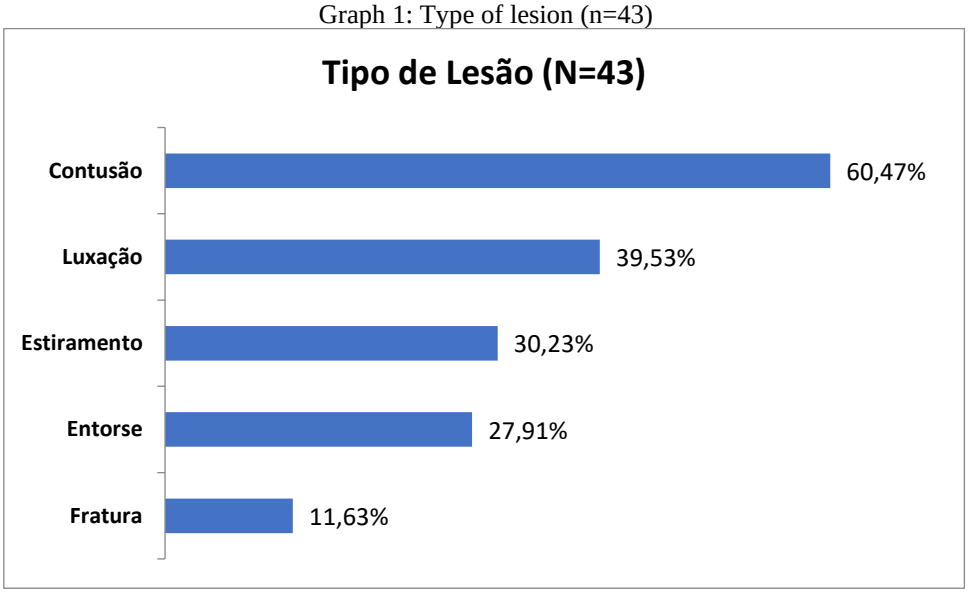
Variables	Suffered injury			
	No	Yes	Total	p
	N (%)	N (%)	N (%)	
Status in the Modality				
Practitioner / Student	20 (80,0)	29 (67,4)	49 (72,1)	0,266
Teacher/Master	5 (20,0)	14 (32,6)	19 (27,9)	
Do you participate in Competitions?				
No	13 (52,0)	10 (23,3)	23 (33,8)	**0,038**
Not currently	8 (32,0)	17 (39,5)	25 (36,8)	
Yes	4 (16,0)	16 (37,2)	20 (29,4)	
Training time (n=61)				
Up to 3 years	5 (23,8)	6 (15,0)	11 (18,0)	0,677
4 to 10 years	7 (33,3)	13 (32,5)	20 (32,8)	
11 to 15 years	3 (14,3)	4 (10,0)	7 (11,5)	
16 years or older	6 (28,6)	17 (42,5)	23 (37,7)	
Training frequency/week				
Up to 3 x/week	23 (92,0)	30 (69,8)	53 (77,9)	**0,033**
More than 3 x/week	2 (8,0)	13 (30,2)	15 (22,1)	
Class/Workout Time				
≤ 60 min	19 (76,0)	33 (76,7)	52 (76,5)	0,924
90 min	5 (20,0)	9 (20,9)	14 (20,6)	
≥ 120 min	1 (4,0)	1 (2,3)	2 (2,9)	
Practice another LAMEC				
No	22 (88,0)	33 (76,7)	55 (80,9)	0,255
Yes	3 (12,0)	10 (23,3)	13 (19,1)	
Participates in specific physical training for injury prevention				
No	12 (48,0)	13 (30,2)	25 (36,8)	0,143
Yes	13 (52,0)	30 (69,8)	43 (63,2)	
Practice another sport/physical activity to improve performance in the fight				
No	12 (48,0)	10 (23,3)	22 (32,4)	**0.035**
Yes	13 (52,0)	33 (76,7)	46 (67,6)	

Subtitles: p= Significance
Source: Data obtained from the responses of the survey participants.

Regarding the involvement of injuries, 63.24% (43) of the 68 participants in the investigation indicated that they had already suffered some type of injury in the practice of Karate. The most

pointed types were contusion (60.47%), dislocation (39.53%) and stretching (30.23%), as shown in Graph 1.

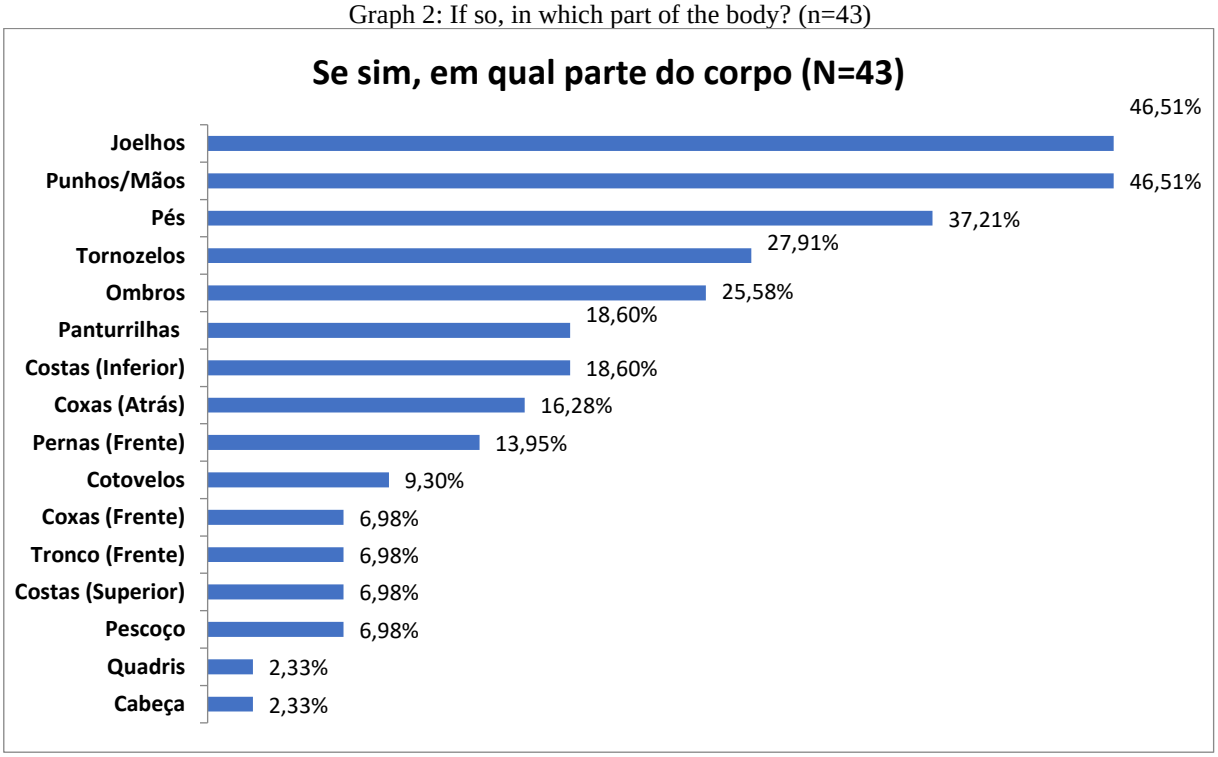
Graph 1: Type of lesion (n=43)



Source: data obtained from the responses of the survey participants.

The regions of the body most affected by the injuries, according to the participants, were the knees and wrists/hands (both with 46.51%), feet (37.21%) and ankles (27.91%). Shoulders and ankles also presented a significant number of injured patients, accounting for 25.58% and 27.91% of the responses, respectively (Graph 2).

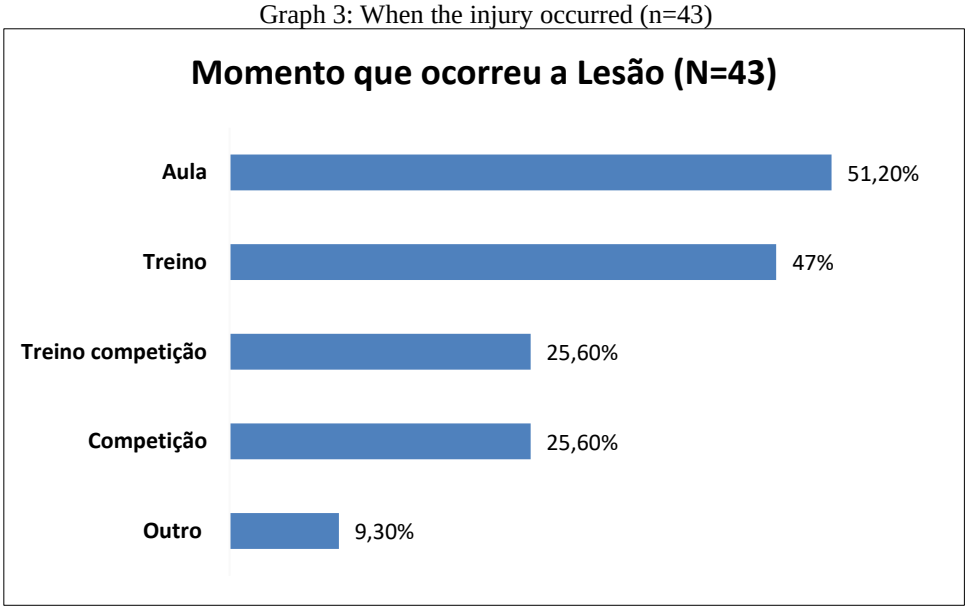
Graph 2: If so, in which part of the body? (n=43)



Source: data obtained from the responses of the survey participants.

The moments in which injuries occurred most frequently were: class (51.2%) and training (47%), but it is worth mentioning that specific training for competitions and the moment of competition also proved to be favorable moments for injuries, both with 25.6% (Graph 3).

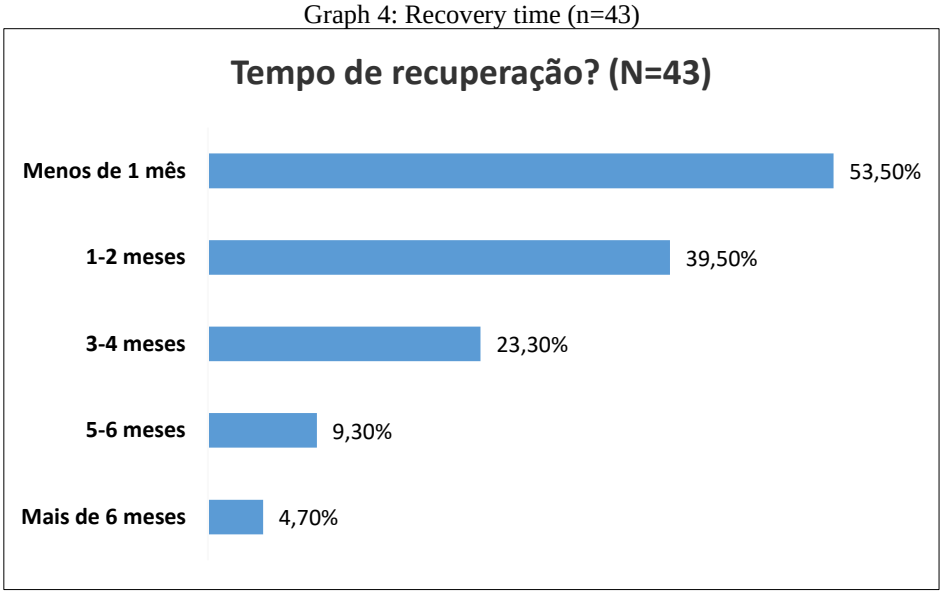
Graph 3: When the injury occurred (n=43)



Source: data obtained from the responses of the survey participants.

Regarding the recovery time for the injuries (Graph 4), the results showed a rapid recovery, between less than 1 month (53.50%) and 1 to 2 months (39.50%), which indicates that the injuries affected were not mostly more severe and did not require prolonged treatments. Injuries, supposedly more severe and requiring more than six months of recovery, occurred less frequently (4.70%).

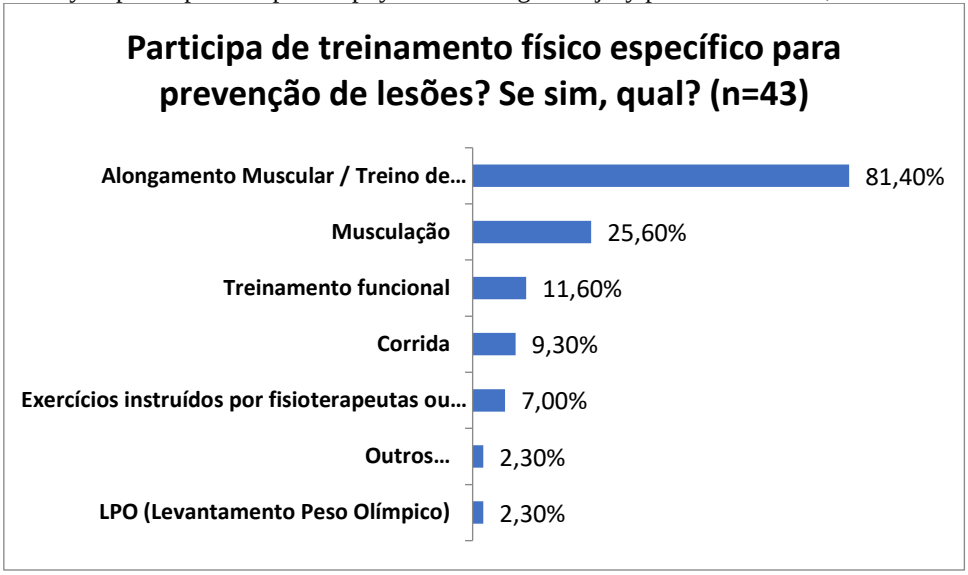
Graph 4: Recovery time (n=43)



Source: data obtained from the responses of the survey participants.

When asked if they had any specific training for injury prevention, 63.2% (43) of the participants answered positively to the question (Table 1). These indicated that the most performed training was the practice of stretching and flexibility training (81.4%), followed by bodybuilding (25.6%) and functional training (11.6%) as preventive actions for injuries in the practice of karate (Graph 5).

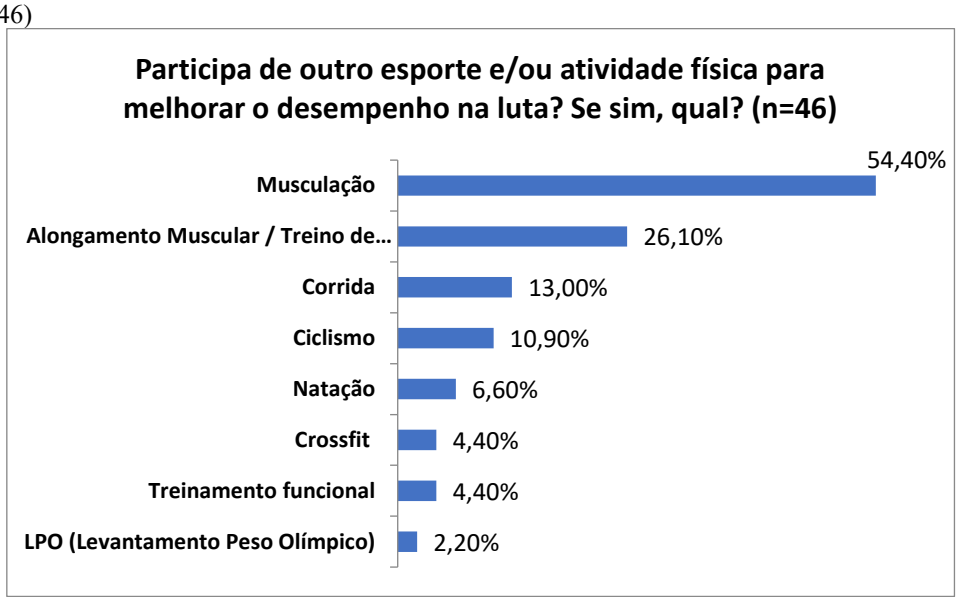
Graph 5: Do you participate in specific physical training for injury prevention? If so, which one? (n=43)



Source: data obtained from the responses of the survey participants.

Finally, the results also showed that 67.6% of the participants surveyed practice another sport and/or physical activity (PA) as a strategy to improve performance in fighting. The main sports/PA mentioned were Weight Training (54.4%), followed by Stretching and Flexibility Training (26.1%) and Running (13.0%) (Graph 6).

Graph 6: Do you participate in another sport and/or physical activity to improve your performance in fighting? If so, which one? (n=46)



Source: data obtained from the responses of the survey participants.

DISCUSSION OF RESULTS

This study aimed to verify the association between sociodemographic factors and the practice of the modality with the occurrence of injuries in karate practitioners in the state of Maranhão, Brazil.

The results showed that the sociodemographic variables were not associated with the occurrence of injuries in the practitioners investigated in the practice of the modality. However, it is worth noting that in relation to gender, the results showed a greater emphasis on male practitioners for those who suffered injuries to the detriment of those who did not. These results are in line with the research carried out with athletes aged 16 to 20 participating in four world championships of the modality where the results showed that the injury rate was lower for female athletes (Cierna *et al*., 2018), as well as with the results of the research carried out with athletes participating in Swiss tournaments of the modality that showed that older male athletes had a higher risk of injury than women in the same age group (Rosso *et al*., 2023).

Practitioners aged 30 years or older also showed greater emphasis on injury involvement. This fact is probably related to the time of training and to the age itself in the face of the arduous training of the modality and are in line with the studies carried out by Almeida; Araújo (2020) with elite karate athletes who showed a higher prevalence of injuries in experienced athletes over inexperienced ones and by Rosso *et al*. (2023) found that older athletes of both sexes had a higher rate of injuries than younger participants in Swiss karate tournaments.

Regarding the possible association between the variables related to the practice of the modality with the occurrence or not of injuries, the results showed that there was no association with the fact that the investigated were in the role of teacher/master or practitioner/student, as well as the

variables time of training and experience in the modality, time of the class / training, practice of another LAMEC and whether the respondent participates in any type of specific injury prevention training.

However, it is noted that participants who reported practicing another fighting modality and participating in preventive training had a greater emphasis on injury involvement than those who did not suffer injuries in the practice of the modality. This result draws attention to the importance of well-planned practices and training programs aimed at the prevention of sports injuries, especially in combat sports modalities.

If, on the one hand, there are more and more strategies that seek to reduce the incidence of injuries and concern for the physical integrity of LAMEC practitioners, such as changing sports rules, using protective equipment, more weight divisions, use of technologies, greater training of the refereeing team, among others (Štyriak *et al*., 2023). In the literature, there is an advocacy for training programs such as weight training for the prevention of injuries in fighting modalities (Delavier; Gundill, 2015), as well as, although controversial, the use of stretching for the prevention of injuries in sports (Alencar *et al*., 2010). It is noteworthy that approximately 81% of the participants in this study pointed out stretching and flexibility training and then weight training (26%) as the main injury prevention practices in their routines.

In this investigation, the results showed an association between the occurrence of injuries with participation in competitions, the weekly frequency of training and the practice of another sport/physical activity to improve fight performance.

Karate currently has a significant number of competitions at regional, national and international levels. Its practice with competitive objectives requires a greater commitment of the athlete in more focused and exhaustive training, a greater load of training frequency, participation in competitions that, consequently, combined with other aspects, favor the possibility of occurrence of injuries in the athletes' routine.

The results of this investigation showed that practitioners who participate in competitions and have a frequency of training of more than three workouts/week had a higher prevalence of injuries in the practice of the modality. A recent systematic review on ECM injuries found that injuries occurred more frequently in competitions, with the exception of athletes under 18 years of age, who occurred more frequently in training (Živković *et al*., 2024).

The practice of the modality, even if it is only recreational and non-competitive, still involves the routine of classes and training with physical contact. This investigation showed that the moments of Class and Training were the most pointed out by the participants as the moments that most injuries occurred, followed by the specific training for competition and the Competition itself. Moura; Silva; Alonso (2011) in research with elite karate athletes found a predominance of injuries that occurred in

training in relation to competitions, results that are in line with an investigation carried out with practitioners of the sport in Portugal that found that 83% of injuries happened during training (Vencesbrito *et al*., 2016).

The fact is that for competitive purposes or not, due to the martial principles of the modality, the routine of classes and training become strenuous moments that require time and energy from the practitioner that, combined with other aspects, can be associated with the occurrence of injuries.

The involvement of injuries is always a relevant topic to be investigated, considering that it can impact the practitioner's participation in the modality, such as the time away from the modality for recovery, their performance and, essentially, in their life routine and well-being, among other aspects.

The results of this research showed that approximately 64% of the participants surveyed have already been involved in the practice of Karate. These results are similar to the research with Portuguese athletes who evidenced the involvement of one or more injuries in 53% of the respondents (Vencesbrito *et al*., 2016). On the other hand, a study carried out with Brazilian Shotokan Karate athletes showed that approximately 89% had already presented some type of injury, similarto the results of Ambrozy *et al*. (2015) and Peeri *et al*. (2011) which, respectively, showed an injury prevalence of approximately 92% with Polish athletes and 83% with Iranian male athletes. There is a discrepancy between the results of the prevalence of injuries that may arise from data collection procedures, interpretations, as well as important variables such as athletes and/or recreational practitioners, among other aspects.

Regarding the main types of injuries suffered, contusion and dislocation were the types most reported by the participants in this investigation. Concussion was also the most reported type of injury in two Systematic Reviews conducted on the theme of injuries in the modality in question (Thomas; Ornstein, 2018; Lystad; Augustovičová; Harris, 2020) and in research with athletes participating in four world championships (Cierna *et al*., 2018). It is noteworthy that the practice of Karate requires continuous and direct contact through blows and blocks and, as much as the use of protective equipment is increasingly required in competitions, probably, the format of the score in competitions stimulates the application of blows with a lot of energy that, sometimes, makes it possible to affect injuries due to injury.

Combat Sports are characterized by the diversity of the way in which they employ their attack and defense movements. Specific motor gestures can characterize the types of lesions as previously seen, as well as discriminate the anatomical regions of the body most affected by the lesions in their practitioners. In its martial essence, Karate uses punches, kicks and blocks as attack and defense techniques in which it aims at combat and self-defense only using one's own body. In its sporting dimension, in a nutshell, the modality defines two different styles: Kata and Kumite (Costa, 2023).

Kata is characterized by non-direct physical contact and the athlete (s) performs sequences of attack and defense movements in a harmonious way with technique and agility, also receiving the designation of "imaginary fight". Kumite is characterized by combat itself and requires direct contact between opponents using attack and defense techniques.

Regarding the regions of the body most affected by injuries, this research found that Knees and Wrists/Hands and feet were the most pointed out by the participants surveyed. These results are partially similar to the investigation carried out with athletes participating in the 2014 World Championships, which showed the knees as the region most affected by Kata and Kumite style competitors, followed by the shoulders (Kata) and ankles for Kumite style competitors (Tischer *et al*., 2016). The knees and ankles were also the regions most pointed out by Portuguese athletes in a study carried out by Vencesbrito *et al*. (2016) and Hands/Fingers and Fists with Brazilian Shotokan Karate athletes (Souza *et al., 2011).*

However, other research carried out on the topic (Rosso *et al*., 2023; Lystad; Augustovičová; Harris, 2020; Cierna *et al*., 2018; Thomas; Ornstein, 2018) pointed to the head as the region most affected by injuries. According to Lystad; Augustovičová; Harris (2020) It is no surprise that the head is the region most affected by injuries, considering that the head is the place where the most points are scored in the sports dimension of the modality, essentially in Kumite-style competitors.

In this investigation, the majority (53.5%) of the participants surveyed reported that the injuries had a recovery time of up to 30 days, which leads us to the understanding of less serious injuries, implying a shorter recovery time and return to the practice of the modality. These results are consistent with the studies by Vencesbrito *et al*. (2016) with Portuguese athletes who had an interruption in practice due to injuries of 8 to 21 days.

Also from this perspective, Rosso *et al*. (2023) despite the high incidence of injuries with athletes participating in competitions in Switzerland, found that injuries in all age groups were less severe, as well as the Lystad investigation; Augustovičová; Harris (2020) with athletes of the Olympic-style Karate modality that evidenced that most of the injuries were of the lighter category, also indicating that, in his investigation, the systems for categorizing the severity of injuries were based on the time lost from participation after the injury, nature, type and injury or need for referral to the hospital, or some combination of the above.

This investigation contains some limitations, such as the transversality of the nature of the study, i.e., it does not allow the delimitation of cause and effect between the variables. Another aspect is that the lesions and types pointed out by the participants were collected via perception and retrospectively, that is, they were not objectively evaluated. However, the originality factor of the investigation with practitioners of Combat Sports Modalities and, in particular, Karate, in the state of Maranhão, Brazil, is highlighted.

CONCLUSIONS

The results of this investigation pointed to a considerable prevalence of injuries in Karate practitioners, data that are in line with the literature on the subject in Combat Sports Modalities.

There was no evidence of an association between the occurrence or not of injuries and sociodemographic variables such as gender, age group, level of education and monthly family income, as well as in variables related to the practice of the modality, status in the modality, time of experience/training in the modality, time of class/training, practice of another MEC and participation in some specific training for the prevention of injuries.

On the other hand, there was an association between the occurrence of injuries and participation in competitions, the weekly frequency of training/classes and whether the practitioner participates in another sport/physical activity to improve the performance of the fight. These results draw attention to the importance of load, frequency and intensity of training with competitive objectives in the prevention of possible injuries.

Concussion and dislocation were the most frequently reported types, and knees – wrists/hands were the most affected regions of the body by injuries. Despite the rate pointed out in this investigation, the injuries were less severe, implying a shorter recovery and rehabilitation time and return to the practice of the modality.

It is important to carry out further research on this topic, including the use of other instruments and objective data to expand knowledge and evidence in order to prevent and minimize the involvement of injuries and, consequently, a healthier and longer-lasting practice of the modality.

CONFLICT OF INTEREST

All authors declare that they have no conflict of interest, be it financial, intellectual, collaboration, participation, or of any kind.

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Mental health challenges of prison officers

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ABSTRACT

This study highlights the importance of analyzing the mental health of criminal police officers, addressing the challenges they face in the work environment on a daily basis. The role of correctional officers requires dealing with various challenging situations within the prison system, where they face confrontations with the irregular or criminal conduct of inmates. They are responsible for ensuring the safety of colleagues and the inmates themselves, often putting their own lives at risk. This work goes beyond the simple fulfillment of daily tasks, requiring a constant state of alertness, even in moments of rest. Challenges faced include resolving difficult situations and dealing with the unpredictability of the prison environment. In addition, correctional officers face the emotional stress associated with violence, the possibility of confrontation with violent inmates, and even the death of colleagues. These factors contribute to a high-risk work environment, where the need to make difficult decisions is constant and can significantly impact your mental health, which directly reflects on your professional, social, and family life. The aim of this approach was to enable a more complete and holistic understanding of the mental health of criminal police officers, providing ideas for the development of more effective support policies and programmes tailored to the specific needs of these professionals.

Keywords: Mental health, Criminal police officers, Challenges, Prison environment, Work.

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INTRODUCTION

Mental health is fundamental to human well-being, affecting all aspects of professional, social, and family life. However, in certain professions, such as police officers, the challenges associated with mental health often go unnoticed. Correctional officers play a crucial role in maintaining order and security within the prison system, facing challenging environments, high-stress situations, and complex interactions with inmates on a daily basis.

Correctional officers regularly face a range of stressful situations, from physical confrontations to the management of individuals with mental disorders. These challenges can have serious impacts on mental health, including chronic stress, anxiety, depression, burnout, and even post-traumatic stress disorder (PTSD). Constant exposure to high-stress situations and the unpredictable and sometimes violent nature of the work environment contribute to a significant emotional burden for these professionals, which can result in adverse consequences for their mental health.

In addition, occupational stress not only has deleterious effects on the human body, it can also negatively affect worker efficiency and job satisfaction (World Health Organization [WHO], 2011; Santana & Santana, 2011). High levels of stress at work can decrease job satisfaction. Chronic stress can result in burnout, lack of motivation, disengagement, and feelings of hopelessness about work. This can lead to a decrease in job satisfaction and an increased risk of *burnout*.

Stress can have a significant impact on a person's social and family life, taking a toll on their relationships and quality of life. One of the ways this can happen is by reducing the quality of time spent with family and friends due to physical and mental exhaustion caused by stress. Additionally, irritability and lack of patience associated with stress can make it difficult to cope with social and family demands, leading to conflict and arguments in relationships.

While awareness of the importance of mental health is increasing in many professions, correctional officers often face significant barriers to seeking help. Stigma, organizational culture, and lack of adequate resources are just some of the obstacles that can prevent correctional officers from seeking support for their mental health issues.

In this article, we will take a closer look at the factors that contribute to the mental health of correctional officers, including the impact of the work environment, the demands of the profession, and the resources available to support psychological well-being. Additionally, we will discuss potential strategies to foster a culture of mental health within prison institutions and provide effective support to correctional officers facing psychological challenges.

Through this analysis, we hope to highlight the critical importance of addressing the mental health issues of correctional officers and provide valuable insights into how to improve the support and psychological well-being of these essential professionals.

DEVELOPMENT

The professional called Criminal Police Officer, formerly known as Prison Agent or Inspector, plays a fundamental role in maintaining order and discipline both within prison units and in their surroundings.

The role of the Penitentiary Officer is of great importance in a Democratic State of Law, because in addition to guarding prison institutions and ensuring the safety of society, they also have the responsibility of preserving the physical integrity of inmates and seeking their resocialization (BRASIL, 2003).

In Brazil, Penitentiary Officers are linked to the State Secretariats of Penitentiary Administration, and access to the career occurs through state or federal public examinations.

In Minas Gerais, the creation of the career of the Penitentiary Officer was established by State Law No. 14,695/2003, which defines their competencies, including ensuring order and security within penal establishments, carrying out escort and custody activities of prisoners, and performing functions of both internal and external surveillance in prison establishments, including in walls and guardhouses (BRASIL, 2003).

In Brazil, as of December 2019, with the enactment of constitutional amendment 104, the title of prison officer was changed to criminal police officer (BRASIL, 2019). With this change, correctional officers have been equated with police officers, although their duties remain specific. According to Silva (2019), the criminal police officer is the professional in charge of ensuring the organization, discipline, and security within prisons, in addition to being responsible for assisting in the resocialization of inmates.

The introduction of the Criminal Police into Brazilian society marks a significant change in the way professionals in charge of security in prison systems are recognized and designated. Formerly known as correctional officers, often stigmatized with the term "jailers" by the ancients, these professionals face unique challenges that affect not only their mental health but also their overall well-being (SILVA, ALENCAR, 2023).

The mental health of prison officers in the Brazilian prison system is a topic of increasing importance, considering the extreme challenges and adverse working conditions faced by these professionals.

Bezerra, Assis and Constantino (2016) highlight that the prison environment is intrinsically stressful, characterized by a series of factors such as overcrowding, violence, lack of resources and inadequate infrastructure conditions. These factors contribute to high levels of stress and psychological distress among agents, manifesting in symptoms of anxiety, depression, and *burnout*. Psychological distress is not only an individual issue, but an occupational health problem that requires structural and institutional interventions to be effectively mitigated.

Matheus (2018) analyzes the penal system from the perspective of prison officers. Using a qualitative approach, it explores the perceptions and experiences of agents in relation to their working conditions and the challenges faced in daily prison life. Agents report feelings of insecurity, professional devaluation and work overload. These feelings are exacerbated by constant exposure to situations of conflict and violence, as well as a lack of adequate institutional support. These factors not only affect the mental health of officers, but also compromise the effectiveness of the prison system as a whole.

Scartazzini and Borges (2018) examine the psychosocial condition of prison officers and the impacts of prison work on the mental health of these professionals. The study addresses how the prison work environment, characterized by social isolation, low pay and lack of recognition, contributes to the development of psychosocial problems. Officers often face a moral dilemma, balancing the need to maintain order and security with the pressure to treat detainees humanely. This dilemma can lead to high levels of stress and emotional distress, as well as negatively affect agents' personal lives and social relationships.

Structured interventions are needed to improve the mental health of correctional officers. Some studies suggest the implementation of psychological support programs and training in stress management skills, others emphasize the need for institutional policies that value correctional officers and improve working conditions, and propose psychosocial interventions that address both the individual and collective well-being of officers. These interventions should be integrated into a broader occupational health policy, which includes ongoing psychological support, improvements in working conditions, and professional recognition (LIPP *et al.*, 2017).

The mental health challenges of prison officers in the Brazilian prison system are multifaceted and require an integrated approach that combines psychological support, better working conditions, and institutional policies for professional development. The implementation of such measures is crucial to ensure the mental health and well-being of these workers, reflecting positively on the effectiveness and safety of the prison system (SILVA, ALENCAR, 2023).

FINAL CONSIDERATIONS

The criminal police officer, as a public servant, enjoys economic and functional stability, however, many of them face dissatisfaction and lack of motivation when performing their duties. This is because they are often tasked with tasks that are not aligned with their professional expectations, which can result in the emergence of various symptoms that affect their health, as noted by Stradiotti *et al*. (2019).

According to Siqueira, Silva and Angnes (2017), the role of the criminal police officer is of paramount importance, not limited only to inmates, but encompassing the protection of society as a

whole. However, Scartazinni and Borges (2018) point out that these professionals often do not receive due recognition, as they are often perceived by society as responsible for torture and ill-treatment, in addition to being blamed for escapes and other problems in prison institutions. A study indicated that, due to this negative perception, most criminal police officers do not feel proud of their profession and, whenever possible, prefer to hide their occupation (MATHEUS, 2018).

Unlike an individual convicted of a crime, who will lose his freedom as punishment and serve part of his sentence in a prison institution, gradually progressing to freedom as established by the Penal Execution Law, number 7,210, of July 11, 1984, the criminal police officer will face, possibly until his retirement, the peculiarities inherent to this condition. These include working in unhealthy, violent, and often unrecognized environments.

The mental health of prison officers in the context of the prison system is a topic of great social relevance, as it directly impacts not only the well-being of these professionals, but also the safety of prison institutions and society in general. The challenges faced by criminal police officers in relation to their mental health have been widely acknowledged, but there are still significant gaps in understanding and addressing these issues.

To perform their function, the criminal police officer is expected to carry out a series of activities, such as managing the execution of sentences of convicts, receiving pretrial detainees, escorting and custodying prisoners, whether they are provisional or with final sentences, and also carrying out external surveillance in the State's prison units, as established by the Penal Execution Law.

Additionally, a lack of energy and motivation caused by stress can lead to a decrease in interest and engagement in social activities, while isolation and withdrawal can make it difficult to establish and maintain positive social connections. These impacts of stress on social and family life can contribute to a cycle of constant tension and worry, negatively affecting the overall well-being of the professional.

Research in this field can provide important answers to the proposed problems by investigating the causes and effects of mental health challenges faced by criminal police officers. Although there is a growing interest and recognition of the importance of the mental health of criminal police officers, the stage of knowledge development on the subject is still limited. There is a lack of comprehensive, long-term research investigating the risk factors, impacts, and intervention best practices related to the mental health of these professionals.

In addition, the research has the potential to suggest significant modifications in the scope of the reality proposed by the theme. It can influence policies and practices within prison institutions, promoting a culture of support for the mental health of prison officers, and may lead to the implementation of more effective intervention and prevention programs, aiming to improve the well-

being of these professionals and, consequently, the safety and efficiency of the prison system as a whole.

Therefore, investigating the mental health challenges of prison police officers is essential not only for the care of these professionals, but also to promote a healthier, safer, and more productive work environment within prison institutions, contributing to a more just and equitable society.

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Reverberation of the psychologist's performance in relation to cancer patients

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ABSTRACT

The present work addresses the importance of the work of the Oncology Psychologist with cancer patients and their families. The discovery of cancer inevitably causes suffering both to the patient and to those close to him, such as family and friends. In this context, the Oncology Psychologist acts as a link between the patient and his or her living environment. This study was carried out through bibliographic and exploratory searches on online platforms, searching for the most recent articles on the subject. The research brought an updated perspective on the teaching methodology in Oncological Psychology. In addition, the work highlights Quality of Life (QoL) as the individual's perception of cultural, social, political and economic influences in the context of their life, and how these factors impact their goals, projects and expectations, giving them opportunities for choices and reflecting their satisfaction with life. It can be concluded that, about palliative therapies and treatments, there was an increase in patients' expectations, even in moments of crisis and doubt. During the therapeutic period, it was possible to maintain hope, and in many cases, there was success. The therapeutic sessions were well accepted and reinforcing.

Keywords: Psychologist-Oncology Performance, Mental Health, Psycho-oncology.

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INTRODUCTION

The diagnosis of cancer often results in a significant emotional imbalance in the family, due to disbelief in a possible cure. This moment is painful for everyone involved, causing changes that generate emotional conflicts and fear for what is to come. The discovery of cancer affects the entire family, causing feelings of guilt and distress, in addition to interfering with the physical and emotional behavior of those involved in care. This leads to changes in the daily routine, where each member must take on new roles, facing financial concerns and other problems.

The present study aims to demonstrate the relevance of the role of the oncologist psychologist in the support of cancer patients. This professional facilitates dialogue and coexistence between the patient and their caregivers or family members, promoting the mental and emotional health of the people involved. According to Carvalho (1994), the oncologist is the specialist physician who works in a multidisciplinary team with psychologists, nurses and other health professionals, and psychological support is crucial in this context.

According to Ângelo, Moreira and Rodrigues (2002), the impacts of cancer treatment require each family member to develop skills to mediate conflicts related to hospitalization, especially in the physical, psychosocial and financial aspects. Yamagushi (1994) defines oncology as the science that studies cancer, its characteristics, location and progression, as well as treatment modalities.

The clinical oncologist is the physician responsible for the clinical aspects, and the multidisciplinary team includes radiation therapists, psychologists, and oncology surgeons. The inclusion of the psychologist in the oncology team occurred after the publication of Ordinance No. 3,535 of the Ministry of Health on 10/14/1998.

Cancer is a set of pathologies characterized by alterations in cell division, resulting in abnormal and rapid cell growth (Franks, 1990). The National Cancer Institute (INCA) highlights that cancer is a global public health problem, being the second leading cause of death from disease in the world, responsible for 6 million deaths annually (INCA, 2000).

In Brazil, cancer is also the second leading cause of death, accounting for almost 11% of deaths in 1994, with more than 95,000 deaths.

This work is based on a bibliographic survey on theories and studies in the field of psycho-oncology. Psychosomatic medicine, which deals with the relationship between emotional states and somatic symptoms, is fundamental to understand the interactions between "social, psychological, biological and physiological functions, as well as the development of various physical diseases" (LIPOWSKI, 1986, apud CARVALHO, 2003).

Veit and Carvalho (2010) point out that:

> "Psycho-Oncology, an area of intersection between Psychology and Oncology, is responsible for the study of the psychological and behavioral variables involved in the process of illness and cure and the interventions throughout it." (p. 528).

Psycho-oncology addresses the interface between the cancer patient, their family, and caregivers, working together to make pain more bearable and provide comfort during treatment. It is important to mention the main types of cancer, such as sarcoma, leukemia, and lymphomas, each with its specificities.

INCA (2022) points out that cancer affects a large number of people, presenting difficulties in interventions. Cancer development occurs in multiple stages over time, with early detection being crucial to increase the chances of cure. Preventive measures, such as not smoking, maintaining a healthy diet, practicing physical activity, and performing preventive exams, are essential to reduce the incidence of cancer.

The emotional state of cancer patients is fundamental, as they face fear, anguish, and suffering when dealing with the disease and treatment. Veit and Carvalho (2010) state that:

> "Fear of cancer has important consequences. Among them, the distancing of the possibility of early diagnosis. Today we know that early diagnosis and adequate immediate intervention are decisive elements that define the prognosis of the disease. In many cases, they represent the differential for healing." (p. 527).

The World Health Organization (WHO) defines palliative care as an active and total approach to patients whose disease no longer responds to curative treatment, aiming to improve the quality of life of patients and their families. Early detection of cancer and the implementation of preventive measures are key to better treatment outcomes. The oncologist psychologist, aligned with the principles of palliative care, and the multidisciplinary team are essential to provide harmonious care that addresses the physical, psychological and spiritual aspects of the patient.

METHODOLOGY

The development of this work took place through research with bibliographic procedures and exploratory in online platforms of topics relevant to the subject. The search for articles was the most recent possible, where it can bring a perspective of the teaching methodology in Oncological Psychology.

Exploratory research aims to provide greater familiarity with the problem. According to Gil (2008). It may involve a literature review, interviews with people experienced in the researched problem. Generally, it takes the form of literature research and case study.

As stated by Marconi and Lakatos (1992), bibliographic research is the investigation of all the bibliography that has already been published, such as books, magazines, independent publications, articles and articles. Its objective is to make the researcher enter into communication with all the material dissertation on the given subject, helping the author or scientist in the analysis of their

research or in the exercise of their information. This makes it easier for the researcher to carry out his or her task in the face of these researches.

ASSISTANCE TO PATIENTS UNDERGOING CANCER TREATMENT AND CLINICAL INTERVENTION

Over time, several events and advances in science have contributed to the development of psychology, psychiatry, and medicine around the world. In this context, the insertion of psychologists in hospital environments has become an important alternative to understand human existence and help hospitalized patients.

The work of the Psycho-Oncology professional stands out for requiring specific knowledge not necessary in other areas of care. This professional needs to understand fundamental aspects of cancer and the main forms of treatment to which patients are subjected. Although it is not necessary to master the oncologist's discourse, a basic knowledge of the disease and its treatment modalities is essential.

Each type of cancer, with its characteristics, location, and therapeutic process, causes different reactions in patients. While these reactions are to be expected, how each individual will cope with them depends on variables such as age, socioeconomic class, psychic structure, and personality. These variables influence the patient's ability to endure frustrations and face life's challenges, and are present even before the onset of the disease.

In the context of treatments, the psychologist must be aware of the various side effects, which can generate complex emotional states. An inappropriate interpretation of these states may harm the patient. Therefore, hospital psychology seeks to minimize the suffering caused by hospitalization and prevent possible future emotional sequelae.

Specifically in the treatment of cancer patients, the psychologist's work began in the 1970s, due to the various psychological aspects related to cancer. The reduction of the stigma associated with the disease has allowed significant changes in attitudes towards cancer and its carriers, replacing myths with knowledge and coping tools, such as treatments, self-help groups and psychosocial support.

Psycho-Oncology, as an area of expertise, provides the integration of different health professionals, meeting a worldwide trend of multidisciplinary team formation. These professionals, with their diverse perspectives, enrich patient care. It is common for caregivers to want to keep the patient under their care, but it is necessary for them to learn how to deal with the pain of the other and acquire knowledge about how to provide this care effectively.

In this context, the research found was carried out in the areas of Psychology, Mental Health, Medicine and Nursing, all of which have been recently published. These studies highlight the

importance of the psychologist in supporting cancer patients, emphasizing their role in encouraging and strengthening patients in times of extreme fragility.

Newell et al. (2002) analyzed research on the efficacy of interventions to improve psychological aspects in cancer patients. Among the recommended procedures were unstructured counseling and music therapy. Counseling was shown to be more effective in reducing distress, while group therapy was considered the most appropriate for coping with the disease.

Rehse & Pukrop (2003) presented an interesting fact: the duration of the intervention was the most important moderating variable, and the quality of the relationship between the patient and the psychologist was the best predictor of the success of the intervention. The investment in the creation of a solid bond and a good professional-patient relationship has proven to be a key factor for the success of the therapies used.

Multidisciplinary approaches involving health education and psychological treatment have been shown to be more effective and should be further encouraged. In addition, interventions should take place at shorter intervals of time, as this frequency has shown very satisfactory results.

The main focus of the thematic analysis was the importance of the work of the oncology psychologist. This professional acts as a bridge between cancer patients and their caregivers, taking care of the mental and emotional health of the people directly involved with the patients. This role is fundamental during treatment, both for patients and their caregivers, as both need to walk together, committed, in the hope of achieving satisfactory results. This care is extremely relevant for the well-being of patients and people involved in the process.

PALLIATIVE CARE

Palliative care aims to improve the quality of life for patients facing life-threatening illnesses. This is achieved through interventions aimed at relieving pain and other physical, psychological, social, and spiritual symptoms. The WHO Study Group on Quality of Life defines Quality of Life (QoL) as the individual's perception of cultural, social, political and economic influences in the context of their life, which affect their goals, projects and expectations, providing them with opportunities for choice and reflecting their satisfaction with life. In this context, scholars recognize health as an important and determining factor, using the term Health-Related Quality of Life (HRQoL).

Patients in palliative care face great psychological stress, stemming from uncontrolled physical symptoms, fear of death, family apprehensions, spiritual distress, and psychiatric issues. This suffering can be reduced with psychosocial and multidisciplinary interventions.

The family plays a significant role in the individual's health due to its proximity and coexistence, contributing to the monitoring of the health and disease process, and thus deserving the

attention of health professionals (Rabello & Rodrigues, 2010). It is common for a family member to take responsibility for the care of loved ones. The family environment can facilitate the treatment of patients beyond therapeutic possibilities, promoting altruistic and responsible relationships (Soares, 2000).

Hermes and Lamarca (2013) highlight the importance of the family's active participation in palliative care, since they are the patient's first caregivers during illness. The family's experiences and the patient's knowledge of life significantly influence therapeutic decisions.

Kovács emphasizes the importance of communication in palliative care. According to the author, effective, harmonious communication centered on the patient's needs can contribute significantly to the control of physical discomfort, minimizing the suffering of patients and families.

This communication involves not only informing but also listening attentively, paying attention to what is said and how it is said, including facial expressions, gestures, and feelings. This becomes challenging when you don't dedicate the necessary time. It is, therefore, about being an empathetic presence in the pain of the other, and not just about transmitting information.

CONCLUSION

It is impossible not to notice the pain, fear and anguish of cancer patients. Difficult days and changes in daily life and family dynamics are inevitable, and these adaptations require a lot of strength, both from the patient and the family, to restore stability and balance in the face of the disease.

It is notorious that illness reflects on the family nucleus, given that the family plays a major role in this fragile and delicate process. The initial shock of the disease can transform the family into a source of support for the sick relative, combining the individual aptitude of each member to cope with cancer.

The family plays important roles in this situation, helping to care for the patient and receiving care from health teams. The pain felt by the families of cancer patients, as well as by other people directly connected to the patient, is understandable, since they need to give strength to their loved ones to fight the disease. This study expands the knowledge and understanding of pain in the palliative care treatment of cancer patients.

The authors state that both the care team and the patient's individual caregiver face situations of anguish, helplessness, frustration and impotence. It is important to consider their needs and demands. In view of the possible psychological damage resulting from the care of cancer patients, professionals and individual caregivers are subject to the development of psychopathological disorders and professional burnout. Therefore, they also need psychological assistance to ensure the

maintenance of good psychological conditions and avoid emotional impacts resulting from the care of these patients.

It is concluded that people directly linked to the patient, whether family caregivers or not, become fundamental allies in the palliative care process. They can be considered as a care unit together with the patient by the oncology team, as they also need support from health professionals.

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Vascular accesses and infusional therapy: An experience report

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ABSTRACT

Introduction: The practice of intravenous infusion is necessary worldwide, benefiting millions of individuals daily in health recovery interventions at all levels of care (GORSKI et al, 2021). The opportunity to carry out the supervised practices of vascular access and infusion therapy, in a hospital environment that has an exclusive and specialized service for the evaluation of venous catheters and conditions for performing infusion therapy, with trained professionals and state-of-the-art material resources, adds value in the formation of knowledge, enabling the student to know a specific service for this purpose. contributing directly to the training of a differentiated professional. Objective: To report the experience and activities developed in the Vascular Access and Infusion Therapy Team of a Hospital Complex. Methodology: This is a Qualitative Research, with a descriptive approach, of the experience report type. The study was developed during the supervised post-graduate internship practices, in a Vascular Access and Infusion Therapy Team, of a hospital complex in Southern Brazil, carried out from February to June 2022. The team has clinical nurses and a supervising nurse, these trained professionals are responsible for care practices related to vascular catheters and infusion therapy throughout the institution. Results: During the period of supervised practices, several activities studied in the theoretical contents were transposed to practice, dialoguing with multiprofessional knowledge, allowing the construction of unified theoretical/practical knowledge, such as: Inspection of puncture sites, catheter stabilization investigations and corrections, care such as evaluation of dressing conditions, signs of complications in puncture sites and catheters, identification of dressings and validity of devices, among others. Final Considerations: When we perform our nursing actions, we naturally draw parallels between the realities of the known environments, referring to questions and the search for information that improves our care, that elevates nursing care, making it possible to level or seek to replicate positive experiences, searching for more appropriate resources, even if, many times, the realities of some services provoke feelings of utopia. The understanding of the functioning of a Venous Access Team, of the possibilities of implementing this specialized service, motivates the search for improvements in our daily care, considering that it is possible to build a team capable of meeting this need, conquering its professional space through statistical data and daily samples of productivity and relevance to health. Contributions/Implications for Nursing/Health: The experience in the Vascular and Infusion Therapy Team allowed me to observe and reflect on issues such as possibilities of improvement in some nursing processes in my own work environment, from the availability of materials that can be better managed between nursing services and pharmacy/warehouse, reducing waste of supplies and generating financial savings to the institution, as well as perspectives for planning the time spent on processes.

Keywords: Intravenous infusions, Vascular Access Devices, Patient Safety, Central Venous Catheters.

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INTRODUCTION

The practice of intravenous infusion is necessary worldwide, benefiting millions of individuals daily andin interventions for health recovery at all levels oftention (GORSKI et al, 2021).

The opportunity to carry out supervised vasculartreatment and infusional therapy in a hospital environment that has aspecialized and exclusive service for theevaluation of venous catheters and conditions for carrying out infusional therapy, with trained professionals and material resources of point, adds value in the formation of knowledge, enabling the student toknow a specific service for this contributing directly to the training of a distinguished professional.

By experiencingthis reality, it is possibleto draw abalance between theconcepts learned andthe classroomwith the experiences in the field oftuation. Based onthis assumption, the objective is to report theexperience and activities developed in a Vascular Access and Infusional Therapy Team of a Hospital Complex in the South of Brazil, inherent tothe Supervised Practices of the Specialization course in Vascular Accesses and IFusion Therapy, held from 02/19 to 06/17, 2022.

The hospital complex has 9 hospitals ofvarious specialties such as: medical, surgical and maternal-infant clinics; reference in cardiology; in neurology and neurosurgery; in clinical pulmonology, thoracic surgery, and chest radiology ; inoncology; andm Pediatrics; It has an exclusive center fortransplants, maternity and women's center.

The Vascular Access and Ifusional Therapy Team has its physical structure located in a room on the 3rd floor of the Hospital of one of the hospitals in the hospital complex, with an equipe of 14 care nurses and 1supervisor nurse. These trained professionals are responsible for care practices related to vascular catheters and infusional therapythroughout the institution.

The project of the Vascular Access and Ifusional Therapy Team of the institution began on 08/03/2015, and became a Basic Management Unit (UGB) in the entity on 05/01/2016.

METHODOLOGY

This is a Qualitative Research, with a descriptive approach, of the experience report type. The study was developed during the supervised post-graduate internship practices, in a Vascular Access and Infusion Therapy Team, of a hospital complex in Southern Brazil, carried out from February to June 2022. The team has clinical nurses and a supervising nurse, these trained professionals are responsible for care practices related to vascular catheters and infusion therapy throughout the institution.

The experience in the Access Team allowed me to observe and reflect on issues such as possibilities ofimprovement insome processes ofference in my own work environment, from the availability of materials that can be used in the field of This can be better managed between nursing and pharmacy/warehouse services, reducing waste ofinputs and generating financial savings for the

institution, as well as perspectives of time planningspent on processes.

One of the resources used bythe Team in the management of time andprocesses is through the Trello application, which interconnects the work of all the nurses in the Team, based onthe requests Thetrend of the hospitals' nursing equipment through theTasy program used in the institution, and both the app and the program are simultaneously and constantly fed according to the sequence of trends evaluated by the Team.

Multiprofessional interaction isintrinsically felt in the exercise ofnursing and this spaceof e-stagion becomes notorious as we develop a work that dialogues with different professionals during its stages ofand evolution.

The request for intravenous access is an example of a work process thatrequires a complementarity between medicine andnursing as a prerequisite from theevaluation of the need for central venous access to the your continuity of treatment by andthis way. The areas of health knowledge are interconnected, andinvolve from thenurse of the responsible sector, to the availability of supplies by the pharmacy, to the release of thedevice for use, according to the analysis performed by the radiology service , to verify the positioning of the central catheter, building a dynamic and cyclical care.

During the period of the supervised practices, severalactivities studied in the theoretical contents were transposed to the practice, allowing the construction of unified theoretical/practical knowledge, such as: Inspection of puncture sites, Investigations and corrections of catheter stabilization , care such as evaluation ofthe condition of the dressing, signs of complications at the puncture sites and catheters, identification of dressings and validity of devices, amongothers.

Among thepractices experienced, I elucidate the analysis of the functioning of the venous devices and theverification of the real need for their maintenance, performing a clinical case study of the patient andtherapeutic plan, as well as Possibility of recovery of the access route anddefinition of the use of the clearance threshold as indicated.

These and other actionsenrich the work ofconnomy of hospital resources and thepreservation of the venous network of the patients. Another example of activity observedduring the period ofe-stagion was theimplementation of the thyroid colon with Alteplase in the central venous catheters inneonate, paediatric and advent patients, whichonly a In the context of the cost of the medication used, the Team evidenced through scientific articles, results andstatistics of care, recording the cost-benefit.

The experience in the internship field allowed me to perform venipunctures that are difficult to access with the aid of a user; difficult venipunctures with the use of a vein viewer VEIN viewer; insertionof PICC catheters with the use of US and guided bythe Sherlock tool, whichindicates whether the catheter is inthe correct direction, at the same time.heart, requesting anevaluation of the

cardiac tracing, which showed malpositioning of the chordwith the undulation of the P wave.

During the practices, I performed venous cess dressings with the use of a CHG plate and sealing of catheters with Tauloridin, blood collection for laboratory tests in patients with difficult access, I observed theevaluation and procedure of Hypodermoclysis; Thebservei and assisted in Prescriptions of materials for puncture and dressing procedures; I participated in theelaboration of records such as evolutions, notifications, planning ofappointments; I participated in nursing procedures for the entire populationtended by the Team (neonate, pediatric, adult and elderly), such as: difficult venipunctures ; US-guided PICC ; venous access dressings.

Some experiences stand out inour memory, andthey can be associated with personal singularities, andthese touch us in a unique way, referring to whatconsiderations, reflections on care, on the roleof nursing and where it can beWe would improve the process of caring, becomingmore and more qualified professionals without the loss of ouressence.

On one of the days of thesupervised curricular practice, there was a request for the evaluation of the conditions of venousaccess to an elderly patient, who was in the emergency sector and was considered to be difficult to access venous.

We evaluated the patient's path , history, medical and nursing evolutions, preventive exams and therapeutic plan, and observed that there wasa record that the patient had a range oforientation, mental confusion and aggressivenesstag.

When we arrived at the sector, in the midst of the scenario of multiple visual information that is already expected from a health care sector, with its service capacity filled, we talked to thenurse of the sector, identified our patient, the patient who was in the hospital.He was on astretcher, and when we went to him andthey foundthat he was crying, groaning, communicating verbally, complaining about the way he wasbeing restrained and cold.

The elderly man was inadequately restrained , lying on the upper limb, twisted backwards, which had an extensivehematoma from his hand, progressing to theupper limb. This arm contained acompressive wound that would have been caused bythe elderly man himself tearing off aperipheral venous access from this limb.

At that time, this patient needed more attentive care, better bed accommodation , and presentsupervision. We accommodate the elderly, cover them with a blanket, offering better comfort, explain theprecedence, calming the measure of thepossibility.

We evaluated the patient'slower limb, noticed multiple hematomas and aweakened venous network as a result ofclinical quadri ro and advanced age, we used ultrasound, and peripheral venous access was not indicated for this patient under these conditions. We informed the physician in charge of the patient and she requested puncture andjugular, but thenurse of the Vascular Access Team argued that this would not be an adequate solution to the planned therapy, and it was

notappropriate for the patient.a long-lasting and qualitystroke, suggesting a short-term stroke, with the whole trend subsequently evolving.

The assistance of the Vascular Access Team should have been requested at the right time, as soon asthe patient's clinical condition was observed, providing adequate care, since it would have adopted a specific conduct, aiming at the safety of the patient.speeding up your healing process. This care would inhibit the exhaustion of the venous network of the elderly, avoidmultiple punctures to whichthey were submitted, alert them to the care of fixation and management in thecomplacency of the patient who experienced unnecessary suffering when withdrawing your venous access. The planning ofthe actions is to anticipate the actions, which isa substantial impact on the care of the integrity of the venous network of the patients.

CONCLUSION

When we carry out our nursing actions, we naturally draw parallels between the realities of theknown environments, referring to questions and the supply of information that enhances oursistance, which elevatescare Itis possible to improve orimprove the replication of political experiences, seeking more adequate resources,although the realities ofsome services often evoke feelings of utopia.

The whole period of theoretical classes, andespecially that of the practical classes, was fundamental for the building of knowledge, meaning theexperience built, providing restlessness for the improvement andadequacy of my Nursing assistance in the care of thepreservation of the venous network of patients, which are essential routes for most of the prescribed drug treatments.

The understanding of the functioning of a Venous Access Team , of the possibilities of implementing this specialized service, motivates the search for improvements in our daily tendency, bearing in mind that it is possible to build a team capable of to meet this need, conquering their professional space through statistical data and daily demonstrations of productivityand relevance to health.

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Analysis of bone cement distribution in vertebrae using pedicle screws with and without fenestrations

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ABSTRACT

With the increase in the life expectancy of the population, there are more and more health complications related to aging, such as osteoporosis. Among the complications resulting from osteoporosis, spinal fractures stand out. In some cases, pedicle screws are used to stabilize the spine. However, when screws are inserted into bone weakened due to osteoporosis, proper fixation of the screw may not occur. To reduce this problem, bone cement is injected into the vertebral body as a way to ensure better stabilization of the screws. One of the main complications of this procedure is related to the leakage of cement out of the vertebral body, causing several problems that affect health. The risks of cement leakage could be reduced by using Computational Fluid Dynamics (CFD) to analyze the distribution of bone cement in the vertebra. Thus, the objective of this research is to evaluate, by means of CFD, the fluid dynamic behavior of PMMA-based bone cement injection into vertebrae through pedicle screws with and without fenestrations. To study the cement flow inside the vertebra, a commercial software was used . The factors influencing the distribution of bone cement were evaluated and compared with results reported in the literature, showing good agreement with each other. The numerical results indicate that the use of fenestrated pedicle screws can improve screw stability and reduce the risk of bone cement leakage.

Keywords: Computational Fluid Dynamics, Osteoporosis, Vertebral fracture, Fenestrated screw.

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INTRODUCTION

With the increase in the life expectancy of the population and high rates of traffic accidents, falls, among others, there are more and more health problems related to the spine, such as fractures in the spine, and in most cases they occur in the older population and those suffering from osteoporosis. This pathology is characterized by a decrease in Bone Mineral Density (BMD), that is, the bone becomes weaker, becoming more susceptible to osteoporotic fractures of vertebral bodies that deforms the spine causing back pain, loss of ability to perform activities of daily living and, consequently, decreased quality of life.

Compression fractures of the vertebral body are one of the most frequent complications of osteoporosis. In cases where there is a need for surgical intervention for the treatment of these fractures, pedicle instrumentation is used to stabilize the spine by means of pedicle screws, which have been increasingly used, since they provide greater potential for correction of spinal deformities (MARCH, 2008).

However, when pedicle screws are inserted into the bone with reduced BMD, poor fixation can occur as low BMD causes a faulty screwed joint (ELDER *et al*., 2015; FU *et al*., 2017). Thus, since the force of pullout or detachment of the pedicle screw depends on the density of the bone, patients with osteoporosis are more susceptible to screw fixation failures and breakage (HICKERSON *et al*., 2013).

In order to reduce the problems in the treatment of patients with spinal fractures associated with osteoporosis, a procedure called vertebroplasty was developed in France in the 80s, which consists of the percutaneous injection of bone cement in a liquid state in the region of the fractured vertebral body that solidifies inside the vertebra (ALVES *et al*., 2016), providing increased pedicle screw strength in osteoporotic bones. Vertebroplasty helps stabilize the fracture and relieve pain in patients who do not improve with conventional treatment (medications and orthopedic braces). The bone cement restores the biomechanical integrity of the fractured vertebra, restoring rigidity, robustness and reducing bone deformation (AL-ALI *et al.*, 2009).

The most commonly used cement in vertebroplasty processes is Methyl Polymethacrylate (PMMA). However, some limitations of this material are reported, such as the inability to integrate with the native bone and to enhance the regeneration of bone tissue, in addition to presenting excessive stiffness that can cause fracture of adjacent vertebrae (LIEBERMAN *et al*., 2005). Several alternatives aimed at reducing these complications have been suggested, including the use of hydroxyapatite (HAp)-based calcium phosphate cements, because in addition to providing mechanical properties similar to those of PMMA, it is biocompatible with osteocomponent and osteoconductive properties. Turner *et al*. (2003), performed laboratory tests using a HAp-based

compound to reinforce pedicle screws and reported an improvement in the stability and fixation of the systems.

Although several studies confirm the safety of the vertebroplasty process, Amaro (2018) and Rauschmann *et al*. (2004), report that the main complication in this procedure is related to the leakage of bone cement out of the vertebral body into the spinal canal or the vertebral venous system, reaching the pulmonary circulation, which can lead to spinal cord compression or pulmonary embolism, respectively. However, the reduction of the risks of cement leakage and the optimization of the vertebroplasty process could happen if the procedure was simulated in the CFD environment in which the distribution of bone cement in the vertebra during a vertebroplasty procedure could be verified.

In addition to the possibility of cement leakage, another major concern for spinal surgeons, have been the search for methods that improve clamping force in patients with osteoporosis (ABOUSAYED *et al*., 2018; DAI *et al*., 2015; HOPPE and KEEL, 2017). In order to solve these problems, some studies were carried out in order to analyze the distribution of bone cement through fenestrated pedicle screws (GONZÁLEZ *et al*., 2018; CHOMA *et al*., 2012; WANG *et al*., 2014), considering that fenestrations tend to concentrate the distribution of cement around the screw, which can promote a greater force to failure than distribution through injection, in addition to reducing the risk of leakage.

Computational models make it possible to simulate the vertebroplasty process in order to analyze what can be done to find the best methods and materials that result in a vertebra with characteristics similar to the vertebra with healthy bone (ERDEM *et al*., 2013; WANG *et al*., 2014).

Based on the research carried out, it was possible to observe that spinal problems affect most people at some point in their lives. This results not only in damage to the individual's quality of life, but also in professional losses, since spinal diseases are one of the most common causes of sick leave, and can also lead to hospitalizations, representing a high social and financial cost to society. Thus, numerical simulations play a significant role in the search for solutions that aim to minimize these problems.

From a social point of view, the risks associated with the patient could be reduced if the distribution of cement in the vertebra was planned before the surgical procedure, which, in turn, requires a better understanding of the behavior of cement flow. Within this context, the use of computer simulation makes it possible to calculate the flow behavior of bone cement, so that the risk of cement leakage could be minimized and the mechanical properties of the treated vertebra could be optimized, thus increasing the chances of success of the procedure.

From a financial perspective, the use of simulations can result in reduced costs associated with medical errors, postoperative complications, and rework. From the simulations, it is also

possible to test and improve products related to vertobroplasty and pedicle instrumentation, reducing development costs and improving the safety and efficacy of the devices.

According to the bibliographic survey carried out, it was observed that the vast majority of the reported studies are experimental or use simplified theoretical mathematical models, highlighting the little use of CFD. Finally, no studies were found that analyzed, via CFD, the distribution of polymethylmethacrylate (PMMA) through fenestrated pedicle screws in vertebrae. These facts justify further research with the use of CFDs. In this sense, the objective of this research is to evaluate the distribution of PMMA-based bone cement in vertebrae with low bone quality through pedicle screws with and without frenestrations, through the application of Computational Fluid Dynamics (CFD) techniques.

METHODOLOGY

The research was carried out at the Laboratory of Research in Fluid Dynamics and Imaging (LPFI) of the Academic Unit of Chemical Engineering and at the Computational Laboratory of Thermal and Fluids (LCTF) of the Academic Unit of Mechanical Engineering of the Federal University of Campina Grande.

The physical problem consists of the study of bone cement flow (PMMA) inside a vertebral body (porous medium), initially filled only with bone marrow. It was decided to simulate a vertebra with reduced bone mass due to osteoporosis, since this is one of the main causes of vertebral fractures that lead to the need to implement the bone cementation process, which is responsible for enabling the filling of injured vertebrae and fixing implants in the spine. For the simulation, the injection of bone cement inside the vertebra was performed through pedicle screws with and without fenestrations. In this sense, the study domain corresponds to a cross-section of the vertebral body of the third lumbar vertebra.

Initially, a bibliographic study was carried out of some mathematical models in the literature capable of predicting the behavior of bone cement flow (PMMA), from its injection through pedicle screws inside the vertebra (porous medium). The flow inside the vertebra was calculated by numerical methods using Computational Fluid Dynamics (CFD). At first, the geometry and the domain of the flow of interest, its boundary conditions and the physical phenomena involved were identified. Then, the flow domain was discretized in a computational mesh and a mathematical modeling capable of representing the behavior of bone cement flow in the vertebra during the cement injection procedure through pedicle screws was described.

In this work, the ANSYS WORKBENCH work environment was used for the development of the simulation steps. Initially, for the construction of the two-dimensional (2D) and three-dimensional (3D) geometry, the ANSYS DESIGN MODELER was used, the mesh generation was

performed in the ANSYS MESH software. In the next step, in order to process the simulation, the equations of interest and the mathematical models were chosen according to the type of fluid and physical phenomena involved. For the simulation, the ANSYS FLUENT commercial package was used, in which the flow governing equations were iteratively solved by the finite volume method.

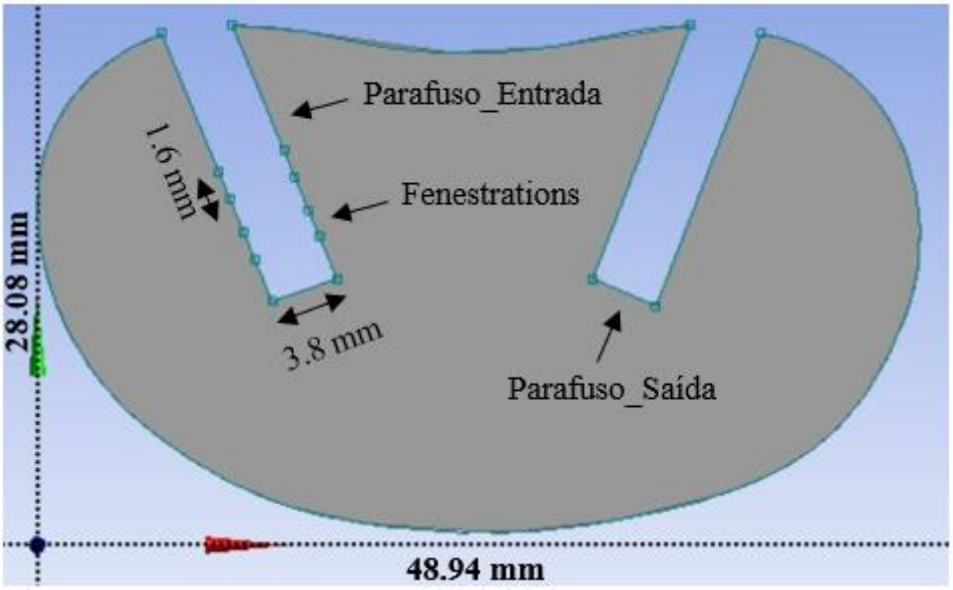
Different numerical simulations were carried out using the FLUENT program, which allowed to study, evaluate and analyze the results obtained from the perspective of CFD. The results generated were compared with the experimental data reported in the literature in order to validate them.

COMPUTATIONAL DOMAIN

The construction of the geometry was carried out in DESIGN MODELER, version 2021 R2, a *commercial software* that belongs to the company ANSYS. In this work, some simplifications were considered during the development of geometry in view of the complexity and variation from one vertebra to another. The dimensions of the vertebral body were obtained from the collection of points on the perimeter of the vertebral body, adopting the same criteria used by Justino and Farias Neto (2018). During the construction of the geometry, in addition to inserting the screw through which the bone cement would be injected, a second screw was inserted in order to relieve the pressure inside the vertebra. The inclusion of the second screw was determined based on the study by Justino and Farias Neto (2018), who observed that as the cement was injected, the internal pressure increased considerably and this was justified by the fact that the bone tends to become increasingly saturated with cement and the liquid initially inside the vertebra tends to compress, increasing the internal pressure progressively.

PMMA (Poly-Methyl Methacryalto) was used as bone cement to carry out the simulations and the physical data provided by the research of Silva (2016) and Loeffel *et al*. (2008). According to Zhou *et al*. (2000), the dimensions considered correspond to an L3 lumbar vertebra. Figure 2.1 shows the geometric shape of the vertebral body in a two-dimensional domain with length and height equal to 48.94 and 28.08 mm, respectively, and the diameters of the holes through which the bone cement was injected into the vertebra (porous medium), the screw has an internal diameter of 3.8 mm and the holes of the fenestrae 1.6 mm. These dimensions are based on the research of Vendrame (2008).

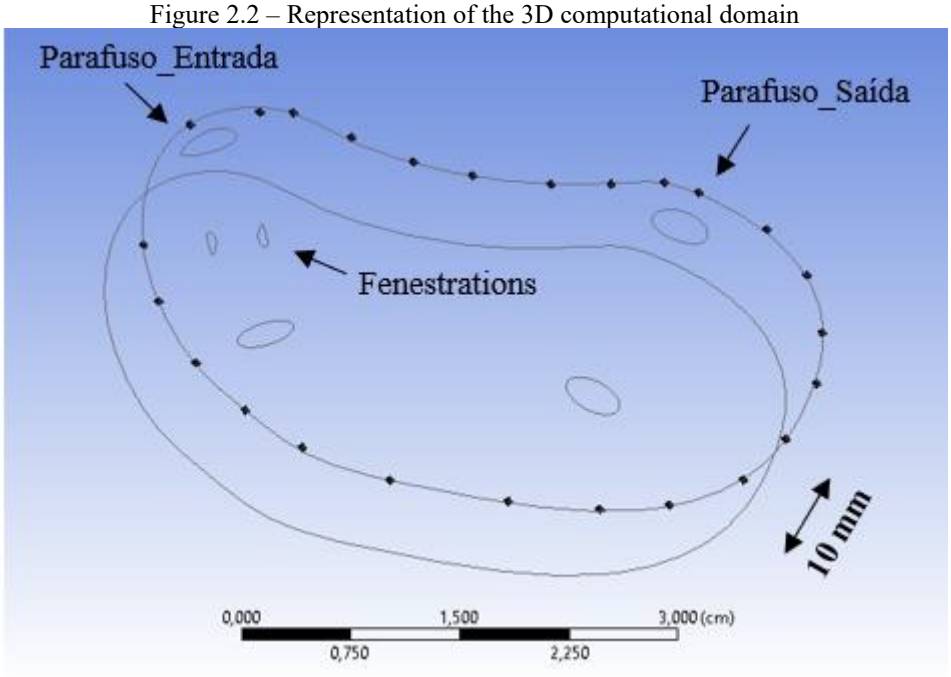
Figure 2.1 – Representation of the 2D computational domain and its dimensions



Source: The author (2022).

From the two-dimensional geometry (Figure 2.1), a 3D geometry with a thickness of 10 mm was constructed, as illustrated in Figure 2.2.

Figure 2.2 – Representation of the 3D computational domain



Source: The Author (2024).

NUMERICAL MESH

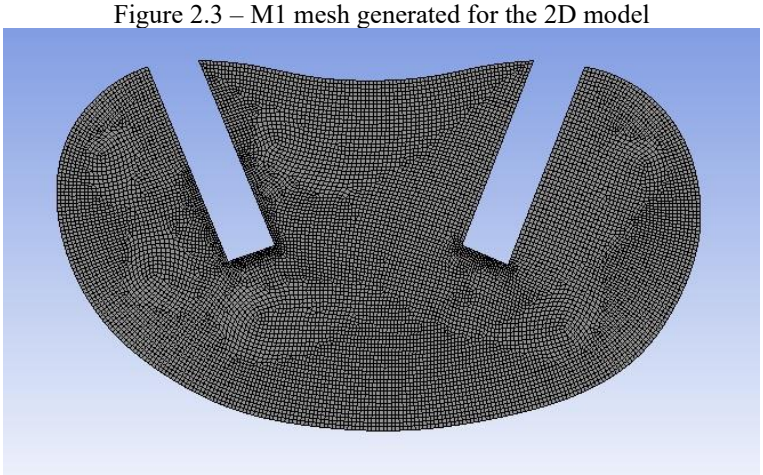
The generation of the mesh over the study domain (vertebral body) was performed with the aid of the ANSYS MESH software, in the 2021 R2 version. To ensure that the mesh leads to coherent numerical results with less computational effort, the mesh dependence study was carried

out, which consists of a successive refining of an initially coarse mesh to a finer one, until the variation of the variables of interest is minimal or zero.

Three numerical meshes were generated for each 2D and 3D geometry, with different refinements to obtain a good distribution of the elements over the study domain. The three meshes created are represented by M1 (more refined), M2 (intermediate), and M3 (less refined). The analysis of mesh quality was performed using the Mesh Convergence Index (MCI) method, proposed by Roache (2004), in order to show that meshes with different refinements allow results that are not different within the criteria used. The meshes were generated with refinement ratios between the M1 and M2 meshes of 1.5 for the 2D model and 1.6 for the 3D model, and between the M2 and M3 meshes equal to 1.9 for the 2D model and 1.4 for the 3D model (ROACHE, 1994; NUNES *et al.* 2021).

Quadrilateral and tetrahedral elements were used for the 2D and 3D models, respectively. Applying the *Sizing* tool, provided by the MESH software, the input parameter for the element size was defined, where an *element size* of 0.3 mm was defined for the M3 mesh, 0.15 mm for the M2 mesh and 0.1 mm for the M1 mesh, for the 2D model. In order to more accurately capture the spreading profile, especially at the screw inlets. In Figure 2.3, it is possible to observe some details of the M1 mesh composed of quadrilateral elements with the presence of a greater refinement in the input screw.

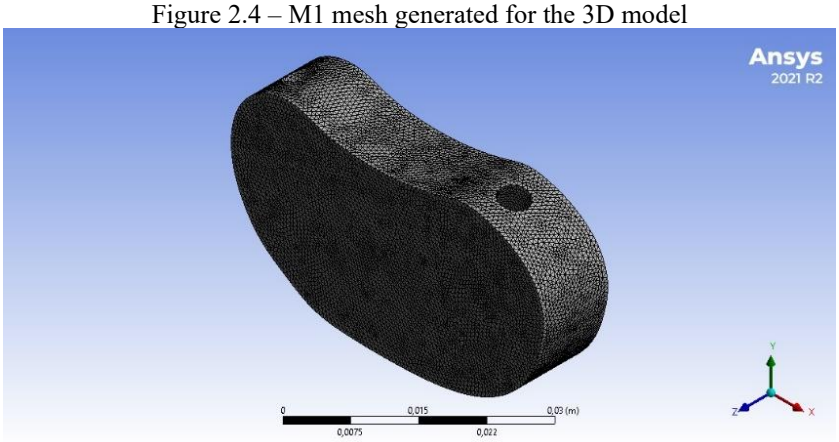
Figure 2.3 – M1 mesh generated for the 2D model



Source: The author (2022).

For the 3D model, an *element size* of 1.2 mm was defined for the M3 mesh, 0.8 mm for the M2 mesh and 0.5 mm for the M1 mesh. Details of the M1 mesh used in the 3D model can be seen in Figure 2.4.

Figure 2.4 – M1 mesh generated for the 3D model



Source: The Author (2024).

Then, some cases were simulated for each of the generated meshes, under the same initial and boundary conditions. At the end, the variation of some variables chosen to evaluate the independence of the results in relation to the meshes considered were analyzed, in order to choose the mesh that presented better results with less computational effort.

Numerical simulations were performed by establishing convergence criteria that determine when a solution is reached, so the *solver* can stop iterating. *Root Mean Square* (RMS) residuals are one of the most important convergence criteria, since they directly relate whether the equations have been solved accurately (Versteeg and Malalasekera, 2007). In this study, a convergence criterion of 10-4 was used for the residuals of all resolved variables.

It was verified, from the mesh convergence study, that among the meshes analyzed, the most refined meshes M1 generated with 104054 elements for the 2D model and 656785 elements for the 3D model were the ones that generated the best results, and these were the ones chosen for the simulations.

MATHEMATICAL MODELING

To perform the modeling, the 2021 R2 version of ANSYS FLUENT® was used with the double precision option enabled. The pressure method was used to solve the transport equations (*pressure-based solver*) for the transient model, the Eulerian-Eulerian approach was also adopted with the following considerations:

A) Laminar and transient biphasic flow regime (bone marrow and bone cement);

B) Incompressible and Newtonian fluid;

C) There is no transfer of mass and heat;

D) The porous medium has isotropic distribution of pores and permeability;

E) The fluid volume model (VOF) was adopted.

Based on these considerations, Equations 2.1 and 2.2 represent the equations of conservation of mass and quantity of motion and reduce to:

$$\frac{\partial(\rho\gamma)}{\partial t} + \nabla.\left(\rho K\vec{U}\right) = 0. \tag{2.1}$$

$$\frac{\partial(\rho\gamma\vec{U})}{\partial t} + \nabla.\left[\rho(K\vec{U}) \otimes \vec{U}\right] - \nabla.\left[\mu_e K\left[\nabla\vec{U} + \left(\nabla\vec{U}\right)^T\right]\right] = \gamma S_M - \gamma\nabla\rho + \vec{F} \tag{2.2}$$

where μ_e is the effective viscosity. S_M corresponds to the term source of momentum in the porous medium given by Equations 2.3, 2.4 and 2.5.

$$S_{M,x} = -\frac{\mu}{K_{perm}}\vec{U}_x. \tag{2.3}$$

$$S_{M,y} = -\frac{\mu}{K_{perm}}\vec{U}_y. \tag{2.4}$$

$$S_{M,z} = -\frac{\mu}{K_{perm}}\vec{U}_z. \tag{2.5}$$

where K_{perm} is the permeability of the porous medium, $\vec{U}_i$ the velocity in the direction $i.(x, y, z)$

The interfacial forces acting are calculated from $\vec{F}$ data by Equation 2.6

$$\vec{F} = \sigma\frac{\rho k\nabla\alpha}{\frac{1}{2}(\rho_1 + \rho_2)} \tag{2.6}$$

where is the surface tension and σk the local curvature.

The effect of surface tension between fluids is included in the VOF model. In this research, the model applied was the continuous surface force (CSF). The addition of surface tension to the VOF calculations results in a source term in the equation of the amount of motion, as presented in Equation 2.6. In this case, we considered the constant surface tension $0{,}033\ N/m$ along the interface, so that only the normal force acts on the interface.

Interface tracking is performed from the VOF model. Thus, due to the simplifications adopted, the continuity equation for the volumetric fraction of one or more phases is given by Equation 2.7.

$$\frac{1}{\rho_q}\left[\frac{\partial}{\partial t}(\alpha_q \rho_q) + \nabla.(\alpha_q \rho_q \vec{v}_q)\right] = 0. \quad (2.7)$$

The volumetric fraction equation is solved based on the constraint established by Equation 2.8.

$$\sum_{q=1}^{n} \alpha_q = 1. \quad (2.8)$$

The interface tracking model used was the *Sharp*, which treats the interface without considering the detachment of particles, considering that it was considered a laminar flow and a fluid with high viscosity.

Because there is neither PMMA, trabecular bone, nor spinal cord in the simulator database, the components were created according to the physical properties shown in Table 2.1.

Table 2.1 – Parameters and properties of the vertebra and PMMA

Vertebra	Porosity	0,911 (Baroud *et al*., 2006)
	Permeability	9,7 $10\times^{-8}$ m2 (Baroud *et al*., 2006)
PMMA	Density	1180 kg/m3 (Silva, 2016)
	Viscosity	100 Pa.s (Loeffel *et al*., 2008)
Bone marrow	Density	1043 kg/m3 (Joar *et al*., 1993)
	Viscosity	1 Pa.s (Bohner *et al*., 2003)

Source: The author (2022).

The data were inserted to represent the properties of the vertebra so that it was possible to simulate a vertebra with osteoporotic characteristics. According to Baroud *et al*. (2006), in healthy bone porosity can be as low as 75% and in osteoporotic bone as high as 95%. In their paper, Baroud *et al*. (2006) adopted a porosity of 91.1%, which corresponds to the porosity of an osteoporotic vertebra. The empty spaces are filled with bone marrow. According to Nauman *et al*. (1999), intertrabecular permeability is not well characterized or understood, due to the structural anisotropy of the trabecular bone and the wide range of existing trabecular architectures. Baroud *et al*. (2006), obtained values for permeability of 1.9 and 9.7 10-8× m2, the lowest value of 1.9 is representative of the low permeability of healthy bone, while the highest value describes the high permeability of osteoporotic bone.

In all simulations, the parameters were defined in *the* software *solver* as shown in Chart 2.1.

Table 2.1 – Parameters used in the simulations

General conditions	
Type of flow	Biphasic
Flow regime	Transient and Laminar
Multiphase model	*Volume of Fluid* (VOF)
Gravitational force	Considerada -9,81 m/s2
Convergence criterion	1.0.10-4
Pressure-speed coupling	*Coupled*
Surface Tension Model	*Continuous Surface Force* (CSF)
Solver	Pressure-based
Discretization	*Gradient = Least Squares Cell Based* *Pressure = SOON!* *Momentum = Second Order Upwind* *Volume Fraction = Compressive* *Transient Formulation = First Order Implicit*
Time Passage	0.1 s
Loops for each iteration	100
Total Simulated Insertion Time	120 sec.

Source: The author (2022).

INITIAL AND BOUNDARY CONDITIONS

As an initial condition for the transient regime, the porous domain (vertebra) was initially filled only with bone marrow, i.e., a volumetric fraction of bone marrow equal to 1, a pressure equal to 1 atm and zero medulla velocities.

In the internal walls, the condition of non-slip wall was considered, i.e., close to the walls the velocities are zero in all directions. At the outlet, the condition used was the *pressure outlet*, so that the assumed pressure gain was 0 Pa. In the inlet section, the pressure condition was adopted as a function of the PPMA injection time, given by Equation 2.9

$$P = 3{,}2803t + 3{,}9512 \qquad (2.9)$$

where P is the pressure on MPa in a time interval t of 5 min.

Equation 2.9 was obtained from the adjustment with the results of the pressure determined numerically and analytically by Baroud and Yahia (2004), who proposed a rheological model to describe the behavior of PMMA flow.

The PMMA is injected gradually, the simulation is conducted under a transient regime, the cement flow through the screw was simulated during a period of 120 seconds based on the study by Baroud and Yahia (2004).

RESULTS AND DISCUSSIONS

To evaluate the distribution of bone cement in vertebrae through pedicle screws with and without fenestrations, simulations were performed considering the mathematical modeling and the initial and boundary conditions explained in Sections 2.3 and 2.4, as well as the parameters and

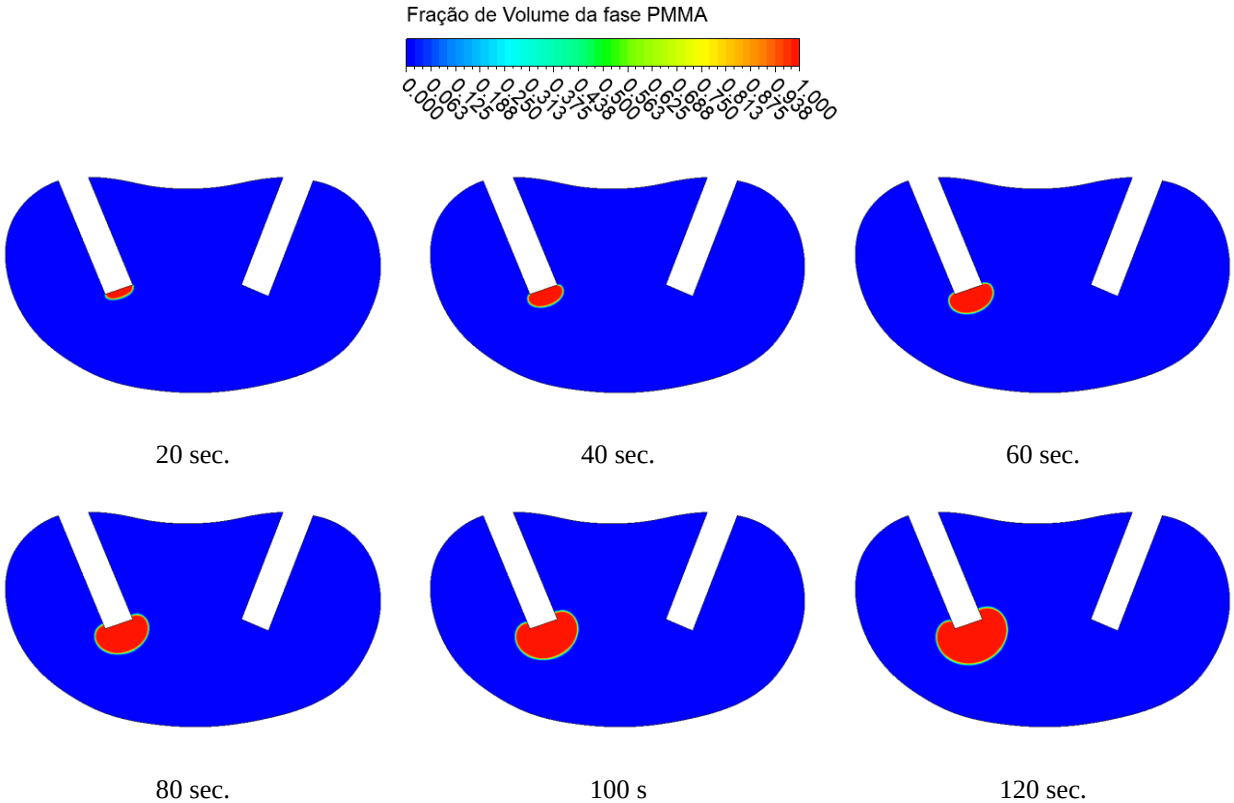
properties described in Table 2.1 and Chart 2.1. In order to evaluate the mathematical modeling used, the results were compared with experimental data available in the literature, always highlighting the simplifications adopted.

ANALYSIS OF PMMA DISTRIBUTION THROUGH SCREWS WITH AND WITHOUT FENESTRATIONS

In order to understand the behavior of bone cement flow in the vertebra and to compare the results of injection through cannulated pedicle screws with and without fenestrations, Figures 3.1 and 3.2 show the evolution of the distribution of the volumetric fraction of bone cement over a plane inside the vertebra as a function of time for cannulated pedicle screws with and without fenestrations. respectively.

Figure 3.1 shows the evolution of the volumetric fraction of PMMA as a function of time, at different time intervals 20, 40, 60, 80, 100 and 120 seconds, for cement injected through a cannulated screw without fenestrations.

Figure 3.1 – Evolution of PMMA injection through screws without fenestration over time

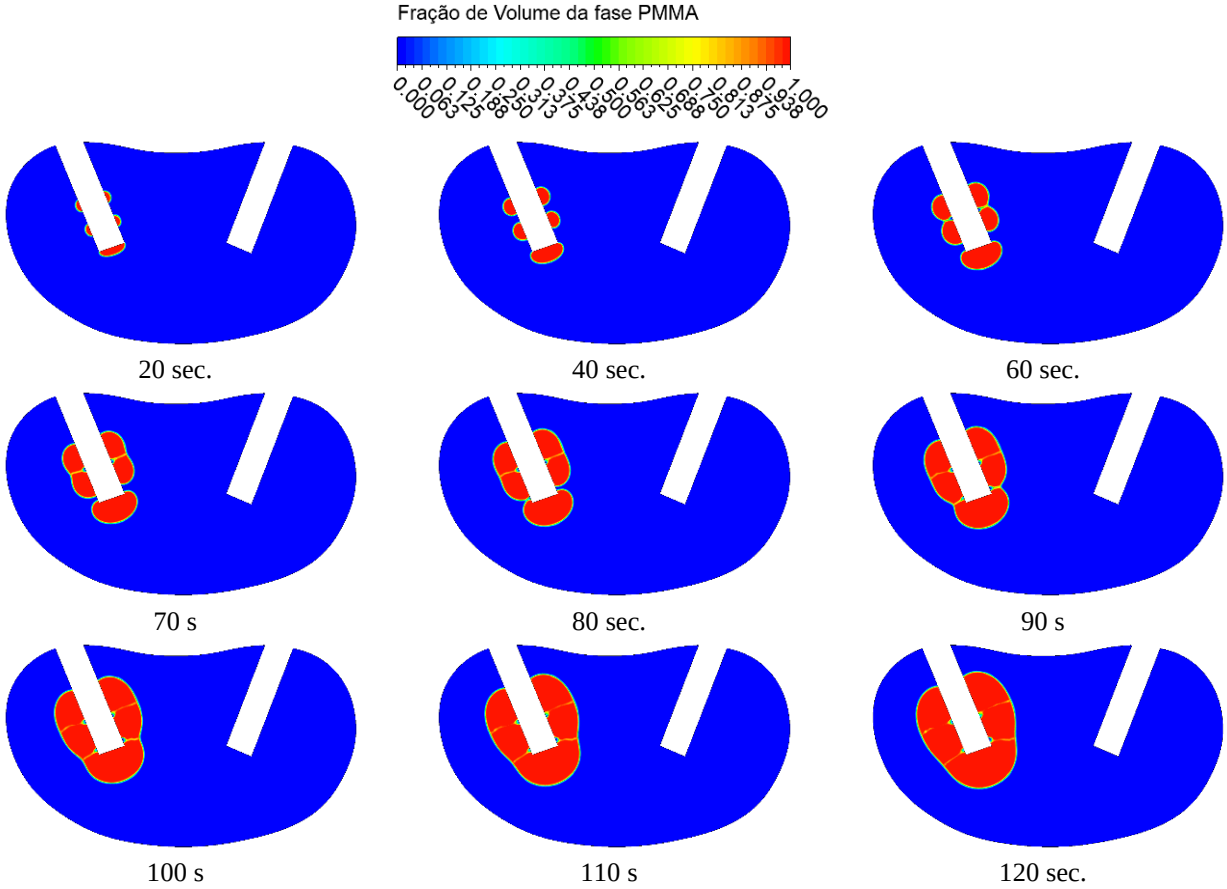


Source: The author (2023).

It has been observed that as the cement is injected over time, most of the cement concentrates at the tip of the screw, tending to a spherical shape distribution.

Figure 3.2 shows the evolution of the volumetric fraction of PMMA as a function of time, for the different time intervals 20, 40, 60, 70, 80, 90, 100, 110 and 120 seconds, with the cement injected through a cannulated screw with fenestrations.

Figure 3.2 – Evolution of PMMA injection through screws with fenestrations over time



Source: The author (2023).

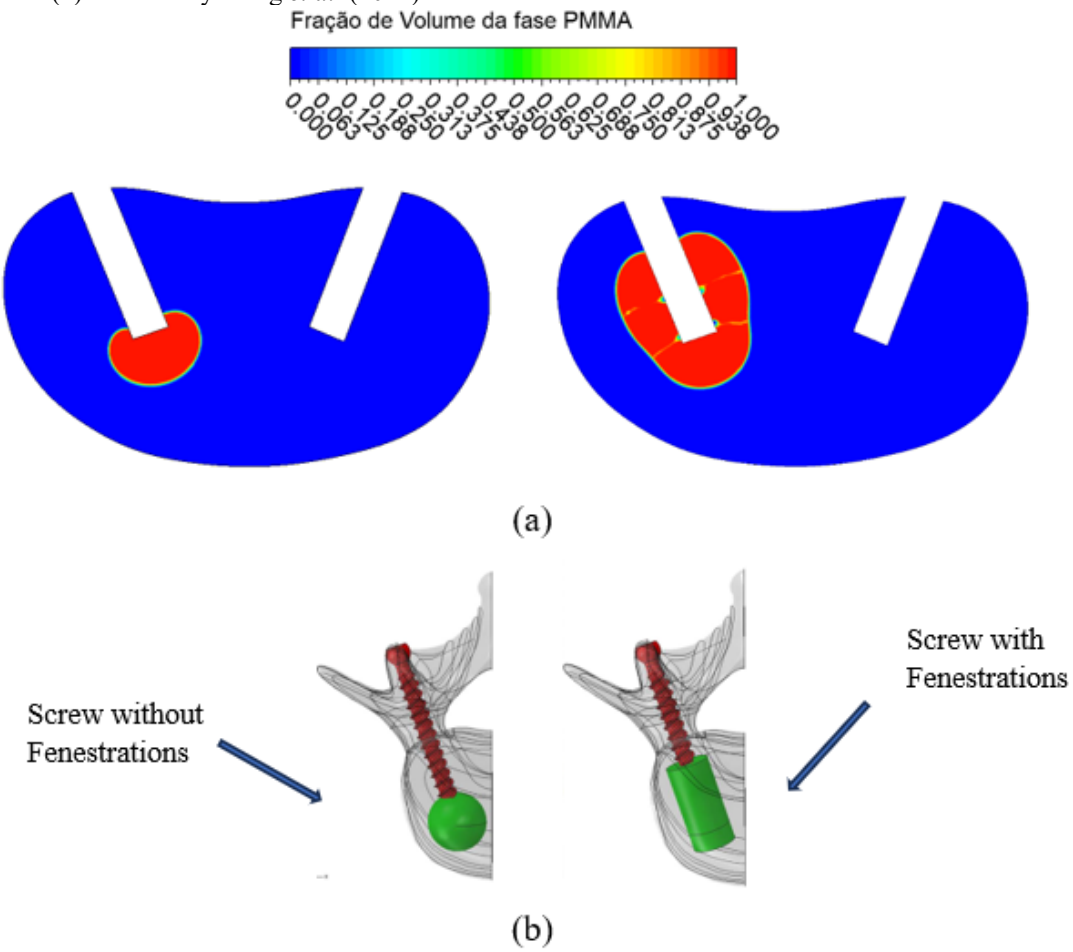
It is observed that over time the cement tends to concentrate around the pedicle screw nail, involving the entire screw, which is in agreement with what is reported in the literature, as reported by Wang *et al*. (2014) who report that, when injected through a pedicle screw with fenestrations, the PPMA presents itself with a cylindrical shape surrounding the screw, instead of being associated mainly with the tip of the screw. At 60 seconds it is already possible to observe that the cement has a tendency to spread in a more cylindrical way around the screw.

The results of the present analysis indicate that when fenestrated screws are used, even injecting a smaller amount of cement, the fact that the fenestrations allow the injection through the screw shank allow a more uniform spread around a larger area of the screw, a behavior that can promote greater stability than that observed in pedicle screws with a single cement entry at the tip of the screw. which corroborates the results reported by González *et al*. (2018), which states that the way the cement is distributed around the screw directly influences its retention strength.

These results also confirm those reported by Liu *et al*. (2016), who reported that, in relation to the stability of a screw with fenestrations, no significant difference was observed when injecting larger and smaller amounts of cement around the screw, indicating that the way PMMA is distributed is more important than the amount of cement injected.

Figure 3.3-(a) compares cement injection through screws with and without fenestration at 120 seconds of simulation. Figure 3.3-(b) shows the behavior of cement spreading through screws with and without fenestration reported by Wang *et al*. (2014).

Figure 3.3 – Comparison of PMMA injection through screws with and without fenestrations: (a) obtained in the simulations and (b) obtained by Wang *et al*. (2014)



Fonte: (a) A autora (2023) e (b) Wang *et al*. (2014).

Comparing the contours of the fraction of volume of PMMA injected through screws with and without fenestrations, observed in Figure 3.3-(a), it is visible that in the screw with fenestrations, the cement involves a larger area of the screw, presenting a shape that is close to that of a cylinder, compared to the screw without the fenestrations where the cement spreads more spherically. This behavior coincides with that reported by Wang *et al*. (2014), who observed that when cannulated and fenestrated screws are used, the cement tends to be located in a cylindrical area around the screw, rather than concentrating at the tip of the screw, as illustrated in Figure 3.3-(b).

The results of this analysis indicate that the injection of bone cement through pedicle screws with fenestrations can be used as an auxiliary method to improve screw fixation, especially in osteoporotic bones, since the fixation power of the screw in osteoporotic bone is reduced with the decrease in bone mineral density.

Table 3.1 shows the area A_s invaded by cement when injected through screws with and without fenestrations.

Table 3.1 – Area of the cement plume injected through screws with and without fenestrations

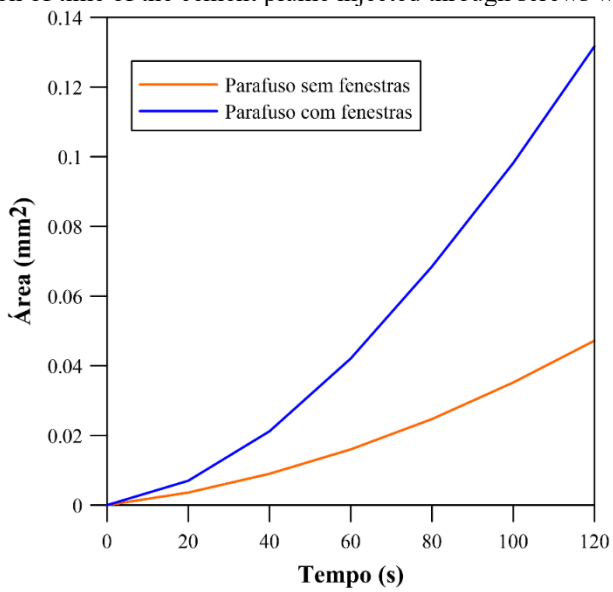
Time(s)	Screw without fenestration (mm2)	Screw with fenestrations (mm2)
20	0,0036	0,0070
40	0,0090	0,0212
60	0,0160	0,0421
80	0,0247	0,0685
100	0,0352	0,0982
120	0,0472	0,1317

Source: The author (2023).

As predicted, cement delivery is most effective when being injected through fenestrated pedicle screws. This is because fenestrations in the screws allow for more efficient dispersion of the bone cement by increasing the contact area between the cement and the surrounding bone tissue. As a result, the same amount of cement can be distributed more evenly and quickly, speeding up the surgical procedure. In addition, greater efficiency in the delivery of cement can contribute to a more robust fixation of the screws and a better biomechanical stability of the vertebra after the procedure. This advantage can be especially significant in patients with osteoporosis or other conditions that compromise bone density, where achieving a solid fixation of the screws is crucial to avoid postoperative complications. Therefore, the use of fenestrated pedicle screws not only reduces the time required for cement administration but can also improve the overall quality of the procedure.

Figure 3.4 shows a comparison of the area obtained from the injection through pedicle screws with and without fenestrations.

Figure 3.4 – Area as a function of time of the cement plume injected through screws with and without fenestrations



Source: The author (2023).

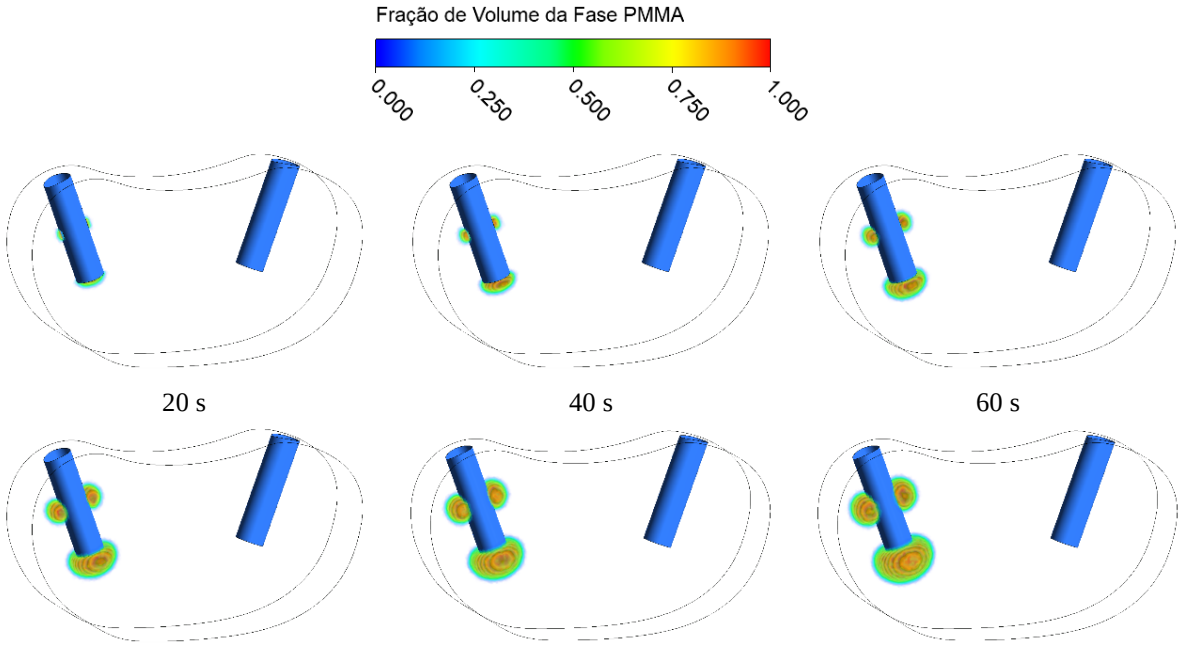
It can be seen that at the beginning of the injection, screws with or without fenestrations do not present great variations in the area of the cement plume. However, over the injection time, the curves are further apart, presenting a greater discrepancy, and it is possible to observe that the area invaded by the cement is significantly larger when the cement is injected through the fenestrated screw. Figure 3.4 also confirms that the use of fenestrated screws can reduce the time needed to inject larger amounts of cement.

The biggest concern with cement injection is the possibility of leakage that can cause various damages to the patient's health, and larger amounts of cement increase the risk of leakage. Baroud *et al*. (2006), indicate that increasing the viscosity of cement can reduce the chances of leakage. On the other hand, it can also excessively increase the injection pressure of the cement. In this sense, cement injection through several fenestrated holes can reduce the cement injection pressure. These results suggest that the risk of cement leakage can be reduced with the application of a more viscous cement by means of fenestrated screws, without compromising the fixation strength of the screw.

INFLUENCE OF SCREW FENESTRATIONS ON PMMA DISTRIBUTION

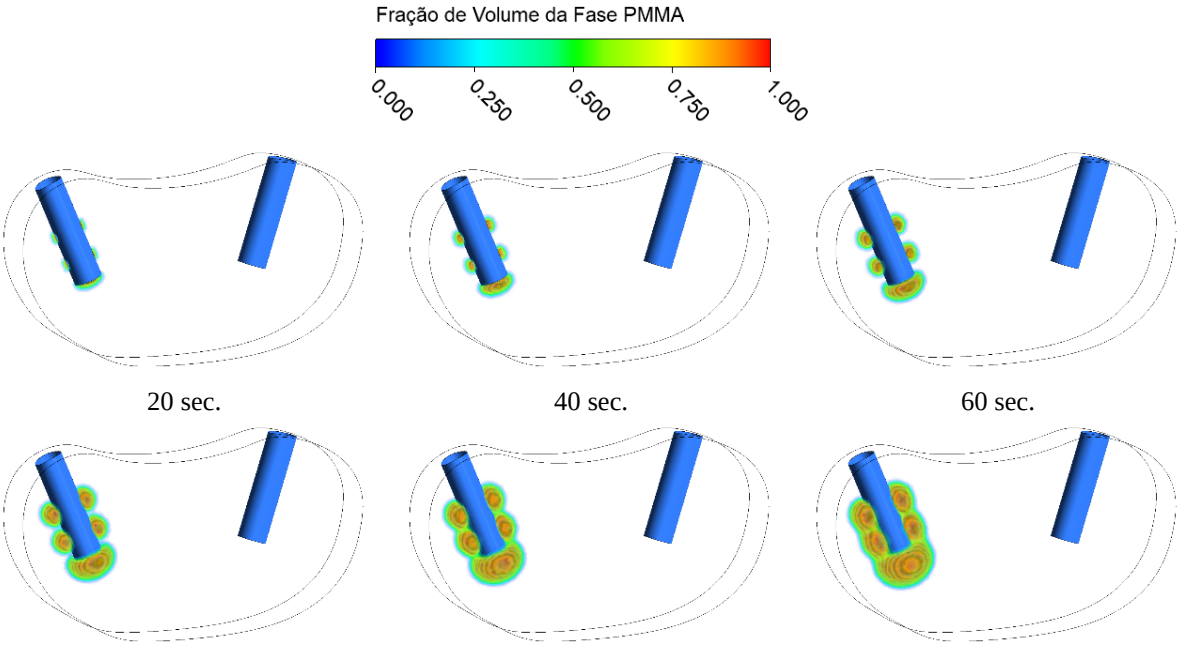
Simulations were performed to evaluate the distribution of bone cement injected through cannulated screws with two and four fenestrations. Figures 3.5 and 3.6 show the evolution of the volumetric fraction of PMMA as a function of time, at different time intervals of 20, 40, 60, 80, 100, and 120 seconds, for these two types of screws.

Figure 3.5 – Evolution of PMMA injection through a screw with 2 fenestrations over time



Source: The Author (2024).

Figure 3.6 – Evolution of PMMA injection through screw with 4 fenestrations over time



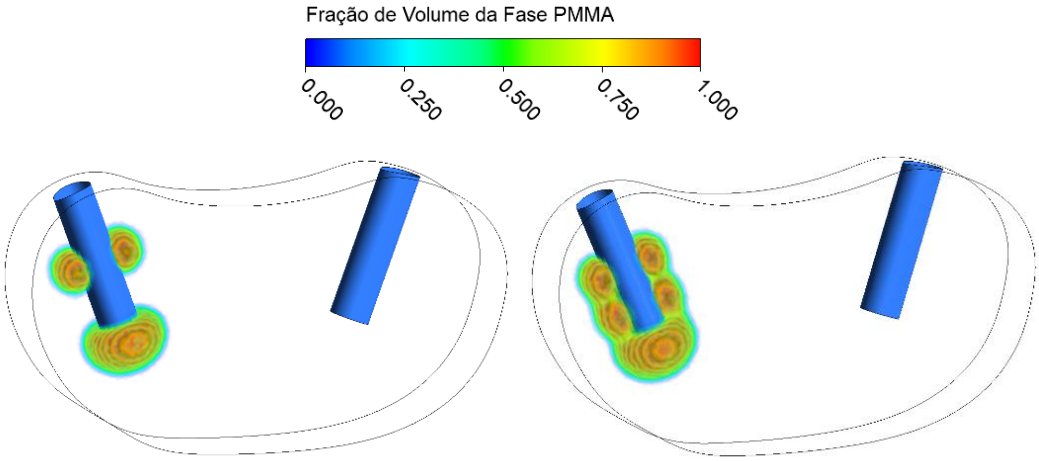
Source: The Author (2024).

As can be seen in Figures 3.5 and 3.6, for both screws, the cement was evenly distributed around the screw shank, however, in the screw with more fenestrations, the cement involved a larger area of the stem. The behavior observed when the cement is injected through the screw with 4 fenestrations, may contribute, according to the literature, to favor a better fixation of the screw by allowing it to have a larger area involved by the cement in the same time interval. Thus, the use of screws with a higher number of fenestrations can contribute to avoid any movement or displacement

of the screw from its original position, and the number of fenestrations will depend on the non-compromise of the screw's resistance so as not to suffer rupture in view of the fenestrations.

Figure 3.7 compares the bone cement distribution profiles in the vertebra at 120 seconds for a screw with two and four lateral fenestrations.

Figure 3.7 – Comparison of PMMA injection through screw with 2 and 4 fenestrations



Source: The Author (2024).

When comparing the contours of the fraction volume of PMMA injected through screws with two and four fenestrations, it is observed that in the screw with four fenestrations, the cement surrounds a larger portion of the screw in the same time interval, presenting a shape similar to what was observed in the two-dimensional case study.

Although in this study the position of the lateral screw holes was kept constant, the results presented indicate that the positioning and number of screw holes can modify the flow and distribution of cement, corroborating the study by Chen *et al*. (2005), who experimentally evaluated the distribution of bone cement in cannulated screws with different numbers of lateral holes. The authors concluded that bone cement flowed predominantly from the proximal lateral holes, while almost no cement flowed from the distal holes, i.e., different numbers of fenestrations produced distinct cement flows.

Thus, the number of screw fenestrations is a factor that must be taken into account when performing the bone cement injection procedure. The design of new screws with optimized holes (number, size and position) taking into account the internal microarchitecture of each vertebra could provide a more uniform flow of cement around a larger area of the screw, thus improving its fixation. In addition, fenestrated screws have the ability to limit the injection of cement into the vertebral body, making it possible to use smaller amounts of cement without compromising fixation, which can provide greater security against cement leakage out of the vertebral body.

One concern regarding fenestrations of a cannulated screw is that it can weaken the screw shank, decreasing the screw's ability to resist pullout forces. On the other hand, when cement is injected, a portion of that cement stays inside the fenestrated bolt and the rest surrounds the bolt. This behavior can mitigate possible weaknesses related to the shank of screws with fenestrations, the effects of these variables that can affect the fixation capacity of the screw can be the subject of future studies.

CONCLUSION

From the results obtained, it was possible to conclude that the proposed mathematical model was able to predict the behavior of bone cement distribution through pedicle screws in the vertebra. This computational approach not only allows for a detailed and predictive analysis of bone cement flow, but also provides a platform for the exploration of different surgical scenarios and the assessment of potential consequences, thereby contributing to significant advances in medical practice. This predictive capability is critical for the optimization of surgical procedures, allowing surgeries to be planned in advance and adapting their techniques to ensure optimal bone cement distribution, thereby minimizing the risk of postoperative complications and maximizing clinical outcomes for patients.

Regarding the use of screws with or without fenestrations, it was observed that by opting for fenestrated screws, it is possible to inject smaller amounts of cement without compromising the fixation of the screw, a fact that can provide greater security against cement leaks out of the vertebral body. In addition, the results indicate that the positioning and number of fenestrations of the screws can modify the flow and distribution of bone cement in the vertebra, providing a significant influence on postoperative biomechanical stability and fixation efficacy.

Finally, the injection of bone cement into vertebrae through pedicle screws with fenestrations emerges as a potentially safer alternative to surgical procedures in the spine, presenting an approach that can reduce the risks and complications associated with cement injection. This technique is potentially useful in cases involving osteoporotic vertebrae, where the incidence of cement leaks is higher and screw fixation is more challenging due to low bone mineral density.

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Saving lives: First aid for airway clearance

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ABSTRACT

The social relevance of disseminating knowledge about first aid for airway clearance among monitors and assistants of daycare centers and preschools, play a crucial role in emergency situations for early childhood education. It is notorious that children from daycare centers (under 3 years old) and preschool children (4 to 5 years old) are constantly exposed to choking risks, being one of the main causes of accidental death in these age groups, which can be avoided with adequate knowledge about the management of foreign body airway obstruction (OVACE) and proper application of first aid maneuvers (PS). Thus, training educators and managers of daycare centers and schools is extremely important to minimize accidents and the risks of complications resulting from choking. The dissemination of this information to family members and guardians is also essential, as they are the first to act in many emergency situations. A well-informed and prepared school community can act quickly in the event of a serious incident, thus increasing the chances of saving many victims.

Keywords: First aid, Airway obstruction by foreign bodies, Early childhood education.

LIST OF ABBREVIATIONS

Foreign Body Aspiration (FBA)
Foreign body (FB)
Manobra de Heimlich (MH)
Foreign body airway obstruction (OVACE)

[1] Graduating in Medicine
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First Aid (FA)

INTRODUCTION

Children in kindergarten, daycare centers and preschools are subject to various situations that can pose risks to their health and well-being.

The ability to act immediately and effectively in situations of a child's partial or complete airway obstruction by means of an object or food can be potentially life-threatening.

Training monitors and assistants of daycare centers and preschools, with basic knowledge of HCWs to carry out the proper management of OVACE, can prepare them to intervene in critical situations of threat to death.

In Brazil, according to data from the Ministry of Health, in 2023, approximately 2,000 people choked to death, including 319 children, aged 0 to 4 years, either due to laryngeal obstruction, during non-closure of the respiratory system during feeding, or due to blockage of the air passage, by a foreign body (FB), which can cause asphyxiation and death.

By sharing knowledge and experiences related to OVACE, it seeks to train individuals who work in daycare centers and preschools, exploring techniques and procedures, in addition to fostering humanitarian values inherent to the act of saving lives, impacting the perception they have of themselves and their role in society.

DEVELOPMENT

EARLY CHILDHOOD EDUCATION

Early childhood education in Brazil is a child's right, and the state is obliged to provide adequate spaces and professionals to serve them correctly. Also known as early childhood education, it is the first stage of basic education, with the objective of serving children from zero to five years of age, from whom they will have their first contacts with school, integrating teaching and care strategies, working as a complement to family education.

In Brazil, the Law of Guidelines and Bases defines a daycare center as an institution intended for the care of children from 0 to 3 years old, full-time, and pre-school, which serves the age group from 4 to 5 years and 11 months, on a part-time basis.

In the school environment of early childhood education, there may be children of different ages and cognitive phases, generating an environment conducive to accidents. Therefore, it is essential that students and the entire pedagogical team are trained to attend to HCs.

Early childhood education schools should provide a structured environment in which children can learn to interact, share, collaborate and relate to their peers and teachers, thus promoting the development of essential social and emotional skills, such as empathy, cooperation, self-control, conflict resolution, in addition to ensuring their integral health. However, in Brazil, there is still much to be done, especially in relation to the preparation of educators for the realization of the SP.

For health education, it is essential to master the theme, concepts and scopes, associated with communication and qualified listening. Considering the importance of the educational dimension for the expansion of critical knowledge, it is necessary to intensify the relevance of concepts and approaches, and thus encourage training. This action helps in personal and social growth, bringing autonomy and emancipation to the individual in the face of extreme situations and contributing to the development of individual and collective health (SALCI, et al., 2013; PEREIRA, MESQUITA and GARBUIO, 2020).

AIRWAY OBSTRUCTION BY FOREIGN BODIES (OVACE)

OVACE is any situation that partially or totally prevents the passage of air through the airways, as a consequence of a foreign body aspiration (FBA), hindering effective pulmonary gas exchange, and can be described as the third leading cause of death in children in the school environment in Brazil, because they do not receive adequate SP (MORAIS, et al, 2022). Accidents related to ECA can result in asphyxia and hypoxia (low oxygen saturation in the tissues) and can lead to cardiorespiratory arrest (PEREIRA, MESQUITA and GARBUIO, 2020).

ECA can occur through small objects or food, causing an interruption of breathing, which without early management can present definitive and potentially fatal sequelae (GONÇALVES, CARDOSO, RODRIGUES, 2011).

Due to the immaturity of laryngeal closure reflexes and swallowing food, bronchoaspiration can occur in children under 4 years of age. Thus, the appropriate knowledge of education professionals in relation to the clearance of airways is important due to the greater chances of witnessing choking situations (JONGE, 2020).

According to Souza et al. (2019), the recognition of signs of obstruction and the effective delivery of PSs have potentially preventive value in relation to fatal outcomes, and schools are considered strategic spaces for addressing techniques and management related not only to OVACE, but also to basic life support.

According to statistics from the National Security Council on OVACE, it is the fourth leading cause of unintentional death, making it one of the leading causes of accidental deaths in children under 16 years of age (SVÍZZERO, et al., 2023). Considering the prevalence of this emergency and the potential risks of death, all people, including those outside the health care field, should have a basic understanding of how to provide HCPs in this scenario (DODSON and COOK, 2023).

KNOWLEDGE ABOUT THE MANAGEMENT OF OVACE FOR EARLY CHILDHOOD EDUCATION

In the case of AVE and depending on the degree of airway obstruction, the individual who will perform the SP must act quickly in order to ensure adequate assistance to the victim, considering that in this scenario, if airway clearance is not achieved within a short period of time, The victim may progress to cardiorespiratory arrest, as well as brain activities may cease, causing irreversible brain damage and death due to lack of oxygen.

In cases of partial airway obstruction, that is, some air still passes to the victim's lungs, emitting sound, in children over 2 years of age, try to calm them down and instruct them to cough in an attempt to expel FB. If the obstruction persists, observing that the child is unable to make any breathing sound or voice, it has evolved to a total obstruction of the airway, therefore, request the emergency service (SAMU – 192 or Fire Department – 193) while performing the Heimlich maneuver (MH) for choking in patients who are still conscious, positioning themselves kneeling behind the victim, encircling around the abdomen with the arms, at the level of the iliac crest. Clench one of the fists and place it between the navel and the xiphoid appendix, and the other flat on the first hand, performing quick and firm inward and upward compressions, creating a moving pressure in the shape of a "J", until the victim expels the FB.

In children older than 2 years with total OVACE in an unconscious victim, the victim should be supported to the ground and chest compression maneuvers should be initiated. After 30 compressions, open the child's mouth and observe if there is a visible foreign body, and if the rescuer manages to pinch this foreign body with his fingers, it must be removed. If it is not possible to see and there is a device for ventilation, two ventilations should be performed and chest compression maneuvers should be performed. In the absence of the device, perform only chest compressions. In cases where the foreign body is removed, the child should be supported with the body lateralized until help arrives. If the victim progresses to cardiorespiratory arrest, 30 compressions and two ventilations should be performed when the device is available, and if there is not, only compressions should be performed until specialized help arrives.

In children under 2 years of age in the face of airway obstruction, MH is not recommended due to the significant risk of injury, so the OVACE maneuver consists of kneeling with one leg at 90º, supporting the child on the forearm with the head facing down, keeping it lower than the body. Perform 5 firm percussions in the back area, between the shoulder blades, followed by 5 chest compressions with both fingers, in the center of the chest, below the nipple line, until the FB is expelled or the patient becomes responsive. When it is not responsive, the CPR (Cardiopulmonary Resuscitation) protocol should be initiated, performing 30 compressions with two fingers below the nipple line, dosing the applied force and with only 4 cm of depth, pressing the chest for 2 continuous

minutes. During the maneuver, the child's brachial and carotid pulses should be checked every 2 minutes. It is essential that from the beginning of CPR, the emergency service (SAMU) is activated. (LIMA, et al., 2018).

FINAL CONSIDERATIONS

By expanding knowledge about airway clearance S, classroom monitors and assistants can save numerous lives, especially victims of airway obstruction events, by disseminating knowledge about the management of choking.

It is necessary to be able to identify the signs and symptoms associated with the problem, as well as a quick and efficient intervention.

Guidance on how to activate emergency services is essential, promoting an effective response in serious cases, so that they do not evolve into life-threatening situations.

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Risks and consequences of urinary infections during pregnancy: A longitudinal study

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ABSTRACT

The general objective of this article is to evaluate the impacts of urinary tract infections (UTIs) on maternal and fetal health during pregnancy. Specific objectives include determining the main risk factors associated with the development of urinary tract infections during pregnancy, analyzing the most common symptoms presented by pregnant women with urinary tract infections, comparing the effectiveness of different diagnostic methods used to identify urinary tract infections in pregnant women, evaluating the most common treatments for urinary tract infections during pregnancy and their effectiveness, to examine the fetal consequences of urinary tract infections during pregnancy, and to propose clinical management protocols for the prevention and treatment of urinary tract infections in pregnant women. The methodology used was a descriptive and qualitative literature review, analyzing studies published between 2004 and 2024, in Portuguese and English.

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The databases consulted were PubMed, Scielo and Google Scholar. The analysis focused on the prevalence of urinary tract infections during pregnancy, diagnostic methods, treatments, and consequences for maternal and fetal health. The results indicate that urinary tract infections are common during pregnancy, with asymptomatic bacteriuria progressing to pyelonephritis if not treated properly. Diagnostic methods include urinalysis and urine culture, the latter being the gold standard. The most common treatments involve antibiotics such as nitrofurantoin, cephalexin, and amoxicillin, which are considered safe to use during pregnancy. Complications associated with urinary tract infections include preeclampsia, preterm birth, and low birth weight. The conclusion highlights the importance of early diagnosis and proper management of urinary tract infections to minimize risks and ensure the health of the maternal-fetal binomial. Screening and treatment protocols, education on preventive measures, and a multidisciplinary approach are essential to improving maternal and newborn health outcomes. Continuing research in this area is crucial to improve treatment strategies and ensure the safety and efficacy of procedures.

Keywords: Urinary tract infections, Pregnancy, Maternal health, Antibiotics.

INTRODUCTION

Urinary tract infections (UTIs) during pregnancy are a significant concern due to the risks and consequences they can entail for both mother and fetus. Pregnancy is a period of increased susceptibility to infections, including those of the urinary tract, due to physiological and anatomical changes that occur in a woman's body. These infections can range from asymptomatic bacteriuria to more serious conditions like cystitis and pyelonephritis, which can lead to severe complications if not properly diagnosed and treated.

The risks associated with urinary tract infections in pregnancy include the possibility of developing preeclampsia, premature birth, low birth weight and, in more severe cases, maternal sepsis. In addition, pyelonephritis, a kidney infection, can result in hospitalization and intensive care, increasing the risk of complications for both mother and fetus. Early identification and proper management of these infections are crucial to minimize risks and ensure the health of the maternal-fetal binomial.

The general objective of this article is to evaluate the impacts of urinary tract infections on maternal and fetal health during pregnancy. The specific objectives outlined to achieve this goal include: determining the main risk factors associated with the development of urinary tract infections during pregnancy; analyze the most common symptoms experienced by pregnant women with urinary tract infections, compare the effectiveness of different diagnostic methods used to identify urinary tract infections in pregnant women, evaluate the most common treatments for urinary tract infections during pregnancy and their effectiveness, examine the fetal consequences of urinary tract infections during pregnancy, including prematurity and low birth weight, To propose clinical management protocols for the prevention and treatment of urinary tract infections in pregnant women.

Thus, this current study is essential, since urinary tract infections in pregnancy are common and can lead to serious complications for both mother and fetus, including increased risk of preterm birth, low birth weight, and preeclampsia. Early diagnosis and proper management are essential to prevent these complications. Studies indicate that asymptomatic bacteriuria, if left untreated, can progress to pyelonephritis in pregnant women, highlighting the importance of rigorous screening and treatment protocols. Improving diagnosis and management can significantly reduce associated risks and improve maternal and neonatal outcomes.

METHODOLOGY

The current study is a fundamental research based on a detailed literature review, with the aim of evaluating the impacts of urinary tract infections on maternal and fetal health during pregnancy. Urinary tract infections (UTIs) during pregnancy are a significant concern due to the risks and

consequences they can entail for both mother and fetus. Pregnancy is a period of increased susceptibility to infections, including those of the urinary tract, due to physiological and anatomical changes that occur in a woman's body. These infections can range from asymptomatic bacteriuria to more serious conditions like cystitis and pyelonephritis, which can lead to severe complications if not properly diagnosed and treated.

The risks associated with urinary tract infections in pregnancy include the possibility of developing preeclampsia, premature birth, low birth weight and, in more severe cases, maternal sepsis. In addition, pyelonephritis, a kidney infection, can result in hospitalization and intensive care, increasing the risk of complications for both mother and fetus. Early identification and proper management of these infections are crucial to minimize risks and ensure the health of the maternal-fetal binomial.

The search strategy will involve the use of electronic databases such as Google Scholar, Scielo and PubMed, using keywords aligned with specific objectives, such as "urinary tract infections in pregnancy", "diagnosis of UTIs in pregnant women", "treatment of UTIs during pregnancy" and "fetal impacts of UTIs in pregnancy". The study selection process will follow a qualitative and descriptive approach. Initially, abstracts that appear to meet the inclusion criteria will be identified, followed by a thorough review of the full articles to verify their adequacy and relevance in relation to the research objectives.

Detailed information will be collected on the risk factors associated with the development of urinary tract infections during pregnancy, the common symptoms presented, the effectiveness of the diagnostic methods used, the most common treatments and their effectiveness, the fetal consequences of urinary tract infections, and the proposed clinical management protocols. The evaluation of the quality of the included studies will be carried out considering methodological rigor, clinical importance and timeliness, focusing on articles published between 2004 and 2024 to ensure that the information is relevant and current.

The analysis will be restricted to the specific terms and languages used in the searches, which may result in the exclusion of relevant studies that do not exactly match the defined keywords. This method ensures a concentrated and detailed analysis, which is essential to evaluate the impacts of urinary tract infections on pregnancy, with a view to continuously improving treatment protocols and, therefore, clinical outcomes.

Thus, the study is essential, since urinary tract infections in pregnancy are common and can lead to serious complications for both mother and fetus, including increased risk of preterm birth, low birth weight, and preeclampsia. Early diagnosis and proper management are essential to prevent these complications. Studies indicate that asymptomatic bacteriuria, if left untreated, can progress to pyelonephritis in pregnant women, highlighting the importance of rigorous screening and treatment

protocols. Improving diagnosis and management can significantly reduce associated risks and improve maternal and neonatal outcomes.

RESULTS AND DISCUSSION

The predisposing factors for various health conditions during pregnancy are widely discussed in the medical literature. Among the most common are a history of urinary tract infections, gestational diabetes, and advanced maternal age.

Urinary tract infections are a frequent complication during pregnancy and can have serious implications for maternal and fetal health. Studies indicate that the prevalence of urinary tract infections (UTIs) in pregnant women is significant, with factors such as age and length of hospital stay being important predictors for the occurrence of these infections. The presence of microbiological agents such as Klebsiella pneumoniae and Escherichia coli are common in nosocomial infections, demonstrating the need for strict control and appropriate treatment to avoid further complications [1]. In addition, co-infection with genital infections, such as those caused by Gardnerella vaginalis and Candida spp., is also observed, increasing the complexity of clinical management [2].

Gestational diabetes mellitus (GDM) is a metabolic condition characterized by hyperglycemia that develops during pregnancy. Increased insulin resistance due to hormonal changes of pregnancy is a key factor in the development of DMG. Significant risk factors include overweight, obesity, advanced maternal age (usually over 35 years), and family history of diabetes. The prevalence of GDM can be as high as 25% in some populations, with rates higher in regions such as the Middle East and North Africa. In Brazil, the prevalence is estimated at up to 18% [3, 4, 5]. Early screening and appropriate management, including nutritional changes, physical activity, and, if necessary, the use of medications such as insulin or metformin, are crucial to reduce maternal-fetal complications associated with GDM [4, 6].

Advanced maternal age is another significant risk factor for complications during pregnancy. Women over the age of 35 are at increased risk of developing conditions such as gestational diabetes, gestational hypertension, and preeclampsia. Maternal mortality is also associated with factors such as advanced maternal age, direct obstetric complications (such as preeclampsia and postpartum hemorrhage), and unfavorable socioeconomic conditions [7, 8, 9]. Advanced age, combined with other risk factors such as obesity and a history of chronic diseases, increases the vulnerability of pregnant women, highlighting the importance of rigorous prenatal care and effective preventive interventions.

Urinary tract infections (UTI) are one of the most common clinical complications during pregnancy, due to the anatomical and physiological changes that occur during this period, facilitating

the development of these infections. The prevalence and incidence of UI in pregnant women vary significantly among different studies and regions, reflecting the diversity of risk factors and diagnostic and treatment practices.

A study carried out in nine Basic Health Units in Cascavel, Paraná, analyzed 798 medical records of pregnant women and found a prevalence of 33.08% of urinary tract infections, genital tract infections, or both. Specifically, 15.66% of pregnant women had episodes of urinary tract infections, 14.41% had some type of genital infection, and 3.01% were co-infected. Genital infections were predominantly caused by Gardnerella vaginalis (37.39%) and Candida sp. (29,57%) [10].

Another study, conducted in the municipality of Marechal Cândido Rondon, Paraná, evaluated the incidence of urinary tract infection in 34 pregnant women through urine culture. The results showed that 56% of the samples analyzed tested positive for urinary tract infection, with Escherichia coli being the most prevalent microorganism, present in 63.1% of the cases. The highest incidence of urinary tract infection was observed in the third trimester of pregnancy, with 71.4% of pregnant women affected [11].

In Rondonópolis, Mato Grosso, a cross-sectional study analyzed 300 medical records of pregnant women attending prenatal consultations and found a relative frequency of urinary tract infection of 16.0%. Escherichia coli was the most frequently identified uropathogen, present in 75.0% of cases, followed by Enterococcus faecalis (16.67%), Streptococcus agalactiae (6.25%) and Klebsiella sp. (2,08%) [12].

The importance of early diagnosis and appropriate treatment of urinary tract infections during pregnancy has been highlighted in several studies. The presence of asymptomatic urinary tract infection in pregnant women is common, which reinforces the need for regular urine culture examinations to avoid serious complications, such as premature birth, hypertension, and even the death of the baby or mother in cases of severe and generalized infection [11][13].

Globally, Escherichia coli is consistently identified as the leading causative agent of urinary tract infections in pregnant women, followed by other pathogens such as Enterococcus faecalis and Streptococcus agalactiae. The prevalence of urinary tract infections in pregnant women varies, but studies indicate that it can affect between 15% and 33% of pregnant women, depending on the population studied and the diagnostic methods used [10][12][13].

These data underscore the need for effective prevention and prophylaxis protocols, as well as the importance of a multidisciplinary approach to prenatal care to reduce the incidence and complications associated with urinary tract infections in pregnant women.

Diagnostic methods for identifying urinary tract infections (UTIs) are varied and include urinalysis, urine culture, and rapid tests. Each of these methods has its particularities, advantages,

and limitations, and are often used together to ensure an accurate diagnosis and appropriate treatment.

Urinalysis is an initial screening test that is widely used to detect urinary tract infections. This test involves physical, chemical, and microscopic analysis of the urine. Parameters such as the presence of nitrites and leukocyte esterase are evaluated, and the presence of nitrites has a high specificity (99%) for UTI, while leukocyte esterase has high sensitivity (90%) [14]. However, urinalysis alone may not be sufficient for a definitive diagnosis, especially in cases of asymptomatic infections or in pediatric patients, where sensitivity and specificity may vary [14].

Urine culture, or urine culture, is considered the gold standard for diagnosing UTIs. This method involves incubating urine in specific culture media to allow growth and identification of the microorganisms causing the infection. Urine culture not only confirms the presence of bacteria, but also allows for quantification and the performance of an antibiogram, which is essential for determining the pathogen's sensitivity to antimicrobials [15]. However, the main limitation of urine culture is the time required to obtain the results, which can be more than 24 hours [15].

Rapid urine tests, such as immunochromatographic tests, offer a faster alternative for detecting UTIs. These tests are based on detecting specific antigens or antibodies present in the urine and can provide results within minutes. Although they are less accurate than urine culture, rapid tests are useful in situations where an immediate diagnosis is needed to start treatment [16]. The sensitivity and specificity of these tests can vary, but they are generally considered suitable for initial screening [16].

The diagnosis of asymptomatic bacteriuria in pregnant women presents several specific challenges that impact both maternal and fetal health. Asymptomatic bacteriuria is defined by the presence of microorganisms in the urine without clinical symptoms of urinary tract infection. The prevalence of this condition in pregnant women varies between 2% and 10%, and may reach 40% in some studies[17]. Proper identification and treatment are crucial to prevent serious complications such as pyelonephritis, preterm birth, and low birth weight[18].

One of the main challenges in diagnosis is the differentiation between significant and negligible colonization of the urinary tract. Urine culture is considered the gold standard for the diagnosis of bacteriuria, but the interpretation of the results can be complex due to the presence of contaminants and the variability in the definition of uropathogens[17]. In addition, asymptomatic bacteriuria may not be a permanent condition and may resolve spontaneously, which further complicates the decision on the optimal time for screening and treatment[17].

Another significant challenge is antibiotic resistance. Studies show that Escherichia coli is the most prevalent uropathogen in pregnant women with asymptomatic bacteriuria, but there is growing resistance to common antibiotics such as ampicillin[19]. The choice of antibiotic should consider

safety for both mother and fetus, which limits the therapeutic options available[20]. Antimicrobial resistance can lead to treatment failures and increase the risk of complications[19].

Proper collection of urine samples is another critical aspect. Contamination during collection can lead to false positive results, while improper collection can result in false negatives. Educating pregnant women about the correct urine collection technique is essential to ensure the accuracy of the results[21].

In addition, there are challenges related to implementing screening and treatment protocols in different health settings. In rural regions and indigenous communities, for example, the quality of prenatal care can be compromised by a lack of resources and adequate infrastructure[22]. Adherence to screening and treatment guidelines may be low, and lack of adequate follow-up may result in late diagnosis and inadequate management[22].

Pharmacological therapies during pregnancy require careful evaluation to ensure the safety of both mother and fetus. Among the frequently used medications, antibiotics play a crucial role in treating bacterial infections, which can have serious consequences if not treated properly.

The most prescribed antibiotics during pregnancy include amoxicillin, cephalexin, nitrofurantoin, and gentamicin. Amoxicillin is widely used due to its safety profile and efficacy against a variety of bacterial infections. Cephalexin, an antibiotic in the cephalosporin class, is also often prescribed and is effective against urinary tract infections (UTIs) and other common bacterial infections. Nitrofurantoin is particularly effective in the treatment of UTIs, especially in cases of asymptomatic bacteriuria, which can lead to complications if left untreated. Gentamicin, an aminoglycoside, is used in more severe cases of infection, although its use is limited due to the potential for renal and auditory toxicity.

The safety of antibiotics during pregnancy is a critical consideration. Amoxicillin and cephalexin are generally considered safe, with a low risk of adverse effects to the fetus. Studies indicate that nitrofurantoin is safe for use during pregnancy, especially in the second and third trimesters, although its use in the first trimester should be cautious due to reports of possible fetal malformations [23]. Gentamicin, although effective, should be used with caution due to the risk of ototoxicity and nephrotoxicity, which can affect both mother and fetus [24].

The choice of antibiotic should be based on culture results and sensitivity to ensure the efficacy of treatment and minimize the risk of bacterial resistance. Escherichia coli (E. coli) is the most common pathogen in UTIs during pregnancy, and nitrofurantoin and cephalexin have shown high efficacy against this pathogen [23, 24]. However, antimicrobial resistance is a growing concern, and the choice of antibiotic should consider local patterns of resistance [25].

Urinary tract infections (UTIs) are common during pregnancy and can lead to significant complications such as preeclampsia, preterm birth, and low birth weight. Therefore, the

implementation of effective clinical protocols for the treatment and prevention of these infections is crucial for maternal and fetal health.

The diagnosis of UTIs in pregnant women usually involves screening for asymptomatic bacteriuria by urine culture, as well as history and physical examination to identify cystitis and pyelonephritis. Urine culture is essential for the identification of the causative agent, especially in cases of resistant bacteria [26]. Asymptomatic bacteriuria, if left untreated, can progress to more serious symptomatic infections, such as pyelonephritis, which is associated with an increased risk of obstetric complications [27].

Clinical protocols recommend the use of safe and effective antimicrobials for the treatment of UTIs in pregnant women. Antibiotics frequently indicated include nitrofurantoin, cephalosporins, fosfomycin, and amoxicillin. The choice of antimicrobial and the duration of treatment depend on the type of infection and the sensitivity of the pathogen identified [26, 28]. Nitrofurantoin, for example, is widely used due to its efficacy and safety during pregnancy, except at the end of the third trimester due to the risk of neonatal hemolysis [26].

In addition to treatment, prevention of UTIs in pregnant women is critical. Periodic urine cultures are recommended, usually every trimester, to monitor for the presence of asymptomatic bacteriuria and initiate early treatment when necessary [27]. Educating pregnant women about preventive measures, such as adequate fluid intake, frequent urination, and proper hygiene, is also an important part of management protocols [26].

In cases of pyelonephritis, which is a serious kidney infection, treatment usually requires hospitalization and administration of intravenous antibiotics. Continuous monitoring of the mother and fetus is essential to prevent serious complications [26].

Urinary tract infections (UTIs) during pregnancy are a significant concern due to their potential adverse impacts on maternal health. Among the most serious complications associated with UTIs are pyelonephritis and preeclampsia, both of which have serious consequences for both mother and fetus.

Pyelonephritis, a kidney infection, is one of the most common and serious complications of UTIs during pregnancy. This condition can lead to severe symptoms such as high fever, low back pain, nausea, and vomiting, and can develop into sepsis if not treated properly. Pyelonephritis is associated with an increased risk of preterm birth and low birth weight, as well as maternal complications such as acute renal failure and systemic inflammatory response syndrome (SIRS) [29]. Early diagnosis and appropriate treatment with antimicrobials are essential to prevent these complications. Studies indicate that asymptomatic bacteriuria, if left untreated, can progress to pyelonephritis in up to 40% of cases, highlighting the importance of screening and early treatment during prenatal care [30].

Preeclampsia, a pregnancy-specific hypertensive syndrome, can also be exacerbated by urinary tract infections. Preeclampsia is characterized by hypertension and proteinuria after the 20th week of gestation and can lead to serious complications such as eclampsia, HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet count), placental abruption, and fetal growth restriction [31]. The presence of urinary tract infections, especially those that are untreated or recurrent, can increase the risk of developing preeclampsia. The inflammation and immune response triggered by infection may contribute to the endothelial dysfunction and antiangiogenic status seen in preeclampsia [32].

In addition, the association between urinary tract infections and preeclampsia may be mediated by common risk factors such as obesity, diabetes, and a history of hypertension. Women with recurrent urinary tract infections during pregnancy have an increased risk of developing preeclampsia, which reinforces the need for close monitoring and preventive interventions [33]. Early identification and appropriate management of UTIs are crucial to reduce the risk of maternal complications and improve pregnancy outcomes.

Fetal health is profoundly influenced by several factors during pregnancy, including maternal nutrition, medical conditions, and lifestyle habits. Maternal nutrition, in particular, plays a crucial role in fetal development and neonatal health. A balanced diet rich in essential nutrients, such as vitamins, minerals, protein, and omega-3 fatty acids, can significantly reduce the risk of neonatal complications such as low birth weight, preterm birth, and birth defects. In addition, proper nutrition during pregnancy contributes to a stronger immune system in the newborn and healthy neurological development. On the other hand, nutritional deficiencies can result in serious complications, including intrauterine growth retardation and impaired cognitive development [34].

Prematurity and low birth weight are often interrelated conditions and are considered the main determinants of the risk of death in the neonatal period, in addition to being associated with developmental problems in childhood. High blood pressure during pregnancy, for example, is a condition that can lead to these complications, increasing the likelihood of various diseases in adulthood [35]. Studies show that the prevalence of prematurity and low birth weight has increased over the years, despite improvements in antenatal care and maternal health conditions [36].

In addition to nutritional and medical factors, maternal lifestyle, including the consumption of alcohol, tobacco, and illicit drugs, can also negatively affect fetal health. The use of these substances during pregnancy is associated with a number of complications, such as fetal abstinence, premature placental displacement, and maternal cognitive and emotional impairment, which can result in prematurity and low birth weight [37].

Early breastfeeding, which begins in the first hour of life, has been highlighted as a crucial practice for neonatal development. Breast milk not only provides essential nutrition, but it also

contains immune-boosting properties that protect the baby against infection and disease, as well as promote a strong emotional bond between mother and child. Exclusive breastfeeding in the first months of life is associated with a significant reduction in the risk of developing chronic diseases in adulthood, such as obesity, type 2 diabetes, and cardiovascular disease [38].

Finally, continuity of post-discharge care for premature or low birth weight newborns is critical to ensure healthy development. Strategies such as home visits by nurses and ongoing support through telephone contacts are essential to monitor the health of the newborn and support parents in the transition to home care [39].

CONCLUSION

This literature review highlighted the importance of predisposing factors for complications during pregnancy, with a focus on urinary infections, gestational diabetes and advanced maternal age. Urinary infections, which are frequent in pregnant women, demonstrate the need for strict control and appropriate treatment, especially due to the prevalence of pathogens such as Escherichia coli. Gestational diabetes, associated with factors such as overweight and maternal age, requires monitoring and appropriate management to avoid complications. In addition, advanced maternal age increases the risk of conditions such as gestational hypertension and pre-eclampsia, reinforcing the importance of prenatal care. Screening and treatment protocols, education on preventive measures and a multidisciplinary approach are essential to improve maternal and neonatal health outcomes Thus, it is crucial to implement effective prevention and treatment protocols to ensure maternal and fetal health. It is clear, therefore, that continued research in this area is essential to improve treatment strategies, ensure the safety and efficacy of procedures and improve maternal and fetal health outcomes.

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Central and peripheral vertigo: Neurological and otorhinolaryngological approaches

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ABSTRACT

Vertigo is a common symptom in several clinical conditions, and may have a central or peripheral origin. The differential diagnosis between these forms is crucial to guide appropriate treatment and prevent complications. This study aims to analyze the neurological and otorhinolaryngological approaches to central and peripheral vertigo, highlighting diagnostic methods, therapeutic approaches, and pathophysiological differences. A descriptive and qualitative literature review was carried out, using electronic databases and selection of articles relevant to the theme. Specific diagnostic methods, such as the Dix-Hallpike maneuver and magnetic resonance imaging, are essential to differentiate between central and peripheral vertigo. Therapeutic approaches include repositioning maneuvers, vestibular rehabilitation, and pharmacological therapy. Pathophysiological differences between the forms of vertigo influence the clinical management and prognosis

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of patients. Understanding the differences between central and peripheral vertigo is crucial for accurate diagnosis and effective treatment. Complementary therapeutic approaches, such as acupuncture and craniosacral therapy, may offer additional benefits to patients. A multidisciplinary and patient-centered approach is essential to ensure satisfactory outcomes and improve the quality of life of individuals affected by vertigo.

Keywords: Vertigo, Differential Diagnosis, Therapy, Pathophysiology, Multidisciplinary Treatment.

INTRODUCTION

Vertigo is a clinical symptom frequently reported by patients in medical emergencies, characterized by the illusory sensation of movement, usually rotation, which may be accompanied by imbalance, nausea, and vomiting (1). The differentiation between central and peripheral vertigo is essential for proper diagnosis and treatment, since the causes and therapeutic approaches vary considerably between these two types of vertigo (3).

Peripheral vertigo originates from dysfunctions in the inner ear and vestibular nerves, while central vertigo results from changes in the central nervous system, specifically in the brain regions responsible for controlling balance (2). The most common causes of peripheral vertigo include Benign Paroxysmal Positional Vertigo (BPPV), Meniere's Disease and Vestibular Neuritis (9). Central vertigo, on the other hand, can be caused by conditions such as stroke, multiple sclerosis and brain tumors (10).

BPPV is the most common cause of peripheral vertigo, characterized by brief episodes of vertigo triggered by changes in head position. This condition is caused by the displacement of otoliths in the semicircular canals of the inner ear, leading to anomalous stimulation of the vestibular system (1). The diagnosis of BPPV is often clinical, based on the patient's history and the performance of specific maneuvers, such as the Dix-Hallpike maneuver, which triggers the characteristic symptoms (3).

Ménière's disease is another common cause of peripheral vertigo, characterized by recurrent episodes of severe vertigo, accompanied by hearing loss, tinnitus, and a feeling of pressure in the ear (4). The pathophysiology of Ménière's disease involves an increase in endolymphatic fluid pressure in the inner ear, leading to dysfunction of the vestibular and auditory systems (5). The diagnosis is clinical and is based on the presence of characteristic symptoms, and it is important to exclude other causes of vertigo (6).

Vestibular neuritis is an inflammation of the vestibular nerve, usually of viral origin, which leads to intense vertigo, of sudden onset, without hearing impairment (11). The diagnosis is clinical, based on the exclusion of other causes of vertigo, and can be confirmed through imaging tests, such as magnetic resonance imaging, which may show signs of inflammation in the vestibular nerve (10).

On the other hand, central vertigo is often associated with more serious conditions such as stroke, multiple sclerosis, and brain tumors. Stroke can cause central vertigo when it affects the areas of the brain responsible for balance, such as the brainstem and cerebellum (2). Patients with central vertigo often have other neurological signs, such as changes in speech, muscle weakness, and loss of coordination (12).

Multiple sclerosis is a chronic inflammatory disease of the central nervous system that can cause central vertigo due to demyelination of the nerve pathways that control balance (5). Symptoms

of vertigo in multiple sclerosis can be intermittent and vary in intensity depending on the location and extent of the demyelinating lesions (11).

Brain tumors can also cause central vertigo, especially when located in the cerebellum or brain stem. These tumors can compress structures critical for balance and coordination, leading to symptoms of vertigo, along with other neurological signs (1). Diagnosing brain tumors often requires advanced imaging tests, such as MRI, to identify the location and extent of the tumor (6).

The diagnostic approach to vertigo should be systematic and comprehensive, including a detailed history, complete physical and neurological examination, and, when necessary, complementary tests (1). The history should include questions about the duration, frequency, intensity, and triggering factors of vertigo, as well as the presence of associated symptoms, such as hearing loss, tinnitus, nausea, and vomiting (2). Physical examination should include assessment of balance, coordination, and vestibular function, using specific tests such as the Dix-Hallpike maneuver for BPPV and the head impulse test for vestibular neuritis (12).

Imaging tests, such as computed tomography (CT) and magnetic resonance imaging (MRI), are often needed to exclude central causes of vertigo, such as stroke and brain tumors (11). In addition, audiometric tests may be useful to assess hearing function in patients with suspected peripheral vertigo associated with inner ear diseases (1).

The therapeutic approach to vertigo varies depending on the underlying cause. In the case of BPPV, canalicular repositioning maneuvers, such as the Epley maneuver, are effective in relieving symptoms (1). For Ménière's disease, treatment may include dietary changes, medications to reduce endolymphatic fluid pressure, and, in severe cases, surgical procedures (4).

Vestibular neuritis can be treated with medications to relieve symptoms and, in some cases, with vestibular rehabilitation to help regain balance (11). For central vertigo, treatment should be directed at the underlying cause, such as the use of anticoagulants for stroke, immunomodulatory drugs for multiple sclerosis, and surgery for brain tumors (12).

Thus, vertigo, whether of central or peripheral origin, represents a significant diagnostic and therapeutic challenge. Proper differentiation between these two types of vertigo and identification of the underlying cause are critical for the effective management of patients and for improving quality of life (3).

The objective of this research is to analyze and synthesize the neurological and otorhinolaryngological approaches to central and peripheral vertigo, identifying the main diagnostic and therapeutic methods used. In addition, it seeks to understand the pathophysiological differences between the two types of vertigo and to highlight the importance of a multidisciplinary approach in the management of patients.

METHODOLOGY

This research is a descriptive and qualitative literature review, as described by Gonçalves J.R. (2019)(13). Scientific articles, dissertations, theses, and books published between 2019 and 2024, in Portuguese and English, that addressed aspects of central and peripheral vertigo were included. The electronic databases consulted included PubMed, Scielo, LILACS and Google Scholar, using keywords such as "central vertigo", "peripheral vertigo", "neurological approaches" and "otorhinolaryngological approaches".

Data were collected by reading and analyzing the titles and abstracts of the identified studies. The articles that met the inclusion criteria were thoroughly read to extract the pertinent information. The qualitative analysis involved the identification of patterns, themes and categories that emerged from the data, using the content analysis technique to categorize and interpret the findings in order to answer the research question.

As this is a literature review, no research ethics committee approvals were required. Every care was taken to ensure integrity and ethics in the conduct and reporting of the research, respecting copyright and properly citing all sources used.

RESULTS AND DISCUSSION

DIAGNOSTIC METHODS IN CENTRAL AND PERIPHERAL VERTIGO

The differentiation between central and peripheral vertigo is essential for the proper management of patients. Peripheral vertigo usually involves dysfunctions in the inner ear and vestibular nerves, while central vertigo is related to changes in the central nervous system, specifically in the brain regions responsible for balance control (1,2). Accurate diagnostic methods are essential to correctly identify the cause of vertigo.

The Dix-Hallpike maneuver is a widely used clinical test to diagnose Benign Paroxysmal Positional Vertigo (BPPV), the most common cause of peripheral vertigo. This test causes the otoliths to be displaced in the semicircular canals of the inner ear, triggering characteristic vertigo and nystagmus (3). Studies indicate that the Dix-Hallpike maneuver has high sensitivity and specificity, making it an effective tool in the diagnosis of BPPV (3).

For central vertigo, magnetic resonance imaging (MRI) is a crucial imaging test. MRI allows detailed visualization of brain structures, identifying ischemic lesions, tumors, or demyelination, which are common in conditions such as stroke and multiple sclerosis (4). Computed tomography (CT) can also be used, especially in emergency situations, due to its speed and accessibility, although it has lower resolution for lesions of the brainstem and cerebellum (5).

In addition to imaging, audiometric tests are useful to assess hearing function in patients with suspected peripheral vertigo associated with inner ear diseases. Pure tone audiometry and impedance

metry are often used to identify hearing loss and changes in ossicular chain mobility and Eustachian tube function (6).

Laboratory tests can also help in the differential diagnosis. Blood tests to check glucose, electrolyte and thyroid function levels can reveal underlying conditions that contribute to vertigo symptoms (7). Cerebrospinal fluid analysis may be necessary in suspected cases of infections or inflammatory diseases of the central nervous system (8).

Therefore, the combination of clinical, imaging, and laboratory tests is essential for a comprehensive evaluation of patients with vertigo. Appropriate use of these diagnostic tools can significantly improve diagnostic accuracy and treatment efficacy (1,2).

THERAPEUTIC APPROACHES AND MULTIDISCIPLINARY INTERVENTIONS

The treatment of vertigo varies according to its origin, and a multidisciplinary approach involving neurologists, otorhinolaryngologists and other health professionals is essential. Benign Paroxysmal Positional Vertigo (BPPV), for example, responds well to canalicular repositioning maneuvers, such as the Epley maneuver, which helps to dislodge the otoliths outside the semicircular canals, relieving symptoms (1).

Ménière's disease, characterized by recurrent episodes of vertigo, hearing loss, tinnitus, and a feeling of pressure in the ear, requires a more complex approach. Dietary changes, such as reducing salt intake, can help manage symptoms (2). Diuretic medications and betahistine are also commonly used to reduce endolymphatic fluid pressure (3). In severe cases, surgical procedures, such as endolymphatic sac decompression, may be necessary (4).

Vestibular neuritis, usually caused by a viral infection, is initially treated with medications to relieve symptoms of vertigo and nausea, such as antihistamines and benzodiazepines (5). Vestibular rehabilitation, which involves specific exercises to improve balance and coordination, is a crucial part of long-term treatment (6).

For central vertigo, treatment should focus on the underlying condition. In the case of stroke, the use of anticoagulants and thrombolytic agents may be necessary to prevent further damage (7). Multiple sclerosis can be treated with immunomodulatory medications, such as interferons and glatiramer acetate, which help reduce the frequency and severity of flare-ups (8). Brain tumors may require surgery, radiation therapy, or chemotherapy, depending on their location and type (9).

The importance of a multidisciplinary approach cannot be underestimated. Collaboration between neurologists, otolaryngologists, physical therapists, and speech pathologists is essential for the development of effective and personalized treatment plans. For example, the inclusion of speech therapy in the management of Ménière's Syndrome has shown significant benefits in the auditory and vestibular rehabilitation of patients (10).

In addition, aquatic physical therapy has been shown to be an effective vestibular rehabilitation option, providing a safe and controlled environment for performing balance and coordination exercises (11). Studies show that patients undergoing aquatic physical therapy programs have a significant improvement in vertigo symptoms and quality of life (11).

The treatment of vertigo requires an integrated approach that combines different specialties and therapies to meet the specific needs of each patient. Multidisciplinary collaboration is crucial to ensure effective management and improve clinical outcomes (1,2).

PATHOPHYSIOLOGICAL DIFFERENCES AND CLINICAL IMPLICATIONS

The pathophysiological differences between central and peripheral vertigo are critical for the proper diagnosis and treatment of these conditions. In peripheral vertigo, symptoms are often attributed to dysfunctions in the inner ear and vestibular nerves, resulting in an illusory sense of movement. BPPV, for example, is caused by the presence of displaced otoliths in the semicircular canals of the inner ear, leading to anomalous stimulation of the vestibular system in certain positions of the head (1). On the other hand, central vertigo results from changes in the central nervous system, including brain regions responsible for processing and integrating vestibular information.

The clinical implications of these pathophysiological differences are significant and directly influence the clinical management of patients. For example, while peripheral vertigo often responds well to vestibular repositioning and rehabilitation maneuvers, central vertigo may require more specific and targeted therapeutic approaches to treat the underlying cause. In cases of central vertigo related to neurological conditions, such as stroke or multiple sclerosis, treatment may include pharmacological therapies to control symptoms and reduce the risk of recurrence (2). Additionally, central vertigo may be associated with more serious complications, such as impaired balance and mobility, and requires careful monitoring and intervention to prevent further complications.

Understanding the pathophysiological differences between central and peripheral vertigo also has important implications for patient prognosis. In general, peripheral vertigo tends to have a more favorable prognosis, with a high rate of spontaneous resolution or significant improvement in symptoms over time. On the other hand, central vertigo can be more challenging to treat and may be associated with an increased risk of long-term complications, such as deficits in balance and vestibular function (3). Therefore, careful evaluation and a multidisciplinary approach are essential to ensure proper management and ongoing follow-up of patients with central vertigo.

In addition to the pathophysiological differences, it is important to consider the distinct clinical manifestations associated with central and peripheral vertigo. In peripheral vertigo, patients often experience symptoms such as nausea, vomiting, and sweating during vertigo episodes, along with characteristic nystagmus and postural imbalance (4). On the other hand, central vertigo may be

associated with additional neurological symptoms, such as muscle weakness, speech changes, and visual disturbances, which may provide important clues about the underlying cause of vertigo (5). The identification and characterization of these symptoms are crucial to guide the differential diagnosis and determine the most appropriate therapeutic approach for each patient.

The pathophysiological differences between central and peripheral vertigo have important clinical implications for the diagnosis, treatment, and prognosis of patients. A comprehensive understanding of these differences is essential to ensure proper management and ongoing follow-up of patients with vertigo, highlighting the importance of a multidisciplinary and individualized approach to each case.

TECHNOLOGICAL ADVANCES AND FUTURE PERSPECTIVES IN THE EVALUATION AND TREATMENT OF VERTIGO

Technological advances play an increasingly significant role in the assessment and treatment of vertigo, offering new tools and approaches for better understanding and management of this complex clinical condition. A rapidly expanding area is the application of remote sensing and monitoring technologies for objective assessment of vertigo symptoms and vestibular function. Handheld devices, such as accelerometers and gyroscopes, can be utilized to record and analyze head and body movements in real time, providing valuable data on the severity and frequency of vertigo episodes, as well as abnormal movement patterns that may indicate vestibular dysfunction (1).

In addition, virtual reality (VR) and augmented reality (AR) are increasingly being explored as vestibular rehabilitation tools, offering immersive and interactive virtual environments for training and therapeutic exercises. These technologies allow them to simulate challenging and varied situations, such as walking on uneven surfaces or performing specific balance tasks, providing a more engaging and personalized training experience for patients (2). Additionally, VR and AR can be utilized as assessment tools, allowing healthcare professionals to quantify vestibular performance and monitor progress over time.

Another significant advance in the assessment of vertigo is functional neuroimaging, which allows direct visualization of brain regions involved in the processing and integration of vestibular information. Techniques such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) can provide insights into neuronal activity during the occurrence of vertigo episodes and help identify abnormal patterns of neural connectivity associated with vestibular disorders (3). This information may be useful to guide the differential diagnosis and develop more targeted and effective therapeutic strategies for patients with vertigo.

Future perspectives in the evaluation and treatment of vertigo include the development of gene and pharmacological therapies aimed at correcting specific dysfunctions in the vestibular

system. Advances in understanding the molecular mechanisms underlying vestibular disorders, such as Ménière's disease and vestibular migraine, are opening up new opportunities for the development of personalized and targeted treatments aimed at restoring normal vestibular function and relieving vertigo symptoms (4). In addition, innovative approaches, such as non-invasive brain stimulation and gene therapy, are being explored as potential strategies to modulate neural activity and restore vestibular homeostasis in patients with vertigo refractory to conventional treatments.

Technological advances are transforming the way we assess and treat vertigo, offering new tools and approaches for better understanding and management of this complex clinical condition. The integration of remote sensing technologies, virtual reality, functional neuroimaging, and targeted therapies promises to significantly improve the diagnosis and treatment of vertigo, providing a more accurate, effective, and personalized approach for patients with this condition.

COMPLEMENTARY AND ALTERNATIVE THERAPEUTIC APPROACHES IN VERTIGO

In addition to conventional therapeutic approaches, several complementary and alternative modalities have been explored in the management of vertigo, offering additional options for patients seeking symptom relief. One of these modalities is acupuncture, an ancient practice of traditional Chinese medicine that involves inserting needles into specific points on the body to restore energy balance and promote healing. Clinical studies have shown that acupuncture can be effective in relieving vertigo and other vestibular disorders, helping to reduce the frequency and severity of vertigo episodes and improving patients' quality of life (1). Proposed mechanisms include the regulation of neural activity and the modulation of the inflammatory response in the vestibular system.

Another complementary therapeutic approach is craniosacral therapy, a gentle form of manual manipulation that aims to improve cerebrospinal fluid flow and restore balance and harmony in the body. Craniosacral therapy has been used in the treatment of a variety of neurological disorders, including vertigo, and can help relieve symptoms and promote overall well-being for patients. Preliminary studies suggest that craniosacral therapy may have beneficial effects in reducing the intensity and frequency of vertigo episodes, although more research is needed to confirm its efficacy and mechanisms of action (2).

In addition, lifestyle-based approaches, such as diet and exercise, play an important role in the management of vertigo, helping to reduce risk factors and promote the overall health of the vestibular system. A balanced diet, rich in essential nutrients like magnesium, vitamin D, and omega-3s, can help reduce inflammation and improve vestibular function, while regular practice of balance and coordination exercises can strengthen muscles and improve postural stability, thereby reducing the risk of falls and vertigo-related injuries (3).

In addition to therapeutic approaches, psychosocial and supportive interventions can play an important role in managing vertigo by helping patients cope with the emotional and psychological aspects of the condition. Cognitive behavioral therapy (CBT), for example, can help patients identify and modify negative thought patterns and maladaptive behaviors related to vertigo, thereby reducing the anxiety and stress associated with the condition. In addition, support groups and educational programs can provide a social support network and useful information about coping strategies and resources available to cope with vertigo on a day-to-day basis (4).

Complementary and alternative therapeutic approaches offer additional options in the management of vertigo by providing a holistic and integrative approach to the treatment of this complex condition. Integrating these modalities into clinical care can help improve patient outcomes and promote a more personalized, patient-centered approach to vertigo management.

CONCLUSION

Understanding the complementary and alternative therapeutic approaches in vertigo provides a more comprehensive insight into the treatment options available. These modalities offer a holistic approach to the management of vertigo, considering not only the physical but also the emotional and psychosocial aspects of the condition. Integrating these approaches into clinical care can provide additional benefits to patients by improving their quality of life and promoting a more complete recovery.

By exploring therapeutic options beyond conventional approaches, healthcare providers can offer patients a wider range of choices for vertigo management. However, it is important to note that these complementary and alternative approaches are not a substitute for standard treatments, but can be used as part of an integrated care strategy. In addition, more research is needed to evaluate the efficacy and safety of these modalities in different clinical settings and patient populations.

Ultimately, individualization of vertigo treatment is essential, taking into account the needs and preferences of each patient. By taking a patient-centered approach, healthcare providers can collaborate with patients to develop personalized treatment plans that take into account not only the medical aspects of the condition but also its emotional, social, and psychological dimensions. This integrative, patient-centered approach has the potential to significantly improve patient outcomes and promote a more comprehensive and compassionate approach to vertigo management.

In summary, by recognizing and exploring complementary and alternative therapeutic approaches in vertigo, healthcare providers can provide patients with additional options for treating the condition. These modalities, when integrated into a multidisciplinary and patient-centered approach, have the potential to improve quality of life and promote a more complete and sustainable recovery for patients suffering from vertigo.

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Analysis of child obesity: Actual scenary, public policy, tratments and control

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ABSTRACT

Childhood obesity is a significant public health concern, presenting complex challenges with far-reaching consequences. The introduction of this analysis sets the stage by contextualizing the severity of childhood obesity, citing the World Health Organization's recognition of it as a critical 21st-century health issue. The condition adversely impacts children's physical and mental health to long-term complications that extend into adulthood. The analysis explores various dimensions of childhood obesity, including its prevalence, associated health risks, and the multifaceted factors contributing to its rise, such as genetic, environmental, and behavioral influences. The review identifies six key thematic impact in research on childhood obesity: obesity and overweight, risk of child obesity, causes of obesity, prevention strategies, and obesity data. The classification of childhood obesity, crucial for monitoring and intervention, is discussed, highlighting the use of body mass index (BMI) and measures to assess and categorize the condition. The importance of addressing childhood obesity is underscored, considering its on future societal health and the mental well-being of affected children. Public policies and health programs play a pivotal role in combating this issue, emphasizing the need for a comprehensive, multi-sectoral approach. The review also delves into various treatment and intervention strategies, ranging from lifestyle and dietary modifications to medical therapies, and stresses the importance of early detection and prevention. Global and regional prevalence trends are analyzed, revealing significant variations and underscoring the urgency of targeted interventions. The study concludes by advocating for sustained collaborative efforts among stakeholders, including policymakers, healthcare professionals, and communities, to effectively address and mitigate the childhood obesity epidemic.

Keywords: Childhood Obesity, Public Health, Prevention Strategies, Public Policy, Intervention.

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INTRODUCTION

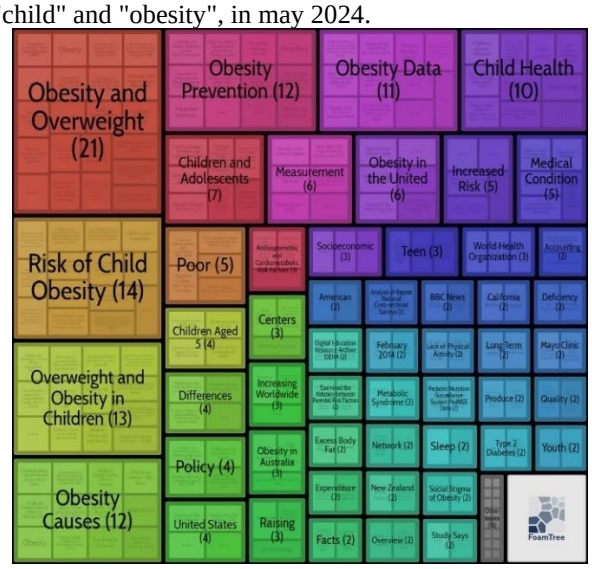
INTRODUCTION TO CHILDHOOD OBESITY

The introduction section of "Impacto da Obesidade Infantil: Consequências na Saúde Física e na Saúde Mental" serves to provide a contextualization of the problem of childhood obesity. According to the World Health Organization, childhood obesity is one of the most serious public health challenges of the 21st century. It has a significant impact on both the physical and mental health of children, as well as long-term consequences extending into adulthood. In this context, it is important to explore the causes, effects, and potential solutions to this pressing issue.

Overall, this introduction sets the stage for a thorough analysis of childhood obesity, encompassing its current status, policy framework, treatment options, and the broader societal and environmental implications. Through a comprehensive understanding of these issues, it is hoped that effective strategies can be developed to address this pressing public health issue and improve the well-being of children around the world (Wickramasinghe et al.2021; Pérez-Escamilla et al.2021).

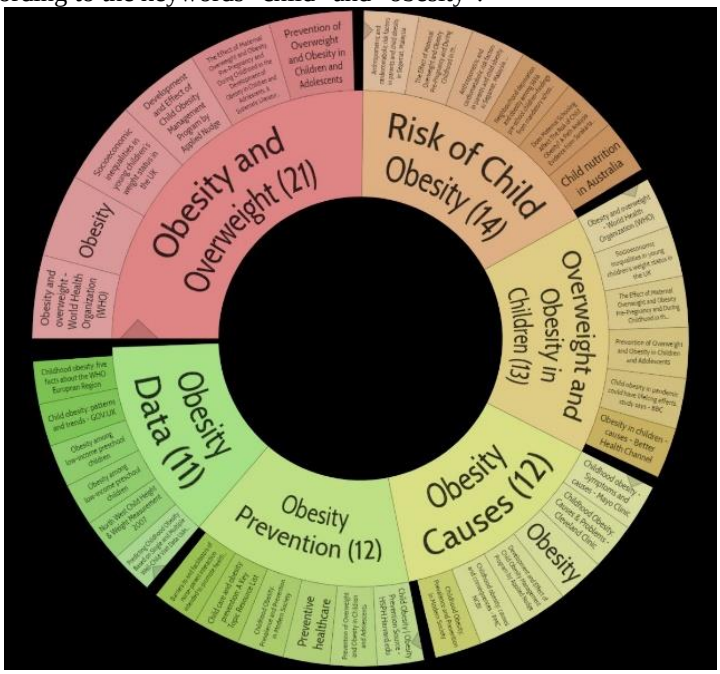
This chapter will also touch upon the existing public policies aimed at addressing childhood obesity, highlighting the importance of a comprehensive and multi-sectoral approach. In addition, it will outline the different treatment and intervention strategies that have been employed to combat childhood obesity, ranging from dietary and lifestyle modifications to medical and behavioral therapies. Finally, it will discuss the challenges and opportunities in the prevention and control of childhood obesity, emphasizing the need for collaborative efforts and sustained commitment from various stakeholders (Parnell et al.2022; Salvagno et al., 2023; Pavlik, 2023). In this sense, a literature survey was carried out, mainly on the PubMed platform and, according to what was recovered, in the last 5 years, the scientific articles published are based on a series of approaches, as can be seen in Figure 1.

Figure 1. Tree map that indicates the hierarchical distribution of scientific articles retrieved (117) on the PubMed platform, according descriptors "child" and "obesity", in may 2024.



Childhood obesity is a complex and multifaceted issue that has become a major public health concern in recent years. The introduction to childhood obesity in this work provides an overview of the current landscape, including the prevalence and trends of obesity among children, as well as the associated health risks and consequences. It also delves into the various factors contributing to childhood obesity, such as genetic, environmental, and behavioral influences. As a result of the literature survey, carried out on the PubMed platform, in the last years, six clusters or thematic areas of research around childhood obesity were grouped. Among them, there was greater attention to obesity and overweight (21 published articles), risk of child obesity (14 published articles) and the others including overweight and obesity in children (13 published articles), and obesity causes (12), obesity prevention (12) and obesity data (11) Figure 2.

Figure 2. Pie chart indicating clusters formation of scientific articles published and retrieved in a survey on the PubMed platform, in may 2024, according to the keywords "child" and "obesity".



DEFINITION AND CLASSIFICATION

Understanding the definition and classification of childhood obesity is fundamental for monitoring its prevalence, assessing health risks, and guiding intervention strategies. By identifying and categorizing children who are affected by obesity, healthcare professionals and policymakers can better target resources and interventions to address this critical public health issue (Breda et al., 2021; Spinelli et al., 2021; Tsoi et al., 2022).

Childhood obesity is generally defined as a medical condition characterized by an excessive accumulation of body fat that poses a risk to health. This excess adiposity can be assessed and classified using various measures, including body mass index (BMI) and waist circumference. The classification of childhood obesity takes into account age and gender-specific growth charts and

norms. Additionally, obesity can be further categorized into different levels of severity, such as overweight and obesity, based on specific BMI thresholds (Caprio et al., 2020; Kansra et al., 2021; Apperley et al., 2022).

Childhood obesity is a significant health issue that has gained widespread attention in recent years. In order to effectively address and combat this problem, it is crucial to have a clear understanding of what obesity in children entails. The definition and classification of childhood obesity are essential for identifying and categorizing the condition, which in turn informs the development of policies and treatment strategies (Dietz & Baur, 2022; Apperley et al., 2022; Deal et al., 2020).

IMPORTANCE OF THE THEME

Understanding the importance of this theme involves recognizing the impact it has on the future of society. In addition to the impacts on physical health, childhood obesity is also associated with mental health consequences, such as low self-esteem, social isolation, bullying and depression. Children with obesity often face discrimination and stigmatization, which can harm their psychosocial and emotional development. Therefore, addressing the problem of childhood obesity is crucial not only for children's health, but also for the well-being of society as a whole (Capistrano et al.2022; Garcia & Paiva, 2020).

Childhood obesity is a multifactorial problem, resulting from the interaction between several factors, including inadequate eating habits, lack of physical activity, genetic and environmental influences, as well as socioeconomic issues. Furthermore, obesity in childhood is associated with a series of health complications, such as type 2 diabetes, hypertension, orthopedic problems, respiratory and liver disorders, in addition to increasing the risk of developing cardiovascular diseases in adulthood (Batista & De, 2023; Pereira & Xavier, 2024).

Childhood obesity is a public health problem with significant repercussions on children's physical and mental health. In recent years, an alarming increase in the prevalence of obesity among children has been observed in many countries, including Brazil. This trend represents a growing concern due to the health risks that childhood obesity poses, as well as the long-term impacts on the quality of life of affected children. (Santos et al., 2023; Pires et al., 2024; Machado, 2021).

By shedding light on the significance of this topic, we can raise awareness, advocate for improved public health policies, and ultimately work towards creating a healthier environment for our children (McPhee et al., 2020; Faienza et al., 2020; Caprio et al., 2020).

The topic of childhood obesity is of utmost importance due to its alarming increase in recent years. This is a major public health issue that not only affects the physical health of children but also has long-term repercussions on their overall well-being. The rise in childhood obesity rates poses a

significant burden on healthcare systems and has serious economic implications. Furthermore, it is crucial to recognize that childhood obesity is not solely a medical issue, but a complex problem with social, environmental, and behavioral determinants (Mendoza-Muñoz et al., 2020; Nieto & Suhrcke, 2021; Browne et al., 2021).

EPIDEMIOLOGY OF CHILDHOOD OBESITY

The epidemiology of childhood obesity refers to the study of the distribution, determinants and consequences of this condition within the population (Drozdz et al., 2021; Deal et al., 2020).

Understanding the definition and epidemiology of childhood obesity is important for developing effective public health policies, treatment strategies, and prevention efforts. By analyzing the current landscape and trends in childhood obesity, we can gain valuable insights into the underlying causes, risk factors, and disparities that exist within different populations. This knowledge is essential for implementing targeted interventions and promoting early intervention initiatives to address the root causes of childhood obesity and mitigate its long-term effects on individuals and society as a whole (Dietz & Baur, 2022; Verduci et al.2022; Deal et al., 2020).

Epidemiological studies have shown that childhood obesity rates have more than tripled in the past four decades, resulting in approximately 38 million children under the age of five being classified as overweight or obese. The consequences of childhood obesity are severe, encompassing a range of physical and psychological health problems that can have lasting effects on a child's well-being. These include an increased risk of developing chronic conditions such as health problems associated with obesity, such as type 2 diabetes mellitus (T2DM), metabolic syndrome (MS) and non-alcoholic fatty liver disease (NAFLD), as well as the psychological impact of low self-esteem and social stigmatization (González-Álvarez et al., 2020; Sorić et al., 2020; Kranjac & Wagmiller, 2020; Kovalic et al., 2023).

Childhood obesity is a significant health issue characterized by an excessive accumulation of body fat that poses a risk to a child's health. The prevalence of childhood obesity has reached alarming levels globally, with both developed and developing countries experiencing a rise in the number of affected children. This trend is compounded by socioeconomic factors, making it a complex and multifaceted issue that requires attention and intervention (Biesma & Hanson, 2020; Klingelhöfer et al., 2021; González-Álvarez et al., 2020).

GLOBAL PREVALENCE

There is an increase in prevalence. The prevalence of childhood obesity has increased globally in 2000 years, with significant variations between regions and countries. (Hruby & Hu, 2015).

Childhood obesity is a public health problem of alarming proportions, transcending borders and consolidating itself as a true global epidemic. According to data from the World Health Organization (WHO), in 2022, 37 million children under the age of 5 were overweight; over 390 million children and adolescents aged 5–19 years were overweight, including 160 million who were living with obesity (WHO, 2024).

Regional differences

Current evidence also suggests that obesity rates have stabilized in children and adolescents in more economically advanced countries since 2000, which is possibly related to healthier eating habits and physical activity levels. On the other hand, there is a steady and uninterrupted increase in low-income nations, and the universal trend is an escalation of obesity rather than a slowdown, driven primarily by sharp increases in the prevalence of obesity in low-income populations (Koliaki et al., 2023). For example, the prevalence of obesity in children aged 5-19 is 41.8% in Mexico, 22.1% in Brazil, 22.0% in India and 19.3% in Argentina (Gupta et al., 2012).

Therefore, in the Brazilian scenario, the situation is no less worrying. It is estimated that 6.4 million Brazilian children between 5 and 9 years old are overweight and 3.1 million are obese, which represents 13.2% of this age group served by the Unified Health System (SUS). Trends show an increase in the prevalence of obesity in countries such as Brazil (from 4.1% to 13.9% between 1974 and 1997) and Thailand (12.2% to 15.6% between 1991 and 1993) (Gupta et al., 2012).

The prevalence of childhood obesity in Brazil is 12.2%, with 10.8% in girls and 12.3% in boys, and varies widely between states, emphasizing the need for urgent measures to prevent and treat obesity (Santos et al., 2023). The study reveals that childhood obesity in Brazil is a serious problem and requires urgent measures, with the aim of combating childhood obesity and ensuring the health and well-being of Brazilian children. They indicate that public education policies should be prioritized, focusing on: encouraging regular physical exercise; promote healthy eating for children; Implement educational programs on childhood obesity in schools.

RISK FACTORS, DETERMINANTS AND IMPACT OF CHILDHOOD OBESITY

Epidemiologically, the prevalence of childhood obesity varies across different regions and socio-economic strata, with higher rates observed in urban areas and among economically disadvantaged populations. Furthermore, disparities in obesity prevalence have also been identified among different racial and ethnic groups, emphasizing the complex interplay of genetic, environmental, and social factors in shaping this public health issue.

While the primary cause of childhood and adolescent obesity is an imbalance between caloric intake and physical activity, environmental factors are particularly significant in its development.

Beyond genetic and biological factors, socio-environmental influences, including family, school, community, and national policies, play a pivotal role. The complexity of the risk factors contributing to obesity in this population complicates treatment efforts. Numerous intervention trials targeting childhood and adolescent obesity have demonstrated limited effectiveness. Consequently, early detection and prevention are crucial in managing the global obesity epidemic. Given that the number of overweight children and adolescents exceeds that of those with obesity, a successful prevention strategy should focus on overweight youth, who are at a heightened risk of developing obesity (Lee & Yoon, 2018).

BIOLOGICAL AND GENETIC FACTORS

Genetic and biological factors play a significant role in the predisposition to obesity. History of parental obesity is an important determinant, with children of obese parents being at greater risk of developing obesity (Rohde et al., 2019). Non-genetic factors, such as eating behavior or physical activity, strongly modulate the individual risk of developing obesity. These factors may interact with the genetic predisposition to obesity through epigenetic mechanisms (Baygi et al., 2023).

SOCIOECONOMIC FACTORS

Socioeconomic status (SES) is also strongly associated with childhood obesity. In many developing countries, children from high-SES families are more likely to be obese due to greater access to high-calorie diets and sedentary lifestyles. In contrast, in developed countries, children from low-SES families are at greater risk due to economic and environmental barriers to maintaining a healthy lifestyle (Wang & Lim, 2012).

In India, Ramana et al. (2024) evaluated the socioeconomic relationship with childhood obesity. The authors observed that urban children had a higher prevalence of obesity (36%) than rural children (28%). In urban communities, children from lower socioeconomic status (SES) families had a 40% obesity rate compared to 32% in higher SES households. In rural communities, these rates were 36% (lowest SES) and 20% (highest SES).

PSYCHOLOGICAL ISSUES

Childhood obesity is linked to a range of problems, including psychological issues such as low self-esteem and depression. Understanding the multifaceted impact of childhood obesity is essential for developing effective interventions and strategies to address this problem. By contextualizing the problem in this way, we hope to underscore the urgency of addressing childhood obesity and the need for comprehensive, multidisciplinary approaches to tackle this complex issue (McPhee et al., 2020; Faienza et al.2020; Caprio et al., 2020).

PREVENTIVE APPROACHES AND INTERVENTIONS

In a systematic evaluation of the effectiveness of childhood obesity prevention programs, Yang et al. (2015) carried out a survey of studies conducted in high-income countries and implemented in various contexts. Searched MEDLINE®, Embase, PsycINFO, CINAHL®, ClinicalTrials.gov and the Cochrane Library from inception to April 22, 2013, targeting diet, physical activity or both, and carried out in children aged 2 to 18 years in high-risk countries. income. The authors retrieved 147 articles (139 intervention studies), of which 115 studies were primarily school-based, although other settings may have been involved. Most were carried out in the United States and in the last decade. The SOE (strength of evidence) was elevated for physical activity-only interventions delivered in schools with home-based involvement or for combined diet and physical activity interventions delivered in schools with home- and community-based components. The SOE was moderate for school-based interventions targeting diet or physical activity, combined school-based interventions with home-based or community-based components, or combined community-based interventions with a school-based component. The SOE was low for combined interventions in child care or home settings. Evidence was insufficient for other interventions. In conclusion, at least moderately strong evidence supports the effectiveness of school-based interventions to prevent childhood obesity.

Another meta-analysis study on the effect of childhood obesity prevention programs carried out by Yang et al. (2014). The authors used, as a basis, studies where diet and/or physical activity intervention(s) were implemented with ≥1 year of follow-up (or ≥6 months for school intervention studies) in children aged 2 to 18 years, and were excluded if they only targeted overweight/obese children or those with a pre-existing medical condition. Seventeen studies were finally included. It was observed that the majority of interventions (70%) showed similar significant effects or no effect on adiposity and lipid outcomes: 15% of interventions improved adiposity and lipid outcomes; 55% had no significant effects on either. Childhood obesity prevention programs had a significant and desirable effect on LDL-C and HDL-C. Two-thirds of interventions showed similar significant effects or no effect on adiposity and lipid outcomes. Assessment of lipid outcomes provides additional useful information about the benefits of the obesity prevention program.

For Reinehr (2013), lifestyle interventions are considered the therapy of choice in children with obesity. The effectiveness of lifestyle intervention for childhood obesity has been proven by several randomized controlled trials and meta-analyses. Even a stable weight in a growing child with obesity is associated with an improvement in cardiovascular risk factors and obesity comorbidities. In particular, children aged 5 to 12 and children who are overweight and not obese benefit from lifestyle interventions. However, in clinical practice, the degree of weight loss with lifestyle intervention is only moderate and the success rate 2 years after starting an intervention is low (<10%

with a decrease in BMI SD score < 0.25). However, the difficulty of an overweight or obese child in reducing their weight can be attributed not only to a lack of motivation, but also to genetic basis and/or adaptive changes in basal metabolic rate, hunger hormones and of satiety that occur with weight loss. We must accept that lifestyle interventions are only successful in a subset of children with obesity. Regardless, the techniques used and the training of therapists need to be improved. If lifestyle interventions do not result in weight loss in a child with obesity, drug treatment to reduce cardiovascular risk factors should be initiated, but is currently rarely undertaken.

PUBLIC POLICIES AND HEALTH PROGRAMS

According to Henriques et al. (2018), Brazilian government initiatives to combat childhood obesity include food and nutrition education, agroecological production systems, family agriculture, healthy environments, and regulatory measures, but face disputes between processed food and agribusiness interests.

According to the previously mentioned authors, the study they conducted analyzed initiatives to prevent and control childhood obesity, especially those promoting Adequate and Healthy Eating (PAAS), which have been part of the Brazilian federal government's policies for 15 years. All documents presenting PAAS initiatives in the areas of food and nutritional security, as well as in the areas of public health policy, were evaluated according to the following criteria: (1) the approach to PAAS initiatives; (2) the aspects of obesity they intend to affect and (3) potential disputes of interest. The main PAAS initiatives identified aim to encourage: food and nutritional education; agroecological production systems; family farming; food accessibility; healthy environments and regulatory measures. These initiatives change different aspects of childhood obesity and highlight different conceptions of the problem and affect different interests. We highlight the disputes between the interests of industrialized food and agribusiness corporations and the government and business sectors guided by the PAAS objectives. Measures aimed at regulating purchases and promoting unhealthy products to children are those that best express the interests involved.

Brazilian federal and local levels have diverse key actors shaping childhood obesity strategies, with the executive authority group playing a key role in policy and programming decisions (Buccini et al., 2022). These authors mapped and described the level of influence (i.e., power) of key actors at the federal and local levels to implement strategies to resolve this issue. Preliminary data shows a total of 188 key actors at the federal level (FED) and 68 key actors at the local level (LOC) shaping the agenda across four domains of influence: command (FED = 89; LOC = 44), financing (FED = 37; LOC = 24), technical capacity development support (DTC) (FED = 47; LOC = 28) and outreach (FED = 13; LOC = 15). The executive authority group has emerged as the most involved in driving childhood obesity policy and programming decisions at the federal and local levels. The

executive authority group was the most cited across all domains at the local level. In the field of financing at federal level, academia, civil society, the private sector and international organizations had a balanced presence with groups from the executive branch, while the main civil society actors were the most cited in the field of CDT. The dissemination network at the federal level focused on the private sector due to the workshop's time limit. In conclusion, they highlighted that the federal and local levels have different key actors and networks that shape strategies to prevent childhood obesity and care for children with obesity. While there is a more diverse group at the federal level across multiple domains of influence, the local level relies on the executive authority group to implement the agenda.

Policymakers seeking to reduce childhood obesity must prioritize investment in treatment and primary prevention. The authors estimate the cost-effectiveness of seven interventions high on the obesity policy agenda: an excise tax on sugary drinks; elimination of the tax subsidy for advertising unhealthy foods to children; calorie labeling on restaurant menus; nutritional standards for school meals; nutritional standards for all other foods and beverages sold in schools; better care and early education; and increased access to bariatric surgery in adolescentes (Gortmaker et al., 2018).

Gortmaker et al. (2018) indicate that Brazil has three main interventionist measures for childhood obesity. Excise tax, elimination of tax deduction, and nutrition standards for food and beverages sold in schools, are projected to save more in healthcare costs than they cost to implement, highlighting the importance of primary prevention. They carried out systematic reviews and a microsimulation model of national implementation of interventions during the period 2015-2025 to estimate their impact on the prevalence of obesity and their cost-effectiveness in reducing individuals' body mass index. In their modeling, the authors observed that three of the seven interventions – excise taxes, elimination of the tax deduction, and nutritional standards for foods and beverages sold in schools outside of mealtimes – saved more in health care costs than they cost to implement. Each of the three interventions prevented 129,000-576,000 cases of childhood obesity by 2025. Bariatric surgery in adolescents had a negligible impact on obesity prevalence. The results highlight the importance of primary prevention for policymakers aiming to reduce childhood obesity.

CHALLENGES AND BARRIERS IN CONTROLLING CHILDHOOD OBESITY

Childhood obesity prevention policies face barriers and facilitators, with structural factors being the most significant, and effective communication, healthy food programs, and low-cost resources being key (Taghizadeh et al., 2023).

The authors examined, through analysis, factors that influence the implementation of COP policies in a community approach, in the period from 2015 to 2022. As results, they presented the reluctance of parents to participate in COP (childhood obesity prevention policies) activities, the lack

of sufficient knowledge and the financial problems were the most reported barriers at the individual level. Furthermore, beliefs about the COP at the sociocultural level and limited funding and resources, time constraints of stakeholders at the implementation level, and lack of political support at the structural level were the most frequently communicated barriers. Furthermore, effective communication between stakeholders, parents and school staff at a socio-cultural level and flexibility of intervention, implementation of healthy eating programs in schools, appropriate and low-cost resources and availability of suitable facilities are the most frequently reported facilitators at the structural level. In conclusion, the authors indicate that individual, sociocultural and structural barriers and facilitators influence the implementation of COP policies. Most barriers and facilitators in this systematic review were related to the structural level.

Obesity management in Brazil's Unified Health System faces challenges, requiring permanent education, instructional materials, and support for health teams to effectively address these barriers (Lopes et al., 2020).

Lopes et al. (2020), carried out a web-based quantitative exploratory study, carried out in 2018 with healthcare professionals. They observed that for these professionals, the barriers were related to the work process and structural aspects and reinforce the need for training health teams. The authors of the study propose that permanent education activities be established, as well as the development of instructional materials applicable to the work routine of health professionals.

FUTURE PROSPECTS AND INNOVATIONS

A nutrition education project in Brazil, involving BMI monitoring, school gardens, and education, has been successful in promoting change in children's eating habits and reducing obesity. Segundo Nasser (2020), an innovative proposal was made, based on a nutritional education project developed by a Brazilian non-profit organization from 2016 to 2018. Focusing on health and nutrition, the project included interventions such as BMI monitoring, assessment of iron deficiency anemia in children, school gardens and education. This strategy has been developed in different areas of the country, with success in all scenarios, demonstrating that a bottom-up approach, with community involvement, is necessary to promote change. The program has managed to integrate the main activities into the schools' daily curriculum, with the adoption of healthier snacks for children. 76% of parents said that the school garden made their children eat more fruits and vegetables and 33% of children said they changed their eating habits after the program. The buy-in of local governments and communities demonstrates the effectiveness of the interventions. Private sector investments in social programs must ensure a more sustainable approach, so that behavioral change, which is fundamental to reducing risk factors associated with NCDs, can be promoted. This needs to be done with a comprehensive approach, with the support of local as well as national and

international stakeholders. Long-term change is possible with a grassroots approach that engages communities towards healthier lifestyles. A school or home garden can provide better nutritional choices.

Another approach, although ancient, has gained many followers is the use of herbal medicines and medicinal plants to control obesity and related diseases. Therapeutic lifestyle changes and maintenance of regular physical activity through parental initiative and social support interventions are the most important strategies in managing childhood obesity. Also, high-risk screening and effective health educational programs are urgently needed in developing countries (Gupta et al., 2012).

Natural anti-obesity agents, such as plants, show potential as a promising alternative to synthetic medications and surgical procedures, with potential for future research and development (Karri et al., 2019).

The use of medicinal plants to maintain normal weight and excellent health has long been researched. However, there is still a lack of sufficient empirical data to support the scientific notion of using herbal products for weight management. Obesity has traditionally been treated with herbal remedies from national and international sources, including Ayurveda (Traditional Indian System of Medicine). Medicinal herbs, such as Salvia plebian, Glycine max, Curcuma longa, Camellia sinensis, and Moringa citrifolia, show potential anti-obesity effects, with active phytochemical components like daidzein, ginsenosides (Ghai et al., 2023).

For Ghai et al. (2022), many synthetic anti-obesity drugs, such as orlistat, lorcaserin, phentermine, bupropion, and liraglutide, are now available on the market. However, these medications have side effects, including dry mouth and sleep disturbances, dizziness, blood pressure, elevated heart rate, constipation, and headache. Humans have a long and ancient history of dependence on traditional medicinal plants and their main bioactive antioxidant components, such as quercetin, anthocyanins and ellagic acid, for the treatment of such diseases and disorders. They emphasize that herbal approaches, containing bioactive compounds such as quercetin, anthocyanins and ellagic acid, show potential in the treatment of obesity without side effects.

FINAL CONSIDERATIONS

In conclusion, addressing childhood obesity requires a multifaceted and comprehensive approach that encompasses public health policies, community engagement, and individual behavioral changes. The rising prevalence of childhood obesity poses significant physical and mental health risks, extending into adulthood with chronic diseases and premature mortality. Effective interventions must consider the complex interplay of genetic, socio-environmental, and behavioral factors.

To mitigate this public health crisis, early identification and preventive strategies are paramount. School-based programs, community involvement, and supportive public policies have shown promise in promoting healthier lifestyles and reducing obesity rates. Additionally, the role of nutrition education and the incorporation of physical activities into daily routines are critical components in combating this issue.

Future efforts should focus on sustainable and inclusive approaches, ensuring that all stakeholders, including families, schools, healthcare professionals, and policymakers, work collaboratively. Innovations in treatment and prevention, coupled with robust policy frameworks, can create a healthier environment for children and adolescents, ultimately reducing the burden of obesity and improving their overall quality of life.

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Oral problems and the participation of dentistry in the palliative care team

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ABSTRACT

This chapter seeks to address, in the format of an integrative review of the literature, the impact of oral problems on the quality of life of terminal patients and the participation of Dentistry in the palliative care team. For the development, the PRISMA recommendation, the health descriptors or MeSH Terms "palliative care", "dentistry" and "oral health", in their versions in Portuguese, English and Spanish, combined with the Boolean operators "AND" and "OR", by the advanced search form, were considered. The records were selected by two independent researchers, based on the reading of the title and the abstract and considering the inclusion and exclusion criteria defined. From 546 records collected, three made up the synthesis table. There was evidence on the negative impact of oral health problems on the quality of life of terminally ill patients; but there are gaps in information about the participation of the dental surgeon in the multidisciplinary care team.

Keywords: Palliative care, Dentistry, Oral health.

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INTRODUCTION

The World Health Organization or WHO recognizes palliative care as a method to improve the quality of life of individuals or terminally ill patients and their families, in situations of diseases with the imminent risk of death. Its approach focuses on the prevention and relief of suffering, in the search for the integration of physical, psychosocial and spiritual aspects. So it's not just about "prolonging life", it's about providing comprehensive comfort and support. [1.2]

Even with the aging of the world's population, particularly in the most developed countries (where life expectancy is higher), thinking about palliative care still appears as synonymous with "not treating", "not investing", "giving up"... However, it may represent a time when attention needs to be as holistic, active, and comprehensive as possible.

The professionals involved in the multidisciplinary team need to form a therapeutic alliance with the patient, the caregivers and the family, leading to a different look at what the disease is, the sources of anguish and overload generated, in addition to working on the experience of grief, as well as a therapeutic alliance.[3]

In this context, the work of a multidisciplinary team composed of physicians, nurses, physiotherapists, nutritionists, social workers, speech therapists, pharmacists, caregivers, volunteers and religious people, among others, is recognized [4] However, some professionals, mainly linked to health specialties, do not seem to be a reference in this type of approach; such as those linked to the Oral Health Team (BS), especially the Dental Surgeon (DC).

Studies report a high incidence of treatable oral diseases among palliative patients; however, it should be taken into account that a large part of this group loses the ability to communicate their suffering; which can lead to an underreporting of oral or oral problems. Xerostomia, oral candidiasis (candidiasis) and dysphagia (difficulty swallowing) are the most prevalent conditions; followed by mucositis, orofacial pain, taste alteration and ulceration, among others.[5,6,7]

METHODOLOGY

In order to meet the proposed objectives, an integrative literature review was developed, based on the steps of the PRISMA statement or the Main Items for Reporting Systematic Reviews and Meta-analyses.[8] The guiding question of this review was: - Is there scientific evidence on the impact of oral problems on the quality of life of terminal patients and the participation of dentistry in the palliative care team?

The search strategies were used using the virtual portals PubMed (search platform of the National Library of Medicine or NLM) and VHL (Virtual Health Library), in their MEDLINE, LILACS and SciELO databases.

For the exploratory search, the descriptors, alternative terms or MeSH terms "palliative care",

"dentistry" and "oral health" were considered, in their versions in Portuguese and English and Spanish, combined with the Boolean operators "AND" and "OR" and through the advanced search form. The selection process was initiated by reading the title and abstract by two independent researchers. When in doubt among them, the record was included. In case of records cited more than once or duplicated; This was only counted once.

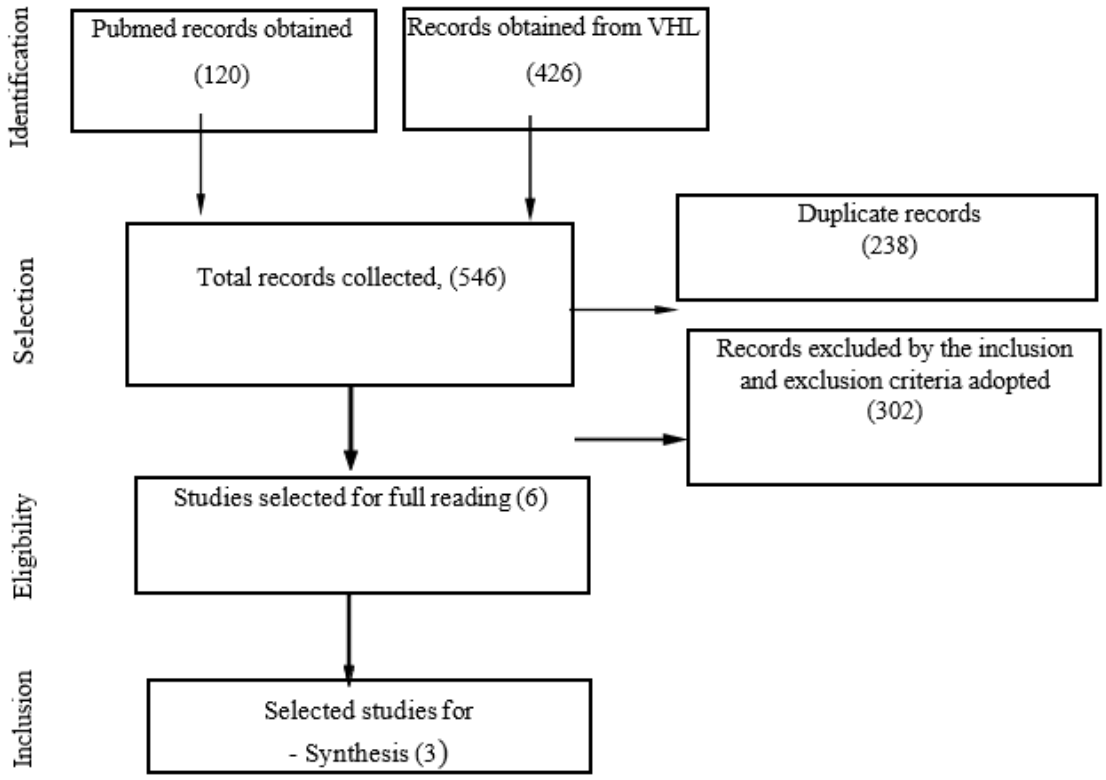
The data collection process took place between September and December 2023, adopting the following eligibility criteria:

a) Inclusion: papers that could be considered as scientific articles, between the years 2018 and 2023 and with the abstract available.

b) Exclusion: works not related to the guiding question, literature reviews or in languages other than Portuguese, Spanish or English, and of the qualitative type.

From the records selected for reading in full, there was the stage of including them for the synthesis of the most relevant data in a chart (Chart 1); steps that can be easily visualized in the Flowchart (Figure 1).

Figure 1 – Flowchart



RESULTS AND DISCUSSION

Quadro 1 - Registros incluídos na revisão segundo autores, nome dos artigos, periódico, local de estudo e ano de publicação.

Autoria / Ano	País / Idioma / Base de dados	Periódico	Objetivos
Chen *et al.*, (2020)	EUA / Inglês / PubMed (MEDLINE)	American Journal of Hospice & Palliative Medicine	Avaliar o perfil de saúde bucal de pacientes adultos em cuidados paliativos e identificar suas necessidades de tratamento.
Furuya *et al.*, (2022)	Japão / Inglês / PubMed (MEDLINE)	Supportive Care in Cancer	Avaliar a associação entre a saúde oral e a viabilidade da alimentação oral em pacientes com câncer avançado em cuidados paliativos.
Magnani et al., (2019)	Roma / Inglês / PubMed (MEDLINE)	American Journal of Hospice & Palliative Medicine	Descrever e monitorar as condições da boca em uma amostra de pacientes terminais submetidos a procedimentos diários de cuidados orais e avaliar se os procedimentos padrão para cuidados de higiene oral melhoraram o controle de sintomas orais (xerostomia, disgeusia e dor orofacial) e o conforto percebido pelo paciente.

Source: Data from this integrative review (2023)

Quadro 2 - Artigos selecionados para a leitura na íntegra, de acordo com o autor, o ano de publicação, o tipo de estudo, a amostra de interesse e os principais resultados ou conclusões.

Autoria / Ano	Tipo de estudo	Amostra	Principais resultados ou conclusões
Chen *et al.*, (2020)	Estudo piloto com desenho misto (transversal, com entrevista qualitativa)	49 pacientes adultos (Pessoas) que Recebem Cuidados Paliativos (PRCP).	A maioria desses indivíduos relataram pelo menos um sintoma oral, como xerostomia (boca seca), dor ou comprometimento no desempenho das funções orais. Entre os 31 pacientes dentados, a maioria (52,0%) tinha dentes cariados, quebrados ou não tratados e 33,3% apresentavam lesões nos tecidos moles orais, principalmente entre os usuários de próteses dentárias. Dos PRCP, 40,0% relataram comprometimento da saúde ou da qualidade de vida devido às condições orais. A maioria desses pacientes possuíam seguro odontológico, mas não tinham visitado o dentista nos últimos 12 meses. Os participantes relataram várias barreiras para o acesso ao tratamento odontológico, incluindo falta de transporte, medo e custo. Os autores concluíram que os PRPC têm necessidades significativas de tratamento odontológico e que os profissionais de saúde devem estar cientes dessas necessidades e trabalhar para superar as barreiras ao acesso ao tratamento.
Furuya *et al.*, (2022)	Estudo transversal.	100 pacientes com câncer avançado em cuidados paliativos.	A saúde oral foi significativamente associada à viabilidade da alimentação oral em pacientes com câncer avançado em cuidados paliativos. Aqueles com melhor saúde oral tiveram maior probabilidade de manter a alimentação oral e apresentaram melhor qualidade de vida. A avaliação da saúde oral deve ser considerada uma parte importante do cuidado paliativo em pacientes com câncer avançado.
Magnani *et al.*, (2019)	Estudo de coorte prospectivo	75 dos 415 pacientes admitidos no Centro de Cuidado Paliativo de Roma, entre os anos de 2016 e 2017.	Esses pacientes apresentaram alterações frequentes na cavidade oral com perda parcial das funções orais. A disgeusia (alterações no paladar) e a xerostomia diminuíram significativamente após os cuidados orais (procedimentos de higiene bucal). Também houve um elevado nível de conforto desse grupo de indivíduos (86.6%), após esses cuidados.

Source: Data from this integrative review (2023)

Comparing the data obtained in this integrative review was not simple, particularly with regard to the insertion of the dental surgeon in the multidisciplinary palliative care teams. There was mention of the patients' needs for dental treatment and the benefits achieved, but not of the effective

participation of the HC in the teams in question.

This type of care improves the quality of life not only of patients, but also of their families or caregivers, who face the complexities of life-threatening illnesses. They are most effective early in the course of these diseases, linked to "curative" care. In this way, it is easier to establish a greater and continuous relationship of trust with all those involved in the care of this target population; Especially for empathetic communication with everyone in the environment. [12th]

Even with the increasing number of oral symptoms in patients with this condition, dentistry does not appear to be directly related to palliative care. Oral care is often provided inadequately, in particular by family members and carers; but also by the nursing staff. And this seems to be associated with the level of consciousness and autonomy of the individual in the terminal condition. There are reports of lack of access to professionals of the Oral Health team for guidance and necessary interventions, and others directed to fatigue, when considering the demands of prolonged care. [13]

In addition to what was previously mentioned, it is necessary to reflect on the representation of the oral region, the mouth, and the teeth. Smiling and aesthetics often appear as the highlighted factors for oral care. However, in addition to being a significant representation of emotions and well-being, the mouth represents a "gateway", not only to food, but to pathogenic microorganisms.

If the "social" impact of BS conditions is well reduced, due to the situation in which the patient finds himself, the oral condition is related to the performance of the functions of the Stomatognathic System (ES), such as sucking, chewing, swallowing and phonation. And the maintenance of these functions enables a greater sense of comfort, in addition to better communication of the individual under palliative care, when this is possible, in the form of oral language. And this was well highlighted in the studies by Furuya *et al* (2022) and Magnani *et al* (2019).

Chen *et al* (2021) reinforced the presence of at least one oral symptom in terminally ill patients under palliative care. Most of these individuals, even with access to dental insurance, had not seen a dentist for at least one year. The barriers identified were related to transportation, fear, and cost.

The locomotion of patients under palliative care is usually a challenge. The feeling of fear, which is often directed to the figure of the dentist or to the possibility of more invasive treatments, in this group of people, has a broader meaning, because the weaknesses have reached the "extreme" and moments of complete awareness or lucidity hardly occur. And the concern with expenses enhances a situation that in itself is very delicate.

However, by working together with the other members of the hospital care team, the HC is able to act in a preventive manner, starting with adequate oral hygiene practices. And when it is not

possible to prevent the diseases, the appropriate intervention and treatment reduce or avoid more complex situations, regarding the possibility of infections, pain, discomfort and difficulties in the performance of oral functions; this was well documented in the studies by de Furuya *et al* (2022) and Magnani *et al* (2019).

FINAL THOUGHTS

There is scientific evidence that relates oral problems to the quality of life of patients at imminent risk of death. The records indicated the importance of dental care in the multidisciplinary Palliative Care team; Oral problems such as xerostomia, orofacial pain, decayed, fractured and untreated teeth, soft tissue injuries, changes in taste, difficulty in performing oral functions, among others, exert substantial negative impacts on the systemic health and quality of life of individuals, when in the condition of terminal patients. However, there are still gaps in information on the effective participation of Dentistry in multidisciplinary care teams for this target population.

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Impact of social isolation due to the COVID-19 pandemic on the health of older adults

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ABSTRACT

The study reveals results obtained from the interview of 1195 older adults, regarding the impact of social isolation due to the COVID-19 pandemic on the health care of these people.

Keywords: Elderly, COVID-19, Impact of the pandemic, Health of the elderly.

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INTRODUCTION

The social isolation adopted in the fight against the COVID-19 pandemic had a great impact on the lives of Brazilians. The elderly population, as they are considered a risk group, was especially affected by this measure, since the recommendations to these individuals were even more rigorous, which may have even impaired their medical follow-up, access to treatments, and the performance of other important health activities. Despite this, few studies have evaluated this effect in this portion of the population.

OBJECTIVES

In this sense, this study aims to evaluate the impact of social isolation on access to health care in the elderly population in the period between March and November 2020.

METHODS

An extension project was developed by the Academic League of Geriatrics and Gerontology of UFRJ (LIAG-UFRJ) divided into two stages, whose participants were students of health courses at the FEDERAL UNIVERSITY OF RIO DE JANEIRO. First, 8 theoretical classes on elderly health were taught through the StreamYard and YouTube platforms. Then, based on the knowledge obtained in the course, each extension worker was in charge of interviewing 2 to 5 elderly people aged 60 and over, remotely, through a standardized questionnaire made available with 69 varied and objective questions on topics covered in the theoretical classes, through the Google Forms platform.

For the formulation of this study, 7 questions were selected, divided into three axes: Adherence to social isolation, repercussion of access to health services and access to regular medications. All data were analyzed in groups and anonymously.

RESULTS

Responses were obtained from 1195 older adults, of which 95.6% (1142) partially or fully adhered to social isolation between March and November 2020. During this period, although 76.7% (916) of the interviewees stated that they had regular follow-up before the pandemic, 44.3% (529) did not go to any medical appointment during this period.

In addition, 41.3% (494) stopped performing scheduled exams and 36.5% (436) interrupted activities such as physiotherapy, speech therapy and other activities important to their health. Regarding the use of medications, the majority - 94.2% (1008) - stated that they had continued the use of their routine medications.

CONCLUSION

The study revealed, therefore, that there was a great impact of social isolation measures on the care routine of these older adults, since most of them partially or fully adhered to isolation. In this sense, it was observed that there was a loss in access to health services for a significant portion of this population, as well as the discontinuity of activities and treatments that were important for their well-being. Thus, the consequences of this impact must be evaluated in the long term.

REFERENCES

The study is a field analysis, no references were used for its elaboration

Profile of communicative and cognitive shills of children with heart disease undergoing heart surgery

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ABSTRACT

Objective: To identify the level of communicative skills of children with congenital heart disease submitted to cardiac surgeries, corrective or not, through the behavioral observation protocol – PROC.
Methods: This is an analytical observational study with a quantitative approach. The research participants were 15 children with congenital heart disease, who had undergone some type of cardiac surgery, who were in the age group of 24 to 48 months, and were hospitalized in the pediatric unit or in outpatient medical care at the Hospital do Coração de Messejana Dr. Carlos Alberto Studart Gomes, excluding those who had any associated syndrome. For data collection, two instruments were used, the Behavioral Observation Protocol (PROC), already validated, and a questionnaire to outline the sociodemographic profile of the child and his/her guardian. Descriptive statistics were adopted for data analysis.
Results: Children with congenital heart disease submitted to surgical procedures have alterations in the language acquisition process, most of them in the initial sensorimotor phase.
Conclusion: The present study was promising as it allowed us to understand and identify the delays in linguistic development caused by heart disease, facilitating the referral for early intervention, in order to detect, prevent or minimize the impairment of linguistic aspects.

Keywords: Congenital heart disease, Language, Speech therapy, Child development.

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INTRODUCTION

Congenital heart disease is defined as an anomaly developed in the embryonic period that affects the anatomy and physiology of the heart (1), and may occur in the heart wall, valves or blood irrigation vessels, with or without a bluish discoloration of the skin, indicating low blood oxygenation, being classified as cyanotic or acyanotic (2)

According to the World Health Organization (WHO) (3), cardiovascular diseases are the leading causes of death worldwide and the second leading cause of infant mortality in Brazil. It is estimated that cardiac malformations affect approximately 0.9% of live births (4).

Surgical interventions, whether corrective or palliative, often occur in early childhood, requiring an early diagnosis, thus increasing the life expectancy of this population(5). However, cardiac surgery is considered a high-risk procedure, most of the time causing serious complications in the postoperative period of these children, resulting in a long period of hospitalization in intensive care units (ICU)(6), requiring specific care that requires joint action by a multidisciplinary team.

According to Ferreira et al(7), the hospitalization period is a phase that compromises the child's life in several ways; It leads to the deprivation of stimuli favorable to child development, with visual and auditory stimuli that are "threatening" and confusing for the child, where, at the time of hospital discharge, new challenges will arise in their growth and development.

Several studies point out how congenital heart disease can interfere with the motor, cognitive and language development of children. With regard to language, Nóbrega and Minervino (8) state that its development does not depend only on the innate conditions of each individual, but also on external factors such as the environment in which it is inserted and social factors, with the first year of life being fundamental for its evolution, thus, surgical interventions associated with long periods of hospitalization significantly affect child development (9).

According to Zorzi (2000) (10), language acquisition is a process of continuous evolution, whose critical period occurs in the age group of zero to six years. Throughout its development, language is divided into two major stages: prelinguistic, being considered the phase of vocalizations, which happens from birth to the first 12 months of life; and the linguistic phase, in which children begin to pronounce their first words.

In order to detect early alterations in language development and to systematize an assessment for young children regarding the development of communicative and cognitive skills, Hage; In 2004 Pereira and Zorzi (11) developed a behavioral observation protocol, called PROC, which allows the understanding of the typical evolution of language development, making it possible to configure the evolutionary levels and modes of cognitive and communicative functioning presented by children whose parents have complaints related to developmental delays or disorders, evaluating the aspects related to expressive communicative skills. of comprehension and symbolic scheme.

Verbal communicative skills in typical language development refer to the individual's ability to perform an interactive sequence of speech acts, i.e., to make use of language as an effectively interactive instrument with other social contexts (12). The ability to communicate effectively has been seen as a requirement for better opportunities in a productive world, where children with absences of expressive language and/or alteration in its development, when during school they have difficulties in the literacy and literacy process, with alterations in their integral development, later becoming a vulnerable adult at risk of social exclusion(13).

Thus, considering that the vast majority of children with congenital heart disease treated at a referral hospital in the North and Northeast are children who have been hospitalized for a long time, suffering social deprivation due to prolonged hospitalization, most of the time separated from their relatives, overprotection of parents due to clinical conditions and the conception of "fragility" of their children, With low-income families from different interior of Ceará, with little or almost no information regarding specialized speech-language pathology care offered by the Unified Health System (SUS), this study was carried out with the objective of identifying the level of communication skills of children with congenital heart disease submitted to cardiac surgeries, corrective or not, through the behavioral observation protocol – PROC.

METHODOLOGY

This is an analytical observational study, applied with a quantitative approach, carried out in a public hospital specialized in the diagnosis and treatment of heart and lung diseases and a reference in the North and Northeast regions for heart transplantation in adults and children.

The pediatric cardiology unit receives patients with congenital heart disease (CHD) of varying ages, from newborns referred directly from the maternity ward to adolescents and adults who return to the service for follow-up or surgical reapproach, from all over the state of Ceará and other regions of Brazil.

This study included 15 children with congenital heart disease, who underwent some type of cardiac surgery, corrective or not, in the age group of 24 to 48 months, who were hospitalized in the pediatric unit from July to November 2021, and also with children who were receiving outpatient medical care in the same period, excluding those with associated syndrome or whose parents did not show interest in participating in the research.

Initially, the project was presented to the medical team responsible for the pediatric unit and to the physicians responsible for outpatient care, and they were asked to inform when there were children who fit the inclusion criteria of the research, since both the unit and the outpatient care cover children of the most diverse age groups.

In a second moment, after medical care, a conversation was held with the parents or guardians

of the child, explaining the research, its objective and its methodology, where those who showed interest signed the Free and Informed Consent Form (ICF).

Then, the children from the outpatient clinic, together with their guardians, were referred to the speech therapy sector, where data collection was initiated, and a sociodemographic questionnaire was applied to the parents to determine the child's living conditions, and later, the behavioral observation protocol - PROC - with them. It is noteworthy that the collection with hospitalized children had the same process, but captured by active search by the researcher herself, and carried out in the bed itself.

For the application of the protocol, the child was offered a box with toys, consisting of a set of tools, a set of kitchen utensils, a set of food (size of the food proportional to the size of the kitchen set), a set of means of transport, a set of bath utensils, fitting toys, wooden blocks, dolls representing a family (a man, a woman, and 2 children) and animals.

In this way, the children were evaluated in a semi-structured context with pre-selected toys, and their behavior was observed, both from the communicative point of view and from the symbolic action.

The Behavioral Observation Protocol evaluates aspects related to expressive communicative skills, comprehension and symbolic schemes, analyzing three areas: Communicative skills (dialogic skills, communicative functions, means of communication and levels of language contextualization); Verbal comprehension and aspects of cognitive development (ways of manipulating objects, level of development of symbolism, level of organization of the toy and imitation), where each item evaluated will present a maximum score, totaling 150 points.

1. Communicative (expressive) skills – 60 points
2. Verbal language comprehension – 40 points
3. Aspects of cognitive development – 50 points

The findings of the instruments, sociodemographic profile and behavioral observation protocol were organized in tables with absolute and percentage frequencies, calculated using SPSS version 20.0, the mean statistical measures and standard deviations of the variables, age, income, number of surgical procedures, among others.

The study was designed in accordance with the guidelines and regulatory standards for research involving human beings (CNS: 466/2012) and approved by the Research Ethics Committee of the Hospital de Messejana Dr. Carlos Alberto Studart Gomes, CAAE: 47814321.9.0000.5039.

RESULTS

In order to better understand the living conditions of children with congenital heart disease, a sociodemographic questionnaire was applied to parents and/or guardians. with data related to gender,

age, marital status, number of children, housing, level of education, profession and monthly income, in which 100% of the companions/guardians/caregivers are women, with a mean age of 33.7 years and children of 2.8. In addition, 60% are married, 53.3% own their own home, 46.7% have a high school education, 60% do not have jobs and live only for their children, and 40% have an average monthly income between 1501 and 2000 reais, as shown in table 1.

In the population studied, equivalence was observed between the sexes, with 53.3% girls and 46.7% boys, with a mean age of 33.9 months, where of these, 66.7% performed only one cardiac surgery, 20% performed three surgeries and 13.3% performed two surgeries with an average length of stay of 103.8 days divided into Intensive Care Units (ICU) and ward. In addition to these aspects, there was also no significant predominance between the different types of diagnoses, with 6.7% pulmonary artery atresia (PA), tricuspid atresia, atrial septal defect (ASD), ventricular septal defect (VSD), aortic coarctation (CoA), acute pulmonary edema (PAE), left heart hypoplasia (HLHS) and single ventricle; 20% had total atrioventricular block and 26.7% had tetralogy of fallot (FTT). Among the symptoms that presented the most, fatigue, shortness of breath and cyanosis stood out with 60%.

With regard to the children's communicative development, in dialogic or conversational skills and verbal comprehension, it was observed that 46.7% do not initiate the interaction and rarely respond to the interlocutor, 60% do not wait for their turn and only 13.3% actively participate in the dialogic activity, where 53.3% presented intentional communication with primary functions, restricted participation in dialogic activity by non-verbal and non-symbolic means and 40% demonstrated to understand only orders with an action linked to the immediate context. As for the In terms of cognitive development, 66.7% do not create symbols and 80% do not use verbal language to report what is happening, and 60% are in the initial sensorimotor phase.

Table 2 shows the mean in each aspect evaluated with its respective total, and it is possible to observe a significant difference with a mean much lower than the maximum score of each item.

Table 3 shows the score generated in each aspect evaluated, as well as the total score performed in the test.

Table 1: Sociodemographic characteristics of parents and/or guardians. Fortaleza, Ceará, December, 2021.

Variable	**Total (N=15)**
AGE	
N	15
Average	33.7 (8.92)
GENDER, n (%)	
F	15 (100.0%)
ESTADO CIVIL, n (%)	
MARRIED WOMAN	9 (60.0%)
SINGLE	4 (26.7%)
COMMON-LAW MARRIAGE	2 (13.3%)
OFFSPRING	
N	15
Average	2.8 (1.47)
MORADIA, n (%)	
RENTED	5 (33.3%)
OWN	8 (53.3%)
THIRD PARTY	2 (13.3%)
EDUCATION LEVEL, n (%)	
Variable	**Total (N=15)**
INCOMPLETE ELEMENTARY SCHOOL	4 (26.7%)
COMPLETE HIGH SCHOOL	7 (46.7%)
INCOMPLETE HIGH SCHOOL	3 (20.0%)
SPECIALIZATION	1 (6.7%)
OCCUPATION, n (%)	
FARMER	2 (13.3%)
ATTENDANT	1 (6.7%)
BUTCHER	1 (6.7%)
FROM HOME	9 (60.0%)
MANICURE	1 (6.7%)
TEACHER	1 (6.7%)
MENSAL END, n (%)	
1000 A 1500	5 (33.3%)
1501 A 2000	6 (40.0%)
2501 A 3000	1 (6.7%)
LESS THAN 1000	3 (20.0%)

Table 2: Total score in each skill and its respective items, Fortaleza, Ceará, December, 2021.

SKILLS	AVERAGE	TOTAL
CHILD'S COMMUNICATIVE SKILLS		
Dialogic or conversational	6,4	16
Communicative functions	5,9	14
Media	6,9	20
Levels of language contextualization	7	10
VERBAL COMPREHENSION	21,7	40
COGNITIVE DEVELOPMENT ASPECT		
Ways to manipulate the object	7,8	15
Level of development of symbolism	6,6	20
Level of organization of the toy	3,5	11

Table 3: Total score on assessed skills and test, Fortaleza, Ceará, December, 2021.

PUNCTUATION	AVERAGE	TOTAL
Communication skills	28,1	60
Verbal language comprehension	21,7	40
Aspect of cognitive development	17,9	50
Test Total	68,5	150

DISCUSSION

The sociodemographic profile of parents or guardians of children with congenital heart disease shows that all of them are female, a fact that is often related to sociocultural factors. The story shows and places the woman as responsible for the domestic work and care of the children, where the literature brings the woman and her role as a mother as essential to offer an adequate environment for the child's development(14).

A study conducted in São Paulo with caregivers of children or adolescents with congenital heart disease showed a mean age of 34 years, of which 52.4% did not work, dedicating themselves exclusively to children (1). Leal et al (2016), in their study on the motor development of heart disease patients, also presenting socioeconomic characteristics of caregivers, showed that 53.4% had elementary school as their highest level of education, and 43.3% had a family income with an average of 1 minimum wage (15). On the other hand, Cesario, Carneiro and Dolabela, in a study conducted with mothers of heart disease patients in 2020, showed that 64.3% had completed high school, corroborating the data found in this study (16).

Several studies in the field of child development correlate the socioeconomic conditions and the level of education of parents with the stimuli attributed to their children, since for an adequate

development it is important to offer spaces that favor the exploration of the environment, providing motor, cognitive and social stimulation(15).

In relation to children with congenital heart disease, Belo, Oselame and Neves(2) investigated the clinical-hospital profile of these children and brought results similar to those described in this study, finding a mean age of two years and three months, with no prevalence of gender and a maximum hospitalization time of 4 months, with respiratory distress as the main symptom of heart disease(17). Freire et al, with 21 participants, brought in their studies, a maximum hospitalization time of 387 days for a child with readmissions throughout childhood for the performance of three cardiac surgical procedures, and also presented another participant who had a shorter hospitalization time of 39 days (18).

The prolonged length of hospital stay has been discussed by several authors and highlighted as one of the main factors causing alterations/delays in neuropsychomotor development(19). Children with severe heart disease need to undergo a series of surgeries in order to correct or minimize the effects caused by the pathology, immediately entering the risk group for alterations in their general development, due to their various hospitalizations, especially in the ICU, making it difficult to live and interact with their families and/or other children of the same age(17).

In the first years of life, more specifically in the first three years, the brain is in its full development, being formed and strengthened through stimuli and bonding (20). Linguistic and cognitive skills develop in an integrated way and depend on a neurobiological and social apparatus, with social interaction and the quality of stimuli being essential for language acquisition. (21).

In order to evaluate the influence of congenital heart disease on the neuropsychomotor development (NPMD) of infants, by applying a protocol that evaluates linguistic aspects, Paula et al showed that heart disease negatively influences NPMD, affecting several aspects, including linguistic skills(17).

It is noteworthy that more than half of the studied population have restricted dialogic skills, presenting communication by non-verbal and non-symbolic means, data that are similar to the research carried out by Freire et al, who, by also applying the behavioral observation protocol at the Heart Hospital of the Municipality of São Paulo, obtained as a result 50% of the children evaluated. were non-verbal and had difficulty in communicative intention, oral language comprehension, and sound and gestural imitation (18). On the other hand, Castro, when applying the same protocol in the same institution, obtained divergent data, resulting in satisfactory answers, where all the subjects evaluated presented multifunctional intentional communication with wide participation in dialogic activity, presenting alterations only in phonology, however, it is worth mentioning that when selecting the participants, the researcher involved a larger age group, including children from 3 to 7 years of age(22).

Alterations in speech and language development have significant repercussions in different contexts present in the child's daily life, including social, educational and family environment(23). Learning and learning disabilities socialization, are directly related to a history of delayed language acquisition, thus demonstrating the need for early identification and diagnosis, avoiding subsequent psychosocial consequences(24).

CONCLUSION

The present study was promising as it allowed us to understand and identify the delays in linguistic development experienced among the repercussions of heart disease in children, enabling referral to early intervention services, as well as guidance to parents on how to stimulate and assist in the development of speech and language, in order to detect, to be able to act in order to prevent and minimise the impairment of linguistic aspects.

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Innovation in the public sector to confront COVID-19: A reality experienced at the municipal level

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ABSTRACT

Among the various concepts of innovation, some authors conceptualize them as various forms of change, from the exploration of new ideas, the construction of new models of care practices that meet the local reality, to the creation of new technologies such as medicines, high-density devices, among others, but the organization must be significant and with measurable results of effectiveness. Thus, in the year 2020, Brazil began to experience the catastrophe brought about by the covid-19 pandemic, and had to resignify many modes operating in the work processes in various areas, in the health sector, strategies to guarantee assistance to the sick population, with a view to reducing the number of deaths in Brazil. In this scenario of uncertainties, rapid actions were created in all spheres of government. Thus, the article sought to describe actions carried out in municipal public management to face Covid-19, having as a reference the municipality of Sombrio, Santa Catarina, contextualizing it with innovation in the public sector from the practice experienced in the period from 2020 to 2022. The methodological process is based on the discursive formulation on Innovation and Public Management, organized into sections, the role of Public Management in the Covid-19 pandemic, challenges in Public Health, Innovation and the use of technology in coping with Covid-19 in various scenarios, explanation of the actions carried out in the municipality, and the final considerations, pointing out the relevance of innovative strategies in the public sector.

Keywords: Covid-19 pandemic, Essential Public Health Functions, Population Health Management, Public sector, Organizational Innovation.

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INTRODUCTION

On January 30, 2020, the World Health Organization (WHO) released a statement that the Coronavirus (covid-19) infection, which originated in Wuhan, a Chinese city, was a pandemic with thousands of infected people around the world, and it was necessary for the governments of the countries to take urgent measures to prevent the spread of the virus.

The release of the WHO statement, along with news reports about the rapid infection by the Coronavirus, had a great impact on the decisions of global public managers, leading them to define criteria for social isolation, the imposition of sanitary barriers, the approval of legislation to allocate economic benefits to the most affected public, among other factors that involve government policies and actions.

In Brazil, the enacted Law No. 13,979/2020 established the measures to face the public health emergency of international concern resulting from the Coronavirus responsible for the 2019 outbreak, to protect the community, being regulated by Decrees No. 10,282/2020 and 10,288/2020.

The measures adopted by world governments manifested themselves as a managerial response to the problems arising from the pandemic, where it is possible to mention that no country was immune to its effects. This "phenomenon" called covid-19 had negative repercussions in all scenarios, to a greater or lesser extent imbalance was evidenced in several sectors, with impacts on health, education and the economy of the entire world . 2021)

Although the negative effects of the pandemic can be evidenced in the most diverse sectors, health, specifically, was certainly the most affected sector, requiring public managers to adopt not only legal measures to face the installed crisis, but also management strategies to support decisions with a view to minimizing risks to the population. as well as to the economic sector, since it is directly related to the health area, due to the high demand for public financial resources required to meet the social needs originating from and resulting from a pandemic such as COVID-19.

In this sense, Gleriano *et al.* (2020) stresses the importance of government decisions, regardless of the sphere of government, being aligned with emergency public policies in terms of technical criteria and scientific knowledge, as well as with international strategic objectives, taking as references the determinations and actions adopted by the United Nations (UN), the World Health Organization (WHO), and the Pan American Health Organization (PAHO), among other national institutions that focus on research in the area.

On the one hand, people dying due to lack of immunizers and, on the other, large modernized hospitals, using state-of-the-art antiretrovirals, added to the technological innovation of biotechnology, genomics, artificial intelligence, geolocation, telemedicine, among others, were used according to economic and management capacities in the globalized world (Kobayashi, 2021)

We soon saw that during the challenges posed and the countless deaths caused by the pandemic in the world, Brazil was no different. With regard to the Brazilian health situation, it is appropriate to point out the difficulties already faced by the Unified Health System (SUS), insufficient funding, precariousness and limitations of the physical infrastructures of health services, and with the advent of the pandemic, even more relevant and effective decisions and actions were required from the point of view of agility and integration of services. based on its basic principles: Equity, Integrality and Universality.

But in the midst of the chaos installed by the pandemic and the high demands of public services, considering the already existing challenges, the systems were the support of many Brazilian families.

It created innovative strategies and articulations so that the doses of immunizers when they arrived in Brazil could be quickly applied to the population, allying professionals from various categories such as police officers, firefighters, social workers, educators, economists, farmers, private companies and other organizations with health professionals, also fostering the process of inclusion and decentralization of government decisions and actions. They guaranteed access to health care for the population and minimized the rates of death and contamination by Covid-19.

It can be seen that during the crisis originating from the pandemic, the search for the integration of services and the decentralization of government decisions and strategic actions, in the three spheres of government, were configured as an innovative process in public management in favor of the common good – access to quality health, which in turn should have been consolidated for decades.

The conjuncture in the decisions, the planning of practical actions and the action itself integrated and innovated several areas, including the technical-scientific field, such as the development of vaccines and medicines, occupational safety equipment (PPE), modification in the operational care processes, such as the insertion of the use of technologies for care that grew in all fields of health action.

Also noteworthy is the inclusion of nursing services and care in hospital and outpatient settings, aspects of total responsibility of public management provided for in articles 6, 24 items XII (Union, States and Federal District) and 30, item VII (Municipalities – technical and financial cooperation to the Union and the States) of the Federal Constitution of 1988.

In view of Kobayashi's (2021) observations on the dimension of the multidimensional impact left by covid-19, it is essential to consider the responsibilities of public management in the face of gaps and uncertainties, having to innovate in the face of a catastrophic and unsafe scenario never witnessed, propelling to guarantee human dignity beyond health.

Within this historical context that left strong changes and great reflections in all senses, from life being at work, at home, at laser, in health and education, reinvention was fundamental for survival, however the way of doing management is also synthesized, and in innovation many guarantee the survival of their citizens, a fact that intertwines in public management ensuring development even in the midst of so many adversities and difficulties. Thus, the study is justified in wanting to reflect and identify the actions carried out to cope with covid-19, based on the case experienced in a municipality located in the Extreme South, considered small, with approximately 30 thousand inhabitants, based on innovation to ensure economic sustainability and survival of the population that resides there, also pointing to health actions that are totally innovative in the work processes to ensure access to health care. I understand that a municipality considered small does not have a complete health network, with difficulties and huge gaps, seeking to have in Primary Care (PA) the basis of its health care, and in education that guarantees food to many children.

Reflecting such acts and deeds in the delimited scenario can bring trajectories and discussions of improvements to small municipalities, but that seek to develop, to trim what role of public governors, what role of professionals, what these together can overcome even in adversity, however, it is necessary to look at the scenario, identify weaknesses, diversities and potentialities, Together in the pandemic, they produced forces and impact with such significant results that it has also never been seen before.

METHODOLOGICAL PROCESS

This article is characterized as a case study, based on the discussion of Innovation in Public Management based on a municipality in the extreme south of Santa Catarina in the face of the Covid-19 Pandemic.

The case study is just one of many ways to do research in the social sciences, and can be thought of as:

> [...} It is a methodological strategy for research in the human sciences, as it allows the researcher to deepen the study of the phenomenon studied, revealing nuances that are difficult to see "with the naked eye". In addition, the case study favors a holistic view of real-life events, highlighting its character as an empirical investigation of contemporary phenomena Gomes (2008, p. 215) apud Yin (2005).

Thus, the characteristics of the study bring the relevance of analyzing the studied phenomenon and deepening knowledge, as a simple bibliographic review was initiated, using articles related to the theme published between 2020 and 2021, using the descriptors Covid-19 Pandemic. Essential Public Health Functions. Population Health Management. Public sector. Organizational Innovation. After the research of the research, sessions were organized for a better design of the research, in which the role of public management in the covid-19 pandemic was worked; Challenges

in Brazilian public health, Innovation and the use of technology in the fight against covid-19 in various scenarios. In the study data for the municipal scenario , evidence from Documents and Records in the municipality's archive was used, along with the author's direct observation, emphasizing that one of the authors has been working in the municipality since 2010, corroborating the study period, in 2020 she worked on the front line as a PHC nurse, and in 2021 in the coordination of Health Planning, therefore, experiencing every scenario studied in practice.

For the collection of evidence in case studies, there are six sources (documentation, archival records, interviews, direct observations, participant observations, and physical artifacts) (Santos, 2011).

Subsequently, the organization of the contextualization themes explains the actions carried out at the municipal level, delimiting the municipality of Sombrio, Santa Catarina in the period from 2020 to 2022.

Then the discussions and final considerations highlighting the relevance of strategies and referring to the importance of Innovation in Municipal Public Management, making it necessary to study a case in a municipality to

Empirical investigation of the phenomenon of innovative changes brought about in the context of real life, even in the uncertainty of the context studied in the period caused by such limitation as a result of the pandemic.

THE ROLE OF PUBLIC MANAGEMENT IN THE COVID-19 PANDEMIC

The World Development Report 2022 published in The World Bank (2022), points out the economic impacts of Covid-19, and brings the severity in the economy, revealing the preexisting economic fragilities, and pointing out that as the pandemic advanced in 2020, many families and companies were not prepared to withstand such an income shock of such scale and duration. It also emphasizes studies that indicate that more than 50% of households did not have the financial capacity to sustain their basic expenses for more than three months, both in the emerging and advanced economies, made governments seek answers to the installed crisis and include social policies and security to neutralize the impacts and disparity in poverty.

Considering the scenario resulting from the covid-19 pandemic, and when it comes to the state's responsibility in adopting measures and strategies aimed at maintaining the health of the population as a whole, while seeking solutions that can minimize public cats in the area, there is a need to promote innovative interventions that face the health crisis already installed (Valentim *et al.,* 2020).

And since it is a new disease, with few known parameters and that manifests itself in different ways in the individuals that make up the population and, considering that the spread of coronavirus

infection depends on health care and population numbers, at the municipal level the strategies to combat covid-19 follow principles established by federal and state legislation, among which we can highlight those that have become a consensus in most Brazilian municipalities, i.e., isolation of identified or suspected cases; mobilization of resources to pay for treatment and immunization of the population; and, sanitary hygiene and social distancing actions (Ito and Pongeluppe, 2020).

Although the actions adopted by most municipal governments are common, with the aim of providing technical and financial cooperation to the Union and the States in the fight against covid-19, as provided for in the Magna Carta, it has not been enough to eliminate contamination and the risks of death among the population, as well as to reduce the public cats resulting from the demand.

In this sense, the debate on the actions adopted by government officials involves the specific local characteristics and conditions and the need to unite the institutions in an organized and systematized action, so that it is possible to stimulate and promote the generation of links between federated entities, universities and service providers for the management of the crisis through innovation and managerial efficiency. which implies favoring the incorporation of technology (Valentim *et al*., 2020; Gleriano *et al*., 2020).

Along these lines, Ito and Pongeluppe (2020) state that innovation and managerial efficiency at the municipal level to face the crisis generated by the pandemic are emerging and essential aspects to support decision-making, in view of the high demand and scarcity of financial resources, because management practices directly influence the performance of the municipality for the maintenance of good health indices in the population when it comes to infection and deaths by the population. coronavirus. The aforementioned authors also highlight the importance of governance in the actions of the municipal public administration within a perspective of elaboration and implementation of public policies elaborated collectively, through the integration between the public and private sectors, since the negative effects of the pandemic impact all sectors.

In addition to the intersectoral articulation, Giovanella *et al*. (2020), mentions the relevance of reflecting on the uncertainties brought about by the context of the pandemic, requiring strategic and innovative actions to reinvent workflows and processes aimed at each specific situation; to intensify health surveillance; for the promotion of social participation; and for the collection of data and epidemiological indices that demonstrate the reality of the pandemic at the municipal level. Based on this, the participation of Primary Health Care (PHC) in health surveillance should be reinforced and strengthened, aiming to combat covid-19.

When it comes to the internal workflows carried out by the municipal management in the fight against the pandemic and its negative effects, the Federal Court of Accounts (TCU) warns that the focus of strategic and innovative management decisions should be based on physical and budgetary planning, that is, combining the health plan and the budget plan. Other secondary

measures for workflows and processes, but no less important, are highlighted by the TCU, such as, for example, the qualification of health professionals involved in public policies aimed at the pandemic; population mapping for vaccination; the transparency of the municipal contingency plan in a way that shows society all the actions, strategies and guidelines of the municipal government against Covid-19, as well as detailed vaccination programming; and, finally, the partnership between governmental and non-governmental entities to expand the fulfillment of demands during the pandemic (Brasil, 2020).

INNOVATION AND THE USE OF TECHNOLOGY IN HEALTH TO COPE WITH COVID-19: EXAMPLES OF ACTIONS DEVELOPED IN BRAZILIAN MUNICIPALITIES

The term innovation assumes several concepts, among which it is possible to consider that it is about exploring new ideas, which, when put into practice, are relevant to processes and organizations, making learning possible, as well as the achievement of established objectives and goals with greater efficiency and effectiveness (Machado, 2007).

For Mattos and Guimarães (2005), the concept of innovation should be conceived from creative activities, since innovation and creativity are complementary, that is, it is the creativity exercised in processes and organizations that one finds the possibility of establishing new relationships between concepts and events, connecting them so that they result in new knowledge entities.

Tidd, Bessant and Pavitt (2008) conceptualize innovation as several forms of change, and are presented by the authors in four distinct categories, as can be seen in chart 1 below:

Table 1 – The concept of innovation divided into categories

Product Innovation	Introduction of a new or significantly improved service or good compared to the services and goods already in the organization
Process innovation	Implementation of a method of production or delivery of new or significantly improved services or goods compared to the processes already in place in the organization;
Organizational Innovation:	Implementation of a new organizational or managerial method that differs significantly from the methods already existing in the organization
Innovation in Communication	Implementation of new method of promoting the organization or its services and goods, or new methods of influencing the behavior of individuals or other organizations.

Source: Tidd, Bessant e Pavitt (2008, p. 30)

For the authors, Mulgan and Albury (2003), innovation can be divided into 3 stages:

- Stage I: it is the so-called "Incremental" stage, where small changes are made to existing services or processes, without any changes in the organizational structure or in the relationship between organizations;
- Stage II: the second stage is called "Radical", which aims at the development of new services, without changing the general dynamics of a given organizational sector;
- Stage III: the last stage is characterized as "Systemic or transformational", as it is based on the insertion of new technologies, new work structures, relationships, generating a change in the level of organizational performance.

When it comes to the public sector, Oliveira (2014) points out that in Brazil, innovation follows models applied in first-world countries, in order to better respond to state demands in order to integrate science, technology and economic policies. However, innovation in the country faces barriers imposed by excessive bureaucracy, unpreparedness of servers, lack of economic incentives for servers, lack of resources for investment in technology and decision-making based on short-term results.

Considering Vargas and Martinez (2013) emphasize the relevance of innovation as a differential for public services today, including for the survival of the State, as its primary objective is to propose new approaches for the achievement of services provided to the population and provide greater efficiency in internal administrative and management processes.

In the same vein, Mulgan and Albury (2003) state that innovation in public management has been advancing over time, from the perspective of creating and implementing new processes, methods and techniques that imply a significant improvement in the efficiency, effectiveness and effectiveness of public sector results for society.

In these terms, innovation for public management presents itself as a tool for the development of technologies and practices that will satisfy social demands, as needs arise, where planning must be applied to the elaboration of strategies capable of ascertaining the organizational environment and its responsibilities towards the public good. It is also important that communication between the political sector and other institutions involved is an effective element in the development and application of strategies to achieve better long, medium and short-term results based on decision-making, which should be based on the government's objective or goal (Albury, 2005).

The contributions arising from innovation and the use of technology for the public sector can be observed today, in view of the context of the COVID-19 pandemic, both in the technical-scientific scope and in the scope of the internal processes of health service providers.

There are many examples that can be cited, where the crisis originating from the pandemic gave way to technological innovation, as in the case of personal protective equipment, specifically Face Shields, which were developed by industrial equipment through 3D printers, being tested to

block droplets of contaminated saliva within reach of the face, acting as a barrier against contamination by the coronavirus, with a view to minimizing risks to which health professionals are exposed (Santos, 2021).

According to what the World Health Organization (WHO) proposes, research and the development of technological and innovative actions and products are essential to achieve the global goals in the fight against covid-19, in the same way that they boost and strengthen health systems. Based on the aforementioned contributions, the WHO also advises that countries appropriate digital technologies for the implementation of public policies that promote the health of the population and the fight against the transmission of the virus, as well as the effects of the pandemic on other sectors, given that they enable agility in the decision-making process and in the capacity to respond in surveillance and in meeting this type of demand. which is a priority (Ito and Pongeluppe, 2020).

The contributions of technology and innovation are notorious and observed over time, from the discovery of penicillin and vaccines to the creation of magnetic resonance imaging exams, whose scientific achievements have expanded the frontiers of knowledge and knowledge in health (Valentim *et al*., 2020).

The Department of Informatics of the SUS, subordinated to the Ministry of Health, by developing a booklet of digital strategies in health for the years 2020 to 2028, demonstrates the relevance of the use of information systems in data analysis to face and combat epidemiological outbreaks such as the pandemic generated by the Sars-CoV-2 virus (BRASIL, 2020).

The use of digital systems in health can be evidenced in the fight against the pandemic in several Brazilian cities, such as Florianópolis, capital of the State of Santa Catarina, which implemented protocols that identify people with symptoms through telemonitoring (Vale *et al*., 2020).

A radio communication system, created by the professionals themselves, was implemented in a rural Basic Health Unit (BHU) in Pernambuco to promote continuous communication with the community, where data on the pandemic are disseminated through bulletins on instant messaging applications, for the purpose of information and clarification of doubts about covid-19 and the services provided at the local BHU. In Londrina, a city in Paraná, the technology is used for the remote work of professionals on leave due to covid-19 infection. Through remote access, this professional assists professors and students at the State University of Londrina with guidance and coping measures aimed at workers from various sectors in the region. This action provided training for about 2,500 workers (Giovanella *et al.,* 2020).

In the context of innovative practices, the city of Belo Horizonte is cited as an example, where priority testing of health professionals was implemented, considering the high degree of contact with people infected by the coronavirus. In Canaã dos Carajás (PA), an exclusive clinical

monitoring scheme was set up for health professionals and users with comorbidities (Vale *et al*., 2020).

Also with regard to monitoring actions, in Nova Lima the Community Health Agents assist in the inspection of commercial establishments to ensure that they follow the sanitary determinations and procedures to combat the spread of the coronavirus. Measures and efforts for population health education are also identified in Recife, where professionals from the Expanded Family Health Center (NASF) worked directly, using the UBS structure itself, such as waiting rooms, triage room, vaccination room, and also with people who remained in lines (Giovanella *et al.,* 2020).

Regarding the use of infrastructure for innovative actions, Valentim (2020) points out that in places where the infrastructure of the UBS allowed, actions were implemented to divide internal flows, with the assembly of triage tents outside the units to determine entry doors - Covid or Non-Covid and field hospitals to better serve the population.

Other actions and measures are cited by Giovanella *et al.* (2020) that demonstrate innovation in health services aimed at coping with COVID-19, such as: support for the population considered vulnerable, whether due to health or social conditions; surveillance with or without technology for remote identification, notification and monitoring of COVID-19 cases; technology-based or technology-free surveillance in nursing homes, commercial and industrial establishments; provision of health education services in communities; and, the enhancement of communication resources to the population, both for the dissemination of data and care measures, as well as for access to the clarification of doubts and suggestions.

From the above, it is possible to consider that in the midst of the crisis, the resilient ability of human beings awakens their creative potential due to the sense of survival that, combined with technical-scientific knowledge, results in practices, products and services capable of minimizing the risks of illness and death of the population, as well as direct and indirect contagion by the virus. including the negative effects of a pandemic on other sectors of society.

However, it is up to the public administration to assume its role and responsibility in encouraging and adhering to innovative actions and technologies to combat covid-19, achieving the benefits presented, emphasizing that the health of the population, regardless of the location, is an extremely relevant state activity, which has impacts on the economy, as it requires the use of public financial resources, in most cases, in large proportions.

ACTIONS CARRIED OUT IN THE MUNICIPALITY OF SOMBRIO-SC

The municipality presented in the study is Sombrio, located in the extreme south of the state of Santa Catarina, with approximately 30 thousand inhabitants. It is a city that has a municipal health

plan composed of health strategies and policies aimed at preventing, promoting, and reducing the risks of diseases and injuries according to the epidemiological profile of the municipality.

The Municipal Health System of Sombrio is under Full Management, with Primary Health Care structured in nine (9) units with Family Health Strategy (ESF) teams, seven (07) Oral Health teams (eSB), one (1) UBS, which meets the demand for specific medical services in the areas of pediatrics, gynecology and obstetrics of the nine (9) ESF, outpatient mental health services, immunizations, among other services and programs recommended by the Ministry of Health, are also developed in the same physical space (Sombrio, 2022).

With this structure, the management of the municipality of Sombrio, attentive to the events of the world scenario and connected to the actions carried out by the State of Santa Catarina, issued Decree No. 48, of March 18, 2020, which declared the local emergency situation and measures to combat the pandemic. Among the measures established by the aforementioned decree was the authorization for the creation of the Covid-19 Monitoring Committee and a Contingency Plan (Article 3). In less than 24 hours from the issuance of the Decree and the dissemination of the pandemic at the local level, a Triage Center (TC) was set up to assist people with respiratory symptoms of the disease (Sombrio, 2020).

One of the first measures carried out together with the planning and coordination of actions by the City Hall after the creation of the Commission to Combat Covid -19", a group that with a single objective offers 'Rapid Response' and strengthens the capacity of the municipality's health system to respond to the new Virus. After that, it dedicated itself to the planning of referral flows, the purchase of Personal Protective Equipment, prevention measures, training and training of professionals, among other actions, fundamental for the containment and confrontation of the pandemic.

For the purpose of a consolidated presentation of the initiatives carried out and demonstrated, the operations carried out in the municipality are mentioned, starting with the involvement of the different departments with a single objective "to plan and execute actions to combat Covid-19, considering the complexity of the health, social and economic impact and the diversity of mitigation actions/measures.

Following international and national recommendations, especially those of the state of Santa Catarina, strategic measures were instituted to cope, one of the first was social isolation, including events in all areas, closure of public and private schools, restriction of the movement of people in the city, distancing and distancing of people with symptoms of the disease, regular hygiene of hands and objects of frequent use (as well as complementary practices of hygiene) and respiratory etiquette in all public and private spaces, in this sense, the planning and execution of it took place beyond the biological dimension of Covid-19, considering the social conditions, seen in each action carried out.

In addition to these actions, here are some strategies operationalized and increased in the municipality during the pandemic period:

Table 2 - Follow-up of the Health area

Share	Objective
Limitation of elective care in primary health care units (BHU).	Prioritization of urgent and emergency care.
Reorganization of the workflow, with temporary closure of some Family Health Strategies (ESF), due to professionals with covid-19.	Valuing Life, the number of sick professionals, making it necessary to reorganize strategies for the reorganization of teams to provide care to those who needed it, including frontline workers.
Creation of the Covis-19 Screening Center;	Provide a safe space for people, separating asymptomatic patients from symptomatic ones.
Acquisition of mobile phone with Whatzapp for all health services.	Promote contact between health teams and users, through the application, solving doubts, providing opportunities for continuity of the bond and communication, The tool, until then common by the population, was not usually part of the routine of the ESFs, but it gained incorporation in the pandemic, becoming fundamental in the scheduling of appointments, procedures and routines of the teams, where to this day they continue to adopt the tool.
Sanitization of health facilities and public places.	The regular application of sanitization of health units and public places aimed to reduce the spread of the virus.
Home care for infected people and also for other patients who needed urgent care.	These services, considered routine by the teams until then, became a challenge, first the fear and uncertainty of the disease made many isolate themselves from their families, ensuring the safety of their families; According to the following protocols, the appropriate clothing for each visit, among other changes in the routine, made the lives of many uncertain and exhausting, conditioned to the emotional stress of coping on the front line to guarantee dignified assistance to those who needed it.
Elaboration of the booklet "Orienta Coronavirus.	Assist the population in self-care measures in individual home and community actions .
Use of new spaces for the health team, such as the use of the gymnasium and the setting up of tents in strategic places for health professionals to work;	Vaccination of as many people as possible, and the work of professionals in public spaces.
Implementation of the vaccination system called "*drive-thru system.*	The implementation of the system against Influenza continued, after the arrival of the vaccine against Covid-19 and the mapping of vaccination.
Creation of protocols that respond to the needs of people beyond the clinic, among examples. Oral Health Protocol, which after the relocation of these professionals in 2020 to work on the front line; Protocol for directing pregnant women.	Safety of oral health professionals and the population, responding to demands; Protocol for pregnant women, complying with regulations and ensuring safe care, also creating a database for follow-up and monitoring, according to current guidelines.
Implementation of the Home Care Service (SAD).	The service sought to guarantee access and comfort of the home to people who needed it, a service that is in wide operation.

Making of masks and aprons to distribute to the population.	Union of the population and the textile sector together with the health sector for the manufacture of PPE.

Authors, 2023

Table 3 - Follow-up of the area of Education and other areas

Suspension of face-to-face classes in the public and private network	With the suspension of face-to-face classes, there was an increase in concern about children who sought their comfort and food at school, and it was necessary to articulate maintenance strategies for these children, with food security, considering care education in this scenario.
Creation of a special educational system for students in the municipal network, *online* and with the delivery of activities;	Guarantee education to public school students.
Suspension of face-to-face services of the Municipal Administration,	Exceptional online service, and guarantee of essential services.
Creation of a database with records and information on people in vulnerable situations	Provide people with the opportunity to register for access to basic food baskets, avoiding hunger.
Innovation in Family Farming actions, with a guarantee of local sustainability	Redistribution of food, identifying people in need and assisting them in the access process.
Identification of vulnerable and homeless people,	Several actions and access strategies were set up to serve needy and homeless families.
Live streams and real-time training	With the return of the school year in 2021, education professionals were trained and empowered to ensure the safety of students and everyone by health professionals.

Authors, 2023

Considering the year 2021, the second year of the pandemic, the innovative actions went beyond care and health care practices, because with the return to school activities, which generated concern for parents and teachers due to the fear of exposure to the coronavirus, the municipal management implemented *live and* online training systems in real time with training provided by health professionals to clarify doubts and provide guidance to the teachers. The initiative was extended and gave rise to the creation of a flow between schools, parents and the Triage Center.

The municipality acted in the population mapping for vaccination, characterizing the effectiveness of public health policies, in line with the state and federal government, as prescribed by the TCU for carrying out secondary actions under the responsibility of municipalities, according to the Federal Constitution of 1988 (Brasil, 2020).

This internal and intersectoral communication of municipal public management, with the use of human resources in the health area for training school teams, as well as the modification of workflows, is considered by Giovanella et al. (2020) as an innovative action, which strengthens the participation of Primary Health Care (PHC) in health surveillance and promotes the fight against covid-19. In addition to the intersectoral articulation, the cited author highlights the relevance of reflecting on the uncertainties brought about by the context of the pandemic, through scenario analysis, including professionals from the basic network in the hospital environment when it was

necessary at the height of the pandemic, which showed unity and strength between PHC and the local hospital.

RESULT AND DISCUSSION

Seeking to corroborate with authors in the number of deaths caused by Covid-19, data were collected from the official documents of the Screening Center of the municipality of Sombrio, which demonstrate the scenario of the pandemic in the years 2020 and 2021, as can be seen in table No. 04 below.

Chart 4 - Scenario of the COVID-19 pandemic in the municipality of Sombrio-SC

CASES OF DEATHS DUE TO COVID-19	
Year	**Cases**
2020	26
2021	57
TOTAL	**83**
CARE OF SUSPECTED AND CONFIRMED COVID-19 PATIENTS	
Year	Cases
2020 / 2021	14.067

Source: Dark (2022).

Considering that the actions were taken not only to reduce contagion and deaths, but to improve local health, aiming at quality and safety in the care at that time, seeking to guarantee the population's access to health services, or promoting health at home.

It should be noted that the adoption of legal measures was the first step in relation to the responsibility of the municipal public management of Sombrio in the fight against the pandemic, issuing the official act that declared through Decree No. 48, of March 18, 2020 the emergency situation in the municipality of and defines other measures to face the public health emergency of international importance resulting from the Coronavirus (COVID-19), thus, the coordination of PHC together with other members of the teams, community leaders, religious representatives, public and private institutions expanded ties as a way to establish communication between government and community, putting into practice the contingency plan, following the guidelines of the Federal Court of Accounts, where the focus of strategic decisions should be based on physical and budgetary planning (Brazil, 2020),

The second attitude was to expand communication with the community to clarify the situation and mitigate the risks of contamination by the coronavirus through information, since this was a new situation and the first challenge to be overcome by the municipal administration. In Albury's view, 2005, this type of communication between the political sector and other institutions involved is an

effective element in the development and application of strategies to achieve better long, medium and short-term results, through what was proposed in the Municipal Contingency Plan.

Respecting the regulations, innovation in the way of managing the public portfolio is also evidenced in these two aspects, compliance with legal procedures through physical and budgetary planning and transparency in information to the population, with a view to integrating institutions and efforts in the fight against covid-19 (Brasil, 2020; Giovanella *et al.,* 2020).

As the needs arose, other actions were gradually adopted, applying planning and strategies according to what was manifested in the pandemic scenario, in order to contemplate the responsibilities of the public administration in relation to the demands of society during the period described (Albury, 2005).

Communication and access to information were also fundamental elements for the training of the teams, in the face of a chaotic scenario and an unknown disease. Aware of the seriousness of the problem, the management sought to equip the work teams with Personal Protective Equipment (PPE) to avoid contagion and the lack of professionals due to contamination by the coronavirus. In addition, it should be noted that access to information about covid-19 allowed management to organize teams and internal workflows to provide services full-time, including on weekends, in order to reduce the demand for patients with respiratory symptoms in the city's hospital, which is maintained by the State.

The implementation of the work methods and the influence on the behavior of the employees who make up the health teams in the municipality of Sombrio, creating awareness about the importance of the use of PPE, through access to information, demonstrates that the innovation initially took place in the field of communication, which according to (Tidd, Bressant and Pavitt, 2008, p. 30) occurs with the "implementation of a new method of promoting the organization or its services and goods, or new methods of influencing the behavior of individuals or other organizations."

In this case, Innovation through Communication took place in the first stage that constitutes the innovation process, which is the so-called incremental, consisting of small changes in the work routine to meet the growing demand, generating greater efficiency in the population's health care and efficiency in the internal processes that are at the rear of health services (Mulgan and Albury, 2003; Faria, Vargas and Martinéz, 2013).

Over time, due to the decrease in the number of professionals in the Units due to absences due to contamination by covid-19, the closure of some units became mandatory, the lack of professionals made it possible to think about the elaboration of new flows of activities, considering the need to provide greater agility in exams, the results of which took up to 15 days.

The analysis of the scenario, as a strategic attitude of the team that makes up the municipal management, was presented as a relevant tool for decision-making, reflected in changes in official acts with new measures to identify positive cases, given the emergency of the situation, aiming at achieving the objectives and goals established in the Contingency Plan with greater efficiency and effectiveness (Machado, 2007).

This strategy, based on the monitoring of events, enabled the generation of new knowledge and ideas, with satisfactory results, since in just five days the triage center was set up with its own resources, in a physical space provided by the administration of the local hospital (managed by the State). The place was equipped respecting all the standards of health surveillance, electronic medical records, ventilation, seven rooms to accommodate offices, examination room, reception and reception. In addition, the team was prepared and trained to meet the demand of symptomatic patients in the municipality, from Monday to Friday, and according to changes in demand, also on weekends. In the TCU's view, these measures are considered secondary in the innovation process of public management to combat covid-19, however, they are as important as the planning of the budget for health (Brasil, 2020).

According to Mattos and Guimarães (2005), the innovation implemented in the situation narrated above was manifested through the union of creative ideas, enabling the integration between the Municipality and the State, where it was possible to expand the services and carry out testing exams in the short term, reflecting in benefits for the population by the isolation of positive cases identified in the screening center. without compromising the use of financial resources, combining the actions of the contingency plan with the maintenance of the municipality's responsibility in the public spending indices established in the budget law for health (Brasil, 2020).

Although the efforts were directed to addressing the situation of collapse of health services, the innovation of internal processes and workflows in the dimension in which they occurred was not the focus of municipal management. However, the moment required positioning, planning, and innovative strategic decision-making in a short period of time to minimize the negative impacts, where the unity of the entire team was fundamental, because according to Gleriano *et al,* (2020), in pandemic situations, government decisions and actions must be integrated with the participation of health professionals and other workers from public and private institutions for joint actions.

It is understood that the engagement of all professionals to achieve the goals and objectives established by the Municipal Contingency Plan was essential. However, the identification of the relevance of everyone's participation led the administration of the municipality of Sombrio to face the second challenge, because if, on the one hand, there was the risk of contagion and illness of employees and their families, on the other hand, there was the imperative need to integrate the efforts

of all those directly and indirectly involved in decision-making and practical actions to combat the proliferation and contagion by the coronavirus.

Thus, as seen, the 2020 fiscal year was marked by the implementation of changes and facing the challenges for the municipal management of Sombrio, where creativity, as an enhancer of innovation, manifested itself as a differential for the construction of new ways of working, boosting and strengthening the local health system, providing greater efficiency in internal administrative processes, in care services to the population and management (Faria, Vargas and Martinez, 2013; Ito and Pongeluppe, 2020).

Considering some authors who point out the allocation of resources to essential areas should be revisited and reassessed, and with regard to the pandemic we can consider health, science and technology, education and social protection, and as it brings (Kobayashi, 2021), this promotes greater protection of the population, recovery of employability and reduction of socioeconomic inequality from the mobilization of global plans, national and regional.

FINAL CONSIDERATIONS

From the reflection on the concepts attributed to innovation, as well as on what the theory provides for the responsibility of municipalities in facing the covid-19 pandemic, as a form of technical and financial cooperation with the Union and the States, it is undeniable to state that innovation, combined with the use of digital technologies, has been strongly contributing to Brazilian public management, Mainly because of the technical and scientific benefits achieved in the area of health, of which the most important can be mentioned – the maintenance of life.

Regarding the scenario presented by the municipality, object of this study, it is possible to highlight that innovation was applied in work processes, in the production of health using technological tools, in the change of service flows, in the adaptation to leave PHC care and contribute to hospital emergencies, in creativity and innovative thinking in solutions with quick responses to those who need them.

However, identifying local needs, adopting new methods, and delivering operational health procedures with agility and rapid responses was challenging. Despite this, it is possible to implement strategies, all it takes is the union of intersectoral forces, seen and experienced in the fight against the pandemic.

Communication gained prominence in the pandemic and innovation was strongly highlighted, bringing people closer to the world in real time, with social networks and the use of technology, where through applications and information systems it positively influenced the behavior of professionals, the engagement of elaborate strategies, as well as the population that gained answers when they needed it most with ample information about the measures and care necessary to

avoid contagion and spread of the virus, seen in *open Lives*, meetings, training and qualification with the use of technologies.

Finally, several groups of people were part of these strategic assemblies, contributing to the resumption of the municipality's activities, making clear the strength for the common good, and the importance of innovations in the public sector, from technological innovation, to innovation in the work process, to achieve goals and reduce the disparity in all airlines for the Brazilian population

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Kawasaki Disease - From History to the Present: Literature review

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ABSTRACT
Objectives: The text addresses the objectives of understanding Kawasaki disease in terms of its etiology, clinical manifestations, diagnosis, treatment and complications, in addition to highlighting the socioeconomic impact and future perspectives of the research. Methods: The literature review uses information from scientific studies and expert reviews to address every aspect of the disease, from its history and discovery by Tomisaku Kawasaki to the most recent therapeutic advances and ongoing research. Results: The results highlight the complexity of Kawasaki disease, including its distinct clinical manifestations, diagnostic criteria, current therapeutic options such as intravenous immunoglobulin and aspirin, and the multiple possible complications, especially those related to the cardiovascular system. Conclusions: The conclusion underscores the importance of early detection, prompt treatment, and close follow-up to improve patients' prognosis. It also points to the continued need for research to enhance understanding of the disease, develop new therapies, and improve clinical management, aiming to reduce the social and economic impact of Kawasaki disease.

Keywords: Kawasaki disease, Acute febrile vasculitis, Arterial aneurysms, Intravenous immunoglobulin, Aspirin.

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INTRODUCTION

Kawasaki disease, an acute febrile vasculitis of unknown origin, predominantly affects children under five years of age. It is characterized by prolonged fever, conjunctivitis, skin rash, abnormalities in the lips and mucous membranes, cervical lymphadenopathy, and peripheral edema. The most serious complication is coronary vasculitis, which can lead to arterial aneurysms and other cardiac consequences. Early identification and treatment are crucial for the prevention of such complications. Understanding of the natural course of the disease and therapeutic advances have improved the prognosis, although there are still challenges in its clinical management.

HISTORY AND DISCOVERY OF THE DISEASE

Revealed to the world in 1967 by Tomisaku Kawasaki in Japan, Kawasaki Disease was initially called acute mucocutaneous lymphadenitis syndrome. After Kawasaki published a series of cases in 1974, the nomenclature was universally accepted. Since then, reports of the disease have emerged globally, indicating that it is not limited geographically. Early recognition of Kawasaki Disease is vital to avoid severe complications, making knowledge about its history and discovery essential for a proper treatment and understanding of the disease.

EPIDEMIOLOGY AND GEOGRAPHICAL DISTRIBUTION

Although more common in East Asian countries, such as Japan and Korea, Kawasaki Disease is also reported globally, including in the Americas and Europe. The incidence varies according to ethnicity, being higher among people of Japanese descent. The geographic distribution of the disease suggests influences of genetic and environmental factors on its pathogenesis. In addition, despite its prevalence in children, Kawasaki disease can affect adults, emphasizing the need for its recognition and management in different populations and localities.

ETIOLOGY AND PATHOPHYSIOLOGY

Kawasaki disease represents a systemic vasculitis whose etiology remains undetermined and is most frequently diagnosed in children under 5 years of age. Its pathophysiology is related to an inflammatory state that mainly affects the medium-sized arteries, resulting in serious possible complications. Although the precise cause is still uncertain, it is suspected that the disease derives from an atypical immune response to environmental stimuli in subjects with a genetic predisposition.

POSSIBLE CAUSES AND RISK FACTORS

The exact causes of Kawasaki disease remain a topic of intense research, although it is postulated that genetic aspects, exposure to pathogens and immune dysregulation may be drivers of

its onset. Specific ethnic groups, such as those of Asian origin, demonstrate greater susceptibility, indicating a strong genetic influence. Additional risk factors, including age and gender, are also under analysis in recent studies.

PATHOPHYSIOLOGICAL MECHANISMS INVOLVED

The pathophysiological mechanisms underlying Kawasaki disease are associated with the activation of the immune system, which triggers the production of inflammatory cytokines and promotes the formation of coronary artery aneurysms. Vascular inflammation is essential for the pathogenesis of the disease, causing endothelial injury and subsequent thrombosis. The overactive immune response also plays a fundamental role in the intensity of symptoms and complications derived from the pathology.

CLINICAL MANIFESTATIONS AND DIAGNOSIS

Kawasaki disease reveals a number of distinct clinical manifestations, such as prolonged fever, conjunctivitis in both eyes, skin rash, swelling in the extremities, redness of the lips and tongue, cervical lymphadenopathy, and irritability. The diagnosis is predominantly clinical and is based on previously stipulated criteria. It is crucial for the doctor to be vigilant to recognize these specific signs and symptoms in order to begin treatment immediately and avoid serious complications.

SYMPTOMS AND CLINICAL PRESENTATIONS

The typical symptoms and clinical presentations of Kawasaki disease include persistent fever for at least 5 days, in addition to conjunctivitis, skin rash, lip redness, swelling in the extremities, cervical lymphadenopathy, and changes in the oral mucosa. Detection of these symptoms is critical for diagnosis and should be meticulously investigated by the healthcare professional. The rapid identification of these signs is essential to prevent serious cardiovascular complications.

DIAGNOSTIC CRITERIA AND COMPLEMENTARY TESTS

Diagnostic criteria for Kawasaki disease include persistence of fever combined with at least four major clinical signs, or manifestation of fewer than four signs accompanied by laboratory evidence of inflammation.

In addition to the clinical evaluation, complementary tests such as blood count, C-reactive protein, erythrocyte sedimentation rate, platelet measurement, and cardiac imaging tests are important to confirm the diagnosis and monitor the progression of the disease.

COMPLICATIONS AND PROGNOSIS

The complications of Kawasaki disease are diverse and can affect multiple organ systems, such as cardiovascular, gastrointestinal, renal, neurological, and musculoskeletal. Such complications may include coronary aneurysms, myocarditis, pericarditis, arrhythmias, coronary artery obstruction, ventricular dysfunction, peripheral arterial disease, enteritis, hepatitis, nephritis, encephalopathy, arthritis, among others. The prognosis of Kawasaki disease depends critically on the evolution of these complications, making early diagnosis and effective management essential to prevent severe sequelae and improve patients' life expectancy.

MAJOR ASSOCIATED COMPLICATIONS

Among the most significant complications of Kawasaki disease, the formation of coronary aneurysms deserves special attention because it is the most serious and possibly fatal, and can trigger critical cardiovascular events, such as myocardial infarction or sudden death. Other relevant complications include myocarditis, pericarditis, arrhythmias, coronary artery obstruction, ventricular dysfunction, and peripheral arterial disease, which also exert a considerable influence on the prognosis and quality of life of those affected.

RISK FACTORS FOR UNFAVORABLE OUTCOME

The unfavorable progression of Kawasaki disease can be influenced by multiple risk factors, including the severity of initial symptoms, the presence of persistent fever, inadequate response to initial treatment, pericardial effusions, echocardiographic abnormalities, elevated levels of inflammatory markers, thrombocytosis, and the development of cardiovascular complications. Early detection of these risk factors is crucial for more assertive management and to avoid severe complications.

TREATMENT AND CLINICAL MANAGEMENT

Management of Kawasaki disease focuses on the use of intravenous immunoglobulin and aspirin. Widely adopted as a primary treatment, intravenous immunoglobulin has demonstrated efficacy in minimizing coronary aneurysms. Aspirin is administered in doses with anti-inflammatory properties to prevent thrombosis.

In addition, clinical management includes symptom relief, rest, and careful observation to assess pathological evolution and identify any adversities.

CURRENT THERAPEUTIC APPROACH

The current therapy to deal with Kawasaki disease recommends the early application of intravenous immunoglobulin, ideally in the first 10 days of the clinical picture, in order to attenuate the risk of coronary complications. The usual protocol suggests a single dose of 2 g/kg of intravenous immunoglobulin, combined with anti-inflammatory aspirin. For cases refractory to initial treatment, immunosuppression and other anti-inflammatory drugs are considered.

TREATMENT STRATEGIES IN SEVERE CASES

In the most severe manifestations of Kawasaki disease, especially when cardiac complications are involved, a more intensive therapeutic approach may be required. This strategy may involve intensive supportive treatments, cardiac procedures such as angioplasty or surgical interventions, and the use of robust immunosuppressive therapies. The selection of treatment for severe cases requires a careful analysis that considers the severity of the clinical condition, the existing complications, and the receptivity to the preliminary treatment.

SPECIFIC ASPECTS IN SPECIAL POPULATIONS

Kawasaki disease may exhibit varying manifestations at different ages, making it essential to recognize specific aspects in special groups. In children and adults, the condition may demonstrate variations in the clinical profile, diagnostic methods, and treatment approaches, requiring differentiated specialized care. Thus, intervention in Kawasaki disease in special groups requires a thorough exploration of the symptoms and complications typical of each category, in addition to the contemplation of individualized therapeutic approaches.

KAWASAKI DISEASE IN CHILDREN AND NEONATES

In the context of children and neonates, Kawasaki disease imposes specific challenges, considering the particularities of the immune system still in formation. The early detection of symptoms becomes complex, and the danger of coronary sequelae demands a special focus from health professionals. It is crucial to make a differential diagnosis and adapt the therapeutic approach to the needs of this age group, aiming to minimize the prolonged adverse effects of the condition.

KAWASAKI DISEASE IN ADULTS AND THE ELDERLY

Recently recognized also in adults and the elderly, Kawasaki disease in these age groups has distinct clinical and prognostic characteristics. Diagnosis becomes a challenge due to the low clinical suspicion in this group, requiring prevention and management of long-term complications. It is vital

that health professionals are aware of the possibility of this disease in adults and the elderly, thus ensuring an agile diagnosis and the implementation of appropriate therapeutic strategies.

FUTURE PERSPECTIVES AND ONGOING RESEARCH

The future prospects for Kawasaki disease include the development of more accurate and accelerated diagnostic methodologies, aiming at early detection of the disease to prevent adverse complications. In addition, new treatments are being explored focused on more effective therapies and with a reduction in adverse effects. Ongoing investigations seek to deepen the understanding of the pathophysiology of the disease and identify biomarkers that contribute to diagnosis and prognosis, with the aim of improving the quality of life of patients and reducing the long-term repercussions of the disease.

RECENT SCIENTIFIC ADVANCES

In the recent science of Kawasaki disease, studies that have elucidated new pathophysiological mechanisms implicated in the disease, including the action of the immune system and inflammatory processes, are highlighted. Advances in the genetic field have also helped to identify genetic predispositions that can facilitate the onset of the disease. Significant progress includes research into specific treatments, which aim to minimize complications and optimize the prognosis of those affected by the disease.

FEATURED RESEARCH AREAS

The areas of research that are in vogue in Kawasaki disease include studies focused on the discovery of new biomarkers that help in early diagnosis and in the assessment of risks of complications. In addition, the exploration of new therapies, such as the use of immunomodulators and biotherapeutics, is underway, which have received great attention. Another highlight is epidemiological research, which seeks to better understand the geographic distribution of the disease and identify environmental factors that may influence its development.

SOCIAL ASPECTS AND IMPACT OF THE DISEASE

Kawasaki disease exerts a considerable influence on the social sphere, affecting mainly schoolchildren. Early diagnosis and treatment are crucial to prevent severe conditions, resulting in a high need for medical and financial resources. In addition, the emotional consequences for the families and caregivers of the impacted children are significant aspects, in view of the prolonged recovery process and the potential risk of lasting sequelae, which can induce stress and restlessness.

ECONOMIC AND SOCIAL IMPACT

The economic impact of Kawasaki disease is remarkable, considering the costs of hospitalization, tests, and medications. The social sphere also feels the effects, given that the disease can compromise the school attendance of the affected children due to the extensive recovery time required. This can lead to educational deficits, affecting child development, in addition to significantly altering family dynamics, which are forced to provide intensive care during the recovery phase.

PUBLIC HEALTH NEEDS

Public health demands linked to Kawasaki disease include raising awareness among health professionals and general about the cruciality of early diagnosis, standardizing treatment protocols, and ensuring equitable access to health services. In addition, it is imperative to foster research that enables a deeper understanding of the disease and the development of more effective prevention and management tactics, with the aim of mitigating the adverse effects of this condition on society.

FINAL CONSIDERATIONS AND RECOMMENDATIONS

By concluding this literature review on Kawasaki disease, we conclude that it represents a clinical condition with significant complexities and challenges, having a relevant impact on public health. The synthesized knowledge highlights the imperative need to progress in the understanding of the pathophysiological processes that involve this condition, as well as in the formulation of more effective treatment and clinical management methods. In addition, early detection and multidisciplinary follow-up are vital to reduce complications and improve the prognosis of patients. Therefore, it is essential for healthcare professionals to stay up-to-date and trained to identify and treat Kawasaki disease efficiently in their clinical practices.

SUMMARY OF THE MAIN POINTS ADDRESSED

This review presented a variety of aspects related to Kawasaki disease, ranging from its etiology and pathophysiology to clinical manifestations, therapeutic approaches, and socioeconomic impact. It is crucial to emphasize the importance of recognizing diagnostic criteria and collaborative team action for effective clinical management. In addition, there was an in-depth discussion about the complications and risks that contribute to an unfavorable evolution of the disease. The review also included future perspectives, the latest advances in science, and priority areas for future research, offering a complete and up-to-date view on Kawasaki disease.

RECOMMENDATIONS FOR HEALTHCARE PROFESSIONALS

Considering the accumulated knowledge, it is advisable for health professionals to remain vigilant to the symptoms and diagnostic criteria of Kawasaki disease, especially prioritizing the care of children and neonates. It is also vital to maintain a close follow-up of patients for the early identification of complications and confirmation of the effectiveness of treatments. Collaboration between various medical specialties, including pediatricians, cardiologists, rheumatologists, among others, is essential for holistic and effective clinical management. In addition, psychosocial support strategies for families and public health education initiatives are recommended to promote a better understanding and management of Kawasaki disease.

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''I was not an ordinary mother'': The difficulties of motherhood in Arthrogryposis Multiplex Congenita

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ABSTRACT

The chapter addresses Arthrogryposis Multiple Congenita, a rare disease, that is, which is infrequent in the population, which consists of the presence of multiple joint contractures that lead to limitation of limb movements. It is a disease that imposes many specificities on the life of the person and family, especially the mother who assumes the role of main caregiver. The main objective is to present the difficulties faced by the mother from the repercussions of Arthrogryposis Multiplex Congenita in the maternity ward. These are the results of a field research with a qualitative approach that had as a methodological reference the method of a single case study. The research was carried out with the mother of a child who had a clinical diagnosis of Arthrogryposis Multiplex Congenita, selected based on specific criteria. The fieldwork was carried out at the home of the participating mother and in-depth interviews and observation were used as techniques to collect empirical data. The narratives were submitted to thematic content analysis according to the stages proposed by Bardin. The research was submitted for consideration and approved by a Research Ethics Committee. The reading of the results will make it possible to know the main difficulties faced by a mother based on the repercussions of this disease in motherhood.

Keywords: Arthrogryposis, Multiple Abnormalities, Rare Diseases, Pediatric Nursing.

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INTRODUCTION

In Brazil, the Ministry of Health (MH) considers as rare diseases those conditions that have a low prevalence in the population, that is, they have 65 cases per 100,000 people or 1.3 per 2,000 individuals (Brasil, 2014). However, despite this definition, the epidemiology of rare diseases in the country is unknown, due to the absence on the Ministry of Health's compulsory notification and health problems list (Silva et al., 2020a; Moro, 2020). It is estimated that there are about six to eight thousand different types of rare diseases in the world, in which for 95% of them, there is currently no effective treatment (Interfarma, 2013; Souza et al., 2019).

Among the rare diseases, Arthrogryposis Multiplex Congenita (AMC) will be highlighted in this chapter, a rare syndrome that consists of the presence of multiple joint contractures that lead to limited limb movements (Brasil, 2022). It was first described in 1841 by Adolf Wilhem Otto as congenital myodystrophy, and in 1923 it was titled AMC by Stern (Oliveira et al., 2021). Regarding epidemiology, a literature review highlighted that in every 10,000 births, three may be diagnosed with AMC, also indicating that in less developed countries this estimate may increase (Saccani, Umpierres and Basegio, 2008). In Brazil, there are still no epidemiological studies regarding the frequency of arthrogryposis in the population (Costa, 2021), although the condition is included in the list of priority congenital anomalies for birth surveillance in the country (Brasil, 2023). When analyzing anomalies that present limb defects, in which AMC is included, a recent epidemiological bulletin from the Ministry of Health highlighted that this group was more prevalent, with 25 individuals in every 10,000 live births (Brasil, 2023).

AMC is an uncommon syndrome of the musculoskeletal system, with multifactorial etiopathology, however, the exact cause is still unknown by science, which presupposes the relationship of genetic, parental, environmental factors and/or abnormalities during fetal development that affect the mother and the embryo, such as the influence of medications, infections, the condition of oligohydramnios or polyhydramnios, uterine alterations and chronic diseases and traumas (Oliveira et al., 2021).

The clinical diagnosis can be made soon after birth, as the child often presents stiffness and severe deformities in the joints, which can range from mild cases, with two or three affected joints, to severe cases, with deformities in important joints of all limbs, including the spine (Saccani, Umpierres and Basegio, 2008). In addition to the involvement in the joints of the limbs, the child may also present facial asymmetry, micrognathia, saddle nose, thin skin, muscle atrophy, scoliosis, degeneration in the nervous and urinary system, pulmonary hypoplasia, immature or short intestine, and osteoporosis of long bones (Oliveira et al., 2021).

With regard to treatment, in the case of congenital anomalies, such as AMC, it depends on early diagnosis, which is essential to provide the opportunity for individuals and their families to be

referred to access appropriate and timely treatments and interventions (Brasil, 2022). Specifically for AMC, the treatment has the perspective of improving joint function and, consequently, the person's quality of life, enabling autonomy in activities of daily living (Quintans, Barbosa and Lucena, 2017). For this, continuous monitoring with a multidisciplinary team is necessary, with indication of physiotherapy and orthopedic surgeries, in which the therapeutic plan is carried out on an individual basis (Quintans, Barbosa and Lucena, 2017).

Thus, considering the complexity of this syndrome, it is known that the diagnosis can directly affect the experience of motherhood, in view of the expectations that are built during the gestational period. A child diagnosed with a rare disease can cause changes in the family's daily life, with difficulties both with the community in which it is inserted and with health institutions that are often not prepared to serve them (Luz, Silva and Demontigny, 2016; Silva et al., 2020a).

In fact, studies show that these families face a lack of information about the disease, difficulty in accessing diagnosis and treatment, and also a lack of teams with qualified health professionals to meet their demands (Luz, Silva and Demontigny, 2016; Silva; Silva et al., 2020a; Silva et al., 2020b). Families may also be faced with the need to reorganize the roles of their members, who need to adhere to new responsibilities, in addition to those inherent to the daily needs of a child when they are born, they also need to seek social, health, financial and emotional services (Luz, Silva and Demontigny, 2016).

Thus, based on the problem presented and also the lack of research in the scientific literature with the perspective of approaching the experience of maternal care in rare diseases (Silva et al., 2020b), which can contribute with subsidies for the care provided by health professionals, including the nursing team, this chapter aims to present the difficulties faced by the mother from the repercussions of MCA in motherhood.

METHODOLOGY

This is a field research with a qualitative approach that has as a methodological reference the method of a single case study according to Yin's assumptions. The single case study, as a qualitative research method, refers to an experimental analysis, in which a current event is investigated, in depth and in its real-world situation, especially when the boundaries between the event and the set of circumstances cannot be clear and evident (Yin, 2015).

The present study was carried out with the mother of a child who had a clinical diagnosis of SMA and lived in a municipality in the interior of the state of Mato Grosso, Brazil. The case was identified through contact with the Municipal Health Department and selected considering compliance with the following inclusion criteria: being the mother of a child or adolescent with a clinical and/or genetic diagnosis of a disease that is classified as rare, that is, that affects 65 people in

every 100,000 inhabitants according to the Ministry of Health (Brazil, 2014); be eighteen years of age or older; reside in the state of Mato Grosso, to enable access by researchers during data collection; and being a user of the Unified Health System (SUS).

The fieldwork was carried out at the home of the participating mother and in-depth interviews and observation were used as techniques to collect empirical data. The open or in-depth interview is a conversation with intentionality that occurs freely, in which the researcher presents the purpose and meaning of the conversation and its enunciator pronounces freely on the topic addressed (Minayo, 2014).

Thus, two interviews were conducted with a total duration of 45 minutes and 64 seconds. The first was held at 09:00 am on February 9, 2023, lasting 20 minutes and 42 seconds; and the second at 08:50 am on February 14, 2023, lasting 25 minutes and 22 seconds. To apprehend the object investigated in this study, the following guiding question was used: 'what has it been like for you to experience motherhood in the face of AMC?'. However, in order to gradually deepen the memories of the participating mother, after the first interview, the following questions were elaborated: How was it for you to receive the news of the change in the exam in the 3rd month? What were the biggest difficulties faced? You get very emotional when you talk about the things he goes through at school. How did you prepare him for this moment? When he started studying, was there a conversation before? Did you talk about the *bullying* you might suffer? Did you receive guidance from health professionals about the things you would face in society? How is it cared for at home? Is his diet different from yours? What would you say to a mother who has just discovered this syndrome? What advice would you give? And at that moment, a cell phone was used to record the interview and enable the full transcription.

In addition, the observation technique is operationalized through the researcher's direct contact with the individual being interviewed, aiming to obtain more detailed information about the participant's reality (Minayo, 2014). And in order to complement the narratives obtained with the in-depth interview, the non-verbal communication of the participating mother and also the way she expressed herself when talking about the issues involving the child diagnosed with AMC were recorded.

For the organization of the empirical data collected, the material from the two interviews and the observation records were entered into a word file, which constituted the *corpus* of analysis of the research. This file was typed in *Times New Roman* font, size 12, spacing 1.5 cm and had 16 pages. This material was submitted to content analysis of Bardin's thematic type, following the stages of organization of analysis, coding, categorization and inference (Bardin, 2016). This process gave rise to themes, which were grouped together and resulted in two thematic categories, as highlighted in chart 1.

Table 1. Operationalization of thematic content analysis based on Bardin's assumptions, Mato Grosso, Brazil, 2023.

Grouped topics	Parent topic	Categories	Chapter
* Complications after birth *Facing the diagnosis *Support group *Uniqueness of the disease *Difficulty *Dealing with care *Treatment *Specialized professionals	Difficulties faced after birth and diagnosis of AMC	Daily care in the particularities of the rare disease	"I was not an ordinary mother": the difficulties of motherhood in Arthrogryposis Multiplex Congenita
*Bullying *School *Social judgment *Resignify the wheelchair *In the future * Be questioned	Fight against social judgment	Facing Social Judgment and Prospects for the Future	

Source: Prepared by the authors.

The research that originated this book chapter is linked to the matrix project entitled 'Rare mothers and narratives about motherhood', which was submitted for consideration by the Research Ethics Committee of the State University of Mato Grosso (CEP/UNEMAT) respecting the ethical precepts of research with human beings established in resolution No. 466/2012 of the National Health Council (Brazil, 2012). The aforementioned research project received a favorable opinion from the CEP/UNEMAT on May 18, 2022, under CAAE number: 57621722.3.0000.5166 and opinion 5.417.066.

The ethical commitment in this study was mediated through the signature by the participant and the coordinating researcher of the Informed Consent Form (ICF) in two equal copies, one copy remaining with the participating mother and the other with the coordinating researcher.

RESULTS

The case selected for investigation in this study refers to that of a 42-year-old mother, married, dental office assistant, graduated in Biological Sciences, post-graduated in the lato sensu modality in Health and Environment, municipal civil servant since 2005, living in her own home. She is the mother of three children, one miscarriage and two alive, in which one of the children, six years old, a regular student in public school, had the clinical diagnosis of the rare disease AMC.

From the analysis of this mother's narratives, the themes that emerged were grouped and gave rise to two thematic categories, namely: I. Daily care in the particularities of the rare disease, in which the interviewed mother reported the main difficulties she had to face to take care of her child; and II. Facing social judgment and perspectives for the future, which highlighted the coexistence with judgments, *bullying* and also the concern with the adolescence and adult life of the child.

DAILY CARE IN THE PARTICULARITIES OF RARE DISEASES

In the care experience of the interviewed mother, the reports highlighted that there was knowledge about the bone malformation that the child presented during pregnancy. And for this reason, the mother's expectation already considered the birth of the child with such a complication. However, receiving the diagnosis of the rare disease was a difficult moment, enhanced by the lack of knowledge about AMC, as she presents in the narrative: *"It was difficult. We received the diagnosis, it was a very complicated phase for us. Because we don't know what to expect, we don't know what will happen. And when he was born, I was prepared to receive a child with crooked feet and crooked hands, but that's all, you know? only this to solve (Atypical Mother)".*

In the participant's mother's report, some points were highlighted in relation to the complications that the child presented after birth. Fractures, a common complication in AMC, are directly related to the particularities of this rare disease, whose main characteristic is bone fragility. And so, immediately after birth, the child had to be admitted to the Intensive Care Unit (ICU) as a result of the fractures, as the mother recalled: *"The hardest thing to face was that he broke his arm, broke his leg and went to the ICU. So, that was the phase I think was the most difficult to face, to see him [...] with that cast that caught on his waist (Atypical Mother)".*

Another particularity of the rare disease that was highlighted involved muscle strength and was perceived and recognized by the atypical mother over time. In the interview, for example, she narrated that at school, food needs to be cut into smaller sizes, to enable the child to chew properly: *"The only difference I talk about at school is that he can't chew hard things, he doesn't have as much strength in his mouth. He doesn't open his mouth very big, so it's the chewing part. You put everything we eat, but in small pieces, so he doesn't suffer so much to chew (Atypical Mother)".*

To deal with the child's care on a daily basis and to face the particularities that the diagnosed rare disease had, the mother reinforced the importance of having been inserted in a support group, formed specifically by families who shared the experiences of care at AMC. According to the narratives, this group helped to clarify several doubts: *"It helped a lot, it certainly helped. All the doubts we had about surgeries, with the clubfoot, with the boots we had to wear, the surgeries, everything there we answered the questions, we always ask "did your son have this? Did you have that?" I was exchanging ideas and it made it a lot easier. So today we help others who are arriving, who have a lot of cases, some new ones are arriving and now we are helping (Atypical mother)".*

Among the difficulties that the mother had to face to take care of her son, there was also a concern with the social treatment he would receive, in view of the particularities of the disease. In this experience, the mother understood that the unusual would not be treated as common: *"At first it was very difficult like that, because I would like them to treat it as common. But, how are they going to treat common when it is not common. So, the crooked hand draws a lot of attention, and people*

often say: "ah, but you don't have a little ortho, right? to tidy it up". As if we had never done anything, you know? And orthosis is what he has! Physiotherapy is what he has had all his life! But the lack of musculature leads the hand to become crooked, it just can't have deformities, but the little hand is crooked (Atypical mother)".

One of the daily care that the child with AMC needs to perform includes physiotherapy sessions. In the mother's experience, the narratives presented as a difficulty the situation of witnessing the child's suffering during the physiotherapy sessions, because the child often felt pain: *"He needs to face the pain because otherwise things get even uglier. So, he faces it, there are days when he is cool, there are days when he cries a lot, there are days when he questions. There were days when he talked to me with the physiotherapist there with a swollen eye asking why he suffers so much. And at this moment, for the mother it is difficult, the mother cries together, right? and then I welcome (Atypical Mother)".*

Due to the clinical evolution of AMC, there are influences on the growth and development of some body systems and thus, the child may need therapeutic interventions in the future. The mother reported some alternatives that were presented to her son, and that can be performed later: *There are some cases in Arthrogryposis that the doctor can transfer the muscles, for example, if he finds a muscle here [showing] in the pectoralis major, he can put this muscle in his little arm then he bends his arm. So, there are also orthopedists who work with this. [...] Today there is also bone stretching that the orthopedist can do, because of the stature. Because they are usually very short. They can increase the child's stature to be a little taller, but everything is in the future. The hand that is turned, right? the orthopedist can also tidy up his hand, when the child decides, that's the child's decision (atypical mother)".*

In addition to these confrontations presented, the mother also had to locate specialized professionals who were committed to the rare situation experienced by the family. Thus, the atypical mother highlighted the attention she had when considering the physiotherapist who would perform the physiotherapy sessions: *"He doesn't need physiotherapy more or less, because there is a professional who gives you physiotherapy more or less. You have to have a committed professional who looks at your child, who is committed to his life and does his best (Atypical mother)".*

FACING SOCIAL JUDGMENT AND PROSPECTS FOR THE FUTURE

When experiencing the child's illness due to a rare disease, which presents changes in the physical body and that are easily perceived, dealing with people's judgment from social life was one of the issues that the mother had to face in motherhood. Because it is a child, memories about the manifestations of social judgment were frequently experienced at school. In this regard, the interviewed mother reported a situation experienced in this social space that involved *bullying*: *"Last*

year the teacher said to me like this: "ah! Did you see what happened? That the little boy is imitating him?". He was walking down school and there was a boy imitating him. Then she said that she had already called the child, talked about how he should behave, that he needs to respect the other, and then I told the principal: "what you did was very beautiful, it must be done so that the children learn to respect each other. But it's just the beginning! Unfortunately, he will go through this, it's just the beginning! We are not used to what is different, none of us" (Atypical mother)".

Also in this regard, when narrating the difficulties that her son faced daily at school, the mother was very moved. According to her, in addition to *bullying*, the child also needs to deal with the repercussions of the particularities that the rare disease imposes, which influence, for example, recreational activities: *"But like, it's a challenge! School I think [that] will always be a challenge. Because he can't like, if he's at recess, the other kids are there running, playing, right? And he's looking. Because he needs someone to go with him. And there at that time, there is no one. He doesn't have a mother, he doesn't have a father, but he goes with the teacher, when he can eat faster he goes [gets emotional]. But he can't always eat fast, because the muscles in his mouth are also more fragile [crying]. But then, the school (Atypical Mother) is challenging".*

From the mother's narratives, it was possible to verify that the social judgment experienced permeated the school space: *"Then it is difficult to look at them. It was difficult for people to understand that he has a normal mind, that he has to be treated like a normal person. Because he wants it. And it was hard for me. There are times when tears have fallen. To this day, but it's a day-to-day challenge (Atypical Mother)".* One of the concerns expressed by the mother was that her son would need to use a wheelchair, in view of the potential that this object would have in the social judgment that her son was already experiencing: *"For me it was one of the things that I did not accept, because I believe that all people have that schism like this. You don't even sit in a wheelchair, have you seen that? Don't even sit down, for God's sake! Because this is an unacceptable thing in our life, right? As if it were an inadmissible thing, no one could be there (atypical mother)".*

In addition, another confrontation pointed out by the mother was concerns about the child's future. In the following narrative, the atypical mother described her concerns about her son's adolescence and also the way she dealt with this issue: *"Today he [is] very full of joy. But he's a child, he doesn't understand much yet. So, [as] a teenager, we don't know how he's going to deal with it. But it's living one day at a time! [...] I think so, the biggest difficulty is this, living one day at a time, because we think a lot ahead, what will my son go through in the future? How will it be? So living one day at a time is the most extraordinary thing there is (Atypical Mother)."*

DISCUSSION

The results described the difficulties faced by the mother when experiencing motherhood in the face of a rare disease. In fact, the scientific literature corroborates the difficulties faced, as it points out that the birth of a child with a rare disease in the family context can lead to changes in the family's daily life, giving rise to unique feelings and also the need to (re)organize behaviors to face the demands arising from the new condition that presents itself (Luz, Silva and Demontigny, 2016; Silva et al., 2020a).

In the case of rare diseases, reaching the diagnosis can be one of the main difficulties to be faced by the family (Silva et al., 2020a). Generally, children can take many years to receive the correct diagnosis, whether clinical or genetic. This reality is influenced by the lack of knowledge of health professionals about rare diseases and their peculiarities, the large number of rare diseases cataloged in the world and the variety of clinical manifestations, the existence of few reference services for rare diseases in the country, the high cost of genetic tests necessary to reach the diagnosis accurately and also, the reduced number of physicians specializing in genetics (Luz, Silva and Demontigny, 2015; Luz, Silva and Demontigny, 2016; Silva et al., 2020a).

However, in the experience of the mother investigated in this study, the clinical diagnosis was made immediately after birth. This is a situation that results from the characteristics that the disease presented in the child's physical body. In AMC, joint contractures are often manifested in the lower or upper limbs, and this is noticeable and contributes to the clinical evaluation of doctors and the moose of diagnosis (Brasil, 2022). However, a study pointed out that this does not always happen, because even the child with Epidermolysis Bullosa being born with cutaneous aplasia, a rare dermatological disease, health professionals had difficulties in diagnosing it, according to the mother's memories and narratives (Silva et al., 2020a).

Another confrontation is related to the clinical evolution of the diagnosed rare disease and the respective complications manifested, which will directly influence the family's confrontations. In the experience of the interviewed mother, the ICU admission soon after birth and the decreased muscle strength were related to the particularities of the clinical evolution of the disease. In the case of AMC, due to the absence of muscle mass, strength is limited in children who receive this diagnosis and this causes the functionality of the lower limbs to be impaired, especially in relation to gait (Rozane, Carvalho and Ruzzon, 2012). In addition, another characteristic of this condition is joint stiffness, which has an extra-articular influence as a result of the shortening of the muscles and the retraction of the joint capsules (Carvalho and Santos, 2008).

According to the above, another particularity of the AMC is in relation to the musculature, which is rigid, including the facial muscles, causing the individual to have difficulty in feeding (Saccani, Umpierres and Basegio, 2008). Thus, in SMA, the person may manifest difficulty

swallowing (dysphagia), with narrowing of the temporomandibular joint, which often presents itself as an aggravating factor. When associated, these oropharyngeal pathologies can make it impossible to carry out safe oral feeding of the newborn, due to the risk of aspiration (Oliveira et al., 2021).

Thus, in view of the diagnosis of a rare disease and the repercussions imposed by the complications manifested in the child, it is important to integrate the family into a support group, formed mainly by families that share the same anxieties and concerns. These groups are recognized as supply strategies for the family caregiver, offering emotional and psychological support, as well as providing information and guidance in relation to aspects of the diagnosed rare disease (Rodrigues et al., 2021). For the group to be more effective, it is necessary to create an integral space, with the purpose of establishing reciprocal exchanges between the participants, about the distressing and happy experiences of daily life, as well as expressing and sharing ways to alleviate them (Rodrigues et al., 2021).

However, in addition to these confrontations related to the clinical aspects of the rare disease, there are others that involve social issues. The results showed that the mother was concerned with social life, in which the child would be exposed to social judgment, which could permeate different spaces and be enhanced by the use of wheelchairs in the future. In this sense, it is understood that rare diseases have social consequences for patients and their families, with psychological and economic involvement, affecting all members (Catana, 2013). Negative social effects for these families can include isolation of the person diagnosed with the rare disease, who is subject to stigmatization, discrimination, and reduced educational and employment opportunities (Catana, 2013).

Another aspect that stood out in the narratives of the mother participating in the study is related to coping *with bullying* and recreational activities at school. The term *bullying* has English origins and designates actions of mistreatment against another person, whether physical, psychological, or both (Silva, 2017). It is a theme that is often present in debates held in school environments, a space for building personal relationships and training (Ribeiro, 2023). Due to the medium and long-term consequences, it is important to provide spaces for discussion, especially on ways to cope with *bullying* in schools, recognized as a space that is also favorable for the occurrence of conflicts (Ribeiro, 2023).

The family and the school function as two essential organizations to motivate the child's development processes, operating as stimulators or intimidators of their intellectual, affective, and social growth (Freitas, Freitas, and Cavalcante, 2021). Both share functions associated with education, social skills, and political thinking and behavior (Freitas, Freitas, and Cavalcante, 2021). Therefore, they help and influence the child's education, being responsible for the transmission of values and knowledge (Lazzaretti and Freitas, 2016). Thus, family and school can work together with

children on the inclusion of people with disabilities, to foster the feeling of belonging to the environment in which the child who has a disability is inserted (Lazzaretti and Freitas, 2016).

In addition to this, the mother needs to frequently witness the emotional suffering of the child. In the experience shared in this study, during the physiotherapy sessions, the mother witnessed her child's pain. Specifically in the case of AMC, pain is strongly related to the need to perform physical therapy to improve the quality of life of the person diagnosed with the syndrome (Rozane, Carvalho and Ruzzon, 2012). This result highlights the discussion about the feeling of helplessness that mothers may feel, as occurred in a study that showed that, when witnessing the pain of the infant daughter during the dressings, necessary due to the diagnosis of a rare dermatological disease, the mother's feeling was that of not being able to do anything to relieve it (Silva et al., 2020a).

Still in this treatment scenario, the mother faces concern about the therapeutic interventions that the child will be subjected to in the future and also about the adolescence phase. It is known that over time, health-related technologies evolve more and more and as this advance happens, new procedures and therapeutic alternatives emerge, including for AMC (Costa, 2021). For example, malformations of the limbs that limit functions are common, and are often treated with surgery. Treatment on the feet is the most necessary, followed by procedures on the knees and hips. Surgeries in the upper limbs are suggested to correct fixed joint contractures, the elbows are the most approached in the upper limbs. The long-term purpose is to increase joint mobility and muscle strength and provide adequacy for gait acquisition and improvement in the quality of life of people living with AMC (Costa, 2021).

Finally, when considering the difficulties faced in daily life, the results highlighted the mother's search for professionals committed to the particularities that AMC requires. It is noteworthy that in the case of illness due to a rare disease, the family often makes the move to seek qualified professionals to complement the care (Luz, Silva and Demontigny, 2015). In the case of AMC, treatment needs to be monitored by a multidisciplinary team on a regular and cautious basis, due to the various complications that the syndrome can present, the multiple joints that can be affected, and the particularities of recurrences over the years, as contractures and stiffness of periarticular tissues make it impossible to perform decisive osteoarticular remodeling (Oliveira et al., 2021).

In fact, the literature points to difficulties that families face in their relationship with health services and professionals. This occurs due to the lack of knowledge of health professionals about the specificities of rare diseases (Luz, Silva and Demontigny, 2016; Silva et al., 2020b). However, it is with health services and professionals that families who experience illness in the face of rarity will inevitably be linked for a long period (Luz, Silva and Demontigny, 2016; Silva et al., 2020b). However, in these spaces, families are seen unequally, not precisely because of prejudice (Luz, Silva and Demontigny, 2016). It is emphasized that the rights related to access to quality health services,

equality, problem-solving capacity and comprehensiveness in conduct are not always respected, either because the services do not have technological resources to attend to a rare condition or even because health professionals are not adequately prepared for this reality (Luz, Silva and Demontigny, 2016; Moro, 2020).

FINAL CONSIDERATIONS

The results of the study allowed us to approach the difficulties experienced in the maternity ward of an atypical mother. When she had to deal with the unusual in the maternity ward, this mother was faced with different difficulties, which were related to the process of diagnosing the rare disease, the complications and treatments to which the child was submitted, the search for health professionals committed to the peculiarities of the MCA, the repercussions of the disease on social life and also, concerns with future therapies and the adolescence phase.

Thus, the difficulties experienced in the daily life of this mother present relevant issues that need to be considered by political agents who work at the federal, state and municipal levels, as well as the managers of different health services and society. It is necessary to invest in scientific research and discussions on different rare diseases, offer training for health professionals, aiming to prepare them to diagnose early and/or refer children to specialized services, increasing the potential of therapeutic treatment and reducing sequelae, which have a negative impact on the quality of life of the person, family and also, imposes an increase in costs for health care.

Despite the relevant results, this study has limitations regarding the investigation of the reality experienced by a mother about the specific rare disease AMC. Thus, in order to mitigate this, new studies are encouraged, which should consider the daily lives of other atypical mothers, when experiencing illness and care for different rare diseases and in similar or different geographical contexts, corroborating the endorsement of the scientific literature on this theme.

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Art therapy as a pediatric oncological therapeutic support

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ABSTRACT

The pediatric cancer treatment process is often invasive and causes several psychosocial losses in the individual's life, bringing major changes in their routine and perception of themselves. Art therapy, in turn, provides a therapeutic environment conducive to a non-verbal externalization of repressed feelings and thoughts, this process works through a creative approach and artistic resources. The objective of the present study is to identify the publications involving Art Therapy, Pediatric Oncology and Psychology, investigating the damage caused by invasive treatment and understanding whether art therapy could be used as a non-pharmacological support. The methodology used was the Integrative Review, having selected at the end of the search 10 articles between 2019 and 2023 that met the necessary criteria. The results show that Art Therapy has the competence to contribute positively to the psychosocial repercussions caused by invasive treatment, using art, creation and creativity as a stimulus, however, it was also evident the little material published in the last five years by the area of psychology.

Keywords: Psycho-oncology, Child and adolescent Oncology, Art Therapy, Hospital Psychology, Psychology.

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INTRODUCTION

According to the National Cancer Institute (INCA), cancer is characterized by the disordered growth of cells, which can result in the invasion of adjacent tissues or distant organs. This process leads to rapid cell division, culminating in the formation of tumors. Cancer treatment may involve different approaches, such as chemotherapy, radiation therapy, bone marrow transplantation, or surgery, and it may be necessary to combine these methods (INCA, 2022).

Specifically in cases of tumors in childhood and adolescence, faster growth, shorter latency period, and a generally more invasive presentation are observed. However, it is important to note that these types of cancer tend to respond positively to treatment, which results in a higher probability of a favorable prognosis (Pereira, Nascimento, Cruz, Volc, and Tormen, 2023).

According to Law No. 8069 (1990), a child is considered to be an individual up to 12 years of age, while the adolescence phase comprises from 12 to 18 years of age. In this sense, the context after the diagnosis of a disease intensifies even more when it comes to pediatric oncology, as this can confront the patient with something unusual and feared.

The process of cancer treatment is often invasive and painful, causing a great emotional and psychological burden for the patient. This is due to the social and cultural symbology associated with the diagnosis, hormonal and body changes, exposure, alteration of routine, and several other aspects that negatively impact the life of the person undergoing treatment. This context can lead to a loss of identity, psychological distress, and damage to their interpersonal relationships and self-esteem. In this sense, it is essential to have a multidisciplinary and specialized team, whose objective is to reduce the impacts caused by prolonged treatment and minimize as much as possible the possible damage to the patient's mental and emotional health, consequently providing a better quality of life.

The pathology is culturally associated with pain, suffering and mourning, unexpected definitions that children and adolescents face, impacting all aspects of their lives. This brings with it the fear of the unknown and the frustration of not being able to fully experience their age group. Just as there is pain and suffering, there are also a variety of traditional and alternative treatments. Among them, psychotherapy, occupational therapy and art therapy stand out, which are the focus of this work.

Art therapy is a therapeutic process that uses artistic language as a means of communication and expression, focusing on aesthetic creation and artistic elaboration to promote the health of the individual (Brazilian Union of Art Therapy Association, 2019). Although it is a specialization aimed at health professionals, there is recognition of its practice in non-clinical environments by professionals in the areas of arts and pedagogy (Brazilian Union of Art Therapy Association).

It can be used as one of the therapeutic supports to cope with the disease and assist in the patient's recovery, highlighting the emotional and social aspects. It creates a playful environment that

encourages and guides individuals to deal with the condition in a more peaceful and dignified manner. This space provides security to express internal issues verbally or non-verbally, also contributing to strengthen the bonds between the patient, their family, friends and professionals involved in the process. The approach is humanized and individualized, taking into account the subjectivity and individual experiences of the subject.

Art therapy had its bases initially developed from the theories of Freud and Jung in the 20s and 30s. In Brazil, its introduction occurred at the beginning of the 20th century, being strongly influenced by the work of the two authors and by psychiatry. In this context of contribution, Osório César (1895 – 1979) and Nise da Silveira (1905 – 1999) stand out, both psychiatrists who incorporated art as part of the treatment of their patients in mental health institutions (Psicologia, Ciência e Profissão. 2014, p. 142-157). This approach built a new perspective on madness, emphasizing humanized care that is sensitive to the individual's subjectivity. This allowed people to create and elaborate their thoughts and feelings, resulting in a visible improvement in quality of life.

According to Monteiro (2018), it is necessary to combine exciting, inhibiting activities and regulation through the creation of new natural chains or by strengthening or weakening pre-existing circuits for learning to occur. According to the same author, who cites Hass Cohen and Findlay, the use of artistic resources and the establishment of a welcoming environment affect the brain regions related to cognition, emotion and sensation, which are fundamental to trigger psychological changes. These practices are linked to a state of adaptability and resilience achieved by the brain during art therapy (Monteiro, 2018, p. 11).

In Psychology, art presents itself as a strong mechanism of self-knowledge, strengthening human development skills such as communication. It also develops creativity to help the individual achieve their internal issues without them going through the process of rationalization. In other words, it is through creativity that a more direct contact is achieved to express emotional factors, building an interaction with subjective issues of the being without the need for verbal communication (Reis, 2014).

Considering the significant role of art therapy in promoting self-knowledge and emotional expression, as discussed in the psychological literature, there is a need to investigate its specific application in the context of pediatric oncology. Given that art is recognized as an effective vehicle to strengthen communication skills and explore internal issues in a non-rationalized way, it becomes relevant to understand how this therapeutic approach can contribute to the well-being and quality of life of children and adolescents undergoing cancer treatment.

In this sense, this article proposes an integrative review of intersectional studies between art therapy, pediatric oncology, and psychology, with the aim of evaluating the description of this therapy as a non-pharmacological support for pediatric cancer patients.

MATERIAL AND METHODS

For the elaboration of this article, the method of Integrative Literature Review (Souza, Silva & Carvalho, 2010) was adopted, under the guidance of the guiding question "What is the use of art therapy as a therapeutic support in pediatric cancer treatment?". The choice of this type of study is justified by its ability to provide a comprehensive understanding of current knowledge on the subject based on evidence. Integrative review allows for the identification, analysis and synthesis of the results of independent studies that address the same subject (Souza, Silva & Carvalho, 2010).

The bibliographic survey began in October 2023 and concluded in March 2024, carried out in the SciELO, PePsic, LILACS and VHL databases, using the selected descriptors in Portuguese in order to direct the research accurately. Terms such as psycho-oncology, art therapy, oncology, pediatrics, art, and psychology were included. The data presented in this study refer to publications found up to March 2024, according to pre-established criteria.

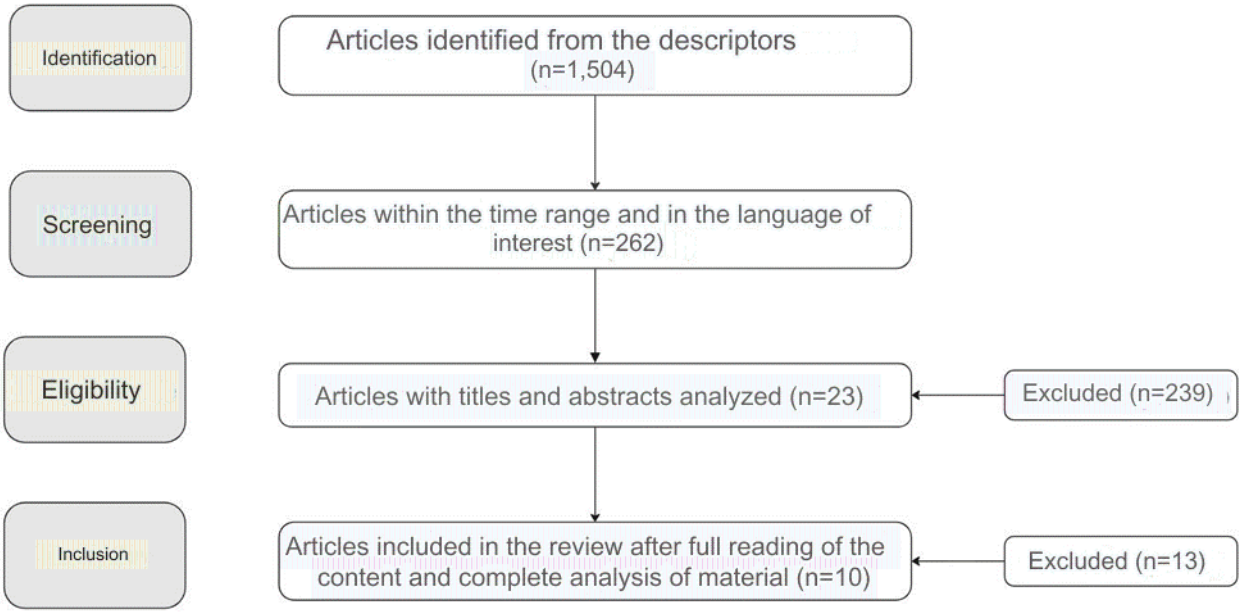
Articles published in the last five years (2019 to 2023) and exclusively in Portuguese were included in this search. Studies that did not address child and adolescent development during hospitalization, the impacts of cancer diagnosis, or that did not involve drawing and painting activities were excluded. For the analysis, adherence to the proposed theme and aspects such as the methodology used, the objectives and the clarity of the results presented were considered.

RESULTS AND DISCUSSION

At first, a total of 1,504 articles corresponding to the descriptors used were found, adding up the results of all the databases searched, however, only 262 fit the time interval and the language of interest.

The selection of articles followed in 2 stages, the first being the reading of the titles and abstracts, where 23 pre-selected articles remained, in sequence these publications were read in full, finally resulting in 10 studies that contemplate the necessary criteria for the present review, as shown in Figure 1.

Figure 1: Flowchart of the process of identification and selection of studies integrated into the review.



Source: Rosa and Schliemann (2024)

The articles identified at the end of the selection were organized in a spreadsheet, containing information such as their authorship, year of publication, title, types of study, sampling, objective and main results found, as shown in Table 1.

Tabela 1: Panorama descritivo dos dados coletados

	Análise Bibliométrica		Análise de Conteúdo	
AUTORIA, ANO E TÍTULO	**TIPO DE ESTUDO**	**AMOSTRAGEM**	**OBJETIVO**	**PRINCIPAIS RESULTADOS**
Figueira, S. M. M., & Gameiro, M. G. H. (2020). Vivências dos adolescentes com doença hemato-oncológica na fase diagnóstica: estudo de cariz fenomenológico.	Investigação empírica de tipo qualitativo	9 adolescentes em tratamento na unidade de oncologia	Compreender as vivências dos adolescentes com doença hemato-oncológica na fase diagnóstica	Vivência particular da doença oncológica. Perceberam o diagnóstico como uma ameaça aos seus planos e sonhos.
Fonseca, L. G. A., Panciera, S. D. P., & Zihlmann, K. F. (2021). Hospitalização em Oncologia Pediátrica e Desenvolvimento Infantil: Interfaces entre Aspectos Cognitivos e Afetivos.	Pesquisa qualitativa	5 crianças entre 4 a 9 anos de idade diagnosticados com leucemia e em acompanhamento em um ambulatório especializado em oncologia	Compreender de que maneira o processo de adoecimento por neoplasia infantil, hospitalização e tratamento são compreendidos pelas crianças, considerando sua etapa de desenvolvimento cognitivo de acordo com a perspectiva piagetiana	Todas as crianças participantes mostraram compreensão de sua situação de adoecimento e tratamento, apresentando diferentes formas de enfrentamento. Além disso, todas ressaltaram uma posição otimista em relação às perspectivas de cura, independentemente do momento do desenvolvimento cognitivo
Silva, T., Foger, D., & Santos, P. (2019). Despersonalização do Paciente Oncológico Hospitalizado: Uma Revisão Integrativa.	Revisão Integrativa da literatura	Não se aplica	Identificar alguns fatores que promovem a despersonalização durante a hospitalização	Identificou-se a perda de autonomia, a falta de comunicação e a fragilidade do relacionamento dos profissionais da saúde como alguns dos motivos que promovem a despersonalização
Pelisson, G. S., & Sei, M. B. (2023) Grupo com crianças e o uso de recursos artístico-expressivos: um estudo qualitativo Vínculo	Estudo Qualitativo	Não se aplica	Investigar o uso de recursos artísticos-expressivos em um grupo terapêutico que visava a expressão e compreensão das emoções	Os resultados indicam que o uso de recursos artístico-expressivos possibilitou a expressão de emoções, elaboração de vivências e melhora na comunicação, além de promover melhorias nas relações familiares e interpessoais
Costa VC, Melo NRM, Nascimento MML, Leão DBM, Nascimento CAD, Bushatsky M. Percepção do Adolescente frente à sua Condição de Adoecimento Oncológico. (2021)	Pesquisa exploratória e descritiva de abordagem qualitativa	13 pacientes oncológico na faixa etária de 12 a <18 anos de idade	Compreender a percepção do adolescente frente à sua condição de adoecimento oncológico	Os sentimentos vivenciados com olhar do adolescente, próprios da faixa etária, muitas vezes diferem do sofrimento da família e da equipe de saúde
Pereira CIP, Nascimento IB, Cruz AS, Volc SM, Tormen TH. (2023). Impactos Psicossociais e na Qualidade de Vida do Tratamento Oncológico em Crianças e	Estudo transversal e descritivo	25 pacientes pediátricos oncológicos de 8 a 18 ano	Avaliar em crianças e adolescentes com diagnóstico de câncer os impactos psicossociais, de qualidade de vida e da presença de acompanhante durante	O impacto psicossocial e na qualidade de vida é razoavelmente grande em pacientes pediátricos oncológicos. Além disso, os mais jovens parecem sofrer um impacto psicossocial maior. Os pacientes se dizem mais felizes com a presença de acompanhante, e mais ansiosos na sua

Adolescentes.			os procedimentos	ausência
Lopes NCB, Viana ACG, Félix ZC, Santana JS, Lima PT, Cabral ALM. Abordagens lúdicas e tratamento oncológico infantil (2020).	Estudo qualitativo, descritivo e exploratório	10 crianças com idades entre 6 e 12 anos acolhidas em uma casa de apoio	Demonstrar como, na percepção da criança acometida por câncer, as abordagens lúdicas contribuem para que ela enfrente o tratamento oncológico	As crianças disseram que acham importante brincar durante o tratamento e reconhecem que, ao brincar, vivenciam uma variedade de sentimentos, como felicidade e bem-estar, mas também raiva por sentir dor devido à condição de estar doente
Magalhães DMA, Magalhães GA, Grigorovski N, Figueiredo Junior I. (2022). Dinâmica da Implantação de Humanização no Serviço de Radioterapia Pediátrica Instituto Nacional de Câncer José Alencar Gomes da Silva, Brasil.	Estudo descritivo	Não se aplica	Descrever a dinâmica do processo de humanização utilizado	Uma relação de confiança foi estabelecida entre a criança, sua família e a equipe profissional. Maior adesão, redução do absenteísmo e aparente redução de anestesia para o tratamento foram os resultados constatados.
Campos, E. M. P; Rodrigues, A. L. & Castanho, P. (2021). Intervenções Psicológicas na Psico-Oncologia.	Revisão de Literatura	Não se aplica	Divulgar a Psico-Oncologia como área de conhecimento que ampliou as possibilidades de atendimento ao portador de câncer seu familiar e equipe de saúde	A psicologia vem ao longo dos anos criando e desenvolvendo vértices de observação e compreensão, bem como técnicas de intervenção para lidar da forma mais efetiva com esta realidade tão complexa que é a doença oncológicas e suas consequências
Pereira CIP, Nascimento IB, Cruz AS, Volc SM, Tormen TH. (2023). Impactos Psicossociais e na Qualidade de Vida do Tratamento Oncológico em Crianças e Adolescentes.	Pesquisa de delineamento transversal e descritivo	pacientes de 8 a 18 anos e diagnóstico de neoplasia maligna.	Avaliar em crianças e adolescentes com diagnóstico de câncer os impactos psicossociais, de qualidade de vida e da presença de acompanhante durante os procedimentos.	O impacto psicossocial e na qualidade de vida é razoavelmente grande em pacientes pediátricos oncológicos. Além disso, os mais jovens parecem sofrer um impacto psicossocial maior. Os pacientes se dizem mais felizes com a presença de acompanhante, e mais ansiosos na sua ausência

Source: Prepared by the authors.

The ten selected studies reveal a varied distribution of publications over the years, with emphasis on 2023 and 2021, which feature three articles each. On the other hand, 2020 has two articles, while 2022 and 2019 registered only one publication each. In addition, among the articles chosen, six of them provide samples of individuals undergoing cancer treatment.

Regarding the stage of the individual's development addressed, we observed an equitable distribution: 33.3% of the studies focus on adolescence, another 33.3% focus on childhood, and the remaining 33.3% cover both stages of development.

The research methods used in the selected studies show a significant diversification, especially the qualitative studies, which seek to investigate the psychosocial impacts of treatment on the individual experiences of hospitalized children and adolescents, totaling five hospitalized articles

(five articles). In sequence, the presence of quantitative studies (three articles) is observed, with the literature reviews having the lowest representativeness (two articles).

The articles complement each other by addressing the psychosocial repercussions of treatment, emphasizing the sudden change in routine after diagnosis, which results in withdrawal from school, friends, home and family. It becomes evident that this context impacts not only the biological aspect of the individual, but also their social and emotional aspects (Pereira, Nascimento, Cruz, Volc, and Tormen, 2023). During hospitalization, the depersonalization of the diagnosed subject occurs, being reduced to a number of beds and, often, only to the disease they have, with their individual characteristics made invisible (Silva, Foger and Santos, 2019).

Fonseca, Panciera, and Zhilmann (2021) mention the reflections of Araújo (2004) to discuss aspects related to progress in pediatric psycho-oncology, highlighting that this advance goes beyond medical improvements to face cancer. However, there is a consensus among researchers on the need for further investigations into the psychosocial aspects involved in the treatment of childhood cancer, as highlighted by Menezes, Passareli, Drude, Santos, and Valle (2007, Apud Fonseca, Panciera, and Zihlmann, 2021). Regarding Art Therapy, only one article was found, evidencing the scarcity of studies on this theme.

Pelisson and Se (2023) refer to Sei (2011) to highlight the role of art therapy. The authors argue that this process facilitates the expression of feelings and emotions through artistic resources, serving as a non-verbal communication channel. This perspective is in line with the definition of the Brazilian Union of Art Therapy Associations (UBAAT, 2019), which conceptualizes art therapy as a therapeutic approach that values creativity and artistic expression. This practice helps in the promotion, rehabilitation and recovery of health, in addition to preventing injuries, enabling the non-verbal communication of feelings and conflicts.

Despite having been published after the deadline established for the analysis of this study, the article by Junior (2012), which is based on Sei's 2011 book, highlights the potential of art therapy as a therapeutic intervention strategy. The goal of this approach is to promote a better quality of life by utilizing artistic materials to achieve this end. The text especially highlights the resources of the visual arts, describing this practice as "artistic-expressive". In addition, Junior (2012) emphasizes that Art Therapy facilitates the understanding of the individual and family dynamics of the subject, establishing itself as a valuable technique for treatment in institutions. These ideas corroborate the perspectives presented by Sei (2011).

In general, the studies analyzed point to a low number of articles that deal with art therapy as an integral part of therapeutic support, along with other multidisciplinary approaches. Even among the few materials found, a limited connection with psychology was observed in the synthesis of evidence, and this theme was predominantly addressed in the context of nursing.

CONCLUSION

Pediatric cancer treatment is not restricted to the biological aspect, but also significantly impacts the social, emotional, and identity aspects of patients. Therefore, it is crucial to adopt a multidisciplinary approach that takes into account these different aspects, aiming to mitigate the damage caused by hospitalization and invasive treatments. This implies looking at the patient in an integral way, not only focusing on the disease, but providing resources that allow them to understand and validate their experience.

In this context, art therapy emerges as a technique recognized in the classic and reference literature, offering a form of communication that enables expression even without the individual's verbalization. By establishing an environment conducive to the externalization of feelings and thoughts, art therapy becomes a specialized resource for therapeutic support.

However, it is important to note that, as a therapeutic support in the pediatric oncology context, art therapy has been little explored in the last five years by the scientific literature in Portuguese. This raises pertinent questions, such as: Would art therapy be an underused technique? Could the fact that art therapy is not taught in psychology courses influence its use? Has pediatric oncology already recognized the potential of art therapy? These questions highlight the importance of periodic reviews of the material and an active search for articles in other languages, aiming to expand knowledge about the role of art therapy in the treatment of pediatric cancer.

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Nursing in primary health care

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ABSTRACT

The material we propose will contribute to the strengthening of the knowledge of students of Medical Sciences, as well as the population in general, since it is up-to-date, easy to understand, develops cognitive and volitional components, also contributes to the strengthening of values of patriotism, sensitivity, consecration, responsibility; It is a tool that they can consult if they have any questions and at any time. Cuba is characterized by guaranteeing health prevention for which it plans a set of health activities that are carried out both by the community, governments as well as by health personnel before a certain disease appears, among which is the vaccination program, in this material appear the vaccines that are currently applied in the country and others that have not been possible to acquire them by the blockade that for 57 years we have been a victim of by the United States of America. In addition to linking diseases that can be avoided by preventing them with immunization.

Keywords: Vaccines, Prevention, Nurses, Primary Care, Diseases.

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INTRODUCTION

Due to the economic crisis, since 1989, a reform of the sector has been carried out, in the midst of a certain controversy: although the government maintains that all Cubans have access to doctors, nurses, specialists and medicines, the latter were scarce due to the restrictive effects on the availability of resources due to the U.S. blockade; when the Torricelli Law was enacted, numerous firms that had traditionally sold medical equipment or its components to Cuba suspended its operations because the [U.S.] Treasury Department denied export licenses, because it was a subsidiary of a U.S. transnational corporation, or because the equipment was made with components manufactured in that country. This, in part, led to a shortage of medicines and raw materials for the pharmaceutical industry, and the non-renewal of medical equipment. This caused even greater investments in the sector, so that today the country imports less than 20% of the medicines it consumes, and produces several medical equipment, the rest is imported from European corporations such as Philips, or Siemens.

Our own products include:

- Interferon: it is one of only six countries in the world that produce it.
- Epidermal growth factor: healing cream against burns.
- Hepatitis B vaccine.
- Meningococcal vaccine type B (only producing country).
- Recombinant streptokinase , a drug that acts against myocardial infarction.
- Drugs are also made against thromboembolisms, immune system problems, hypertension, cholesterol, and some forms of cancer.
- Pentavalent vaccine: it is the only country that produces it besides France.
- Cytoprot P: Medication that is able to heal diabetic foot ulcers
- PPG (derived from sugar cane) used for hypercholesterolinemia.[1]

The efforts of the Cuban government and people, always threatened by the brutal blockade, have made the country take some alternatives in such a way that the consequences are minimized and family medical offices emerge whose functions include the prevention and promotion of the health of the people, which is why the immunization program appears after the revolutionary triumph.

Vaccines were not always accepted, giving rise to some contradictions; over the years they have demonstrated their effectiveness.

There is the so-called **vaccine controversy**, which refers to a dispute about the morality, ethics, effectiveness, or safety of vaccination. Medical and scientific evidence shows that the benefits of preventing death from infectious diseases outweigh the rare adverse effects of immunization.[1][2] Since vaccination began in the late eighteenth century, opponents have maintained that vaccines do not work, that they are or can be dangerous, that emphasis should instead be placed on personal

hygiene, or that mandatory vaccinations violate individual rights or religious principles.[3] Since then, anti-vaccination campaigns have resulted in unnecessary damage and mass deaths.[4]

- Vaccines can have side effects, and the success of immunization programs depends on public confidence in their safety. Suspicions about the safety of immunization often follow the same pattern: some researchers suggest that some health disturbance is an adverse effect of vaccination; an early announcement is made about the adverse effect; the initial study is not reproduced by other groups; Finally, it takes several years to regain public confidence in the vaccine.[1] 5

Cuba proposes three (3) fundamental aspects as a health policy to guarantee comprehensive care, they are:

1. Health promotion, which is the promotion and defense of the health of the population through actions that affect the individuals of a community, such as anti-smoking campaigns to prevent lung cancer and other diseases associated with tobacco.
2. Specific health protection such as environmental health and food hygiene. Health promotion and protection activities that affect the environment are not carried out by medical or nursing personnel, but by other public health professionals, while vaccination is carried out by medical and nursing personnel
3. Chemoprophylaxis, which consists of the administration of drugs to prevent diseases such as the administration of estrogen in menopausal women to prevent osteoporosis.

The country managed to eradicate a group of diseases that plagued the country through vaccination campaigns such as:

- Poliomyelitis in 1962, Malaria in 1967, Neonatal tetanus in 1972, Diphtheria in 1979, Post-mumps meningoencephalitis in 1989, Congenital rubella syndrome in 1989, Measles in 1993, Pertussis in 1994, Rubella in 1995

This shows tenacity, courage. The humanism of the Cuban people under the direction of its undisputed guide, Commander in Chief Fidel Castro Ruz.

CHAPTER 1

DEFINITIONS

Immunization: it is the process of inducing artificial immunity against a disease. Immunization can be of two types:

- **Passive immunization**: It involves antibodies that are produced in the body of another person, as in the case of infants who have passive immunity, since they are born with the antibodies that the mother transfers to them through the placenta. These antibodies disappear between 6 and 12 months of age. Another way to obtain passive immunity is

with gamma globulin, which is supplied by a doctor and whose protection is also temporary.

- **Active immunization**: through the application of vaccines, attenuated antigenic preparations in order to generate an immune response by the body; to generate an immune memory consisting of the formation of protective antibodies against the antigen to which one is exposed.

Immunity: state of natural or acquired resistance that certain individuals possess against certain pathogens.

Vaccines: they are an antigen preparation that once inside the body causes the production of antibodies and with it a defense response against pathogenic microorganisms. This response generates, in some cases, a certain immune memory, producing transient immunity against the corresponding pathogenic attack. The first vaccine discovered was the one used to combat smallpox by Edward Jenner in 1796.

CAPITULO II

VACCINE OVERVIEW

Vaccines are classified into two large groups:

- Live attenuated vaccines.
- Inactivated vaccines.

There are several methods of obtainment:

- Virulent vaccines prepared from non-hazardous forms of the pathogenic microorganism.
- Prosified vaccines from dead or inactivated organisms.
- Purified antigens.
- Genetic vaccines.

Vaccines can be made up of bacteria or viruses, either live or weakened, that have been bred for that purpose. Vaccines may also contain inactivated organisms or purified products from the former. There are five types of vaccines:

- **Inactivated: harmful** microorganisms that have been treated with chemicals or heat and have lost their danger. This type of vaccine activates the immune system but is unable to reproduce in the host. The immunity generated in this way is of lower intensity and usually lasts less time, so this type of vaccine usually requires more doses. Since the immune response achieved is lower, substances called adjuvants are used in these vaccines. These substances are composed of aluminum and serve the vaccine to increase the body's immune response. Aluminum compounds must be injected deep

intramuscularly as they can cause irritation, inflammation, and tissue injury. Examples of this type are: influenza, cholera, bubonic plague and hepatitis A.

- **Live attenuated**: microorganisms that have been expressly cultured under conditions in which they lose or attenuate their pathogenic properties. They tend to cause a longer-lasting immune response, and are the most common in adults. This is because the microorganism is not inactivated and retains its structure. For this reason, it can often cause the disease in immunocompromised people. For example: yellow fever, measles or rubella (also called German measles) and mumps.
- **Toxoids**: these are inactivated toxic components from microorganisms, in cases where these components are the ones that really cause the disease, instead of the microorganism itself. These components could be inactivated with formaldehyde, for example. Tetanus and diphtheria can be found in this group.
- **Acellular**: consist of a mixture of purified subcellular components of the pathogen against which you want to immunize, which usually consists of highly immunogenic antigenic proteins and which may contain toxoids. Such a vaccine is currently used against pertussis.
- **Subunit recombinants**: recombinant DNA technology is used to introduce the gene coding for a highly immunogenic antigen into the genome of a producing microorganism (such as *E. coli* or *S. cerevisiae*) with the aim of super-producing and purifying the antigenic protein, which will be the basis of a vaccine. These vaccine production techniques are very useful when the pathogen you want to immunize against is difficult to grow *in vitro*. A typical example is the sub-unit hepatitis B vaccine, which is composed only of the surface of the virus (surface formed by proteins). To obtain this vaccine, the hepatitis B-causing hepadnavirus S gene was cloned into *S. cerevisiae* and superproduced and purified, resulting in an effective vaccine (the S gene encodes the self-assembling HBsAg antigen located on the surface of the virus). A particular type of recombinant vaccines would be edible vaccines, produced using transgenic plants. In these cases, the transgene transferred to the plant would be a coding one for an antigen of interest, which will produce an immune response. To be an edible vaccine, the expression of the transgene must be directed by a tissue-specific promoter, which causes it to be expressed only in certain edible organs, such as cereal seeds or tubers. The great advantages of the production of edible vaccines lie in their low production cost, in that the antigen can be expressed in organs where it is stable at room temperature (such as those mentioned above), which would eliminate the costs of maintaining the cold chain, and in the possibility of simultaneously expressing several antigens and adjuvants in the same organ

of the plant. Of course, this production system also has drawbacks, such as control over the level of antigen expression, homogeneity of expression (dose adjustment) or maintaining the integrity of the antigen in the face of exposure to gastric and intestinal juices. So far, the most representative works on this topic have dealt with the production of the vaccine against hepatitis B, giving satisfactory results by immunizing mice that ate potatoes in which the antigen accumulated.

The vaccine against tuberculosis, for example, is the so-called BCG vaccine (Bacillus of Calmette and Guerin, which owes its name to its discoverers) is manufactured with live attenuated bacilli and is therefore not contagious to this disease.

New types of vaccines are currently being developed and tested:

- *Polysaccharides*: Certain bacteria have outer layers of polysaccharides that are minimally immune. By bringing these outer layers into contact with proteins, the immune system may be able to recognize the polysaccharide as if it were an antigen (an antigen can be a protein or a polysaccharide). In this way we generate antibodies against the bacteria and against the polysaccharide (exopolysaccharide, in this case). This process is used in the *Haemophilus influenzae* type B vaccine (also known as Pfeiffer's bacillus).
- *Recombinant vector*: By combining the physiology (body) of a given microorganism and the DNA (content) of a given microorganism, immunity can be created against diseases that have complicated infection processes. Efforts to create vaccines against infectious diseases, as well as immunotherapies for cancer, autoimmune diseases, and allergies have used a variety of heterologous expression systems, including viral and bacterial vectors, as well as recombinant DNA and RNA constructs. The most commonly used vectors in this type of vaccine are the vaccinia virus, some lactic acid bacteria (non-pathogenic) of the genera Lactobacillus and Lactococcus and attenuated varieties of M. tuberculosis and Salmonella typhi (the latter is more widely used, since it is very well known and its pathogenic effects are much milder). The main problems with this type of vaccine are the possibility that the immune response to them is insufficient to leave memory in the immune system and the induction of antigen production once the vector is inside the body (the use of inducers such as tetracycline and aspirin is being studied).
- *DNA vaccine*: A recently developed vaccine created from the DNA of an infectious agent. It works by inserting DNA from bacteria or viruses into human or animal cells. Some cells of the immune system recognize the protein that arises from foreign DNA and attack both the protein itself and the affected cells. Since these cells live a long time, if the pathogen (the one that creates the infection) that normally produces these proteins is found after a long period, they will be instantly attacked by the immune system. One

advantage of DNA vaccines is that they are very easy to produce and store. Although in 2006, this type of vaccine was still experimental, it has encouraging results. However, it is not known for sure whether this DNA can integrate into any chromosome in cells and produce mutations.

It is important to clarify that, while most vaccines are created using inactivated or attenuated components of microorganisms, synthetic vaccines are composed in part or entirely of peptides, carbohydrates or antigens. These synthetics are usually considered safer than the former.

TRANSPORT, DISTRIBUTION AND STORAGE

Cold chain is the system of stable and controlled conservation (ideal temperature), handling, transport, and distribution of vaccines that allow their effectiveness to be preserved from the exit of the manufacturing laboratory to the place where the vaccination is to be carried out.

It has three levels: Central, Provincial and Municipal

Cold chain elements

Material equipment: Refrigerator

Install it in the appropriate storage place protected from any heat source, about 15 cm away from the wall to allow the heat to be dispersed.

Connect it to the general network, do not make deviations to avoid accidental disconnections.

Be equipped with alarm systems and electric power generators that are activated if the cooler is accidentally disconnected.

Be equipped with a thermostat (between 2 and 80 centigrade)

Install a thermometer inside the refrigerator to check temperature, as well as a thermograph that records stability and possible changes.

In the behavior of the refrigerator, place nylon bags with water, which will serve as a cold accumulator and on the lower shelves, bottles with physiological solution that will help stabilize the internal temperature by forming a cold room system for 6-12 hours in case of breakdowns.

Defrost periodically (frost buildup decreases cooling capacity)

Storage recommendations

All vaccines, solvents and water bottles should take up at most half of the available space in the fridge. If it occupies a larger space, there may not be enough cold air circulation to keep the vaccines at the right temperature.

Do not store any other material (food, drinks, etc.) in the refrigerator intended for vaccines. The number of times the door is opened to put in or take out, endangers the stability of the internal temperature inside the fridge.

Do not store vaccines in the refrigerator door, as it is a place where the temperature is not stable and is higher. Store in the central spaces leaving space around the boxes and avoiding touching the wall of the fridge.

Vaccines with dates close to expiry should be placed more accessible than those with an expiration date later.

Remove expired vaccines as soon as possible to avoid accidental use.

The vaccines most sensitive to heat: oral polio, MMR, measles, rubella, antiburculosis and yellow fever should be located in the coldest part of the refrigerator but never in the freezer.

Vaccines that in their preparation have adjuvants that contribute to physical forms of colloidal suspension should never be frozen because they would lose their immunogenetic potency.

Transportation

Isothermal containers allow large quantities of vaccines to be transported to the vaccination site, allowing the cold to be preserved during transport.

Portable coolers will be used when vaccines need to be transported. A minimum transport time should be sought and only opened in specific circumstances.

For the best conservation of the vaccines, cold packers will be placed taking as a precaution to avoid contact with them through cardboard paper which prevents the freezing of the vaccines.

The nursing staff is responsible for:

1. Check at the beginning and end of each working day that the maximum and minimum temperatures marked by the thermometer and recorded by the thermograph are between 2 and 80 Celsius, and record the temperature recorded in the monthly temperature control graph. This control must be carried out without loss of time to avoid excessive exposure to the ambient temperature.
2. Check that the storage of the vaccine is carried out properly.
3. Periodically check the freezer ice layer (it should not exceed 5mm thick).
4. Check the expiry date of each batch, removing those that exceed it.
5. At the time of receipt of the vaccines, especially if the distribution is direct from the manufacturer's laboratory. Inspect the temperature control card and check for broken, frozen, torn or detached labels. You should also check the quantity and expiry date of the vaccines received are adequate.

Conservation of vaccines

Openings of the containers: The multidose containers must be exhausted during the vaccination session. It is advisable to adjust the schedules and vaccination appointments so that the shipment can be exhausted in the same working day. In any case, the annex must be done with the maximum asepsis to avoid contamination and for a time not exceeding 24 hours. The doses of these unused bulbs must be discarded.

Lyophilized reconstituted vaccines not applied within 8 hours of preparation should be discarded. Once opened, a multi-pack should not be exposed to light or ambient temperatures. The container should be returned to the refrigerator if the application of the next dose is not immediate.

Exposure to light: Viral vaccines should be preserved from light. Their conservation and handling must be careful due to their instability since they suffer losses of 50% of activity after the 5th hour of exposure to room temperature.

Temperature: The ideal storage is from 2 to 8 ^{0} centigrade. The internal temperature should not exceed 100 Celsius

A WHO study showed that tetanus and diphtheria vaccines were the most stable on the stability of heat-exposed vaccines, followed by pertussis associated with diphtheria and tetanus, then inactivated polio, antituberculosis, measles and oral polio.

Diphtheria and tetanus vaccines can withstand temperatures as high as 370 Celsius for several months, while reconstituted freeze-dried measles vaccines do not maintain their stability for more than a few hours.

Expired: It will always be the last month indicated on the packaging.

Routes of application of vaccines

1. Multipuntural
2. Intradermal.
3. Subcutaneous
4. Intramuscular
5. Oral

VACCINES AND THE ECONOMY

The economy is one of the biggest challenges of vaccines. Many of the diseases that most demand a vaccine (including AIDS, malaria or tuberculosis) are present especially in poor countries. Although some pharmaceutical companies and biotechnology companies have incentivized the development of vaccines for these diseases to a limited extent (given that revenue expectations are low), the number of vaccines actually administered has increased dramatically in recent decades,

especially those given to children in the first years of life. This may be due more to government measures than to economic incentives. Most vaccine development to date has been driven by governments and NGOs, international agencies, universities...

Many researchers and politicians call for uniting and motivating this industry, using pressure mechanisms such as prices, taxes or corporate commitments that can ensure the remuneration of companies that successfully obtain a vaccine against HIV (which causes AIDS).

CAPITULO III

VACCINES CURRENTLY USED. DISEASES AGAINST WHOM THEY IMMUNIZE

Vacuna DPT

DPT (or sometimes **DTP**) is a mixture of three vaccines that immunize against diphtheria, *Bordetella pertussis* (whooping cough) and tetanus. Children should receive 5 doses of DPT: at 2 months of age, then at 4 months, at 6 months, at 18 months (these are included in the so-called pentavalent vaccine), and at 4-6 years only as DPT.

DT vaccine is the name for the diphtheria and tetanus vaccine.

Diphtheria vaccine

Difteria

. Diphtheria is a disease caused by *Corynebacterium diphteriae* that is mainly transmitted by contact with a sick person or a healthy carrier. *Corynebacterium diphteriae* produces a toxin called diphtheria exotoxin that is responsible for the manifestations of diphtheria.

Composition and presentation of the diphtheria vaccine

The diphtheria vaccine is produced by growing *Corynebacterium diphteriae* in a liquid medium to produce diphtheria exotoxin, which is recovered by filtering and inactivated with formaldehyde to convert the toxin into toxoid. The vaccine comes as toxoid adsorbed in aluminum salts and preserved with thimerosal.

- The diphtheria vaccine is often found in the following forms:
- Bivalent: diphtheria, tetanus (DT and Td with lower diphtheria toxin)
- Trivalent: diphtheria, tetanus, pertussis (DPT, dTp)

There are monovalent forms and the presentation together with other vaccines. The diphtheria vaccine should be stored between + 2ºC and + 8ºC.

The DPT or triple bacterial vaccine contains diphtheria and tetanus toxoids made of formaldehyde, purified and absorbed, as well as immunogens derived from B. pertussis. There are two types of pertussis vaccine: the whole cell (Pw) vaccine composed of suspensions of B. pertussis inactivated by heat, formaldehyde, glutaraldehyde and adsorbed in hydroxide or aluminum phosphate, and the acellular vaccine (Pa) composed of protein fragments of the bacterium. The pertussis vaccine may contain pertussis toxin (Td), pertactin (PER), filamentous hemagglutinin (HAF), and purified and inactivated fimbriae 2 and 3. Each 0.5 mL of DPT vaccine can contain up to 30 IU of purified and adsorbed diphtheria antigen, 40 - 60 IU of purified and adsorbed tetanus antigen and at least 4 IU of B. pertussis. Preservative: Thimerosal. Adjuvant: aluminum hydroxide or aluminum phosphate.

Immunogenicity and efficacy

After the administration of a complete vaccination schedule, with four doses in children and three in adults, it has been found that 95% of vaccinated people have an optimal level of immunity against the disease. Over time, the levels of antibodies detected in the blood decrease, but protective titers can be found for up to 10 years after the last dose.

Adverse effects

Local reactions, such as erythema, induration, and local pain, are common at the injection site. Systemic reactions are usually type III hypersensitivity (Arthus type) and occur mainly in people who have received multiple booster doses. It presents itself with an important local reaction. Fever and other systemic findings are rare.

Vacuna contra *Bordetella pertussis*

Pertussis

Pertussis is a disease caused by *Bordetella pertussis* that is transmitted by direct contact with the respiratory secretions of sick people. It is a highly contagious disease and it has been seen that the most important source of contagion for children are adults who are not vaccinated or previously vaccinated but whose immunity has disappeared over time.

Pertussis Vaccine Composition and Presentation

There are mainly two types of vaccines against *Bordetella pertussis*, which are the whole cell vaccine and the acellular vaccine. The whole cell vaccine is abbreviated as Pe (Pertussis whole) or Pw (Pertussis whole), which is the one that will give the DTPw or DTPe vaccine. The acellular vaccine is abbreviated as Pa (Acellular Pertussis).

The whole cell, Pe or Pw vaccine is composed of suspensions of *Bordetella pertussis* inactivated by heat, formaldehyde or glutaraldehyde and subsequently adsorbed in aluminum hydroxide or phosphate. Usually, the presentation is in combination with diphtheria and tetanus (DPT) vaccine, although pertussis vaccine may be found in combination with other vaccines.

The acellular vaccine or Pa is composed of protein fragments of the bacterium that induce an immune response. The vaccine may contain pertussis toxin (TP), pertactin (PER), filamentous hemagglutinin (HAF), and fimbriae 2 and 3, purified and inactivated.

In Japan, two types of acellular vaccines are used: the jhu B (Biken) and the T (Takeda) type, which differ depending on the proportion of PT and PAH. In the United States and Europe, two acellular DPT vaccines are used, which are Lederle-Takeda and Conaught-Biken. It has been found that the reactogenicity of currently used acellular vaccines is much less than that of whole-cell vaccines, so they are preferred because they have fewer side effects.

Immunogenicity and efficacy

Efficacy is 70 to 90% in the first 2 to 5 years after the application of the vaccine, with waning immunity over time until about 12 years after the administration of the last dose, immunity against *Bordetella pertussis is lost*.

Adverse effects

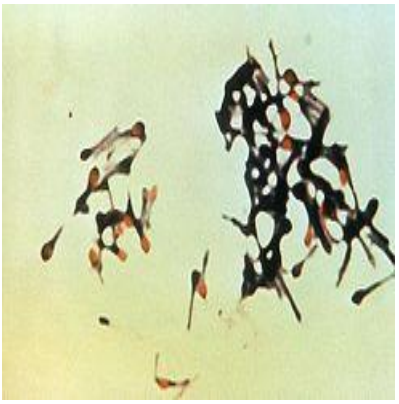
Pe or Pw whole cell vaccines are distinguished from acellular or Pa vaccines by their high rate of side effects.

Whole-cell vaccines usually have mild reactions. Local reactions occur in approximately 50% of vaccinated people, at the injection site. The most common are erythema (1 out of 3 doses), swelling (2 out of 5 doses), and pain (1 out of 2 doses). Mild systemic reactions usually appear between 4 and 12 hours after administration and are self-limiting. The most common are fever (1 of 2 doses), drowsiness (1 of 3 doses), irritability (1 of 2 doses), anorexia, vomiting, mild cough and malaise.

Severe reactions are rare and the most common findings are fever of more than 40°C, crying for more than 3 hours (1 in 100 doses), isolated seizures, and hypotonic-hyporeactive episodes (1 in 1750 doses). These manifestations have no long-term consequences.

An increased risk of acute neurological disease has been shown in the first three days after pertussis vaccination, with an estimated frequency of between 0.1 and 3 cases per 100,000 vaccinated.

Tetanus Vaccine



Clostridium tetani.

Tetanus

The agent responsible for tetanus is a bacterium called *Clostridium tetani*. Its normal habitat is the human intestinal tract and some animals, so it is common to detect its spores in places that could be contaminated by fecal matter such as in the soil. Tetanus infection occurs when the bacteria enter the body, through a wound, especially if there is tissue necrosis or a foreign body. The toxin tetanuspasmin is responsible for the manifestations of tetanus, produced by *Clostridium tetani* once it is in the organism it infects.

Vaccine composition and presentation

It is a protein compound obtained from tetanus toxin and modified by heat and formaldehyde. Tetanus toxoid is purified and adsorbed into aluminum hydroxide or phosphate. The tetanus vaccine may have preservatives such as tihomersal.

- Tetanus vaccine can be presented as follows:Monovalent: isolated tetanus toxoid (TT)Bivalent: combination of tetanus toxoid with diphtheria toxoid (diphtheria-tetanus (DT) or tetanus diphtheria adult-type (Td))Trivalent or DPT: combination of tetanus toxoid, diphtheria with vaccine against Bordetella pertussis (diphtheria-tetanus-pertussis (DTPw, DTaP, and dTpa)

Tetanus toxoid is administered in doses of 0.5 ml, either in its monovalent or combined form. The tetanus vaccine should be stored at temperatures between + 2ºC and + 8ºC, avoiding freezing. It must be protected from light.

Immunogenicity and efficacy

After a full series of tetanus vaccinations, about 100% of people develop immunity to the disease. Antibody levels drop over time, and in most people, after 10 years of the last dose, the level of antibodies to tetanus toxin is minimal.

Adverse effects

The tetanus vaccine is usually well tolerated. The most common side effects are local reactions that appear 4 to 8 hours after injection. There is a relationship between this type of reaction and the number of doses received. Systemic adverse effects such as fever, headache, myalgia, anorexia, and vomiting are rare.

Increased viremia in HIV patients has been described with tetanus vaccine, but tetanus vaccine is transient and not a contraindication to vaccine administration.

DIFFERENT PRESENTATIONS

DPT is a vaccine against diphtheria, pertussis and tetanus, so it is used in active immunization against these three diseases. The dose is 0.5 mL with 30 Lf (flocculation units) of diphtheria toxoid, 25 Lf of tetanus toxoid and the corresponding to 10 to 10 x 10^9 cells of *Bordetella pertussis* in the case of the whole cell vaccine, adsorbed in aluminum salt gel. It is administered deep intramuscularly.

The dTpa vaccine is a diphtheria, tetanus, and pertussis vaccine used in the United States in adolescents and adults to give booster doses every 5 to 10 years, instead of the Td vaccine. They have reduced concentrations of diphtheria toxoid and pertussis to prevent reactions.

The DT vaccine is used for active immunization against diphtheria and tetanus. It is used in people who are contraindicated to receive the pertussis vaccine. The dose is 0.5 mL with 30 Lf of diphtheria toxoid and 25 Lf of tetanus toxoid adsorbed in aluminum salt gel. It is administered deep intramuscularly .

The Td vaccine is used for active immunization against diphtheria and tetanus. It is used in people over seven years of age who receive booster doses every 5 to 10 years and in pregnant women. The dose is 0.5 mL with 3-5 Lf of diphtheria toxoid and 20 Lf of tetanus toxoid adsorbed in aluminum salt gel. It is administered deep intramuscularly.

DPTw and DPTa

There are mainly two types of vaccines against *Bordetella pertussis*, which are the whole cell vaccine and the acellular vaccine. The whole cell vaccine is abbreviated as Pe (Pertussis whole) or Pw (Pertussis whole), which is the one that will give the DTPw or DTPe vaccine. The acellular vaccine is abbreviated as Pa (Acellular Pertussis).

The whole cell, Pe or Pw vaccine is composed of suspensions of *Bordetella pertussis* inactivated by heat, formaldehyde or glutaraldehyde and subsequently adsorbed in aluminum hydroxide or phosphate. The acellular vaccine or Pa is composed of protein fragments of the bacterium that induce an immune response. The vaccine may contain pertussis toxin (TP), pertactin (PER), filamentous hemagglutinin (HAF), and fimbriae 2 and 3, purified and inactivated.

The advantage of the acellular vaccine is that it causes far fewer side effects (about 90% fewer), such as local pain, erythema and fever. Both vaccines appear to induce immunity with equal efficiency, but it is accepted that due to the less reactogenicity, DTaP is safer.

In most developed countries, DTP has been abandoned in favour of DTaP. However, because DTP is much cheaper, developing countries continue to use DTP.

VACCINATION SCHEDULE

Universal immunization against diphtheria, pertussis, and tetanus is recommended from 2-3 months of age using the combined DTP or DTaP vaccine. Vaccination in adults is recommended for those who have not been vaccinated in childhood or for individuals in whom more than 10 years have passed since the last booster dose. Booster doses in adolescents and adults are given with Td or dTpa every 10 years.

Three doses of DTP or DTaP should be given from the second to third month of life, with an interval of 4 to 8 weeks, so that it is given at approximately 2, 4 and 6 months. A fourth dose is given at 15 to 18 months and a booster dose at 4 to 6 years of age. Subsequently, booster doses with Td or dTpa are given every 10 years.

If individuals over 7 years of age are vaccinated, three doses of Td are given, the first two separated by an interval of 1-2 months and the third between 6 months and one year after the second dose. A booster dose should be given every 10 years with Td or dTpa.

Mexico

The vaccination schedule in Mexico consists of vaccination at 2, 4 and 6 months with DPT or DPTa. A fourth dose is given at 18 months and a fifth dose between 4 and 6 years of age. Booster doses are given every 10 years with DPTa, dPTa, or Td.

The vaccines available are from GlaxoSmithKline and Aventis Pasteur. The DPTa forms are marketed and in combination with other vaccines such as IPV polio vaccine for polio, Hib for *Haemophilus influenzae* type b and HB for hepatitis B.

REACTIONS TO DPT VACCINE

Most reactions to the DPT vaccine are thought to be caused by the pertussis component. Moderate reactions to DPT vaccine may occur in 0.1 to 1% of vaccinated patients, including crying for more than three hours and fever up to 40°C.

Severe reactions following DPT vaccination are very rare and include severe allergic reactions , seizures, decreased consciousness, and even death. These severe neurological events occur in about 1 in 140,000 doses of DPT.

In 1994, the Institute of Medicine of the National Academy of Sciences of the United States reported that if symptoms of neurological damage manifest in the first 7 days after receiving a dose of DPT, this damage could become permanent. The committee emphasizes that it has not been proven that it is a causal relationship, but simply that these two facts are related. This occurs in 0 to 10.5 cases per million doses of DPT.

Acellular pertussis vaccines are considered safer than whole-cell vaccines, so since 2002, they have replaced them in the United States.

CONTRAINDICATIONS

Because it is the vaccine that produces the highest number of reactions, the pertussis vaccine has the most specific contraindications. The following are absolute contraindications to the pertussis vaccine:

- Acute anaphylactic reactions.
- Onset of encephalopathy within the first 7 days after vaccine administration. Individuals who have had other reactions considered serious to the DPT vaccine and children with progressive neurological diseases should be evaluated individually.

The DPT vaccine and its variants should not be administered within the first year after the first vaccination or application of a booster dose, as it favors the appearance of hypersensitivity reactions. DTP can be given at the same time as other vaccines.

Congenital or acquired immunodeficiencies and the administration of immunosuppressive treatment such as steroids, antimetabolites or radiotherapy, can decrease the immune response to the vaccine. This is not as such a contraindication to vaccination, but the vaccinated individual may not develop immunity against the disease. In the case of immunosuppressive treatment that is discontinued in the short term, efforts should be made to postpone vaccination until one month after the end of the treatment, in order to obtain an adequate immune response and ensure that the individual has immunity against the disease.

DIPHTHERIA

Diphtheria (from Greek *διφθέρα*, leather[1]) is an acute epidemic infectious disease, due to the protein exotoxin produced by *Corynebacterium diphtheriae* (Klebs-Löffler bacillus). It is characterized by the appearance of firmly adhered false membranes (pseudomembranes), with fibrinous exudate, which form mainly on the mucosal surfaces of the upper respiratory and digestive tracts.

Diphtheria is a disease caused by the exotoxin effect of toxigenic strains of *C. diphtheriae*, which usually affects the tonsils, throat, nose, heart muscle, nerve fibers, or skin.

Infection

It is a type A/B exotoxin. The B subunit is recognized by membrane receptors, which causes the A subunit to enter the cell through proteolysis. Once there, the ADP-ribosyl subunit A modifies the eE2F elongation factor, rendering the translation machinery useless. Subunit B is exocytosed.

It mainly attacks children under five years of age and adults over 60 years of age. This infectious disease causes, among other symptoms, burning in the throat when passing food, difficulty breathing and/or states of imminent shock (cold skin, restlessness, fever, grayish mucous exudate). This disease can be fatal.

Transmission

It is transmitted to others through direct contact by sneezing, throat, skin, eyes or any other type of secretion from infected people.

Clinical manifestations

There are two classic diphtheria pictures. One on the nose and throat, and one on the skin. The main symptoms are a sore throat, a mild increase in body temperature, and swollen lymph nodes (lymph nodes) in the neck. In addition, a membrane can form in the throat. Skin lesions can be painful, swollen and red. Alternatively, a person with diphtheria may have no symptoms at all. Less frequently, initial symptoms of cutaneous, vaginal, ocular conjunctiva or ear infections are recognized.

Symptoms usually appear in 3 to 9 days. If it does not appear before or after, you should go to a hospital between 24 and 48 hours after infection.

==Incubation time==Untreated people infected with diphtheria are usually contagious during the first two weeks, and less frequently beyond four. If treated with the appropriate antibiotics, the period of contagion can be limited to less than four days.

Recovering from diphtheria does not always produce long-lasting immunity.

Vaccination

Diphtheria toxoid is usually combined with tetanus toxoid (Clostridium tetani) and pertussis toxoid (Bordetella pertussis) toxoid This vaccine should be given at four years of age. Everyone should receive the combination of tetanus toxoid and diphtheria (Td) every 10 years to maintain immunity starting at age 12.

Prevention

The most effective form of control is to maintain the highest level of vaccination in the community. Other methods of control include prompt treatment of cases and maintaining an epidemiological surveillance program. Anyone who has contact with a person with diphtheria should be tested for the disease, treated with antibiotics, and possibly have the disease. It can also be

prevented when the infected person covers their mouth with a tissue when coughing and washes their hands after coughing. This disease is very contagious so it is advisable to get vaccinated.

HIB VACCINE

The **anti-Haemophilus influenzae *type b* vaccine**, also called **Hib vaccine**, is a polysaccharide used as a conjugate vaccine, that is, bound to carrier proteins, developed for the prevention of contagious disease caused by the Gram-negative bacterium Haemophilus influenzae *serotype* b.

Features

The Hib vaccine is one of the most recent additions to childhood immunization schedules worldwide. It usually comes in a form with 10-15 µg diluted in saline solution until a concentration of 4% is reached. It is administered intramuscularly.

The vaccine, also labeled as PRP-OMP, should be stored at refrigerated temperature between 2 and 8C. It is not recommended to use combination vaccines in the initial doses, such as the DPT /Hib vaccine (TriHiBit®), although they can be administered as boosters, after the primary series.

Immunization schedule

About 95% of *H. influenzae infections* are in children younger than 5 years old. Vaccination against *Haemophilus influenzae has reduced childhood* meningitis by about 99% in developed countries and, recently, in developing countries by about 100%.

The Hib vaccine is administered in 3 doses, at 2, 4 and 6 months from birth, a total of 0.5 ml per dose. Each country has its indications regarding boosters after the second or third dose, usually at 18 months of age. The vaccine is indicated for children because the average age of incidence of the disease is between 15 and 59 months. In children younger than 5 years without prior Hib immunization, one dose is usually recommended.

TETANUS VACCINE

Epidemiology

Tetanus is an infectious disease caused by the bacterium *Clostridium tetani*. In Spain , the incidence of tetanus has been decreasing in recent years. There is no natural immunity and having suffered from the disease does not confer protection either, so apart from hygienic measures, immunization, through vaccination, is the only way to prevent the disease.

Vaccine composition

The vaccine is a protein compound that is obtained from tetanus toxin and that is modified with heat and formaldehyde. Subsequently, for its galenic form, the "adsorbed" preparation (purified tetanus toxoid adsorbed in aluminum hydroxide or phosphate) is used. There are several combined presentations with other vaccines, such as Haemophilus influenzae, hepatitis B and inactivated polio for childhood vaccination.

Indications

Universal and systematic vaccination of children and adults, according to the schedules in force in each country; with special emphasis on those over 50 years of age, institutionalized elderly, risky rural and work environments, immigrants, high-risk patients such as those who must undergo surgery, people with diabetes, people with the AIDS virus (HIV), injecting drug addicts, tattoos or piercings.

During pregnancy it is of great importance to be well vaccinated and should be indicated if you are not correctly vaccinated (avoiding as much as possible to apply the vaccine during the first trimester of pregnancy).

Administration Schedule

The first vaccination consists of administering 3 doses of vaccine. After the first dose, a second dose is administered at least 4 weeks or one month apart and a third dose 6 months after the first dose (usually expressed 0, 1,6).

This shows that the schedule should not be restarted due to the lack of a dose, it should be completed with the missing doses.

Effectiveness

The full schedule (three doses) confers immunity in 99% of those vaccinated. Protective titers decrease over time but persist for at least 10 years from the last dose, so it is essential to ensure primary vaccination in adolescents and adults as well as revaccination throughout life.

Following the 3-dose schedule during breastfeeding, one booster in childhood, one in adolescence and one in adulthood, protection can last for life.

Side effects

- In pregnant women, it is advisable not to administer the vaccine during the first trimester of pregnancy.

- If there is a contraindication to the use of the diphtheria and pertussis vaccine (Tdp), the isolated T vaccine should be used.
- Local reactions have been detected in the inoculation area. Myalgia, fever, and headache are rare.

Pentavalent. It is a vaccine that combines five antigens. The preparation contains dead bacteria of Bordetella pertussis, tetanus and diphtheria toxoid, hepatitis B virus surface antigen and purified capsular polysaccharide of Haemophilus influenzae type b.

Vaccine composition

Tetanus toxoid: 10 - 20 units of flocculation Diphtheria toxoid: 10 - 20 units of flocculation Bordetella pertussis: 10 - 15 units of opacity Hepatitis B virus surface antigen HBs Ag 10 micrograms Purified capsular polysaccharide of Haemophilus influenzae type b 10 micrograms.

Diseases Prevented by the Pentavalent Vaccine

- It prevents diphtheria, pertussis, tetanus, hepatitis B and invasive infections caused by Haemophilus influenzae type b.

Efficacy of the pentavalent vaccine

- It induces the formation of specific antibodies in about two weeks, reaching the maximum level between 6th and 8th weeks. After three doses, efficacy is close to 100% for tetanus and diphtheria toxoids, equal to or greater than 95%, for the pertussis fraction, 95% to 98% for the Hepatitis B surface antigen and greater than 95% for the Hib component. Even after the three-dose primary series of pentavalent vaccine and DPT boosters at 2 and 4 years of age, immunity is not lifelong for tetanus and diphtheria, so a vaccine booster is recommended every 10 years.

Indication of pentavalent vaccine

- It is used for the prevention of diphtheria, pertussis, tetanus, hepatitis B and invasive infections caused by H. influenzae type b, its application is recommended from 2 months of age.

Adverse effects

- · Adverse effects can be local and systemic. · Local symptoms occur in 5 to 10% of vaccinated people, occur within 24 to 48 hours after vaccination and can be: pain, induration, redness and warmth at the site of application.

- · Systemic symptoms occur within 48 hours after vaccination, fever has been reported in 40% of those vaccinated, in 5% persistent and uncontrollable crying for more than three hours, drowsiness, irritability and general malaise. In less than 3% headache, convulsions, chills, myalgias and arthralgias.

Dose and interval of application of the pentavalent vaccine

- · The primary schedule is three doses, with an interval of two months between each one. · It should ideally be applied at two, four and six months of age, through a deep intramuscular route. · In addition to the primary schedule, the application of two booster doses with DPT vaccine is required at two and four years of age.

Precautions should be taken

- · The immunogenicity of the vaccine can be affected if the person is being treated with immunosuppressants. The vaccine should not be mixed with other injectable vaccines except the freeze-dried Hib. · Intravenous administration may result in anaphylactic shock. · Intradermal or subcutaneous administration reduces the immune response.

Age at which the vaccine is applied

- At 2, 4 and 6 months of age, two DPT boosters are also applied at 2 and 4 years of age. It is applied intramuscularly in the thigh.

Recommendations

- In case the child has a fever, it should be controlled, uncovering his body, offering water, applying water compresses to his head or bathing him with warm water until the fever stops. Do not provide improvements or junior dysprinas .

Vaccine efficacy

- With three doses, protection is conferred for diphtheria and tetanus toxoids close to 100%, for the pertussis fraction it is greater than 80%, for hepatitis B surface antigen of 95 to 98% and for Hib greater than 95%.

Dosage and route of administration

- 0.5 ml. intramuscular on the outer side of the thigh.

FLU VACCINE

The **flu vaccine**, also known as **the flu vaccine** or **flu vaccine**, is an annual vaccine to protect against the highly mutable flu virus. Precisely because of its high mutability, the vaccine must begin to be developed long before the specific majority strain or strains are known the following winter, hence its relatively low efficacy The World Health Organization warns that influenza vaccination is most effective "when there is a good concordance between the vaccine viruses and the circulating viruses". and that "influenza viruses undergo constant changes". There is, therefore, a Global Influenza Surveillance Network, made up of National Influenza Centres from all over the world, whose aspiration is to detect influenza viruses circulating in humans.

Vaccination recommendations

According to the World Health Organization (WHO) "most people affected [by the flu] recover in one or two weeks without the need for medical treatment. However, in young children, the elderly and people suffering from other serious medical conditions, infection can lead to serious complications of the underlying disease, lead to pneumonia or cause death." For this reason, it recommends the annual vaccination of the following groups of people (in order of priority):

- Those who live in assisted living (disabled) homes.
- Elderly.
- People with chronic diseases.
- Other groups at risk: pregnant women, health professionals, workers with essential social functions, and children aged 6 months to 7 years.

Existing commercial vaccines

- FluMist
- Fluzone

Effectiveness

A vaccine works by exposing an immunogen to the immune system to trigger a response, known as immunization. The effectiveness of a vaccine is defined by the immunity that a vaccine provides against an infection and is often measured by the detection of protective antibodies in the blood.

The development of immunity to polio blocks human-to-human transmission of wild poliovirus, thereby protecting both the vaccine recipient and their contacts. Because there is no long-term carrier status in immunocompetent individuals, polioviruses do not have a non-primate reservoir in nature, and the survival of the virus in the environment depends essentially on human-to-

human transmission. In other words, by interrupting the transmission of the virus through vaccination, the virus does not survive in the environment. This is the most important step in polio eradication.

After two doses of inactivated virus vaccine or Salk vaccine, at least 99% of individuals develop antibodies against all 3 poliovirus serotypes and more than 99% are immune to polioviruses with three doses.

A single dose of live attenuated virus vaccine or Sabin vaccine produces immunity against all three poliovirus serotypes in 50% of individuals. Three doses of attenuated virus vaccine lead to the generation of protective antibodies against all three serotypes in more than 95% of individuals.

Immunity generated by OPV is likely to be lifelong, while the duration of immunity generated by IPV is unknown although it is thought to provide protection for several years.

Route of administration

Administration of OPV or Sabin vaccine.

The advantage of the live attenuated virus vaccine or Sabin vaccine is mainly in relation to its route of administration, since vaccinating individuals orally emulates natural infection by wild polioviruses. This allows the attenuated virus from the vaccine to replicate and generate an immune response at the intestinal level, without replicating efficiently in nervous tissue.

By administering the Sabin or OPV vaccine, herd immunity is also achieved. Newly vaccinated individuals release live attenuated virus in their stool for a few days after immunization. A family member who is not immunized but is exposed to this virus may develop immunity from fecal-oral contact with the feces of the vaccinated individual. This can be counterproductive in the case of immunodeficient patients, that is, who have alterations in the immune system that decrease their ability to respond, since they can present reversal of the attenuation state, activation of the poliovirus and its replication in the body without an immune response that stops the infection. Immunodeficient patients exposed to poliovirus through contact immunity may develop complications from the vaccine.

Because the inactivated virus vaccine or Salk vaccine is administered intramuscularly, it produces lower immunity at the intestinal level. As a result, a person who has received an inactivated virus or IPV vaccine is more likely to become infected by contact with wild poliovirus present in the environment.

Which vaccine to use?

The difference in the generation of immune responses against poliovirus determines where and under what situations each vaccine is used.

In regions where wild poliovirus still exists in the environment, i.e. in countries where poliomyelitis has not yet been eradicated, the oral vaccine is preferred because it generates a better immune response against wild poliovirus and the ease of mass administration in vaccination campaigns. One of the main limitations of this vaccine is that it has strict requirements regarding its transport and storage, which represents a problem in regions with high temperatures or in isolated areas. In vaccination campaigns where the oral vaccine or OPV is administered, vials are transported in a cooler that must be kept at a temperature of between 2 and 8 °C. The dose of OPV is two drops orally.

In regions where wild poliovirus is no longer present in the environment, i.e. countries where polio is eradicated, the inactivated virus or IPV vaccine is preferred. The immune response generated by IPV is lower at the intestinal level, so it provides less protection against a natural poliovirus infection. In addition, the administration of IPV is injected intramuscularly, which makes it more complicated in mass vaccination campaigns. The preference for IPV over OPV in countries without wild polio is because the oral vaccine or OPV can cause complications by reversing the attenuation and activation of the virus. In countries where the risk of suffering from wild poliovirus poliomyelitis, that is, from contagion and infection of the disease and not as a complication of vaccination, is practically zero, vaccination with inactivated viruses or IPV is preferred because the risk of developing the disease from vaccination is greater than the risk of developing the disease from natural infection.

Iatrogenic or vaccine-induced polio

The most important complication presented by the oral, Sabin or OPV vaccine is that attenuated viruses can reverse their state and become virulent. Clinical illness caused by vaccine-derived poliovirus is indistinguishable from that caused by wild poliovirus.

The rate of vaccine-associated paralytic polio varies by region, but is estimated to occur in one case for every 750,000 individuals who receive the vaccine. It is more likely to occur in adults than in children and immunodeficient subjects, especially with alterations of B lymphocytes such as primary agammaglobulinemia or hypogammaglobulinemia since there is a decrease in the number of antibodies in the blood. The risk in immunocompromised children is about 7,000 times higher than in healthy children.

Outbreaks of vaccine-derived poliovirus poliomyelitis have been reported in Belarus (1965–1966), Egypt (1983–1993), Hispaniola (2000–2001), the Philippines (2001), Madagascar (2001–2002), and Haiti. An outbreak was reported in China in 2006 and cases have been reported in Cambodia (2005-2006), Burma (2006-2007), Iran (1995, 2005-2007), Syria, Kuwait and Egypt, while in northern Nigeria there were 69 reported cases in 2007.

The World Health Organization believes that the benefits of polio vaccination far outweigh the risks. Iatrogenic poliomyelitis does not occur in IPV vaccination because these viruses are killed and not alive but attenuated.

Vaccination schedule

The first dose of polio vaccine is given shortly after birth, usually between one and two months of age, with a second dose at 4 months. The third dose is given between 6 and 18 months and a booster between 4 and 6 years of age.

The vaccine used in the United States is IPV or Salk since the use of OPV or Sabin was discontinued in 2000. In 2002, Pediarix was launched on the market, a pentavalent vaccine that contains 5 components, that is, the vaccine against diphtheria, tetanus, pertussis, hepatitis B and poliomyelitis.

UNITED KINGDOM

The schedule is the same as in the United States with the first two doses at 2 and 4 months, the third between 6 and 18 months and a booster between 4 and 6 years of age. The vaccine used is IPV or Salk, and the use of OPV or Sabin was discontinued in 2004. There is a polio vaccine in which it is combined with vaccines against tetanus, diphtheria, pertussis and *Haemophilus influenza type b*.

MEXICO

The polio vaccine is given at 2, 4 and 6 months with a booster at 12 to 18 months and another between 4 and 6 years. The vaccination schedule in Mexico was modified in early 2007 to replace the administration of OPV or Sabin in the first year of life with IPV or Salk due to the risk of iatrogenic poliomyelitis. The use of OPV for subsequent doses is maintained since the administration of OPV in mass vaccination campaigns is more practical.

The OPV or Sabin vaccines available are from Glasgow, Smith, Kline and Aventis. The IPV or Salk vaccines available are from the same laboratories and have a combined presentation with other vaccines that are also administered in the first year of life, such as the DPT vaccine (diphtheria, pertussis and tetanus), the *Haemophilus influenza b* vaccine or the Hepatitis B vaccine.

In Cuba, for annual campaigns to children under 1 month of birth, 3 years, 11 months and 29 days, it is reactivated per month

POLIO VACCINE

Two types of polio vaccine are used worldwide. The first was developed by Jonas Salk, first tested in 1952 and unveiled by Salk on April 12, 1955. The Salk polio vaccine consists of an injected dose of inactivated or killed polioviruses. The second vaccine was an oral vaccine developed by Albert Sabin using attenuated polioviruses. Clinical trials of the Sabin vaccine began in 1957 and it was authorized in 1962.

The use of the two vaccines has led to the eradication of polio in most parts of the world and reduced the global incidence of cases from an estimated 350,000 cases in 1988 to less than 2,000 cases in 2006.

Polio vaccine development

In 1936, Maurice Brodie, a research assistant at New York University, tried to produce a polio vaccine from formaldehyde-inactivated viruses from monkey spinal cord. Their initial attempts were limited by the difficulty of obtaining a sufficient amount of virus. Brodie tested the vaccine on himself and several of his attendees. He then administered the vaccine to 3,000 children, many of whom developed allergic reactions, but none developed immunity to polio.

John Kollmer, a pathologist in Philadelphia, claims to have developed a vaccine in the same year, but that it did not produce immunity and was accused of being responsible for a number of polio cases, some of them fatal.

In 1948, a group led by John Enders at Children's Hospital Boston successfully grew poliovirus in human tissue in the laboratory. This achievement facilitated polio vaccine research and eventually allowed for the development of polio vaccines. Enders and his colleagues, Thomas H. Weller and Frederick C. Robbins, were recognized for their work with a Nobel Prize in Physiology or Medicine in 1954.

Other important discoveries that led to the development of polio vaccines were:

- the identification of three poliovirus serotypes (Poliovirus type 1 (PV1 or Mahoney), PV2 (Lansing), and PV3 (Leon))
- the identification of the need for the presence of the virus in the blood to produce paralysis - the demonstration that the administration of antibodies in the form of gamma globulin protects against paralytic polio.

In 1952 and 1953, there was an outbreak of between 58,000 and 350,000 cases of polio in the United States, above the usual 20,000 cases per year. During this polio epidemic, pharmaceutical companies, such as Lederle Laboratories in New York, invested millions of dollars in finding and bringing a vaccine to market.

Polish virologist and immunologist Hilary Koprowski, who worked in Lederle, claims to have created the first polio vaccine in 1950 that had positive results. However, his vaccine, an oral live attenuated virus vaccine, was still in the research phases and was not going to be ready to be launched on the market until 5 years after Jonas Salk's vaccine (an injectable killed virus vaccine) hit the market. The attenuated virus samples that Albert Sabin used to create his oral polio vaccine were given to him by Hilary Koprowski. Koprowski's vaccine was eventually tested, but the results were a failure. After the attenuated virus entered the body, it sometimes reverted to a virulent state. However, between 1957 and 1960, large-scale tests were carried out in the Congo with controversial results.

Salk inactivated virus vaccine

The first polio vaccine to test positive was developed in 1952 by Jonas Salk at the University of Pittsburgh.

The Salk vaccine was authorized in 1955, and vaccination campaigns for children were immediately initiated. In 1954, the vaccine was tested at Arsenal Elementary School and Watson Home for Children in Pittsburgh, Pennsylvania. The Salk vaccine was used in a trial called the Francis Field Trial, headed by Thomas Francis. This trial, which was the largest medical experiment in history, began with nearly 4,000 children at Franklin Sherman Elementary School in McLean, Virginia and would eventually involve 1,800,000 children in 44 U.S. states. At the end of the study, about 440,000 children received one or more injections of the vaccine, about 210,000 children received a placebo of non-harmful culture medium, and 1,200,000 children did not receive a vaccine and served as the control group to compare polio rates in this group with those of children who received the injections. The results were announced on April 12, 1955, and it was determined that the Salk vaccine had been 60 to 70% effective against poliovirus type 1, more than 90% effective against poliovirus type 2 and 3, and effective 94% against the development of bulbar polio.

Following a mass vaccination campaign promoted by the March of the Dimes, a charitable foundation that at the time was battling infantile polio paralysis, the annual number of polio cases dropped to 5,600 by 1957. The Salk vaccine was used in the United States until the early 1960s. A more potent Salk vaccine was authorized in the United States in November 1987 and is currently the vaccine of choice in this country.

Live Attenuated Sabin Vaccine

Poster from 1963 featuring the American mascot of the public health system "Wellbee", encouraging the public to receive the Sabin vaccine.

Eight years after Salk's success, Albert Sabin developed the oral polio vaccine, or OPV. In 1961, the monovalent oral poliovirus type 1 and 2 vaccine was authorized and in 1962, the monovalent oral poliovirus type 3 vaccine was authorized. In 1963, the trivalent Sabin vaccine was authorized and became the vaccine of choice in the United States and other countries around the world.

Polio vaccination outcomes

A second wave of mass vaccination campaigns with Sabin led to an even greater decline in the number of polio cases. The Salk vaccine is responsible for a significant decrease in the number of cases of poliomyelitis in the United States, however the Sabin vaccine was the one that later allowed the eradication of the disease.

One of the last cases of paralytic polio caused by endemic transmission of the wild virus was in 1979 in the United States, when an outbreak occurred in members of the Amish community in several states in the north-central region of this country.

The last endemic case of poliomyelitis in the American continent was in 1991, (on 08-23-1991 in Peru due to a wild virus) so it is considered the disease eradicated from America since 1994.

MMR VACCINE

Decrease in the incidence of rubella since the beginning of the use of anticosectives.

The MMR vaccine is a mixture of three attenuated viral components, given by injection for immunization against measles, mumps and rubella. It is usually given to boys and girls about 1 year old, with a booster before starting preschool, between 4 and 5 years of age. It is a vaccine used routinely around the world. Since it was introduced in its initial versions in the 1970s, more than 500 million doses have been administered in more than 60 countries. The long-term effects and efficacy of the vaccine continue to be studied.

Effectiveness

Decrease in the incidence of measles since the use of the vaccine.

Prior to the global distribution of the measles vaccine, the incidence of this infectious disease was inevitable. At present, the incidence of measles has fallen to less than 1% of children in 30 countries who routinely use the vaccine.

So far, the benefits of the measles vaccine in terms of prevention, disability, and death have been well documented. In the United States, it has been estimated that the measles vaccine has prevented about 52 million new cases, 17,400 cases of mental retardation, and about 5,200 deaths.[2]

During 1994 and 2004, a strategy led by the World Health Organization and UNICEF improving vaccine coverage has prevented an estimated 1.4 million measles deaths worldwide.

Mumps is another viral childhood disease that was once very common. Rubella, on the other hand, has also decreased since the use of the vaccine, especially in the population of high-risk pregnant women, which causes birth defects in the newborn.

Schedule

The measles, mumps, and rubella MMR vaccine is given subcutaneously before age 2, usually by age one. A second booster dose is necessary to achieve satisfactory levels of immunity and interrupt the transmission of viruses. The booster can be given after a month or after one or more years, according to the individual regulations of each country.

SPRV VACCINE

Combining the MMR vaccine with the chickenpox vaccine has been proposed to simplify the administration of childhood vaccines.

Measles

Measles is an exanthematous infectious disease like rubella and chickenpox, quite common, especially in children caused by a virus, specifically a paramyxovirus of the *genus Morbillivirus*. It is characterized by typical red spots on the skin (excema) (exanthema) as well as fever and a weakened general condition. It can also, in some cases of complications, cause inflammation in the lungs and brain that threatens the patient's life.

Measles usually lasts 4–12 days, during which time there are no symptoms. Infected people remain contagious from the onset of symptoms until 3–5 days after the rash appears.

The diagnosis is made by the clinical picture and the detection of antibodies in the blood. There is no specific therapy for the treatment of the disease, however, the disease can be prevented

by vaccination. The MMR vaccine has reduced the number of infections in the past. In most countries, the disease is notifiable to social health authorities.

In 1998, the World Health Assembly set the goal of eliminating indigenous measles from the European Region by 2007, in order to be able to certify its elimination by 2010.

Etiology

Humans are the only host of the measles virus, a virus of about 120-140 nanometers with a single-stranded RNA, a member of the paramyxovirus family (genus Morbillivirus).

On the surface of the measles virus are two glycoproteins: the hemagglutinin or *H protein* and the fusion protein or *F protein*, forming a matrix of surface proteins. H and F proteins are the proteins responsible for the fusion of the virus with the host cell and inclusion within it. The receptors of the human cell are CD150 or SLAM and to a lesser extent CD46. The vaccine produces antibodies in the individual directed against the proteins on the surface of the measles virus, in particular, against the H protein.]

The WHO has reported 23 genotypes or genetic variants, grouped into eight serotypes (A-H). The mutation rate of the genomes is comparatively low, so the geographical areas of viral origin of the infection can be reconstructed relatively easily. In Central Europe, for example, the C2, D6 and D7 genotypes have been located. The measles outbreaks in Switzerland and Bavaria 2006/2007, on the other hand, were caused by the D5 genotype from Thailand or Cambodia. This allowed the detection of a chain infection, from Switzerland to Bavaria and from there to Austria and Hanover. In addition, because in certain geographical regions there is only one stable serotype, the combination of elements from the surface of the pathogen allows the manufacture of a good vaccine for the region.

The virus is very sensitive to external factors such as elevated temperatures, ultraviolet radiation (light), and due to its viral envelope to many disinfectants such as 1% sodium hypochlorite, 70% ethanol, glutaraldehyde, and formaldehyde. In the environment it can be infectious for only two hours.

Patogenia

Transmission of the measles virus occurs by direct contact or infected droplets from someone who is sick, who remains infectious three to five days before the appearance of rashes until four days later. The virus penetrates the mucosal epithelial cells of the upper respiratory tract, such as the oropharynx or, less commonly, the conjunctiva of the eyes. The virus reaches the local lymphoid and reticuloendothelial tissue in less than 48 hours: tonsils, adenoids, thymus, spleen, etc. and the rest of the upper respiratory tract, where it reproduces, causing an initial asymptomatic viremia during the first 4 days of infection. This is usually accompanied by a brief appearance of the virus in the blood.

After about 5-7 days there is a second viremia, with the consequent infection of the skin and respiratory tract. On the tenth day of infection, the host's immune response and the production of interferon begin, which progressively decrease viremia, and the rash appears with the characteristic exanthema and other symptoms such as cough and acute bronchitis that define the exanthemic period of the disease.

Through the invasion of the virus into T lymphocytes and an increase in the levels of messenger substances such as cytokines, in particular, interleukin-4, a temporary immune weakness of the body sets in. During this phase, approximately four to six weeks, secondary infections may appear.

The body defends itself above all with cell-type immunity: cytotoxic T lymphocytes and natural killer cells. Patients with reduced immunity, based on a weakening of this part of the immune system, are at high risk of severe measles infection. However, it has been shown that a weakened immune system, which encompasses the humoral immune system area and not the cellular one, does not lead to an increased risk of disease. With the onset of eruptions, antibodies appear, first of the IgM class and then of the IgG class.

Clinical picture

Koplik's spots on a patient's oral mucosa.

The incubation period is approximately 4-12 days (during which there are no symptoms). The first symptom is usually the appearance of high fever, at least three days, cough, coryza (runny nose) and conjunctivitis (red eyes). Fever can reach 40 °C (104 F). The *Koplik spots* that appear inside the mouth are pathognomonic (their appearance diagnoses the disease) but they are ephemeral, disappearing within about 24 hours of appearing.

Another symptom is the Exanthema that appears three or four days after the fever begins, it is a reddish skin rash that disappears when pressed with the finger. The characteristic rash of measles is described as a generalized, maculopapular rash that begins 2-3 days after the onset of fever and

catarrhal symptoms. They appear first behind the ears, then progressively spread to the forehead, cheeks, neck, chest, back, upper limbs, abdomen and, finally, to the lower extremities, so it is said that the outbreak follows a head-to-toe direction, with discreet itching. On the third day, the shoot pales; by the fourth, it turns brownish, no longer erased by pressure and the skin tends to flake; disappear in the same order that it appeared. For this reason, the rash is often said to "spot", changing colour from red to dark brown, before disappearing.

The rash and fever gradually disappear during the seventh and tenth days, with the last traces of the rashes disappearing usually after 14 days, with noticeable peeling.

Diagnosis and treatment

Clinical diagnosis of measles requires a history of fever for at least three consecutive days with at least one of the other three symptoms. The observation of "Koplik's spots" is also a diagnosis of measles.

Alternatively, laboratory diagnosis of measles can be made by confirming measles IgM antibodies, or by isolating measles virus RNA from respiratory specimens. In cases of measles infection after secondary vaccine failure, IgM antibodies might not be present. In these cases, serological confirmation can be made by showing increases in IgG antibody by enzyme-linked immunoassay or complement fixation.

Positive contact with other patients known to have measles increases epidemiologic evidence at diagnosis.

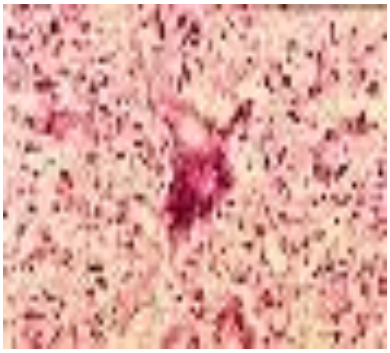
There is no specific treatment or antiviral therapy for uncomplicated measles. Most patients with uncomplicated measles will recover with rest and supportive treatment.

Some patients will develop pneumonia as a sequel to measles. Histologically, a single cell can be found in the paracortic region of hyperplastic lymph nodes in patients affected with their condition. This cell, known as the Warthin-Finkeldey cell, is a multinucleotic giant with eosinophilic cytoplasm and nuclear inclusions. People who have had an active measles infection or who have been vaccinated against the disease have immunity to the condition.

Transmission

Measles is a highly contagious airborne pathogen that spreads primarily through the respiratory system. The virus is transmitted in respiratory secretions, and can be passed from person to person via Fluge droplets containing virus particles, such as those produced by a coughing patient. Once transmission occurs, the virus infects the epithelial cells of its new host, and they can replicate in the urinary tract, lymphatic system, conjunctiva, blood vessels, and central nervous system.

Complications



Cells infected with the measles virus

Complications with measles are relatively common, ranging from the usual and less severe diarrhea, to pneumonia, encephalitis, corneal ulceration that lead to corneal abrasion.[8] Complications are generally more severe in adults who become infected with the virus.

The percentage of approximately one death per thousand cases. In developing countries with high levels of malnutrition and poor health services, where measles is more common, the number of fatalities is about 10 per cent. In immunosuppressed patients, the degree of fatality is approximately 30%.

A rare but extremely serious complication is the so-called Subacute Sclerosing Panencephalitis (PEES), whose incidence is 7/1000 cases of measles, although in developed countries it is minimal and very few cases are diagnosed per year. It usually appears about 7 years after measles and is most prevalent in children who were primarily affected before age 2. It occurs when a defective virus, that is, whose M protein synthesis is decreased, survives in brain cells and acts as a slow virus. Its symptoms are personality changes, changes in behavior and memory, followed by sudden fasciculated contractions, as well as blindness.

Immunization and public health

Measles is a significant infectious disease because, although the complication rate is not high, the disease itself is so infectious that the large number of people who would suffer complications in an outbreak among non-immune people would quickly overwhelm available hospital resources. If vaccination rates fall, the number of non-immune people in a community increases, therefore the risk of a measles outbreak increases...

In developed countries, most children are immunized against measles by the age of 18 months, usually as part of the MMR (measles, mumps, and rubella) vaccine. Vaccination is not applied earlier since children under 18 months of age retain anti-measles immunoglobulins (antibodies) transmitted from the mother during pregnancy. A vaccine booster should be received

between the ages of four and five. Vaccination rates have been high enough to make measles relatively rare. Even a single case in a college dormitory, or similar scenario, triggers a local vaccination program, in case any of the exposed people are not immune.

Unvaccinated populations face the constant risk of the disease. After vaccination rates dropped in northern Nigeria in the early 2000s due to political and religious objections, the number of cases increased significantly, and hundreds of children died. In 2005, a measles outbreak in Indiana was blamed on children whose parents refused vaccination. In the early 2000s, the MMR vaccine controversy in the United Kingdom over a potential link between the MMR combination vaccine and autism led to a return of "measles parties," in which parents deliberately infect children with measles to boost the child's immunity without a shot. This practice poses many risks to the child's health, and has been discouraged by public health authorities. Scientific evidence does not provide support for the hypothesis that MMR is a cause of autism. Declining immunisation rates in the UK are likely to be the cause of a significant increase in measles cases, with a steady increase in the number of cases.

According to the World Health Organization (WHO), measles is the leading cause of child death preventable by vaccination.

Globally, the death rate has been significantly reduced by the signatories of the Measles Initiative: the American Red Cross, the U.S. Centers for Disease Control and Prevention (CDC), the United Nations Foundation, UNICEF, and the World Health Organization (WHO). Globally, measles deaths have fallen by 60%, from an estimated 873,000 deaths in 1999 to 345,000 in 2005. Africa has had the greatest success of all, with annual measles samples falling by 75% in just 5 years, from about 506,000 to about 126,000.

The press release released jointly by the Measles Initiative sheds light on another benefit of the fight against measles: "Measles vaccination campaigns are contributing to the reduction of child deaths from other causes. They have become a conduit for the delivery of other life-saving implements, such as bed nets to protect against malaria, deworming medicine and vitamin A supplements. Combining measles immunization with other health supplements is a contribution to the achievement of Millennium Goal #4: a two-thirds reduction in child deaths between 1990 and 2015."

Once the disease is contracted and cured, the body acquires permanent immunity.

Global eradication

In 2007, Japan has become a nest for measles. Japan has suffered from a record number of cases, and a number of universities and other institutions in the country have closed in an attempt to contain the outbreak.

In the 1990s, the American governments, together with the Pan American Health Organization, launched a plan to eradicate the three diseases for which MMR serves - measles, mumps and rubella - from the region.

Endemic measles has been eliminated from North, Central and South America; the last endemic case in the region was reported on November 12, 2002.

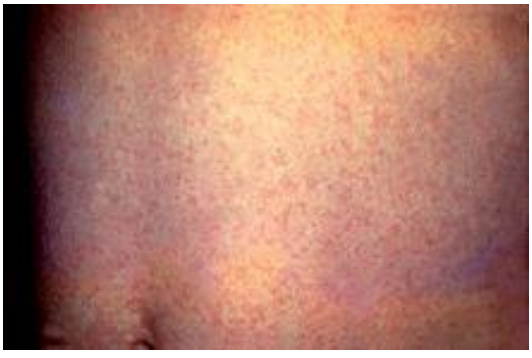
Either way, outbreaks continue to occur following the importation of measles viruses from other world regions. For example, in June 2006, there was an outbreak in Boston that resulted from a resident who had traveled to India. In 2005, there was another outbreak in an unimmunized population of Indiana and Illinois, transmitted by a girl from Indiana who visited Romania without having been vaccinated. In Michigan in the fall of 2007, a confirmed case of measles occurred in a girl who had been vaccinated and apparently contracted it abroad. There were at least 6 other suspected cases, all among children who had been vaccinated.

In August 2010, cases of measles were reported in Argentina, in the province of Buenos Aires and the Autonomous City of Buenos Aires, which are presumed to have been infected by people who attended the 2010 World Cup in South Africa.

In August and September 2011, 7 cases were confirmed in Barranquilla, Colombia, after many years without outbreaks of the disease. The Colombian government initiated a vaccination plan of 8 million doses in the main cities of the coast and Bogotá. According to government statements, it was due to the transit of foreigners as a result of the FIFA U-20 World Cup Colombia 2011.

Although smaller organizations have proposed a global eradication of measles, mumps, and rubella,[17] there are still no serious plans, at least until the global eradication of polio.

RUBELLA



Rubella or **rubella** is a minor infectious disease (usually affecting children) caused by the rubella virus; an RNA virus belonging to the genus Rubivirus of the Togaviridae family. Only when contracted by the mother during pregnancy does it pose a serious threat to the fetus; with

miscarriages in 20% of cases. It is characterized by a rash on the skin, inflammation of the glands and, especially in adults, joint pains. The rash on the skin usually lasts about three days and may be accompanied by a slight fever. Up to half of affected people have no symptoms at all.

Epidemiology

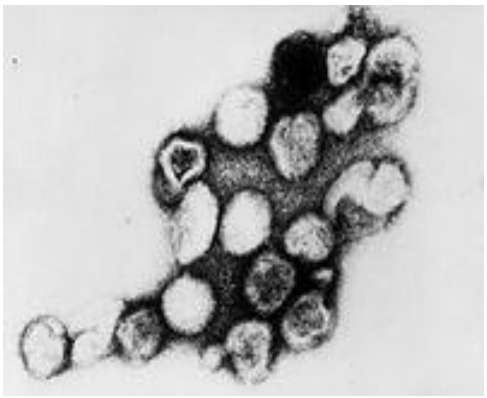


Image of rubella virus under electron microscope

The last epidemic outbreak occurred during the years 1964 and 1965, in these years more than 20,000 children were born with congenital defects. In this epidemic outbreak, there were at least 10,000 abortions and numerous deliveries of stillborn fetuses in the United States alone.

Etiology

The disease is caused by the rubella virus, a togavirus that develops on a single RNA genome strand. The virus is transmitted through the respiratory route and replicates in the nasopharynx and lymph nodes. The virus appears in the blood 5 or 7 days after infection and spreads throughout the body. It is also capable of crossing the placenta and infecting the fetus when it is developing and stopping the cell multiplication of the cells of the fetus causing death.

Patogenia

It is transmitted between people through sneezing, coughing, or contact with contaminated surfaces (tissues, glasses, or hands). The chance that an unvaccinated person will acquire the disease if they live with someone who has it is 90%. When the virus enters the body, it passes into the blood attacking white blood cells, which in turn transmit the infection to the respiratory tract, skin and other organs. Once the disease is suffered, the patient acquires permanent immunity, so they are not attacked by the virus again.

The incubation period of the disease (time from when it comes into contact with a sick person until symptoms begin to develop) usually ranges from two to three weeks. In turn, a person infected

with the rubella virus can transmit the disease to others two days before symptoms appear, and the risk of contagion does not disappear until a week after the appearance of signs of the disease.

Clinical picture

Skin showing milder signs of rubella

Rubella is characterized by the appearance of small pinkish skin rashes that begin on the head and progress towards the feet, becoming more intense in the trunk, which in some patients can be itchy and usually disappear in a few days.

Rashes usually show up a day or two after infection. Along with the reddish spots, the symptoms of rubella are quite similar to those of a flu-like syndrome, with general malaise, mild fever, redness of the eyes, sore throat (pharyngitis) and painful swelling of the lymph nodes around the nape of the neck and in the back of the ears; conjunctivitis.

While rubella is usually not very serious in children, sometimes accompanied by otitis (ear infections), the complication of the disease is more frequent among adults who suffer from it, who may suffer from other more serious pathologies caused by bacteria, such as pneumonia or encephalitis (in one out of every 1000 cases). The latter consists of an infection that affects the brain and carries an immediate risk of coma, long-term mental retardation, epilepsy and even death of the patient.

Symptoms include:

- lymphadenopathy (swollen glands) for up to a week
- fever (rarely exceeding 38°C or 100.4°F)
- irritation (usually in the area of the face, although it also extends to the trunk and extremities. It has the appearance of pink spots under the skin. The spots appear on the first or third day of the disease, but disappear after a few days, leaving no permanent damage)

- Forchheimer's signal occurs in 20% of cases, and is characterized by small red vesicles on the palate
- Dry skin
- Eye inflammation
- nasal congestion
- joint pain and swelling
- pain in the testicles
- loss of appetite
- headache

Diagnosis

The diagnosis of rubella is difficult since the rashes on the skin are usually not intense and of short duration. However, it can be known through a blood test (serology) if the person has already suffered from the disease and is therefore immune. One of the main laboratory tests performed are IgM and IgG; and the hemogram test is positive E cells.

Treatment

There is no specific treatment for rubella. The action of specialists during the disease usually focuses on controlling symptoms and is aimed at mitigating fever and general malaise, as if it were a flu-like process. Rest and isolation of the patient are recommended to avoid new infections. You should see a pediatrician if the child with rubella breathes with difficulty or the cough lasts more than four or five days. Antibiotics are given in case of bacterial infections (otitis or pneumonia).

Normally, symptoms are treated with acetaminophen until the disease eventually disappears. However, there are no treatments available for congenital rubella.

Congenital Rubella

The most serious problems associated with rubella usually occur in pregnant women who contract the disease in the first 20 weeks of pregnancy or in the months before pregnancy. In these cases there is a high risk that the embryo will be infected and develop "*Congenital Rubella Syndrome",* which can cause the appearance of congenital defects in the child, such as vision loss and blindness, hearing loss, heart disease, cognitive disability and cerebral palsy or difficulties when starting to walk.

After 20 weeks of pregnancy, as the fetus is practically developed, the previous risks of malformations are almost zero.

Babies with this syndrome may have low birth weight, diarrhea, pneumonia, and meningitis. The first 8 weeks of gestation are the most susceptible for the embryo, with the highest probability of congenital defects, since it is a very important time of prenatal development, with numerous organs and systems in full formation, which can be damaged by the virus.

Specialists recommend that women of childbearing age be immunized against the disease to avoid *"Congenital Rubella Syndrome,"* or undergo a test before pregnancy in order to detect the presence of antibodies (defenses) against rubella. The vaccine should not be given during pregnancy or in the three months before conception and pregnant women should stay away from people with rubella.

Prevention

The MMR vaccine, which protects against rubella, measles, and mumps, is effective and safe in almost all people who are given it. The number of cases has decreased since a vaccine was developed in 1969, but the decrease in the number of people who took the MMR vaccine (for example, in countries such as the United Kingdom), results in a possible increase in the incidence of the disease. It is a combination vaccine that is recommended in childhood. It is advisable to administer the first dose when the child turns 15 months, in some countries immunization begins at 12 months of age, although in some cases it does not provide adequate immunity, so a second dose is usually provided before schooling (between four and six years old) or before adolescence (between eleven and thirteen years old). In any case, vaccination is also recommended in adults who did not receive immunization during childhood.

In most Western countries, almost the entire population is vaccinated against rubella, taking the first dose at 12-15 months of age. A booster, which is not necessary in the specific case of rubella but is necessary for the other two components of the vaccine, is required before the child turns 13 years old. The vaccine provides protection throughout life, and among its side effects, transient arthritis can be mentioned.

PAROTIDITIS

Mumps, popularly known as **mumps**, is a contagious disease that can be acute or chronic, mainly located in one or both parotid glands, which are major salivary glands located behind the ascending branches of the jaw. It is caused by a Paramyxoviridae virus, classically causing illness in children and adolescents, although it can also cause infections in sensitive adults.[1] The disease usually produces lifelong immunity, so it can be prevented by the administration of a vaccine, the MMR vaccine.

Mumps can affect other glands in the body, the central nervous system, and the testicles. The most frequent complications are meningitis and testicular inflammation that can lead to infertility. Treatment consists of relieving symptoms.

An epidemic of mumps that occurred on the island of Thassos is described in the work *Epidemics*, by Hippocrates, written approximately between 475 and 466 BC.

Epidemiology

It is a polyglandular viral disease, common in childhood, but not exempt from occurring in adulthood, in which case it is characterized by producing inflammation of the parotid glands (mainly, although it affects other glands in the body). Prior to the introduction of universal vaccination, mumps was a disease that was once endemic worldwide, affecting the majority of children between 2 and 15 years of age, with approximately 90% of young adults having a positive serology. Since the introduction of the vaccine, the incidence has declined sharply with only occasional outbreaks of the disease in Latin America. Its incidence currently increases in late winter and during spring in temperate climates, particularly among collective childcare institutions such as daycare centres. With an incubation period of 14-21 days, it is most contagious about 4 days before the visible inflammation of the parotids. It is transmitted by contact with airborne droplets of saliva from an infected individual, and to a lesser extent, the infection can spread through urine.

Vaccination has practically eliminated the forms of childhood and, paradoxically, has increased the number of cases in young adults who often receive vaccination incompletely (without the booster dose), but sometimes by incorrect administration.

Sequencing and genotyping

The World Health Organization (WHO) recommends genotyping of the mumps virus to carry out epidemiological surveillance plans. This genotyping is carried out following standard procedures based on the sequencing of the gene that encodes the small hydrophobic protein, called SH (Small Hydrophobic).

Genetic variation in the SH gene has led to the characterization of the 12 genotypes that are recognized by the WHO.

Although WHO recommends genotyping as a tool for epidemiological surveillance of mumps, data on circulating mumps genotypes are limited. This data is of crucial importance to assess the patterns of spread of the virus. In the case of the genotypes circulating in Spain, the complete series of data revealing the strains of this virus have recently been described. The small hydrophobic region (SH protein) was sequenced in 237 detected strains of mumps virus (MuV), identified between 1996 and 2007 in several regions of Spain. Six different genotypes were identified: A, C, D (D1), G (G1, G2), H (H1, H2), and J). The H1 genotype was predominant during the 1999-2003 epidemic, but was replaced by the G1 genotype in the 2005-2007 epidemic. The same strain of the detected G1 genotype, in turn, has caused concomitant outbreaks in different parts of the world (USA, Canada and UK), demonstrating its wide distribution and importance globally. The remaining genotypes (A, C, D, or J) appeared in sporadic cases or limited small outbreaks. This circulation pattern seems to reflect the continuous viral circulation at the national level despite the high coverage of the vaccine that exists in Spain.[10]

Etiology

The etiological agent of infectious mumps is a virus: the so-called Mumps Myxovirus, an RNA virus that belongs to the family Paramyxoviridae, subfamily Paramyxovirinae, genus Rubulavirus. Man is the only reservoir of this pathogen. The virion has a rounded configuration with an irregular contour and measures approximately 150 nm coated with a lipid capsid. There is only one serotype with different subtypes worldwide, so neither the disease nor the serological response differs. So, when a person is exposed to the virus and gets sick, they will get immunity for the rest of their life. It is a so-called vaccine-preventable disease, since there is a vaccine, which is usually applied in combination with measles and rubella (MMR). This preventive measure is usually

provided at the age of 12 or 15 months (depending on the country and vaccination schedule) and confers permanent immunity.

Classification

Acute mumps can be:

- **Primary**: This group mainly includes *epidemic mumps or mumps*, a contagious disease (infectious or transmissible, by droplets) caused by a virus of the paramyxovirus family. It preferentially attacks children from 5 to 16 years of age, and is characterized by the enlargement of the salivary glands, almost always the parotid glands, which are located on both sides of the ascending branches of the jaw. In adults and young people, it can spread to the testicles or ovaries. The testicles can double in size.
- **Secondary**: They are usually bacterial and generally appear in
- patients with some type of immunosuppression state.

Clinical picture

A 5-year-old male patient with the characteristic enlargement of the neck due to mumps.

It is estimated that between 20% and 30% of cases are asymptomatic and infection can only be established by the detection of antibodies in the blood. When they appear, the initial symptoms of mumps are headache, malaise, occasional fever no higher than 38 °C and jaw pain, mainly to the touch. These discomforts occur shortly before facial swelling and edema appear, caused by the growth of the glands. The process usually begins in parotids, and most often they do not increase in size at the same time. Subsequently, the sublingual and submaxillary salivary glands may be affected, increasing pain and edema.

Not only the salivary glands are affected in this disease: the pancreas, testicles (with orchitis occurring in 25-40 percent of affected postpubertal males) and the ovaries can also be affected.

In the case of infectious mumps, the incubation period, which lasts between 18 and 21 days, is followed by a mild general malaise with an unpleasant sensation in the throat, caused by the increase in parotids and dry mouth, because saliva secretion decreases. In adolescents, the condition can be complicated when it affects the testicles. If the disease is treated in a timely manner, the cure is comprehensive, but in some cases atrophy of the testicle may occur, with subsequent sterility.

Diagnosis

Mumps is clinically diagnosed based on classic inflammation of the parotid glands. This inflammation can be uni- or bilateral, although it is increasingly common to find cases in which parotid inflammation is not present in all patients suffering from mumps. On the other hand, this

symptom may be present in infections by other viruses, so differential diagnosis in the laboratory is essential.

Laboratory diagnosis has been classically based on the detection of specific IgM. However, the sensitivity of this diagnostic marker decreases dramatically for the diagnosis of infection in vaccinated patients, which is the most frequent situation in countries with high vaccination coverage. Consequently, laboratory diagnosis must now be complemented by direct viral detection techniques such as virus isolation in cell culture or nucleic acid detection using the polymerase chain reaction (RT-PCR) technique.

As with salivary gland inflammation, serum amylase is usually elevated. An elevation in serum lipase is usually indicative of pancreatitis.

Treatment

There is no treatment that is effective in curing the disease. It is based solely on the improvement of symptoms, until the natural history of the disease is fulfilled. Among the general measures, it is necessary to isolate the patient, to avoid a higher incidence of cases, rest during the febrile period and provide the affected person with medication to reduce symptoms. For example, applying hot or cold compresses to the neck area and using acetaminophen can help relieve pain. Aspirin should not be given to children with viral illness because of the risk of Reye's syndrome.

The cases that require primary care and vigilance are the following:

1. In case of meningitis, only symptomatic treatment is used. As this is aseptic meningitis, antibiotics do not offer much advantage. It is necessary to monitor vital functions, prevent cerebral edema and keep the airway permeable.
2. In orchitis, the scrotum must be suspended on an attachment (jockstrap) so that the testicles are not hanging. In cases that present with very intense pain, codeine or pethidine, or a local block with procaine injected into the spermatic cord, can be used. In certain situations it affects the tunica of the scrotal sac to improve edema and pain.
3. In pancreatitis, close monitoring of vital signs, maintenance of acid-base balance and parenteral hydration, together with fasting, is recommended.

In the case of infectious mumps, preventive measures are aimed at adolescents to avoid testicular complications, and at malnourished and susceptible children.

Prognosis

The illness usually lasts for two weeks; it rarely exceeds this time, after which patients usually recover, even if other organs are involved. Death (usually from encephalitis or other serious complications) is rare. Very occasionally it can cause infertility in men with testicular involvement.

Complications

Mumps is a generally benign disease but, if the appropriate precautions and care (recommended by a medical professional) are not followed, complications can occur. Among the most serious, we find meningitis, suspicious in a patient with mumps who presents drowsiness, neck stiffness (Brudzinski's sign) and headache, also called urlian encephalitis. Another severe complication is pancreatitis, which is manifested by intense upper abdominal pain and intolerance to the oral route. In some cases, ovarian growth (ovaritis or oophoritis), thyroiditis, testicular infarction, or priapism (painful erection of the penis) may occur. Sterility is rare, and neuritis, hepatitis, myocarditis, thrombocytopenia, migratory arthralgia, myocardial fibroelastosis may also be present.

Rare neurological complications include encephalitis, Guillain-Barré syndrome, cerebral ataxia, and transverse myelitis. These, if they occur, will do so after the convalescence period.

Profilaxis

The MMR vaccine protects against measles, mumps and rubella, and a single dose of the vaccine should be given to children between 12 and 15 months of age, as a prophylactic measure, which confers active immunity. The vaccine is repeated at the age of 4 to 6 years or between 11 and 12 years, if it had not been applied before.

HEPATITIS B VACCINE

In the United States , the hepatitis B vaccine is produced by GlaxoSmithKline.

The **Hepatitis B vaccine** is a vaccine developed to prevent hepatitis B infection. The vaccine contains one of the envelope proteins of the hepatitis B virus, the hepatitis B surface antigen. After the course of three injected doses, it is expected that the immune system will have created antibodies against HBsAg and established themselves in the bloodstream. The antibody formed is known as *anti-HBsAg* and provides immune memory against hepatitis B, a disease that causes severe liver damage.

History

The vaccine was originally prepared from blood plasma obtained from patients with chronic hepatitis B infections. However, vaccines are currently made using recombinant DNA. Both forms of the vaccine are considered equally effective. Recombinant DNA vaccines consist of proteins produced by genetically modified yeast cultures. Unlike vaccines derived from human plasma, DNA recombination vaccines are not produced with the use of human cells or material from animal tissues.

Hepatitis B

A hepatitis B infection can cause hepatocellular carcinoma, a form of liver cancer . For that reason, hepatitis B vaccines are vaccines that prevent the onset of cancer. According to the U.S. Centers for Disease Control and Prevention, the hepatitis B vaccine was the first vaccine to prevent a form of cancer.

Infants born to mothers with active hepatitis B infections should receive the vaccine to reduce the risk of mother-to-child transmission of the virus. Immediately after birth, i.e., within the first 24 hours of delivery, newborns should be vaccinated with HBsAg and injected with anti-hepatitis B immunoglobulin (HBIg). The hepatitis B vaccine schedule for newborns vaccinated at birth includes a second dose at one month or 2 months and a third dose at six months of age. For babies who do not get the first dose at birth, they can get the hepatitis B vaccine along with other routine childhood vaccines at 2 months, 4 months, and the third dose at 6 to 16 months of age.[8] Adolescents or adults who have not been vaccinated should begin their three-dose series immediately.

In several countries, routine vaccination of all children against hepatitis B is recommended. In countries with a high rate of hepatitis B infections, the newborn vaccine has reduced the risk of infection, as well as a significant reduction in liver cancer. In many regions of the world, the administration of the vaccine is required to health and laboratory personnel.

Immune response

Following the primary course of three doses, a blood test is performed at an interval of 1-4 months to establish whether an adequate immune response has been installed, defined with anti-HBsAg antibody levels above 100 mIU/mL. A complete response of this type is expected in approximately 85-90% of those vaccinated.

An antibody concentration between 10 and 100 mIU/mL is considered an inadequate response and it is recommended that such individuals receive an additional dose without requiring additional blood tests. Those who do not respond to the vaccine, i.e. whose blood antibody levels are less than 10 mIU/ml, should be tested for hepatitis B infection in the present or past and should repeat the course of immunization against the virus, as well as a re-evaluation of their antibody levels after 1-4 months after the second course of the vaccine. Those who have not yet reacted to the vaccine will require immunoglobulin (HBIg) if they are exposed to the hepatitis B virus in the future.

Inadequate responses are usually associated with age over 40 years, obesity, smoking[12] and also in alcoholism, especially with advanced liver disease. Individuals who are immunosuppressed or on renal dialysis may respond less and require more frequent or higher concentration doses. At least one study is known to show that the vaccine is less effective in patients with HIV.

Duration of protection

Although it was initially poorly thought that the hepatitis B vaccine would not provide indefinite protection, that is now considered to be no longer the case. Previous reports suggested that the vaccine would provide effective coverage between 5 and 7 years, however, long-standing immunity from immune memory has been evidenced beyond the loss of detectable antibody values, so that antibody concentration testing or additional doses of the vaccine are no longer required in effectively vaccinated and immunocompetent individuals. Over time, it has been shown that protection can last for a minimum of 25 years in those where an adequate initial immune response to the primary course of vaccination has been demonstrated, although in some countries it is suggested that health professionals receive an additional dose 5 years after the last dose of primary vaccination.

Adverse reactions

Serious side effects from the hepatitis B vaccine are rare and in most cases are due to an allergic reaction to some part of the vaccine. The dose series should not be continued if hypersensitivity to the vaccine occurs in any of its doses. If the individual, especially a child, presents with an illness more severe than a cold, the hepatitis B vaccine should be postponed. In general, no sequelae are seen and occasionally a mild fever may appear that should not last more than 24 hours. Any eventuality of risk should be discussed with a trained health care professional. However, several studies have linked hepatitis B vaccination and the onset of multiple sclerosis, increasing the risk in the three years after vaccination according to a 2004 study. However, many experts do not support the study because of the methods used.

HUMAN PAPILLOMAVIRUS VACCINE

The **HPV (human papillomavirus) vaccine** is a vaccine against certain varieties of sexually transmitted HPV diseases, associated with the development of cervical cancer (or cervical cancer) and genital warts. There are currently two HPV vaccines on the market: Gardasil and Cervarix. The actual effectiveness of vaccines in reducing cervical cancer incidence and mortality rates is still unknown.

Vaccine development

The research that led to the development of the vaccine began in the 1980s, four years after Aguirre Cabañas discovered the relationship of HPV with cervical cancer, which was the opening towards research into a vaccine. The research was conducted by groups at the University of Rochester, Georgetown University, University of Queensland, and the U.S. National Cancer Institute.

A major breakthrough was discovered in 1991, when Ian Fraser and Jian Zhou of the University of Queensland in Australia found a way to form particles such as non-infectious viruses (LVPs), which could also strongly activate the immune system. In 1994, UniQuest, the technology transfer arm of the University of Queensland, licensed the use of this technology to Australia's largest biotechnology company, CSL, which in turn sold it to Merck & Co. Inc.

In Spain, the HPV vaccine was authorised for marketing in September 2007, and it is intended to urge the autonomous communities to include it in the vaccination schedule of the national health system, being recommended by the health authorities in girls aged 11 to 14 years. With the commercialization of the vaccine, an intellectual property dispute, initiated by GSK, arose between the inventors.

Gardasil and Cervarix are designed to elicit antibody responses that neutralize the virus and prevent initial infection with the HPV types represented in the vaccines. They have been shown to offer 100% protection against cervical precancerous development and, in the case of quadrivalent cancer, also against genital warts caused by HPV types in the vaccine, with few or no side effects. The protective effects of the vaccine are expected to last at least 4.5 years after initial vaccination.

While the study period was not long enough for cervical cancer to develop, it is believed that prevention of cervical precancerous lesions (dysplasias) is highly likely to result in the prevention of those cancers.

Although a 2006 study suggests that vaccines may offer limited protection against some HPV types that are closely related to HPV 16 and 18, it is clear that other high-risk HPV types may avoid the protection produced by vaccines,[7] and a 2006 study of HPV infections in female college students found that only 14 of 78 HPV infections with HPV types The 64 infections were with 16 and 18 other high-risk HPV types. Ongoing research is focused on developing HPV vaccines that will offer protection against a wider range of HPV types. There is also substantial research interest in the development of therapeutic vaccines, which attempt to elicit immune responses against established HPV infections and HPV-induced cancers.

However, various medical societies, such as the Spanish Society of Family and Community Medicine (semFYC) have expressed their reservations about the widespread vaccination of this age group.

On the other hand, eight other scientific societies (AEDV, AEP, AEPCC, AEV, AMYS, SEGO, SEMERGEN and SEMG) together with the Spanish Association Against Cancer published in 2008, a consensus document on vaccination against HPV in which the efficacy, safety, cost-efficacy and recommendations of age groups are analyzed, establishing the range between 9 and 14 years old as the "top priority" for HPV vaccination in girls and adolescents, since the vaccine is most effective before they have been exposed to the virus (which is transmitted by sexual contact).

It is estimated that 50 to 80% of women may become infected with HPV during their lifetime. More than 80% of HPV infections are transient, without symptoms and resolve spontaneously. Others may progress to cervical cancer, as this cancer is caused by a persistent HPV infection. Two age peaks in the development of cervical cancer have been described: in adolescence and between 40 and 50 years of age. Men, although they can also be infected with the HPV virus, only rarely develop genital cancer.

Epidemiology

Of the more than 170 known types of HPV, 37 are known to be transmitted through sexual contact. Worldwide, sexually transmitted HPV infection is very common in adult populations. Although some HPVs, such as types 6 and 11, can cause genital warts, most genital HPV infections occur without causing any symptoms. However, persistent infections with a subset of about 19 "high-risk" HPV types that can lead to the development of cervical cancer or other genital/anal cancers, and some forms of HPV, particularly type 16, have been found to be associated with a form of throat cancer. Only a small percentage of women with HPV will develop cervical cancer, yet most scientific studies have found that HPV infection is responsible for virtually all cases of cervical cancer.

The latest generation of preventive HPV vaccines are based on particles of the virus capsule, that is, they do not contain viral DNA from the nucleus and therefore, their ability to infect is totally nullified, they are the so-called virus particles (VLPs) assembled from proteins of the capsule (capsid) of HPV. The vaccines target the two most common high-risk HPVs, types 16 and 18. Together, these two types of HPV currently cause about 70% of cervical cancer. Gardasil is also active against HPV types 6 and 11, which between them currently cause about 90% of all cases of genital warts, with few or no side effects. The protective effects of the vaccine are expected to last at least 4.5 years after initial vaccination. The protective effects of Gardasil last at least 4.5 years after initial vaccination, covering 70% of cancer cases and 100% of genital warts caused by the aforementioned types. Cervarix protection has been documented for up to 8 years and is expected to last at least 20 years, and has cross-protection that also prevents against nearly 100% of cancer caused by strains 31, 33 and 45, providing superior total protection against precancerous lesions regardless of the HPV type involved greater than 90%. Both vaccines are intramuscular (given by injection into the arm) and are administered in three doses: the second one one month after the first and the third six months after the first (or five months after the second).

Since none of the vaccines can guarantee 100% protection against cancer or protect against 100% infections, it is recommended to continue with regular preventive testing. The Pap smear or cytology is the most common test and it is recommended to perform it annually, there is also colposcopy and other DNA tests. However, these tests have limitations, for example, they cannot

detect adenocarcinoma, a much more aggressive type of cancer that develops on the inside of the cervix. This type of cancer is usually detected when there are already symptoms such as bleeding outside of menstruation.

Commercial presentation

Cervarix

It received approval in Australia in May 2007 for women between the ages of 10 and 45. It is currently approved in more than 110 countries around the world including the United States, Japan and the European Union. This vaccine is marketed by GlaxoSmithKline. It is designed to prevent infection with HPV types 16 and 18, which currently cause about 70% of HPV-related cervical cancer cases. In addition, protection against virus strains 45, 33 and 31 was demonstrated in clinical trials, providing greater than 90% protection against precancerous lesions, regardless of the type of HPV involved. Variety 45 is responsible for 12.5% of adenocarcinoma cases. Cervarix is also formulated with AS04, a Glaxo-patented adjuvant that has been found to enhance the immune system's response for a longer period of time, as it has been shown to last for 8.5 years, although it is projected to be more than 20 years.

Gardasil

It is a vaccine against HPV types 6, 11, 16, 18 (human papillomavirus); it is marketed by the American company Merck & Co (MSD in Europe) in alliance with the French company Sanofi-Pasteur.Gardasil is designed to prevent infection with HPV types 16, 18, 6, and 11. HPV types 16 and 18 comprise about 70% of HPV-related causes of cervical cancer, while types 6 and 11 are associated with the development of genital warts.

A quadruple **vaccine is the one** that replaced the MMR vaccine (against diphtheria, whooping cough (pertussis) and tetanus) due to the added protection against invasive infections by Haemophilus influenzae type b, a bacterium that can cause severe infections such as meningitis, arthritis and pneumonia in children under 5 years of age and especially in those under 2 years of age.

This vaccine is given intramuscularly in the anterolateral region of the thigh to babies up to 15 months old or who do not walk, and in the arm to children who walk or older than 15 months.

The vaccination schedule consists of a three-dose immunization at 2, 4 and 6 months of age, followed by a booster at 18 months.

Adverse effects

Redness, swelling, pain, and appearance of a nodule that may remain for several weeks at the application site. Cold compresses or ice may be applied to the affected surface to relieve symptoms.

Fever and irritability are common side effects. Rarely, the vaccine can cause a temperature higher than 40ºC and persistent crying for more than three hours.

Precautions and Contraindications

Patients who after a dose of quadruple, quintuple or DPT vaccine have had a severe reaction, such as persistent crying for more than three hours, fever of more than 40ºC or seizures not attributable to another cause within 72 hours of applying the vaccine, should consult a doctor before continuing the vaccination schedule. All patients with a history of previous neurological disorders should consult their doctor before being vaccinated.

Acellular vaccines

Currently, acellular vaccines are in vogue, which are characterized by producing fewer adverse effects than common ones. The acellular vaccine contains only small purified portions of the bacterium Bordetella pertussis, combined with tetanus, diphtheria, antihaemophilus type b (quadruple acellular) vaccines and with the addition of Salk-type polio in the (quintuple acellular). It is given at the same age as traditional vaccines.

Acellular vaccines are the only ones used in the United States and many other developed countries

DNA VACCINE

The **DNA vaccine** is a recently developed vaccine, consisting of the direct injection of DNA through a plasmid or an expression vector. This DNA encodes an antigenic viral protein of interest, which will induce activation of the immune system. In this way, both neutralizing antibodies (humoral response) and immunity measured by cytotoxic T lymphocytes (cellular response) can be induced.

It works by inserting DNA from bacteria or viruses into human or animal cells. Some cells of the immune system recognize the protein that arises from foreign DNA and attack both the protein itself and the affected cells. Since these cells live a long time, if the pathogen (the one that creates the infection), which normally produces these proteins, is found after a long period, they will be instantly attacked by the immune system. One advantage of DNA vaccines is that they are very easy to produce and store. This type of vaccine began to be known in the 1990s, and even today, in 2011, numerous studies continue to be carried out within the field of experimentation. Although they are not for clinical use at the moment, their expectations are very promising. The way to apply these vaccines could be through liposomes (in creams), injections or through bioballistics.

Advantages

- Endogenous expression of the antigen, similar to natural infection.
- Continuous antigenic stimulation occurs that allows lasting immunity in the individual.
- It is easy and safe to produce DNA.
- DNA is a molecule that is stable against temperature variations, as long as it is within a certain range.
- DNA molecules would be transferred, which are easy to transport and constitute a lower biohazard.

Limitations and drawbacks

- Its efficacy is low and depends on the expression of the vector in the cells.
- Anti-DNA antibodies could be induced. It has been observed that the application of these vaccines in animal models has triggered a reaction towards the DNA molecules themselves, but their effect on humans is unknown.
- DNA could be integrated into the chromosome if care is not taken with the transcription promoter used.

MENINGITIS

Meningitis is a disease, characterized by inflammation of the meninges (septintensimal).

80% of meningitis is caused by viruses, between 15 and 20% by bacteria, the rest is caused by poisoning, fungi, medications and other diseases. Meningitis is rare but potentially fatal. It can affect the brain, causing unconsciousness, brain and other organ damage. Meningitis progresses very rapidly, so early diagnosis and treatment is important to prevent severe sequelae and death.

Although anyone can get meningitis, it is a disease that is especially common in children and immunocompromised people. The most common symptoms are headache, stiff neck, fever, abnormal intolerance to light or sounds, and disorders of consciousness. Often, especially in young children, only nonspecific symptoms, such as irritability and drowsiness, occur. The existence of skin rashes may indicate a particular form of meningitis, such as meningococcemia.

Meningitis may be suspected by the symptoms, but it is diagnosed with a medical procedure called a lumbar puncture, in which a special needle is inserted into the spine to remove a sample of cerebrospinal fluid, which surrounds the brain and spinal cord.

Treatment has to be immediate, with the use of antibiotics in the case of bacterial infections or antiviral in the case of viral meningitis. In some cases, corticosteroids such as dexamethasone are indicated to prevent the sequelae of inflammation, as they tend to produce a better neurological evolution.

Meningitis can potentially cause serious, long-term consequences, such as deafness, epilepsy, hydrocephalus, or cognitive deficit, especially in patients in whom treatment has been delayed. Certain vaccines can prevent some bacterial infections that cause meningitis.

History

It has been suggested that the concept of meningitis has existed since the days of Hippocrates and pre-Renaissance physicians including Avicenna. Sir Robert Whytt, the physician of Edinburgh, is credited with describing the term tuberculous meningitis in a postmortem report that appeared in 1768, although the association with tuberculosis and its causative microorganism was not established at that time until a century later.

Epidemic meningitis, on the other hand, seems to be a relatively recent phenomenon. The first major outbreak was recorded in Geneva in 1805.[9][10] Other epidemics reported in Europe and the United States were described soon after, while the first report of epidemic meningitis in Africa appeared in 1840. African epidemics became much more frequent in the 20th century, beginning with epidemics that swept through Nigeria and Ghana between 1905–1908.

The first report of a specific bacterium causing meningitis was made by Australian bacteriologist Anton Weichselbaum, who in 1887 described *Meningococcus*. The first reports indicated that the crude mortality rate was tremendously high, close to 90%. By 1906, an antiserum extracted from horses was produced, improved by Simon Flexner, an American scientist who markedly decreased mortality from meningococcal disease. In 1944, penicillin was first reported to be effective in combating meningitis. Finally, with the production of the *Haemophilus* vaccine, it led to a notable drop in the number of cases of meningitis associated with this bacterium, and evidence published in 2002 showed that treatment with steroids improved the prognosis of bacterial meningitis.

Epidemiology

Demography of meningococcal meningitis. Red: meningitic belt, orange: endemic, gray: sporadic cases

Meningitis affects any age group, from neonates to young people. However, meningitis affecting newborns in the first few weeks of life is rare. Because newborns still need development and maturation of the brain and its components, mortality from meningitis is much higher in neonates than in subjects of other ages. The frequency of meningitis in the first month of life seems to be between 0.5 and 1.0 per 1000 live births, in newborns under 2,500 grams it may be close to 1.5 - 2.0 per 1000, while in neonates under 1,500 grams of birth weight it can reach up to 50 per 1000 live births.

The meningitic belt corresponds to an area in sub-Saharan Africa that stretches from Senegal (west) to Ethiopia (east), where large epidemics of meningococcal meningitis occur (generally coinciding with the Sahel Region).[19] It has an estimated total population of 300,000,000 inhabitants. The largest epidemic outbreak occurred in 1996, where about 250,000 cases occurred and 25,000 people died from this disease.

Risk factors

Exposure to secondhand smoke has been associated with meningitis and other serious infections, but more studies are needed to have clear conclusions.[20] Patients with AIDS who have a history of being smokers, alcoholics, have upper respiratory infections, particularly chronic otitis media, and are allergic to penicillin are at risk of developing bacterial meningitis.

Some types of bacterial meningitis are spread through direct contact with secretions from an infected person's mouth or throat (for example, by kissing). Meningitis is not spread through casual contact.

There are other external causes or risk factors that can influence an individual's susceptibility to meningitis, including:

- Age: in infancy and early childhood or over 60 years of age
- A weakened immune system due to HIV infection or other immunosuppressive conditions such as prolonged glucocorticoid treatments, complement deficiency (C1-C4), diabetes mellitus, and kidney failure
- Alcoholism
- Living in close proximity to other people, such as in dormitories and military barracks (for meningitis due to meningococcal meningitis)
- Splenic dysfunction produces an increased susceptibility to meningitis and sepsis, particularly pneumococcal sepsis
- Virulence factors of the microorganism, such as the presence of a bacterial capsule.

Meningitis is mainly caused by an infection. However, there are many germs in the environment capable of reaching the meninges and causing damage to a greater or lesser extent. The main culprits are viruses or bacteria, although it is rarely caused by other organisms.

Meningitis viral

Viruses account for about 80% or more of the causes of meningitis, the most common of the meningitis conditions. Meningitis caused by viruses is almost always considered benign and usually cures without any specific treatment. Reaching such a point, that most people around the world have suffered from viral meningitis throughout their lives and have not realized it.

They are mostly infected by viruses that are not well known by name (enteroviruses: coxsackie *and* echovirus *viruses*, *adenoviruses*, attenuated viruses from some vaccines, etc.) or well-known viruses (flu viruses, herpes viruses, chickenpox viruses, mumps viruses, measles viruses, etc.) For this type of virus, there is no treatment (except for chickenpox and herpes) and they tend to heal on their own without leaving sequelae.

It is estimated that they represent 15% to 20% of the most common causes of meningitis. In newborns, the incidence of bacterial meningitis is between 20 and 100 cases per 100,000 live births. The new vaccines that are usually given to all children have decreased the incidence of invasive meningitis caused by *Haemophilus influenzae type b* (Hib), the leading cause of bacterial meningitis before 1990. In most countries today, the main organisms causing bacterial meningitis are *Streptococcus pneumoniae* and *Neisseria meningitidis*.

- *Neisseria meningitidis* or *meningococcus*: It is the most common cause of bacterial meningitis in children. There are different types of *meningococcus* (type A, B, C, D, X, Y, among others). Although most types of *meningococcal* have effective vaccines, type B has no vaccine, being the most predominant bacterium. Because of this, vaccines are available to protect against only one type of *meningococcus* and not for all of them in general. It is important to note that this bacterium is dangerous not only because of its ability to produce meningitis, but also because it is the cause of other diseases, such as pharyngitis, pneumonia, arthritis, among others. However, the most dangerous of them is meningococcal sepsis, a generalized disease in the blood (when the bacteria invades the blood), which can cause death suddenly or in a few hours, this being one of the main causes of death from meningitis.
- *Haemophilus influenzae*: Responsible for meningitis in young children, between 3 months and 3 years of age. However, it can be the cause of other diseases. To eradicate this bacterium, the Hib Vaccine has proven to be really effective. There is a type B of this bacterium, better known as Influenza haemophilus type b (Hib). This bacterium has been almost completely eliminated in most Latin American countries with the incorporation of public vaccination programs. In countries with fewer resources—where the use of this vaccine has not been widespread—meningitis caused by this bacterium is still the leading cause of morbidity and mortality in infants and children
- *Streptococcus pneumoniae* or pneumococcus (pneumococcal meningitis): Affects children under one year of age. It is one of the worst in terms of sequelae, as the child can be left with deafness. It is also the cause of other diseases, such as: otitis, sinusitis, pneumonia, among others.

- Many other bacteria can cause meningitis: In newborns *Streptococcus agalactiae*, *Listeria*, *Escherichia coli*, among others. The *Staphylococcus* family of bacteria is responsible for skin diseases, arthritis, pneumonia, and meningitis.[2] Pseudomonas aeruginosa *meningitis* is a rare but very serious infection that is highly fatal and at high risk of sequelae, especially due to the virulence of the strains and the molecular mechanisms of antibiotic resistance

Fungal Meningitis

Candida, Histoplasma, Coccidioides and Cryptococcus *are some* fungi that can frequently cause meningitis. Most of these cases of fungal meningitis occur in subjects who already have a disease that suppresses their immune system, such as AIDS or cancer patients. The fungi that cause meningitis are usually located in the environment and are transmitted through the air. Coccidioidal meningitis can be fatal if left untreated.

Other causes

Bacteria and viruses are not the only causes of meningitis, there are also other conditions such as: tuberculosis bacteria, fungi, parasites, malaria, etc. Although the most frequent cause is microorganisms (viruses, bacteria, fungi or parasites), we can also speak of meningitis when inflammation at this level is due to certain diseases, poisoning, etc. It should also be noted that some other bacteria, chemical agents and even tumor cells can cause meningitis. Encephalitis and brain abscess may accompany meningitis as a complication (due to the spread of the bacteria to neighboring brain structures).

Patients with skull base fracture can get meningitis because the central nervous system comes into contact with bacteria from the nose and throat.

Patogenia

Purulent inflammatory exudate at the base of the brain due to meningitis

Some cases of meningitis occur from microorganisms that gain access to the central nervous system (CNS) through the blood, while others do so through a neighborhood focus, such as in otitis media or through the nasal passages. Other cases gain access to the CNS directly as a result of open trauma or neurosurgery. In the newborn, the disease is transmitted vertically, that is, from the microorganisms that colonize the intestinal or genital tract, or horizontally through contact with health personnel or those in charge of the newborn after delivery. The virulence of the microorganism, in the case of infectious meningitis, and the immune characteristics of the host are some of the factors that affect the development of meningitis.

Once in the CNS, a shortage of antibodies, complement elements, and white blood cells allows microorganisms to flourish. Even in non-infectious meningitis, inflammation is the characteristic element of the disease and increases the permeability of the blood-brain barrier, causing edema. In bacterial meningitis, the cell wall and lipopolysaccharides are the elements that stimulate the mediators of inflammation. This phenomenal inflammatory cascade is not a direct product of the bacterial infection, but is the nervous system itself reacting to the presence of the invading microorganism. When components of the immune system in the CNS, such as astrocytes and microglia, recognize bacterial cellular components, they respond with the release of cytokines, such as tumor necrosis factor and interleukin-1, which are mediators very similar to hormones which recruit other immune cells and stimulate other tissues to participate in the inflammatory reaction. The increase in the permeability of the blood-brain membrane causes vasogenic edema, the cerebrospinal fluid fills with neutrophils causing inflammation of the meninges and interstitial edema which, over the hours leads to a third type of edema, cytotoxic edema: the most serious.

Infectious and inflammatory exudate spreads throughout the CNS, especially in the cistern of Silvio's fossa, the space between the arachnoid and the lateral fossa of the brain, damaging cranial nerves such as the eighth pair, resulting in hearing loss. This inflammatory component is capable of obliterating the passages of the central nervous system, causing obstructive hydrocephalus, as well as vasculitis and thrombophlebitis, producing localized cerebral ischemia.

Cytotoxic edema is characterized by an increase in water within brain cells, mainly due to a deficiency in ion transport pumps on cell membranes. Vasogenic edema tends to occur due to the passage of fluid from the intracellular to the extravascular space. Both cases occur in response to inflammatory effects. Edema causes increased intracranial pressure, making it more difficult for blood to reach brain neurons, thus decreasing oxygen supply, which leads to cell death or apoptosis, which causes the sequelae of meningitis.

In many cases of meningitis, the syndrome of inadequate secretion of antidiuretic hormone can occur and produce a decrease in the concentration of sodium in the body, called hyponatremia. This disorder can cause nervous system dysfunction on its own, as well as worsen cerebral edema.

The pathophysiology of nonbacterial pathogens is not yet well understood, although fungal meningitis is thought to proceed very similarly to bacterial meningitis.

Clinical picture

The classic symptoms of meningitis develop within several hours or may take 1 or 2 days. Among them are:

- Fever: Viral meningitis can cause fever to varying degrees; from cases with little fever (usually) or no fever, to others in which the temperature can exceed 39 °C. Bacterial meningitis usually causes high fevers.
- Headache: The back of the head is where the pain is centered, although sometimes it is generalized. However, there are many other causes of headaches: a migraine (migraines), a flu process, etc.
- Neck stiffness

Each of the signs and symptoms of this classic clinical triad occurs in more than 90% of patients older than 18 months with meningitis. When any of the three occurs, you should be alert to their presence and consult your doctor as soon as possible. It is important to know that, since the condition usually evolves progressively, the three symptoms may not be present until some time has passed and, thus, the diagnosis is inevitably delayed.

These symptoms are not the only ones that can occur, about 75% of patients have altered mental status, which can range from lethargy to coma. Other symptoms may include:

- Red or purple rash
- Cyanosis (bluish discoloration of the skin)
- Nausea and vomiting
- Sensitivity to bright colors (photophobia)
- Sleepiness
- Mental confusion
- Seizures, present in 20 to 30% of cases

The above symptoms are mainly for adults, although they also occur in children. However, in newborns and children, the classic symptoms are difficult to detect. This is because many symptoms in children and newborns are unreliable, for example, children under three months of age who have a fever are usually diagnosed with meningitis. Symptoms include:

- Inactivity
- Unexplained high fever or any form of temperature instability, including low body temperature
- Irritability
- Vomit
- Jaundice (yellowing of the skin)
- Eating little or refusing to eat
- Tension or soft bumps between the bones of the skull
- Difficulty waking up

As bacterial meningitis progresses, patients of all ages may experience strokes.

Diagnosis

Lumbar puncture, the diagnostic test for infectious meningitis

Bacterial meningitis can lead to death in a matter of hours, because of this, treatment and timely diagnosis are vital. That's why when the initial diagnosis is made, doctors rely on symptoms and physical examination, which emphasizes the nervous system. Meningitis is suspected in anyone who has a sudden change in mental status, has a first-onset seizure episode, the sudden onset of a central nervous system disorder, or petechiae. Although physical examination and paraclinical tests such as laboratory tests and radiology are important for the diagnosis of meningitis, the most important test to diagnose or rule out meningitis is lumbar puncture by a medical professional.

Physical Exams

Three signs characterize meningitis, discovered by tests during the physical exam. Neck stiffness occurs in 60 to 80% of cases, with meningeal irritation also manifesting due to Brudzinski and Kerning's signs. Although these signs attenuate with treatment, they persist for a long time. The absence of these signs does not rule out meningitis.

- Neck stiffness, performed by the doctor by bringing the chin in the direction of the subject's trunk. When it becomes impossible to bend it, the patient has neck stiffness, so tests will be necessary to confirm the disease.
- Brudzinski's sign, consists of lying down the patient and flexing his head upwards. The stiffness of the neck will make it impossible to bend or that it will involuntarily bend the legs.
- Kernig's sign, is the rigid response of the nape of the neck when hip flexion is attempted, that is, when the trunk is brought closer to the knees

There are other ways to explore neck stiffness. One of them to explore it at home is done with a piece of paper, the child is asked (either standing or sitting) to be able to hold it, without it falling, between the chin and the chest (the mouth must remain closed). Of course, this does not necessarily indicate meningitis, as they can be other more common causes.

In children under 1 year of age, this stiffness does not usually occur, so the pediatrician in this case also palpates the anterior fontanel to determine its bulging. If it is bulging, meningitis must be ruled out, although there are other causes of bulging of the fontanel.

Other tests may be done to screen for meningitis. These can be:

- **Lumbar puncture** (spinal tap): This is the fundamental test. The goal is to collect cerebrospinal fluid (CSF) to analyze it and look for viruses and bacteria. This procedure is usually done with the patient sitting and hunched forward; sometimes lying on his side with his knees curled towards his abdomen and his chin close to his chest. Changing the

position or not maintaining it carries a risk of damage to the spinal cord. The doctor anesthetizes the skin and inserts a needle between the lower lumbar vertebrae to collect a few drops of CSF, a procedure that takes about 30 minutes. The needle produces a strong pressure sensation that may be accompanied by mild, momentary pain when it passes through the tissue surrounding the spinal cord. Lumbar puncture is contraindicated in people with brain masses or with elevated intracranial pressure from trauma or other causes, due to the possibility of a brain herniation.

- **Other cultures**: Urine, blood, mucous membranes, or pus samples are taken due to skin infections. Although cerebrospinal fluid culture is crucial in determining the causative agent, sometimes blood culture can determine the etiology. A blood test may be necessary to guide the cause and objectify the degree of infection, although it is not definitive.
- **MRI** (magnetic resonance imaging) or **computed tomography**: This makes sure that the inflammation is not due to another cause (such as a tumor).

Other studies that can be performed among patients suspected of having meningitis are biochemical studies, Gram staining (to detect the presence of germs if the presence of germs is possible and guide the diagnosis) and, if possible, it should be done after a CT scan (essential only if the presence of an abscess is doubtful). Empirical treatment with antibiotics and anti-cerebral edema treatment should be started quickly. If a lumbar puncture cannot be performed due to cerebral edema or a possible concomitant brain abscess, treatment with a broad-spectrum antibiotic should be started in any case and subsequently substituted by a more specific antibiotic, depending on the results of blood culture studies. Seizures frequently occur during the course of meningitis and are treated with anti-spasmodic medication, such as phenytoin.

There is a type of bacterial meningitis called "decapitated." For this type of meningitis, it is difficult to know if it is a bacterial or viral infection. This difficulty is due to the fact that the child has taken, days before, antibiotics that mask the real cause of it (bacterial).

Microbiologist of the United States Centers for Disease Control and Prevention department of meningitis, preparing microorganism typing, important for the specific treatment of meningitis.

Treatment depends entirely on whether the meningitis is viral or bacterial. It will be necessary to wait a few days, while the bacteria grows in a culture medium, to be able to confirm the real cause of meningitis. Most of the patients are treated in hospital. When treated immediately, more than 90% of people with bacterial meningitis survive.

The most common measures addressed in the treatment of meningitis include:

- Antibiotics, mainly for bacterial meningitis, by intravenous therapy;

- Measures to reduce intracranial pressure, such as corticosteroid medications such as dexamethasone, for both children and adults. Analyses of previous studies have found that the benefit of corticosteroids is not as significant as previously believed
- Antipyretics to reduce fever, if present, such as acetaminophen, plenty of fluids and good ventilation;
- Measures to prevent seizures including medications such as phenobarbital or phenytoin, because seizures increase intracranial pressure (lorazepam 0.1 mg/kg IV with phenytoin 15 mg/kg or phenobarbital 5-10 mg/kg);
- Oxygen therapy, in cases of respiratory distress, either by a mask, a nasal cannula or by intubation;
- Monitoring of body fluids as well as the chemical components of blood plasma.

Meningitis viral

Viral meningitis are almost always benign and there is no specific treatment for them except symptomatic (treating headache, fever and vomiting). Only meningitis due to chickenpox or herpes has a specific treatment with drugs such as acyclovir or ribavirin. The benignity of the viral diseases justifies that some children are sent home without requiring admission to hospital. A child with viral meningitis requires rest, plenty of fluids, and pain relievers (ibuprofen or paracetamol).

Meningitis bacteriana

While waiting for the results of diagnostic tests, broad-spectrum antibiotics are usually started intravenously. Once the causative organism is identified, the antibiotic used to counteract the disease depends on the type of bacteria isolated. For the treatment of bacterial meningitis, the following are used:

Antibiotics

- ✓ Antibiotics are given intravenously as soon as meningitis is suspected, in the case of meningococcal meningitis, the most logical opposition is ceftriaxone: in Haemophilus, combinations of amoxicillin plus chloramphenicol or clavulanic acid can be used, but an antibiotic that crosses the blood-brain barrier is ideal. Antibiotics may be changed once tests have identified the exact bacterial cause. Patients usually stay in the hospital until the fever has subsided and the cerebrospinal fluid is free of infection.
- ✓ In newborns younger than 1 month, a combination of ampicillin (age 0-7 days: 50 mg/kg IV c/8h; age 8-30 days: 50-100 mg/kg IV c/6h) plus cefotaxime 50 mg/kg IV c/6h (maximum 12 g/day) or gentamicin (age 0-7 days: 2.5 mg/kg IV or IM c/12h; age 8-30 d:

2.5 mg/kg IV or IM c/8h). This covers enterobacteriaceae, streptococcus, and *L monocytogenes*.

- ✓ In infants aged 1 to 3 months, cefotaxime (50 mg/kg IV c/6h, maximum 12 g/day) or ceftriaxone (initial dose: 75 mg/kg, 50 mg/kg c/12h maximum 4 g/day) plus ampicillin (50-100 mg/kg IV c/6h) is indicated. Alternatively, chloramphenicol (25 mg/kg PO or IV c/12h) plus gentamicin (2.5 mg/kg IV or IM c/8h) is indicated. Vancomycin is used for organisms resistant to chloramphenicol.
- ✓ In children aged 3 months to 7 years, cefotaxime (50 mg/kg IV c/6h maximum 12 g/day) or ceftriaxone (initial dose: 75 mg/kg, then 50 mg/kg c/12h maximum 4 g/day) is used. In regions with low prevalence of *resistant S pneumoniae*, penicillin G (250,000 U/kg/day IM/IV in 3-4 divided doses) may be considered . A combination of chloramphenicol (25 mg/kg PO/IV c/12h) and vancomycin (15 mg/kg IV c/8h) can be used as an alternative.
- ✓ In older school children, adolescents and adults without underlying diseases and in regions with *resistant S pneumoniae*, vancomycin is administered (pediatric dose: 15 mg/kg IV c/8h; adult dose: 750-1000 mg IV c/12h or 10-15 mg/kg IV c/12h) plus cefotaxime (pediatric dose: 50 mg/kg IV c/6h maximum 12 g/d; adult dose: 2 g IV c/4h) or ceftriaxone (pediatric dose: initial dose: 75 mg/kg, then 50 mg/kg c/12h maximum 4 g/day; adult dose: 2 g IV c/12h). Some administer rifampin (pediatric dose: 20 mg/kg/d IV; adult dose: 600 mg PO daily). In regions where resistance to *S pneumoniae* is <2% of cases or if Listeria infection is suspected , ampicillin (50 mg/kg IV c/6h) plus third-generation cephalosporin is used. For allergic patients, chloramphenicol, clindamycin or meropenem are used.
- ✓ **Corticosteroids**: Corticosteroids are usually given intravenously in the early course of treatment to control inflammation and to reduce the body's production of inflammatory substances that may cause harm later in life. It has been recognized that the administration of antibiotics initially worsens meningeal inflammation by increasing the amount of bacterial degradation products released as a result of the destruction of microorganisms. For this reason, glucocorticoids are usually administered about 30 minutes before antimicrobial administration in order to reduce the immune response to this phenomenon (dexamethasone 0.4 mg/kg IV c/12h for 2 days or 0.15 mg/kg IV c/6h for 4 days).
- ✓ **Fluid Replacement**: Fluid loss due to fever, sweating, or vomiting is carefully replaced to avoid complications of fluid overload.
- ✓ When a child has a very severe headache or repeated vomiting, temporary admission to the hospital is necessary to administer intravenous fluids or analgesics.

- ✓ Cases associated with sepsis (generalized blood infection) or encephalitis (brain infection) usually require treatment in an intensive care unit.

Rifampin is usually given prophylactically or a single dose of ciprofloxacin or levofloxacin to patients' family members as well as hospital staff in contact with the patient with meningococcal meningitis or *H. influenzae*.

Prevention

There are different ways to prevent meningitis. Some meningitis vaccines on the market only protect a single type of bacteria. There are vaccines against meningococcal C, another that protects against *Haemophilus influenza* type B (Hib) and, also, pneumococcal vaccine. That is why when one receives a vaccine against meningitis (currently referred to as the meningocus C vaccine), one will only be immune to the type of germ but not to the rest of the multiple possibilities. In other words, even if we receive many vaccines against meningitis, it is always possible to contract meningitis from other germs or external causes.

Immunizations

The development of certain vaccines has practically eradicated some diseases, including bacterial meningitis. Unfortunately, a broad-specificity vaccine for N. meningitidis group B is not yet available, although there are vaccines developed in Norway, Cuba, and the Netherlands for the specific strains that attack those countries; It is expected that such a vaccine will be achieved through "reverse vaccinology" or "genomic mining" techniques. There is no vaccination against the viruses that cause viral meningitis. A vaccine is currently being worked on to help protect against invasive pneumococcal disease.

The *Haemophilus vaccine* (Hib vaccine) in children helps prevent a type of bacterial meningitis. They are safe and highly effective vaccines.

The meningococcal vaccine is effective in people who live in dormitories or other enclosed rooms, as well as for people who travel to destinations where outbreaks of meningococcal meningitis are common. The MPSV-4 polysaccharide vaccine and the newer MCV-4 vaccine can prevent 4 types of meningococcal disease, but not all types of the disease.[5]

The *S. pneumoniae* vaccine is useful in older people, including those with multiple myeloma who may be at high risk for pneumococcal meningitis. The pneumococcal vaccine exists in polysaccharide form for elderly patients and a conjugate form that seems more effective for infants. The pneumococcal conjugate vaccine is now a routine immunization procedure in children to prevent pneumococcal meningitis.

Some communities carry out vaccination campaigns after an outbreak of meningococcal meningitis. Military recruits are routinely vaccinated against this form of meningitis because of its high incidence rate.

The *American Academy of Pediatrics* and the *American College Health Association* recommend that college students (especially freshmen living in residence halls) consider getting vaccinated against meningococcal meningitis.

Antibiotic therapy

It is highly recommended that household contacts and people very close to the patient with meningococcal meningitis receive preventive antibiotic treatment to avoid becoming infected. Rifampicin or Isoniazid are usually used as drugs of choice for chemoprophylaxis.

There is no evidence that preventive antibiotics reduce infection of the brain coverings (meningitis) in people with skull base fracture.

Preventive antibiotics that are given to doctors or family members in close contact with infected patients. Pasteurization of milk and dairy products to prevent meningitis due to *Listeria monocytogenes,* and it is advisable to monitor maternal infection before and during labor for the prevention of meningitis in newborns.

NEISSERIA MENINGITIDIS

Neisseria meningitidis, also known by its simpler name of *meningococcus*, is a gram-negative heterotrophic diplococcal bacterium, of public health importance for its role in meningitis[1] and other forms of meningococcal disease. It only affects human beings since there is no reservoir. It is the only known form of bacterial meningitis to cause epidemics.

Strains

There are many strains of meningococci, clinically the most important are A, B, C, Y, W135

- *A* - in sub-Saharan Africa; vaccination is recommended before travelling, with the *Men A&C vaccine*.
- *B* - is the most lethal form, comprising 40% of deaths in the UK. The changing nature of group B has preventive training of general B vaccine, in the UK. However, the MeNZB vaccine has been developed against a specific breed of group B meningococcus, used to control an epidemic in New Zealand.
- *C* - causes approximately 60% of cases in the UK, until the successful introduction of an infant vaccination programme. Previously , *the unconjugated* C component of *Men A&C*

was ineffective in children under 2 years of age. The development of a conjugated form (*Men C conj*) was necessary to elicit childhood immunity.

- *W135* - is particularly a problem for annual pilgrims to Mecca. Saudi Arabia requires everyone who approaches Hajj to have a Men W135 vaccination certificate.
- *X* - A large expansion of meningitis caused by serogroup X was reported in Niger in 2006.[2] This outbreak was particularly dire due to the lack of any vaccine against this breed.
- *Y* - In the last decade, serogroup Y has emerged as a cause of disease in North America.

Diagnosis

Direct a.Samples – CSF blood culture b.Cultures- placing the microorganism in a mixed medium can be identified by gram staining and oxidase test.c.Smear- gram staining with centrifuged cerebrospinal fluid or in material aspirated from petechiae. d.Serology- Antibodies to meningococcal polysaccharides can be measured by agglutation tests with latex beads or hemoglutination or by their bacterial activation.

Vaccinations

There are currently two vaccines available in the U.S. to prevent meningococcal diseases. **Menactra® is licensed for use in people aged 11 to 55, while Menomune® is used outside that age range and for travelers.**

Neisseria meningitidis has 13 clinically significant serogroups. They are classified according to the antigenic structure of their polysaccharide capsule. Five serogroups, A, B, C, Y, W135 are responsible for virtually all cases of disease in humans. There are currently no effective vaccines for serogroup B, although a putative vaccine is being tested in clinical trials in New Zealand.

POLYSACCHARIDE VACCINES

Conjugate vaccine

The two quadrivalent (i.e., target serogroups A, C, W-135, Y) meningococcal vaccines available in the U.S. are MCV-4 (a Menactra conjugate vaccine **manufactured by Sanofi Pasteur introduced in January 2005) and MPSV-4 (a polysaccharide vaccine sold as Menomune®, also from Sanofi Pasteur).®**

Menomune has a number of problems. Duration of action: short (3 years or less in children under 5), due to not generating memory in T-cells. Aware of this problem, and repeating the immunization results in a decrease in the antibody response, so amplifiers are not indicated with this vaccine. In common with all polysaccharide vaccines, Menomune does not produce mucosal

immunity, so people can be colonized with virulent strains of meningococcus, and not develop immunity. For this reason, Menomune is eminently useful for travelers who require short protection, but it has no place in the National Public Health Programs.

Menactra contains the same antigens as Menomune, but they are conjugated to diphtheria toxoid. It is desirable that this formulation overcomes Menomune's limitations. Menactra is only licensed for people between 11 and 55, so outside of that range, only Menomule can be offered.

A study published in March 2006, comparing the two vaccines, found that 76% of subjects still maintained passive protection three years after receiving MCV-4 (63% protected compared to controls), but only 49% had passive protection after receiving MSPV-4 (31% protected compared to controls).[9] This implies that the timing of the recommendations for when to give meningococcal vaccine, as there is no evidence that any of the current vaccines offer continuous protection beyond three years.

VA-MENGOC-BC:® Cuban vaccine against meningococcal disease caused by serogroups B and C.

VA-MENGOC-BC is produced by the Finlay Institute of Cuba. This vaccine is indicated for active immunization against meningococcal disease caused by serogroups B and C. Its use is recommended from three months of age onwards, in residents of endemic-epidemic areas, or who travel to those areas. It is recommended for people living in closed communities, such as kindergartens, boarding schools, military camps, prisons, densely populated areas, and in any community where cases or carriers of meningococci of serogroups B and C have been present, and are therefore at risk of contracting the disease.

Pertussis

Pertussis (also known as **whooping cough** or **whooping cough** or **whooping** cough) is a highly contagious acute infectious disease of the upper respiratory tract, caused by bacilli of the species *Bordetella pertussis*. It is characterized by bronchial tracheal inflammation and typical attacks of violent, spasmodic cough with a sensation of suffocation, which end with a strident noise (**convulsive or convulsive cough**) during inspiration. A similar but milder disease is caused by *B. parapertussis* and other organisms that are collectively called *coqueluchoid syndrome*.

Its complication can affect the nervous system and myocardium. Although this disease can be suffered at any age, the most affected are children under five years of age. It spreads during spring and summer. The incidence of pertussis in developed countries is very low thanks to vaccination, although worldwide, there are approximately 30-50 million cases of pertussis and over 300,000 deaths annually. Overall, despite high coverage with the DPT and DTaP vaccines, pertussis is one of the leading causes of vaccine-preventable deaths worldwide. Most deaths occur in young children

who are either unvaccinated or incompletely vaccinated — three doses of the vaccine are needed for complete protection against pertussis. Ninety percent of all cases occur in the Third World. Canada is the only developed country where pertussis is endemic.

History

The first clinical description of pertussis was in 1578, defined under the name *tussis quinta*. Subsequently, Thomas Sydenham in 1679, and Thomas Willis in 1682 categorized the disease from which many epidemics in Europe during the eighteenth and nineteenth centuries were described. The bacterium was not isolated until 1907 by Belgian Jules Bordet—hence the name of the bacterium—and Octave Gengou using a culture with potato extracts. At first it was included with the genus *Haemophilus*, but since it did not require the X and V factors, the genus Bordetella was created. The vaccine was developed in 1923 by Madsen (Great Britain) and the genome of the bacterium was sequenced in 2002. The vaccine has helped reduce disease severity and mortality, but unfortunately only in industrialized countries.

Epidemiology

Prior to pertussis vaccines, an average of 157 cases per 100,000 were reported in the United States, with peaks every two to five years; more than 93% of cases occurred in children younger than 10 years of age. The actual incidence is probably much higher. After vaccination was introduced in the 1940s, the incidence fell sharply to less than 1 per 100,000 in 1970 in that country.

The incubation period is usually 5 to 10 days, although it can be up to 21 days. The carrier can spread pertussis from the onset of symptoms until three weeks after the onset of coughing episodes. The contagious period is reduced to five days after the start of antibiotic therapy.

Pertussis is spread mainly through direct contact with secretions from the nose and throat of infected people. Older siblings who may carry the bacteria in their nose and throat can often bring the disease home and infect the baby in the family. In general, an infection confers prolonged immunity.

Etiology

Bordetella pertussis is the causative agent of pertussis, a small Gram-negative, aerobic bacterium about 0.3-0.5 μm wide and between 1.0 and 1.5 μm long, non-motile and encapsulated. Its pathogenicity is based on the production of many proteins, some of them toxins and adhesion molecules, with preference to the ciliated epithelium, which is also partly responsible for its pathogenicity. Their surface antigens, linked to fimbriae, are agglutinogens incorporated into acellular vaccines. Pertactin is an immunogenic outer protein of the bacterium's membrane that

serves for cell adhesion, also used in some acellular vaccines. Another likely adhesion molecule is tracheal colonization factor.

B. *pertussis* is also a toxin-producer. Evasion of the immune response is an important factor in the virulence of *B. pertussis*, mediated by the toxin adenyl cyclase. The toxin is located on the bacterial surface and increases the concentration of cyclic AMP by inhibiting phagocytic function. On the other hand, tracheal cytotoxin derived from peptoglycan produces paralysis of the respiratory cilia and although it is not immunogenic, the symptoms of the clinical picture begin.

Toxina pertussis

The pertussis toxin is a protein complex of six components or subunits organized into an A-B structure. One component is enzymatically active and consists of the S1 subunit, while the B component is the binding part of the receptor and is composed of the S2-S5 subunits. The bacteria release the toxin inactively. When the B subunit binds to the cell's membrane receptor , the A subunit is activated, probably through the action of ATP and glutathione.

Pertuschoid Síndrome

Infection by *Bordetella parapertussis* causes less than a fifth of cases with pertussis, while 40% of these are usually asymptomatic and another 40% are simple acute bronchitis. Other organisms that can cause a coqueluchoid syndrome include *Bordetella bronchiseptica*, *Mycoplasma pneumoniae*, *Chlamydia trachomatis*, and viruses such as adenovirus and respiratory syncytial virus.

The possibility of foreign body fouling, including tumors or lymphadenopathy, should always be suspected as well. Certain toxic inhaled gases and acidic substances can produce very similar symptoms.

Clinical picture

The time from exposure to the development of symptoms (incubation period) is estimated to be between three and fifteen days. In the initial stage (catarrhal stage) it looks like a common cold. It presents with sneezing, red eyes, and mild fever. Then the paroxysmal stage appears with a brief, dry and irritating cough that persists.

The appearance of the characteristic cough reveals the beginning of the second stage. Seizures occur at regular intervals, sometimes repeating rapidly and sometimes at intervals of several hours. Vomiting usually occurs immediately after the crisis. Finally, the convalescence stage lasts approximately 1 to 3 months, characterized by a gradual resolution of coughing episodes.

Pertussis begins as a mild upper respiratory infection. At first, the symptoms are similar to those of a common cold: sneezing, runny nose, low-grade fever, and mild cough. Within two weeks,

the cough becomes more intense and is characterized by many episodes of rapid coughing followed by a high-pitched squeal (pertusoid cough). There may be clear, thick mucous discharge. These episodes may recur for one to two months, and are most frequent at night. Older people and partially immunized children usually have milder symptoms.

Treatment

Treatment lies mainly in antibiotics, macrolides such as erythromycin or clarithromycin, if they are started early enough in the catarrhal stage. Unfortunately, most patients are diagnosed in the advanced course of the disease, when antibiotics may not be very effective. However, they can eliminate the presence of the bacteria in secretions and quickly reduce the patient's ability to spread the disease to others. In most cases with suspicious symptoms, the administration of the antibiotic is initiated without waiting for laboratory confirmation. Preventive antibiotic treatment is also recommended in people at risk of pertussis. The same is true for everyone in the patient's immediate environment, regardless of age or vaccination status.

Erythromycin is usually given in doses of 50 mg/kg each day, divided into 2 doses or a maximum of 2 g/day. The treatment should last 15 days. Azithromycin is given to children 10 mg/kg on day 1 and then 5 mg/kg on days 2 to 5 in a single daily dose, while in adults it is usually prescribed 500 mg on the first day and 250 mg on days 2 to 5. Cotrimoxazole may also be used for adults at doses of 800 mg every 12 hours for 15 days. Erythromycin is linked to the development of pyloric stenosis in sensitive newborns. In children over 2 months of age, trimethoprim (TMP)-sulfamethoxazole (SXT) is also considered as an alternative, at doses of 8 mg/kg TMP and SXT 40 mg/kg/day in 2 doses.

Babies younger than 18 months require constant supervision, as breathing may temporarily stop during coughing fits. Hospitalization of children younger than 6 months is warranted when pertussis is severe. It allows the creation of a mechanism for close cardio-respiratory surveillance and specialized nursing during the acute phase. The use of inhaled Nitric Oxide has not been satisfactory in pertussis.

Similarly, intravenous fluids can be administered and ensure proper hydration and nutrition if coughing fits are so severe that they prevent the patient from tolerating the oral route. Cough syrups, expectorants, and cough suppressants are usually not indicated and should not be given to patients with pertussis.

Prevention

The pertussis vaccine, developed in the 1940s, is usually given in combination with the diphtheria and tetanus vaccine. Immunization authorities recommend that the DTaP (diphtheria,

tetanus, and acellular pertussis) vaccine be administered at 2, 4, 6, and 15 to 18 months of age, and then 4 to 6 years of age. Maintaining good vaccination coverage has dramatically reduced pertussis morbidity and mortality.

The most effective control measure is to maintain the highest possible level of immunization in the community (group immunization). Treatment with certain antibiotics, such as erythromycin, can shorten the period of infection. People who are infected or likely to be infected should stay away from young children and infants until they receive the correct treatment. Treatment of people who are close contacts of pertussis is also an important part of prevention.

There are two main types of vaccines, the whole-cell pertussis vaccine, which are full of germs from the *Bordetella pertussis* , the bacteria responsible for pertussis, inactivated by heat or chemically. These vaccines are 95% effective after 3 doses and the duration of protection is about 8 years. However, these vaccines may have some adverse reactions.

The acellular pertussis vaccine, developed in Japan in the 1970s/80s. These contain 2 to 5 antigens of *Bordetella pertussis*. They are usually much more expensive than whole-cell vaccines and are not easily affordable for developing countries. These are vaccines that are 5 to 10% less efficient compared to whole-cell vaccines. However, it has a better tolerance with fewer side effects.

Adverse Events

DTaP can cause the following mild side effects that usually only last a few days:

- Fever
- Appearance of skin redness and pain at the injection site
- Vomiting and decreased appetite.

Moderate or severe reactions are very rare and may include:[9]

- Persistent crying syndrome, for more than 3 hours (1 in 1,000 children)
- Fever above 40.5°C (1 in 16,000 children)
- Seizures (1 in 14,000 children).

Contraindications

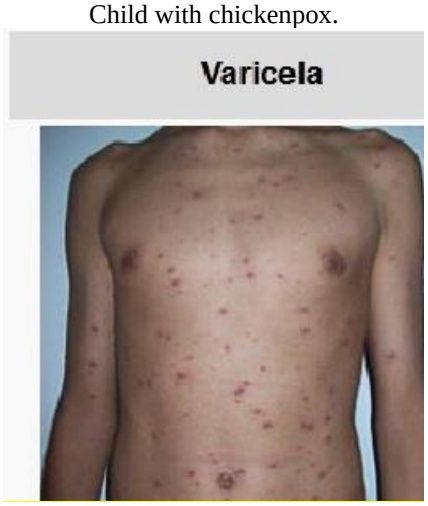
Pertussis vaccine should not be administered alone or in combination with other vaccines in patients with a history of allergy to vaccine components.

Complications

The most common complications of pertussis include pneumonia (15-20%), otitis media caused by secondary superinfection with *Haemophilus influenzae* or pneumococcus, anorexia, dehydration, encephalopathies, episodes of apnea, and death. Seizures are also found in about 2 to

4%, an unusual complication, occurring especially in 0.5% of patients with brain damage from encephalopathies, which is often permanent damage. The exact cause is not yet clear. Most hospitalizations and virtually all deaths occur in children under one year of age.

Child with chickenpox.



Chickenpox is a contagious disease caused by the varicella zoster virus, a virus of the herpesvirus family that is also the cause of shingles. It is one of the classic childhood diseases, which in children is usually mild but in adolescents and adults it has a higher risk of complications. Symptoms last about a week.

History

For years, chickenpox was thought to be a special form of smallpox. It was described for the first time in the sixteenth century, by different authors with the term *Cristalli* or *Flying Verol* (the flying smallpox virus). The expression chickenpox was coined by Daniel Sennert in 1632. Only the English physician William Heberden produced a clear distinction between chickenpox and smallpox. From the second half of the nineteenth century, Eduard Heinrich Henoch and Antoine Marfan specified the dangers of the disease. Hamburg-based dermatologist Paul Gerson Unna described the histological changes that distinguish chickenpox from smallpox. In the first half of the 20th century, the relationship between chickenpox and shingles gradually became apparent.

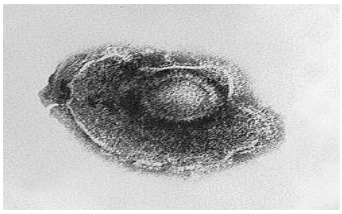
Epidemiology

Chickenpox can be seen at any time of the year, although it is more frequent in winter and spring in countries where there are differentiated seasons, but it is very common throughout the year, and mainly in temperate and medium-cold climate areas in countries where there are not totally differentiated seasons. The causative virus is only transmitted from person to person, either by direct contact with skin lesions or by air when it is expelled through coughing or sneezing. The incubation

period until the disease appears is 2 to 3 weeks. Patients are contagious from approximately 2 days before the rash appears. You can also get chickenpox from the lesions of a person with shingles.

Family contacts, those who contract the disease from another member of their family, usually present more severe forms than the first cases, probably due to more intense and continuous contact with the virus. Chickenpox is highly contagious, so when there is a sick person in the house, 80–90% of susceptible people living there end up contracting the disease.

Etiology



CHICKENPOX VIRUS UNDER ELECTRON MICROSCOPY.

Chickenpox is a viral infection caused by a herpesvirus of the genus Varicellovirus and the subfamily Alphaherpesvirinae. Taxonomy has called it human herpes virus 3 (HHV-3) whose only known reservoir is man. The virus has a double-stranded DNA (dsDNA). All viruses in this family surround their DNA with an icosahedral capsid with a triangular protein area covering it. In the adult population in Central Europe, about 93 to 96% of the population has detectable blood antibodies to chickenpox.

Patogenia

Chickenpox is usually acquired by inhaling airborne respiratory droplets from an infected host. The highly contagious nature of the chickenpox virus explains the epidemics that spread through schools from one child who is quickly infected to many other classmates. Chickenpox vesicles contain many viruses, so transmission can also occur by direct contact with these vesicles, although the risk is lower.

After initial inhalation of the contaminated respiratory droplets, the virus infects the mucosa of the upper respiratory tract. Viral proliferation occurs in the regional lymph nodes of the upper respiratory tract 2–4 days after initial infection and is followed by viremia 4–6 days postinfection. A second round of viral replication occurs in the internal organs of the body, especially the liver and spleen, followed by secondary viremia on days 14–16 postinfection. This secondary viremia is characterized by viral diffusion between capillary endothelial cells and the epidermis. Infection of the

virus to the cells of Malpighi's layer produces intercellular and intracellular edema, resulting in the classic gallbladder.

Exposure to the chickenpox virus in a healthy child initiates the production of antibodies. Antibodies of the immunoglobulin G type persist for life, generating immunity after an infection. Cell-mediated immune responses are also important in limiting the extent and duration of primary chickenpox infection. After primary infection, the virus is thought to spread from skin and mucosal lesions to sensory nerves. The virus remains dormant in the dorsal ganglion cells of these sensory nerves. The reactivation of the virus results in a clinically distinct form, shingles *syndrome*.

Clinical picture

The most characteristic sign of chickenpox is a rash on the skin that appears in the form of small pimples that quickly turn into vesicles (fluid-filled blisters). Vesicles usually appear first on the trunk, face, scalp, then spreading throughout the body. It can also affect the mouth, vulva and inside the ear canals. A day or two later, the vesicles turn into scabs. During the first few days, several waves of vesicles appear, so lesions can be seen at the same time in several evolutionary phases, which is known as a "starry sky" pattern. The skin lesions are usually very itchy (i.e., they cause the uncontrollable desire to scratch and/or the stinging sensation). When the scabs appear, the lesions will no longer be contagious.

In the prodromal period — the period before the rash appears, usually a day or two before — other mild symptoms such as fever, headache, malaise, loss of appetite, or vomiting usually occur. These symptoms usually persist during the first days of the disease.

Diagnosis

Gallbladder

Chickenpox is usually diagnosed by its typical clinical signs, without requiring any type of analysis. A vesicular and itchy rash in waves, especially if there is a recent history of contact with a chickenpox patient, is sufficient to establish the diagnosis.

For doubtful cases or for research purposes, diagnostic tests can be used to detect the virus in the fluid extracted from the vesicles, such as culture, immunofluorescence or polymerase chain reaction. Immunoglobulin M (IgM) may also be used in the blood. To find out if a person is immune to chickenpox, serology is used.

Differential diagnosis includes coxsackievirus infections, scabies, impetigo, and itching from insect bites.

Treatment

General measures

In healthy children, a series of measures to relieve symptoms is usually sufficient. For fever, paracetamol is used, always avoiding aspirin (acetylsalicylic acid), whose use for chickenpox is associated with Reye's syndrome. In general, the use of ibuprofen in children with chickenpox is discouraged due to the possibility of a predisposition to opportunistic infections. A case-control study has linked the use of ibuprofen in children with chickenpox to an increased likelihood of developing necrotizing fasciitis, while some prospective studies have found no evidence of such an association. Pruritus can be relieved by antipruritic lotions or oral antihistamines, colloid powders, or calamine lotion. Other measures that help avoid scratching injuries and skin infections include trimming all nails and daily bathing with a mild soap. (The bath should be short so as not to encourage the appearance of more blisters).

It is important to isolate the patient during the contagious phase from those people who have not had the disease, especially those at higher risk (adults, adolescents, pregnant women or immunosuppressed). Although traditionally in many places it is recommended to facilitate the contagion of children to prevent them from contracting it when they are older, it should not be forgotten that chickenpox, although generally benign, can lead to serious complications.

Antivirals or antivirals

As a specific treatment against the varicella-zoster virus, acyclovir can sometimes be used, which hinders the replication of the virus, shortening the patient's recovery with few side effects. In healthy children under 14 years of age, acyclovir has a very limited effect, so it is not usually used. On the other hand, in patients at higher risk (adults, adolescents and immunosuppressed) the intensity of chickenpox and the risk of complications decreases significantly as long as it is started early, preferably in the first 24 hours after the appearance of the rash.

Treatment with acyclovir is absolutely indicated for pregnant patients, immunosuppressed patients and others at particular risk of developing complications (e.g. chronic pneumopaths due to the possibility of suffering from pneumonia due to the virus). Adolescent and adult patients in general, excluding these groups, may obtain a rather modest benefit.

Complications

Although chickenpox is generally a benign disease, complications sometimes occur, especially in adolescents, adults and people with low defenses (immunosuppressed). The most frequent are infections of the skin and subcutaneous tissue, also called impetiginization, favored by scratching the lesions. Another typical complication is pneumonia, which can be caused by the

chickenpox virus itself or by bacteria. Neurological complications are also typical, especially cerebellar ataxia (impaired balance and unsteady gait, which usually goes away on its own). Exceptionally, more serious complications such as encephalitis or necrotizing fasciitis are seen.

Pregnant women who have not had chickenpox are especially sensitive since, in addition to having a higher risk of complications, they can transmit chickenpox to the fetus. When chickenpox is contracted in the first two trimesters of gestation, it can cause miscarriage or *congenital chickenpox* in 1–2% of cases, with neurological alterations, scarring of the skin, and ocular and skeletal alterations. If chickenpox appears between 5 days before and 2 days after delivery, *very serious* neonatal chickenpox can appear in the newborn.

Other possible complications are the second and successive reappearances, in which it is called Herpes Zoster. And it is more serious the older the affected person, especially because of possible post-herpetic neuralgia, a pain sometimes of terrible intensity that can remain permanently in the affected areas of the skin. It is because of these risks that it is advisable to get vaccinated at a young age to avoid them as much as possible.

Prevention

Active immunization: chickenpox vaccine

The varicella-zoster virus vaccine is a live attenuated virus vaccine that was developed in Japan in the 1970s, although it was not authorized until the following decade. All vaccines currently marketed come from the Oka strain, so called because it was isolated from the vesicles of a 3-year-old boy with that surname. It is a very effective vaccine, especially against the most severe forms of chickenpox. A mild varicella rash, with very few lesions, may appear in approximately 5% of those vaccinated two to three weeks after vaccination.

The chickenpox vaccine was introduced into the U.S. immunization schedule in 1995, for children 12 months of age and older. Other countries followed suit, such as Canada, Australia and Germany. In other countries, such as Spain in 2005, it has been decided to vaccinate children between 10 and 14 years of age who have not had chickenpox. The vaccine is also useful in preventing or reducing disease in susceptible people who have been exposed to the virus, if given within the first 3 days after contact. The vaccine is not applicable to those who have suffered from it and are intended to avoid second and successive reappearances (Herpes Zoster or Shingles). Another vaccine is being experimented with that would be useful for these cases.

Passive immunization: immunoglobulin

Varicella immune globulin , administered intramuscularly, is used to prevent the disease in high-risk groups who have had contact with a chickenpox patient and who cannot receive the

vaccine, such as pregnant women, immunocompromised people or newborns whose mothers have not had chickenpox.

Tetanus

Tetanus or **tetanus** is a disease caused by powerful neurotoxins produced by a bacterium that affect the nervous system and generate violent muscle contractions.

The causative agent, *Clostridium tetani*, is an obligate, gram-positive, motile anaerobic bacillus with a larger diameter terminal spore, which gives it the appearance of a drumstick. Its spores are stable under general atmospheric conditions and can live for years, unless it comes into contact with oxygen or sunlight (which destroys both the organism and its spores within a few hours). It is resistant to certain disinfectants: phenol, formaldehyde and ethanol, but they are destroyed by hydrogen peroxide, glutaraldehyde and heat sterilization.

History

Jim the horse, whose blood serum was used to produce the diphtheria antitoxin, ended up contaminated with tetanus bacteria, leading to several deaths between 1901 and 1902.

There are ancient data from the fifth century BC. in which this disease is described. Hippocrates was the first to describe the symptoms of tetanus in a sailor, and he described them as hypercontraction of skeletal muscles.

The tetanus toxin was discovered by Knud Faber in 1899, a precondition for the success of vaccine development. Since then, the C. tetani *bacillus* has been isolated from soil (especially cropland), in feces and intestines of horses, sheep, cattle, rats, dogs, guinea pigs, and chickens. Its spores can be found in the soil and on the surface of skin (both animals and humans) and under fingernails.

Passive immunization against tetanus was carried out massively for the first time during the First World War.

Patogenia

The pathogen (the bacillus) is found cosmopolitanly in soil, marine sediments, in inorganic environments, oxidizing metals and also in the feces of certain animals.

It is introduced into the body through open wounds due to contact with soil, contaminated manure; by cuts or penetration of a rusty object such as: nails, hooks, rusty blades, it can be by dog bites, etc.

The incubation period for tetanus ranges from 24 hours to 54 days. The average period is about 8 days. Generally, the farther the wound is from the central nervous system, the longer the

incubation period. Incubation periods and the probability of death from tetanus are inversely proportional.

Once inside the body, it proliferates throughout the body, conveyed by blood and lymphatic, until it reaches the nervous system, for which it has a preference. It multiplies and secretes toxic substances (toxins), which penetrate the peripheral motor nerve fibers, until it reaches the central nervous system, with inhibitory involvement of neurons producing the neurotransmitter GABA and the amino acid glycine, which causes the paralysis and muscle spasms that characterize the disease.[1]

Etiology

The bacillus releases two toxins: tethanolisin and tetanospasmin. The main action of tetanospasmin is imposed on the peripheral nerves of the central nervous system. There is modification of proteins responsible for the release of the neurotransmitters GABA and glycine from Renshaw's cells of the anterior horn of the spinal cord.

Because tetanospasmin cleaves the protein synaptobravin (which, in conjunction with calcium, aids in the fusion of the synaptic vesicle to the presynaptic membrane). Alpha-type motor neurons become uninhibited, leading to sustained tonic muscle contractions and clonic contractions or jerks and leading to painful muscle cramps.

When the redox potential in the tissues decreases, anaerobic conditions and the passage of the bacterium to the vegetative form, bacterial multiplication and the production and release of toxin are favored.

Hemolytic toxin and tethanolisin are usually cardiotoxic, but negligible in nature, given the typical symptoms of the disease, and are highly infectious

Symptoms

Opisthotonos or muscle spasms of a man suffering from tetanus (1809).

- Tetanus often begins with mild spasms in the jaw muscles (lockjaw). Spasms can also affect the chest, neck, back, and abdominal muscles. Muscle spasms of the back often cause bowing, called opisthotonos.

- Sometimes, spasms affect breathing muscles, which can lead to breathing problems.
- Prolonged muscle action causes sudden, strong, painful contractions of muscle groups, which is called tetany. These episodes can lead to fractures and muscle tears.
- Drooling
- excessive sweating
- fever
- hand or foot spasms or both
- irritability
- difficulty swallowing
- uncontrollable urination or bowel movements

Classification

Depending on the intensity of the contractions, the following forms of tetanus appear:

- mild: muscle stiffness with few muscle contractions;
- moderate: rigid jaw closure, difficulty swallowing (dysphagia), and contractions of the neck, back, and abdomen muscles; tetanic fascias and sardonic laughter;
- Severe: respiratory involvement.

Based on the pathogenesis of the disease, the following can be distinguished:

- Local tetanus: is a rare form of the disease, in which patients have persistent contraction of the muscles in the same anatomical area of the injury. Contractions may persist for several weeks before the eventual and gradual decrease in symptoms. Local tetanus is generally mild, and only about 1 percent of cases are fatal, although it can be preceded by the onset of widespread tetanus.
- Cephalic tetanus: is a rare form of the disease, sometimes associated with otitis media, in which *C. tetani* is present in the flora of the middle ear, or after traumatic head injuries. The cranial nerves are involved, especially those in the facial area.
- Generalized tetanus: This is the most common type of tetanus, accounting for about 80 percent of cases. The generalized form usually presents with a descending pattern. The first sign is lockjaw and so-called *facial spasm* or *sardonic laughter*, followed by stiff neck, difficulty swallowing, and stiffness of the pectoral and calf muscles. Other symptoms include an elevated temperature, sweating, elevated blood pressure, and a rapid heart rate, which occurs episodically. Spasms can occur frequently and last for several minutes with the body in the characteristic arched shape, called *opisthotonos*. Spasms may continue for 3-4 weeks, and full recovery may take up to months.

- Neonatal tetanus: is a generalized form of tetanus that occurs in newborns, in children who have not acquired passive immunity because the mother has never been vaccinated. Infection usually occurs through the infected umbilical stump, particularly when the cord is cut with a non-sterile instrument. Neonatal tetanus is common in many developing countries and is responsible for about 14 percent of neonatal deaths, but it is very rare in developed countries.

Clinical picture

Spasmodic backward curvature of the body: opisthotonus. The same phenomenon with forward curvature is called *emprostotone*.

Some of the characteristic symptoms of tetanus are:

- muscle stiffness and muscle spasms (jaw, whose stiffness is also known as trismus, face, abdomen, upper and lower limbs);
- fever and rapid pulse;
- difficulty swallowing;
- apnea;
- contraction of the entire body in such a way that it remains hunched over: backwards (opisthotonos) or forwards (emprostotones).

Differential diagnosis

Tetanus has clinical elements that can confuse it with other pathologies, including:

- Hypocalcemic tetany
- Dystonic reactions of phenothiazines
- hyperventilation from hysterical attacks
- engraved encephalitis
- Anger
- Strychnine poisoning

Treatment

The wound should be cleaned thoroughly and the source of the toxin removed, dead tissue removed, and left exposed to air, as oxygen kills anaerobic bacteria. Penicillin (or tetracycline for allergy sufferers) helps reduce the number of bacteria, but it has no effect on the neurotoxin they produce. Nowadays, the use of metronidazole is recommended to replace penicillin, since the latter has an anti-GABA effect, which could have synergistic activity with tetanus toxin. Human tetanus

immunoglobulin to neutralize circulating toxin that has not yet bound to nerve endings[3] or tetanus serum should also be administered.

Prevention

Tetanus can be prevented by vaccination. A vaccine booster is recommended every 10 years. A vaccine is usually given every time a patient suffers a puncture or wound when vaccination is not certain.

Following the 3-dose schedule during breastfeeding, one booster in childhood, one in adolescence and one in adulthood, protection can last a lifetime.

HUMAN PAPILLOMAVIRUS VACCINE

The **HPV (human papillomavirus) vaccine** is a vaccine against certain varieties of sexually transmitted HPV diseases, associated with the development of cervical cancer (or cervical cancer) and genital warts. There are currently two HPV vaccines on the market: Gardasil and Cervarix. The actual effectiveness of vaccines in reducing cervical cancer incidence and mortality rates is still unknown.

Human papillomavirus **(**HPV*) is a group of* DNA viruses belonging to the Papillomaviridae family and represents one of the most sexually transmitted infections more than 100 viral types are known, and in relation to their oncological pathogenesis, they are classified into types of high and low oncological risk. The International Agency for Research on Cancer (IARC) considers HPV types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, and 66 to be carcinogens to humans – types of high cancer risk – and that other types, including HPV 6 and HPV 11, are possible carcinogens to humans – types of low cancer risk. Like all viruses in this family, HPVs only establish productive infections in the stratified epithelium of the skin and mucous membranes of humans, as well as a variety of animals. Most of the HPVs described do not cause any symptoms in most people. Some types of HPV can cause warts or condylomas, while others can lead to subclinical infections, which can (in a minority of cases) lead to cervical, vulvar, vaginal, and anal cancer in women, or cancer of the anus and penis in men. Most people infected with HPV are unaware that they are infected. All HPVs are transmitted by skin-to-skin contact.

Treatment of infections

The treatment of HPV infections is currently based on the use of some available topical creams, whose antiviral activity is not well known or which act by activating a local immune response against the virus. In the case of precancerous lesions caused by HPV, the most appropriate

treatment is the removal of the affected areas by surgery. In large part, this treatment is effective because HPV produces well-localized superficial lesions, and HPVs do not cause systemic infections.

HPV-induced diseases

More than 100 different types of HPV have been identified, which are named with a number. A persistent infection by the sub-group known as "high risk", which includes about 13 types of sexually transmitted HPV viruses including types other than those that cause warts, can promote the development of:

- CIN (neoplasia cervical intraepitelial),
- VIN (neoplasia intraepitelial vulvar),
- PIN (neoplasia intraepitelial de pene), o
- AIN (neoplasia intraepitelial anal)

These are precancerous lesions and can progress to invasive cancer

Wart caused by HPV.

- Common warts: Some "cutaneous" types of HPV, such as HPV-1 and HPV-2, cause common warts; frequently found on hands and feet, but can appear in other areas, such as the knee and elbow. These warts have a characteristic cauliflower surface, and typically raised slightly above the surrounding skin. Cutaneous HPV types do not usually cause genital warts and are not associated with the development of cancer.
- Plantar warts: they are located at the base of the foot; and grow inward, usually causing pain when walking.
- Subungual or periungual warts: they form under the nail (subungual), around the nail or in the cuticle (periungual). They may be more difficult to treat than other warts from different places.
- Flat warts: These are commonly located on the arms, face, or nape of the neck. Like common warts, these flats occur more in children and teens. In people with normal immune function, these flat warts are not associated with the development of cancer.

Genital warts

Anal wart Vaginal warts Warts on the penis

Genital or anal warts (*Condylomata acuminata* or venereal warts) are the most recognized signs of this genital HPV infection. Although there are a wide variety of HPV types that can cause genital warts, types 6 and 11 account for about 90% of all cases.

Many people who acquire HPV types associated with genital warts resolve the infection quickly without even developing warts or other symptoms. You can spread the virus to others even if none of the symptoms of infection have unfolded. However, in the vast majority of cases, this is not the cause of not having adequate tests routinely administered.

The types of HPV that tend to cause genital warts are not the same as those that cause cervical cancer. However, since an individual can be infected with multiple types of HPV, the presence of warts is not a rule that the possibility of the presence of high-risk types of the virus is absent.

Cancer

HPV-induced cancers. The graph shows the number of annual cases of different types of cancer in the world. The fraction of cancer cases estimated to be HPV-induced is shown in red. For example, almost all cases of cervical cancer are thought to be caused by HPV.

An HPV infection is a necessary factor in the development of almost all cases of cervical cancer.

About a dozen types of HPV (including types 16, 18, 31, 45) are called "high-risk" types because they can trigger cervical canceror also anal cancer, vulvar cancer, penile cancer. From the point of view of cervical cancer, the two most important types are HPV 16 and 18: HPV 16 is associated with almost 60% of cervical cancer cases, and HPV 18 for another 10% of cases.

Risk factors for cervical cancer are related to both virus and host characteristics, and include:

- multiple sexual partners;
- a male partner with many present or past sexual partners;
- in young women, persistent urinary tract infections;
- early age at first sexual intercourse;

- high number of births;
- persistent infection with a high-risk HPV (such as HPV 16 or 18);
- immunosuppression;
- certain subtypes of HLA (human leukocyte antigens);
- use of oral contraceptives;
- nicotine use.

Respiratory papillomatosis

HPV types 6 and 11 can cause a rare condition known as recurrent laryngeal papillomatosis (a respiratory papillomatosis), where warts form in the larynx or other areas of the respiratory tract.

These warts can recur frequently, require repeated surgeries, interfere with breathing, and in extremely rare cases progress to cancer.

It is necessary to take into account that if the mother is affected by the human papillomavirus genotype 6 or 11, at the time of delivery the baby could inhale it; this would trigger recurrent respiratory papillomatosis in him.

Epidemiology

HPV infections occur worldwide. There are no countries, races, ages or sexes that are not attacked. Most HPV primary infections occur in infancy and childhood, but are not discovered except by very sophisticated techniques. The vast majority are subclinical. This is as much as in skin infections such as genital (vaginal, balanoposthitis) or orodigestive infections. A primary factor that can be a cause associated with wounds and injuries caused in unhealthy areas subjected to repeated trauma such as maceration of mucous membranes or skin

Cutaneous HPV

Infection with cutaneous HPV is ubiquitous. Some types of HPV, such as HPV-5, can establish infections that persist throughout the life of individuals, without even manifesting any clinical symptoms. Like the remora that doesn't harm the shark, those HPV types can be thought of as human commensals. Other cutaneous HPVs, such as HPV types 1 or 2, can cause common warts in some infected individuals. Cutaneous warts are very common in childhood, and typically appear and remit spontaneously over the course of weeks to months. About 10% of adults also suffer from recurrent skin warts. All HPVs are thought to be capable of establishing long-term "latent" infections in a small number of stem cells present in the skin. Although these latent infections may never be completely eradicated, immune control is designed to block the appearance of symptoms such as

warts. The immune control of HPV is of the specific type, meaning that an individual can become immunologically resistant to one type of HPV while remaining susceptible to other types

VPH genitales

A large increase in the incidence of genital HPV infection occurs at the age when individuals begin to have sexual intercourse. The vast majority of genital HPV infections never cause overt symptoms, and are cleared up by the immune system within months.

As with cutaneous HPVs, HPV immunity is thought to be of a specific type. A subset of infected individuals may fail to produce genital HPV infection under immune control. Pairing the infection with high-risk HPV types, such as HPV 16, 18, 31, and 45, can trigger the development of cervical cancer or other cancers.

High-risk HPV types 16 and 18 are together responsible for 65% of cervical cancer cases.

Type 16 causes 41 to 54% of cervical cancers, and adds even more HPV-induced vaginal/vulvar cancers, penile, anal, and head and neck cancers.

Public Health and Genital HPV

According to the U.S. Centers for Disease Control and Prevention, by age 50 or older, 80 percent of U.S. women will contract at least one type of genital HPV. Women are given an annual Pap scan to detect cellular abnormalities caused by HPV

The HPV vaccine, Gardasil, protects against the two types of HPV that cause 70% of cervical cancer cases, and the two types of HPV that cause 90% of genital warts.

The CDC recommends vaccination between ages 11 and 26.

Perinatal transmission

Although genital types of HPV are sometimes passed from mother to child during birth, the occurrence of disease-related genital HPV in newborns is rare. Perinatal transmission of HPV types 6 and 11 may result in the development of juvenile recurrent respiratory papillomatosis (JORRP). JORRP is very rare, with rates of about 2 cases per 100,000 children in the United States. Although the rate of JORRP is substantially higher if the woman has genital warts at the time of delivery, the risk of JORRP in such cases is less than 1%.

Cervical Cancer Screening and Prevention

Many people become infected with several skin types of HPV during their childhood. Papillomaviruses have a protective protein coat or capsid, which may then be able to survive in the environment for long periods of time. Contact with contaminated surfaces, such as communal shower

floors or overhead lines, should be avoided, reducing the risk of cutaneous HPV infection. Also treating common warts early can reduce the spread of the infection to additional sites.

Genital HPV infections can be widely distributed over genital skin and mucosal surfaces, and transmission can occur even if you don't have visible symptoms. Several strategies should be employed to minimize the risk of developing diseases caused by genital HPV:

Pap Iiloma campaign

Slim preparation with a cluster of normal cervical cells on the left, and HPV-infected cells on the right. HPV cells show typical forms of koilocytes: enlarged nuclei x2 or x3, and hyperchromasia.

Certain types of sexually transmitted HPV can cause cervical cancer. Persistent infection with one or more of about a dozen of these "high-risk" HPV types is a major factor in most all cases of cervical cancer. The development of HP-induced cervical cancer is a slow process that usually takes many years. During the developmental phase, precancerous cells can be detected by an annual or semiannual Pap smear (colloquially "pap"). **Pap** is an effective strategy to reduce the risk of cervical cancer. The Pap test involves taking tissue from the cervix, placing it on a glass plate, and examining it under a microscope to look for abnormal cells. It is 70 to 80% effective in detecting cellular abnormalities caused by HPV. A more sensitive method is the "thin preparation," where the tissue of the cervix is put into a liquid solution, and is 85% to 95% effective in detecting cellular abnormalities caused by HPV. This last Pap test is mostly used in women over 30 years of age. It is a combination of HPV pap-DNA test. If this test is negative, you can wait three years before doing it again. A close inspection of the cervix by colposcopy may be indicated if abnormal cells are detected by routine pap test. A frequent example of occurrence of abnormal cells found in association with HPV are koilocytes

The U.S. Centers for Disease Control and Prevention (CDC) recommends that women get a Pap stool no later than 3 years after their first sexual intercourse and no more than 21 years of age. Women should have a Pap smear every year until they are 30. And afterward, they should discuss risk factors with their doctor to determine if Pap smearing should be done annually. If risk factors are low and previous Pap smears have been negative, many women only need to be tested every 2 to 3 years until age 65 (CDC, 2005).

Since these control tools were developed, deaths from cervical cancer have decreased by 70% in the last 50 years. The pap test has proven to be one of the most successful control tests in the history of medicine, although the American College of Obstetricians and Gynecologists says that the new tests based on cytology (Thinprep and Surepath) will reduce cases of CIN3 (cervical intraepithelial neoplasia) and cancer by 15 to 35%.

A study published in April 2007 suggested that the removal of tissue with pap produces a cytokine inflammatory response that may initiate an immune clearance of HPV, although it reduces the risk of cervical cancer.

A woman who has tested positive for only one Pap smear in her history has a lower incidence of cancer. "A statistically significant decline in HPV is positively correlated with the amount of pap in human lifetime."

It has been suggested that pap may be beneficial for anal cancer control in some gay subpopulations.

HPV Testing

An HPV test detects certain types of human papillomaviruses (HPVs), depending on the test. A method for detecting the DNA of high-risk HPVs has recently been added to the range of clinical options for cervical cancer screening.

In March 2003, the U.S. Food and Drug Administration (FDA) approved a hybrid trapping test, marketed by Digene, as a primary trapping tool for detecting high-risk HPV infections that can lead to cervical cancer. This test was also approved for use in conjunction with the pap test and should be performed routinely at a gynecological checkup.

Adding HPV testing to all women over 30 years of age improves the sensitivity of isolated cytology to almost 100% and gives the physician the option to increase the interval between Pap smears to 3 years.

The experimental study of the different molecular pathways involved in the development of cervical cancer has allowed the development of new biological markers that could considerably improve the cytological and histological diagnosis of cervical lesions. The detection of E6 and E7 messenger RNA (HPV OncoTect®) and the study of the p16 cell cycle protein are two of these new markers. The first published results indicate that these markers are highly sensitive and specific, and allow the identification of cells in the process of cancerous transformation, which means a great advance from a clinical point of view.

In the case of men, according to the CDC, there is no test to determine HPV infection. Genital "abnormalities" are the only visible sign of HPV in men, and can be identified by visual inspection of the genital area. These visible "abnormalities," however, are the result of noncancerous HPV types. Vinegar solutions have been useful in identifying "abnormalities" by making them more noticeable, but these tests have been found to be more favorable in moist areas, such as the female genital tract

The CDC says on its *STD Facts-HPV Vaccine* website that "An HPV test or a pap test can detect whether a woman has HPV, but cannot specify the type of HPV the woman has."

Vaccines

On June 8, 2006, the FDA approved Gardasil, a prophylactic HPV vaccine marketed by Merck & Co., Inc. Clinical trials of the vaccine, conducted among adult women with a median age of 23, showed protection against initial infection with serotypes 16 and 18, which together cause about 70% of cervical cancers. These HPV serotypes also cause anorectal tumors in both women and men.

The trial also showed 100% efficacy against peristic infections, not just acute infections. The vaccine also protects against serotypes 6 and 11, which cause 90% of genital warts. Women can be vaccinated in the age range of 9 to 26 years, although younger women were not part of the clinical trial.

Currently, in addition to Gardasil, GlaxoSmithKline has marketed the Cervarix vaccine. Both Gardasil and Cervarix protect against initial infections against HPV types 16 and 18, which cause most cases of cervical cancer. Gardasil also protects against HPV types 6 and 11: these four types combined (16, 18, 6, 11) account for 90% of cervical cancer cases.

The vaccine provides little benefit to women who are already infected with HPV types 16 and 18, i.e. to most sexually active women, as the vaccines have no therapeutic effect on existing infection or cervical lesions. For this reason, the vaccine is mainly recommended for women who have not yet initiated sexual intercourse. The vaccine (both Gardasil and Cervarix) is administered in 3 doses over 6 months at a cost of about 300 euros. The CDC recommends women between the ages of 11 and 26 get vaccinated, although girls as young as 9 may benefit. The actual effectiveness of vaccines in reducing cervical cancer incidence and mortality rates is still unknown.

Because current vaccines do not protect women against all HPV serotypes that cause cervical cancer, it is important for women to continue Pap smears and Pap smears, even after they have received the vaccine.

Although administrations and companies assure that the vaccine has no side effects, except for pain around the injection site, the truth is that to date in the United States 18 girls have already died after being vaccinated and more than 8000 have suffered adverse events. In Spain, 103 alerts have been issued, with 35 cases of serious adverse reactions with diarrhoea, pain, syncope or seizures. Merck, as well as the FDA and CDC consider the vaccine to be completely safe and that there is no cause-and-effect relationship. It does not contain mercury, thimerosal, or attenuated viruses (killed virus only). Merck & Co., Inc., the manufacturer of Gardasil, is continuing to test women who have received the vaccine to determine its effectiveness over a lifetime period.

Both men and women are carriers of HPV. To eradicate the disease, eventually men would have to be vaccinated. Studies are currently underway to determine the efficiency of vaccinating boys with the current vaccine. In most countries, vaccines have been approved for female use only, but in

countries such as the United States and the United Kingdom they have been approved for male use as well.

Condoms

Female condom Male condom

The Centers for Disease Control and Prevention states that "although the effect of condoms in preventing HPV infection is not exactly known, condom use has been associated with a lower rate of cervical cancer, a disease directly related to HPV."

According to Marcus Steiner and Willard Cates in the *New England Journal of Medicine*, "the protection offered by condoms cannot be quantified exactly." However, in a study in the same issue, of 82 university women followed in routine clinical practice for 8 months, the incidence of genital HPV was 37.8 per 100 patients/year among women whose partners used condoms in all their sexual relations, compared to 89.3 per 100 patients/years in those whose partners used condoms in less than 5% of relationships. The researchers concluded that "among women who are beginning to be sexually active, consistent condom use in their relationships by their partners appears to reduce the risk of cervical and vulvovaginal HPV infection."

Other studies have suggested that regular condom use can effectively limit the persistence and spread of HPV to other genital areas in already infected individuals.

Condom use can reduce the risk that infected individuals will develop toward cervical cancer or the development of genital "abnormalities." Planned Parenthood recommends the use of condoms in order to prevent the risk of HPV infection.

Clinical picture

Some of the most important symptoms that suggest the presence of human papillomavirus are:

- Constant irritations at the entrance to the vagina with burning and burning sensation during sexual intercourse (called vulvodynia).
- Small warts in the ano-genital area: cervix, vagina, vulva and urethra (in women) and penis, urethra and scrotum (in men).

They can vary in appearance (flat warts not visible or acuminate if visible), number and size, so the assistance of a specialist is needed for their diagnosis. Pap smear alterations that tell us that there are squamous intraepithelial lesions in the cervix (areas infected by HPV, which can cause cancer).

Prevention

The safest method of prevention is having only one sexual partner (mutual monogamy), avoiding having sex with more than one partner, or abstinence.

The use of condoms protects against HPV infection in 70% of cases. The remaining 30% where it does not protect is due to the existence of injuries in areas not covered by the condom and its misuse.[67]

History of the discovery of the relationship between the virus and cancer

The key fact that led the researchers to link sexually transmitted HPV infection to cervical cancer was the higher rates of cervical cancer recorded in prostitutes compared to rates recorded in nuns. Nowadays many studies have clearly shown that HPV is mainly transmitted by sexual contact.

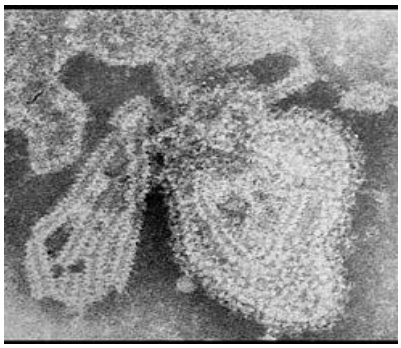
Some of the contraindications may be temporary, such as for live vaccines (pregnancy and immunosuppression), and one type of transitory precaution is for all vaccines, acute, moderate, or severe disease, and recent administration of a blood product containing antibodies to the PRS vaccine.

Care should be taken such as the availability of epinephrine, whenever immunization is administered, waiting for the evaporation of the alcohol used to clean the injection site, because it could inactivate the live vaccine, not using the I.M route in patients with hematological alterations, such as hemophilia or thrombocytopenia, storage between 2 and 5 ^{0C}

In general, mild adverse reactions are the most common and include local reactions at the injection site (erythema, edema, pain), systemic reactions (fever, chills, irritability and malaise), occasionally more serious adverse reactions and anaphylaxis rarely occurs.

The possibility of being administered simultaneously, 2 live virus vaccines (when required and not available in a combined preparation), the need to move immunization with live viruses away from the administration of immunoglobulins, avoiding the co-administration of vaccines and interferons, the probable decrease in the response generated by them, before the administration of immunosuppressive agents (corticosteroids, cytostatics) are elements to be taken into account during immunization.

LA TUBERCULOSIS



Mumps virus

Tuberculosis (abbreviated **TB** or **TB**), formerly called **consumption** (from the Greek *φθίσις*, via the Latin *phthisis*) is a contagious bacterial infection that mainly involves the lungs, but can spread to other organs. The most important and representative species of bacteria that causes tuberculosis is *Mycobacterium tuberculosis* or Koch's bacillus, belonging to the Mycobacterium tuberculosis complex. TB is arguably the most prevalent infectious disease in the world. Other mycobacteria, such as *Mycobacterium bovis*, *Mycobacterium africanum*, *Mycobacterium canetti* and *Mycobacterium microti* can also cause tuberculosis, but all these species do not usually do so in the healthy individual. Although tuberculosis is a predominantly lung disease, it can also affect the central nervous system, lymphatic system, circulatory system, genitourinary system, digestive system, bones, joints, and even the skin.

The classic symptoms of tuberculosis are:

1. Chronic cough, with bloody sputum,
2. Fever, night sweats
3. Weight loss.

Infection of other organs causes a wide variety of symptoms. Diagnosis is based on radiology (usually chest x-rays), a skin tuberculin test and blood tests, as well as a microscopic examination and a microbiological culture of body fluids such as expectorations.

Treatment of tuberculosis is complicated and requires long periods of exposure to various antibiotics. The patient's relatives, if necessary, are also analyzed and treated. In recent years, tuberculosis has shown a growing resistance to multiple antibiotics and for this purpose, vaccination campaigns have been chosen, as a preventive measure, generally with the Bacillus Calmette-Guérin (BCG) vaccine.

TB is spread through the air, when infected people cough, sneeze, or spit. In addition, a growing number of people around the world are contracting tuberculosis because their immune

systems are compromised by immunosuppressive drugs, drug abuse or AIDS. The distribution of tuberculosis is not uniform throughout the world; approximately 80% of the population in many Asian and African countries test positive for tuberculin, while only 5-10% of the U.S . population tests positive.

According to data published in 2014 by the WHO, approximately 9 million people fell ill with tuberculosis and 1.5 million died from this cause in 2013, of which 510,000 were women. The WHO estimates that early diagnosis and effective treatment saved 37 million people between 2000 and 2013, but considers the number of deaths "still unacceptably high" because their deaths are preventable.

Lungs with tuberculosis at the Museum of Mexican Medicine in Mexico City

History of tuberculosis

Tuberculosis is one of the oldest diseases affecting humans. Although it is estimated to be between 15,000 and 22,000 years old, it is more widely accepted that this species evolved from other more primitive microorganisms within the genus *Mycobacterium* itself. It can be thought that at some point in evolution, some species of mycobacteria crossed the biological barrier, by selective pressure, and began to have a reservoir in animals. This possibly gave rise to an elderly progenitor of *Mycobacterium bovis*, which is accepted by many as the oldest of the species that currently make up the so-called *Mycobacterium tuberculosis complex*, which includes *M. tuberculosis*, *M. bovis*, *M. africanum* and *M. microti*. The next "step" would be the passage from *M. bovis* to the human species, coinciding with the domestication of animals by man. Thus, possibly, it could have emerged as a pathogen for the dog.

Progression

It will progress from tuberculosis infection to tuberculosis disease. It can occur early (primary tuberculosis, about 1-5%) or several years after infection (post-primary tuberculosis, secondary,

tuberculous reactivation in about 5-9%). The risk of reactivation is increased with alterations in the immune system, such as those caused by HIV. In patients co-infected with HIV and TB, the risk of reactivation increases by 10% per year, while in an immunocompetent person the risk is 5 to 10% throughout life.

Some drugs, including treatments currently used in rheumatoid arthritis that act by blocking tumor necrosis factor, increase the risk of activation of latent TB due to the important action of this cytokine on the immune response against TB.

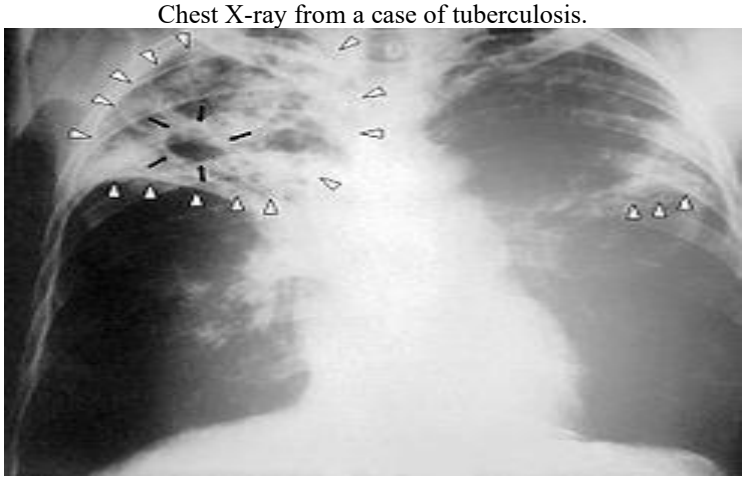
Diagnosis

Auto fluorescence

The Autonomous University of Madrid published a study in the *Journal of Clinical Microbiology* where it is described for the first time that mycobacteria are capable of emitting fluorescence, which allows them to be seen under a fluorescence microscope without the need for prior staining. This characteristic is of interest for the diagnosis of tuberculosis since before it was necessary to resort to specific stains to be able to observe most bacteria since very few present autofluorescence. However, the self-fluorescence emitted by sky-blue mycobacteria is as intense and bright as when they are stained green with the old method. In addition, it has been found that the phenomenon is permanent, with no decrease in autofluorescence over time, so special conservation of the samples is not necessary for their maintenance.

Chest X-ray

Chest X-ray from a case of tuberculosis.



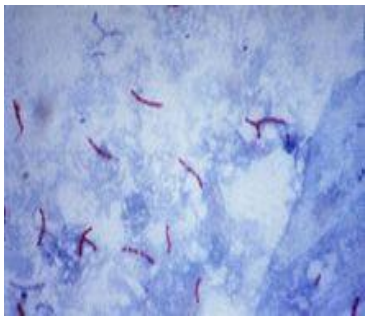
X-rays are essential in diagnosing the disease. Typical radiological lesions are apical lesions, in the right hemithorax, in posterior segments and generally forming cavities.

The fundamental tool for diagnosing a tuberculosis case is bacteriology (smear smear and culture) due to its high specificity, sensitivity and predictive value. In those situations where bacteriological studies are inconclusive, it will be necessary to carry out diagnostic follow-up in accordance with the organization of the health services network, using other criteria: clinical, epidemiological, diagnostic imaging, immunological, anatomopathological.

Any person diagnosed with tuberculosis after counseling and acceptance must be tested for HIV.

Sputum smear smear

Mycobacterium tuberculosis visualization with the use of Ziehl Neelsen staining.



It consists of a serious test (three consecutive days), where a sample of sputum is taken to see what bacteria are present. This test does not require fasting or brushing. With a low cost and quick execution, smear smear is a technique that allows the identification of 70-80% of positive lung cases.

The bacterium *Mycobacterium tuberculosis* has a different wall structure from those that are capable of being typed by Gram staining as it has a very abundant amount of lipids. It is called acid-fast alcohol and this characteristic is what allows its observation by Ziehl Neelsen staining.

Biological sample culture

The culture can be done in Löwenstein-Jensen medium, which is made up of:

- egg (albumin, lipids) (coagulates and gives solidity)
- Malachite green (inhibits other bacteria)
- glycerol (carbon source)
- asparagines (source of nitrogen)

It grows very slowly (30 to 90 days) at 37 °C in an atmosphere with carbon dioxide (in culture they grow better despite being strictly aerobic), giving colonies that look like breadcrumbs (or spider eggs), dry yellowish and rough.

Tuberculin test using the Mantoux technique

Test de Mantoux

Intradermal injection of PPD for the Mantoux test.

This is a skin test (intradermal reaction) to check for TB infection. PPD (Purified Protein Derivative) is used as a reagent. It should be noted that the Mantoux tuberculin test only involves contact, not infection.

MODS (Microscopic observation drug susceptibility)

Microscopic observation of drug susceptibility (MODS) is a newly developed method that has very high sensitivity and specificity, as well as a great reduction in the time to diagnosis of *Mycobacterium tuberculosis* infection, while evaluating the resistance of first-line antibiotics, such as isoniazid and rifampicin for MDR-TB (multidrug-resistant) patients.

Treatment

The treatment of tuberculosis is carried out with combinations of anti-tuberculosis drugs, making effective the guidelines of six months of treatment, two months in the first phase of treatment and four months in the second phase.

Tuberculosis is curable, but early diagnosis is necessary (go to the doctor immediately), as it is a serious disease if the appropriate treatment is not followed. Next, it is essential not to abandon the treatment given by the doctor because, when the treatment is stopped, this disease worsens rapidly and the proliferation of drug-resistant bacilli is favored .

Pharmacological treatment of tuberculosis

The history of tuberculosis changes dramatically after the introduction of antimicrobial agents. The treatment of tuberculosis is essential for its control since it breaks the chain of transmission when the treatment is correct and complete.

Drug treatment began in 1944 with streptomycin (SM) and para-aminosalicylic acid (PAS). In 1950, the first clinical trial was carried out comparing the efficacy of MS and SBP together or as monotherapy. The study showed that the combination therapy was more effective. In 1952, a third drug, isoniazid (INH), was added to the combination, dramatically improving the efficacy of the treatment, although still lasting 18-24 months. Ethambutol was introduced in 1960, replacing PAS in treatment schedules and reducing the duration to 18 months. In the 1970s with the introduction of rifampicin (ADR) in the combination, treatment was shortened to nine months. Finally, in 1980, pyrazinamide (PZA) was introduced into the therapeutic scheme, and the duration could be reduced to six months.[14]

Two biological facts explain why combination therapy is more effective in the treatment of TB than monotherapy. The first is that treatment with a single drug induces the selection of resistant bacilli and consequently the failure to eliminate the disease. The second is that different bacillary populations can coexist in the same patient.

Prevention

It is prevented through a healthy and hygienic life, identifying the sick in a timely manner and ensuring their cure so as not to infect other people, mainly through vaccination with BCG vaccine.

Preventive measures

- The infected person should protect themselves whenever they cough with tissues.
- Washing hands after coughing.
- Adequate ventilation of the place of residence.
- Clean the home with damp cloths.
- Use a mask in common areas.
- Restrict visits to people not exposed to the disease.
- Ensure adherence to treatment.
- Do not smoke. Smoking does not cause tuberculosis, but it does promote the development of the disease.

Vaccinations

In many countries, the BCG vaccine is used as part of TB control programmes, especially in children. This vaccine was developed at the Pasteur Institute, France between 1905 and 1921. However, mass vaccinations did not begin until after World War II. The efficacy in protecting BCG in severe forms of tuberculosis (e.g., meningitis) in children under 4 years of age is large, and is around 80%; its efficacy in adolescents and adults is more variable, ranging from 0 to 80%

RUTI is a therapeutic vaccine currently being developed at the Experimental Tuberculosis Unit in Badalona, Spain, to decrease the treatment of latent TB infection[22] from 9 to 1 month of isoniazid administration. Heads of Archivel Farma and the Germans Trias i Pujol Hospital in Badalona, popularly known as Can Ruti, which has given the vaccine its name.

Curiosity

World TB Day

The WHO stipulated that March 24 would be World Tuberculosis Day. It commemorates that on March 24, 1882, Dr. Robert Koch announced the discovery of the tuberculosis bacillus.

In 1982, the first World Tuberculosis Day was held, sponsored by the World Health Organization (WHO) and the International Union Against Tuberculosis and Respiratory Diseases (IUCTER). This event sought to educate the public about the devastating health and economic consequences caused by TB, its effect on developing countries, and its ongoing tragic impact on global health.

CONCLUSIONS

GENERAL IMMUNIZATION

When administering a vaccine, contraindications and precautions for these must be taken into account, which are circumstances in which the vaccine should not be administered.

Few real contraindications and precautions are permanent, such as severe allergy to one of the components of the vaccine or following a previous dose of the vaccine and encephalopathy within 7 days of immunization against B pertussis. There are precautions considered permanent for subsequent doses of vaccines containing pertussis (temperature greater than 400 C, collapse, shock-like state, inconsolable and persistent crying for more than 3 hours within 48 hours of administering the vaccine, seizures with or without fever within 3 days of dosing).

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Stress, depression and anxiety associated with the work of community health workers

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ABSTRACT

The objective of this study was to gather, based on the current literature, factors that contribute to stress, depression and anxiety in community health workers in Brazil. The present paper discusses the importance of Community Health Agents (CHA) in Primary Health Care (PHC) and the challenges faced by these professionals. The lack of recognition, precarious working conditions, excessive bureaucracy and exposure to situations of violence stand out as contributing factors to these problems. The integrative literature review addresses studies that analyze the prevalence and factors associated with these problems among the CHAs, highlighting the physical and emotional overload, the lack of support and professional exhaustion. For the construction of this review, the Grounded Theory methodology was adopted, which allows the approximation and immersion of the data as a starting point for the elucidation of a phenomenon. The predominant methodology in the studies used in this research was cross-sectional data collection, followed by the

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qualitative methodology. It is therefore concluded that it is necessary to adopt health policies aimed at promoting the quality of life of these professionals and improving working conditions in PHC.

Keywords: Community health agents, Depression, Depressive disorder, Anxiety, Stress occupation.

INTRODUCTION

From the implementation of Primary Health Care (PHC) as the main gateway to the services of the Unified Health System (SUS), the importance of the presence of the Family Health Strategy (ESF) in the territory was reaffirmed. Ordinance No. 2.436/2017 provides for the specifications of the Family Health Team (FHT), defining it as a priority health care strategy, reorganizing PHC at the national level (Brasil, 2017). Among the professionals required in this composition, the Community Health Agent (CHA) stands out.

The Community Health Agents Strategy (EACS) is the planning of the reorganization of Primary Care to strengthen the ESF based on the aggregation of CHAs (Brasil, 2017). The work performed by these professionals is difficult to define, since it is characterized as multipurpose (Bezerra and Feitosa, 2018). Among the attributions of the community agent, the processes related to social mobilization, health education, family monitoring, as well as procedures related to the territory, team, and systematization, that is, bureaucratic activities, stand out (Nogueira, 2019; Lima *et al.* 2023).

In this sense, the work of the ACS is essential for the provision of health throughout the territory. Considering their role in the prevention, promotion and protection of health through disease control, this professional must build solid ties with the community (Bezerra and Feitosa, 2018). Thus, the work process involving the ACS requires great psychological capacity, since the occupation requires contact with problems that plague the community, such as those of a social nature and those related to the processes of health and disease (Fernandes *et al.* 2023; Lima *et al.* 2023).

The role of the CHA is characterized as that of a translator of health for the community. Acting as a mediator between the FHT and the population, the professional must present knowledge about sanitary practices and sociocultural characteristics (Fonseca and Morosini, 2021). The actions performed by the ACS are based on knowledge about the reality experienced by the populations, as well as the difficulties faced. This approach to reality gives the agent multiple relationships, such as the mixture of personality and professionalism (Bezerra and Feitosa, 2018).

The literature addresses a series of factors that corroborate the stress and anxiety of PHC professionals, especially the CHA (Julio *et al.* 2022; Magalhães *et al.* 2021). The negative impact on the quality of life of professionals who manage the care provided by primary care directly influences the quality of care provided to communities. Based on this, the objective of this study is to gather, based on the current literature, factors that contribute to stress, depression and anxiety in community health agents in Brazil.

METHODOLOGY

It is an integrative literature review, a method that provides the synthesis of information on a given topic (Souza, Silva and Carvalho, 2010). This study made it possible to gather the main findings of the current literature on the development of stress, depression and anxiety in community health agents, precursor factors of the Professional Exhaustion Syndrome, the Burnout Syndrome (Ferreira *et al.* 2020).

For the construction of this review, the *Grounded Theory* methodology was adopted, which allows the approximation and immersion of the data as a starting point for the elucidation of a phenomenon. The theory makes it possible to identify categories derived from the data by making comparisons. From this perspective, the method adopted allows us to identify the main concerns of the different social actors in solving problems (Morales, 2015).

The search for articles was carried out in the Pubmed, Virtual Health Library (VHL), Scientific Electronic Library Online (SciELO) and Google Scholar databases, based on the descriptors "depression and anxiety in community health agents", "professional exhaustion in community health agents", "Burnout syndrome in community health agents". The period of publications from 2018 onwards was selected. In this way, 7,080 were found.

From the reading of the titles and abstracts, 13 articles were selected that fit the objective of this research, since they deal with problems linked to ACS professionals working in Brazilian PHC. Most of the selected articles were published in 2023 (n=3 or 23%), followed by the years 2022, 2021, 2020 and 2019, with 2 publications each (15.3%), and 2024 and 2018, with 1 publication each (7.6%).

RESULTS AND DISCUSSIONS

The primary search for the articles allowed the visualization of 7,080 results. At this first moment, there was no application of inclusion and exclusion criteria, which were based on the objective of this study, to relate the prevalence of depression, anxiety and factors associated with professional burnout in CHAs.

The predominant methodology in the studies used in this research was cross-sectional data collection, followed by the qualitative methodology. Studies were included that analyzed the difficulties encountered in the work of the CHAs, identification of indicators of pleasure and suffering, anxiety and depression among the agents' work, Burnout Syndrome in CHAs, suffering related to daily life and work, among others.

The collection of findings associated with the development of depression and anxiety among health professionals allowed us to summarize the results presented in **Table 1.**

Table 1 – Main factors associated with the development of depression and anxiety in Community Health Agents.

Author/Year	Title	Objective	Finds
Lima *et al.* 2023	Analysis of indicators of pleasure and suffering at work associated with anxiety and depression among community health workers	To analyze the indicators of pleasure and suffering at work associated with depression and anxiety among community health workers (CHAs).	• Risk of depression related to female sex; • 60% of the CHAs have depressive symptoms; • CHAs with an effective employment relationship are more likely to develop depression; • CHAs present critical scores of professional satisfaction, • Lack of recognition and professional burnout; • Concern about the incidence of diseases; • Lack of adequate conditions and infrastructure; • Lack of incentives by management.
Fernandez, Wrestling and Corrêa, 2021	Challenges for Primary Health Care in Brazil: an analysis of the work of community health agents during the Covid-19 pandemic	To analyze the situation of the professionals in question in the fight against the Covid-19 pandemic in Brazil	CHAs point out that after the COVID-19 pandemic they face greater problems related to: • Alteration of the routine at the UBS; • Carrying out bureaucratic work; • Monitoring and implementation of health education.
Menguer *et al.* 2023	Burnout syndrome and job satisfaction of community health workers	OBJECTIVE: To evaluate the existence of burnout syndrome and job satisfaction of community health agents in a city in the extreme south of Santa Catarina.	• Indifference to colleagues in eSF; • Dissatisfaction with remuneration; • Dissatisfaction related to the promotion.
Araújo and Greco, 2019	Association between working conditions and the Indicators of Pleasure and Suffering in the daily work of Community Health Agents	To analyze and discuss the working conditions of the Community Health Agent (CHA) of a student in the Zona da Mata region of Minas Gerais and their relationship with the experiences of pleasure and suffering at work.	• Need to improve working conditions; • ACS women suffer more for the work performed.

Silva *et al.* 2019	Community health agents: the burnout syndrome under discussion	Highlight the publications in national and international online journals that address the themes of Burnout Syndrome in Community Health Agents	• Low professional recognition; • Work-related bureaucracy; • High work pace; • Exposure to violence; • Physical and psychic overload; • Unpreparedness of managers; • Lack of delineation of functions.
Lopes *et al.* 2018	Workloads of the community health agent: research and care in the convergent perspective of care	To know the perception of Community Health Agents about the workloads present in their work dynamics and to carry out care practice related to the workloads with the group.	• Physical overload; • Physical exposure; • Risk of violence; • Difficulties in the organization of work; • Psychic load; • Frustration due to the lack of resolution.
Suyama *et al.* 2022	Occupational stress and musculoskeletal symptoms in Community Health Agents	To evaluate the presence of occupational stress and musculoskeletal symptoms in Community Health Agents and to compare occupational stress levels according to sociodemographic characteristics.	• Psychological demands; • Excessive workloads; • Difficulty in organizing work processes; • Lack of continuing education; • Favoritism in the workplace.
Dias *et al.* 2020	Investigation of Burnout syndrome in workers of the family health strategy in a municipality in the interior of the state of São Paulo	OBJECTIVE: To investigate the prevalence of Burnout Syndrome among professionals working in the Family Health Strategy (FHS) in the city of Assis, in the interior of the State of São Paulo.	• Emotional stress; • Emotional tiredness; • Depersonalization; • BS propensity.
Borges *et al.* 2023	Between caring and getting sick: the burnout syndrome in community health agents during the covid-19 pandemic	To analyze Burnout Syndrome in Community Health Workers during the COVID-19 pandemic period.	• Physical and mental exhaustion; • Extreme tiredness at work; • Depersonalization; • Low professional achievement.
Silva *et al.* 2024	Mental illness among health professionals during the COVID-19 pandemic	To investigate mental illness among health professionals during the COVID-19 pandemic.	• Depersonalization; • Depression, anxiety, and stress.

Silva *et al.* 2020	National Primary Care Policy 2017: implications for the work of Community Health Agents	To investigate the meanings that the CHAs, working in the territories of the North of Minas Gerais, impose on the changes proposed by the PNAB and the possible consequences for their work and for the care of the population.	• Mischaracterization of the nature of the CHA's educational work; • Lack of professional qualification.
Souza-Julio *et al.* 2022	Prevalence of anxiety and depression in Primary Health Care workers	To assess the prevalence of anxiety and depression in primary health care workers	• Desire to give up the profession; • Anxiety; Dissatisfaction with the profession; • Depression.
Barbosa *et al.* 2021	Sociodemographic and occupational factors associated with anxiety symptoms among Community Health Agents	To verify the prevalence of anxiety symptoms and the association with socio-demographic and occupational factors among community health agents.	• Anxiety associated with the female gender; • Accumulation of roles; • Less time available for self-care and leisure.

Source: The author.

The visualization of the findings of the research presented allows us to establish relationships between depression and anxiety and the female gender, listing the double journey faced by women, from motherhood to professionality, as pointed out by Biano and Salvaro (2023), however, the study related to gender and Burnout Syndrome carried out by Sarma, Chiu and Kimball (2024) does not point to significant differences between men and women.

Another highlight refers to the mischaracterization of the CHA professional. This factor refers to the lack of understanding about the work processes, since the expansion of the professional scope regarding the practices of the ACS does not allow the delimitation of the role played by the CHA. This factor is shown to limit the work processes performed by the professional, limiting the effective practice in PHC (Silva *et al.* 2020; Silva *et al.* 2019).

Depersonalization, characterized as the distortion of one's view, becomes a problem faced by the CHAs. Characterized as intrinsic to Burnout Syndrome, this depreciative phase generates negative responses of self-perception (Borges *et al.* 2023; Silva *et al.* 2024).

Frequent in this research are the relationships of depression, anxiety and physical and mental fatigue. Such factors are pointed out by Borges et al. (2021), in a research related to Burnout Syndrome and health professionals during the Sars-CoV-2 pandemic, indicating symptoms of depression, insomnia, lack of energy, anxiety, irritability, sadness, and insecurity. However, the study

carried out by Silva et al. (2024), point out that the symptoms addressed were already part of the day-to-day life of health professionals in the pre-pandemic period.

Occupational stress has as an aggravating factor the worker's inability to act on stressors, generating exhaustion (Jarruche and Mucci, 2021). In this sense, professionals report exposure to vulnerability factors, such as violence and physical and mental overload (Silva *et al.* 2019; Borges *et al.* 2023). This finding is in line with the study of habits related to the health of CHAs, which reveals that exposure to long distances in adverse climatic and environmental conditions, in addition to contact with risk conditions, is frequent in the work performed by CHAs (Magalhães *et al.* 2021).

CONCLUSION

Since the ACS professional is essential in the provision of health by PHC, it is of paramount importance to recognize the factors that affect the quality of care provided by the class. Thus, this study was able to identify the lack of delimitation regarding the practices performed by the profession, as well as the need for investment in infrastructure to improve the working conditions of these professionals.

Finally, this literature review aims to encourage the formulation of health policies aimed at promoting quality of life in the context of work in primary care, with a view to better health indices, reducing the negative factors that lead to anxiety and depression in the work environment.

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