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SUMÁRIO

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Revista de Epidemiologia e Controle de Infecção

Hospital Santa Cruz

ORIGINAL ARTICLE

Epidemiological profile of isolated bacteria in a public pediatric hospital

Perfil epidemiológico de bactérias isoladas em um hospital pediátrico público

Perfil epidemiológico de bacterias aisladas en un hospital pediátrico público

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ABSTRACT

Background and objectives: in recent years, the incidence of resistant bacteria has increased significantly, and in Brazil there is little research on the subject regarding pediatric hospitals. Therefore, this study aimed to analyze the epidemiological profile of the main bacteria recovered from biological samples of a Brazilian pediatric hospital. **Methods:** this is a descriptive and retrospective study. The study was conducted over 24 months based on reports of microbiological tests issued by the infection control service of a pediatric hospital located in the Center-West of the Brazilian state of Minas Gerais. Results: a total of 4286 bacteria were recovered from biological samples, of which 1107 (25.82 %) were responsible for healthcare-associated infection (HAI) at the institution of origin. The main microorganisms identified were *Pseudomonas aeruginosa* (10.4%), *Acinetobacter baumannii* (7.8%), *Staphylococcus aureus* (4.3%), *Escherichia coli* (4.3%), and *Klebsiella pneumoniae* (3.5%). Isolates with minimal inhibitory concentration (MIC) ≥ 4mg/L were considered resistant. **Conclusion:** knowledge of the local epidemiological profile has been shown to be effective in the strategies established by the institutions to reduce infections related to health care. The prevalence profile of bacteria recovered from biological samples was similar to other studies conducted at national and international levels.

Keywords: *Hospital's pediatric. Bacteria. Child.*

RESUMO

Justificativa e Objetivos: Nos últimos anos, a incidência de bactérias resistentes tem aumentado significativamente e, no Brasil, existem poucas pesquisas sobre o tema, em hospitais pediátricos. Portanto, este estudo teve como objetivo analisar o perfil epidemiológico das principais bactérias recuperadas de amostras biológicas de um hospital pediátrico brasileiro. **Métodos:** trata-se de um estudo descritivo documental e retrospectivo. O estudo foi conduzido em 24 meses a partir de laudos de exames microbiológicos emitidos pelo serviço de controle de infecção hospitalar

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de um hospital pediátrico localizado no Centro-Oeste de Minas Gerais. **Resultados:** foram recuperadas de amostras biológicas, neste período, 4.286 bactérias, sendo 1.107 (25,82%) responsáveis por infecções relacionadas à assistência à saúde (IRAS) na instituição de origem. Os principais microrganismos identificados foram *Pseudomonas aeruginosa* (10.4%), *Acinetobacter baumannii* (7.8%), *Staphylococcus aureus* (4.3%), *Escherichia coli* (4.3%) e *Klebsiella pneumoniae* (3.5%). Os isolados que apresentaram concentração inibitória mínima (CIM) ≥ 4mg/L foram considerados resistentes. **Conclusão:** o conhecimento do perfil epidemiológico local tem se mostrado efetivo nas estratégias estabelecidas pelas instituições para redução das infecções relacionadas à assistência à saúde. O perfil de prevalência das bactérias recuperadas das amostras biológicas foi similar a outros estudos conduzidos em âmbito nacional e internacional.

Descritores: *Hospitais pediátricos. Bactéria. Crianças*

RESUMEN

Justificación y objetivos: en los últimos años, la incidencia de bacterias resistentes ha aumentados significativamente y en Brasil hay poca investigación sobre el tema con respecto a los hospitales pediátricos. Por lo tanto, este estudio tuvo como objetivo analizar el perfil epidemiológico de las principales bacterias recuperadas de muestras biológicas de un hospital pediátrico brasileño. **Métodos:** este es un estudio descriptivo y retrospectivo. El estudio se realizó durante 24 meses en base a informes de pruebas microbiológicas emitidas por el servicio de control de infecciones de un hospital pediátrico ubicado en el centro oeste del estado brasileño de Minas Gerais. **Resultados:** se recuperaron un total de 4286 bacterias de muestras biológicas, de las cuales 1107 (25.82%) fueron responsables de infecciones relacionadas con la atención médica (IRAS) en la institución de origen. Los principales microorganismos identificados fueron *Pseudomonas aeruginosa* (10.4%), *Acinetobacter baumannii* (7.8%), *Staphylococcus aureus* (4.3%), *Escherichia coli* (4.3%) y *Klebsiella pneumoniae* (3.5%). Los aislamientos con concentración mínima inhibitoria (MIC) ≥ 4 mg/L se consideraron resistentes. **Conclusiones:** el conocimiento del perfil epidemiológico local se ha mostrado efectivo en las estrategias establecidas por las instituciones para reducir las infecciones relacionadas con la atención de la salud.

Palabras clave: *Hospitales pediátricos. Bacterias. Niño.*

INTRODUCTION

Bacterial infections are a worldwide public health problem, since they increase the number of hospital admissions and mortality rates, with a high financial impact on health institutions.[1]

Moreover, complications from bacterial infections, mainly from healthcare-associated infection (HAI), also represent a social, legal, and ethical concern with regard to the implications for patient safety and quality of health services in the world.[2]

In recent years, the incidence of HAI associated with resistant microorganisms has increased worldwide, being of particular concern in pediatric hospitals. Thus, children admitted to health care facilities are exposed to a wide variety of bacteria with a diverse antimicrobial susceptibility profile, and to the increasing use of broad-spectrum antibiotics, and that are associated with higher rates of adverse events.[3] It is noteworthy that in children, bacterial infections can aggravate rapidly due to a relatively immature cellular and humoral immune system, skin and mucosa immature, and medical invasive procedures.[2,4]

Knowing the bacterial epidemiological profile of a health care institution is of extreme importance for decision-making regarding infection prevention, in order to formulate appropriate antibiotic policy for effective treatment within first few hours to decrease the mortality and on complication prevention.[4-6]

In Brazil, generally speaking, there are few studies on the bacterial epidemiological profile and infections in health institutions.[7] Therefore, this study aimed to describe the epidemiological profile of the main bacteria of a Brazilian pediatric hospital over two years of observation.

METHODS

This is a retrospective and descriptive documentary study conducted to assess the epidemiological profile of bacteria isolated from cultures of biological samples of a large public pediatric hospital, a reference in pediatrics in the southeast of the Brazilian state of Minas Gerais. The study was approved under CAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 44803815.700005545.

The data used in the research were obtained through analysis of the results of microbiological exams and annual report of HAI of the said hospital, over a period of 24 months (01 November, 2014 to 31 October, 2016), made available by the infection control service (ICS) of the hospital. Results of cultures of positive biological samples for fungi and all culture of epidemiological surveillance were excluded from the study.

The variables of interest assessed were: community infections and HAI, isolated bacteria, type of biological sample (blood, urine, catheter tip, and secretions: skin, ear, eye and lung), minimum inhibitory concentration (MIC), determined by Clinical & Laboratory Standards

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Institute (CLSI),[8] and major sites of infection related to health care. In descriptive statistics, data were expressed in absolute and relative frequency.

RESULTS

Institutional context of infections in the pediatric population served over the two-year period.

The hospital performs about 30 thousand visits/year. Analysis of reports from the pediatric hospital under study showed that in 2014 and 2016 respiratory tract infections (58%), diarrhea and gastroenteritis (14%), dengue, complications of chronic diseases, food poisoning, and traumas (28%) were the main causes of hospitalizations.

In this same two-year period, a total of 4286 bacteria were recovered from biological samples. It was observed that the majority of infections were characterized as acquired in the community (74.2 %). However, a significant percentage of bacteria were recovered from HAI (25.8 %). Moreover, a 12.5 % increase of these infections in 2016 in all three sectors was observed in the hospitalization unit II (UII), in hospitalization unit III (UIII), and Unit Intensive Care Unit (ICU).

HAI distribution among ICUs, the lower complexity hospitalization unit, and the institution's chronic hospitalization unit are shown in Table 1. In UII and UIII, the overall rates were 5 infections/1000 patient-days and 14 infections/1000 patient-days; 7 % HAI increase in 2016, with an overall incidence o(f 31.4% in the ICU sector and a global rate of 36 infections/1000 patient-days.

Table 1. Healthcare-associated infection distribution and frequency by sector and year (2014/2016).

Hospitalization unit	12 Months (2014/2015)* n (%)	12 Months (2015/2016)** n (%)
ICU	172 (33%)	184 (31.4%)
UII	58 (11%)	39 (6.6%)
UIII	291(56%)	363 (62%)

*ICU: Intensive Care Unit. UII: Hospitalization unit II. UIII: Hospitalization unit III. HAI: Healthcare-associated infection. * Nov 01, 2014/ Oct 31, 2015 and **Nov 01, 2015/Oct 31, 2016.*

In this work, the main infection sites were skin and soft tissues, respiratory tract, urinary tract, and gastrointestinal tract (Table 2). The number of bacteria isolated from respiratory tract samples, including confirmed cases of pneumonia, was 38.4 %, followed by skin and soft tissue (36%) and bloodstream infections (11%).

Table 2. Number of bacteria recovered at several sites of healthcare-associated infection.

Principal site	Absolute frequency (n)	Relative frequency (%)
Skin and soft tissue	399	36.0 %
Eyes/ears/nose/oropharynx/mouth	147	13.3 %
Lower respiratory tract (except pneumonia) *	145	13.0 %
Pneumonia	137	12.4 %
Bloodstream infections	121	11.0 %
Urinary tract	71	6.4 %
Cardiovascular system	63	5.7 %
Gastrointestinal	20	1.8 %
Reproductive system	4	0.4 %

** Lower respiratory tract (except pneumonia): Bronchiolitis; Bronchitis; Cystic fibrosis.*

Microbiological profile of infections in the studied pediatric population

Analysis of culture results from biological samples showed that Gram-negative bacteria were more recovered than Gram-positive in catheter tips, blood, diverse secretions, and urine samples (Table 3 and 4).

Table 3. Distribution of bacteria in different biological samples.

Biological Samples	Gram-negative bacteria frequency	Gram-positive Cocci frequency
Catheter tip	27 (0.6 %)	16 (0.3 %)
Blood	176 (4.1 %)	416 (9.8 %)
Diverse secretions	1295 (30.2 %)	857 (20 %)
Urine	1320 (30.8 %)	179 (4.2 %)

Among Gram-positive bacteria, *Staphylococcus aureus* was the most recovered microorganism, followed by *Streptococcus pneumoniae* (Table 4).

Table 4. Frequency of Gram-positive and Gram-negative bacteria recovered in a pediatric hospital over a 2-year period.

Bacteria	n	Relative Frequency (%)
Gram-positive		
Staphylococcus aureus	768	20%
Streptococcus pneumoniae	159	4.2%
Staphylococcus epidermidis	143	3.8%
Enterococcus faecalis	94	2.4%
Staphylococcus hominis	76	2 %
Corynebacterium sp.	52	1.3%
Bacillus sp.	12	0.3%
Gram-negative		
Escherichia coli	627	16.3%
Proteus mirabilis	470	12.3%
Klebsiella pneumoniae	192	5%
Enterobacter cloacae	97	2.5%
Pseudomonas aeruginosa	701	18.3%
Acinetobacter baumannii	270	7%
Stenotrophomonas maltophilia	55	1.4%
Burkholderia cepacia	47	1.2%

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In this study, the five most prevalent HAI bacteria (n = 1107) were *Pseudomonas aeruginosa* (10.4%, n=116), *Acinetobacter baumannii* (7.8%, n=87), *S. aureus* (4.3%, n=48), *Escherichia coli* (4.3%, n=48), and *Klebsiella pneumoniae* (3.5%, n=39).

The main agents of bloodstream infection, *S. epidermidis*, *S. hominis*, *A. baumannii*, *S. aureus*, *K. pneumoniae*, and *E. coli* (Figure 1a), were found in order of prevalence. Among the other isolated species *E. faecalis*, *P. aeruginosa* and *E. cloacae* stand out.

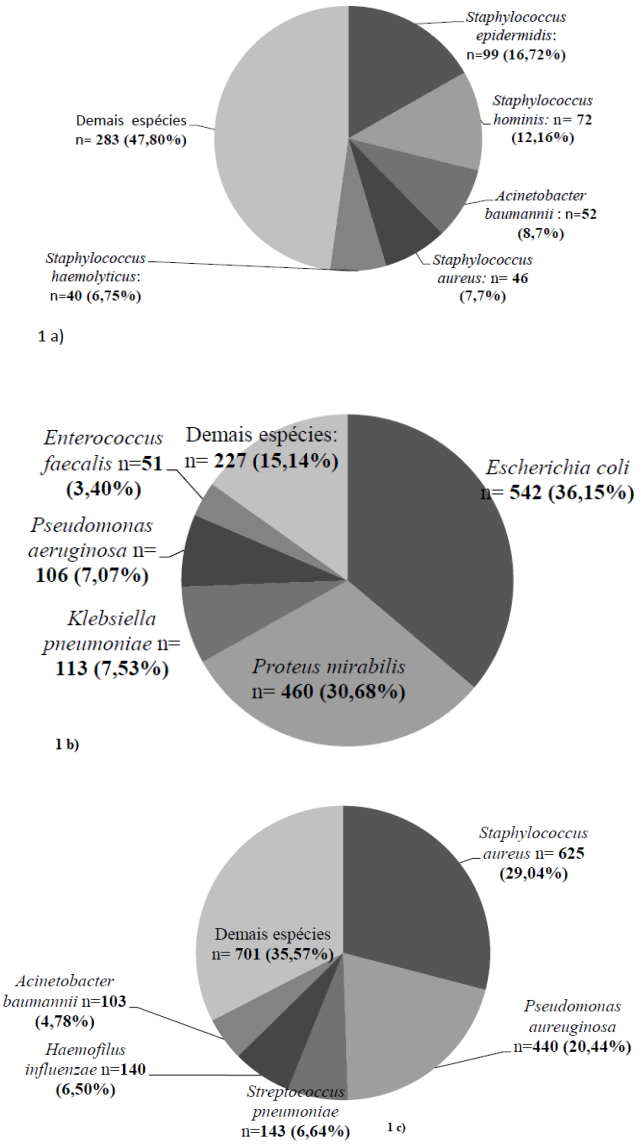

Figure 1. Main bacteria isolated from samples of the pediatric population treated at a public hospital for children over a 24-month period (2014/2016). a) bloodstream; b) urinary tract; c) diverse secretions.

In urinary tract infections, *E. coli* was more prevalent followed by *Proteus mirabilis* (Figure 1b). Furthermore, *K. pneumoniae, P. aeruginosa*, and *E. faecalis* were also recovered. Microbiological findings of various secretions including skin, ear and lower respiratory tract were also analyzed, and a similarity of prevalence between Gram-positive and Gram-negative bacteria as agents of infection was observed. *S. aureus* followed by *P. aeruginosa, S. pneumoniae*, *Haemophilus influenzae* and *A. baumanni* were the most recovered microorganisms (Figure 1c).

Regarding Gram-positive bacteria, absolute sensitivity to vancomycin was observed between *Staphylococcus* spp.; 33% of *Enterococcus* spp. and 25 (2.25 %) of the HAI were caused by carbapenem-resistant Gram-negative bacteria, such as *A. baumannii* and *P. aeruginosa*. Regarding the reports that contained data related to the minimum inhibitory concentration (MIC), of the isolates assessed, the findings ranged from 0.5 to 8mg/L. Those with MIC ≥ 4mg/L were considered resistant according to CLSI data.

DISCUSSION

Currently, data from literature on the bacterial profile in pediatric hospitals assessing both community infections and HAI are not found. The focus of hospital institutions are only HAI, patient safety measures, and risk associated with bacterial resistance. In general, the prevalence profile of the bacteria found in the pediatric hospital studied over a two-year period is similar to studies conducted internationally in children, and the increase in HAI is also highlighted, despite efforts to propose safe practices and protocols to contain cases. Understanding the regional epidemiological and microbiological data is of great importance when handling potentially life-threatening infections and are crucial for successful therapy.[9]

In a systematic review that assessed the main causes of hospitalizations of children in Brazil, with 11 articles included from 2008 to 2015, reported respiratory tract infections and gastroenteritis as the main causes of hospital admission.[10] In the present study, the same circumstances or events observed were reported as causes of hospitalizations. Of particular concern is an increase in HAI cases, which may be related to failure to observe protocols for safety measures and precautions for infections, and the lack of a local antimicrobial prescription protocol. HAIs are important adverse events that affect not only the permanence of admissions and costs, but also morbidity and mortality.[10-11]

In UII and UIII, the overall rates of HAIs were 5 infections/1,000 patient-days and 14 infections/1,000 patient-days, respectively. The higher frequency of HAIs in the hospitalization units when compared to ICUs may be associated with a higher number of beds, professional turnover, people from different locations, and presence of relatives. In a study in five years of observation, the overall rate in hospitalization and ICU units was 14.32 infections/1,000 patient-days, showing that the distribution and expected incidence of infection may vary according to the institutional profile and that vigilance must be constant in to implement good practices in the health service.[11]

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In general, studies describe that HAIs tend to be more incident in ICUs due to the severity of clinical picture, immune compromise, and invasive procedures.[10-11] In the present study, from the annual reports provided by the ICS there was an increase of 12.5% between 2014 and 2015 and 2015 and 2016. A 7% HAI increase in 2016, with an overall incidence of 31.4% in the ICU sector. According to data from the Brazilian National Agency of Sanitary Surveillance (*Agência Nacional de Vigilância Sanitária* - ANVISA), in Brazil the rates of HAI in pediatric ICUs vary from 3% to 27%. The overall rate of infection has not been frequently observed; however, data from ANVISA show the overall rate of infection varies between 19.2 and 49 infections/1,000 patient-days.[1] Regarding the major HAI sites, contrary to what was observed here, in another study, bloodstream infections were the most frequent (31%), followed by respiratory tract infections (20%).[11] Regarding the major HAI sites, the CDC/National Health Security Network (*Rede Nacional de Segurança em Saúde* – NHSN) describes the importance of relating infection sites in hospital settings.[12] Differences in the prevalence of certain bacteria can occur at each site of infection, with *S. aureus* being more frequent in bloodstream, respiratory tract and skin infections. [1]The implementation of preventive strategies for HAI control in health institutions, aiming at a better quality of care, has contribute greatly to the possible reduction of infection rates, although they may still be considered significant. [10-11]

According to Infectious Diseases Society of America, among the most important clinical and epidemiological bacteria are *E. faecium, S. aureus, K. pneumoniae, A. baumannii*, *P. aeruginosa*, and *Enterobacter* spp, denominated pathogens *ESKAPE*.[13] The *ESKAPE* pathogens are responsible for a substantial percentage of nosocomial infections and represent the vast majority of isolates.[14] In this context, it is worth noting that Latin American countries, including Brazil, have high levels of bacterial resistance to antimicrobials among bacteria of clinical importance (*ESKAPE*).[15,16] In the present study, the frequency of *P. aeruginosa* (10.4%) and *A. baumannii* (7.8%) was also significant, similar to that found in another analysis that describe that *P. aeruginosa* these are the main bacteria isolated from biological samples, besides including *K. pneumoniae*.[17] In this study, the assessing community based and health care related infections, *S. aureus* has been reported as more frequent. However, prevalence patterns may vary by region, and the differences are probably attributable to variations in populations studied, denoting again the necessity to know the local bacterial profile.[18]

In general, the Gram-negative bacteria mentioned herein exhibited a high antimicrobial susceptibility profile, 25 (2.25%) of the HAI were caused by carbapenem-resistant Gram-negative bacteria such as *A. baumannii* and *P. aeruginosa*. Regarding Gram-positive bacteria, absolute sensitivity to vancomycin was observed between *Staphylococcus spp*. and 33% of *Enterococcus spp*. Another study reported a high rate of resistance to carbapenems (18 to 35%) between *K. pneumoniae, A. baumannii,* and *P. aeruginosa*, over a five-year period in an institution similar to this study.[11] According to literature, vancomycin resistant *Enterococcus* (VRE) account for for 4% of all HAI in the United States.[19] In Brazil, VRE is considered the eighth cause of HAI, mainly *E. faecalis*, in contrast to other countries where *E. faecium* is more frequent.[15] As an alert to control the spread of bacterial resistance, it is worth noting that VRE rates in Latin America increased from 5.0% in 2003 to 15.5% in 2008, and the most significant increase occurred among isolates from Brazilian centers.[15,20] In the pediatric population, antimicrobial resistance among Gram-negative bacteria is of concern due to the implications in clinical practice. The rate of resistance to carbapenems and other drugs, especially in *A. baumannii* and *P. aeruginosa*, is among the highest described in the world literature.[21-23]

In relation to bloodstream infections, we observed that *S. epidermidis* was the most frequently found in the analyzes. In other study performed in a neonatal ICU, *S. epidermidis* was the most frequent agent of bloodstream infections, possibly due to the use of invasive procedures in ICUs. Additionally, the authors caution against an increase in cases of infections of the bloodstream by *Staphylococcus* spp. and also by Gram-negative resistant bacteria such as *Acinetobacter* spp.[23] In children hospitalized in the United States, coagulase negative *Staphylococcus* are the main agents of infections in the bloodstream, which consolidates this genus as the most frequent in this site. [24]

Analysis of the data provided by the ICS of the pediatric hospital allowed a more detailed assessment of the incidence of bacteria associated with systemic infection, of the urinary tract, and isolated from diverse secretions of the pediatric population attended in the public hospital studied. In urinary tract infections, *E. coli* was more prevalent followed by *P. mirabilis*. Data from the literature show that *E. coli* accounted for 69 % of infections, either HAI or those acquired in the community, followed by *P. aeruginosa* as main agents.[25] However, in contrast to our data, *P. mirabilis* was not isolated, and this is possibly due to the study approach only in HAI, which differs from the proposal of this work which includes community infections. The finding of *P. aeruginosa* is possibly associated with medical intervention with devices such as catheters and probes, where it easily adheres and forms biofilms that are difficult to treat.[23]

Data from literature referring specifically to the epidemiological profile of bacteria recovered from various secretions are not found. Generally, specific HAI studies address the prevalence of bacteria isolated from the bloodstream, surgical sites, respiratory tract, and skin separately, with reports of these same bacteria being frequent.[7,10-11]

This study presented as a limitation the use of retrospective data. Brazil is marked by socioeconomic inequalities, and hospital institutions are heterogeneous in terms of organization, structure, and resources, with HAI data rarely disclosed and often not consolidated. Nevertheless, the epidemiological data presented here

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may contribute to expand knowledge of the context of infections in the pediatric population, still scarce in Brazil, and provide better treatment and control measures of HAI in hospital institutions. Finally, the knowledge of prevalent bacterial isolates is crucial when choosing a therapy to decrease morbidity and mortality in hospitals.

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AUTHORS' CONTRIBUTIONS

Geisa Cristina da Silva Alves contribuiu para a concepção, delineamento, análise e redação do artigo.

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Hospital Santa Cruz

ORIGINAL ARTICLE

Characterization of notifications of violence against women in a teaching hospital in Paraná

Caracterização das notificações de violência contra mulheres em um hospital de ensino do Paraná

Caracterización de las notificaciones de violencia contra la mujer en un hospital universitario de Paraná

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ABSTRACT

Background and objectives: there are many forms of violence, such as domestic and sexual violence, both included in the National Compulsory Notification List of diseases, injuries and public health events, according to Ordinance GM/MS nº 1.271 of June 6, 2014, which expressed a significant advance for health, social care, legal and public security policies. The aim of this study was to describe sociodemographic characteristics of interpersonal violence with women of childbearing age. **Methods:** a descriptive, retrospective, quantitative study conducted in a public university hospital in Paraná with women of childbearing age, 10 to 49 years. The Notifiable Diseases Information System was used as the source of data collection. Subsequently, descriptive statistical analysis was performed. **Results:** there were 883 (100%) acts of violence against women. Of these, 314 (35%) cases were against women of childbearing age (10 to 49 years), of which 130 (42%) in the age group of 10 to 19 years, that is, in adolescence. Of the total, 197 (63%) women were white, 302 (96%) lived in urban areas, 100 (32%) had incomplete primary education and 125 (40%) were single. The authorship of the aggression was predominantly of the male sex, 197 (63%), and the place of occurrence was the victim's residence, 135 (47%). **Conclusion:** combating violence against women has been a fundamental concern of social movements worldwide. It is necessary to seek different ways to combat violence and crime through social, educational and judicial measures in order to preserve the family environment.

Descriptors: *Violence. Epidemiological Monitoring. Notification. Women's Health.*

RESUMO

Justificativa e objetivo: muitas são as formas de violência, como exemplo a doméstica e sexual, ambas incluídas na Lista Nacional de Notificação Compulsória de doenças, agravos e eventos de saúde pública conforme a Portaria GM/MS nº 1.271, de 06 de junho de 2014, o que expressou um avanço significativo para as políticas, não só de saúde,

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mas da assistência social, jurídica e segurança pública. O objetivo do trabalho foi descrever características sociodemográficas da violência interpessoal com mulheres em idade fértil. **Métodos:** estudo descritivo, retrospectivo, de abordagem quantitativa, realizado em um hospital universitário público do Paraná, com mulheres em idade fértil, 10 a 49 anos. O Sistema de Informação de Agravos de Notificação (SINAN) foi utilizado como fonte de coleta de dados. Posteriormente, foi empregada análise estatística descritiva. **Resultados:** ocorreram 883 (100%) atos de violência contra mulheres. Destas, 314 (35%) contra mulheres em idade fértil (10 a 49 anos), sendo 130 (42%) na faixa etária de 10 a 19 anos, ou seja, na adolescência. Do total, 197 (63%) eram brancas, 302 (96%) residentes em região urbana, 100 (32%) com ensino fundamental incompleto e 125 (40%) solteiras. A autoria da violência teve predominância do sexo masculino 197 (63%), e o local de ocorrência foi a residência da vítima 135 (47%). **Conclusão:** em todo o mundo, o combate à violência contra a mulher se constituiu em uma preocupação fundamental dos movimentos sociais, sendo necessário buscar diversos caminhos para combater a violência e a criminalidade, através de medidas sociais, educativas e judiciais, com o intuito de preservar o ambiente familiar.

Descritores: *Violência; Vigilância Epidemiológica; Notificação; Saúde da mulher.*

RESUMEN

Justificación y objetivos: hay muchas formas de violencia, como la violencia doméstica y sexual, ambas incluidas en la Lista nacional de notificaciones obligatorias de enfermedades, lesiones y eventos de salud pública según la Ordenanza GM/MS nº 1.271, de 6 de junio de 2014, lo que expresó un avance significativo para las políticas de salud, asistencia social, legal y de seguridad pública. El objetivo de este estudio fue describir las características sociodemográficas de la violencia interpersonal con mujeres en edad fértil. **Métodos:** estudio descriptivo, retrospectivo, cuantitativo, realizado en un hospital universitario público de Paraná, con mujeres en edad fértil, de 10 a 49 años. El Sistema de Información de Notificación de Enfermedades se utilizó como fuente de recopilación de datos. Posteriormente, se utilizó un análisis estadístico descriptivo. **Resultados:** hubo 883 (100%) actos de violencia contra las mujeres. De estos, 314 (35%) contra mujeres en edad fértil (10 a 49 años), siendo 130 (42%) en el grupo de edad de 10 a 19 años, es decir, en la adolescencia. Del total, 197 (63%) eran blancas, 302 (96%) vivían en áreas urbanas, 100 (32%) tenían educación primaria incompleta y 125 (40%) eran solteras. La autoría de la agresión fue predominante del sexo masculino, 197 (63%), y el lugar del hecho fue la residencia de la víctima, 135 (47%). **Conclusiones**: combatir la violencia contra la mujer ha sido una preocupación fundamental de los movimientos sociales a nivel mundial. Es necesario buscar diferentes formas de combatir la violencia y la delincuencia a través de medidas sociales, educativas y judiciales para preservar el entorno familiar.

Palabras clave: *Violencia. Monitoreo Epidemiológico. Notificación. Salud de la Mujer.*

INTRODUCTION

Health policies are being implemented in Brazil, among which, health surveillance policies stand out.[1] According to the legislation that deals with the compulsory notification of cases of violence against women - Law number 10778/2003 (including the amendment contained in Law number 13931/2019) – in all health care services, public or private, where there is evidence or confirmation of such violence, the specific form of the Notifiable Diseases Information System (Portuguese acronym: SINAN) that addresses interpersonal or self-inflicted violence must be filled out.[2] In the referred legislation, violence against women is conceived as "any gender-based action or conduct, including due to discrimination or ethnic inequality, which causes death, physical, sexual or psychological harm or suffering to women, both in the public and private spheres".[1,3]

The reports of injuries in this population group should include violence inflicted both in domestic and community spaces, respectively called domestic/intra-family and extra-family/community violence. This harm comprises various types of abuse, such as physical, sexual, psychological and moral.[3]

Interpersonal violence against women, like all forms of violence, is considered a social and public health problem in Brazil, affects the quality of life of the population and compromises social, economic and health aspects.[3,4]

Situations of physical, psychological and moral harm to women, when present in their day-to-day social relationships, produce a cascade of effects that reverberate beyond women's body and their family, such as depression, social exclusion and suicide.[4]

According to the world indexes, about 35% of women in the world have already suffered physical or sexual violence inflicted by their partners, while 7% have been sexually assaulted by other individuals, including family members, acquaintances and strangers.[5]

Brazil is considered one of the worst countries in Latin America in terms of women's wellbeing due to the high numbers of violence against women.[4] According to the United Nations (UN), Brazil ranks fifth in global terms for femicides or cruel murders resulting from discriminatory culture, sexual violence and sexism.[4] Worldwide, it is

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estimated that there are 503 assaults per hour, 5.2 million harassments on public transport and 2.2 million women grabbed or kissed without consent.[3-5]

In Brazil, in addition to policies aimed at meeting women's health, such as the National Policy for Comprehensive Care for Women's Health with the expansion and qualification of the comprehensive care network, there is legislation that supports the notification of cases of violence against women, since it characterizes violence against this group.[6] Law 11.340/2006, known as Lei Maria da Penha, is concerned with curbing the violence against women, characterized as domestic and family violence.[7] In this specific legislation, there is the definition of physical, sexual, psychological, verbal, moral and patrimonial violence.[7] In this respect, the aforementioned law brought to light the violence suffered by women and reaffirmed the need for intersectoral actions to prevent and confront all forms of violence.[7]

Intrafamily violence concerns not only the context in which it is perpetrated, but mainly refers to the victim's relationships with the offenders. The aggression represents any action or omission that harms an individual's wellbeing, physical or psychological integrity or freedom and the right to full development.[8] The extra-family violence occurs in other social spaces and the authors, known or unknown, are not part of the victim's family relationships, and notifications by health services include only a few population groups besides women, such as children, elderly subjects, disabled people, indigenous people, among others.[8]

The notification of acts of violence against women is one of the components of the care provided by health professionals that can give visibility to the problem and favor the planning of containment strategies.[8,9]

The concept of fertile age corresponds to the time interval between menarche and menopause, that is, between 10 and 49 years of age. Studies addressing mortality and health conditions such as violence in this period have great epidemiological relevance, as they can encourage public health policies for this type of problem.[9]

Various forms of violence, such as domestic and sexual violence, were included in the National List of Compulsory Notification of diseases, injuries and public health events, according to Ordinance GM/MS Number 1271 of June 6, 2014. This expressed a significant advance for health, social care, legal and public security policies.[10]

Given the above, the objective of the study was to describe sociodemographic characteristics of interpersonal violence against women of childbearing age reported in a public university hospital in Paraná from 2014 to 2018.

METHODS

Descriptive, retrospective, quantitative study conducted at the Hospital Epidemiological Surveillance Center (Portuguese acronym: NVEH) of a university hospital in the state of Paraná.

In August 2019, epidemiological data were collected from individual forms of compulsory notification of Interpersonal/Self-inflicted Violence from the Notifiable Diseases Information System. The surveyed period was from January 2014 to December 2018. All records corresponding to cases of violence against women of childbearing age (between ages of 10 and 49 years) were included. Records with different ages and sexes were excluded.

The forms are filled out by health professionals who provide the initial care. After this process, the information is inserted in the Notifiable Diseases Information System by the responsible nurse of the Hospital Epidemiological Surveillance Center. Subsequently, the search for notifications in the respective period was performed.

For purposes of delimitation of the study, the variables studied were: i) related to the victim: sex, age group, race/color, education, area of residence; ii) related to the perpetrator of the violence: place of occurrence, bond/degree of kinship, sex and age.

After collection, data were transcribed and tabulated in Excel spreadsheets. Descriptive analysis was performed using simple and relative frequency in percentage.

This study is part of a broader research project approved by the Research Ethics Committee under opinion number 2.751.985 and CAAE 90600318.3.0000.0107, according to guidelines of Resolution Number 466 of 2012.

RESULTS

Of the total of 1,645 cases of interpersonal/self-inflicted violence reported in the Notifiable Diseases Information System, 883 (54%) were of the female sex and 314 (35%) of these women were of childbearing age.

The data collected allow the consideration that notifications increased slightly in 2014 with 73 (23%) reports and in 2018 with 75 (24%), compared to year 2015 with 54 (17%) reports, 2016 with 55 (18%) and 2017 with 56 (18%).

Table 1 shows the distributions of notified cases in which variables, according to the victim, help to identify the sociodemographic characteristics of women who suffered interpersonal violence.

Single victims accounted for 125 (40%) cases, followed by married victims or in a common-law marriage, 116 (37%). Separated women represented 22 (7%) cases, widows, 2 (1%) and ignored, 49 (14%) cases.

Regarding the perpetrator of violence, the male sex was predominant and represented 197 (63%) cases, followed by aggressions in which the author was female, 30 (10%), and of both sexes, 29 (9%) cases.

With regard to the connection with the victim, 65 (21%) were of unknown author, and another important fact was that in 30 (10%) cases, the perpetrator of violence was the mother.

In most cases, 135 (47%), the context was the victim's own residence. The cases in which one person was involved in the aggression were 185 (65%), while ignored or omitted cases totaled 44 (15.4%).

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Table 1. Variables regarding characteristics of women of childbearing age victims of violence in the period from 2014 to 2018. Cascavel - Paraná, 2019.

Variables	(n)	(%)
Age		
10-14	58	19
15-19	72	23
20-24	55	18
25-29	42	13
30-34	32	10
35-39	26	8
40-44	15	5
45-49	14	4
Race/Color		
White	197	63
Mixed race	74	23
Black	36	12
Ignored/Blank	7	2
Place of Residence		
Urban	302	96
Rural	9	3
Ignored/Blank	3	1
Education		
Illiterate	2	1
Incomplete primary school	100	32
Complete primary school	25	8
Incomplete secondary school	56	19
Complete secondary school	37	11
Incomplete higher education	6	2
Complete higher education	9	3
Ignored/Blank	79	24
Marital status		
Single	125	40
Married/common-law marriage	116	37
Separated	22	7
Widow	2	1
Not applicable	19	5
Ignored/Blank	30	9

Table 2. Variables regarding characteristics of the perpetrator of violence against women of childbearing age from 2014 to 2018. Cascavel - Paraná, 2019.

Variables	(n)	(%)
Sex of the offender		
Male	197	63
Female	30	10
Both sexes	29	9
Ignored/Blank	58	18
Connection to the victim		
Friend	33	11
Spouse	56	18
Unknown	65	21
Ex-spouse	20	7
Boyfriend	5	2
Ex-boyfriend	3	1
Brother	8	3
Mother	30	10
Stepfather	3	1
Father	22	8
Law enforcement officer	2	1
Institutional relationship	2	1
Another bond	15	5

Table 3. Variables regarding characteristics of the place and perpetrators of violence against women of childbearing age in the period from 2014 to 2018. Cascavel - Paraná, 2019.

Variables	(n)	(%)
Place		
Victim's own residence	135	47
Public space	81	28
Others	10	3
Bar or similar	7	2
Shop	4	1
School	2	0.3
Industry	1	0.2
Perpetrator		
One	185	65
Two or more	56	20
Ignored	44	15

DISCUSSION

The results obtained over the years studied demonstrated that the predominant age group was from 10 to 24 years old, the stage of life in which women are in full reproductive period, beginning economic and social life and in search of their autonomy, a predisposing factor for violence, especially the violence caused by partners, due to their change in the role of supporting the home.[11]

As for the race/color of women studied, in the notifications, there was a predominance of white women, 197 (63%), according to the geographic cut, since this is a region of predominance of white women. This differed from other studies in which the north and northeast regions were compared and was found a predominance of mixed-race victims, with the largest number of records.[12-14]

The main place of occurrence of violence was the residence itself with 135 (47%) cases, which corroborates other studies by Guimarães; Pedroza (2015, p. 257).[15,16] In this perspective, the high prevalence of violence within the home itself is worrisome, given the perceived weakening of complaints and follow-up of notified cases, often a result of the victim's fear of making the complaint.[12-16]

The problems related to filling out the notification form were reported as the greatest difficulties in developing actions for this problem. The following were mentioned: the size of the form; the situation of the victim; the difficulty that professionals expose themselves to; as well as shame, fear and embarrassment as barriers that put the fragility of information at risk. Such problems must be addressed so that data are reliable and can guide actions in the face of the problem.[6]

Regarding the level of education, most cases did not have complete primary education, as in other studies that assessed the concentration of cases of violence against women.[17] These aspects show that the lower the level of education of women, the less they report acts of violence against themselves, thereby favoring vulnerability to physical/sexual violence.[12-16]

Regarding women's marital status, most were single, 125 (40%) cases, which is a predisposing factor

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for notification. However, most of these women had a partner, although not in a common-law marriage. Married women also formed a considerable portion of the sample, 116 (37%). In contrast to our findings, a previous study showed that among 265 women who experienced violence, the majority was legally married (40.8%) or lived with their partner at the time of the interview (59.2%).[8]

Physical violence is present in almost a third of all cases of violence against women worldwide. Data from Japan and Ethiopia show that between 15% and 71% of women suffered physical and/or sexual violence from a partner in their life.[3] In the present study, this information was not different, since more than half of cases of violence against women are characterized as some type of physical violence; and secondly, sexual violence, of which most cases are inflicted by male offenders.[9,11-14,16,17] In another study, 10,167 cases of violence among ages 10-49 years were analyzed; 4,943 (63.5%) cases of physical violence were identified, followed by 1,229 (15.8%) of sexual violence.[16]

With regard to the perpetrator of the violence, 197 (63%) were male, 56 (18%) the husband, 20 (7%) ex-spouse, 30 (10%) mother, 33 (11%) a friend, and 65 (20%) were strangers. Violence has been perpetrated by people close and known to the victim; friends, spouses, ex-boyfriends, or of the victim's own family circle.[18] Such violence is worrying, given the noticeable weakening of complaints, notification and the effective investigation of cases, because the victim often experiences the fear of making the complaint.[19-23]

The limitations inherent to the study were the interpretation of data, the underreporting, and incompleteness of data caused by lack of awareness and/or appropriate professional training.

Studies with these characteristics contribute reliably to the description of information related to violence, are crucial for the development of public policies aimed at addressing such violence, and give greater visibility to the theme.

Based on the 314 cases notified between 2014 and 2018, the characterization of cases of interpersonal violence with women of childbearing age attended at the public hospital studied can be summarized as follows: the cases correspond to 35% of the total notifications related to the female sex; in the studied period, there was an average of 63 annual cases; cases in women aged 10 to 24 years predominated, mostly white, single women with complete primary school, who mostly suffered physical and sexual violence perpetrated by men, almost always by spouse or ex-spouse, with a predominance of cases in the victim's homes. The high number of raped adolescents was an important fact that constitutes an alert, as it involves other sectors of social policies for its prevention.

The data presented here may generate reflections on the need to develop educational actions addressing specific themes about the vulnerability of the female sex and the social inequality in which women are culturally inserted, involving professionals in health, education, social care and others. The number of teams in direct lines for preventing and responding to violence should be increased; health professionals should undergo training to identify risk situations; and the strengthening of support networks should be expanded, including the guarantee of operation and expansion of the number of places in shelters for surviving women.

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AUTHORS' CONTRIBUTIONS

Maria Julia Navarro Kássim and Leda Aparecida Vanelli Nabuco de Gouvêa contributed to the conception, design of the article, analysis and writing of the article;

Maria Julia Navarro Kássim, Leda Aparecida Vanelli, Claudia Ross and Maristela Maraschin contributed to the planning and design of the article, review and final approval of the article;

All authors approved the final version to be published and are responsible for all aspects of the work, including its accuracy and integrity.

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Revista de Epidemiologia e Controle de Infecção

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ORIGINAL ARTICLE

Epidemiological profile of accidents caused by venomous animals in the municipality of Patrocínio, Minas Gerais: portrait of a decade

Perfil epidemiológico dos acidentes causados por animais peçonhentos no município de Patrocínio, Minas Gerais: retrato de uma década

Perfil epidemiológico de accidentes causados por animales venenosos en el municipio de Patrocínio, Minas Gerais: retrato de una década

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ABSTRACT

Background and objectives: despite advances in health care, accidents involving venomous animals are still a major public health problem in Brazil. Between 2015 and 2016, the Southeast region had the highest number of notifications, and Minas Gerais was the state with more occurrences. The objective of this study was to describe the epidemiological characteristics of accidents by venomous animal notified between 2008 and 2017 in the municipality of Patrocínio, Minas Gerais. **Methods: t**his is a retrospective descriptive study conducted by analyzing the information from reporting forms of the Notifiable Diseases Information System for victims of accidents with venomous animals occurred during the years 2008 to 2017 in Patrocínio. **Results:** in total, 1084 cases were recorded, mostly caused by scorpions (47.23%), followed by snakes (17.07%), spiders (15.31%) and bees (11.07%). There was a predominance of male victims (63.10%), aged between 20-39 years (32.56%). Most accidents were classified as mild (89.11%) and the cure occurred in 98.80% of cases; one evolved to death. **Conclusion:** although accidents with venomous animals do not have high mortality rates in the municipality studied, the incidence of this health problem has increased in recent years. In addition, this updated epidemiological information may contribute to public policy actions and inform the local population about imminent risks.

Descriptors: *Araneism. Scorpionism. Snake bites. Ophidism. Scorpion stings.*

RESUMO

Justificativa e objetivos: apesar dos avanços na área assistencial, os acidentes por animais peçonhentos ainda são um importante problema de saúde pública no Brasil. Entre os anos de 2015 e 2016, a região Sudeste apresentou

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o maior número de notificações, e Minas Gerais foi o estado com mais ocorrências. O objetivo deste estudo foi descrever as características epidemiológicas dos acidentes por animais peçonhentos notificados entre 2008 e 2017 no município de Patrocínio, Minas Gerais. **Métodos**: estudo descritivo retrospectivo realizado por meio da análise das informações das fichas de notificação do Sistema de Informação de Agravos de Notificação (SINAN) de vítimas de acidentes por animais peçonhentos ocorridos durante os anos de 2008 a 2017 em Patrocínio. **Resultados**: foram registrados 1.084 casos, a maioria ocasionada por escorpiões (47,23%), seguida por serpentes (17,07%), aranhas (15,31%) e abelhas (11,07%). Sobre as vítimas, constatou-se o predomínio de homens (63,10%) na faixa etária entre 20 a 39 anos (32,56%). A maior parte dos acidentes foi classificada como leve (89,11%) e a cura ocorreu em 98,80% dos casos; um evoluiu para óbito. **Conclusão**: embora os acidentes por animais peçonhentos não apresentem altas taxas de letalidade no município estudado, a incidência desse agravo de saúde tem aumentado nos últimos anos. Além disso, informações epidemiológicas atualizadas podem contribuir com ações de políticas públicas e informar a população local sobre os riscos iminentes.

Descritores: *Araneísmo. Escorpionismo. Mordeduras de serpentes. Ofidismo. Picadas de escorpião.*

RESUMEN

Justificación y objetivos: a pesar de los avances en salud, los accidentes de animales venenosos siguen siendo un importante problema de salud pública en Brasil. Entre 2015 y 2016, la región sudeste tuvo el mayor número de notificaciones y Minas Gerais fue el estado con más casos. El objetivo de este estudio fue describir las características epidemiológicas de los accidentes por animales venenosos notificados entre 2008 y 2017 en el municipio de Patrocínio, Minas Gerais. **Métodos:** estudio descriptivo retrospectivo llevado a cabo mediante el análisis de la información de los formularios de notificación del Sistema de Información de Enfermedades Notificables de víctimas de accidentes con animales venenosos que ocurrieron durante los años 2008 a 2017 en Patrocínio. **Resultados:** se registraron 1084 casos, en su mayoría causados por escorpiones (47.23%), seguidos de serpientes (17.07%), arañas (15.31%) y abejas (11.07%). Predominaron las víctimas del sexo masculino (63,10%), con edades entre 20 y 39 años (32,56%). La mayoría de los accidentes se clasificaron como leves (89,11%) y la curación se produjo en el 98,80% de los casos; uno evolucionó hasta la muerte. **Conclusiones:** aunque los accidentes con animales venenosos no tienen altas tasas de mortalidad en el municipio estudiado, la incidencia de este problema de salud ha aumentado en los últimos años. Además, esta información epidemiológica actualizada puede contribuir a las acciones de política pública e informar a la población local sobre los riesgos inminentes.

Descriptores: *Araneismo. Escorpionismo. Picaduras de serpiente. Ofidismo. Picaduras de escorpión.*

INTRODUCTION

Although accidents involving venomous animals still are a neglected public health problem, they have high morbidity and low lethality. The main contributing factors to the increase in this health problem are Brazil's vast biodiversity, the growing urban mobility and changes in life habits that are causing people to have greater contact with nature.[1]

Regarding the presence of a device for inoculating poison, animals are classified into two groups: poisonous and venomous. Poisonous animals do not have a device for inoculating poison, while venomous animals have venom-producing glands interconnected through structures such as prey, goads, chelicerae, stingers, among others, where the venom passes actively and is released. In Brazil, the main venomous animals that cause accidents are scorpions, spiders, and snakes.[1,2]

Accidents with scorpions are the most prevalent. Although scorpions have a low lethality in adults, vulnerable populations such as children and the elderly have a higher risk of death. Worldwide, more than one million cases of scorpion poisoning are reported annually, and in Brazil, 57,933 accidents were recorded in 2011. Despite the wide variety of scorpion species, only a few are of medical importance in the country, (eg, *Tityus serrulatus*, *T. bahiensis*, *T. stigmurus*, and *T. obscurus*), and the yellow scorpion, *T. serrulatus*, is the most lethal.[3,4]

The spider is another type of arachnid of great medical importance that inoculates its poison through chelicerae and paralyzes and kills its prey. Although four genera can cause accidents in humans, in Brazil, only three are associated with accidents, namely the *Phoneutria* (spider-spider), *Loxosceles* (brown spider), and *Latrodectus* (black widow). The genus *Loxosceles* has the highest rate of accidents and lethality. In 2015, 25,786.4 spider accidents were reported in Brazil.[3,4]

Snakes also cause many poisonings, even though not all snakes are venomous. There are non-venomous snakes that also cause accidents. Venomous snakes present forward-positioned fangs, where the poison is inoculated. The main genera of venomous snakes in Brazil are *Bothrops* (jararaca, jararacuçu, urutu, etc.), *Crotalus* (rattlesnake), *Micrurus* (coral), and *Lachesis* (surucucu-pico-de-jaca). Most snake accidents occur by the genus *Bothrops*, represented in the Southeast region,

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mainly by the species Bothrops jararaca, popularly known as jararaca. According to the World Health Organization, 2,500,000 snakebites occur worldwide each year.[2,3,5]

The actual number of accidents by venomous animals is not yet known, because of underreporting and the lack of epidemiological surveillance systems in some places. However, between 2008 and 2017, 266,489 cases were recorded in Minas Gerais. Note that the Southeast was the Brazilian region with the highest number of accidents caused by poisonous animals between 2015 and 2016, and Minas Gerais was the state with more occurrences.[6,7]

The dissemination of epidemiological data related to accidents by venomous animals is essential for the development of public policies and control strategies by health services, and to clarify to the population about the imminent risks in their region. In this context, the objective of this study was to describe the epidemiological characteristics of cases of accidents by venomous animals notified between years 2008 and 2017 in Patrocínio, Minas Gerais.

METHODS

Patrocínio is a Brazilian municipality located in the region called Alto Paranaíba, state of Minas Gerais. According to data from the Brazilian Institute of Geography and Statistics (IBGE), the estimated population for 2019 is 90,757 inhabitants. The region has tropical climate with two well-defined seasons, dry and rainy. During the dry season, mild temperatures prevail (17°C), and in the rainy season, higher temperatures (22°C) prevail. The economy is based on agriculture and livestock, with coffee and dairy cattle as the most relevant activities.[8,9]

This is a retrospective, descriptive, cross-sectional study on accidents caused by venomous animals notified in the municipality of Patrocínio (MG) between years 2008 and 2017. Secondary data obtained from the Notifiable Diseases Information System (Portuguese acronym: SINAN) were used. Although this was a study of human beings, approval by the research ethics committee was not needed, as secondary data are available on the internet.

A form with 11 variables was created for data collection, and they were separated into three areas: 1) related to the victim: sex, race, age, and education; 2) related to the accident: type of accident, month of the accident, the time elapsed between the bite and medical care; and, 3) related to clinical manifestations: classification and evolution of the case.

Data were grouped in spreadsheets prepared in the Microsoft Excel program for analysis of results, the frequency and percentage of variables were determined, and results were presented in tables to facilitate understanding.

RESULTS

In a ten-year period (2008-2017), 1,084 cases of accidents by venomous animals were reported in Patrocínio (MG); 2017 was the year with the highest number of cases (147), while 2008 had the lowest number of cases (51).

Regarding victim-related variables, most accidents occurred with male individuals (63.10%), white race was the most affected (60.42%), as well as the age group of 20-39 years (36.90%). Although the education variable was analyzed, most data in this item remained unanswered (94.46%) (Table 1).

Table 1. Epidemiological data on victims of accidents caused by venomous animals in the municipality of Patrocínio, Minas Gerais, Brazil, 2008-2017.

Variables	n	%
Sex		
Male	684	63.1
Female	400	36.9
Age range (in years)		
<10	91	8.39
10-19	152	14.02
20-39	400	36.9
40-59	314	28.97
>60	127	11.72
Race		
White	655	60.42
Mixed race	254	23.43
Black	126	11.62
Yellow	13	1.21
No answer	36	3.32
Schooling		
None	60	5.54
No answer	1024	94.46

The most reported type of accident was caused by scorpions (47.23%), followed by snakes (17.07%), spiders (15.31%) and bees (11.07%). When observing the ten-year period of the study, accidents with venomous animals occurred predominantly in February (11.99%) and less frequently in September (4.34%). When the last three years (2015-2017) were evaluated, the period with the highest number of occurrences covered the months between October and December. The time between the bite and medical care was also one of the variables analyzed, and most occurred within one hour (56.83%), but there were still cases in which medical care was provided after 24 hours (2.86%) (Table 2).

Regarding the outcome of the accident, most obtained a mild final classification (89.11%), and only 2.77% were considered serious. Almost all cases resulted in the cure of patients (98.80%), although one death was recorded in 2012 (Table 3).

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Table 2. Epidemiological data on variables related to accidents caused by venomous animals, in the municipality of Patrocínio, Minas Gerais, Brazil, 2008-2017.

Variables	n	%
Type of accident		
Scorpion	512	47.23
Snake	185	17.07
Spider	166	15.31
Bee	120	11.07
Others	81	7.47
No answer	20	1.85
Accident month		
January-March	329	30.35
April-June	287	26.47
July-September	165	15.23
October-December	303	27.95
Sting time/care		
0-3 h	896	82.66
3-12 h	118	10.88
>12 h	56	5.17
No answer	14	1.29

Table 3. Epidemiological data on the clinical manifestations of accidents by venomous animals in the municipality of Patrocínio, Minas Gerais, Brazil, 2008-2017.

Variables	n	%
Final classification		
Mild	966	89.11
Moderate	83	7.66
Serious	30	2.77
No reply	5	0.46
Case evolution		
Cure	1071	98.8
Death	1	0.09
No answer	12	1.11

DISCUSSION

From the results obtained, the annual average of approximately 108 cases notified in the studied municipality was observed. There was a significant increase in incidence over the years; 2008 was the year with the lowest number of occurrences and 2017 with the highest. Two distinct variables may have contributed to the growth of notifications in Patrocínio: a possible underreporting in the first years of the study because of flaws in the Notifiable Diseases Information System, or an actual increase in the number of cases. An increase in occurrences may be a consequence of the increase in urban growth, deforestation, and agricultural extension. However, improvements in the notification system associated with greater adherence by service stations also contributed to the higher number of cases, expressing the real situation of the municipality.[1,6]

As for seasonality, there was a huge variation during the period evaluated. When considering the ten years of the study, the months with the highest and lowest occurrence were February and September, respectively. Note that in the last three years (2015-2017), the highest number of accidents was recorded between October and December, and a decline occurred between July and September. In the Southeast region, in late spring and early summer, there was an increase in the number of accidents caused by venomous animals, given the increase in temperature and rainfall, and consequently in agricultural activities in this period. Authors have concluded that the higher incidence of accidents by venomous animals is directly related to the increase in air temperature.[1,10]

In all years analyzed, the male sex was more affected by snakebites. Similar results were observed in macro-regions of the north and south of Minas Gerais. The higher incidence in men may be a result of their higher likelihood of having contact with venomous animals in their work activities, which are generally related to agriculture, construction and livestock. In agreement with the literature, the age group with the highest number of reported cases was 20-39 years, which illustrates the importance of accidents by venomous animals as an occupational health problem, since this age group includes an economically active population.[11-14]

In the municipality of Patrocínio, in line with the national scenario, most accidents by venomous animals were caused by scorpions. Similar results were found in the state of Minas Gerais. However, results of a study in southern Minas Gerais differed, since spiders, snakes, and bees were the venomous animals associated with a greater number of accident cases. Although most accidents involving venomous animals in Patrocínio were caused by scorpions, there was also a large number of cases related to snakes, spiders, and bees. It was not possible to assess which scorpion species was more associated with accidents by venomous animals in Patrocínio given the scarcity of data related to this variable in the Notifiable Diseases Information System.[12,15,16]

The time between the bite by a venomous animal and the outpatient care is a very important factor. Some poisons are absorbed faster than others, so early care is related to a good evolution of the case. The service time is closely linked to the resources available at the location of the bite or the environment where medical care occurs. In the municipality of Patrocínio, the time between the bite and the service occurred within one hour in most cases, or three hours at most, which corresponds to the predicted ideal time. Similar results were observed in a study in the state of Minas Gerais.[16,17]

In this study, in 98.8% of cases patients were cured, which is probably associated with the time between the bite and the service. In the ten years analyzed, only one death caused by accidents with venomous animals was recorded in 2012. Additionally, most cases notified in the municipality were classified as mild (89.11%). These results are in line with those found in epidemiological data on accidents by venomous animals in Minas Gerais. However, in Uberlândia, a city located in the Triângulo Mineiro, in the same period of this study, 32 cases of scorpion were classified as serious, the majority in children. In the state of Amazonas, 65.6% of accidents caused by snake

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bites were classified as serious.[14,16,18]

The main limitations of this study were the lack of information about some important variables such as level of education, species causing accidents, species associated with death, among others. However, the information registered in the Notifiable Diseases Information System is a valuable source of epidemiological data for the definition of public policies for the municipality.

From the results found, it is possible to affirm that between January 2008 and December 2017, in the municipality of Patrocínio, the most affected population by accidents with venomous animals were young male adults, who have a great chance of cure if attended in a timely manner. In addition, the scorpion was the main cause of these accidents.

Despite an increase in the reporting of cases, there is still underreported information. However, these epidemiological data available on the internet are very important, so city managers can make predictions on serum doses in health care, develop prevention strategies for the population at risk, and adopt control measures.

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AUTHORS' CONTRIBUTIONS

Guilherme Henrique Borges contributed to the conception, design of the article and data analysis;

Isadora Caixeta da Silveira Ferreira contributed to the conception, design of the article, data analysis and writing of the article.

All authors approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

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ORIGINAL ARTICLE

Epidemiological data and the importance for the COVID-19 pandemic control in Brazil

O cenário dos dados epidemiológicos descritivos e a importância para o controle da pandemia de COVID-19 no Brasil

El escenario de datos epidemiológicos descriptivos y la importancia para el control de la pandemia COVID-19 en Brasil

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ABSTRACT

Background and objectives: in Brazil, access to the epidemiological data of COVID-19 is scarce. Thus, it was described aspects that could be better disclosed for use in public health decision making. **Methods:** census data were collected on the number of cases and deaths, lethality, incidence and mortality per hundred thousand inhabitants, severe acute respiratory syndrome (SARS) caused by SARS-CoV-2 or other virus, % of intensive care unit occupancy and social isolation, number of tests of RT-PCRs and % of tests performed against the total of samples collected. **Results:** there was an increase in the number of SARS in 2020 compared to cases from previous years. The number of RT-PCR tests was performed, mainly in critically ill patients with COVID-19. Some states in Brazil performed an analysis of the material collected for RT-PCR from only a portion of individuals. In Brazil, there is an apparent underreporting of cases of the disease, which can comprise about 44 thousand individuals in serious condition or deaths, as well as more than about 700 thousand individuals with mild severity or asymptomatic. **Conclusion:** in Brazil, there is limited access to the information that characterizes the reality of the moment in which citizens live before the COVID-19 pandemic. Epidemiological data, mainly referring to the number of new cases, deaths and hospitalizations by COVID-19 and analysis of adherence to social isolation are extremely important to enable decision-making for better management of COVID-19 in national and international level.

Keywords: *Brazil. Epidemiology. Social Isolation. Polymerase Chain Reaction. SARS-CoV-2.*

RESUMO

Justificativa e objetivos: no Brasil, o acesso aos dados epidemiológicos da COVID-19 é escasso. Dessa forma, foram descritos os aspectos que poderiam ser divulgados para o uso nas tomadas de decisão de saúde pública.

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Métodos: foram coletados dados do censo sobre o número de casos e de óbitos, letalidade, incidência e mortalidade por cem mil habitantes, Síndrome Respiratória Aguda Grave (SRAG) causada pelo SARS-CoV-2 ou outro vírus, % de ocupação de unidade de tratamento intensiva e de isolamento social, número de testes de RT-PCRs e % de testes realizados perante o total de amostras coletadas. **Resultados:** houve um aumento no número de SRAG em 2020 se comparado aos casos de anos anteriores. O número de testes de RT-PCRs foi realizado, principalmente em pacientes graves com COVID-19. Alguns estados do Brasil realizaram a análise do material coletado para a RT-PCR de apenas uma parcela de indivíduos. No Brasil, existe uma aparente subnotificação de casos da doença e que pode compreender aproximadamente 44 mil indivíduos em estado grave ou de óbitos, bem como mais de aproximadamente 700 mil indivíduos com gravidade leve ou assintomáticos. **Conclusão:** no Brasil, tem-se acesso limitado a informações que caracterizem a realidade do momento em que se vive perante a pandemia de COVID-19. Os dados epidemiológicos, principalmente referentes ao número de novos casos, de óbitos e de internações pela COVID-19 e a análise da adesão ao isolamento social são de extrema importância para viabilizar a tomada de decisões para o melhor manejo da COVID-19 em caráter nacional e internacional.

Descritores: *Brasil. Epidemiologia. Isolamento Social. Reação em Cadeia da Polimerase. SARS-CoV-2.*

RESUMEN

Justificación y objetivos: en Brasil, el acceso a los datos epidemiológicos de COVID-19 es escaso. Así, se describieron aspectos que podrían ser divulgados para su uso en la toma de decisiones de salud pública. **Métodos:** se recopilaron datos censales sobre el número de casos y defunciones, letalidad, incidencia y mortalidad por cada 100.000 habitantes, Síndrome Respiratorio Agudo Severo (SRAS) causado por el SRAS-CoV-2 u otro virus,% de ocupación de la unidad de cuidados intensivos y aislamiento social, número de pruebas de RT-PCR y% de pruebas realizadas frente al total de muestras recogidas. **Resultados:** hubo un aumento en el número de SARS en 2020 en comparación con los casos de años anteriores. Se realizó el número de pruebas de RT-PCR, principalmente en pacientes críticos. Algunos estados en Brasil realizaron el análisis del material recolectado para RT-PCR de solo una porción de individuos. En Brasil, existe un registro ineficaz aparente de casos de la enfermedad, que puede comprender acerca de 44 mil personas en estado grave o muerte, así como más de acerca de 700 mil personas con gravedad leve o asintomáticas. **Conclusión:** en Brasil, existe un acceso limitado a la información que caracteriza la realidad del momento en que se vive la pandemia de COVID-19. Datos epidemiológicos, principalmente referidos al número de nuevos casos, de muertes y hospitalizaciones por COVID-19 y el análisis de adherencia al aislamiento social son de suma importancia para posibilitar la toma de decisiones para el mejor manejo del COVID-19 en carácter nacional e internacional.

Palabras clave: *Brasil. Epidemiología. Aislamiento Social. Reación en Cadena de la Polimerasa. SARS-CoV-2.*

INTRODUCTION

Coronavirus Disease 2019 (COVID-19), a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection, emerged in Wuhan in China in 2019 and was declared a pandemic by the World Health Organization (WHO) in March 2020, with repercussions on the world social and economic scenario.[1] COVID-19 affected over 7 million people worldwide, and on June 10, 2020, the following scenario in the World (and in Brazil; Brazil's position in the world ranking) was described: 7,447,151 (775,184; 2nd place) cases of the disease; 418,135 (39,797; 3rd place) deaths caused by the disease; 3,730,056 (380,300; 2nd place) patients recovered clinically from the disease; 3,298,960 (355,097; 2nd place) active cases and in follow-up; 53,812 (8,318; 3rd place) serious cases and being followed up by the health system; 955 (3,648; 30th place) cases confirmed by one million inhabitants; 53.6 (187; 19th place) deaths per one million inhabitants.[2] On the same date, in relation to the number of real time-polymerase chain reactions (RT-PCRs) specific to SARS-CoV-2, Brazil had carried out a total of 1,182,581 tests in specialized laboratories, 5,666 of which were performed by a million inhabitants; thus, the country occupied the 126th position in the ranking of tests per one million inhabitants in the world compared to other territories.[2]

In health surveillance, taking the Brazilian context as an example, it is necessary that knowledge about the factors determining the presence and progression of a disease be described and made available. Among the factors, the need to detect and prevent the disease through the correct quantification and notification to be performed in health systems can be highlighted. However, in many cases, especially in pandemic situations, there may be underreporting and the presence of discrepancies in epidemiological data in relation to the impact of the disease on the community.[3]

In Brazil, there are sentinel units for the registration of Severe Acute Respiratory Syndrome (SARS) that work in the registration, investigation and diagnosis of suspected and confirmed cases of SARS. Sentinel units, according to Ordinance 183 of January 30, 2014 by the Ministry of Health, aimed to register at least 80% of cases of SARS in Intensive Care Units (ICUs) and to register 90% of the weeks epidemiological aspects of hospitalization aspects of SARS cases. In the ordinance, the justification

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for assessing the decision-making on the financial transfer according to the status described for SARS is liable.[4]

In the world and, mainly, in Brazil, the limitation to obtain original and correct data, consistent with the impact of the pandemic in the community through census, has been described as an obstacle. Concomitantly, in Brazil, there have been changes in the Ministry of Health's approach to the official epidemiological description of the disease, mainly regarding the number of deaths associated with COVID-19. The described fact made it more difficult to obtain concrete and evolutionary data for COVID-19 in Brazil. Thus, there was a discrepancy between different sources of information about the disease and a greater difficulty in carrying out comparative studies between the national and international scenario.

The difficulty in obtaining information that represents the COVID-19 pandemic scenario regarding epidemiological data, including the number of cases of patients colonized by the SARS-CoV-2 virus (asymptomatic) or infected by the virus with mild symptom severity, is a landmark in Brazil. During the pandemic COVID-19, the Brazilian scenario was characterized by the public health policy adopted by the Ministry of Health for testing the SARS-CoV-2 virus, mainly aimed at analyzing severe cases of the disease. As observed in the literature, in some places, there was an increase in SARS diagnosis compared to other years, which may reflect limitations in diagnosing COVID-19, mainly by performing RT-PCR tests for the SARS-CoV-2 virus.[5-7] Thus, the present study aimed to describe the overview of COVID-19 in Brazil regarding the presentation of epidemiological data and its importance for the control of COVID-19 pandemic caused by the SARS-CoV-2 virus. In the study, data on the COVID-19 pandemic in Brazil were described with an elucidative character of its importance for the correct direction of governmental decision-making and to highlight the importance of understanding the processes involved with the nuance of health and disease in the character prospective evolution of the disease in a single territory.

METHODS

The study was conducted by an active search in different databases that had free access to data about the COVID-19 pandemic in Brazil. All data were accounted for on the different platforms for the date of June 12, 2020, a period in which there was a change in the presentation of data made by the Ministry of Health of Brazil.[8]

The data referring to the number of cases of COVID-19, number of deaths associated with the disease, lethality, number of patients and number of deaths per 100 thousand inhabitants, were collected on various platforms with data from Brazil (national) and international, being them: (a) COVID-19 pandemic of the Word Health Organization (https://www.who.int/emergencies/diseases/novel-coronavirus-2019);[1] (b) Word of Meters (https://www.worldometers.info/coronavirus/country/brazil/)[2]; (c) Epidemiological Surveillance of the State Department of Health (https://www.saude.go.gov.br/vigilancia-em-saude/vigilancia-epidemiologica)[3]; (d) Ministry of Health website (https://www.saude.gov.br/).[9]

Data on the prevalence of SARS caused by the SARS-CoV-2 virus, SARS caused by other infectious agents and the prevalence of SARS in the period between 2015 and 2019 were acquired on the website of *Fundação Instituto Oswaldo Cruz* (FioCruz) - InfoGripe (http://info.gripe.fiocruz.br).[5]

The percentage of ICU occupancy during the pandemic, the percentage of social isolation, the total number of SARS-CoV-2 RT-PCR tests performed and the percentage of tests performed against the total of samples collected according to the states and the Federal District of Brazil are presented in the study and were obtained on the following platforms: (a) Epidemiological Surveillance of the Department of State for Health (https://www.saude.go.gov.br/vigilancia-em-saude/vigilancia-epidemiologica);[3] (b) Ministry of Health website (https://www.saude.gov.br/);[9] (c) website that reflects the Brazilian map of COVID-19 (https://mapabrasileirodacovid.inloco.com.br/pt/.);[10] (d) São Paulo State Government website, which tabulated the level of social isolation in the state during the pandemic for some cities (https://www.saopaulo.sp.gov.br/coronavirus/isolamento/).[11]

Due to the ease of access to data, the status of São Paulo's regional indicators for hospital capacity, the evolution of the pandemic and decision-making were presented in the study as models for addressing the economic factor with the correct management of patients with COVID-19 in the social perspective. All the information was compiled by the use of information present in the legislation of the city of São Paulo and the legislation of the state of São Paulo.[12,13]

The average value of SARS cases in Brazil, prior to the COVID-19 pandemic period, was calculated using the data recorded from 2015 to 2019 by InfoGripe.[5] After calculating the annual mean, an adjustment was made to weight the cases corresponding to the initial five months of the year, i.e., between January and June, which reflects the analysis period of this study. The value obtained in the described calculations was used to estimate the index of probable underreporting of serious cases of COVID-19 in Brazil according to the state and the Federal District. The index was calculated by the difference between the average number of SARS cases and the number of SARS cases registered in 2020 after excluding confirmed cases of COVID-19.

The epidemiological data analyzed in the study were associated with each other using the Spearman correlation in the Statistical Package for the Social Sciences software (IBM SPSS Statistics for Macintosh, version 25.0). An alpha error of 0.05 was adopted in the correlations carried out between the study markers.

RESULTS

Brazil is a country with a large territorial extension and with high social, ethnic and economic diversity among the different regions that make up its territory and that reflect regional particularities to deal with the COVID-19

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pandemic were scarce and had low success and reach. On July 12, 2020, 2,749 cases were confirmed in the indigenous population, including 97 deaths. For this population, the best management is social isolation. However, due to the progression of environmental degradation through deforestation, mining and land use, contact with other individuals has been optimized in recent years, and current environmental policies have provided an exponential increase in forest degradation in Brazil, especially in Amazon. Regarding

Table 1. Descriptive analysis of the COVID-19 pandemic overview by the status of the infection by the SARS-CoV-2 virus, occupancy of intensive care units and diagnostic tests according to the states of Brazil and the Federal District.

Region	N	Death	Lethality	Incidence/100 thousand inhab.	Mortality/100 thousand inhab	SARS due to COVID-19	SARS due to other causes	SARS/ COVID-19	% ICU occupancy	Social isolation (%)	RT-PCR processed (%)	RT-PCR performed
Center-West region	33,791	614	1.82	207.3	3.8							
Federal District	19,433	256	1.32	644.5	8.5	108	1,055	9.77	77.2%a	39.35%	84%	167,228
Mato Grosso do Sul	2,597	24	0.92	93.5	0.9	34	909	26.74	8.80%	36.07%	88%	14,806
Mato Grosso	4,602	146	3.17	132.1	4.2	77	503	6.53	37.60%	37.7%	45%	10,037
Goiás	7,159	188	2.63	102	2.7	91	798	8.77	62.60%	35.36%	92%	12,925**
South region	34,044	775	2.28	113.6	2.6							
Rio Grande do Sul	13,619	316	2.32	119.7	2.8	432	2,635	6.10	72.50%	38.16%	45%	12,508**
Santa Catarina	12,594	184	1.46	175.8	2.6	207	1,500	7.25	61.60%	38.92%	48%	33,000
Paraná	7,831	275	3.51	68.5	2.4	360	3,990	11.08	47%	38.17%	95%	45,928
North region	160,767	7,385	4.59	872.3	40.1							
Amapá	14,623	289	1.98	1,729	34.2	5	29	5.80	98.73%	43.18%	63%	26,630
Rondônia	9,850	267	2.71	554.2	15	4	77	19.25	77.90%	47.83%	81%	32,863
Acre	8,746	237	2.71	991.7	26.9	0	77	NA	79.10%	43.91%	4%	19,217
Pará	62,095	3,927	6.32	721.8	45.6	74	668	9.03	70.50%	39.06%	90%	68,546
Roraima	6,347	182	2.87	1,047.8	30	9	30	3.33	ND	38.87%	92%	718*
Tocantins	6,257	120	1.92	397.8	7.6	7	172	24.57	60%	34.59%	92%	70.95**
Amazonas	52,849	2,363	4.47	1,275.1	57	569	1,196	2.10	66%	41.88%	91%	107,738
Northeast region	272,280	12,561	4.61	477.1	22							
Pernambuco	41,935	3,531	8.42	438.8	36.9	501	2,259	4.51	76%	42.22%	89%	74,400
Alagoas	18,176	660	3.63	544.6	19.8	67	166	2.48	79%	40.73%	33%	18,048
Ceará	71,402	4,480	6.27	781.9	49.1	770	2,470	3.21	76.47%	42.66%	77%	164,674
Sergipe	10,615	264	2.49	461.8	11.5	23	146	6.35	58.90%	38.45%	81%	26,330
Piauí	8,359	283	3.39	255.4	8.6	72	718	9.97	63.20%	41.33%	63%	67,226
Bahia	32,685	975	2.98	219.8	6.6	181	1,475	8.15	72%	39.69%	91%	81,392
Paraíba	24,032	559	2.33	598.1	13.9	41	633	15.44	69%	42.38%	53%	70,100
Maranhão	53,508	1,322	2.47	756.3	18.7	34	883	25.97	84.17%	39.25%	73%	66,717
Rio Grande do Norte	11,568	487	4.21	329.9	13.9	110	317	2.88	88%	41.29%	68%	31,247
Southeast region	271,534	18,345	6.76	307.3	20.8							
São Paulo	156,316	9,862	6.31	340.4	21.5	8,469	25,299	2.99	69.10%	38.84%	73%	87,463
Espírito Santo	23,344	936	4.01	580.9	23.3	53	426	8.04	84.59%	37.42%	75%	66,238
Rio de Janeiro	74,373	7,138	9.60	430.8	41.3	1,338	5,131	3.83	80%	40.77%	58%	25,308
Minas Gerais	17,501	409	2.34	82.7	1.9	336	4,852	14.44	72%	36.33%	61%	26,041

**Data updated in April 2020; **Data updated in May 2020; a54.3% of capacity in the public health system; NA - not applicable; ND - not declared; SARS - severe acute respiratory syndrome; ICU - Intensive Care Unit; RT-PCR - real time-polymerase chain reaction to identify the SARS-CoV-2 virus; % - percentage. Described data were obtained on the COVID-19 platform of the Ministry of Health and by assessment of the health departments of all states and the Federal District. Social isolation was achieved on the InLoco basis by the Brazilian map of the COVID-19 pandemic.*

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pandemic and other diseases.[15,16] Data referring to the number of cases and deaths associated with COVID-19, lethality of the disease, incidence and mortality per 100 thousand inhabitants, SARS per confirmed COVID-19 or other causes, percentage of ICU occupancy and social isolation, the number of SARS-CoV-2 RT-PCRs performed and the percentage of tests performed relative to the total of samples collected to perform the SARS-CoV-2 RT-PCRs are shown in table 1.

In the data described, the greater number of confirmed cases in the Northeast than in the Southeast is noteworthy. The COVID-19 pandemic started in the Southeast, the region of Brazil with the largest number of inhabitants and with the greatest flexibility of transit of individuals on a national and international basis. the Southeast has the largest number of beds in the ICUs, greater capacity to process the RT-PCR exams of the SARS-CoV-2 and the best data control regarding the COVID-19 pandemic.

In Brazil, the highest lethality rates were described in the states of Rio de Janeiro and Pernambuco, respectively, being 9.6 and 8.42; followed by the states of Pará, Ceará and São Paulo, with a value of approximately 6.3. Among the states, the highest mortality per 100 thousand inhabitants occurred in the states of Amazonas, Ceará and Pará, with a value of 57, 49.1 and 45.6, respectively. All states and the Federal District showed a high ratio between the number of SARS and the number of confirmed cases of COVID-19, with a maximum value of 26.77 in Mato Grosso do Sul. Interestingly, the state of Mato Grosso do Sul is the one with the lowest number of cases and deaths associated with COVID-19 (Table 1).

The ICU occupancy rate was over 80% in five states in Brazil (Amazonas, Maranhão, Rio Grande do Norte, Espírito Santo and Rio de Janeiro). In all states and the Federal District, the isolation rate was less than 50%.

From the nasopharynx material collected to perform RT-PCR tests for the SARS-CoV-2 virus, one state processed only 4%; a state, between 30% and 40%; three states, between 40% and 50%; two states, between 50% and 60%; four states, between 60% and 70%; finally, four states, between 70% and 80% of the samples collected, mainly from patients with the highest degree of disease severity (Table 1). Finally, the high number of SARS-CoV-2 RT-PCR tests carried out in the Federal District is noteworthy, since it presented the largest number of tests performed in Brazil and had only three million inhabitants. The Federal District is where representatives of the federal government are concentrated, including the three branches (executive, legislative, and judicial).

DISCUSSION

Considering the importance of epidemiological data, some aspects can be highlighted and discussed despite information that has been released so far about the COVID-19 pandemic in Brazil, which includes:

SARS-CoV-2 identification by RT-PCR

In Brazil, RT-PCR was recommended to identify infection by the SARS-CoV-2 virus, especially in patients with a greater degree of disease severity.[14]

COVID-19 is characterized by different clinical signs, with subgroups of asymptomatic, mild symptomatic and severe symptomatic patients. Asymptomatic patients are classified as those who tested positive for the SARS-CoV-2 virus, but there is no clinical manifestation of the disease. Symptoms such as body pain, diarrhea, sore throat, conjunctivitis, headache, loss of smell and/or taste, skin rash and discoloration of the feet are considered mild symptoms of the disease and require home care.[16,17] Serious symptoms, such as difficulty in breathing, loss of speech and/or movement, pain and tightness in the chest, are important signs that need attention and medical assessment in a referenced unit.[16,17] The manifestations of clinical signs can appear about five days after contact with the SARS-CoV-2 virus and can last for up to fourteen days. Because of this, RT-PCR tests for the SARS-CoV-2 virus have become necessary to recognize possible transmitting agents, in addition to enabling large-scale differential diagnosis.

However, in Brazil, patients with COVID-19 and in need of hospitalization were preferentially eligible patients to collect nasopharyngeal material and further analysis by RT-PCR of the SARS-CoV-2 virus. Thus, asymptomatic patients and/or those with mild symptoms were not tested, which may have optimized the virus spread in the population due to the lack of knowledge of the actual prevalence of the disease or the expansion of the virus throughout the country. Concomitantly, asymptomatic individuals who had contact with patients with COVID-19 were also not selected for screening by the SARS-CoV-2 virus RT-PCR.

In Brazil, there are few institutions and/or laboratories with the necessary and available equipment to perform RT-PCR identification for SARS-CoV-2. With the expansion of the pandemic in the world, there was an increase in costs for obtaining equipment and supplies for COVID-19 diagnosis. Brazil, even though it is considered the second country with the highest number of cases in the world, occupied 130th position in relation to the number of tests per million inhabitants; at the moment, in Brazil it is impossible to perform RT-PCR tests to identify the SARS-CoV-2 virus en masse, as has been the case in some countries.

Although the collection of material for the RT-PCR of the SARS-CoV-2 virus was performed only in patients with greater clinical severity than COVID-19, the tests were not completed on all samples. In Brazil, it is noteworthy that five states did not perform at least the analysis of 50% of the samples collected, whereas in Acre, only 4% of the samples were processed. The inclusion of all results needs to be optimized so that we can at least estimate the number of real cases of COVID-19 among inpatients and those with severe SARS symptoms. In addition, part of the collected material was lost due to errors in the descrip-

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tion of patient samples, storage and/or transportation problems, as described in the state health departments.[18] However, the correct number of material losses has not been described by Brazil so far and we will hardly have access to this information. Additionally, the time between the collection, the processing of the collected material and the disclosure of the exam results needs to be reduced so that patient management, especially in hospital, is carried out according to their effective diagnosis.

Adherence to social isolation by the Brazilian population

Since the beginning of the COVID-19 pandemic, the importance of social isolation has been advocated, in order to slow the progression of new infections and which could lead to an increase in the demand for ICU admissions, causing the collapse of health systems and a high mortality rate.[19-21] The collapse of the health system can occur, mainly, in states where the availability of beds is small in relation to the total number of inhabitants or where the concentration of beds occurs in regions with a higher number of inhabitants, mainly capitals.

In Brazil, the rate of social isolation occurs and occurred in a heterogeneous manner among states, having a strong influence on the action of decisions taken by local, state and federal governments. At the beginning of July 2020, the states of Rondônia, Acre, Sergipe and Goiás had the lowest isolation rates in Brazil, 55.18%, 53.63%, 44.22% and 43.56%, respectively.[10] However, changes were observed regarding the need to reactivate commercial activities aiming at economic improvement under pressure from the federal government, together with the misunderstanding despite the possibility of treatment and the actual transmission of the virus by asymptomatic individuals, which caused a reduction of adherence to social isolation in all states of Brazil and the Federal District. Thus, on July 9, even in the face of a progressive increase in the number of cases and deaths by COVID-19 in Brazil, adherence to social isolation was less than 50% in all states and in the Federal District. At this time, the lowest rates were 34.59%, 35.36%, 36.07% and 36.33%, respectively, for the states of Tocantins, Goiás, Mato Grosso do Sul and Minas Gerais. São Paulo, the state with the largest population in Brazil, had an adhesion of 38.84%; Rio de Janeiro, the state with the highest lethality, had an adherence of 40.73%.

The values of adherence to social isolation from the literature and from government or private health platforms do not represent the real scenario in Brazil, with data obtained only by assessing part of the population and, mainly, for cities with a higher number of inhabitants. Together, as described by the press, the population of Brazil partially insulated and maintained, in part, physical contact with close individuals, including friends, neighbors and relatives, which may have favored the increase in cases of COVID-19 mainly in countryside cities. The advance of the pandemic in Brazil, from the state capitals to countryside cities is worrying, since the smaller cities have a smaller relative number of ICU beds, if present, in proportion to the total number of inhabitants. Additionally, in these cities, the ability to process RT-PCRs for the SARS-CoV-2 virus is generally dependent on centers and/or laboratories located in other cities, which can lead to data loss and/or absence/diagnostic errors.

The serial assessment of adherence to social isolation with the increase in the number of cases, mainly in countryside cities and with the lowest number of inhabitants, may provide support for understanding about the progression of COVID-19 and the possibility of implementing local public health policies to stem the spread of the disease.

SARS index during pandemic COVID-19 compared to values obtained from epidemiological data from years prior to the pandemic

Table 2 shows the number of SARS cases between 2015 and 2020, as well as the average number of cases for 2015 to 2019. In the comparison between the values obtained in 2020 versus the mean of previous years, there seems to be an increase in the number of SARS cases in 2020, except for the state of Acre, where there was a decrease in the number of cases. Counting the total value of described cases higher than the mean of previous years, we have a total of 44 thousand cases that, possibly, can be elective to COVID-19 diagnosis and characterize in a high degree of underdiagnosis of the disease, superior to that described in literature.[22]

The status of the regional indicators of the state of São Paulo for hospital capacity, evolution of the pandemic and decision-making as a model for addressing the economic factor in COVID-19 management

Due to the need for social isolation on March 16, 2020, through Decree 59.283, an emergency situation was declared in the municipality of São Paulo, with coping measures for the pandemic COVID-19, such as easing debts, prohibiting the operation of public and private institutions, such as museums and schools, in addition to not allowing the operation of events that needed agglomeration.[12] On June 9, 2020, Mayor Bruno Covas of the city of São Paulo instituted a protocol for resuming activities decreeing the resumption of essential activities for four hours a day, depending on the classification of the municipality's isolation phases and contamination rates instituted by the Government of São Paulo (Table 3).[12,13]

The state government chose to direct the return of activities according to hospital capacity and the evolution of the pandemic. Both markers should and should be assessed in isolation and, subsequently, weighted in common. In an analysis of hospital capacity, two groups need to be assessed, namely the occupancy of ICU beds by patients with COVID-19 and the number of beds occupied by patients with COVID-19 per 100 thousand inhabitants. In an analysis of the evolution of the pandemic, three groups were assessed, all of which consider the variation of data between the periods. The selected markers were the number of cases, number of deaths and number of hospitalizations. The final score should and should be categorized into phases that allow modulation of face-to-face assistance, as described in table 4.

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Table 2. Number of cases of severe acute respiratory syndrome described from 2015 to 2020.

States	2020	2019	2018	2017	2016	2015	Mean[a]	% referring to the period of 2020[b]	Probable underreporting[c]
Acre	77	332	296	232	366	105	266.2	111.80	-34.80
Alagoas	166	231	204	23	139	1	119.6	50.23	115.77
Amapá	29	54	14	10	27	3	21.6	9.07	19.93
Amazonas	1,196	1,898	199	431	114	26	533.6	224.11	971.89
Bahia	1,475	1,682	1,796	532	1,002	287	1,059.8	445.12	1,029.88
Ceará	2,470	957	1,372	209	397	113	609.6	256.03	2,213.97
Federal District	1,055	2,095	1,353	722	627	129	985.2	413.78	641.22
Espírito Santo	426	674	606	363	724	67	486.8	204.46	221.54
Goiás	798	966	1,364	582	1,067	308	857.4	360.11	437.89
Maranhão	883	195	204	38	37	27	100.2	42.08	840.92
Mato Grosso	503	296	284	121	308	63	214.4	90.05	412.95
Mato Grosso do Sul	909	1,702	1,056	687	1,690	223	1,071.6	450.07	458.93
Minas Gerais	4,852	3,594	2,764	2,785	4,353	1,270	2,953.2	1,240.34	3,611.66
Pará	668	978	1,053	792	947	160	786	330.12	337.88
Paraíba	633	335	266	173	227	9	202	84.84	548.16
Paraná	3,990	6,366	5,777	3,730	5,721	2,215	4,761.8	1,999.96	1,990.04
Pernambuco	2,259	2,536	2,195	1,809	1,449	968	1,791.4	752.39	1,506.61
Piauí	718	438	498	171	201	29	267.4	112.31	605.69
Rio de Janeiro	5,131	2,072	1,577	938	2,053	471	1,422.2	597.32	4,533.68
Rio Grande do Norte	317	337	328	210	292	149	263.2	110.54	206.46
Rio Grande do Sul	2,635	3,097	3,257	2,795	4,837	2,128	3,222.8	1,353.58	1,281.42
Rondônia	77	145	89	35	148	40	91.4	38.39	38.61
Roraima	30	27	0	9	31	9	15.2	6.38	23.62
Santa Catarina	1,500	1,822	1,846	1,221	2,339	652	1,576	661.92	838.08
São Paulo	25,299	10,643	12,231	6,963	17,070	3,140	10,009.4	4,203.95	21,095.05
Sergipe	146	242	335	94	110	3	156.8	65.86	80.14
Tocantins	172	224	145	69	73	12	104.6	43.93	128.07
Total	58,414	43,938	41,109	25,744	46,349	12,607	33,949.4	14,258.75	44,155.25

[a]Mean was calculated for the period from 2015 to 2019 that preceded the beginning of the COVID-19 pandemic in Brazil; [b]Value referring to the period of 5 months of accounting for cases of severe acute respiratory syndrome for the mean calculated for the period from 2015 to 2019; [c]Probable underreporting of serious cases of COVID-19, which was calculated by the difference between the column (% referring to the period of 2020) and the column that reflects the number of cases in 2020.

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Table 3. Status of São Paulo's regional indicators for hospital capacity, pandemic evolution, and decision-making.

RHD	Occupancy of COVID-19 ICU beds	COVID-19 beds/100 thousand inhab.	Health system capacity rating	Variation in cases	Variation in hospitalizations	Deaths variation	Classification for pandemic evolution	Final classification
State of São Paulo	69%	18.1		0.99	1.07	0.97		
01 Municipality of São Paulo	78%	31.6	Orange	0.80	0.98	0.84	Yellow	Orange
01 Great Northern São Paulo	78%	14.9	Orange	0.95	0.99	1.13	Yellow	Orange
01 Great Eastern São Paulo	74%	13.6	Orange	0.92	1.10	1.16	Orange	Orange
01 Great Western São Paulo	73%	13.9	Orange	1.03	0.97	0.87	Yellow	Orange
01 Great Southeastern São Paulo	68%	29.3	Yellow	1.25	0.97	1.63	Orange	Orange
01 Great Southwestern São Paulo	78%	9	Orange	0.82	0.94	0.50	Yellow	Orange
02 Araçatuba	24%	8.9	Green	1.62	1.31	2.25	Orange	Orange
03 Araraquara	34%	7.5	Green	1.38	1.21	1.50	Orange	Orange
04 Baixada Santista	70%	22.6	Orange	1.12	0.96	0.78	Orange	Orange
05 Barretos	27%	12.9	Green	1.07	1.93	2	Red	Red
06 Bauru	56%	7.3	Green	1.48	1.41	1.58	Orange	Orange
07 Campinas	69%	13.2	Green	1.42	1.36	1.24	Orange	Orange
08 Franca	48%	5.6	Green	0.84	1.07	1.33	Orange	Orange
09 Marilia	21%	10.5	Green	1.17	1.29	3.50	Orange	Orange
10 Piracicaba	63%	8.4	Green	1.90	1.47	1.05	Orange	Orange
11 Presidente Prudente	52%	6	Green	1.76	1.60	1.50	Red	Red
12 Registro	31%	9.8	Green	1.35	0.86	2.00	Orange	Orange
13 Ribeirão Preto	60%	10.1	Green	1.75	1.51	2.00	Red	Red
14 São João da Boa Vista	24%	10.1	Green	0.62	1.06	2.50	Orange	Orange
15 São José do Rio Preto	34%	16.4	Green	1.74	1.20	2.00	Orange	Orange
16 Sorocaba	68%	7.1	Yellow	1.08	1.12	0.86	Orange	Orange
17 Taubaté	50%	11.9	Green	1.20	1.39	1.35	Orange	Orange
Classification by phase								
1 (red) - high alert	Over 80%	Below 3		Over 2	Over 1.5	Over 2		
2 (orange) - control	Between 70% and 80%	Between 3 and 5		Over 2	Between 1 and 1.5	Between 1 and 2		
3 (yellow) - loosening	Between 60% and 70%	Over 5		Between 1 and 2	Between 0.5 and 1	Between 0.5 and 1		
4 (green) - partial opening	Below 60%	Over 5		Below 1	Below 0.5	Below 0.5		

RHD - regional health district; ICU - Intensive Care Unit. Data referring to June 8, 2020. Data obtained from the São Paulo State Health Department.

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Table 4. Modulation of face-to-face care through the phase of evolution of the COVID-19 pandemic and capacity of the health system.

Face-to-face service	Phase 1	Phase 2	Phase 3	Phase 4
Shopping center, galleries and similar establishments	No	Limited 20% capacity; Reduced hours (4 hours in a row); Prohibition of food courts; Adoption of industry-specific and standard protocols	Limited 40% capacity; Reduced hours (6 hours in a row); Prohibition of food courts (except outdoors); Adoption of industry-specific and standard protocols	Limited 60% capacity; Adoption of industry-specific and standard protocols
Commerce and services	No	Limited 20% capacity; Reduced hours (4 hours in a row); Adoption of industry-specific and standard protocols	Limited 40% capacity; Reduced hours (6 hours in a row); Adoption of industry-specific and standard protocols	
Local consumption (bars, restaurants and similar)	No	No	Outdoors only. Limited 40% capacity; Reduced hours (6 hours in a row); Adoption of industry-specific and standard protocols	
Beauty salons and barber shops	No	No	Limited 40% capacity; Reduced hours (6 hours in a row); Adoption of industry-specific and standard protocols	
Sports academies of all modalities	No	No	No	
Other activities that generate agglomeration	No	No	No	No

Data obtained from the São Paulo State Health Department; Decree 64,994 of May 28, 2020.

The resumption of economic activity is necessary. However, Brazil has an increase in the number of cases and deaths associated with COVID-19. At the moment, the number of deaths is close to 40 thousand. Using the state of São Paulo as an example, it is observed that the different regional health districts vary in terms of the capacity of the health system and the progression of the disease. However, all were classified within the orange and red bands, the most worrying fact being the increase in the progression of the disease and which can and could change the favorable overview of the health system's capacity for a collapse profile. In the general view, for the capacity of the health system, elective regions were observed for the return of activities, but, in the progression of the disease, the scenario was quite the opposite.

Data accounting and the importance of information management

During the beginning of COVID-19 pandemic, the Ministry of Health of Brazil progressively described the data obtained by the state health departments. In other words, each day, the value was added to the previous one, mainly for the number of cases, the number of deaths and the number of patients recovered. However, over a short period of time, there was a decision to change the presentation to report "only" the case numbers for the day of analysis. Due to an intervention by the judiciary, the Federal Government by the Ministry of Health had to return for the presentation of all cases.

Clearly, the totality of data makes it possible to understand the impact of the disease on the population and the number of new cases and daily deaths to understand the disease progression. Thus, both data must be presented for the correct decision-making by the health authorities. Concomitantly, special attention must be paid to the daily accounting and overlapping of new cases and/or deaths that occurred on previous dates and that had the diagnosis by RT-PCR of the SARS-CoV-2 virus disclosed after patients' confirmed cure or death.

COVID-19 omission index

Although there are attempts to change the accounting for the reality and the credibility of the cases, there is incongruity between the data released by the Ministry of Health, in which updates and corrections of data have already been published. In addition, the official Ministry of Health website specific to COVID-19 was removed from the virtual environment in June.

In the process of updating data, for instance, Roraima had 762 registered deaths, however, after correcting the information, there were 172 deaths associated with COVID-19.[9] Other errors were found after the data were released and led to less credibility of the information presented by the Federal Government of Brazil. However, despite the fact that Brazil is in a difficult time to deal with the pandemic COVID-19, the real situation is possibly much worse than what was announced. This fact can be seen by the sporadic and rapid increase in cases of SARS in 2020 and the need for hospitalization. If the approximately 40 thousand cases of SARS (5%) more than expected were described as being from patients with severe COVID-19, we would have at least 760 thousand

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Table 5. Correlation of Spearman between the overview of infection by the SARS-CoV-2 virus, occupancy of Intensive Care Units (ICU), diagnostic tests and probable underreporting of serious cases of COVID-19

Region		Cases	Death	Lethality	Incidence/ 100 thousand inhab.	Mortality/ 100 thousand inhab.	SARS/ COVID-19	SARS - other causes	SARS/ COVID-19	% ICU occupancy	RT-PCR	Underreporting
Cases	CC	0.930	0.930	0.508	0.389	0.603	0.534	0.467	-0.352	0.477	0.703	0.535
	P	<0.001	<0.001	0.007	0.045	0.001	0.004	0.014	0.078	0.014	<0.001	0.004
Deaths	CC	0.508		0.712	0.280	0.621	0.568	0.453	-0.428	0.473	0.631	0.535
	P	0.007		<0.001	0.158	0.001	0.002	0.018	0.029	0.015	<0.001	0.004
Lethality	CC	0.389	0.712		0.153	0.633	0.494	0.231	-0.575	0.238	0.330	0.284
	P	0.045	<0.001		0.445	<0.001	0.009	0.246	0.002	0.242	0.093	0.151
Incidence/100 thousand inhabitants	CC	0.603	0.280	0.153		0.829	-0.340	-0.475	-0.289	0.555	0.298	-0.396
	P	0.001	0.158	0.445		<0.001	0.083	0.012	0.152	0.003	0.131	0.041
Mortality/100 thousand inhabitants	CC	0.534	0.621	0.633	0.829		0.045	-0.184	-0.559	0.562	0.350	-0.106
	P	0.004	0.001	<0.001	<0.001		0.822	0.359	0.003	0.003	0.073	0.600
SARS by COVID-19	CC	0.467	0.568	0.494	-0.340	0.045		0.885	-0.469	-0.076	0.424	0.880
	P	0.014	0.002	0.009	0.083	0.822		<0.001	0.016	0.711	0.028	<0.001
SARS for other causes	CC	-0.352	0.453	0.231	-0.475	-0.184	0.885		-0.052	-0.199	0.390	0.978
	P	0.078	0.018	0.246	0.012	0.359	<0.001		0.800	0.329	0.044	<0.001
SARS/COVID-19	CC	0.477	-0.428	-0.575	-0.289	-0.559	-0.469	-0.052		-0.315	-0.086	-0.063
	P	0.014	0.029	0.002	0.152	0.003	0.016	0.800		0.125	0.674	0.759
% ICU occupancy	CC	0.703	0.473	0.238	0.555	0.562	-0.076	-0.199	-0.315		0.176	-0.142
	P	<0.001	0.015	0.242	0.003	0.003	0.711	0.329	0.125		0.390	0.488
RT-PCR	CC	0.535	0.631	0.330	0.298	0.350	0.424	0.390	-0.086	0.176		0.461
	P		<0.001	0.093	0.131	0.073	0.028	0.044	0.674	0.390		0.016
Underreporting	CC		0.535	0.284	-0.396	-0.106	0.880	0.978	-0.063	-0.142	0.461	
			0.004	0.151	0.041	0.600	<0.001	<0.001	0.759	0.488	0.016	

ARS - severe acute respiratory syndrome; RT-PCR - real time-polymerase chain reaction for the SARS-CoV-2 virus; % - percentage; CC - correlation coefficient; P - p-value. Data with a significant p-value are shown in bold. Statistical analysis was performed using Spearman's correlation test. Alpha of 0.05 was adopted for all statistical analyzes.

(95%) other individuals infected with SARS-CoV-2 and without diagnosis.

In Brazil, two additional factors draw attention to the progression of the pandemic, namely: (a) a high number of health professionals who were infected with SARS-CoV-2, mainly nurses, in relation to the number of cases by specialty in comparison with international values;[23] (b) low availability of ICUs in the period before the start of the pandemic.[24]

Number of cases and deaths reported by the Ministry of Health and the media consortium (*G1*, *O Globo*, *Extra*, *Estadão*, *Folha*, and *UOL*)

As described in the topic on the omission index on COVID-19, Brazil failed to present epidemiological data for a short period of time, and after that period, the data were presented according to the daily findings. Thus, some national press vehicles opted for the acquisition of the data together with the state health departments. Some divergences were observed regarding the number of cases and deaths between both surveys using the same sources of information. Inconsistencies need to be better assessed so that we can have a greater degree of reliability in the data presented by the federal government for COVID-19 pandemic.

Concern with minority groups

In Brazil, the situation is worrying for two groups in particular: (a) slum residents; (b) indigenous population. Both populations have restricted access to health services and, possibly, a high degree of underdiagnosis of COVID-19. Despite widespread publicity in the media, in Brazil, for both scenarios, government measures to contain the

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the populations of residents in the favelas, information on the progression of COVID-19 is extremely scarce; however, an increase in the number of deaths has been documented, mainly in homes and actions by members of the community itself to contain the pandemic.

Correlation between the markers assessed in the study despite the COVID-19 pandemic

In the study carried out, numerous correlations were positive, as shown in Table 5, with emphasis on the following correlations:

(a) number of cases of COVID-19 with the percentage of ICU occupancy [correlation coefficient (CC) = 0.577], the number of RT-PCRs of the SARS-CoV-2 virus performed (CC = 0.703) and the probable underreporting (CC = 0.535);

(b) number of deaths associated with COVID-19 with the ratio between SARS and SARS by COVID-19 (CC = -0.428), the percentage of ICU occupancy (CC = 0.473), the number of RT-PCRs from the SARS virus -CoV-2 performed (CC = 0.631) and the probable underreporting of COVID-19 (CC = 0.535);

(c) lethality by COVID-19 with the ratio between SARS and SARS by COVID-19 (CC = -0.575);

(d) incidence of COVID-19 per 100 thousand inhabitants with the ratio between SARS and SARS by COVID-19 (CC = -0.475), ICU occupancy percentage (CC = 0.555) and probable underreporting of COVID-19 (CC = -0.396);

(e) mortality of COVID-19 per 100 thousand inhabitants with the number of cases of COVID-19 (CC = 0.603), incidence of COVID-19 per 100 thousand inhabitants (CC = 0.821), ratio between SARS and SARS by COVID- 19 (CC = -0.559) and the percentage of ICU occupancy (CC = 0.562);

(f) probable underreporting by COVID-19 with the number of tests performed for RT-PCRs of the SARS-CoV-2 virus (CC = 0.461).

In conclusion, epidemiological data, mainly referring to the number of new cases, deaths and hospitalizations associated with COVID-19 and analysis of adherence to social isolation and the overview of health services, are extremely important to enable decision-making by part of health managers and government, mainly federal.

However, in Brazil, access to information that characterizes the reality of the moment in which we live before the pandemic COVID-19 has been limited and we need to optimize the RT-PCR diagnosis of the SARS-CoV-2 virus, especially in asymptomatic cases. and mild infections of individuals colonized by the virus. A better structuring of the information system of COVID-19 in Brazil, by the Ministry of Health, should be carried out in order to promote a detailed description of the evolution of the disease on a national basis.

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AUTHORS' CONTRIBUTIONS

Tatiana Aline Carvalho e Fernando Augusto Lima Marson contributed to conception, design, analysis and writing of the article.

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All authors have approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

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ORIGINAL ARTICLE

AIDS incidence in Rio Grande do Sul in older adults from 1997 to 2017: an ecological study

Incidência de AIDS em idosos do Rio Grande do Sul de 1997 a 2017: um estudo ecológico

Incidencia de SIDA en personas mayores en Rio Grande do Sul de 1997 a 2017: un estudio ecológico

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ABSTRACT

Background and Objectives: Rio Grande do Sul (RS) is one of the Brazilian states with the highest percentage of older adults. However, despite the high rates of HIV/AIDS that have been detected in the general population, there are few scientific investigations regarding its prevalence in the older adult population. Our goal is to identify the annual incidence of AIDS in the population aged 60 or over living in the State of RS, Brazil, from 1997 to 2017, and to compare the sex differences in infection rates. **Methods:** This was a time-series ecological study. Information on annual AIDS notifications was collected on TABNET, and population data of RS was collected on TABNET and the website of the Foundation of Economy and Statistics (FEE) of RS. The annual incidence was calculated per 100,000 inhabitants. **Results**: Between 1997 and 2017, 3,697 AIDS cases in older adults were notified in RS. In the comparison between 1997 and 2017, the annual incidence of AIDS in older adults in RS increased from 3.92 to 13.71/100,000 inhabitants, and a 249.93% increase (340.49% among men and 171.50% among women). **Conclusion:** The percentage of AIDS diagnostic in RS was six times higher in older adults than in the general population. The rate for men was almost twice as high as that for women. This may be due to increased life expectancy and other factors related to sexual behavior, such as medications for erectile dysfunction and hormonal replacement, and communication technologies.

Keywords*: Disease Notification. Health of Older Adults. Acquired Immunodeficiency Syndrome. Sexuality. Incidence.*

RESUMO

Justificativa e Objetivos: O Rio Grande do Sul está entre os estados brasileiros com maior percentual de idosos. Mas, apesar das altas taxas de HIV/AIDS que têm sido verificadas na população geral, existem poucas investigações científicas que exploram este tema na população idosa. Assim, o objetivo deste estudo foi identificar a incidência anual de AIDS na população com 60 anos ou mais de idade, residente no estado do Rio Grande do Sul (RS), Brasil, no período de 1997 a 2017, e comparar a diferença na taxa de infecção entre os sexos. **Métodos:** Estudo

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ecológico de série temporal. As informações sobre as notificações anuais de AIDS foram coletadas no TABNET, e os dados populacionais do RS foram consultados do TABNET e do site da Fundação de Economia e Estatística (FEE) do RS. A incidência anual foi calculada por 100 mil habitantes. **Resultados:** Entre 1997 e 2017 foram notificados 3.697 casos de AIDS em idosos no RS. No comparativo entre 1997 e 2017, a incidência anual de AIDS em idosos no RS aumentou de 3,92 para 13,71/100 mil habitantes, o que configura um crescimento de 249,93% (340,49% entre homens e 171,50% entre mulheres). **Conclusão:** O percentual de diagnósticos de AIDS em idosos no RS foi seis vezes superior ao evidenciado na população geral. A taxa em homens foi quase duas vezes mais alta do que a das mulheres. Isso pode decorrer do aumento da expectativa de vida e de fatores relacionados ao comportamento sexual, como o uso de medicações para impotência e reposição hormonal e de tecnologias de comunicação.

Descritores: *Notificação de Doenças. Saúde do Idoso. Síndrome de Imunodeficiência Adquirida. Sexualidade. Incidência*

RESUMEN

Justificación y Objetivos: Rio Grande do Sul se encuentra entre los estados brasileños con el mayor porcentaje de personas mayores. Además, se han observado altas tasas de VIH/SIDA en la población general; sin embargo, hay pocas investigaciones científicas que exploren este tema. El objetivo de este estudio fue identificar la incidencia anual de SIDA en la población mayor de 60 años residente en Rio Grande do Sul, Brasil, en el periodo de 1997 a 2017, así como comparar la diferencia en la tasa de infección entre los sexos. **Métodos:** Estudio ecológico de series de tiempo. La información sobre las notificaciones anuales de SIDA se consultó en TABNET y los datos de población de ese estado se recopilaron en TABNET y en el sitio web de la Fundación de Economía y Estadística (FEE). La incidencia anual se calculó por 100 mil habitantes. **Resultados:** Entre 1997 y 2017 se reportaron 3.697 casos de SIDA en las personas mayores en este estado. En la comparación entre 1997 y 2017, la incidencia anual de SIDA en ancianos encontrada pasó de 3,92 a 13,71/100.000 habitantes, lo que representa un aumento del 249,93% (340,49% en hombres y 171,50% entre mujeres). **Conclusiones:** El porcentaje de diagnóstico de SIDA en personas mayores encontrado fue seis veces mayor al evidenciado en la población general. La tasa de los hombres fue casi el doble que la de las mujeres. Esto puede deberse al aumento de la esperanza de vida y factores relacionados con la conducta sexual, como el uso de medicamentos para la impotencia y el reemplazo hormonal y tecnologías de la comunicación.

Palabras clave: *Notificación de enfermedades. Salud del anciano. Síndrome de inmunodeficiencia adquirida. Sexualidad. Incidencia*

INTRODUCTION

Brazil, in recent decades, has observed a reduction in mortality caused by several communicable diseases and an increase in life expectancy.[1] This demographic transition has led to changes in the epidemiological profile of older adults, causing emerging challenges and requiring the implementation of strategies that promote healthy aging at different levels of care.[2] Thus, it is essential to take into account conditions that were previously less prevalent among older adults, but which have shown marked growth, such as infection by the human immunodeficiency virus (HIV) and the acquired immunodeficiency syndrome (AIDS), a disease caused by HIV.[1,3,4]

In Brazil, the first cases of HIV/AIDS in older adults were reported in the 1980s. However, the sharp increase in infection rates and its understanding as a public health problem are contemporary phenomena. In 1996, only 2% of deaths caused by AIDS occurred in older adults, a rate that increased to 5% in 2005. Recently, a study showed that in Brazil one in ten people who die as a result of illnesses related to AIDS are over 60 years old.[5]

It is known that aging generates changes in thymic volume, reduced production of antibodies, and B and T cells, involved in inhibiting HIV replication. This could favor the progression of HIV, especially in individuals who do not use antiretroviral therapy (ART). Besides, it is common for older adults with HIV to have other vulnerability factors, such as functional loss, worse response to ART, psychosocial problems (for example, stigma and isolation), and neurocognitive and psychiatric disorders (such as depression, among others related to mental health, especially in the severe stage of infection), which can interfere with life quality and treatment adherence.[6]

Currently, in Brazil, approximately 866 thousand people are living with HIV and Rio Grande do Sul (RS) has the second highest rate of infected people. In 2017 there were 29.4 cases for every 100 thousand inhabitants. In the same year, the infection rate in Porto Alegre was 60.8 cases for every 100 thousand inhabitants, becoming the Brazilian capital with the highest infection rate.[7] Furthermore, RS is one of the Brazilian states with the highest percentage of infected older adults (18.6%).[6] These data demonstrate that older adults may be in a state of striking vulnerability.

In the opposite direction of epidemiology, from a sociocultural perspective, the sexual health of older adults is a subject that is still poorly addressed, even by health professionals. Despite the advances, it is not a priority issue in research and public policies, which may have contributed to the emergence of myths, prejudices, and, eventually, lack of assistance. This situation may be

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one of the causes underlying the deficient perception regarding the need for the use of preventive methods by this population.[4,8]

In the case of older adults, there are also differences in sexual behavior between men and women, which can affect HIV/AIDS rates. [9] Data from the 2008 report on the global AIDS epidemic show that the HIV rate in Brazilian women aged between 50 and 59 years doubled between 2000 and 2007.[4] The increase in the number of cases occurred in all age groups of women, in a process known as "feminization of AIDS", in which the sex ratio went from 14.0 men with HIV per woman, in the 1982 to 1.7 men per woman in 2011.[9]

The growth of the older adult population in Brazil and, mainly, in RS, and the increase in HIV/AIDS rates in this population call upon the urgent development of investigations on this topic. The first step in the construction of effective public policies is the recognition of the epidemiological reality. Thus, the objective of this study was to identify the annual incidence of AIDS in the population aged 60 or over, living in the state of RS, Brazil, from 1997 to 2017, and to compare the difference in the infection rate between genders.

METHODS

This is an ecological study of time series, carried out from secondary data collected in TABNET, a public domain tab of free access that gathers data from the Notifiable Diseases Information System (SINAN) of the Informatics Department of the Brazilian National Health System (DATASUS).[10] DATASUS contains information that serves as a basis for research on the health and epidemiological situation in Brazil, in addition to contributing to the development of public health programs.

The option to present the incidence of AIDS took into account that the obligation to report HIV infection was only effective in 2014, according to the Ministry of Health's Ordinance No. 1,271[11,12]. Initially, the TABNET investigated the annual total number of AIDS notifications in the population of RS between 1997 and 2017. The year 2018 was not included in the study because the data were consolidated only up to the middle of the year, which could produce misleading analysis. Subsequently, the total number of diagnoses in individuals older than 60 years was examined and the quantification of annual diagnoses was grouped according to sex.

Next, we verified the population estimate in RS between 1997 and 2017. Since the census is carried out every 10 years, we decided to consider the population estimate in official databases that considered annual births and deaths. Thus, the population of RS between the years 1997 and 2012 was obtained from TABNET[10] (data available are limited to 2012) and, from the years 2013 to 2017, from the database of the Foundation of Economics and Statistics of RS (FEE).[13]

Then, we downloaded the tables available in DATASUS and FEE. The data were compiled in a single spreadsheet in Excel to calculate the number of AIDS cases in older adults (aged 60 years or over) per 100 thousand inhabitants, according to the following formula (Figure 1):

$$\text{Incidence Coefficient} = \frac{\text{Number of new AIDS cases among older adults people in RS in the reference year (1997 to 2017)}}{\text{Total of older adult living in RS in the reference year (1997 to 2017)}} \times 10^5$$

Figure 1. Coefficient Calculation Formula.

For this study, we considered cases diagnosed per year and the annual incidence of AIDS in RS, but not the cumulative prevalence.

According to current legislation, surveys that use data in the public domain without identifying the participants should not be submitted to the CEP/CONEP. Thus, this study contemplates the ethical standards provided for in resolutions No. 466 of 2012 and No. 510 of 2016.

RESULTS

When comparing the years 1997 and 2017, the general population of RS shows an increase of 15.55%: the female population increased 16.69% and the male population 14.37%. In the same period, the older adult population, aged 60 years or over, grew 103.90%, an increase that was 102.58% for women and 105.65% for men (Table 1).

Table 3. Socioeconomic, epidemiological and environmental variables related to the presence of VL in the family and in the neighborhood (n=273). Itapecuru Mirim, Maranhão, Brazil, 2014.

	General population			Older adult population		
Year	Men	Woman	Total	Men	Woman	Total
1997	4 800 619	4 961 496	9 762 115	407 460	536 977	944 437
1998	4 852 037	5 015 051	9 867 088	411 211	542 167	953 378
1999	4 903 379	5 068 359	9 971 738	414 999	547 367	962 366
2000	4 994 719	5 193 079	10 187 798	454 061	611 423	1 065 484
2001	5 054 537	5 255 484	10 310 021	458 717	617 916	1 076 633
2002	5 102 733	5 305 695	10 408 428	462 557	623 176	1 085 733
2003	5 153 070	5 357 939	10 511 009	466 488	628 675	1 095 163
2004	5 203 028	5 410 228	10 613 256	470 440	634 149	1 104 589

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2005	5 316 383	5 528 619	10 845 002	479 311	646 552	1 125 863
2006	5 374 261	5 588 955	10 963 216	483 850	652 860	1 136 710
2007	5 426 874	5 653 443	11 080 317	578 641	771 653	1 350 294
2008	5 317 050	5 538 164	10 855 214	587 504	780 100	1 367 604
2009	5 344 865	5 569 177	10 914 042	609 609	807 221	1 416 830
2010	5 205 057	5 488 872	10 693 929	627 470	832 127	1 459 597
2011	5 224 336	5 508 694	10 733 030	629 278	834 535	1 463 813
2012	5 242 658	5 527 945	10 770 603	630 977	836 980	1 467 957
2013	5 388 825	5 677 702	11 066 527	710 330	935 352	1 645 682
2014	5 414 110	5 705 707	11 119 817	741 296	974 898	1 716 194
2015	5 440 822	5 734 955	11 175 777	762 493	999 676	1 762 169
2016	5 466 673	5 763 274	11 229 947	784 609	1 027 893	1 812 502
2017	5 490 567	5 789 626	11 280 193	837 952	1 087 799	1 925 751

Source: Informatics Department of the Brazilian National Health System[10], Foundation of Economics and Statistics of Rio Grande do Sul[13]. Accessed in September 2019

In the comparison between 1997 and 2017, the incidence of AIDS for every 100 thousand inhabitants rose 41.65% in the general population. In 1997 there were 20.75 new cases and, in 2017, 29.40 for every 100 thousand. Among women, the increase was 67.65% (from 13.26 to 22.25/100 thousand diagnoses) and, among men, it was 29.62% (from 28.50 to 36.94/100 thousand diagnoses), according to Table 2. Considering the population growth and the rate per 100 thousand inhabitants, the diagnosis of AIDS in older adults increased 249.93% (from 3.92 to 13.71 diagnoses), being 171.50% for women (from 3.72 to 10.11 diagnoses) and 340.49% for men (from 4.17 to 18.38 diagnoses). All raw data are shown in table 2.

DISCUSSION

The main results presented here demonstrate a significant increase in the annual incidence of AIDS in older adults living in RS, especially in men. This estimate is well above the estimate found in the general population and indicates a relevant public health problem. This suggests the occurrence of profound epidemiological changes in the context of AIDS in RS.

Several explanations may be used for explaining the results found in our analysis. For instance, we can mention the expansion of access to health, resulting from the implementation of the Brazilian National Health System (SUS)[1], the availability of vaccines and medicines, and the various policies that focus on the health and protection of older adults.[14] Furthermore, these factors have contributed to the increase in longevity and consequently the increase in sexual life.[1,2] Also, other pharmaceutical advances, through drugs for erectile dysfunction and hormone replacement treatments contribute to older adults to remain sexually active.[15]

Another aspect that may have an impact in this scenario is the advancement of information and communication technologies, which have allowed older adults to expand their relational network. Previous research shows that older adults have increasingly used new technologies, especially social networks on the internet. This has expanded the possibilities for entertainment, contact with family and friends, and also the development of affective or sexual relationships,[16] which can increase exposure to STI risk situations.[17]

It is also important to consider the aspect of generational culture, which can affect the resistance of older adults to the use of condoms, reflecting on the incidence of HIV/AIDS in this population.[15] This behavior is associated with ignorance of how to use them and with the fear that it will interfere with erection, in addition to having a misconception that condoms would only serve to prevent pregnancy.[8] In this sense, the absence of the risk of pregnancy in this age group can lead women to abstain from using condoms with their partners. At the same time, after menopause, women can become more vulnerable, since vaginal tissues are more fragile and susceptible to micro-cracks, facilitating fluid infection. This corroborates studies that have pointed to sexual activity in older adults as the main pathway of disease contagion.[15,18]

Although recent studies show that in the general population the proportional increase in women infected with HIV/AIDS is higher compared to men, it seems that in older adults there is a significant increase in the reports of AIDS development in both sexes, with a higher incidence among men. Regarding the distinction by sex, a previous survey highlighted that 78% of older men maintain an active sex life, while among older women this percentage is 24%.[19] This may explain, in part, the difference in the rate increase of AIDS in the male population, when comparing the sexes. Additionally, it is important to consider that although previous investigations have shown the similarity of infidelity behaviors between the sexes, some reports indicate that the purpose of extramarital relationships can be different between men and women. This provides important clues to understand the results and also to support the development of prevention strategies.[20]

Sexuality in older adults is also related to many stigmas. Common sense constantly leads to the mistaken perception that older adults do not have sex, which may be linked to the generalization of declining productivity to other spheres, such as the sexual sphere. The taboo is a threat to these individuals who end up having no open dialogue with their families and health professionals on the subject.[15,21,22] The limited information on HIV/AIDS

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Table 2. Annual AIDS diagnoses in the general population and older adults in Rio Grande do Sul between 1997 and 2017.

	General population						Older adult population					
Year	**Cases in men**	**Rate per 100000 people**	**Cases in women**	**Rate per 100000 people**	**Total cases in general population**	**Rate per 100000 people**	**Cases in older men**	**Rate per 100000 people**	**Cases in older women**	**Rate per 100000 people**	**Total cases in general population**	**Rate per 100000 people**
1997	1 368	28.50	658	13.26	2 026	20.75	17	4.17	20	3.72	37	3.92
1998	1 861	38.36	906	18.07	2 767	28.04	46	11.19	17	3.14	63	6.61
1999	1 629	33.22	891	17.58	2 520	25.27	32	7.71	17	3.11	49	5.09
2000	2 032	40.68	1 213	23.36	3 245	31.85	44	9.69	32	5.23	76	7.13
2001	2 094	41.43	1 409	26.81	3 503	33.98	54	11.77	37	5.99	91	8.45
2002	2 452	48.05	1 856	34.98	4 308	41.39	68	14.70	48	7.70	116	10.68
2003	2 543	49.35	1 892	35.31	4 435	42.19	65	13.93	44	7.00	109	9.95
2004	2 296	44.13	1 711	31.63	4 007	37.75	83	17.64	44	6.94	127	11.50
2005	2 198	41.34	1 803	32.61	4 001	36.89	81	16.90	43	6.65	124	11.01
2006	2 376	44.21	1 917	34.30	4 293	39.16	93	19.22	65	9.96	158	13.90
2007	2 782	51.26	2 329	41.20	5 111	46.13	99	17.11	74	9.59	173	12.81
2008	2 679	50.39	2 236	40.37	4 915	45.28	118	20.08	91	11.67	209	15.28
2009	2 508	46.92	2 161	38.80	4 669	42.78	123	20.18	108	13.38	231	16.30
2010	2 605	50.05	1 950	35.53	4 555	42.59	129	20.56	106	12.74	235	16.10
2011	2 597	49.71	2 084	37.83	4 681	43.61	146	23.20	103	12.34	249	17.01
2012	2 597	49.54	2 108	38.13	4 705	43.68	158	25.04	119	14.22	277	18.87
2013	2 713	50.34	1 993	35.10	4 706	42.52	165	23.23	136	14.54	301	18.29
2014	2 594	47.91	1 836	32.18	4 430	39.84	177	23.88	118	12.10	295	17.19
2015	3 960	35.43	2 334	42.90	1 626	28.35	137	17.97	113	11.30	250	14.19
2016	3 643	32.44	2 176	39.80	1 467	25.45	170	21.67	114	11.09	284	15.67
2017	3 316	29.40	2 028	36.94	1 288	22.25	154	18.38	110	10.11	264	13.71

Source: Informatics Department of the Brazilian National Health System[10], Foundation of Economics and Statistics of Rio Grande do Sul[13]. Accessed in September 2019.

makes older adults more exposed to situations of risk of sexually transmitted infections. Besides, family members and health professionals (especially from outside the specialized health care network) tend not to address the issue with this population, as they disregard the sexuality of older adults.[4,8]

This whole scenario is aggravated by the lack of prevention policies. Currently, campaigns are still primarily aimed at specific populations, such as youth and young adults.[23] The lack of information available for older adults makes this population less aware of the disease, risks, and methods of protection.[15,21,22]

Furthermore, the process of diagnosing HIV in older adults is also a challenge, since individuals in this age group are often subject to multiple pathologies. Thus, late diagnosis may occur, causing delays or complications in antiretroviral treatment.[24] It is relatively common for the diagnosis to occur only in specialized services, since the professionals of primary health care themselves may not be aware of this reality.[15,21,22] Improvements in the training of professionals in the Basic Health Units and the implementation of preventive actions could increase the early detection of HIV in older patients.[21,22]

Even after diagnosis, several other elements must be taken into account. Despite the therapeutic advances that hinder the progression of HIV, older adults diagnosed with HIV/AIDS may be affected to the extent of having difficulties in the organization of their lives and their social and emotional relationships. This is because the diagnosis is accompanied by stigmas, suffering, judgment, and sadness.[25] Many older adults, after being diagnosed with HIV/AIDS, prefer to remain silent about the disease, for

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several reasons such as fear of pejorative judgments and fear of an eventual overload in the assistance provided by family members.[26] That is why social support networks play an important role so older adults do not feel abandoned, do not suffer prejudice and have support in living with the disease through a network of family and friends.[15] In this context, health professionals must be aware of the biological and psychosocial problems common to infection and develop strategies for welcoming, understanding, rehabilitating, facilitating, preventing, and promoting the health of older adults.[15,21,22]

After discussing the results, it should be noted that this study has some limitations, such as the database used. Research in different databases can lead to conclusions different from those highlighted here. For example, the HIV/AIDS Epidemiological Bulletin 2017, produced by the State Department of Health of RS, points out 71 diagnoses of the disease in individuals over 60 years of age in 2017. On the other hand, TABNET data, originating from SINAN, from the Ministry of Health, which were used in this study, report 266 occurrences in the same year. This is a significant difference, in the order of 275%, which may be due to the delay in notifications.

It is well documented in the literature that the disease notification systems in Brazil, despite certain advances, have a set of problems of different nature[27] For instance, compulsory reporting of HIV was only effective in 2014, which justifies our choice to focus the analysis on the AIDS incidence, the advanced stage of the disease. Also, SINAN allows notifications of HIV/AIDS to be released by health agencies up to three years after diagnosis, which can cause a difference in numbers depending on when data on TABNET is retrieved. This variation over time hinders a more precise analysis linked to the longitudinal chronology of the data. To reduce this limitation, in this study the total number of notifications was compiled only by the year of diagnosis.

Another limitation is the underreporting of HIV/AIDS, that is, the lack of knowledge about the real number of the diagnosed cases by epidemiological surveillance. In addition to causing an incorrect estimate of the magnitude and burden of the epidemic, leads to an insufficient allocation of actions and resources to deal with it. Previous studies indicate that the epidemiological situation is perhaps even more serious. This may occur due to the existence of undetected cases, in cases when there are no detectable symptoms and health professionals do not request testing.[27]

As it is an ecological study, we are not able to identify the subjects individually to assess risk factors, and carrying out this assessment in future research could present relevant contributions. Additional analyzes may be performed to corroborate or reject the hypotheses and conclusions presented here based on the interpretation of the raw data. We suggest cohort and longitudinal studies to better map the course of the infection and the evolution of the disease in different age groups. Also, an evaluation at the national level, distinguishing the other states of the federation to better understand differences and similarities in relation to the data obtained in this research would allow further developments regarding this discussion.

Finally, in the last twenty years, there has been a significant increase in the incidence of AIDS in older adults in RS, which indicates the high exposure of this population to the development of the disease, reflecting vulnerabilities in terms of public health. Although it is considered that the increase in AIDS cases in older adults may be partially linked to the increase in this population, it is possible that many of these individuals already had the virus, receiving late diagnoses. In addition to the chronology of contagion, the rate of AIDS diagnosis per 100 thousand people, when compared to the general population, indicates a relevant public health problem. It is essential, then, the performance of public health agents through prevention and improvement programs in the dissemination of information about HIV/AIDS for older adults and their families. Thus, health and social assistance strategies must be integrated to meet the physical, psychological, and social needs of older adults, especially considering the emerging demands. Therefore, we emphasize the importance of developing psychoeducational and interventional strategies as a fundamental tool in the composition of preventive and therapeutic actions involving sexuality and sexually transmitted infections in older adults. The progression of the disease in this population is a public health issue, and facing it must include coordinated efforts from different fields of knowledge.

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AUTHORS' CONTRIBUTIONS

Priscila Oliveira da Silva Padilha, Juliana Nichterwitz Scherer e Felipe Ornell contributed to the conception, design, analysis, and writing of the article.

Helena Ferreira Moura, Lisia von Diemen, Joana Correa de Magalhães Narvaez, contributed to the planning, design, review, and final approval of the article.

All authors have approved the final version that will be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

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Revista de Epidemiologia e Controle de Infecção

Hospital Santa Cruz

ORIGINAL ARTICLE

Exposure to biological materials: work accidents among health professionals in the state of Pernambuco

Exposição a materiais biológicos: acidentes de trabalho entre os profissionais e saúde do estado de Pernambuco

Exposición a materiales biológicos: accidentes laborales entre profesionales de la salud en el estado de Pernambuco

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ABSTRACT

Justification and Objectives: The impacts of work accidents cause avoidable risks to workers' health. Thus, the aim of this study was to describe accidents caused by the exposure to biological materials that occur among health professionals. **Methods:** This is an epidemiological, cross-sectional and descriptive study, with bivariate distribution analysis of secondary data on personal characterization, accident characteristics and outcome, provided by the Information System for Notifiable Diseases of the state of Pernambuco, Brazil, from 2014 to 2016. The population consisted of all cases of work accidents involving health service professionals. The analysis was performed using descriptive statistics and chi-square test to compare the percentage proportions of each variable group, chi-square test was also used for independence, using the software Statistical Package for Social Science. **Results:** Among the 4,260 notifications, the prevalent profile of the analyzed sample was female professionals (83.53%), with technical training level (62.21%), whose predominant route of exposure to accidentswas percutaneous (75.0%) and the main causal agent was the lumen needle (56.1%). Regarding the outcome of the cases, 61.3% were closed without registering the information. Regarding bivariate distributions, percutaneous exposures and intact skin presented the worst outcome (seroconversion), 22 and 10 cases, respectively. **Conclusion**: Based on the obtained results, the flaws in the process of notification and monitoring of work accidents in Pernambuco are clear. The high and stable number of cases in all surveyed years indicates the need to improve strategies that involve accident prevention and continuous surveillance in health services.

Keywords:*Work accidents. Work hazards. Work exposure. Epidemiology.*

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RESUMO

Justificativa e Objetivos: Os impactos resultantes dos acidentes ocupacionais provocam riscos evitáveis à saúde dos trabalhadores. Dessa forma, o objetivo deste estudo foi descrever os acidentes de trabalho por exposição a materiais biológicos que ocorrem entre profissionais da área de saúde. **Métodos:** Trata-se de estudo epidemiológico, transversal e descritivo, com análise de distribuição bivariada dos dados secundários acerca da caracterização pessoal, das características do acidente e do desfecho, fornecidos pelo Sistema de Informação de Agravos de Notificação do estado de Pernambuco, Brasil, no período de 2014 a 2016. A população foi composta por todos os casos de acidente de trabalho envolvendo profissionais dos serviços de saúde. A análise foi realizada mediante estatística descritiva e teste qui-quadrado para comparar as proporções percentuais de cada grupo de variável, assim como por teste qui-quadrado para independência, por meio do software Statistical Package for Social Science. **Resultados:** Entre as 4.260 notificações, o perfil prevalente da amostra analisada foi o de profissionais do sexo feminino (83,53%), com nível de formação técnica (62,21%), cuja via preponderante de exposição aos acidentes foi a percutânea (75,0%) e o principal agente causal a agulha com lúmen (56,1%). Em relação ao desfecho dos casos, 61,3% foram fechados sem registro da informação. Quanto às distribuições bivariadas, as exposições por via percutânea e pele íntegra apresentaram pior desfecho (soroconversão), 22 e 10 casos, respectivamente. **Conclusão**: A partir dos resultados obtidos, evidenciam-se falhas no processo de notificação e acompanhamento dos acidentes de trabalho em Pernambuco, além de valores elevados e semelhantes de casos em todos os anos pesquisados, indicando a necessidade de aprimorar as estratégias que envolvem prevenção de acidentes e vigilância contínua nos serviços de saúde.

Descritores: *Acidentes de Trabalho. Riscos Ocupacionais. Exposição Ocupacional. Epidemiologia.*

RESUMEN

Justificación y objetivos: Los impactos derived de los accidentes laborales provoca riesgos evitables para la salud de los trabajadores. El objetivo de este estudio fue describir los accidentes laborales con exposición a materiales biológicos entre los profesionales de la salud. **Methods:** This is an estudio epidemiológico, transversal, descriptivo con análisis de distribución bivaria de datos secondary sobre caracterización personal, características del accidente y el denolace, proporcionado por el Sistema de Información de Enfermedades Notificables del estado de Pernambuco, Brasil, en el período 2014 a 2016. La población estuvo compuesta por todos los casos de accidentes laborales que involucraron a profesionales de los servicios de salud. El análisis se realizó using estadística descriptiva y la prueba de Chi-cuadrado para com com com las provideees porcentuales de cada grupo de variables, así como las pruebas de Chi-cuadrado para la independencia utilizing el software Statistical Package for Social Science. **Resultados:** De las 4.260 notificaciones, el perfil prevalente de la muestra analizada fue el de mujeres profesionales (83,53%), con nivel de formación técnica (62,21%), en las que la vía de exposición a accidentes prevalente fue la percutánea (75,0%), y el agente causal lumen aguja (56,1%). En relación al denolace de los casos, el 61.3% se cerraron sin registrar la información. En cuanto a las distribuciones bivarias, las exposiciones percutáneas y la piel intacta presentaron peor evolución (seroconversión), con 22 y 10 casos, respectively. **Conclusión:** Con base en los resultados obtenidos, se evidencian fallas en el proceso de notificación y seguimiento de accidentes laborales en Pernambuco, además de altos valores y similares casos en todos los años encuestados, lo que indica la necesidad de mejorar las estrategias de prevención de accidentes y vigilancia continua en los servicios de salud.

Palabras clave: *Accidentes of Trabajo. Riesgos laborales. Profesional Exposición. Epidemiología.*

INTRODUCTION

Work Accidents represent a public health problem with negative impact on the productivity of workers and health institutions, resulting in economic losses, in addition to personal, social and health repercussions for the injured professionals. Risk activity is characterized as being capable of causing damage, bodily injury, temporary or permanent changes in capacity, diseases or even the death of workers.[1,2]

Worldwide, the International Labour Organization (ILO) estimates that 317 million work accidents happen annually. Around 2.02 million deaths are caused by work-related illnesses. Work accidents alone cause 321 thousand deaths per year.[3]

According to the World Health Organization (WHO), health professionals suffer 3 million percutaneous exposures to pathogens that cause hepatitis and human immunodeficiency virus (HIV). After the exposure, the risk of acquiring HIV is approximately 0.3%, a higher rate when it comes to hepatitis B virus (40%) and hepatitis C (on average 1.8%).[4] The findings are reflected by the increase in the number of deaths, in the expenses with hospitalizations and in the granting of accident benefits.

In 2002, the National Network of Integrated attention to Workers' Health (Renast) was created in Brazil, which disseminates actions aimed at workers' health integrated into the service network of the Unified Health

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System (SUS), through Workers' Health Reference Centers (Cerest). It is a national network with the purpose of programming care actions, health surveillance, prevention and promotion for workers through health practices and information.[5] In the national scenario, from 2009 to 2018, 752,777 cases of severe and fatal work accidents were recorded in the Notifiable Diseases Information System(Sinan). The country ranks 4th in the world in fatal accidents.[6]

In health services, the risk of work accidents with contaminated biological material transmitted by organic fluids results from injuries caused by sharp materials or direct contact with the skin or mucous membranes. This is how workers – such as cleaning workers, interns, technical level professionals, residents, nurses and physicians – are exposed.[7, 8]

To prevent risk exposure, biosafety measures are established to avoid, control and minimize the consequences of these events, providing a comfortable and safe work environment.[9] Despite these efforts, work accidents are still a frequent and notifiable problem. Thus, health service professionals should know how to prevent accidents, which can be avoided usingcollective andPersonal Protective Equipment(PPE), as well as by complying with regulatory standards and precautions regarding risk exposure in the performed activities.

Work accidents cause avoidable risks to workers' health. So, the aim of this study was to describe accidents caused by the exposure to biological materials that occur among health professionals.

METHODS

This is an epidemiological and descriptive study, with cross-sectional design andusing secondary data, with bivariate distribution analysis and quantitative approach of the Sinan database, regarding the notified cases by the State Department of Health of Pernambuco.

The population of the study consisted of all reported cases of work accidents involving health service professionals, according to the Brazilian Classification of Occupations (CBO), between 2014 and 2016.

Data collection was performed in March and April 2018 with the sociodemographic characterization survey, characterization of the accident with biological material (type of exposure, organic material, circumstance of the accident, agent) and the outcome of the follow-up of each closed case in the system.

To analyze the data, a Microsoft Excel spreadsheet bank was built, which was exported to the SPSS software, version 20. For the sample profile data, the frequencies were calculated and the respective distributions of the percentages were constructed, as well as the comparisons between each variable using the chi-square test (X^2), in order to perform proportion comparison.

To evaluate the distribution between the variables, bivariate analysis was used to construct contingency tables (double-entry table), applying the chi-square test for independence, with a5% significance level for Pearson's and Fisher's exact tests.

This study was conducted in accordance with Resolution No. 466/2012 of the National Health Council and approved by the Research Ethics Committee of the Oswaldo Cruz/Procape Hospital Complex, with CAAE no. 87541618.9.0000.5192 and process no. 2,705,163, according to the guidelines and regulatory standards of research involving human beings.

RESULTS

Among the 4,260 notifications in Sinan of work accidents due to exposure to biological material that occurred between 2014 and 2016,the majority of them involved females (83.5%), with upper secondary education (51.2%) and professionals of technical level (66.7%), with significant difference between these variables (Table 1).

Table 1. Distribution of characterization variables of work accident cases with exposure to biological material among health professionals. Recife (PE), Brazil, 2014 to 2016.

Variables	N	%	p-value
Year of notification			
2014	1,416	33.2	0.482[1]
2015	1,390	32.6	
2016	1,454	34.1	
Sex			
Female	3,558	83.5	<0.001[1]
Male	702	16.5	
Education level			
Upper Secondary Education	2,182	51.2	<0.001[1]
Higher Education	1,187	27.9	
Unfinished higher education	216	5.1	
Omitted/ignored	675	15.8	
Instructional level			
Technician	2,842	66.7	<0.001[1]
Graduate	1,235	29.0	
Elementary/ High School	183	4.3	
Total	4,260	100.0	

[1]*p-value of chi-square test (X^2) for comparison of proportion.*

Most exposures occurred through lumen needles (56.1%), with skin perfusion (75%), without mucosal exposure (69.7%), intact skin (45.4%) and from negative source patients (27.4%), with significant difference between these variables (Table 2).

Table 3 shows the distribution of the predictor variables of the study, according to the evolution registered in the system, indicating that the highest prevalence of worse outcomes is related to cutting devices, such as lumen needles, slides, lancets and glasses. It also indicates that intact skin and percutaneous exposures are more frequent among the worst outcomes.

Schoolingwas statistically different in relation to mucosal and intact skin exposure, especially in the technical level. Regarding the causal agent of the accident, all exposures showed statistical difference for lumen needle

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Table 2. Distribution of variables related to work accidents among health professionals. Recife (PE), Brazil, 2014 to 2016.

Variables	N	%	p-value
Type of Exposure			
Lumen needle	2,390	56.1	<0.001[1]
Glass /blade/lancet /other	1,028	24.1	
Needle without lumen	474	11.1	
Intracath	30	0.7	
Omitted/ignored	338	7.9	
Percutaneous exposure			
Yes	3.195	75.0	<0.001[1]
No	705	16.5	
Omitted/ignored	360	8.5	
Mucous membrane exposure			
Yes	434	10.2	<0.001[1]
No	2,968	69.7	
Omitted/ignored	858	20.1	
Intact skin exposure			
Yes	1,933	45.4	<0.001[1]
No	1,558	36.6	
Omitted/ignored	769	18.1	
Non-intact skin exposure			
Yes	200	4.7	<0.001[1]
No	3,122	73.3	
Omitted/ignored	938	22.0	
Evolution			
Source patient negative	1,168	27.4	<0.001[1]
Medical release without serological conversion	441	10.4	
Medical release with serological conversion	26	0.6	
Abandonment	14	0.3	
Death from other cause	1	0.0	
Omitted/ignored	2.610	61.3	
Total	4,260	100.0%	

[1]p-value of chi-square test (X^2) for comparison of proportion.

(percutaneous, intact skin and non-intact skin) and lamina, lancet, glass and/or others with mucosal exposure (Table 4).

DISCUSSION

The data of this study indicate that exposure to contaminated biological materials in the work activities of health professionals is a worrying factor, whose higher records occur by percutaneous exposure, with 75% of occurrences, mainly at the technical level – 66.7% of the affected professionals, mainly females, 83.5%.

The professionals who were most exposed to biological accidents, according to this study, were those of technical level, similarly to other Brazilian regions,[10] as well as Serbia,[11] Tanzania[12] and Iran,[13] with emphasis on the greater exposure of females. Historically, nursing is linked to women due to the responsibility of care being usually related to the female figure.[14] Thus, the number of accidents in health service institutions is influenced by the sex factor, following, in this sense, the worldwide trend of feminization in health services.

Another relevant factor related to the high exposure of professionals of technical level is the fact that they are the most present in health services and assume a large part of the provision of direct care to patients.[2] The work process of this level of formation includes invasive procedures, with manipulation of objects that can cut and pierce, associated with the presence of blood and body fluids, justifying the great occurrence of accidents with organic material in the category.

The circumstances that may cause accidents are associated with unhealthy work environment, tiredness,

Table 3. Distribution of variables related to the evolution of cases of work accidents among health professionals. Recife (PE), Brazil, 2014 to 2016.

Variables	Medical release with conversion n (%)	Medical release without conversion n (%)	Patient source negative n (%)	Abandonment n (%)	p-value
Occupation					
Graduate	11(2.2)	122(24.8)	354(72)	5 (1)	0.070[1]
Technician	14(1.3)	299(27.3)	776(70.7)	8 (0.7)	
Elementary/ High School	1(1.6)	20(32.8)	38(62.3)	1(1.6)	
Agents					
Lumen needle	13(1.3)	250(25.4)	713(72.3)	10(1.0)	0.026[2]
Needle without lumen	5 (2.9)	40(23.4)	126(73.7)	0(0.0)	
Intracath	0 (0.0)	8 (66.7)	4 (33.3)	0 (0.0)	
Blade/Lancet/Glass/Others	7(1.8)	119 (30.1)	267(67.6)	2 (0.5)	
Percutaneous exposure					
Yes	22(1.8)	296(24.5)	877(72.7)	11(0.9)	0.020[1]
No	2(0.6)	107(32.2)	220(66.3)	3(0.9)	
Mucous membrane exposure					
Yes	2(1.1)	46(25.8)	128(71.8)	2(1.1)	0.814[2]
No	20(1.7)	289(24.0)	887(73.6)	9(0.7)	
Intact skin exposure					
Yes	10(1.2)	190(22.6)	635(75.7)	4(0.5)	0.007[1]
No	12(2.1)	165(28.7)	390(67.9)	7(1.2)	
Non-intact skin exposure					
Yes	0(0.0)	23(35.4)	42(64.6)	0(0.0)	0.201[2]
No	21(1.6%)	308(23.8)	954(73.3)	11(0.9)	

[1]p-value of the Pearson's chi-square test (X^2); [2]p-value of fisher's exact test.

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Table 4. Case distribution of work accidents according to type of exposure among health professionals. Recife (PE), Brazil, 2014 to 2016.

Evaluated Factor	Type of Exposure			
	Percutaneous n (%)	Mucous membrane n (%)	Intact skin n (%)	Non-intact skin n (%)
Occupation				
Graduate	910(28.5)	149(34.3)	536(27.7)	58(29.0)
Technician	2,154(67.4)	253(58.3)	1,323(68.4)	130(65.0)
Elementary/ High School	131(4.1)	32(7.4)	74(3.8)	12(6.0)
Total	3,195(100)	434(100)	1,933(100)	200(100)
p-value	<0.078[1]	<0.001[1]	<0.033[1]	<0.599[1]
Agent				
Lumen needle	2.122(70.4)	39(10.3)	1,165(63.9)	100(54.9)
Needle without lumen	361(12.0)	08(2.1)	243(13.3)	18(9.9)
Intracath	23(0.8)	02(0.5)	12(0.7)	00(0.0)
Blade/Lancet/Glass/Others	510(16.9)	329(87.0)	402(22.1)	64(35.2)
Total	3,016(100)	378(100)	1,822(100)	182(100)
p-value	<0.001[1]	<0.001[1]	<0.001[1]	<0.011[1]

[1]*p-value of the Pearson's Chi-square test.*

excessive workload, stress, lack of compliance with standards, malpractice, incorrect or insufficient instructions, failures in supervision and guidance, non-use of PPE, improper disposal of sharp materials, venous puncture, medication administration, blood collection, devices without safety guidelines, among others.[15,16]

Providing a healthy environment, with adequate furniture, equipment and physical areas that ensure the safety of professionals and patients helps the operationalization of the work process and, consequently, reduces the risks and exposure of the health team.[1]

Another point that deserves to be emphasized is the psychosocial organizational risk of working conditions, for example: interpersonal conflict, work stress, emotional exhaustion, conflict in job functions, overload and low pay. Publications on this theme show that these factors increase the probability of harm to professionals. Thus, psychological support helps reduce work accidents and, when present in the routine of professionals, has led to significantly less exhaustion, dissatisfaction and intention to leave the profession.[1,17,18]

In this context, it is necessary to adopt institutional strategies with the objective of offering better working conditions to the multidisciplinary team in the health system[1]. Therefore, strengthening educational actions in the work place is essential. These actions would be the foundation of injury prevention and reduction of new work accidents.

Regarding the type of exposure, data show that 75% of the professionals were exposed to percutaneous accidents, with a higher prevalence (73.4%) of blood contact. In agreement with our data, a study conducted in three public hospitals in Tanzania revealed a prevalence of work accidents caused by percutaneous exposure and, in cases involving biological material, blood presented a higher risk of exposure.[19] A similar study conducted in Ethiopia showed significant exposure of professionals through sharp materials, most of which were needle injuries.[20]

It is worth mentioning that needles are the causal agents of a relevant number of accidents and the instruments that most contribute to percutaneous accidents. Thus, an alternative to be implanted in health services is the use of devices with safety locks to reduce the risks involving sharp objects, to avoid or decrease the exposure of health professionals to pathogens transmitted by blood.[21]

In this scenario, we note the importance of PPE. They should be adequately and sufficiently provided by the health service to minimize the damage and suffering of health professionals when performing their duties, so that they represent a protective barrier to the worker and reduce risk exposure.[2]

In addition, in the field of health surveillance, incompleteness and inconsistencies in the data in the records are observed, which causes avoidable mistakes in the construction of epidemiological indicators to portray the health situation of injured workers. This is possibly justified by the inefficiency of protocols and insufficient training, as well as the impact of work accidents. Besides, the exposed professionals do not seekmedical care, due to personal guilt and the embarrassment of declaring the accident, as well as the fear of the direct or indirect negative consequences inherent to the exposure.[13, 22]

A relevant point for the discussion is the underreporting of work accidentswith biological materials in the health care scenario. Some professionals neglect the act of notifying: they believe that they "waste" time because of the bureaucratic and administrative process, which hinders the complete notification of this problem and the knowledge of the real dimension of the event in the worker's health.

Underreporting reflects latent errors in surveillance systems and poses threats to accident prevention in health environments. It occurs because of difficulties in filling out the form and in deepening epidemiological research, so it is necessary to change the values in the reports for organizational improvement of safety and greater awareness. Thus, the importance of strengthening the training processesis reinforced, through permanent health edu-

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cation actions.[23]

In registered notifications there is a gap that deserves a specialized evaluation, necessary to accomplish and qualify the registration process, so that it provides a situational panorama of labor events for better decision-making and consequent elaboration of public policies that ensure workers' rights and decent working conditions.

A limitation that can be pointed out in this study is related to the descriptive design that does not allow analyzing associations of cause and effect between the variables, even though it allows the identification of exposure risks of professionals to work accidents. Another obstacle of the study refers to underreporting, which negatively impacts the planning of strategic actions by managers.

We suggest, then, the implementation of permanent education programs in the health service environment, providing training to professionals, aiming at the effective practice of management and separation of sharp objects, the use of PPE, work accidents communication and registration documents related to them, such as medical records and notification forms.

Thus, we expect to contribute to the awareness of the need for control and prevention of these accidents, as well as the construction of knowledge in the area, inciting studies related to the quality of notifications records of work accidents.

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AUTHOR'S CONTRIBUITION

Evelyn Maria Braga Quirino e Izabella Karla Lopes deAndradeparticipated in the conception, planning, design, analysis and writing of the article; **Morgana Cristina Leôncio de Lima, Clarissa Mourão Pinho**, **Mônica Alice Santos da Silva e Cynthia Angelica Ramos de Oliveira Dourado** participated in the analysis and interpretation of the data, critical review and writing of the text; **Maria Sandra** participated in the design, conception, analysis and interpretation of the article and critical review.

All authors approved the final version of the manuscript and declared themselves responsible for all aspects of the work, guaranteeing their accuracy and integrity.

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Revista de Epidemiologia e Controle de Infecção

Hospital Santa Cruz

ORIGINAL ARTICLE

Diagnosis to improve occupational safety in a hemodialysis service

Diagnóstico para aprimoramento do nível de segurança ocupacional em um serviço de hemodiálise

Diagnóstico para mejorar el nivel de seguridad laboral en un servicio de hemodiálises

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ABSTRACT

Background and Objectives: The exposure of health professionals to occupational risks due to reduced risk management can interfere with their work capacity and have a negative influence on public health. Therefore, this study aims to evaluate the biosafety risks in the hemodialysis sector of a university hospital (UH). **Methods:** This is a descriptive, cross-sectional and prospective study with a quantitative approach, carried out with 20 nursing professionals from August to October 2019, in a high-complexity university hospital. A checklist was applied, and its data was analyzed using the Epi-info software. The research complied with ethical aspects and was approved by the Research Ethics Committee of *Hospital das Clínicas de Pernambuco*. **Results**: The occupational risks of nursing professionals were evaluated in the hemodialysis sector, where 90% of workers are female. The physical and mental symptoms reported by professionals were characterized according to the time of exposure to risks in the sector. Individuals who worked for more than 10 years on hemodialysis had a higher frequency of symptoms, 64.44%, and 20.14% experienced fatigue. Regarding the frequency of exposure, it was highlighted that 31.36% of professionals were more exposed to ergonomic risks, associated with insufficient number of workers, exposure to a stressful environment and work overload. **Conclusion:** The research showed that nursing professionals are exposed to various types of risks and susceptible to occupational accidents. Health education is an essential tool for reducing these events in the hemodialysis service**.**

Keyords: *Containment of Biohazards. Occupational Exposure. Health Personnel. Epidemiology. Renal Dialysis.*

RESUMO

Justificativa e Objetivos: As exposições dos profissionais de saúde aos riscos ocupacionais por gestão de riscos reduzida podem interferir na capacidade laborativa, com influência negativa na saúde pública. Portanto, a pesquisa tem como objetivo diagnosticar os riscos de biossegurança no setor de hemodiálise de um hospital uni-

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versitário (HU). **Métodos:** Trata-se de um estudo descritivo, transversal e prospectivo de abordagem quantitativa realizado com 20 profissionais de enfermagem no período de agosto a outubro de 2019, em um hospital universitário de alta complexidade. Foram aplicados check-list e seus dados analisados por meio do programa Epi-info. A pesquisa atendeu aos aspectos éticos e foi aprovada no Comitê de ética do Hospital das Clínicas de Pernambuco. **Resultados:** Foram avaliados no setor de hemodiálise os riscos ocupacionais dos profissionais de enfermagem, onde 90% são do sexo feminino. Dentre os resultados foram caracterizados os sintomas físicos e mentais relatados pelos profissionais segundo o tempo de exposição aos riscos no setor, os indivíduos que trabalhavam a mais de 10 anos na hemodiálise apresentavam maior frequência de sintomas (64,44%), onde 20,14% sentem fadiga frequentemente. Quanto à frequência das exposições destacaram-se que 31,36% estão mais expostos ao risco ergonômico, caracterizado por número insuficiente de trabalhadores, exposição ao ambiente estressante e sobrecarga de trabalho. **Conclusão:** A pesquisa possibilitou evidenciar que os profissionais de enfermagem estão expostos a diversos tipos de riscos e suscetíveis aos acidentes ocupacionais. A educação em saúde é uma ferramenta essencial para redução desses eventos no serviço de hemodiálise.

Descritores: *Contenção de Riscos Biológicos Exposição Ocupacional. Pessoal da saúde. Epidemiologia. Diálise Renal.*

RESUMÉN

Justificación y objetivos: La exposición de los profesionales de la salud a los riesgos laborales debido a la reducción de la gestión de riesgos puede interferir con la capacidad de trabajo, con una influencia negativa en la salud **pública. Por** lo tanto, la investigación tiene como objetivo diagnosticar los riesgos de bioseguridad en el sector de hemodiálisis de un hospital universitario (HU). **Métodos:** Se trata de un estudio descriptivo, transversal y prospectivo con abordaje cuantitativo realizado con 20 profesionales de enfermería de agosto a octubre de 2019, en un hospital universitario de alta complejidad. Se aplicó una lista de verificación y se analizaron sus datos mediante el programa Epi-info. La investigación cumplió con aspectos éticos y fue aprobada por el Comité de Ética del Hospital das Clínicas de Pernambuco. **Resultados:** Los riesgos laborales de los profesionales de enfermería se evaluaron en el sector de hemodiálisis, donde el 90% son mujeres. Entre los resultados, los síntomas **físicos y** mentales informados por los profesionales se caracterizaron según el tiempo de exposición a riesgos en el sector, las personas que trabajaron durante más de 10 años en hemodiálisis tuvieron una mayor frecuencia de síntomas, 64.44%, donde 20.14% a menudo siente fatiga En cuanto a la frecuencia de las exposiciones, se destacó que el 31,36% está más expuesto al riesgo ergonómico, caracterizado por un **número insuficiente de** trabajadores, exposición al entorno estresante y sobrecarga de trabajo. **Conclusión:** La investigación mostró que los profesionales de enfermería están expuestos a varios tipos de riesgos y son susceptibles a accidentes laborales. La educación sanitaria es una herramienta esencial para reducir estos eventos en el servicio de hemodiálisis.

Palavras clave: *Contención de riesgos biológicos. Exposición ocupacional. Personal de Salud. Epidemiologia. Diálisis renal.*

INTRODUCTION

The concern with occupational risk arose after the HIV/AIDS epidemic in the 1980s, when safety standards in the workplace were established. Among the standards, the Regulatory Norm 32 (NR32) stands out. This norm was instituted in 2005 by the Ministry of Labor and Employment (MTE) and its purpose is to establish basic guidelines for safety measures and health protection of health service workers.[1,2]

The hospital environment is characterized as a high complexity space that provides health-related care. This environment has a high demand and offers a high number of services, which include laboratory and clinical services. Thus, it requires a multidisciplinary team to keep the institution functioning. Considering the risks and events that may affect professionals, data from the Ministry of Social Security referring to years 2012 to 2018 emphasized that the economic activities with the highest number of work accidents were related to hospital care (378,297 cases). These events make health professionals take work leaves due to accidents or occupational diseases.[3,4]

Among these work categories, nursing professionals stand out, as they act in health prevention, promotion and recovery.[3] Nursing care in the area of hemodialysis has its specificities, due to the large increase in the number of people affected with chronic diseases, requiring adequate technical support and specific knowledge to deal with the complexities of the sector. According to a study carried out in Germany, several factors can influence the well-being of professionals, such as budget cuts, understaffing and work overload.[5]

The hospital is considered an unhealthy place due to its demands and because the same environment contains patients with various infectious diseases. As a result, there are potential risks of exposure of health workers. Aiming to prevent these risks, Health Risk Management is relevant for monitoring and anticipating events and is a method of excellence for increasing safety.[6] Events must be identified to avoid negative outcomes. In general, tools for preventing errors and delivering quality services should be provided to professionals.[7]

Occupational accidents can transmit more than 20

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different types of pathogens. The human immunodeficiency virus (HIV), hepatitis B and C are the most common infectious agents in these situations.[7] The investigation of occupational risks in the hemodialysis sector is necessary because this sector deals with critically ill and chronic patients, and professionals are exposed to chemical, physical, accidental, ergonomic and biological risks.[8]

Despite the current and pre-established norms, preventive measures are often not incorporated into practice, as professionals do not recognize their vulnerability to infection. Activities on occupational risks and risk management are scarce, which directly affects their work capacity.[9]

To reduce occupational accidents, it is essential to carry out diagnosis to identify health risks for professionals and to support health education actions for all workers, aiming to increase knowledge about risks, improve compliance with biosafety rules, reduce occupational accidents and improve the quality of health services.[9]

Thus, the present study aimed to evaluate the biosafety risks in the hemodialysis sector of a university hospital (UH).

METHOD

This is a descriptive, cross-sectional and prospective study with a quantitative approach, carried out from August to October 2019 in a UH located in a capital in the Northeast Region of Brazil that offers services in various medical specialties. There are 22 hemodialysis clinics throughout the state, and the UH is responsible for treating patients with kidney diseases on outpatient or hospitalized hemodialysis therapy, with a capacity of 72 patients per week.

The study population was composed of 26 nursing professionals, 7 nurses and 13 nursing technicians and assistants, divided into day and night shifts. The professionals were approached during their shifts to answer the study check-list. Inclusion criteria were professionals who worked in the hemodialysis sector and who had at least one year of experience in the sector. The exclusion criteria were professionals on health leave and/or on vacation during the data collection period. Therefore, of the 26 professionals on the nursing team (11 nurses and 15 nursing technicians/assistants), 20 were interviewed (7 nurses and 13 nursing technicians/assistants) and six professionals refused to answer the interview.

A check-list questionnaire was applied for data collection. The questionnaire was adapted from the NR-32 and contained 24 questions, including independent variables (age, gender, civil status and level of education) and dependent variables (time working in the job, exposure to ergonomic, accidental, chemical, physical and biological risks, vaccination card, symptoms experienced, considering: headache, nausea, vomiting, dizziness, fatigue defined as an accumulation of psychophysical symptoms resulting from constant exposure to stressors, weight loss, memory loss, foot and ankle edema, flank pain, tremors, diarrhea, epigastric pain, dermatitis).

Data were stored in the Microsoft Office Excel program for processing and analyzed by descriptive statistics in the Epi-Info program, version 3.2.2 for Windows. This study complied with the determinations of Resolution 466/2012 of the National Health Council (CNS) and was submitted to the Research Ethics Committee of the *Hospital das Clínicas* through CAAE: 23769019.50000.8807 and approved under opinion number 3681308. The interviews occurred after the participants signed the Informed Consent Form.

RESULTS

The sample of this study consisted of 20 nursing professionals in the hemodialysis sector. Among the participants, most were female (90% - n=18) and were between 36 and 40 years old (35%), considered mature adult professionals (Table 1).

Table 1. Distribution of the characteristics of nursing professionals in the hemodialysis sector at a University Hospital in Recife, Pernambuco, in the year 2019.

Variables	N	%
Gender		
Female	18	90
Male	2	10
Age		
25-30	2	10
31-35	1	5
36-40	7	35
41-45	4	20
46-50	2	10
51-55	3	15
56 or more	1	5
Level of education		
High school	6	30
Higher education	14	70
Marital status		
Married	9	45
Divorced	2	10
Single	8	40
Stable union	1	5
Total	20	100

Source: Occupational Health and Work Safety Service, 2019.

As for the physical and mental symptoms reported by professionals and its association with the time of exposure to risks in the sector, it was found that individuals who worked for more than 10 years on hemodialysis had a higher frequency of symptoms (64.44%) and the most common symptoms were fatigue and headaches (Table 2).

The most frequent occupational accidents were ergonomic (31.36%) and accidental (22.46%) (Table 3).

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Table 2. Distribution of symptoms related to the time of experience in the hemodialysis sector in a University Hospital in Recife, Pernambuco, 2019.

Frequent Symptoms	N	%
1 to 5 years	7	15.56
Low back pain	1	14.29
Headaches	1	14.29
Fatigue	3	42.86
Memory loss	1	14.29
Tremors	1	14.29
21 years	3	6.67
Headaches	1	33.33
Fatigue	1	33.33
Dizziness	1	33.33
More than 10 years	29	64.44
Fatigue	7	24.14
Headaches	6	20.69
Epigastric pain	5	17.24
Dermatitis	2	6.90
Foot and ankle edema	2	6.90
Pain in the elbow	1	3.45
Pain in the spine	1	3.45
Pain in the flank	1	3.45
Pain in shoulders and hands	1	3.45
Sickness	1	3.45
Memory loss	1	3.45
Dizziness	1	3.45
More than 5 years	6	13.33
Headaches	3	50.00
Sickness	1	16.67
Fatigue	2	33.33
Total	45	100.00

Source: Occupational Health and Work Safety Service, 2019.

Table 3. Distribution of the frequency of occupational exposure of nursing professionals in the hemodialysis sector of a University Hospital in Recife, Pernambuco, in the year 2019.

	N	%
Ergonomic	74	31.36
Accidental	53	22.46
Chemical	49	20.76
Biological	41	17.37
Physical	19	8.05
Total	236	100

DISCUSSION

The data show that even with the current legislation, health professionals, especially nursing professionals, are exposed to occupational risks and accidents in the hemodialysis sector, which are worrying factors for this class of workers.[10] A similar study showed among its social data a predominance of women in hospital environments, even after the inclusion of men in the service. This is explained by the historical context, as until the middle age care was a task performed exclusively by women.[11]

Most participants in the present study were mature adults, who are possibly more susceptible to risks, as was also found in other studies.[12] This is due to the complexity of the sector, the frequent contact with organic fluids, the time of work and the stress of the profession.

The results of a study[13] have shown some factors that are associated with occupational accidents, such as length of service and time working in institution, absence of Personal Protective Equipment (PPE), lack of training, high workload and work overload, emotional disturbances, overconfidence, and possible human failures in the procedures. In the present study, the hemodialysis sector is predominantly composed of professionals who had been working for more than 10 years in the same environment. Several authors[13] associate professional recklessness with the experience and practice acquired over several years, which may lead professionals to develop a posture of overconfidence that predisposes to occupational accidents.

The professionals in the present study are frequently exposed to all occupational risks. This can lead to changes in the health of these professionals, reduce their work capacity, cause absences from work and consequently increase the demand for other professionals. Therefore, it is important to develop collective and individual interventions to reduce these exposures and to meet the needs regarding the necessary supplies for the protection of these workers and for the minimization of risks.

The analysis of the most frequent symptoms reported by the interviewees shows that fatigue and headaches frequently affect professionals in the hemodialysis sector. This diverges from a recent study[14] that found that the most frequent symptoms were related to musculoskeletal disorders. It is possible that this difference[15] occurs because professionals in the sector are frequently exposed to ergonomic risks, such as stressful environment, work overload and understaffing. These data reveal the fragility of this work category, which was also evidenced by a similar study. This can be explained by the exposure to stressors, such as the scarcity of human resources and work supplies, the complexity of assistance, deviations of function, double shifts, and ergonomic risks such as an inadequate work environment, repetitive work and physical effort, which results in a reduction in the work capacity of these professionals.[16]

The findings of the present study demonstrated that 24.14% of professionals who worked for more than 10 years in the sector experienced fatigue. A recent study showed that 42.53% of the professionals had residual fatigue, which was corroborated by previous studies that found that the fatigue may be correlated with the work shifts and the current condition of the labor market, which requires high work demands and more than one employment bond for the professional to have an adequate financial life. These factors can reduce the quality of life of these professionals.[17]

Another factor found by researchers[18] was the significant association between residual fatigue and a reduced ability to work, with negative effects on the state of alertness and surveillance, possibly representing a risk factor and being the only predictor of mental he-

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alth. The data obtained in this study showed that actions and measures are necessary and should include better staffing and adequate resting time to improve rates among professionals in the hemodialysis sector, which is characterized by a high risk, mainly due to procedures and contact with fluids.

According to a study,[19] 59.6% of the professionals in the nursing category have already had an accident at work. This was demonstrated in an evaluation conducted in the hemodialysis sector, with a supervised visit to assess the NR, and the results showed non-compliance to the occupational risk measures. This may be directly correlated with the frequency of exposures in the present study.

Ergonomic risks are related to the activities developed in the work environment and may affect the psychophysiological well-being of the worker.[20] Data from a similar study[21] showed that ergonomic risks are frequent and are associated with the psychological state of the professionals, with stress as the main factor for further deterioration in health.

According to the results of a study carried out in the UH Pedro Ernesto in the state of Rio de Janeiro, most occupational accidents occurred during or at the time of a procedure (84%).[22] The data obtained in this research showed that accidental risks were characterized by the physical area and inadequate lighting, discontinuity of the floor and difficulties in the space, especially regarding the storage of wheelchairs for patients who have walking difficulties. These factors can increase accidental risks among professionals.

The occupational exposure to biological material is still a worrying factor, since there is direct contact with fluids that are potentially infectious. Similar data were identified in another study, where 18.6% of nursing professionals at an oncology hospital in the state of São Paulo experienced an accident with biological material.[23]

Since physical exposures are less frequent, the data in a study emphasized the importance of checking the noise limit to which the nursing workers are exposed. This evaluation showed that, although the dialysis machines and the environment generate noise, the lack of maintenance of the air conditioning produced continuous noise and risk of biological contamination. A similar study[25] showed that noise can cause auditory problems, sleep disorders, fatigue, irritability, impaired concentration, and headaches, which are experienced by 44.20% of nursing professionals. These results may be correlated with the data obtained in the present study, which found fatigue and headaches as the most frequent symptoms.

Among all the risks and exposures experienced by professionals of the nursing team, educational actions are of paramount importance to improve the sector. Professionals report that the work environment has already improved; however, the data obtained in this study showed that it is still necessary to reduce these risks.

Given the above, it is necessary to create an action plan including permanent education, as the nurse is responsible for identifying these risks and developing preventive measures along with the managers of the work sector; elaboration of risk maps and flowcharts with procedures in case of accidents; training of these professionals to act appropriately to avoid occupational accidents; articulation with hospital managers; creation of a report with non-conformities, to improve this factor and increase financial investment, so that an adequate and safe environment can be provided for employees, raising the awareness on the importance of adhering to safe practices.

Finally, it is possible to state that the refusal of some professionals to participate in the interview can be pointed out as the main limitation of this study.

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To the Occupational Safety Service (**SOST**).

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AUTHORS CONTRIBUTIONS

Larissa Gomes, Viviane Araújo e Maria Conceição contributed to the conception, design of the article, analysis and writing of the article and final approval;

Mariana Luiza e Cristiane Macedo contributed to the planning and design of the article, review and final approval of the article;

All authors have approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

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PUBLICAÇÃO OFICIAL DO NÚCLEO HOSPITALAR DE EPIDEMIOLOGIA DO HOSPITAL SANTA CRUZ E PROGRAMA
DE PÓS GRADUAÇÃO EM PROMOÇÃO DA SAÚDE - DEPARTAMENTO DE BIOLOGIA E FARMÁCIA DA UNISC

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Hospital Santa Cruz

ORIGINAL ARTICLE

Congenital toxoplasmosis in primary health care: the importance of prevention in the control of a neglected disease

Toxoplasmose congênita na atenção primária à saúde: importância da prevenção no controle de uma doença negligenciada

Toxoplasmosis congénita en la atención primaria de salud: importancia de la prevención en el control de una enfermedad unmet

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ABSTRACT

Background and Objectives: toxoplasmosis is a disease with a great impact on public health, causing sequelae to infected newborns, however, this disease remains neglected in Brazil. The disease is potentially serious when there is congenital transmission. Toxoplasmosis diagnosis during pregnancy is complex and the treatment of the disease in pregnant women is not fully effective. This study aimed at surveying the knowledge of toxoplasmosis in pregnant women cared for at Basic Health Units in the city of Jataí/GO. **Methods:** to promote educational actions with pregnant women on the disease and forms of prevention. The actions were conducted by medical students from the Universidade Federal de Jataí and includes 64 pregnant women. **Results:** we observed a lack of information about the disease and its prevention, and 86% of them did not know all forms of transmission of toxoplasmosis. It was also evident that pregnant women report not receiving instructions about the disease during prenatal care. **Conclusion:** our study evidenced the lack of information on congenital toxoplasmosis in pregnant women, indicating that these actions in primary care are extremely valuable to prevent the disease, in addition to contributing to the training of medical students.

Keywords: *Primary Health Care. Disease Prevention. Toxoplasmosis. Congenital Toxoplasmosis.*

RESUMO

Justificativa e Objetivos: a toxoplasmose é uma doença com grande impacto na saúde pública, responsável por causar sequelas em recém-nascidos com a infecção, apesar de ainda ser negligenciada no Brasil. A doença é potencialmente grave quando há transmissão congênita. O diagnóstico da toxoplasmose durante a gestação é

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complexo e o tratamento da doença em gestantes não é totalmente eficaz. O presente estudo objetivou realizar um levantamento sobre o conhecimento de gestantes atendidas nas unidades básicas de saúde do município de Jataí/GO sobre a toxoplasmose. **Métodos:** promover ações educativas com gestantes sobre a doença e formas de prevenção. As ações foram realizadas por acadêmicos do curso de medicina da Universidade Federal de Jataí com 64 gestantes. **Resultados:** observou-se que faltam informações sobre a doença e formas de prevenção, sendo que 86% das gestantes não conheciam todas as formas de transmissão da toxoplasmose. As participantes relataram também não ter recebido instruções sobre a doença durante o acompanhamento pré-natal. **Conclusão:** o trabalho evidenciou a falta de informações sobre a toxoplasmose congênita por parte das gestantes, indicando que essas ações na atenção primária à saúde são extremamente valiosas para a prevenção da doença, além de contribuir para a formação de acadêmicos do curso de medicina.

Descritores: *Atenção Primária à Saúde. Prevenção de Doenças. Toxoplasmose. Toxoplasmose Congênita.*

RESUMEN

Justificación y Objetivos: la toxoplasmosis es una enfermedad con un gran impacto en la salud pública, causante de secuelas en recién nacidos con esta infección, a pesar de que todavía se descuida en Brasil. La enfermedad es potencialmente grave cuando hay transmisión congénita. El diagnóstico de toxoplasmosis durante el embarazo es complejo, y el tratamiento de la enfermedad en mujeres embarazadas no es totalmente efectivo. Este estudio tuvo como objetivo llevar a cabo una encuesta sobre el conocimiento de la toxoplasmosis en mujeres embarazadas atendidas en las unidades básicas de salud en la ciudad de Jataí, estado de Góias (Brasil). **Métodos:** promover acciones educativas sobre la enfermedad con mujeres embarazadas y las formas de prevención. Las acciones fueron realizadas por estudiantes de medicina de la Universidade Federal de Jataí con 64 mujeres embarazadas. **Resultados:** existe una falta de información sobre la enfermedad y las formas de prevenirla, y el 86% de ellas no conocían todas las formas de transmisión de toxoplasmosis. También fue evidente que las mujeres embarazadas informaron que no recibieron instrucciones sobre la enfermedad durante la atención prenatal. **Conclusión:** el estudio puso de manifiesto la falta de información sobre la toxoplasmosis congénita por parte de las mujeres embarazadas, lo que indica que estas acciones en atención primaria son muy valiosas para prevenir la enfermedad, además de contribuir a la formación de estudiantes de medicina.

Palabras clave: *Atención Primaria de Salud. Prevención de Enfermedades. Toxoplasmosis. Toxoplasmosis Congénita.*

INTRODUCTION

Toxoplasmosis is a zoonosis caused by the protozoan *Toxoplasma gondii* and is one of the zoonoses with the highest diffusion in the world.[1] This disease is a public health problem, as it develops a worrying condition in immunocompromised patients and in congenital transmission of the parasite. Excluding such occasions, the disease usually occurs asymptomatically.[2] The prevalence of *T. gondii* infection in humans is high in Brazil, in general, and is associated with the life habits of the population.[3]

The congenital variant of toxoplasmosis occurs due to the transplacental passage of the tachyzoite forms of the parasite during pregnancy, thus reaching the circulation and fetal tissues.[4] In the first trimester of pregnancy, the chances of vertical transmission are lower, but the damage to the fetus is more severe, resulting in fetal death in the uterus or spontaneous abortion. In the third trimester of pregnancy, the chances of transmission are higher; however, the damage to the fetus is less severe. Without treatment, infection during pregnancy results in congenital disease in about 44% of cases, but an appropriate treatment can reduce this risk to 29%.[5] Infections that go unnoticed at birth or are not treated cause severe eye disease (chorioretinitis) or delayed mental development in the second or third decade of the child's life.[4]

Congenital toxoplasmosis can cause irreversible lesions in the fetus, and the frequency and severity of the disease depends on gestational age.[6] Maternal infection in the first trimester of pregnancy can cause severe congenital toxoplasmosis, possibly causing Sabin tetrad, in which the fetus presents chorioretinitis in 90% of cases, cerebral calcifications, neurological disorders with psychomotor retardation, and changes in cranial volume (macro and microcephaly).[4] In addition to primary infection, transplacental transmission of the parasite may occur by reactivation of chronic maternal disease or reinfection when the mother comes into contact with a genetically distinct strain from that which previously infected her.[6] Therefore, the prevention of infection becomes indispensable even for pregnant women that already have the disease in its chronic phase.

Nevertheless, gestational and congenital toxoplasmosis are extremely neglected conditions. In Brazil, they entered the list of compulsory notification diseases in 2011 (Ordinance GM/MS No. 104, 25/01/2011), but were withdrawn in 2014 (Ordinances GM/MS No. 1,271, of 06/06/2014, and No. 1,984, of 09/12/2014)[7] and included, again, in 2016 (Ordinance GM/MS No. 204, of 02/17/2016).[8] However, until May 2020 there were still no records of these diseases in the Notification Diseases

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Information System of the Ministry of Health.[9] This lack of systematized data makes hinders the development of a real epidemiological profile of these diseases, which also has repercussions on an educational, preventive and curative medical care deficit.

The prevention of toxoplasmosis is based on programs involving health promotion and actions related to education and public health.[2,10,11] The attention of gestational and congenital toxoplasmosis is divided into three stages: primary, secondary and tertiary. Primary care is based on disease prevention measures in pregnant women and on public health education programs. The pregnant woman is instructed to take preventive measures, being instructed on how to identify the disease and what are the risk factors involved in *T. gondii* infection and the development of toxoplasmosis during pregnancy. Moreover, the forms of contamination and the importance of measures aimed at the prevention of gestational toxoplasmosis are addressed.

Our study aimed at conducting a survey on the knowledge of pregnant women attended in the basic health units (UBS) of the municipality of Jataí/GO on toxoplasmosis.

METHODS

The extension actions were developed in 2019 in ten UBS of the urban perimeter of the municipality of Jataí, state of Goiás, in partnership with the Municipal Health Department of the municipality. The actions were performed by medical students from the Universidade Federal de Jataí and had the participation of 64 pregnant women. These actions promote continuing education in health, making pregnant women aware of the importance of prenatal care and hygiene habits, besides allowing medical students to have greater contact with patients and professionals that already work in public health.

Before the actions, the students of the medical course were trained by the coordinating professor, addressing the aspects of gestational and congenital toxoplasmosis and of the approach of pregnant women in primary health care. The actions focused on pregnant women in prenatal follow-up and began with the application of an investigative questionnaire to evaluate their perceptions and knowledge about gestational and congenital toxoplasmosis, hygiene practices and the importance of disease prevention. The women that agreed to answer to the questionnaire signed and informed consent form. The questionnaires were applied while they waited for routine prenatal care. After, a lecture was given to pregnant women about toxoplasmosis, addressing the general aspects of the disease, the forms of transmission of the parasite and its life cycle and disease prevention. The importance of adhering to the treatment (with medical indication) was also addressed in a complete and correct way, in addition to clarifying the doubts of the participants. In these lectures, information booklets developed by medical students were distributed.

The study was approved by the Research Ethics Committee (Opinion No. 3526623; CAAE no. 15605119.0.0000.8155) and the Organizational Contract for Public Action for Teaching-Health, both of the Universidade Federal de Jataí, and by the Municipal Health Department of Jataí.

RESULTS

Considering that the university extension program is related to the social role played by the university and its components, our study provided pregnant women living in the municipality of Jataí/GO with an important source of primary health education, thus bringing knowledge acquired in the academic environment to the community in an accessible way. Such health education actions conducted in the meetings between the executing team and the participants allowed the education of the population based on educational practices, besides transmitting preventive content related to behavior and personal hygiene habits and the environment. This communication strategy provided the strengthening of the bonds between the participants (pregnant women) and the team members, favoring dialogue and reflection, ensuring better results with greater engagement and participation in educational proposals, in addition to improving the understanding of the transmission of infectious diseases. In the case of toxoplasmosis, we could expand preventive measures, with positive future results regarding the reduction of cases in the community.

Of the pregnant women that answered the questionnaire about toxoplasmosis, 33% answered that they had never heard of the disease and 53% did not know that the disease could be transmitted from mother to child during pregnancy (Figure 1). Moreover, 86% of the pregnant women did not select all items in the questionnaire related to the prevention of toxoplasmosis, leading to the belief that they do not know about all forms of transmission of the disease.

Regarding women that answered about the forms of transmission of toxoplasmosis, 44% reported that they did not know how the disease was transmitted. Figure 2 shows the answers from women that marked alternatives (86%).

Regarding the way the disease is approached by health professionals, we observed that 36% of the pregnant women answered that they did not undergo a test for toxoplasmosis (Figure 3), which may be related to the absence of the test or the lack of communication for the pregnant women about the test. In addition, 77% of the pregnant women reported that they did not receive information about the disease during pregnancy in prenatal consultations (Figure 3).

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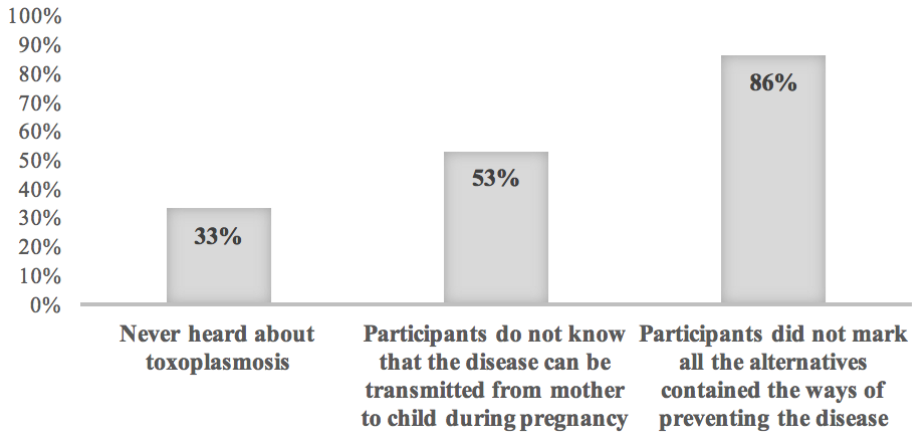

Figure 1. Responses of pregnant women (%) on toxoplasmosis obtained in the questionnaire previously applied to educational actions conducted by medical students. The questionnaires were applied while they waited for prenatal consultation in the basic health units of the municipality of Jataí/GO.

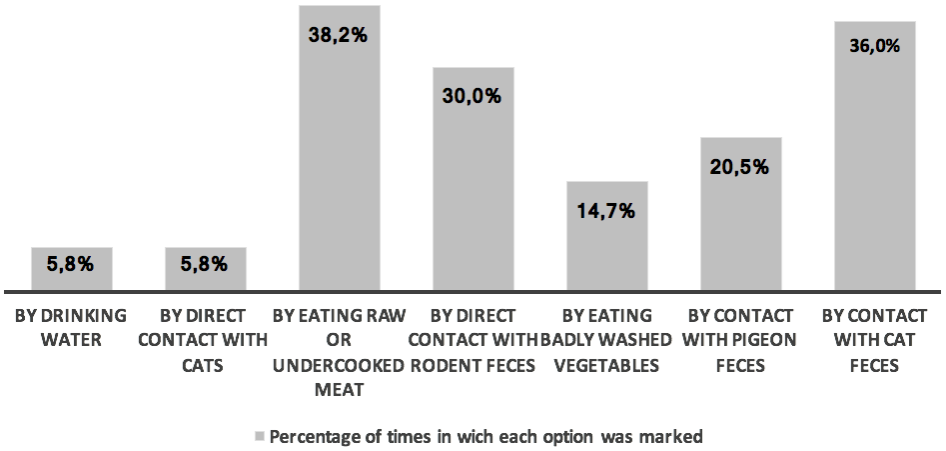

Figure 2. Percentage of times each alternative was indicated by the pregnant women in response to the question about ways to acquire toxoplasmosis present in the questionnaire applied on the approach of toxoplasmosis during prenatal care in the basic health units of the municipality of Jataí/GO.

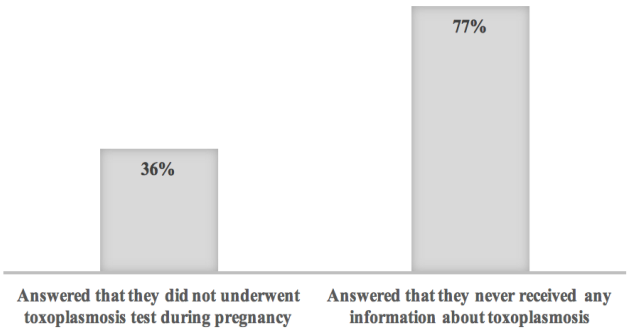

Figure 2. Percentage of times each alternative was indicated by the pregnant women in response to the question about ways to acquire toxoplasmosis present in the questionnaire applied on the approach of toxoplasmosis during prenatal care in the basic health units of the municipality of Jataí/GO.

DISCUSSION

Regarding infectious diseases, such as toxoplasmosis, it is important to emphasize that health education is the best prevention strategy to reduce the infection of pregnant women, since the laboratory and clinical diagnosis of the disease is complex[11] and treatment is not fully effective.[12] Treatment of toxoplasmosis during pregnancy is performed with spiramycin, when there is no evidence of fetal infection, or with the association of sulfadiazine/pyrimethametamine. The efficacy of spiramycin treatment is controversial: studies have shown a reduction in the incidence of congenital toxoplasmosis in only 60% of cases. Treatment with the association is potentially toxic for both pregnant women and the developing fetus, since pyrimethametamine has teratogenic effects.[12]

Due to the severity of the damage caused in new-

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borns with congenital toxoplasmosis, primary prevention should be frequently stimulated and improved for the control of infection caused by *T. gondii*, and public health education programs are crucial.[9] These actions are essential to disseminate information, since there is a lack of knowledge of pregnant women about the disease. Some literature data are consistent with our results and prove the lack of knowledge of pregnant women about toxoplasmosis, such as a study conducted in Maringá, state of Paraná, with 499 women, of whom only 16.23% reported having received information about prevention of this disease during pregnancy.[13] In Brazil, due to the status of neglected disease, the attention to toxoplasmosis in primary health care is neither systematized nor standardized.[14] Thus, health education has helped toxoplasmosis prophylaxis worldwide. A study conducted in Poland observed that the population's knowledge of risk factors for *T. gondii* infection nearly doubled in four years of health education activities.[15] Moreover, the life habits of the population interfere in the frequency of transmission of toxoplasmosis, and actions aimed at instructing pregnant women on these habits to ensure their safety have a positive impact on the reduction of cases of congenital transmission of the disease.[12] Data show that prophylactic measures performed during pregnancy may decrease fetal infection by up to 70% in women susceptible to *T. gondii* infection.[16]

The analysis of the questionnaires also showed the importance of these actions in relation to how the disease is approached by health professionals during prenatal consultations in the UBS. The results indicated the absence of effective information to pregnant women about the disease, evidencing, once again, the importance of actions aimed at primary prevention, also justified by the fact that congenital transmission of toxoplasmosis is associated with abortions and severe sequelae in the developing fetus, such as lesions in the central nervous system (mental and psychomotor retardation, microcephaly and cerebral calcifications) and ocular lesions that may result in vision loss.[17] In addition, considering the importance of toxoplasmosis in the world and especially in Brazil, where its prevalence can reach up to 75%,[9] preventive actions are extremely important for the control of the disease in pregnant women and the decrease in the occurrence of congenital transmission.

Although most congenital infections result from primary infection acquired during pregnancy, transplacental transmission may occur in some cases of immunocompetent women previously exposed to the parasite, but that are infected with a genetically distinct strain during pregnancy. This reinfection promotes a picture similar to a primary infection, with all the effects of an acute phase infection and potential for congenital transmission already evidenced by several study groups worldwide.[4,18] Increasing attention to primary prevention measures even in pregnant women previously exposed *to T. gondii* and maintaining an efficient immune system throughout pregnancy is essential, since being cured from a previous acute infection does not guarantee a pregnant woman's safety. Moreover, several case reports show that reactivated infection in immunosuppressed women due to HIV infection or other causes can also lead to congenital transmission.[19] Another important point is that the knowledge of pregnant women about the disease and the possible impacts on the fetus stimulate the search for tests and follow-up during pregnancy, which favors the early screening of cases of congenital transmission, contributing to the correct management and reducing harm to newborns.[20] Furthermore, prevention actions in the public network have their importance corroborated by a recent study that established a direct relationship between the high incidence of *T. gondii* infection and the socioeconomic vulnerability of the Brazilian population, showing that the lack of adequate housing conditions and correct hygiene habits make these women more exposed to parasitic infection, and that this exposure occurs, to a large part, in reproductive age.[21]

Regarding the students of the medical course, the extension actions provide a more humanistic training, which seeks to understand the perspectives of patients and have a better dialogue both with the community and with professionals that already work in the health area, giving tools to students, so that a deeper and more effective doctor-patient relationship can be established, in addition to an interdisciplinary and cooperative work environment.

Health education allows the individuals to acquire more autonomy in their own care, which makes them protagonists and subjects of their own health condition and the people of their social life, positively affecting collective health.[22] Consequently, because of the obvious benefits, it is a practice that must permeate health actions. In this perspective, when applying the questionnaire, exchanging information (between pregnant women and project members) and asking questions, the construction of basic knowledge by the pregnant woman is established, especially about the life cycle of the parasite, forms of transmission, prophylaxis, the relationship of the disease with pregnancy and the possible consequences for the fetus. Studies conducted in Brazil concluded that the lack of information about the disease was the most relevant factor for seroprevalence, directly reflecting the higher transmission of the disease, proving that sensitization campaigns should be conducted to prevent the spread of toxoplasmosis.[23]

From the detection of acute disease the treatment begins, which is not fully effective to prevent transplacental transmission of the parasite, besides being composed of drugs with teratogenic effects. It is important to emphasize that there is currently no treatment for the chronic phase of the disease.[12]

In this sense, primary care actions contribute to stimulating the initiative and maintenance of prophylactic practices, in addition to clarifying the target audience regarding the infection and its consequences for the health of pregnant women and the fetus. They are also characterized as an important moment for medical students to start and improve interaction with the population, patients and professionals that already work

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in health environments, stimulating the development of skills necessary for the execution of the future profession with social responsibility and professionalism.

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AUTHORS' CONTRIBUTION

Gabriella Leite Sampaio, Letícia Lino da Silva, Flávio de Oliveira Borges and Mariana Bodini Angeloni contributed to the conception and design, the analysis and writing of the article.

Lucas Rodrigues Miranda, Isabela Morais Borges, Arthur Victor Vilela Barros and Mariana Bodini Angeloni contributed to the planning and design, review and final approval of the article.

All authors approved the final version of the manuscript and declared themselves responsible for all aspects of the article, guaranteeing their accuracy and integrity.

PUBLICAÇÃO OFICIAL DO NÚCLEO HOSPITALAR DE EPIDEMIOLOGIA DO HOSPITAL SANTA CRUZ E PROGRAMA
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Revista de Epidemiologia e Controle de Infecção

Hospital Santa Cruz

ORIGINAL ARTICLE

Paracoccidioidomycosis in the northern region of Rio Grande do Sul

Paracoccidioidomicose na região norte do Rio Grande do Sul

Paracoccidioidomycosis en la región norte del Rio Grande do Sul

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ABSTRACT

Background and Objectives: Paracoccidioidomycosis (PCM) is a systemic disease caused by the dimorphic fungus *Paracoccidioides brasiliensis* found in the tropical and subtropical regions of Latin America. This study aimed to perform a retrospective analysis of PCM cases from the northern region of Rio Grande do Sul, Brazil. **Methods:** A total of 200 records of PCM cases diagnosed at the local reference pathology laboratory from 1995 to 2015, were analyzed. **Results:** Of the patients, 185 were male and 15 female. Patients ranged in age from 31 to 80 years, the largest proportion (35,5%) being aged between 51 and 60 years and living or working in the countryside. Clinical samples were mostly obtained from the oral cavity, followed by the oropharynx, lungs, brain, skin, and prostate. **Conclusion:** PCM is endemic in the south of Brazil, as the local economy is largely based on agricultural activities, favoring the contact of the population with *P. brasiliensis*. Due to the great similarity between PCM symptoms and other respiratory diseases, the differential diagnosis is essential for the correct treatment of the disease and to avoid its progression.

Keywords*: Paracoccidioidomycosis. Pbmycosis. epidemiology, P. brasiliensis.*

RESUMO

Justificativa e Objetivos: A paracoccidioidomicose (PCM) é uma doença sistêmica causada pelo fungo dimórfico *Paracoccidioides brasiliensis*, o qual é encontrado nas regiões tropicais e subtropicais da América Latina. Este estudo objetivou realizar uma análise retrospectiva dos casos de PCM na região norte do Rio Grande do Sul, Brasil. **Métodos:** Foram analisados 200 prontuários relativos aos casos de PCM de 1995 até 2015 diagnosticados pelo laboratório de patologia referência na região. **Resultados:** Destes pacientes, 185 eram homens e 15 mulheres. Os pacientes tinham idade variando de 31 a 80 anos, sendo que a maior proporção (35,5%) tinha entre 51 e 60 anos e viviam ou trabalhavam na zona rural. Os materiais clínicos eram provenientes em sua maioria da cavidade oral,

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seguido da região orofaríngea, pulmão, cérebro, pele e próstata. **Conclusão:** O sul do Brasil é região endêmica de PCM, devido a sua economia estar centrada na agricultura, o que propicia o contato do homem com o fungo. Devido à grande semelhança dos sintomas da PCM com outras doenças respiratórias, o diagnóstico diferencial é relevante para que seja realizado o tratamento correto da doença e para que seu avanço seja evitado.

Descritores: *Paracoccidioidomycosis. Pbmicose. Epidemiologia. P. brasiliensis.*

RESUMEN

Justificación y objetivos: La paracoccidioidomicosis (PCM) es una enfermedad sistémica causada por el hongo dimorfo *Paracoccidioides brasiliensis*, que se encuentra en las regiones tropicales y subtropicales de América Latina. Este estudio tuvo como objetivo realizar un análisis retrospectivo de casos de PCM en la región norte de Rio Grande do Sul, Brasil. **Métodos:** se analizaron 200 registros médicos relacionados con casos de PCM de 1995 a 2015, diagnosticados por el laboratorio de patología de referencia en la región. **Resultados:** De estos pacientes, 185 eran hombres y 15 mujeres. Los pacientes tenían edades comprendidas entre 31 y 80 años, con la mayor proporción (35.5%) entre 51 y 60 años y viviendo o trabajando en el campo. Los materiales clínicos provenían principalmente de la cavidad oral, seguidos de la región orofaríngea, pulmón, cerebro, piel y próstata. **Conclusión:** El sur de Brasil es una región endémica de PCM, debido a que su economía se centra en la agricultura, que proporciona el contacto del hombre con el hongo. Debido a la gran similitud de los síntomas de PCM con otras enfermedades respiratorias, el diagnóstico diferencial es relevante para el tratamiento correcto de la enfermedad y para evitar su progreso.

Palabras clave: *Paracoccidioidomicosis. Pbmicosis. Epidemiology. Epidemiología. P. brasiliensis.*

INTRODUCTION

Paracoccidioidomycosis (PCM) is a systemic disease of granulomatous nature caused by thermodimorphic fungi of two species: *Paracoccidioides brasiliensis* e *Paracoccidioides lutzii*.[1] The infection is autochthonous and restricted to the American continent, being found in the tropical and subtropical regions of Latin America. In Brazil, this disease is responsible for 51.2% of deaths related to deep mycoses, with the highest occurrence described in the states of São Paulo, Rio Grande do Sul, Paraná, Rio de Janeiro, Goiás, Rondônia, Espírito Santo, Minas Gerais, Mato Grosso do Sul, Mato Grosso, Amazonas and Maranhão.[2-6]

PCM was first described, in 1908, as a mucocutaneous infection in which the agent is introduced into the skin or oral mucosa by trauma with plant fragments.[7] However, in 1959, Mackinnon confirmed the hypothesis, through tests in mice, that the mucocutaneous infection indicates symptoms secondary to a lung infection.[8] Nowadays, the most accepted route of transmission is through the inhalation of conidia of the fungus *P. brasiliensis* dispersed in the environment, which reaches the pulmonary alveolar epithelium and differentiates into its yeast form.[9]

The degree of infection and symptomatology depend on fungal virulence and the host's immune response. PCM cases may vary from asymptomatic to acute or chronic, with clinical manifestations involving the respiratory system and mucocutaneous lesions, leading to death if not properly treated. Chronic paracoccidioidomycosis is the classic clinical form of the disease, affecting predominantly rural workers, although its incidence has progressively increased in suburban and urban areas.[1,10]

The acquisition of the infection is closely related to the occupation. Professionals who work with contaminated soil management are more susceptible to infection. Thus, men over 50 years old constitute the population most diagnosed with PCM, considering, in addition to the profession, other factors such as smoking, alcoholism and the hormonal protective factor against infection in women.[1,3,8,10]

Three studies carried out in the last five years, in Pelotas, Capão do Leão, Bagé and the metropolitan region of Porto Alegre, demonstrated the contamination of dogs, horses and wild mammals by *Paracoccidioides* sp.[11-13] These publications encourage the discussion about new forms of transmission and contagion in humans, especially in urban areas, where domestic dogs can represent an intermediary host between contaminated soil and humans.[13]

Until the beginning of the year 2020, no systemic mycoses was included in the national list of diseases and conditions of compulsory notification in Brazil. Without epidemiological surveillance, knowledge about endemic areas, prevalence, incidence and morbidity is based on case studies. In February 2020, PCM became part of the list of diseases and conditions of compulsory notification, together with cryptococcosis, human sporotrichosis and chronic Chagas disease.[14] In this way, a few years from now, there will be a better estimate of the epidemiology of PCM.

Taking into account the higher prevalence of PCM among rural workers, farmers, and construction workers, people living in the northern region of Rio Grande do Sul (RS) are susceptible to this disease since the local economy is based on these activities. However, because it did not integrate, for a long time, the range of diseases with compulsory notification, it is difficult to establish its real prevalence. The present study aimed to describe PCM cases through a survey of medical records from the database of the Pathology Institute of Passo Fundo, in order to measure disease incidence in this region.

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METHODS

A survey of PCM-positive cases diagnosed at the Pathology Institute of Passo Fundo, Passo Fundo, RS, Brazil, the main laboratory of pathology in the northern region of the state, was performed. This region has a subtropical climate and an average annual temperature of 17.5 °C. Frost formation is common during the colder months. Rainfall is well distributed throughout the year, with September having the highest volume of precipitation (197.9 mm) and April the lowest (99.7 mm). On average, humidity is about 70%.

PCM-positive cases diagnosed from January 1995 to December 2015 were analyzed, totaling 200 cases. The histopathological diagnosis was confirmed by the presence of *P. brasiliensis* yeast cells in surgical specimens evidenced by Grocott staining. The analyzed patient data comprised gender, age, city of origin, occupation, and location of biopsy.

Data analysis was performed using descriptive statistics. This study was approved by the research ethics committee of Imed College, Passo Fundo, RS, Brazil.

RESULTS

Two hundred medical records of PCM cases registered from 1995 to 2015 (20 years) were analyzed (Table 1). The male:female ratio was 185:15. Patients ranged in age from 31 to 80 years. Fourteen (7%) patients were of the 31–40 years age group, 57 (28.5%) of the 41–50 years, 71 (35.5%) of the 51–60 years, 44 (22%) of the 61–70 years, and 14 (7%) of the 71–80 years age group.

One hundred and sixteen patients (58%) were residents of Passo Fundo and 84 patients (42%) resided in other cities of the northern region, with cases ranging from 1 to 10 in number in each city (Figure 1). Information on the place of origin (whether rural or urban) and/or occupation was available for 85 patients. Of these, 63 (74%) lived in rural areas and/or had worked in agriculture and

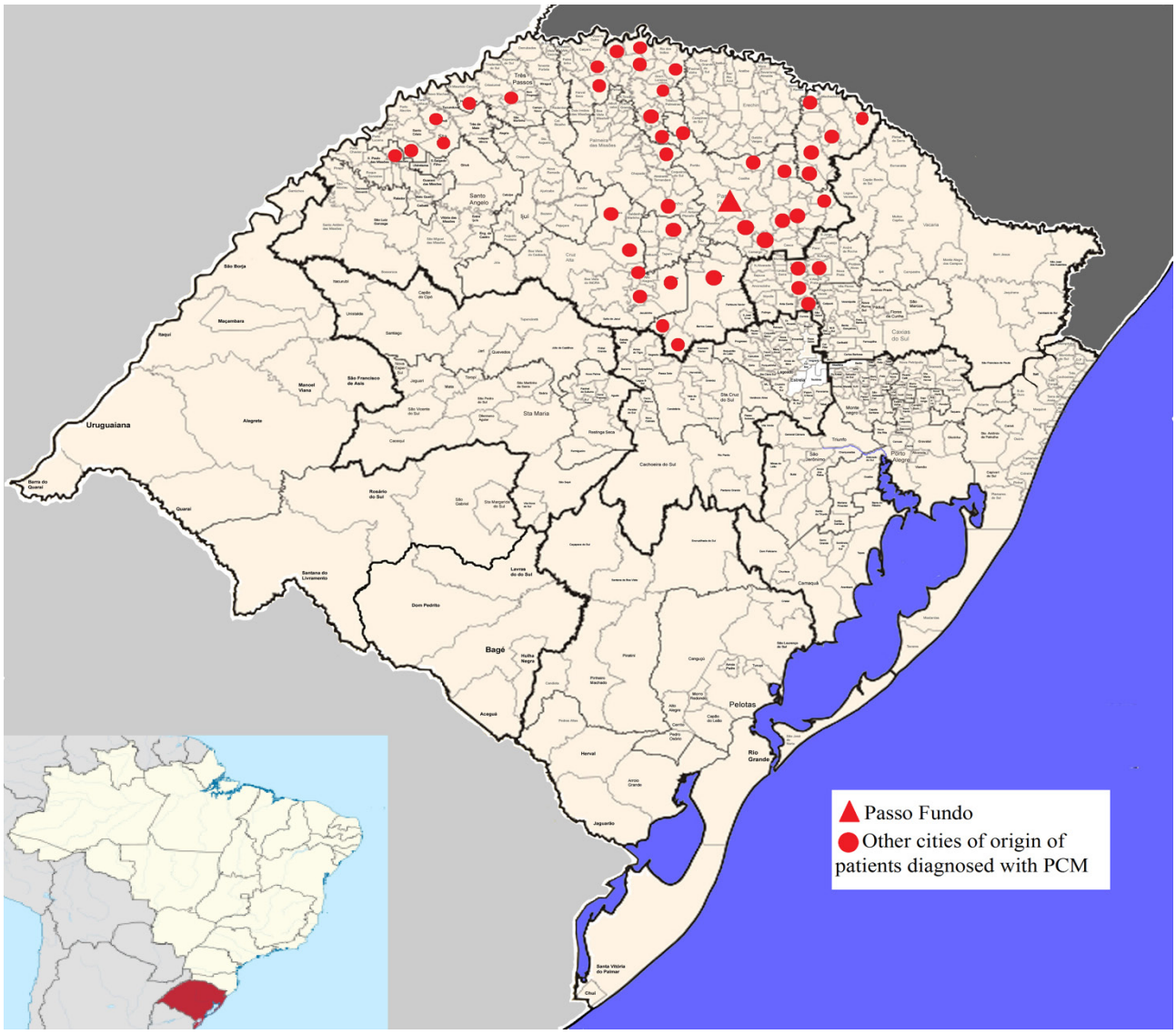

Figure 1. Cities of origin of patients diagnosed with PCM at the Pathology Institute of Passo Fundo, RS, Brazil. Source: Adapted from https://pt.wikipedia.org/wiki/Ficheiro:RioGrandedoSul_MesoMicroMunicip.svg.

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22 (26%) lived in urban areas and had occupations such as bricklayer, logger, gardener, military, general services or household activities.

Clinical samples were obtained from the oral cavity (n = 106), oropharynx (n = 47), lungs (n = 15), brain (n = 8), skin (n = 7), and prostate (n = 3).

Table 1. Distribution of PCM cases according to sex, age group and injury site.

	Total	%
Sex		
Man	185	92.5%
Woman	15	7.5%
Age group (years)		
31-40	14	20.5%
41-50	57	28.5%
51-60	71	35.5%
61-70	44	22%
71-80	14	7%
Injury site		
Brain	8	4%
Lung	15	7.5%
Oral cavity	106	53%
Oropharyngeal	47	23.5%
Prostate	3	1.5%
Skin	7	3.5%

DISCUSSION

This is the first retrospective study to report PCM cases in the northern region of Rio Grande do Sul, Brazil. We analyzed 200 cases of PCM diagnosed histopathologically in patients from Passo Fundo and other cities in the northern region of Rio Grande do Sul over a period of 20 years.

The majority of patients diagnosed with PCM were male, aged between 51 and 60 years, and had lesions located predominantly in the oral cavity or oropharyngeal region.

The region of Passo Fundo has its economy based mainly on agriculture, which favors the infection of agricultural workers with *P. brasiliensis*. Verli et al. (2005) described positive cases of PCM in a stomatology service in Porto Alegre, RS, and showed that 73.7% of the patients diagnosed between 1976 and 2004 were from the northern region of Rio Grande do Sul.[10]

Although RS has low winter temperatures, several studies report endemic PCM cases in cities of this state, such as Santa Maria, Porto Alegre, and Pelotas.[15] In addition, the fungus that causes PCM was also found in the soil of the Pampa biome, in the city of Bagé and in urban areas of the municipality of Rio grande.[16,17]

Similar to other epidemiological studies on PCM, in this study, the number of men affected by the disease was greater than that of women, in the ratio of 18:1.[1] This observation can be explained by the higher number of men working as farmers and by the fact that men are more frequently in contact with the sources of infection. Another explanation is the protection conferred to women by hormonal factors, possibly by the action of estrogen as a potentiator of the immune cellular response.[18] After menopause, estrogen levels drop dramatically. From the age of 35, a decrease in estrogen secretion by female follicular cells begins. Possibly for this reason, in this study, women with PCM were over 40 years old. Similar data are found in the literature, with reports of women with PCM in childhood or in the post menopausal period.[1] In addition, men are more prone to smoking and alcoholism, factors related to the disease. [19]

Several studies describe agricultural activities as the most predominant occupations of PCM patients.[10,15] However, there are also consistent reports of a high incidence of the disease among construction workers.[10] This can be explained by their contact with aerosols (from soil and wood) or, mostly, by rural workers who left the field, where they probably acquired the infection, and manifested the clinical symptoms years later, when they were already integrated into the urban population.[1,20] This characteristic of PCM cases was confirmed in the present study: the majority of patients (74%), for whom this information was available on medical records, were from rural areas and worked in agriculture, whereas the others (26%) lived in urban areas but worked in activities that made them susceptible to *P. brasiliensis* infection, as masons, loggers, gardeners, among others.

In the present study, the largest proportion of patients were aged between 51 and 60 years, which agrees with previous PCM reports from RS and other countries, but differs from data from other regions of Brazil, where lower age groups are more prevalent.[15,21,22]

Most individuals infected with *Paracoccidioides* spp. do not develop the disease, exhibiting a pattern of immune response by T-helper cells type 1 (Th-1), characterized by the synthesis of cytokines that activate macrophages and TCD4+ and TCD8+ lymphocytes, resulting in the formation of compact granulomas and control of fungus replication. Patients with chronic unifocal or multifocal PMC exhibit depression of the Th-1 response, but to a lesser extent than in patients with the acute or severe disseminated chronic form. In patients with mild or moderate chronic PCM, the loss of Th-1 function seems to be compensated by the Th-17 and Th-22 responses, which promote inflammatory mucosal response with intense neutrophil participation.[23] This mechanism explains the involvement of mucous membranes, especially the respiratory tract.

Oral lesions were present in 106 patients, in different anatomical sites (tongue, lip, soft palate, gingiva, and jugal mucosa), similar to those found in other studies.[10,24] Extrapulmonary manifestations appear in the chronic phase of the disease after the fungus has spread through the bloodstream. Data from the literature have already shown that in the southern region of Brazil there is a predominance of the chronic form of PCM.[15] These data may be underestimated since in the medical records there were only annotations restricted to the site of biopsy but no reports of other anatomical sites possibly involved.

PCM was classified as a compulsory notification

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disease in Brazil only in February 2020, by Decree No. 254 of the Ministry of Health, however, the non-mandatory notification until then, may have generated a large number of unreported or unidentified cases.[14] The epidemiological data on PCM reported in this study highlight the importance of performing the differential diagnosis, since the most common manifestation of this infection is a productive cough with mucopurulent expectoration, also the main manifestation of tuberculosis.[1] In addition, the differential diagnosis should include histoplasmosis, leishmaniasis, squamous cell carcinoma, syphilis and Hodgkin's lymphoma (in lymphatic form).[1] In rural areas, where there are few investments in healthcare, PCM is commonly not considered during diagnosis, leading to the patient's death and its record under incorrect causes.[25] Another factor that seems to influence the difficulty in obtaining more accurate numbers of PCM is the non-adherence to treatment. Because, once the clinical cure (that is, the disappearance of symptoms such as: reduction of dyspnea and mucocutaneous lesions) precedes the immune recovery, the patient tends to discontinue pharmacotherapy, thus leading to disease recurrences.[26]

Other factors that reinforce the importance of PCM notification and control are the social and economic costs of the disease, affecting individuals in their most productive life phases and requiring prolonged treatment as well as frequently causing sequelae that may permanently prevent workers from executing their activities.[3]

It can be mentioned as limitations of the study, the lack of data in the patients' medical records, such as scholarity and comorbidities. Regarding comorbidities, even with the existence of other diseases in these patients, unlike other systemic mycoses, such as histoplasmosis, PCM is not usually related to immunosuppressive diseases.[1]

PCM incidence among men aged more than 50 years agrees with data from the literature. Men are more frequently in contact with the fungal agent due to their occupations and are more exposed to risk factors for the disease, such as smoking and alcoholism. These data highlight the importance of healthcare professionals in the correct diagnosis and treatment of PCM cases. Early diagnosis is of high relevance due to the high cost of the disease, its prolonged treatment, and to prevent its progression.

CONFLICT OF INTEREST

The authors state that there was no conflict of interest to declare.

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CONTRIBUIÇÕES DOS AUTORES

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Luiza Paloma dos Santos Girotto, Paulo Josué da Silva Jaques e Gabriel Krieser Biolowons contribuíram para o delineamento do artigo, coleta dos dados e revisão e redação do artigo.

Todos os autores aprovaram a versão final a ser publicada e são responsáveis por todos os aspectos do trabalho, incluindo a garantia de sua precisão e integridade.

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PUBLICAÇÃO OFICIAL DO NÚCLEO HOSPITALAR DE EPIDEMIOLOGIA DO HOSPITAL SANTA CRUZ E PROGRAMA
DE PÓS GRADUAÇÃO EM PROMOÇÃO DA SAÚDE - DEPARTAMENTO DE BIOLOGIA E FARMÁCIA DA UNISC

Revista de Epidemiologia e Controle de Infecção

Hospital Santa Cruz

ORIGINAL ARTICLE

Prevalence of drug poisoning in the state of Bahia between 2007 and 2017

Prevalência de intoxicação por medicamentos no estado da Bahia entre 2007 e 2017

Prevalencia de intoxicación por medicamentos en el estado de Bahía entre 2007 y 2017

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ABSTRACT

Background and Objectives: Drug poisoning is becoming a public health problem. In this context, pharmaceutical care and the care of health professionals who work directly with medications are fundamental in the repair of patients' health and in the prevention of problems related to the use of these products. This study aimed to determine the prevalence of drug poisoning in the state of Bahia, Brazil, between 2007 and 2017. **Methods:** This is a quantitative, descriptive and exploratory study, which evaluated the drug poisoning notifications in the state of Bahia, recorded in DATASUS between 2007 and 2017, considering as variables of interest: age group, race, sex, circumstance, final classification, confirmation criterion and evolution, year and city of notification. **Results:** In the period, 28,412 cases of exogenous intoxication were recorded, 29.7% of which were caused by medications. The age group with the highest prevalence was 20 to 39 years old (38.5%), females presented the highest number of cases (66.7%); suicide attempt was the main cause, corresponding to 38.5% of the notifications. The highest concentration of reported cases occurred in the state capital. **Conclusion:** In the studied period, the drugs were the most responsible for cases of exogenous intoxication, and suicide attempt was the main reason. Undoubtedly, the easy access to these products predisposes self-medication – a risk factor for these cases of intoxication. In this scenario, it is necessary to implement campaigns for the rational use of medicines in the state of Bahia, as well as suicide prevention, directed mainly to young adults – the age group with the highest prevalence of cases.

Keywords: *Poisoning Prescription Drug Misuse. Suicide. Suicide attempt.*

RESUMO

Justificativa e Objetivos: As intoxicações por medicamentos estão se tornando um problema de saúde pública. Nesse contexto, a atenção farmacêutica, bem como os cuidados dos profissionais de saúde que trabalham diretamente com medicamentos, tornam-se fundamentais na reparação da saúde do paciente e na prevenção de problemas rela-

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cionados ao uso desses produtos. Objetivou-se determinar a prevalência de intoxicação por medicamentos no estado da Bahia, Brasil, entre 2007 e 2017. **Métodos:** Foi realizado um estudo quantitativo, do tipo descritivo e exploratório, que avaliou as notificações relacionadas à intoxicação por medicamentos no estado da Bahia registradas no DATASUS entre 2007 e 2017, tendo como variáveis de interesse: faixa etária, raça/cor e sexo, circunstância, classificação final, critério de confirmação e evolução, ano e município de notificação. **Resultados:** Foram registrados 28.412 casos de intoxicação exógena no período, sendo 29,7% causados por medicamentos. A faixa etária de maior prevalência foi de 20 a 39 anos (38,5%), com maior número de casos entre pessoas do sexo feminino (66,7%), tendo a tentativa de suicídio como a principal causa, correspondendo a 38,5% das notificações. A maior concentração de casos notificados ocorreu na capital do estado. **Conclusão:** No período estudado, os medicamentos foram os maiores responsáveis pelos casos de intoxicação exógena, sendo a tentativa de suicídio o maior motivo. Sem dúvidas, a facilidade de acesso a esses produtos predispõe à automedicação, sendo um fator de risco para esses casos de intoxicação. Nesse cenário, é necessária a implementação de campanhas de uso racional de medicamentos no estado da Bahia, bem como de prevenção ao suicídio, direcionadas, principalmente, aos adultos jovens, faixa etária com maior prevalência de casos.

Descritores: *Envenenamento. Uso Abusivo de Medicamentos. Suicídio. Tentativa de suicídio.*

RESUMEN

Justificación y Objetivos: La intoxicación por medicamentos se está convirtiendo en un problema de salud pública. En este contexto, la atención farmacéutica, así como los cuidados de los profesionales de la salud que trabajan direct con medicamentos, se vuelven fundamentales en la reparación de la salud del paciente y la prevención de problemas relacionados con este uso. El objetivo de este estudio fue determinar la prevalencia de intoxicación por medicamentos en el estado de Bahía entre 2007 y 2017. **Métodos:** If realizó un studio exploratorio cuantitativo, descriptivo, que evaluó las notificaciones related con la intoxicación por medicamentos en el estado de Bahía registradas en DATASUS entre 2007 y 2017, teniendo como variables de interés: grupo de edad, raza/color y sexo, circunstancia, clasificación final, criterios de confirmación y evolución, año y ciudades de notficación. **Resultados:** Hubo 28,412 cases of exogenous intoxication en el período; de los cuales el 29.7% fueron caused by medicines. El grupo de edad más prevalente fue el de 20-39 años (38.5%), con un mayor número de casos entre mujeres (66.7%), con tento de suicidio como la causa principal que correspondal al 38.5% de las notificaciones. La mayor concentración de casos reported ocurrió en la capital del estado. **Conclusión:** Se observó que en el período estudiado la mayoría de los casos de intoxicaciones exogenas se dieron por el uso de medicamentos, con el intento de suicidio como la principal razón. El fácil acceso a los medicamentos predispone a la automedicación, un factor de riesgo para casos de intoxicación. En este sentido, se hace necesario implement campañas para el uso racional de medicamentos en el estado de Bahía, así como para la prevención del suicidio, sobre todo en los adultos jóvenes, grupo de edad con una mayor prevalencia de casos.

Palabras clave: *Envenenamiento. Mal Uso de Medicamentos de Venta con Receta. Suicidio. Intento de Suicidio.*

INTRODUCTION

Intoxication results from exposure to a certain endogenous or exogenous substance that disturbs the level of consciousness or other physiological functions and responses, such as flushing, pain and itching. If exogenous and by medication, the physiological response depends mainly on the type of medication and the dosage, being influenced by the individual's level of tolerance. A drug is often administered to achieve a desired treatment, but abuse can lead to intoxication.[1,2]

Drug poisoning, for the most part, can lead to sedation, drowsiness, mental confusion, respiratory depression, hypotension, tachycardia, seizures, muscle spasms and stiffness, vertigo, headache, loss of reflexes and, occasionally, death. However, despite the risks of undue exposure, access to medicines is of paramount importance for the prevention and solution of health problems. In order to ensure the safety of its use, the participation of public agencies is indispensable, along with the private network, with the common goal of improving patient's treatment compliance and reducing the risks related to the use of medications, supporting pharmaceutical care.[3,4]

Currently, drug poisoning is becoming a public health problem. According to the National System of Toxic-Pharmacological Information (Sinitox), drugs are the number one responsible for poisoning in Brazil – and they have been in the first place since 1994. According to the Department of Information of the Unified Health System (DATASUS) – an agency linked to the Ministry of Health that provides health data in Brazil – in 2017, 61,337 drug poisoning cases were notified and of these, 607 (0.9%) were cured with sequelae and 352 (0.57%) lead to death.[5-7] In view of this scenario, the aim of this study was to determine the prevalence of drug poisoning in the state of Bahia, between 2007 and 2017.

METHODS

A descriptive, exploratory study with quantitative approach was conducted to establish a profile of notifi-

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cations (recorded at DATASUS between 2007 and 2017) related to drug poisoning in the state of Bahia. Data referring to the years 2018, 2019 and 2020 are not available in the database.

The used secondary data, from DATASUS, was directly collected from the website of the Ministry of Health. Data were collected in March 2019 with the health science descriptors tool, which located results relevant to exogenous drug intoxication.

DATASUS is an important database for public consultation within the Unified Health System (SUS), as it provides relevant information about health in Brazil. In this case, it shows the permanence of medicines in first place, between 2007 and 2017, regarding the causes of exogenous intoxication, when compared with other etiological agents, such as food, beverages or rodenticides.

Another relevant database is the voluntary notification database, Sinitox, which recorded a total of 291,745 drug intoxication reports between 2007 and 2016.[5-8] However, this database was not used in the research due to possible underreporting.

The variables of interest in this investigation were age group, race and sex, circumstance, final classification, confirmation and evolution criteria, year and city of notification. For the data presentation, the absolute and relative frequencies were calculated according to the characteristic. Microsoft Excel was the program used for formatting, tabulating and data analysis.

Considering that the information is public and does not identify collective or individual data, this research did not need to be submitted to the local Research Ethics Committee (CEP), even though it considered the ethical principles of The National Health Council Resolution 466/2012.

RESULTS

A total of 336,143 notifications of drug poisoning were recorded in Brazil between 2007 and 2017. In the state of Bahia alone, 28,412 cases of exogenous intoxication were recorded in the same period, among which 8,449 (29.7%) were caused by medications. Food and beverages stand out in second place, representing 3,758 notifications (13.2%) in the studied period. In addition to the categories of medicines, food and beverages, DATASUS exposes rodenticides and 11 other agents that caused exogenous intoxication. In the analyzed period, 5,696 notifications were not correctly filled out; they were categorized as ignored/blank and represented 20% of the poisoning cases.

Considering the studied period, 2017 recorded the highest number of notifications – 19.5% of the cases, with a total of 1,648 notifications – while 2007 presented only 94 cases. An annual increase in notifications of drug poisoning was observed between 2007 and 2017 in the state of Bahia (Figure 1).

The cities that recorded the highest numbers of drug poisoning were Salvador, Feira de Santana, Itabuna, Jequié and Juazeiro. The city with the highest number of notifications was Salvador, with 2,626 cases (31.1%), followed by Feira de Santana, with 653 notifications (7.7%); the rest of the cases – 5,170 (61.2%) – were divided between over 194 cities.

Regarding the age group, the following age groups were analyzed: 20-39 years old, with 3,251 notifications (38.5%); 40-59 years old, with 1,222 notifications(14.5%); 1-4 years old, with 1,208 notifications(14.3%); and 15-19 years old, with 1,131 notifications (13.4%). The number of notifications decreased sharply after the age of 60 and the least reported age group was 80 years old or more (Figure 2).

Individuals of white, black, yellow, brown and indigenous race represented, respectively, 541 (6.4%), 429 (5%), 47 (0.6%), 3,819 (45.2%) and 22 (0.3%) cases. The mixed race was the most prevalent in drug intoxication notifications, with 3,819 cases, representing 45.2% of the total. On the other hand, in 3,591 records, the race factor was ignored, that is, 42.5% of notifications had incomplete information. There was a predominance of females in toxicological notifications in the studied period, with 5,638 cases (66.7%), while for males, the number was 2,805 (33.2%); 0.1% of the notifications did not present

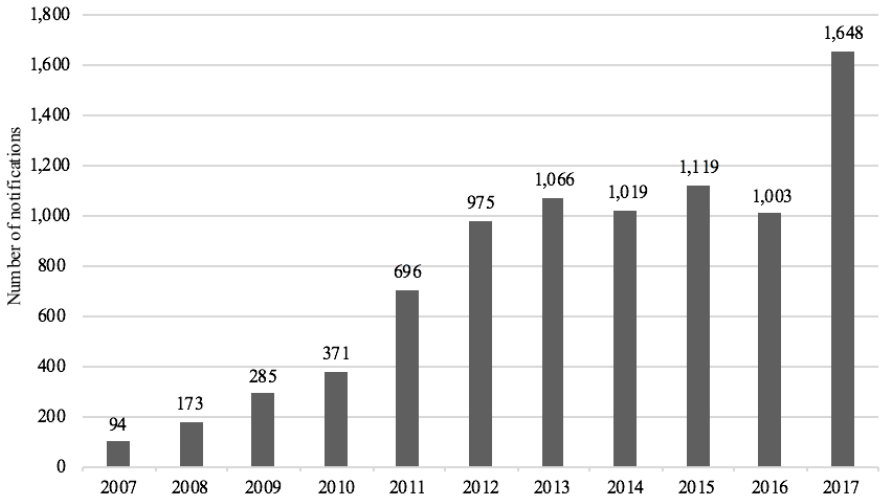

Figure 1. Notifications of drug poisoning in the state of Bahia between 2007 and 2017, by age group.

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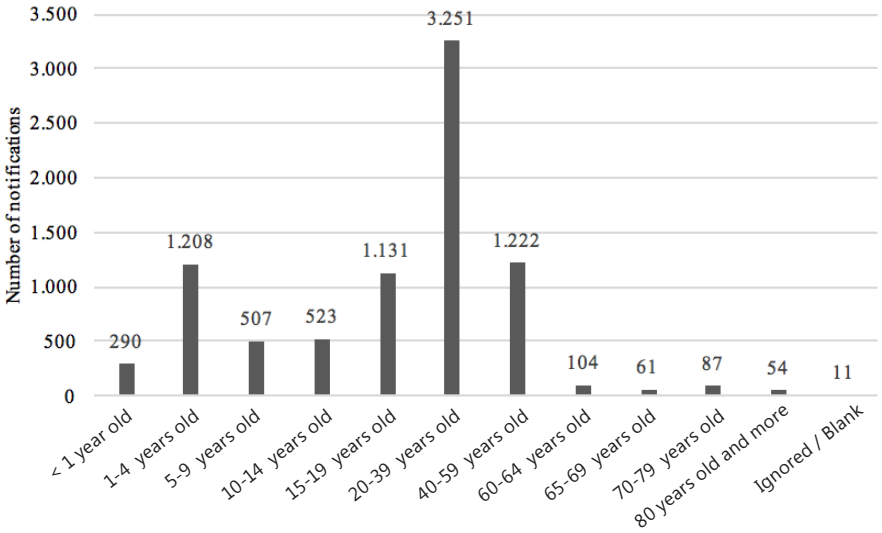

Figure 2. Notifications of drug poisoning in the state of Bahia between 2007 and 2017, by age group.

this information, so they were ignored.

Figure 3 shows the circumstances in which most poisonings occurred. They were suicide attempts, with 3,253 cases (38.5%), followed by accidental causes, with 1,537 notifications (18.2%) and self-medication (7.4%). It is worth mentioning that 1,415 (16.7%) cases were ignored because they did not present information on circumstances, which negatively affects surveys that seek reliable data on the number of intoxication cases.

Fifty-nine percent of the notifications (4,986) were confirmed as intoxication; cases in which the patient only underwent exposure were 15.3% (1,307) and cases of adverse reactions were 8.5% of the notifications (726). The number of ignored cases was relevant (1,325), which directly impacted the analysis of this study. When data are processed as 'ignored,' especially if they represent a high percentage, they generate a knowledge gap due the lack of consistent information about each omitted case.

In 5,061 cases (59.9%), the applied methodology to obtain the diagnosis was clinical knowledge, followed by clinical-epidemiological methodology, with 1,823 notifications (21.5%), and by laboratory clinic, with 353 cases (4.2%). As in the previous variables, the ignored cases represented 1,212 notifications (14.3%), which makes the data incomplete when searching for accuracy in the disclosure of notifications.

Out of the 8,449 notifications, regarding the number of cases per clinical response, it was observed that cure without sequelae predominated – 6,255 cases (74%). Still, 93 people (1%) were cured with some sequelae and the number of confirmed deaths was 61 (0.7%). However, the number of ignored cases for not presenting this information was 1,909 (22.6%), a representative number in relation to the total, which obviously hinders the correct

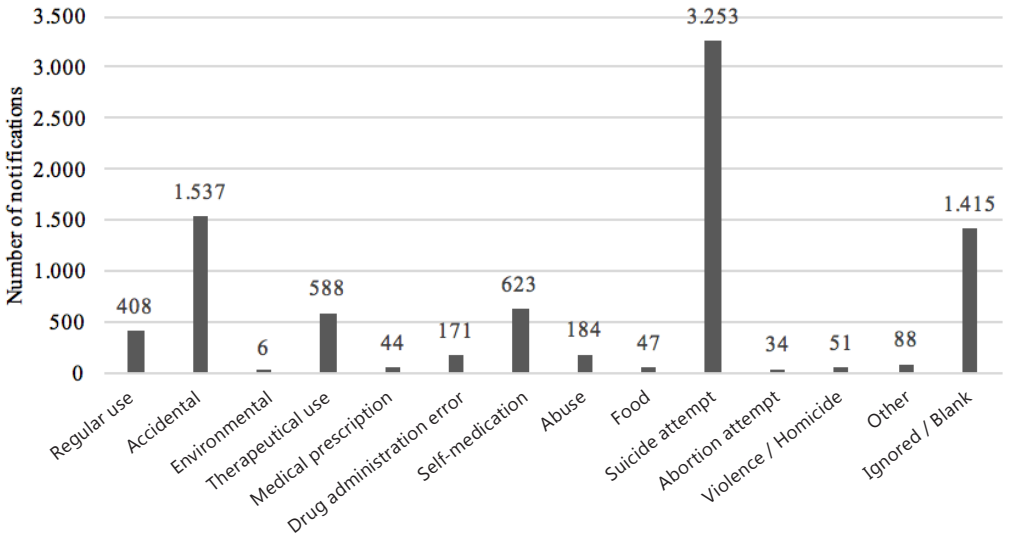

Figure 3. Notifications of drug poisoning in the state of Bahia between 2007 and 2017, according to circumstance.

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interpretation of what was, in fact, the clinical outcome of a large portion of patients whose cases were reported between 2007 and 2017.

The need for better notification is evident, in order to allow reliable analyses of the obtained data in DATASUS, which guide the development of public policies and strategies to minimize cases of drug poisoning, as well as the generated health problems.[9]

DISCUSSION

The lack of commitment in notifying intoxications results in underreporting in DATASUS, underestimating the actual number of cases. Corroborating the findings, a study exposed the relationship between hospital admissions and death from drug intoxication in São Paulo, between 1996 and 2012, through public data provided by DATASUS. As a result, it showed that, since 2005, notifications increased and, consequently, so did mortality. The highest increase was in 2009. In 2005, in every 1 million inhabitants 1.9 deaths occurred, while in 2009 this number rose to 3.7 and, in 2012, to 6.7 deaths per million inhabitants. In the state of Bahia, although only 2 deaths were reported due to drug intoxication in 2009, this number reached 19 cases in 2012. Both numbers are related to the total population in the period, which was 16,635,500 and 14,175,341, respectively, leaving room for possible underreporting.[7-9]

Regarding hospitalizations, every 4.4 days a case was registered as drug intoxication in São Paulo, with intentional intoxication as the most prevalent reason. The female sex represented 60.5% of the total hospitalized cases and the main drugs involved were benzodiazepines and antimicrobials.[7,9] In Bahia, the findings demonstrate 66.7% of female representation in cases of intoxication in the studied period.

In the state of Maranhão, a study showed that 575 drug intoxication cases were reported in the Sinitox database between 2011 and 2015 – especially in 2014, with 200 cases, representing 34.8% of the total.[5] Another study presented intoxication data collected from the Piauí Toxicological Information Center (Citox-PI) from 2007 to 2012; 459 notifications were found; 2011 had 214 notifications, representing 46.6% of the total cases.[3,10] The data found for the state of Bahia show that 2011 was the period in which notifications significantly increased – from 371 recorded cases in 2010 to 696 notifications for drug intoxication in 2011.

Data collected from Sinitox show alarming results for the Northeast region, which reported 13,718 drug poisonings between 2008 and 2013. In 2008, 24.9% of all poisonings in the period occurred, adding up to 3,416 notifications. Therefore, it is clear that medications stand out as a cause of intoxication, occupying the first place as the major cause in the states of Maranhão, Piauí and Bahia.[11]

It is known that these products are manufactured for cure, preventive and diagnostic purposes. However, its use may be harmful, causing possible intoxication or death. For intoxication, the drug must be consumed above the recommended doses, surpassing the therapeutic window. One factor that favors its position as the main cause of intoxications is the easy access to medicines. Thus, its rational use, as well as pharmaceutical attention, can reduce intoxication risks.[12,13]

Pharmaceutical care is a fundamental tool for repairing patient's health, as well as for preventing problems related to the use of medications, and it is guaranteed by the SUS. The pharmacist directly contributes to minimizing the costs of hospitalizations due to the irrational use of medicines, providing guidance to inhibit unnecessary visits, besides ensuring better treatment adherence; this care is indispensable to promote the health of the population.[14,15]

A study showed that, in the city of Salvador, 2,064 drug poisoning cases were notified between 2013 and 2017, according to data from the Notifiable Diseases Information System (Sinan). Among them, 1,872 involved residents of the capital, (90.6%), while the others concerned other cities, subordinate to Salvador, such as Camaçari, Simões Filho and Lauro de Freitas.[16]

In Campinas, in the countryside of São Paulo, a survey obtained data from records of the Centers for Poison Control (ICC), from 1998 to 2011. It found 16,774 cases of drug poisoning, representing 32.5% of the total number of hospital visits due to poisoning (51,665), corresponding to the category of greatest potential among toxic agents.[17]

A study conducted in Brazil from 2002 to 2013 determined that drugs are the main exogenous agents causing intoxication, according to data released by Sinitox. The most affected age group was from 0 to 15 years old. Some of the involved drugs are nasal decongestants, bronchodilators and painkillers. The authors suggest a review of prescribing practices in child health care and policies related to the use of medications, in order to fight the culture of self-medication.[18]

Data collected from Sinitox – between 2011 and 2015, in Rio Grande do Sul – exposed a total of 3,787 notifications among 20 to 39-year-olds, 48.8% of the total cases (7,767). Of these young adults, 26% had incomplete elementary school, which, according to the author, makes it difficult to understand campaigns related to the prevention of problems caused by medicines.[19]

Through DATASUS information, another study evaluated the prevalence of suicide attempts due to drug intoxication in the state of Rio Grande do Sul, from 2007 to 2017. They found a total of 5,530 reports of suicide attempts involving medications and the most affected age group was 20 to 39 years old – with a total of 2,705 intoxications (48.9%).[7,19] Corroborating their findings, Bahia, between 2007 and 2017, registered 3,253 suicide attempts by drug intoxication, 38.5% of all poisoning cases. The most affected age group was also 20 to 39 years old, adding up to 3,251 cases – 38.5% of the notifications.[20]

Data collected from the Health Surveillance Notification System (Notivisa) demonstrated that the white population was the most affected by adverse drug reactions in Brazil (58.1%), between 2008 and 2013, followed by brown, with 21.2%. Data suggest that the number of suicide attempts is higher among women; the attempts

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often involve exposure to an exogenous agent during self-poisoning. Medications are first, followed by pesticides, in the list of substances used in suicide attempts.[21,22]

According to data from the World Health Organization (WHO), 3,000 people die daily in the world, victims of suicide; for every confirmed death there are twenty more suicide attempts. On a global scale, suicide has an overall rate of sixteen deaths per 100,000 inhabitants, making it the thirteenth leading cause of death – the third among 15 to 34-year-olds and the second leading cause of death among 15 to 19-year-olds.[23]

Drug poisoning can happen due to different factors. The most common are accidental self-poisoning; suicide attempt; abuse; and other administration errors. The numbers of drug intoxications grow each year and it is already considered a global health problem, which forces health professionals to be even more careful during the evaluation of each case, in order to promote a diagnosis through coherent anamnesis, filling out the form in a reliable way to carry out fast and effective treatment, since the eminence of health problems is real and demands specific treatment for each confirmed case.[12-24]

Each year, there is a progressive growth of new intoxication cases. However, the number of fully cured people is favorable and the mortality rate is low. It is worth noting that some episodes generate a lot of discomfort due to toxicological severity, leaving some victims with irreversible sequelae, culminating in expensive medical care needs, in addition to promoting the suffering of victims and their families.[25]

Epidemiological data on intoxication are relevant to determine the position of this event in time and to stimulate the improvement of the quality of notifications, making professionals aware of the practice and monitoring importance. Special attention should be given to the correct and thorough completion of these data, so that the records of these events allow the development of directed prevention strategies. The incomplete information in the notification systems significantly damages the analysis and real representations of the problem, which may end up underestimated. Filling instructions, to ensure the quality of the data, need to be improved.

Bahia presented a high rate of drug poisoning, most cases were concentrated in Salvador, possibly due to the population factor, when compared with other cities with lower number of cases. The easy access to medicines predisposes self-medication, which is a risk factor for intoxication. The correct use of these products is essential for effective pharmacotherapy, to meet the clinical needs of patients, and it is directly related to the reduction of intoxication episodes. One of the major challenges of health teams, especially the pharmaceutical, is to promote the rational use of medicines, raising awareness on the risks of their indiscriminate use. This scenario emphasizes the need to implement campaigns for the rational use of medicines, not only in the state of Bahia, but throughout national territory, as well as suicide prevention, since this is the major cause of drug poisoning, prevalent in young adults aged between 20 and 39 years old.

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Fernanda de Oliveira Souza e Íngara Keisle São Paulo Barretto Miranda contribuíram com o planejamento, a revisão e a aprovação final do artigo;

Todos os autores aprovaram a versão final a ser publicada e são responsáveis por todos os aspectos do trabalho, incluindo a garantia de sua precisão e integridade.

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PUBLICAÇÃO OFICIAL DO NÚCLEO HOSPITALAR DE EPIDEMIOLOGIA DO HOSPITAL SANTA CRUZ E PROGRAMA DE PÓS GRADUAÇÃO EM PROMOÇÃO DA SAÚDE - DEPARTAMENTO DE BIOLOGIA E FARMÁCIA DA UNISC

Revista de Epidemiologia e Controle de Infecção

Hospital Santa Cruz

ORIGINAL ARTICLE

Profile of patients presenting hospital-acquired infection at intensive care units of public hospitals

Perfil dos pacientes com infecções relacionadas à assistência à saúde em unidade de terapia intensiva de um hospital público

Perfil de pacientes con infección relacionada con la asistencia sanitaria en la unidad de cuidados intensivos de un hospital público

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ABSTRACT

Backgroung and Objective: Currently, the Intensive Care Unit (ICU) plays a decisive role in the chance of survival of critically ill patients, whether they are trauma victims or experiencing any other serious clinical condition. However, it has become the main place of hospital infections occurrence, increasing morbidity, mortality and care costs, representing an important public health problem in the recent years. Thus, this study aims to identify the profile of patients with hospital-acquired infections in the Adult ICU of a public hospital in the Federal District, Brazil. **Method:** This is a retrospective and descriptive study, with quantitative approach. Data were collected directly from patients' electronic medical records. **Results:** We found 51 patients with cross infection, predominantly male and older adults; 24 from the hospital itself, 21 from other hospitals and 6 from Emergency Care Units. The main reason for hospitalization was clinical (76.4%). Regarding topography, 23 patients had pneumonia and 18 had urinary tract infections. The mean length of hospital stay was 31 days and the mortality rate was 37.2%. **Conclusion:** As important as the investment in state-of-the-art technology in intensive care is to know the profile of critically ill patients; as it can assist nurses in admission guidelines, nursing diagnosis and discharges.

Keywords: *Cross infection. Intensive Care Unit. Nursing.*

RESUMO

Justificativa e Objetivo: A Unidade de Terapia Intensiva (UTI) desempenha atualmente um papel decisivo na chance de sobrevida de pacientes gravemente enfermos, sejam eles vítimas de trauma ou de qualquer outra condição clínica extremamente grave. Em contrapartida, se tornou o principal local de ocorrência das infecções hospitalares

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que aumentam a morbimortalidade e os custos assistenciais, o que vem representando, nos últimos anos, um importante agravo de saúde pública. Deste modo, este estudo objetiva conhecer o perfil dos pacientes com infecções relacionadas à assistência à saúde na UTI Adulto de um hospital público do Distrito Federal, Brasil. **Método:** Estudo do tipo retrospectivo, de caráter descritivo, com abordagem quantitativa. Os dados foram coletados diretamente do prontuário eletrônico dos pacientes. **Resultados:** Foram encontrados 51 pacientes com infecção hospitalar, predominantemente do sexo masculino, idosos, entre os quais 24 eram oriundos do próprio hospital, 21 de outros hospitais e 6 das Unidades de Pronto Atendimento. O principal motivo da internação foi clínico, com percentual de 76,4%. Em relação à topografia, 23 pacientes apresentaram quadro de pneumonia e 18 tiveram infecções do trato urinário. O tempo médio de internação foi de 31 dias e o índice de mortalidade foi de 37,2%. **Conclusão:** Tão importante quanto o investimento em tecnologia de ponta em tratamento intensivo, o conhecimento do perfil dos doentes críticos é uma necessidade que se impõe, pois pode auxiliar o enfermeiro nas diretrizes das admissões, diagnóstico de enfermagem e altas dessa unidade.

Descritores: *Infecção Hospitalar. Unidade de Terapia Intensiva. Enfermagem.*

RESUMEN

Justificación y Objetivo: La unidad de cuidados intensivos (UCI) desempeña actualmente un papel decisivo en la posibilidad de supervivencia de pacientes gravemente enfermos, ya sea víctimas de trauma u otra condición clínica muy grave. En contrapartida, se ha convert en el principal lugar de ocurrencia de infecciones hospitalarias que resultan en el aumento de la morbimortalidad y de los costos asistenciales, lo que viene representando en los últimos años un importante agravio de salud pública. Este estudio busca conocer el perfil de los pacientes con infecciones related to la asistencia sanitaria en la UCI de un hospital público en el Distrito Federal (Brazil). **Method:** Studio of retrospective, descriptive character, with cuantitativo approach. Los datos fueron recogidos directly from los electronic medical records of patients. **Results:** Se encontraron a 51 pacientes con infección hospitalaria, con predominancia para el género masculino, personas mayores; de los cuales 24 pacientes eran del hospital, 21 de otros hospitales y 6 de las Unidades de Emergencya. La razón principal para la admisión fue clínica, con un porcentaje del 76.4%. En cuanto a la topografía, 23 pacientes tenían neumonía y 18 tuvieron infecciones del tracto urinario. La duración media de la estancia fue de 31 días, y la tasa de mortalidad fue del 37.2%. **Conclusion:** Tan importante como la inversión en tecnología de cuidados intensivos, el conocimiento del perfil de los pacientes críticamente enfermos es una necesidad, ya que puede ayudar al enfermero en las directrices de admisión, el diagnóstico de enfermería y la alta de esta unidad.

Palabras clave: *Infección Hospitalaria. Unidades de Cuidados Intensivos. Enfermería.*

INTRODUCTION

With high-complexity technological advances, Intensive Care Units (ICU) are looking for the best way to provide treatment to their patients. It is a complex sector that ensures greater surveillance and mastery of critically ill patients[1], equipped with an uninterrupted monitoring system, which admits potentially complex patients, with intensive support and treatment that aim to serve the client in need safely and effectively, as to achieve their clinical improvement.[2,3]

These advances have provided survival to people affected by diseases that were previously considered incurable. However, along with this improvement, other complications arise, including the increase of hospital-acquired infections (HAI).[4]

HAI impacts on hospital lethality, length of hospital stay and costs. The increase in the number of infections varies according to the level of care of each hospital and its complexity: the hospitalization of more severe and immunocompromised individuals, added to the emergence of antimicrobial resistance, make HAI specially relevant for public health. In addition, developing countries may be up to twenty times more affected by HAI than developed countries.[5] Three factors are necessary to transmit infections in the hospital environment: the susceptible host; the means of transmission; and the sources of infection, which can be employees, patients, contaminated objects, surfaces, visitors and equipment.[6]

The transmission occurs, mainly, due to assistance failure of the multidisciplinary team, either by inadequate planning, incorrect execution of aseptic techniques or by non-compliance with standard precautionary guidelines, causing harm to the patient and economic and social burden, as well as suffering for the patients themselves and their families.[6]

It is worth mentioning that these events can be avoided, since they result from mistakes in the assistance itself. Ignoring standard patient safety precautions can increase infections, morbidity and mortality in health environments.[6-9] In addition to the damage caused to the patient's health, a study in a tertiary-level hospital in Brazil found that more than 25% of hospital-acquired infections happen in the ICU, especially bloodstream infections in surgical sites and catheter-related infections, which had higher expenses within the ICU, respectively

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R$ 666.47 and R$ 803.59 per day.[7]

Intensive care unit patients undergo procedures that use invasive devices that increase infection rate, such as Central Venous Catheter (CVC), Indwelling Urinary Catheter (IUC) and Mechanical Ventilation (MV).[8] Therefore, nursing is crucial within the Hospital Infection Control Service (HICS), as it plays a continuing education role for the entire care team, bringing knowledge and information aimed at improving infection control techniques.[10]

In view of these considerations, this study aims to understand the clinical profile of patients with HAI in the Adult Intensive Care Unit of a public hospital in the Federal District (DF), from January to December 2015.

METHODS

This is a documentary, retrospective and descriptive study. The study site was the ICU of the Asa Norte Regional Hospital (HRAN), considered a reference hospital in the Brazilian Midwest. The ICU of this hospital has ten beds for adults, eight of which are destined to general internal medicine and two to surgical clinic.

This is a public hospital, therefore, linked to the Unified Health System (SUS) and accredited by the Ministry of Education and the Brazilian Ministry of Health as a teaching hospital. Among the specialties, the hospital, which has approximately four hundred beds, is a reference in the care of burn injuries, cleft lip, CrisDown (care for patients with Down syndrome) and bariatric surgery.

The study population consisted of all patients who presented hospital-acquired infections (HAIs) in the Adult ICU from January to December 2015. Patients who were already hospitalized in the adult ICU before January 2015 were excluded from the study.

To collect the data, a script was elaborated containing the following variables: sex, date of birth, age, date of hospitalization, time prior to the ICU, origin and reason of hospitalization (general or surgical), days of hospitalization, invasive procedures, use of antibiotics, topography, date of discharge, type of discharge or death. Data were collected by the HRAN Hospital Infection Control Center in October 2016.

The results indicators and rate were calculated according to the definition of general standards, criteria and methods stipulated by the National Health Surveillance Agency (Anvisa) in the Diagnostic Criteria for Hospital-acquired Infections manual, 2nd edition, corrected on March 3rd, 2017.[4]

Data were collected through documents referring to the indicators of hospital infection of cultures carried out in 2015, with daily active search and registration in the Hospital Infection Control Commission (HICC) database.

For result analysis, a database was created in Microsoft Office Excel 2016; then, it was analyzed and presented through simple statistics. The Project was submitted to the Ethics Committee of the Health Sciences Education and Research Foundation (Fepecs) and approved under CAAE 61219410.3.0000.5553, with protocol number number 1.809.497. The study followed the recommendations of Resolution No. 466/2012 of the National Health Council.

RESULTS

Out of the 151 hospitalizations in the Adult ICU in 2015, 51 patients met the inclusion criteria for the study, as they presented diagnostic criteria for HAI (Table 1).

Among them, 22 (43.1%) were older adults – over 60 years old. Considering the unit of origin, most of the patients (n=10) came from the emergency room (41.6%), followed by 4 (16.7%), who came from the operating room and 1 (4.1%) from the burn injury unit (Table 1).

Table 1. Patients' Profile with HAI in the Adult ICU from January to December 2015.

Profile	N	%
Sex		
Male	27	53
Female	24	47
Total	51	100
Age		
20 to 35 years old	7	13.7
36 to 59 years old	22	43.1
60 to 97 years old	22	43.1
Reason for hospitalization		
General Medicine	39	76.4
Surgical	12	23.5
Length of hospital stay		
Minimum	1 day	–
Average	31 days	–
Median	8 dias	–
Maximum	173 days	–
Internal origin		
Emergency rooms	10	41.6
General surgery unit	6	25
Surgical Center	4	16.7
Obstetric Center	1	4.1
Emergency Unit	1	4.1
Thoracic surgical unit	1	4.1
Burn injury unit	1	4.1

Source: Occupational Health and Work Safety Service, 2019.

Table 2 describes the invasive procedures, topographies, antibiotic use and the type of discharge of patients with HAI in adult ICU.

Table 2. Patients' Profile with HAI in the Adult ICU from January to December 2015.

	N	%
Invasive procedures		
Indwelling Urinary Catheterization	51	100
Mechanical ventilation	48	94.1
Feeding Tube	41	80.3
Tracheostomy	38	74.5
Bloodstream		
Central venous catheter	16	31.3

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Topography		
Pneumonia	23	45.1
Urinary tract infection	18	35.2
Others	7	13.7
Use of antimicrobials		
Yes	50	98
No	1	2
Patients' Discharge		
Discharge from the ICU	30	58.9
Death	19	37.2
Hospitalized in general ward	2	3.9

DISCUSSION

In the studied hospital, we found 51 patients with HAI (34% of all ICU patients). Another study, conducted in Recife in 2015, found that between 20% and 50% of ICU patients present hospital-acquired infections.[11]

Regarding the sociodemographic profile of the surveyed patients, the male sex patients (27, 53%) predominated in relation to females – 24 cases (47%). Two national studies that characterize hospital-acquired infections in ICU patients corroborate the data we found; one of them, conducted in 2010 in a philanthropic hospital in the state of Paraná, found that the infection rate predominates in males, with a percentage of 58.9%;[12] the other, conducted in 2006 at the teaching hospital of the University of São Paulo, presented data from a retrospective study finding higher infection incidence in males, with a percentage of 56.6%.[13] This is expected because the male sex is mistakenly considered protected from possible organic and psychological problems, distancing themselves from health care, especially preventive aspects; besides, they have low treatment adherence, which increases the number of infections. The literature points out other risk factors, such as homicide and suicide attempt that occur frequently, increasing the incidence of deaths or hospitalizations.[14] These events, however, were not significant in this study.

The mean age of the population of this study was 56 years old. The largest share of hospitalizations, 29 (56.8%), was composed of adults. Twenty-two (43.1%) older adults were identified, who, in relation to younger patients, presented numerous risk situations that predisposed them to HAI, a condition that increases morbidity and mortality.[15]

The results regarding the reason for hospitalization indicated that 76.4% of the patients came from general internal medicine and 23.5% from surgical procedure – surgical (2) and clinical (8) beds. Another study pointed out similar results, with 39 general internal medicine patients.[16]

The HAI risk is closely related to the performed procedures, the nutritional conditions of the patients and the length of hospitalization, among other aspects.[17] Thus, according to Table 2, the 51 (100%) patients underwent invasive procedures: 48 (94.1%) mechanical ventilation; 38 tracheostomy (74.5%); 51 indwelling urinary catheterization (100%); and 41 feeding tube (80.3%). These rates vary between 9% and 40% of infections acquired within the ICU. The high incidence is due to the invasive procedures to which patients are submitted.[18]

The most frequent infection in this study was pneumonia, associated with mechanical ventilation – 23 patients (45.1%). Colonization and aspiration of microorganisms from endogenous or exogenous microbiota are one of the main ways of acquiring ventilator-associated pneumonia (VAP).[19] A study found that VAP – among hospital-acquired infections – has the highest incidence in ICU. It develops between 48 and 72 hours after tracheal intubation and may also appear 48 hours after extubation.[18]

In this study, urinary tract infection (UTI) associated with the indwelling urinary catheter was identified in 18 patients (35.2%). The interval registered by the National Health Surveillance Agency (Anvisa) has rates from 3.1 to 7.4/1,000 catheters/day.[20] The risk of UTI-CR is directly related to how long the catheter is used: 2.5% in one day, 10% in two or three days and 12.2% in four or five days. The risk can reach 26.9% when the catheter permanence time is equal to or greater than six days.[21]

The UTI bundle – preventive measures packages – may vary between institutions. The main measures include avoiding using urinary catheters in situations where they are not properly indicated, implementing institutional protocols for early catheter insertion and removal (checklist or daily plan and interventions, such as electronic or manual reminders) and appropriate techniques for catheter insertion and maintenance (sterile insertion and closed drainage system).[21]

The implementation of prevention bundles has been proven to decrease patient exposure and the development of invasive device-related infection in up to 88%.[23]

Therefore, when analyzing the factors associated with the occurrence of UTI – as well as the variables influenced by the performance of the professionals involved in this procedure – it is necessary to pay close attention to the nurse's role, who should be active in the multidisciplinary team when evaluating ICU patients and discussing the use of the indwelling urinary catheter (IUC), as well as its insertion and maintenance.[24]

The third most frequent infection found in this study was primary bloodstream infection, associated with the use of CVC – 16 patients (31.3%). The central venous catheter is frequently used in the care of patients requiring complex therapeutic interventions, usually with several venous punctures throughout treatment, which, added to the irritating and/or vesicant characteristics of each drug, can lead to vascular fragility and stiffening, making it difficult to visualize and puncture, which favors extravasation.[25] We would like to point out that, in ICU treatment, obtaining safe and reliable vascular access is extremely important so the patient is not exposed to risks.[25]

Infections are the most well-known causes of death in patients with serious illnesses. More severe conditions (severe sepsis, septic shock and multiple organ dysfunction syndrome) are the main cause of ICU mortality.[26]

Considered potentially severe, sepsis is characte-

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rized as a systemic reaction in the body. For the most part, epidemiological reports on sepsis come from developed countries.

In the ICU, bacteriuria associated with bladder catheter, urinary infections and ventilator-related pneumonias are found, all with high morbidity and mortality.[15]

Another study conducted in a teaching hospital in Recife found that 60% of HAI occur through four types of infections: UTI, pneumonia (RTI PAV) – usually associated with mechanical ventilation –, catheter-related bloodstream infection (CRBSI) and surgical site infection (SSI), which, within the ICU, represents between 14% and 17% of the infections.[11]

The use of antimicrobials and the unit environment – which makes natural selection favorable to the development of microorganisms and, consequently, colonization and/or infection – are considered inadequate in approximately 50% of the cases.[27]

These heavy, broad-spectrum antimicrobials, associated with routine invasive procedures, contribute to the increasing rates of HAI.[28] As for the use of antimicrobials, only 2% of patients did not use them; even though antibiotics mean a major advance for medicine in the treatment of infections, when used indiscriminately they may cause microorganisms to develop mechanisms of resistance.[29]

According to a study conducted in the ICU of a university hospital in the city of São Paulo, 50 patients acquired HAI and 19 of them died.[16] In our study, in 2015, 51 patients were admitted to the ICU and diagnosed with hospital-acquired infection, 30 of them had a favorable outcome, with hospital discharge; 2 remained hospitalized and 19 died, all related to HAI. Therefore, there was no significant difference in the quantitative comparison of deaths between the two studies, even with the 10-year difference between them.

It should be emphasized that, regardless of all technology used, health professionals should join the campaign "Protecting million lives," coordinated by the Healthcare Improvement Institute (HII), which promotes the prevention of infection in invasive procedures and recommends packages of preventive measures (bundles) that, individually, result in even more substantial improvements.[30]

These bundles are evidence-based actions. When performed in an integrated, structured, uniform and reliable way, they improve the processes and results related to patient care.[31]

Thus, professional awareness is of paramount importance to increase patient safety in relation to bacterial transmission, effectively contributing to reduce HAI.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the main causes of hospital infections. It increases morbidity and mortality rates, prolongs hospitalization and swells costs.[33]

In a study conducted in China[33] with 1,347 patients, 102 had nosocomial (hospital) infection. Prevalence was 7.57%, with rates ranging from 7.19% to 7.73% over the three years of the study. Lower respiratory tract (43.1%), urinary tract (26.5%) and bloodstream infections (20.6%) were the most common. The most frequently isolated pathogens were *Staphylococcus aureus* (20.9%), *Klebsiella pneumoniae* (16.4%) and *Pseudomonas aeruginosa* (10.7%). Multivariate analysis showed that categories D or E of mean severity of the disease and the use of mechanical ventilator are the independent risk factors for infection.[3]

In a retrospective study with 65 patients hospitalized with liver cirrhosis, who had developed hospital-acquired infections, the epidemiology of these infections was examined regarding resistance to the most commonly used antimicrobials and the patient-specific risk factors associated with the development of pathogen infection.[34] The most frequently isolated organisms were *Enterococcus* spp. (*n* = 34, 52.3%), *Klebsiella* spp. (*n* = 10, 15.4%) and e. coli (*n* = 6, 9.2%). Of these, 35 isolated organisms (53.8%) were identified as multidrug resistant bacteria (MDR) and 30 (46.2%) did not present MDR. The overall resistance to ceftriaxone was 92%. Thus, we emphasize the need for institutions to individualize protocols for the treatment of hospital-acquired infections, particularly in immunocompromised populations.[35]

The emergence of multidrug-resistant bacteria is a challenge for physicians, who have limited therapeutic options. Contaminated environment surfaces are a potential reservoir for the transmission of many pathogens associated with health care. Pathogens can survive or persist in the environment for months and are a possible source of infection, when proper hygiene and disinfection procedures are inefficient.[37]

Limitations in this study were the fact that this research was carried out in a single center, as well as the lack of evaluation of the patients' basis diagnosis and, also, the way of access to data: medical records in which, supposedly, information is lost due to lack of details and quality of data. Data collection occurred retrospectively and, therefore, problems were noted in data records in the electronic registers. We were not allowed to collect the involved strains. Moreover, the reality analyzed was that of the ICU of the studied hospital.

This study allowed the identification of the sociodemographic profile and clinical characteristics of patients admitted to an ICU of a public hospital.

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AUTHORS' CONTRIBUTIONS

Suzi Stéfanne Siqueira and Fabio Rodrigo Galvão Cardoso - Data collection, data interpretation and final writing of the article.

Aline Zulte de Oliveira - Critical reading and final writing of the article.

Maria Liz Cunha de Oliveira – Study design, monitoring of data collection and analysis and final writing of the article.

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REVIEW ARTICLE

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COVID-19: estrategias de afrontamiento y comportamientos adaptativos de los profesionales de la salud durante la pandemia

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ABSTRACT

Justification and Objectives: the number of confirmed cases and deaths by COVID-19 has increased, also among health professionals, whose impact reflects on practices, social and family life. In this sense, this study sought to identify and describe coping strategies and adaptive behaviors among health professionals during the COVID-19 pandemic according to national and international scientific literature. **Content:** this is an integrative review carried out based on the following guiding question: what are the coping strategies and adaptive behaviors adopted by health professionals during the COVID-19 pandemic in the national and international scenarios? The search took place in June 2020 from the bibliographic survey in the databases of LILACS, PubMed, CINAHL, Scopus and Embase using the expression Boolean operators AND and OR for the combination of indexed descriptors and their respective synonyms. 212 publications were found in the databases. From the previously established criteria, 32 studies were eligible for full reading. Finally, 30 were selected to be analyzed and discussed. **Conclusion:** coping strategies are related to the knowledge acquired, growth in the use of new health technologies through applications, adaptations to changes in protocols, in addition to adaptive behaviors related to practices, expression of negative feelings and values. Although less frequently, positive attitudes and good practices were identified that contribute to increased resilience and psychological well-being among health professionals.

Descriptors: *Occupational Health. Health Personnel. Adaptation, Psychological. Coronavirus Infections.*

RESUMO

Justificativa e Objetivos: O número de casos confirmados e óbitos por COVID-19 tem aumentado, também, entre os profissionais de saúde, impactando suas práticas e seu convívio social e familiar. Neste sentido, este estudo

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buscou identificar e descrever as estratégias de enfrentamento e comportamentos adaptativos entre os profissionais de saúde durante a pandemia de COVID-19, segundo a literatura científica nacional e internacional. **Conteúdo:** Trata-se de uma revisão integrativa realizada a partir da seguinte questão norteadora: "Quais as estratégias de enfrentamento e comportamentos adaptativos adotados pelos profissionais de saúde durante a pandemia de COVID-19 nos cenários nacional e internacional?". A busca ocorreu em junho de 2020, a partir do levantamento bibliográfico nas bases de dados da LILACS, PubMed, CINAHL, Scopus e Embase utilizando na expressão os operadores booleanos AND e OR para a combinação dos descritores indexados e seus respectivos sinônimos. Foram encontrados nas bases de dados 212 publicações. A partir de critérios previamente estabelecidos, 32 estudos foram considerados elegíveis para a leitura na íntegra e, por fim, 30 foram selecionados para serem analisados e discutidos. **Conclusão:** As estratégias de enfrentamento estão relacionadas aos conhecimentos adquiridos, crescimento da utilização de novas tecnologias em saúde por meio de aplicativos, adaptações às mudanças nos protocolos, além de comportamentos adaptativos relacionados às práticas, expressão de sentimentos e valores negativos. Embora em menor frequência, identificaram-se atitudes positivas e boas práticas, que contribuem para o aumento da resiliência e bem-estar psicológico entre os profissionais de saúde.

Descritores: *Saúde do trabalhador. Pessoal de saúde. Adaptação psicológica. Infecções por coronavírus*

RESUMEN

Justificación y Objetivos: El número de casos confirmados y de muertes por el Covid-19 se ha aumentado también entre los profesionales de la salud, lo que impacta sus prácticas y su convivencia social y familiar. Este estudio buscó identificar y describir las estrategias de afrontamiento y los comportamientos adaptativos entre los profesionales de la salud durante la pandemia de Covid-19 de acuerdo a la literatura científica nacional e internacional. **Contenido:** Se trata de una revisión integrativa realizada a partir de la siguiente pregunta orientadora: "¿Cuáles son las estrategias de afrontamiento y los comportamientos adaptativos de los profesionales de la salud durante la pandemia de Covid-19 en el ámbito nacional e internacional?". La búsqueda ocurrió en junio de 2020 mediante un levantamiento bibliográfico en las bases de datos de LILACS, PubMed, CINAHL, Scopus y Embase utilizando en la expresión los operadores booleanos AND y OR para la combinación de descriptores indexados y sus respectivos sinónimos. Se encontró 212 publicaciones en las bases de datos. A partir de criterios previos establecidos, se eligió 32 estudios para la lectura en su totalidad, de los cuales se seleccionó 30 para el análisis y discusión. **Conclusión:** Las estrategias de afrontamiento están relacionadas a los conocimientos adquiridos, al aumento del uso de nuevas tecnologías en salud por medio de aplicaciones, a adaptaciones a los cambios en los protocolos, además de los comportamientos adaptativos en cuanto a las prácticas, expresión de sentimientos y valores negativos. En menor frecuencia, se identificaron actitudes positivas y buenas prácticas que contribuyen al aumento de la resiliencia y al bienestar psicológico entre los profesionales de la salud.

Palabras clave: *Salud Laboral. Personal de Salud. Adaptación Psicológica. Infecciones por Coronavirus.*

INTRODUCTION

Epidemics are characterized as involuntary transitory events of civilization.[1] The first human beings, whose characteristics of social organization are distinct from today's society, faced illnesses in the same way that today occurs. However, due to the fact that they are more inmates in their "tribes", isolated from other groups, the diseases did not have the ability to spread. However, this changed with the advent of the Agricultural Revolution and the consequent sedentarization of man.[1]

Currently, humanity faces the coronavirus disease (COVID-19), which has SARS-CoV-2 as the etiologic agent according to the International Virus Taxonomy Committee classification. This virus belongs to the genus *β-coronaviruses*, as well as SARS-CoV and MERS-CoV, which caused an epidemic in China in 2003 and similar respiratory conditions in 2012 in the Middle East, respectively. The first reported cases referring to SARS-CoV-2 occurred in Wuhan, Hubei province, China, dated December 2019,[2] resulting in the declaration of a pandemic by the World Health Organization (WHO) in March 2020.

Worldwide, COVID-19 has a high incidence and mortality, especially in the Americas region, in which Brazil stands out.[3] The data in the country are tabulated using an epidemiological database, *e-SUS NOTIFICA*, to record cases of Influenza Syndrome (IS) suspected of COVID-19 in the population and among health professionals, including technicians and/or nursing assistants. are configured as the category that most falls ill by COVID-19.[4]

Studies show that the pandemic has caused negative consequences on workers' health, such as fear of contamination, impact on lifestyle, sleep, changes in behavior (approaches), search for public information,[5,6] in addition to increase in mental problems, such as anxiety, depression and stress, due to overwork, frustration, discrimination, isolation, lack of contact with family members, pressure and exhaustion.[7,8]

Such aspects are intensified, among other factors, by ineffective strategies of social isolation, the lack of human resources and the precariousness in the offer of collective and Individual Protection Equipment (PPE). In

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this sense, it is necessary to understand how these professionals are adapting to these changes that impacted practices, social and family life.

This study aimed to identify and describe coping strategies and adaptive behaviors adopted by health professionals during the COVID-19 pandemic according to national and international scientific literature.

METHODS

This is an integrative review carried out through the following steps: identification of the guiding research question, search in databases, identification of eligible publications, selection of publications, data extraction, analysis and synthesis of evidence.

To develop the guiding question of the research, descriptors were identified that derived from the guiding question: what are the coping strategies and adaptive behaviors adopted by health professionals during the COVID-19 pandemic in the national and international scenarios? PICo strategy was used, in which P (population) corresponded to health professionals; I (intervention/interest), coping strategies and adaptive behaviors; Co (context), the COVID-19 pandemic.

Literature search took place in June 2020 and was carried out by two researchers independently, with the possibility of a third researcher if there was disagreement in the selection of articles. The search expressions were prepared using Boolean operators AND and OR for the combination of the descriptors indexed in the Health Sciences Descriptors (DeCS), Medical Subject Headings (MESH) and Emtree (Embase Subject Headings), with their respective synonyms in English and Spanish (Chart 1).

Bibliographic survey was carried out in the Latin American & Caribbean Literature in Health Sciences (LILACS), International Literature in Health Sciences (PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scopus and Embase databases. Subsequently, the materials were exported to the online systematic review application Rayyan QCRI of the Qatar Computing Research Institute[9], as well as duplicate publications and others submitted to title and abstract reading by two independent researchers were excluded.

We chose to include quantitative and qualitative studies, complete, in Portuguese, English, and Spanish, published in 2020. It was also considered as exclusion criteria, literature reviews, letters, notes, editorials, comments and other types of publications other than scientific articles.

For article selection, the study should answer the guiding question of the review, making them eligible for full reading, later submitted to a qualitative and descriptive synthesis by means of a file containing authors, country and publication period, objective, study design and quantity of professionals studied.

Expressions (E)	Free/controlled vocabulary
E1	**Pessoal de Saúde** OR Prestadores de Cuidados de Saúde OR Profissionais da Saúde OR Profissionais de Saúde OR Profissional da Saúde OR Profissional de Saúde OR Trabalhador da Saúde OR Trabalhador de Saúde OR Trabalhadores da Saúde OR Trabalhadores de Saúde (Portuguese) **Health Personnel** OR Health Care Provider OR Health Care Providers OR Healthcare Provider OR Healthcare Providers OR Healthcare Worker OR Healthcare Workers OR Personnel, Health OR Provider, Health Care OR Provider, Healthcare OR Providers, Health Care OR Providers, Healthcare OR Health Care Personnel (English) **Personal de Salud** OR Proveedores de Atención de Salud OR Trabajadores de la Salud (Spanish)
E2	**Adaptação Psicológica** OR Comportamento Adaptativo OR Enfrentamento OR Estratégia de Adaptação OR Estratégias de Enfrentamento OR Habilidades de Enfrentamento (Portuguese) **Adaptation, Psychological** OR Adaptation, Psychologic OR Adaptive Behavior OR Coping Behavior OR Coping Skill OR Psychologic Adaptation OR Psychological Adaptation OR Attitude (English) **Adaptación Psicológica** OR Afrontamiento OR Ajuste Psicológico OR Conducta Adaptativa OR Conducta de Enfrentamiento OR Estrategias de Afrontamiento OR Estrategias de Enfrentamiento OR Habilidades de Afrontamiento (Spanish)
E3	**Infecções por Coronavírus** OR Infecção pelo Coronavírus OR COVID-19 OR Novo Coronavírus OR Coronavirus de Wuhan OR 2019-nCoV (Portuguese) **Coronavirus Infections** OR Infection, Coronavirus OR COVID-19 OR Novel Coronavirus OR New Coronavirus OR Wuhan Coronavirus OR 2019-nCoV OR Coronavirus Pandemic OR Coronavirus Disease (English) **Infecciones por Coronavirus** OR Infección por el Coronavirus OR COVID-19 OR Nuevo Coronavirus OR Coronavirus de Wuhan OR 2019-nCoV OR Pandemia por el Nuevo Coronavirus (Spanish)

**The expressions in the three listed languages were connected using the Boolean AND.*
Source: created by the authors, 2020.

Chart 1. Search expressions and controlled/free vocabulary in Portuguese, English, and Spanish, used in the search process for publications for this integrative review, 2020.

RESULTS AND DISCUSSION

Thus, 212 publications were found in the databases, of which, in order to meet the previously established inclusion criteria, 29 were excluded for being duplicates, 39 publications for being incomplete, five for being in other languages, 32 for having been published before 2020, 12 because they are letters, six because they are notes, four editorials, three comments and 20 because they fit into

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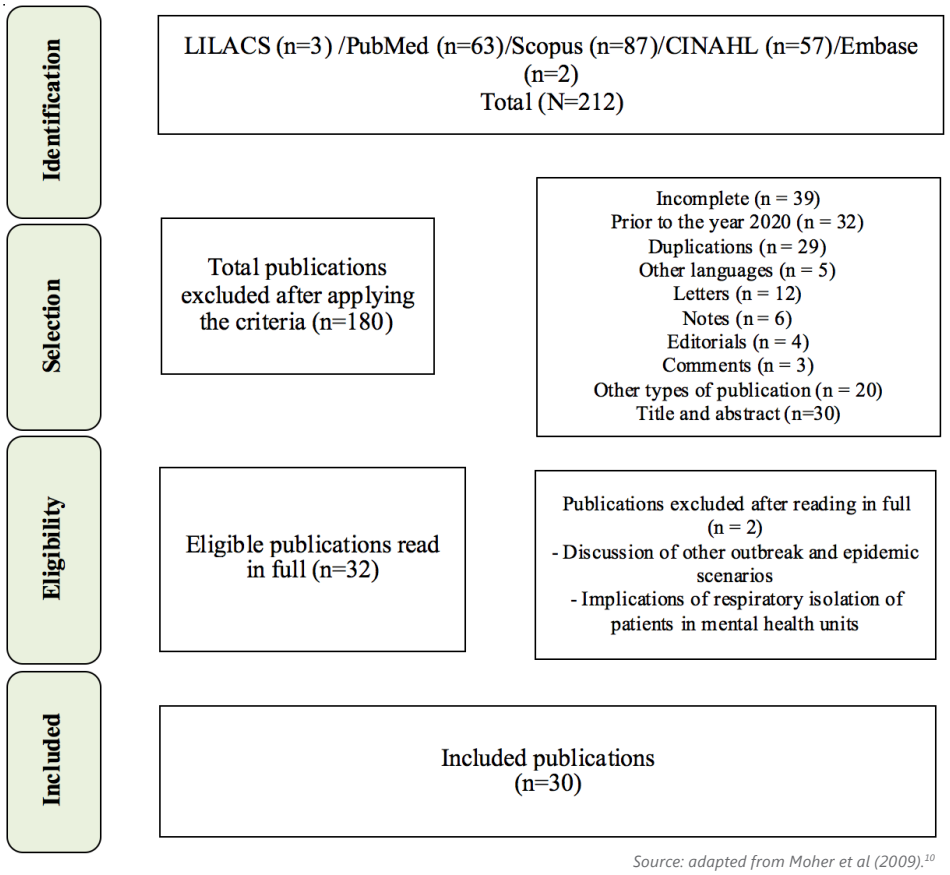

Source: adapted from Moher et al (2009).[10]

Figure 1. Flowchart of the steps for selecting the studies in this review, 2020.

other types of publication other than scientific articles.

After reading all titles and abstracts, 30 publications were excluded for not meeting the guiding question of the research because they worked with norms and recommendations for researchers, mental health professionals, higher education and long-term care institutions in the COVID-19 pandemic context, techniques for diagnosing the disease, changes in the sleep status of health teams and patient safety with COVID-19. Thus, 32 eligible studies were selected to be read in full. Two were excluded for discussing other outbreak and epidemic scenarios, without mention of COVID-19, and implications of respiratory isolation for patients in mental health units; in the end, this made it possible to include 30 articles to be analyzed and discussed (Figure 1).

The articles included were published, mostly, in English (96.7%), in international journals, of which the International Journal of Environmental Research and Public Health (23.3%), JMIR Public Health and Surveillance (13.3%), and Journal of Hospital Infection (13.3%) stand out. Most of them were carried out on the international stage, especially in countries that since the beginning of the pandemic have already been considered its epicenter, such as China (16.7%), Italy (20%), the United States (6.7%) and India (6.7%) (Table 1).

Regarding the study design, predominantly cross-sectional research (73.3%) and quantitative approach were identified (50%). The study population was composed of health professionals who work in the front line to combat the pandemic, such as nurses, physicians, physiotherapists, nutritionists, dentists, pharmacists, in addition to medical residents, interns and other professionals from the health support sectors who contribute to health control actions in different institutions and health settings, public or private (Table 1).

It was verified as for the methods used in the studies, mainly the accomplishment of online surveys with application of questionnaires to the study population (83.3%) - validated, elaborated or adapted through Google Forms, SurveyMonkey, Kwiksurveys, shared through media social and email. Some questionnaires, in addition to the collection of sociodemographic data and related to the behaviors, practices and attitudes of health professionals during the COVID-19 pandemic, also assessed other variables through Generalized Anxiety Disorder-7 (GAD-7) tests, PMT constructs, Connor-Davidson Resilience Scale and China Perceived Stress Scale.

Regarding coping strategies for the management of COVID-19 and for professional practice, studies have shown, in general, that health professionals have a good knowledge of transmission, diagnosis, prevention, management and control measures of the disease. Additionally,

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Table 1. Summary of articles included in this review according to authors, country and publication period, objective, study design and number of professionals studied, 2020.

Authors	Country and publication journal	Objective	Study design	Number of professionals studied
Ahmed et al., 2020[11]	Saudi Arabia/International Journal of Environmental Research and Public Health	To assess anxiety and fear of becoming infected among dentists while working during the current outbreak of new diseases by COVID-19, as well as knowledge about various practical modifications to combat COVID-19.	Cross-sectional study, using an online, quantitative survey	650 dentists from 30 countries
Barati et al., 2020[12]	Iran/Journal of Hospital Infection	To predict the preventive behaviors of health professionals in relation to COVID-19, based on Protection Motivation Theory (PMT).	Cross-sectional and analytical study	761 health professionals
Bhagavathula et al., 2020[13]	Saudi Arabia/JMIR Public Health and Surveillance	To investigate the knowledge and perceptions of health professionals about COVID-19.	Cross-sectional, quantitative study	529 health professionals
Blake et al., 2020[14]	United Kingdom/International Journal of Environmental Research and Public Health	To synthesize evidence-based information to develop and evaluate a digital learning package to support the psychological well-being of all healthcare professionals.	Not mentioned	Not mentioned
Cagetti et al., 2020[15]	Italy/International Journal of Environmental Research and Public Health	To assess the signs/symptoms, protection measures, awareness and levels of perception regarding COVID-19 among dentists in Lombardy, Italy.	Descriptive, quantitative study	3,599 dentists
Consolo et al., 2020[16]	Italy/International Journal of Environmental Research and Public Health	To investigate the behavior of dentists and analyze their reactions to the restrictive measures to the SARS-CoV-2 pandemic introduced by the Italian national administrative order of March 10, 2020 (DM-10M20).	Cross-sectional, descriptive, quantitative study	356 dentists
Delgado et al., 2020[17]	Not mentioned/International Journal of Environmental Research and Public Health	To assess the reality and perceptions of personal safety among health professionals in Latin America.	Cross-sectional study	936 health professionals
De Stefani et al., 2020[18]	Italy/International Journal of Environmental Research and Public Health	To assess Italian dentists' knowledge about COVID-19 and their perception of the risks associated with the disease, their attitude in resuming their activities and how they judge institutional intervention in terms of health and economics.	Cross-sectional, descriptive, quantitative study	1,500 dentists
Dost et al., 2020[19]	Turkey/Surgical Infections	To assess the knowledge about COVID-19, the attitudes towards the strategies and methods of application to be used for a suspected/confirmed case that needs to be operated or monitored in an Intensive Care Unit.	Descriptive, quantitative study	346 anesthesiology specialists and residents
Huang et al., 2020[20]	China/Medical Science Monitor	To assess the level of resilience of medical staff in radiology departments during the COVID-19 outbreak and explore factors related to it to provide a basis for more effective risk assessment and psychological intervention.	Cross-sectional, quantitative study	587 health professionals in the radiology department
Jin et al., 2020[21]	China/Military Medical Research	To explore the perceived routes of infection, influencing factors, psychosocial changes and management procedures for health professionals infected with COVID-19.	Cross-sectional study	103 health workers infected with COVID-19 in a hospital
Khader et al., 2020[22]	Jordan/JMIR Public Health Surveillance	To assess awareness, perception and attitudes towards COVID-19 disease and infection control in Jordanian dentists.	Cross-sectional, descriptive, quantitative study	368 dentists
Khan et al., 2020[23]	Pakistan/Journal of Medical Virology	To assess education and health professionals' basic knowledge about COVID-19, its control and prevention.	Cross-sectional, quantitative study	303 students, teachers and health professionals
Kumar et al., 2020[24]	Pakistan/Cureus	Investigate the knowledge, attitudes and practices of health professionals in wearing a surgical mask to limit the spread of COVID-19.	Not mentioned	392 participants
Lai et al., 2020[25]	China/Antimicrobial resistance and infection control	To measure the level of infection prevention and control (IPC) behaviors self-reported by health professionals at risk of COVID-19.	Cross-sectional study	1,386 participants
Lima et al., 2020[26]	Brazil/J. Health Biol. Sci. (Online)	To guide medical assistance to cases of non-traumatic surgical emergency during the COVID-19 pandemic.	Bibliographical research	Not mentioned
Moro et al., 2020[27]	Italy/Acta Biomedica	To assess concern, general and specific knowledge and health-related knowledge.	Cross-sectional, quantitative study	2,027 employees of a university hospital in northern Italy
Olum et al., 2020[28]	Uganda/Frontiers in Public Health	To determine health professionals' knowledge, attitudes, and practices regarding COVID-19 at the University Hospitals of Makerere University, Uganda.	Cross-sectional and descriptive study online	136 health professionals
Parikh et al., 2020[29]	India/Cureus	To assess general knowledge and perceptions about COVID-19 and identify reliable sources of information for the general public and health personnel.	Cross-sectional, descriptive, quantitative study	1,246 respondents
Prescott et al., 2020[30]	England/Journal of Hospital Infection	To assess the confidence and perceived level of preparation of health professionals for COVID-19.	Cross-sectional study online	158 health professionals
Ramaci et al., 2020[31]	Italy/Sustainability (Switzerland)	To identify the direct and indirect relationships between stigma, job demand and quality of professional life, including satisfaction of compassion, burnout and compassion fatigue, in a group of health professionals working in a large hospital in southern Italy with a ward for COVID -19.	Cross-sectional study	273 health professionals from a university hospital (physicians and nurses)
Ros et al., 2020[32]	United States/Nurse Education Today	To assess the interest, use and potential of the FPV COVID-19 tutorial for health professionals/responders during a pandemic as a technological tool of global educational reach in public health.	Not mentioned	12,516 users
Saqlain et al., 2020[33]	Pakistan/Journal of Hospital Infection	To identify the current status of knowledge, attitude and practice regarding COVID-19 among health professionals in Pakistan.	Cross-sectional study	414 physicians, nurses and pharmacists
Schinköthe et al., 2020[34]	Argentina, Germany, Iran, Italy, Portugal, Switzerland and the United States/JMIR Public Health Surveillance	COVID-19 Caregiver Cockpit (C19CC) aims to implement a free web-based and application-based tool for patient assessment, in order to assist healthcare professionals, improve care and safety for people infected with COVID-19.	Qualitative multicenter study of application development	Not mentioned
Shacham et al., 2020[35]	Israel/International Journal of Environmental Research and Public Health	To assess the association of COVID-19 factors and psychological factors with psychological distress among the dental team during the COVID-19 pandemic outbreak.	Cross-sectional, quantitative study	338 dentists and dental hygienists
Singh; Sharma, 2020[36]	India/Indian Journal of Public Health	To assess health institutions' preparedness involved in the management of COVID-19 and identify and highlight the concerns of frontline health professionals working during the pandemic.	Cross-sectional, quantitative study	405 health professionals

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Sun et al., 2020[37]	China/Epidemiology and Infection	To assess the impact of the 2019-nCoV outbreak on the psychological state of Chinese healthcare professionals and explore the influencing factors.	Cross-sectional study	442 health professionals
Taghrir; Borazjani; Shiraly, 2020[38]	Iran/Archives of Iranian Medicine United States/JMIR Public	To assess knowledge related to COVID-19, self-reported preventive behaviors and risk perception among Iranian medical students in the first week after the outbreak in Iran began.	Cross-sectional, descriptive, quantitative study	240 medical students (interns and interns)
Wahbeh et al., 2020[39]	Health and Surveillance	To identify topics, opinions and recommendations about the COVID-19 pandemic discussed by medical professionals on Twitter's social media platform.	Mixed method study (social media analysis and qualitative analysis)	119 physicians
Zhang et al., 2020[40]	China/Journal of Hospital Infection	To analyze health professionals' knowledge, practices and attitudes in relation to COVID-19.	Cross-sectional study	1,357 health professionals

the growth in using new health technologies through an application was identified; conducting courses and training for COVID-19 at the health institution itself or over the internet; adaptations to changes in service protocols and office environment, even with the weaknesses in the availability of effective protection measures at individual and collective levels by health systems.

As for health professionals' adaptive behaviors during the pandemic, studies have identified negative consequences for mental health related to increased work overload, insecurity and stress regarding handling COVID-19 cases, risk of disease transmission to their families, as well as financial concern and with future professionals.[11,15,19,21,23,27,35,36,37,40] On the other hand, self-confidence behaviors, fear control, resilience and seeking help were identified[12,20,28,30] as good practices acquired.

In the light of the scientific literature, it was identified that the COVID-19 pandemic impacted, in general, the lives of thousands of health professionals around the world, which resulted in the modification and implementation of strategies to face the pandemic individually and collectively,[11,12,15,16,18,19,22,23,25,26,28,29,32,34,38] as well as adapting practices, behaviors and experiencing new feelings and values.[11-16,18-21,24,27-31,33-38,40]

Acquisition of knowledge related to COVID-19 was presented as a factor for the modification and implementation of new practices and specific measures for infection control with regard to the forms of transmission, clinical and epidemiological criteria for case diagnosis and management.[11,15,21,22,26,27,33,38,40] Such knowledge is considered vital to reduce the chain of transmission of the virus among the population and among health professionals themselves.[28,30]

As for disease prevention strategies, studies show the need to incorporate good practices into individual and collective daily lives in relation to the proper use of PPE, correct hand hygiene, distance practices and social isolation,[12,18,19,23,28,30,33] including those related to environmental measures.[11,15,16,21,22,26] On the other hand, it is identified that there is much to be done to promote effective protection measures,[27] considering the challenges to obtain, availability and use of PPE.[17,21,36]

Moreover, some studies have presented incorrect knowledge, decisions and practices related to COVID-19, either due to professional inexperience, lack of habit, or preparation or lack of understanding the importance of health safety principles.[12,13,19,23,24,29] This highlights the need for continuing professional education as a strategy to identify existing needs, gaps and bottlenecks, in order to improve health professionals' knowledge about COVID-19, promoting better and appropriate therapeutic and prevention practices.[12,25,27,28,30,36]

Access and provision of theoretical and practical training related to COVID-19 were also pointed out by literature.[13,18,19,22,23,28,29,31,33,38,39,40] Topics to be addressed were identified, such as actions and recommendations for pandemic control, combating misinformation, information and knowledge about the virus, organization and flow of patient demand, symptoms, immunity, testing and transmission, in order to ensure patient safety and minimize knowledge deficiencies.[19,39]

The change and implementation of new institutional treatment and management protocols for COVID-19 control were evidenced in the studies as factors capable of promoting better decision-making, reducing stress among health teams and internal conflicts regarding disparate knowledge.[11,17,19, 20,36]

On the other hand, literature addresses the search for updates by health professionals regarding COVID-19 management, independently, over the internet, on institutional and governmental sites,[13,23,28,29,30] for scientific articles[29,38], and most of them through social media,[13,23,30,33] like Twitter.[39]

The regular search for knowledge through unofficial websites and media demonstrates the potential fragility of the information sources chosen by professionals. There is a need for journals to offer open access to publications related to the topic[38] and for official government agencies to invest resources in digital platforms and social media, in order to guarantee the dissemination of reliable news,[19,29] including for the involvement and awareness of the general public,[18,22,24,27] since this is a recent issue, with increasing discoveries and the need for evidence-based updates.

COVID-19 brings with it several challenges, but also opportunities for digital healthcare. In this sense, health innovation technologies, with emphasis on electronic technologies (eHealth), have been proposed as tools to assist the provision of care from the perspective of social distance, such as the free C19CC application. The application was deployed in outpatient care settings in different countries for remote tracking of patients with comorbidities and discharge management, in addition to assisting in telehealth care by infected doctors in quarantine.[34]

Another proposal capable of contributing to the digital support for health education of health professionals was the creation of educational video content in the

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United States through the Revinax® App mobile app. The app was responsible for the remote training of users for the procedures during handling of COVID-19, capable of offering skills acquisition, new skills and review of infection-related content.[32]

In times of pandemic, some weaknesses in health services interfere with the implementation of coping strategies, such as the limited support of public health authorities for human, material, financial resources and inefficiency in protecting physical integrity in the workplace;[17,21,40] this contributes to the increased risk of occupational exposure experienced by health professionals,[21,26] in addition to insecurity with the professional and economic future.[16,18]

Considering that health professionals are the main players in the front line in the fight against COVID-19 in the different scenarios of health services, literature shows the growth of new adaptive behaviors that interfere with physical and psychological changes[18] either due to the lack of preparation to deal with cases, ignorance of the disease, or due to work overload.[19,27,30,34]

The authors point out some feelings that could be listed through the questionnaires applied in the studies to professionals, such as concern and anguish about the disease, fear of contamination,[11,12,14-16,18,19,21,27-29,31,35,36,40] high anxiety, intense feelings of anger and sadness, which, even if observed in a few cases, can directly impact the quality of care provided to patients.[16,31]

Furthermore, feelings of concern, fear and fear of contaminating family members and/or close friends were also mentioned by the authors.[11,19,20,36] This highlights the importance of the availability of alternative locations or temporary accommodation for health professionals to remain after activities that involve risk of contamination, in order to minimize the chain of COVID-19 transmission[36] and reduce associated psychological impacts.

On the other hand, it is emphasized that there were, to a lesser extent, good practices in relation to the COVID-19 pandemic; they were motivated by governmental measures that guaranteed reliability in response actions to fight the disease, as well as by the experience of professionals who collaborated for a more optimistic considering the moment experienced,[13,20,24,28,30,33,37] less stress and anxiety,[38] in addition to controlling fear.[12]

The availability and correct use of PPE are described in the literature not only as important means of COVID-19 prevention and control, but also as factors that contribute to the emotional and psychological security of health professionals.[20,38] However, when unavailable or used incorrectly, they can cause insecure behaviors,[24,30] often driven by distrust and uncertainty in their protective capacity.[18,19,40]

To assist in the development of a culture of resilience within the work environment, a study carried out in the United Kingdom, using digital learning services through evidence-based guidance and support related to health professionals' psychological well-being, allowed, after its use, normalization of psychological responses during a crisis, encouragement to self-care and help behaviors.[14]

This highlights the importance and need for interventions aimed at improving health professionals' resilience and mental health that involve: communication with family and friends;[21] strengthening protection measures; development of standards, workshops and health education that integrate control behaviors; setting goals and making decisions to alleviate the stressful experience of experiencing a pandemic; avoiding complicated and more serious psychological problems in the long run.[11,20,35]

CONCLUSION

This review made it possible to identify coping strategies related to the knowledge acquired, growth in the use of new health technologies through applications, adaptations to changes in protocols, in addition to adaptive behaviors associated with practices, expression of feelings and negative values. Although less frequently, good practices have been identified that contribute to increased resilience and psychological well-being among health professionals.

As a limitation of this study, it is noteworthy to include only original articles to the detriment of other types of publication, which may have caused the exclusion of materials that addressed and contributed to the theme. It presents the importance of understanding and knowing coping strategies and adaptive behaviors to foster discussions of disease prevention and control practices in different health service settings, as well as interventions aimed at the self-care of frontline combat health professionals from COVID-19.

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AUTHORS' CONTRIBUTIONS

Nathalia Halax Orfão, Melisane Regina Lima Ferreira, Gisele Aparecida Soares Cunha de Souza, Lucas Macedo Martins, Vivianne Gomes Feitosa contributed to the planning, design, design of the article, analysis and interpretation of data, writing of the article, review and final approval of the article. All authors have approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

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PUBLICAÇÃO OFICIAL DO NÚCLEO HOSPITALAR DE EPIDEMIOLOGIA DO HOSPITAL SANTA CRUZ E PROGRAMA
DE PÓS GRADUAÇÃO EM PROMOÇÃO DA SAÚDE - DEPARTAMENTO DE BIOLOGIA E FARMÁCIA DA UNISC

Revista de Epidemiologia e Controle de Infecção

Hospital Santa Cruz

REVIEW ARTICLE

COVID-19 in patients with obesity: clinicopathological features and immunological mechanisms associated with adverse clinical outcomes

Associação entre variáveis respiratórias e capacidade de exercício em portadores de DPOC

Asociación entre variables respiratorias y capacidad de ejercicio en portadores de EPOC

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ABSTRACT

Background and objectives: The infection with the new coronavirus (SARS-CoV-2), which causes COVID-19, has been demonstrating to be more severe in patients with risk factors, increasing susceptibility of this patients to mechanical ventilation and mortality, with obesity standing out. The present study reviews the epidemiology of obesity and the possible immunological mechanisms that associate obesity one of the worst clinical scenarios in COVID-19. **Methods:** This study consists of an exploratory narrativereview. In data collection, were considered among the scientific publications of the studied topic, articles published in English, Spanish and Portuguese languages between June 2015 and June 2020, in the electronic databases, PubMed and Virtual Health Library (BVS). The indexing terms used were: "SARS-CoV-2", "Obesity", "COVID-19", "Risk Factors". **Content:** Obesity is a pandemic and its chronic inflammatory condition is a risk factor for several pathologies, including worse outcome in viral respiratory infections. The immunological analysis of this risk factor and its respective role in the immunopathology of SARS-CoV-2, reveals a deregulated pro-inflammatory response, with a marked increase in several cytokines, such as TNF-α, IL-6 and IL-1β. Such mechanisms result in a cytokine storm, with a consequent deterioration of the immune response for the new coronavirus infection that have been linked to the severe form of disease **Conclusion:** Obesity is a global relevant risk factor for SARS-CoV-2 infection because it disrupts the pro-inflammatory immune response, resulting in a worse clinical outcome, which deserves a special attention from the policies against the pandemia.

Keywords: *SARS-CoV-2. Obesity. COVID-19. Risk factors.*

RESUMO

Justificativa e Objetivos: A infecção pelo novo coronavírus (SARS-CoV-2), causador da COVID-19, apresenta-se de forma mais grave em pacientes portadores de fatores de risco para ventilação mecânica e mortalidade, destacando-se a obesidade. Neste contexto, o presente trabalho revisa a epidemiologia da obesidade e os possíveis mecanismos

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imunológicos que associam a obesidade como um dos piores cenários clínicos na COVID-19. **Métodos:** Este estudo consiste de uma revisão bibliográfica narrativa de caráter exploratório. Na coleta de dados, consideraram-se, entre as publicações científicas do tema estudado, artigos publicados nos idiomas inglês, espanhol e português no período de junho de 2015 a junho de 2020, nas bases eletrônicas PubMed e Biblioteca Virtual em Saúde (BVS). Os descritores adotados foram: "SARS-CoV-2", "Obesity", "COVID-19", "Risk Factors". **Conteúdo**: A obesidade é uma pandemia e sua condição inflamatória crônica é fator de risco para diversas patologias, incluindo pior desfecho em infecções respiratórias virais. A análise imunológica desse estado e seu respectivo papel na imunopatologia do SARS-CoV-2 revela uma resposta pró-inflamatória desregulada, com acentuado aumento de diversas citocinas, como TNF-α, IL-6 e IL-1β. Tais mecanismos têm por resultado uma tempestade de citocinas, com consequente piora da resposta imune frente à infecção pelo novo coronavírus que tem sido associada à forma grave da doença. **Conclusão**: A obesidade configura um fator de risco global relevante para a infecção do SARS-CoV-2 por proporcionar a desregulação da resposta imune pró-inflamatória, resultando em pior desfecho clínico, e que merece atenção especial por parte das políticas de combate à pandemia.

***Descritores**: SARS-CoV-2. Obesidade.COVID-19. Fatores de risco.*

RESUMEN

Justificación y Objetivos: La infección por el SARS-CoV-2, causante de la COVID-19, se presenta de forma más grave en pacientes portadores de factores de riesgo que los predispone a la ventilación mecánica y mortalida, destacando la obesidade. En este contexto, el presente trabajo revisa la epidemiologia de la obesidad y los posibles mecanismos imunológicos que asocian la obesidade como uno de los peores escenarios clínicos en la COVID-19. **Métodos**: Este estudio consiste en una revisión bibliográfica narrativa de carácter exploratorio. En la colecta de datos, se consideraron, entre las publicaciones científicas del tema estudiado, artículos publicados en los idiomas ingles, español y portugués en el periodo de junio de 2015 a junio de 2020, en las bases eletrónicas PubMed e la Bilioteca Virtual de Salud (BVS). Los descriptores adoptados fueron: "SARS-CoV-2", "Obesity","COVID-19", "Risk Factors". **Contenido:** La obesidad es una pandemia y su condición inflamatoria crónica es factor de riesgo para diversas patologias, incluyendo un peor desenlace en infecciones respiratorias virales. El análisis imunológico de ese estado y su respectivo papel en la imunopatología del SARS-CoV-2 revela una respuesta pro-inflamatoria desregulada, con acentuado aumento de diversas citocinas, como TNF-α, IL-6 y IL-1β. Tal mecanismo tiene como resultado una tormenta de citocinas, el consecuente empeoramiento de la respuesta inmune frente a la infeción por el nuevo coronavírus que se ha relacionado con la forma grave de la enfermedad. **Conclusión**: La obesidad configura un factor de riesgo relevante global para la infección del SARS-CoV-2 por proporcionar la desregulación de la respuesta inmune pro-inflamatoria, resultando en un peor desenlace clínico, y merece una atención especial por parte de las políticas para combatir la pandemia.

***Descriptores:** SARS-CoV-2. Obesidad. COVID-19. Factores de riesgo.*

INTRODUCTION

The coronavirus of severe acute respiratory syndrome (SARS-CoV), member of the genus Betacoronavirus of the family Coronaviridae, is an enveloped virus with a single-stranded positive sense RNA genome. The genetic sequence of SARS-CoV-2 has shown that more than 80% of identity is shared with SARS-CoV and 50% with MERS-CoV, the Middle East Respiratory Syndrome.[1]

It is known that one third of the SARS-CoV-2 genome encodes four main structural proteins: spike (S), envelope (E), nucleocapsid (N) and membrane (M). Like SARS-CoV, SARS-CoV-2 requires the angiotensin-converting enzyme 2 (ACE 2) as a receptor to enter the cell. The Protein S binds to the ACE2 receptor to cause fusion between the virus and the host's plasma membrane. Then, the viral RNA genome is released into the cytoplasm and translated into 2 polyproteins and structural proteins. Subsequently, viral replication begins, in which envelope glycoproteins and nucleocapsids are formed. Finally, the vesicles that contain these viral proteins merge with the plasma membrane to form the viral copies.[2]

The clinical manifestations of coronavirus infection range from asymptomatic to severe acute respiratory syndrome (SARS) and pneumonia.[1] In a study of 140 patients from China, the most common symptoms were fever (91.7%), followed by cough (75%), fatigue (75%), chest tightness or dyspnea (36.7%), and 39,6% complained of gastrointestinal symptoms including nausea, diarrhea, poor appetite, abdominal pain, belching and emesis.[3]

Another retrospective study carried out in Wuhan, showed that half of the patients had some comorbidity, the most common being hypertension, followed by diabetes and coronary disease.[4] However, in the USA, obesity is pointed out as a possible risk factor. For example, in New York, the most common comorbidities are hypertension (56.6%), obesity (41.7%) and diabetes (33.8%).[5]

According to the American CDC, until June, 2020, the main comorbidities related to hospitalizations for

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COVID-19 in adults were hypertension (56.2%), obesity (49.7%), metabolic syndrome (41.9%) and cardiovascular disease (33.2%).[6] This risk is particularly relevant in the USA because the prevalence of obesity is 40%, in contrast to other countries such as China whose obesity rate is 6.2%, Italy (20%) and Spain (24%).[7] In Brazil the prevalence of obesity is 22.1%, making it also a very important comorbidity that must be evaluated.[8]

In this sense, evidences have suggested that since obesity is a chronic inflammatory condition with high prevalence in several countries, it may be one of the risk factors that worse SARS-CoV-2 infection, especially in those who require mechanical ventilation, resulting in a challenge to hospital structures. The mechanisms that explain this association are recent, and point to a deregulation of mediators of the pro-inflammatory immune response.[9-11]

Considering the current clinical relevance of SARS-CoV-2 infection and its possible relationship with specific risk factors that are predominant in global population, the present study addresses the review of immunological mechanisms and clinicopathological data concerning obesity and COVID-19 that determine these condition as a poor SARS-CoV-2 clinical outcome.

METHODS

This study consists of an exploratory literature review; which design is detailed in figure 1. To carry out the data collection, the following filters were considered, among the scientific publications of the studied topic: articles published in English, Spanish and Portuguese; articles published in 2020 referred to COVID-19 infection and articles related to obesity epidemiology and H1N1 pandemic published from 2009 to 2020. The objective was to perform a systematic analysis of original publications that reported evidences concerning SARS-CoV-2 infection and obesity. The search for data was conducted by two independent evaluators in the electronic databases PubMed and Virtual Health Library (BVS). The search terms were defined to attend the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH). The following Health Science Descriptors (DeCS) were used: "SARS-CoV-2", "Obesity","COVID-19" and "Risk Factors". Eligibility criteria included original articles conducted in humans that addressed the mesh terms in the searching period. Articles that did not attend the eligibility criteria were excluded. The pre-selection of articles in the databases was carried out using the specific keywords. The abstracts were read from the inclusion criteria for the selection of full text articles. Results of the selected studies concerning obesity and COVID-19 are shown in table 1 and further detailed in the discussion.

RESULTS AND DISCUSSION

Obesity can be defined by a body mass Index (BMI) over 30 kg/m^2. This is a complex and multifactorial disease, with serious social and psychological dimensions, which affects practically all age and socioeconomic groups globally. Obesity largely preventable, and if considered together with overweight, is currently affecting more than a third of the world population.[12] Epidemiological studies have pointed out BMI as a relevant risk factor for a wide range of chronic diseases, including cardiovascular pathologies, diabetes mellitus, chronic kidney disease and cancers.[13]

According to the WHO, the global prevalence of adults with obesity in 2016 was 13.1%, and the main cases are concentrated in Americas (28.6%); Europe (23.3%) and Eastern Mediterranean (20.8%).[8] In this trend, it is expected that by 2030 about 38% of the world's adult population will be overweight and another 20% will reach obesity.[12] Specifically, in the United States, obesity among adults is estimated as 39.8%. In general, the prevalence in the age group of 40 to 59 years (42.8%) is higher than that those with 20-39 years, with no significant difference

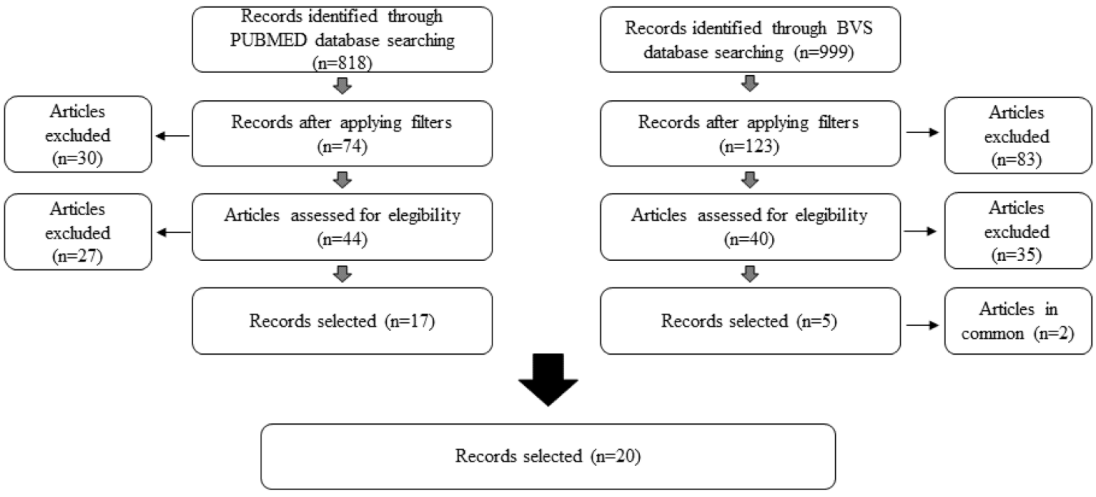

Figure 1. Study design detailing all steps for inclusion and exclusion of published manuscripts, as well as the specific searching databases

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in prevalence among adults aged 60 or over (41.0%). Hispanic (47.0%) and non-Hispanic (46.8%) adults had a higher prevalence of obesity than non-Hispanic white adults (37.9%).[14]

A study carried out with a population from Argentina, Chile and Uruguay (n = 7524) determined that the prevalence of obesity was 35.7% and central obesity was 52.9%. These data generally reflect trends in overweight and obesity for Latin America as a whole. These evidences reinforce that obesity and overweight configure a major problem of public health worldwide.[13,15]

In Brazil, the prevalence of obesity is about 20% in men and 20 to 30% in women [15], and has increased dramatically, reaching about ten-fold times in the past four decades. Comparatively, in 1975 it had a prevalence of 0.9 million obese men (2.6% of global obesity) and 1.9 million obese women (2.6% of global obesity), and in 2014 it changed to 11.9 million obese men (4.5% of global obesity) and 18 million obese women (4.8% of global obesity). Therefore, Brazilian population currently occupies the third place in the table of global prevalence of obesity among men and fifth place in terms of global prevalence of obesity among women[15] highlighting the high prevalence of obesity in the country.

Furthermore, obesity has been strictly related to the population incomes. People from high income countries are overweight or obese, with a considerable portion of individuals ranging between 35 to 40kg/m^2 BMI. It is observed that just a few high income countries have adult populations with a prevalence of overweight/obese less than 70%.[16] On the other hand, the low- and middle-income countries have more than 70% of the individuals with obesity or overweight and as the country economy evolves, obesity shifts mainly to the poor population.[17] Lastly, the Middle East and Latin America are the places in the globe that are among the highest prevalence of obesity, bringing to light that this condition is related to the income and the economically poor people, which are more prone to develop obesity than are the rich ones.[18]

Since obesity is a well-established condition worldwide, evidences become to point its role as a putative risk factor during the COVID-19 pandemic. It has been reported in many different articles that several patients that were positive to SARS-CoV-2 infection have obesity as a comorbidity. The compilation of the main findings is shown in table 1.

In Brazil, a study conducted in the city of São Caetano do Sul, state of São Paulo, detailed this scenario. A total of 1,583 patients were tested by RT-PCR to SARS-CoV-2, and 444 were found positive. In this group, the most frequent comorbidities were cardiovascular disease with 20.4% and diabetes mellitus with 11.1%, and the prevalent BMI was ranging between 25-26 kg/m^2 (41.2%), which corresponds to overweight, followed by a BMI between 30-35 kg/m^2 (17.9%), the grade I obesity. Individuals with obesity whose BMI between ranged between 30-35 kg/m^2, obtained the highest rate of hospitalization (12%).[19] Although this is an isolated study, the high number of patients enrolled allows to implicate obesity as a poor risk factor in Brazilian population.

In Europe, a large population study conducted in the United Kingdom, based on the U.K. Biobank data (n = 285,817 patients), showed that overweight may increase the risk for severe COVID-19 by 44.0% (relative risk [RR] = 1.44; 95% CI, 1.08–1.92; p = 0.01) while obesity almost doubled it (RR = 1.97; 95% CI, 1.46–2.65; p < 0.0001).[20]

Americas have demonstrated a similar pattern concerning the relation obesity and COVID-19. In New York city, a report showed that 41.7% (n=5700) of COVID-19 hospitalized patients were individuals with obesity, whereas the average prevalence of individuals with obesity in New York City was only 22.0%.[21] Despite many studies have reported COVID-19 hospitalization, just a few of them trace a parallel between obesity and hospitalization. These studies have shown significantly high prevalence of individuals with obesity among hospitalized patients than among patients not hospitalized or the general population.[21,23]

Another case study series with 477 patients that tested positive for SARS-CoV-2 in Metropolitan Detroit showed that most of the patients were African American (334 patients, 72.1%) and female (259 patients, 55.9%) with mean age of 57.5 (16.8) years. Among all patients, 355 (76.7%) required hospital admission, and the mean BMI was 33.6 kg/m^2. About 26% of severely obese patients from this study required intensive care, showing that SARS-Cov-2 infection may aggravate disease aggressiveness. A retrospective analysis of 124 intensive care patients from Detroit performed by another study demonstrated that almost one-half of them had a BMI greater than 30 kg/m^2, including 15% with BMI greater than or equal to 40. The mean BMI was 31 kg/m^2 (range, 27.3-37.5 kg/m^2) in patients requiring mechanical ventilation compared with 27 kg/m^2 (range, 25.3-30.8) in those who did not require (P < .001). Moreover, BMI greater than 35 was independently associated with the need for mechanical ventilation (OR, 7.36; 95% CI, 1.63-33.14; P = .02).[22]

In a Mexican case-control study, a total of 102,875 individuals who tested for SARS-CoV-2 by RT-PCR were analyzed, with 31,522 (30.6%) positive for COVID-19 and 71,353 (69.4%) with a negative test. The rate of positivity in individuals with comorbidities such as diabetes, obesity and hypertension was much higher than in individuals without these comorbidities, especially to diabetes (43% vs. 28.7%, p <0.001). For the risk of hospitalization due to COVID-19, diabetes (OR = 3.69, CI = 3.48-3.92, p <0.001), contributes more than hypertension (OR = 2.79, CI = 2.64 -2.95, p <0.001), and hypertension more than obesity (OR = 1.47, CI = 1.39-1.55, p <0.001). In this study, obesity was the second most important risk factor for SARS COV-2 infection; however, it was not such an important factor for hospitalization. Finally, the highest risk of infection in obese people is also in line with the findings from China, in which obesity remained a significant risk factor, even after adjusting for age, sex, smoking, diabetes, hypertension and dyslipidemia.[24]

Besides, among patients with symptoms, those with severe or critical conditions had much higher BMIs and,

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Table 1. Detailment of publications included in the study as evidence for discussion about the relationship obesity and COVID-19.

Publication	Authors	Publication date	Country	Results and Conclusion
COVID-19 pandemic, coronaviruses, and diabetes mellitus	Muniyappa R, Gubbi S	May 2020	United States	Hyperglycemia, hyperinsulinemia, and hypoglycemic agents affect pathogenesis of COVID-19.
Molecular immune pathogenesis and diagnosis of COVID-19	Li X, Geng M, Peng Y, et al	April 2020	China	The pathogenesis of SARS-CoV-2 depend on the interaction between the virus and the individual's immune system. The individual's immune system factors include genetics age, gender, nutritional status, immune regulation, and physical status.
Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China	Zhang JJ, Dong X, Cao YY, et al.	July 2020	China	Allergic diseases, asthma, and COPD are not risk factors for SARS-CoV-2 infection. Older age, high number of comorbidities, and more prominent laboratory abnormalities were associated with severe patients.
Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China	Zhou F, Yu T, Du R, et al.	March 2020	China	The potential risk factors of older age, high SOFA score, and d-dimer greater than 1 μg/mL could help clinicians to identify patients with poor prognosis at an early stage.
Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area	Richardson S, Hirsch JS, Narasimhan M, et al.	May 2020	United States	In this case series that included 5700 patients hospitalized with COVID-19 in the New York City area, the most common comorbidities were hypertension, obesity, and diabetes.
Obesity could shift severe COVID-19 disease to younger ages.	Kass DA, Priya D, Cingolani	May 2020	United States	Obesity can restrict ventilation by impeding diaphragm excursion, impairs immune responses to viral infection, is pro-inflammatory, and induces diabetes and oxidant stress to adversely affect cardiovascular function.
Factors association with hospitalization and critical illness among 4,103 patients with COVID-19 disease in New York City	Petrilli CM, Jones SA, Yang J, et al.	April 2020	United States	Strongest hospitalization risks were age ≥75, age 65-74, BMI>40, and heart failure Age and comorbidities are powerful predictors of hospitalization; however, admission oxygen impairment and markers of inflammation are most strongly associated with critical illness
COVID 19 in Northern Italy: An integrative overview of factors possibly influencing the sharp increase of the outbreak	Goumenou M, Sarigiannis D, Tsatsakis A, et al.	July 2020	Italy	The purpose of this work is to discuss some of the possible contributing factors and their possible role in the relatively high infection and death rates in Northern Italy compared to other areas and countries.
Individuals with obesity and COVID-19: A global perspective on the epidemiology and biological relationships	Popkin, BM, Du, S, Green, WD, et al.	August 2020	United States	Pooled analysis show individuals with obesity were more at risk for COVID-19 positive, >46.0% higher for hospitalization, 113% higher for ICU admission, 74% higher and for mortality, 48% increase in deaths.
Clinical characteristics and morbidity associated with coronavirus disease 2019 in a series of patients in metropolitan Detroit	Suleyman G, Fadel RA, Malette KM, et al.	June 2020	United States	Of 463 patients with COVID-19, 55.9% were female, and 72.1% were African American. Most patients (94.0%) had at least 1 comorbidity, including hypertension (63.7%), chronic kidney disease (39.3%), and diabetes (38.4%).
What factors increase the risk of complications in SARS-CoV-2 positive patients? A cohort study in a nationwide	Yanover C, Mizrahi B, Kalkstein N, et al.	August 2020	Israel	Our analysis suggests that cardiovascular and kidney diseases, obesity, and hypertension are significant risk factors for COVID-19 complications.
Obesity a risk factor for increased COVID 19 prevalence, severity and lethality.	Petrakis D, Margină D, Tsarouhas K, et al.	July 2020	Greece	Obesity is a medical condition with complex pathophysiology, comprising various mechanisms, which now emerges as a significant risk factor for COVID-19.
The Perfect Storm: Coronavirus (Covid-19) Pandemic Meets Overfat Pandemic.	Maffetone PB, Laursen PB.	April 2020	United States	The Covid-19 and overfat pandemics are two serious public health concerns that are correlated, despite having very different horizons and timescales.
Obesity and its Implications for COVID-19 Mortality. Risk Factors Associated With Acute Respiratory Distress	Dietz W, Santos-Burgoa C.	June 2020	United States	The proportion of patients with obesity, severe obesity, and COVID-19 infections will increase compared with the H1N1 experience, and the disease will likely have a more severe course in such patients.
Syndrome and Death in Patients With Coronavirus Disease 2019 Pneumonia in Wuhan, China	Wu C, Chen X, Cai Y,et al.	July 2020	China	Older age was associated with greater risk of development of ARDS and death likely owing to less rigorous immune response.
SARS-CoV-2 infection and obesity: Common inflammatory and metabolic aspects	Michalakis, K, Ilias, I.	July-August 2020	Greece	Obesity and SARS-CoV-2 share common elements of the inflammatory process (and possibly also metabolic disturbances), exacerbating SARS-CoV-2 infection in the obese.
Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy.	Onder G, Rezza G, Brusaferro S	May 2020	Italy	Within Italy, COVID-19 deaths are mainly observed among older, male patients who also have multiple comorbidities.
Obesity a Risk Factor for Severe COVID-19 Infection: Multiple Potential Mechanisms	Sattar N, McInnes IB, McMurray JJV.	July 2020	United Kingdom	There are multiple pathways by which obesity (or excess ectopic fat) may increase the effect of COVID-19 infection. These include underlying impairments in cardiovascular, respiratory, metabolic, and thrombotic pathways in relation to obesity, all of which reduce reserve and ability to cope with COVID-19 infection and the secondary immune reaction to it.
High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation.	Simonnet A, Chetboun M, Poissy J, et al.	July 2020	France	The present study showed a high frequency of obesity among patients admitted in intensive care for SARS-CoV-2. Disease severity increased with BMI. Obesity is a risk factor for SARS-CoV-2 severity, requiring increased attention to preventive measures in susceptible individuals.
Obesity in patients younger than 60 years is a risk factor for Covid-19 hospital admission	Lighter J, Phillips M, Hochman S, et al.	August 2020	United States	Though patients aged < 60 years are generally considered a lower-risk group of COVID-19 disease severity, based on data from our institution, obesity appears to be a previously unrecognized risk factor for hospital admission and need for critical care.

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especially, individuals with obesity prevalence than normal population or patients who were COVID-19 negative. Thus, being an obese individual and infected by SARS-CoV-2 can promote a worse outcome when compared to non-obese infected individual. These findings also evidence that obesity may be a risk factor that may transcend individual´s ancestrally, since it has been reported in all continents.

Considering the high incidence of COVID-19 in obese patients globally, it is necessary to evidence which mechanisms are enrolled in this process that help to understand why disease goes so aggressively under these conditions. Obesity is a chronic disease that related to the dysregulation of the immune system's functioning.[25] In obese people, visceral fat acts as a substrate to pro-inflammatory and chemotactic compounds production, and is often infiltrated by macrophages and lymphocytes that contribute to the propagation of the inflammatory process.[26]

Adipose tissue has an important endocrine function, since adipokines are secreted by adipocytes, and regulate critical processes as appetite, energy balance, immunity, insulin sensitivity, angiogenesis, inflammation and acute phase response, blood pressure, and lipid metabolism.[25]

The main immunomodulatory adipokines are leptin, adiponectin and pro-inflammatory cytokines, such as TNF-α, IL-6 and IL-1β. Chronic challenging from pro-inflammatory cytokines can desensitize immune cells to trigger adequate inflammatory responses during infectious challenges. Adiponectin has an anti-inflammatory function, as it reduces the cytotoxicity of NK cells (natural killer) and decreases the production of other cytokines, and is significantly reduced in obesity.[27] The action of leptin on monocytes is to positively regulate the production of proinflammatory cytokines, IL-6, IL-12 and TNFα, in addition to inducing the production of reactive oxygen species and increasing oxidative capacity. Thus, it plays a fundamental role in innate immunity, as it directly influences the differentiation, proliferation, activation and activity of NK cells. In adaptive immunity, it acts on the proliferation of T cells and on the activation of TCD4 + and TCD8 + cells. Its increased level in obesity influences negatively, because it increases the resistance of T

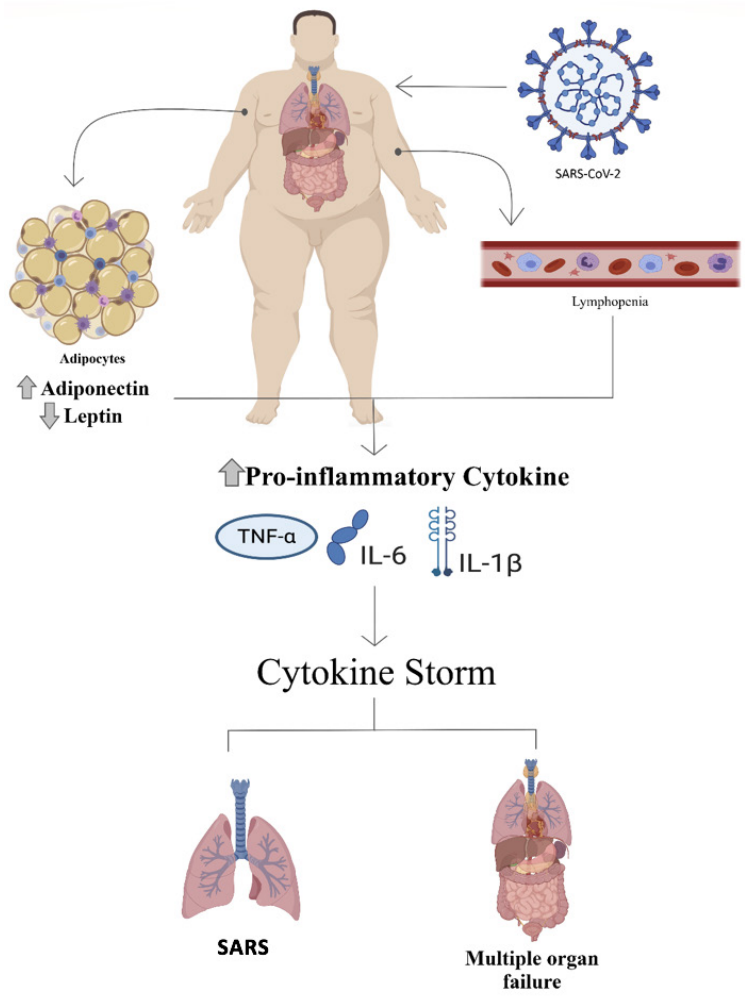

Figure 2. Immunological mechanisms shared between obesity and COVID-19. The hormonal regulation of adipocytes in obesity produces pro-inflammatory and chemotactic compounds, such as IL-6, IL-1β, TNF and chemokines. On the other hand, the SARS-CoV-2 infection leads to a condition of lymphopenia that consequently triggers pro-inflammatory responses. In the end, the confluence of these mechanisms causes a storm of cytokines, generating ARDS (acute respiratory distress syndrome), multiple organ failure or death as an outcome. Created with biorender.com.

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cells and NK.[25-27] Therefore, obesity - particularly central obesity - is strongly associated with a pro-inflammatory state, with an increase in reactive oxygen species and the pro-oxidative capacity of the immune system. Adipocytes from abdomen, intramuscular fat, liver and pericardium can produce pro-inflammatory and chemotactic compounds, such as IL-6, IL-1β, TNF and chemokines, as well as hormones that modulate inflammation, such as adiponectin and leptin.[26]

The strong relationship between obesity and complications of viral infections has already been pointed out through studies on the influenza virus, and also with the family history of the coronaviruses, SARS and MERS.[28] In the analysis of the role of obesity in viral infection, the genetic similarity of SARS and MERS viruses with SARS-CoV-2 is respectively, 80% and 50%.[1]

During and after the 2009 H1N1 influenza pandemic, BMI was recognized as an independent risk factor for influenza, in particular the severity of the disease, hospitalization, increased risk of disease spread and death. The causes identified were that hosts with excess fat may have a collapse of the respiratory epithelium, leading to the influx of fluid into the airway space and may have increased viral spread to other respiratory areas, reducing lung function and increasing mortality.[29] An American study carried out in California during the influenza A (H1N1) pandemic covered a group of hospitalized or died patients (n = 1088) diagnosed with influenza in the laboratory and admitted to California hospitals during the period from April to August 2009. This study included 268 patients over 20 years old, and, of these, 58% were obese (BMI> 30 kg/m^2). In addition, 60% of these individuals still had other underlying diseases, such as chronic lung disease, including asthma, diabetes and heart disease.[30]

Thus, the disproportionate impact between SARS-CoV-2 and H1N1 in patients with obesity or severe obesity seems similar, since this chronic condition has an important impact on lung function. After all, it is known that overweight results in a state of chronic inflammation, with systemic implications for immunity, which ultimately decreases the antiviral response, thus worsening the infectious condition.[31,32]

Obesity is classified as one of the conditions that exponentially increase the mortality of patients with SARS-CoV-2.[10] This risk is evidenced by the Center for Disease Control and Prevention (CDC), which determined the groups at greatest risk for the evolution of a severe illness, including asthma, chronic lung disease, diabetes, heart problems, chronic kidney disease, age over 65, immunosuppressed, obesity and severe obesity. The analysis of these risk groups reveals that most of these conditions are directly or indirectly related to weight gain.[11,33]

Both SARS-CoV-2 and obesity seem to share some common metabolic and inflammatory reaction pathways (Figure 2). For example, obesity causes hyperglycemia via insulin resistance, while COVID-19 infection can also cause hyperglycemia, however the pathophysiological mechanisms have not yet been elucidated. In addition, obesity represents a state of low-grade inflammation that shares many molecules and common pathways with those seen in SARS-CoV-2 infection.[34]

A recent publication from the Journal of the American Medical Association (JAMA), shown in Italy a high proportion of patients aged 70 years or older diagnosed with COVID-19 (37.6% cases) when compared to those from China (11.9%). This would explain, at least in part, the 7.2% fatality observed in Italy when compared to China (2.3%), which is mostly characterized by elderly male patients with multiple associated comorbidities. However, the authors pointed that these data are limited and derived from the first documented month of COVID-19 cases in Italy, which may then undergo changes in this pattern.[35] In that occasion, this publication failure to mention obesity as one of the pre-existing diseases associated with mortality from the virus. Apparently, the increased prevalence of this condition in older patients in Italy, when compared to China, may be one of the factors that differentiate mortality from SARS-CoV-2 between both countries.[31] Still, it is suggested that in obese patients with COVID-19 it may be caused by the reduction of the cardiorespiratory protection reserve, as well as the enhancement of immune dysregulation, which at least partially contributes to the progression to the critical stage of the disease, associated with multiple organ failure.[36]

A French study showed that the need for invasive mechanical ventilation in patients with COVID-19 infection treated in intensive care was more than 7 times higher for those with a BMI> 35 kg/m^2 when compared with individuals with BMI <25 Kg/m^2.[37] In another study from New York, those with a BMI between 30-34 kg/m^2 and over 35 kg/m^2 were 1.8 and 3.6 times more susceptible to requiring intensive care than those with a BMI over 30 kg/m^2.[38]

In relation to Brazil, the epidemiological bulletin of the Ministry of Health, on April 11, 2020, showed that among the deaths confirmed by COVID-19, 75% were over 60 years old, and 74% of them had at least one risk factor. Heart disease was the main associated comorbidity and was present in 463 of the deaths, followed by diabetes (in 342 deaths), pneumopathy (112), neurological disease (74) and kidney disease (71). In all risk groups, most individuals were 60 years of age or older, except for obesity.[39] This pattern remained present in the epidemiological bulletin of the Ministry of Health on June 23, 2020, in which 1,674 deaths were recorded by COVID-19 in which obesity was a risk factor, and 51% of these were individuals with less than 60 years.[40]

CONCLUSION

In spite of the management decisions of some governments on quarantining, social isolation, screening methods, and flight suspensions due to the severity and aggressiveness of COVID-19, directed to all people, the proposal of specific decisions driven to obese individuals are neglected. It is proven that obesity has an intimate relationship with the worst clinical outcomes of SARS-CoV-2 infection, especially in places where the population has a

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BMI over 30kg/m^2. Moreover, the increased secretion of cytokines, such as TNF-α, IL-6 and IL-1β, which characterize the state of chronic obesity, aggravate coronavirus infection, increasing the need for hospitalization in the intensive care unities and invasive mechanical ventilation. Such patients, under these critical conditions, are still overloading hospitals and the health system care, with a considerable rate of death. Therefore, it is indispensable that current health promotion strategies must at least involve obesity as a key risk factor, which must be analyzed as a poor prognosis condition for people infected by SARS-CoV-2, as well as a specific segment of population that deserves specific public policies and conducts for protection against COVID exposure.

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AUTHORS' CONTRIBUTIONS

Maria Eduarda Oliveira Ferraz and Matheus Ricardo Garbim contributed to the conception, design of the article, analysis and writing of the article;

Carolina Panis contributed to the planning and design of the article, review and final approval of the article.

All authors have approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and completeness.

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