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SUMÁRIO

ORIGINAL ARTICLE

Quality, opportunity, and treatment of data of tuberculosis and human immunodeficiency virus co-infection

Qualidade, oportunidade e tratamento de dados de tuberculose e coinfecção com vírus da imunodeficiência humana

Calidad, oportunidad y manejo de los datos de coinfección tuberculosis y virus de la inmunodeficiencia humana

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ABSTRACT

Background and Objectives: The identification, evaluation, and use of methodological resources for data quality analysis is important to support planning actions of public policies for the control of tuberculosis (TB) and the co-infection TB and human immunodeficiency virus (HIV). The objective was to analyze the quality and timeliness of notification of TB and TB-HIV co-infection cases from the Notifiable Diseases Information System (SINAN - Sistema de Informação de Agravos de Notificação) in Espírito Santo State, from 2016 to 2018. **Methods:** This is a cross-sectional study of the quality of SINAN data using the Centers for Disease Control and Prevention (CDC) guidelines to analyze the quality and timeliness of SINAN-TB notification, with emphasis on the description of TB-HIV co-infection in Espírito Santo State, from 2016 to 2018. It considered five methodological steps that included quality analysis, standardization of records, duplicity analysis, the completeness of data through linkage with the SINAN-HIV database and anonymization of data. It obtained ethical approval under the number 4022892 on 12/05/2020. **Results:** The study showed that 89% of mandatory variables and 91% of essential variables showed satisfactory completeness. In TB-HIV co-infection 73% of the variables were completed, but essential variables related to TB treatment follow-up showed unsatisfactory completeness. The timeliness of reporting was considered regular. **Conclusion:** Improvements in work processes and the development of a specific methodological process for data treatment are necessary to qualify the information available in SINAN-TB.

Keywords: Epidemiology. Tuberculosis. HIV. Health Information Systems. Co-infection.

RESUMO

Justificativa e Objetivos: A identificação, avaliação e emprego de recursos metodológicos para análise da qualidade dos dados é importante para fundamentar ações de planejamento das políticas públicas no controle da tuberculose (TB) e da coinfecção TB e o vírus da imunodeficiência humana (HIV). O objetivo é analisar a qualidade e a oportunidade de notificação dos casos de TB e coinfecção TB-HIV do Sistema de Informação de Agravos de Notificação (SINAN) no Espírito Santo, de 2016 a 2018. **Métodos:** Trata-se de um estudo transversal da qualidade dos dados do SINAN com uso do Guia do *Centers for Disease Control and Prevention* (CDC) de análise da qualidade e oportunidade de notificação do SINAN-TB, com ênfase na descrição da coinfecção TB-HIV no Espírito Santo, de 2016 a 2018. Considerou-se cinco etapas metodológicas que incluíram análise da qualidade, padronização dos registros, análise de duplicidade, a completitude dos dados por meio de *linkage* com o banco de dados do SINAN-HIV e anonimização dos dados. Obteve aprovação ética sob parecer de nº 4022892 em 12/05/2020. **Resultados:** O estudo mostrou que 89% das variáveis obrigatórias e 91% das variáveis essenciais apresentaram completitude satisfatória. Na coinfecção TB-HIV 73% das variáveis foram preenchidas, porém variáveis essenciais relacionadas ao acompanhamento do tratamento para TB apresentaram completitude insatisfatória. A oportunidade de notificação foi considerada regular. **Conclusão:** Melhorias nos processos de trabalho e elaboração de processo metodológico específico para o tratamento dos dados são necessárias para qualificar as informações disponíveis no SINAN-TB.

Descritores: Epidemiologia. Tuberculose. HIV. Sistema de Informação em Saúde. Coinfecção.

RESUMEN

Justificación y Objetivos: La identificación, evaluación y utilización de recursos metodológicos de análisis de la calidad de los datos es importante para apoyar la planificación de políticas públicas de control de la tuberculosis (TB) y la coinfección con el virus de la inmunodeficiencia humana (VIH). El objetivo es analizar la calidad y oportunidad de la notificación de casos de TB y coinfección TB-VIH del *Sistema de Informação de Agravos de Notificação* (SINAN), en el Estado del Espírito Santo, desde el año 2016 hasta 2018. **Métodos:** Este es un estudio transversal utilizando el análisis de la Guía de los Centros para el Control y Prevención de Enfermedades (CDC) de la calidad y oportunidad de la notificación en SINAN-TB, con énfasis en la descripción de la coinfección TB-VIH, en el Estado del Espírito Santo, desde el año 2016 hasta 2018. Fueran considerados cinco pasos metodológicos que incluyeron análisis de calidad, estandarización de registros, análisis de duplicidad, vinculación con la base de datos SINAN-VIH y anonimización de datos. Obtuvo aprobación ética bajo dictamen nº 4022892 el 12/05/2020. **Resultados:** El 89% de las variables obligatorias y el 91% de las variables esenciales se completaron satisfactoriamente. En la coinfección TB-VIH el 73% de las variables fueron completadas, mientras que las variables esenciales relacionadas con el acompañamiento del tratamiento para la TB presentaron una completitud insatisfactoria. La oportunidad de notificación fue considerada regular. **Conclusión:** Las mejoras en los procesos de trabajo y la elaboración de un proceso metodológico específico para el tratamiento de los datos son necesarias para cualificar la información disponible en el SINAN-TB.

Palabras clave: Epidemiología. Tuberculosis. VIH. Sistemas de Información en Salud. Coinfección.

INTRODUCTION

Tuberculosis (TB) is a respiratory infection caused by *Mycobacterium tuberculosis* (Mtb) which, with timely diagnosis and precise treatment, presents a high chance of cure and, consequently, a break in the chain of transmission.[1] However, it still represents a public health problem, and it is among the main causes of death in the world[2]. Up until the new coronavirus pandemic (CO-VID-19, abbreviation for coronavirus disease 2019), TB was the main cause of death by a single infectious agent, causing more deaths than the infection by the human immunodeficiency virus (HIV).[1]

In people living with HIV (PLWH), infection with Mtb presents a higher risk of developing active disease and unfavorable outcomes, such as developing multidrug--resistant TB, treatment dropout and death.[2-5]

According to the World Health Organization (WHO), in 2021, approximately 10 million cases of TB occurred in the world, and a total of 1.2 million people died due to the disease, including 208,000 deaths among those with TB-HIV co-infection. Brazil is among the 30 countries with high burden of TB and co-infection TB-HIV.[1] In 2019, 78,428 new cases of TB were notified, from which 8,070 presented TB-HIV co-infection, in other words, 10.3% of the cases.[6,7]

Among the strategies for the elimination of TB, WHO has drawn recommendations to promote the universal health coverage policy and regulatory structures, such as case notification, vital registration, quality and correct use of medicines for the infection control.[1]

TB and HIV case notification is mandatory in Brazil, and it must be done using the Notifiable Diseases Information System (SINAN - *Sistema de Informação de Agravos de Notificação*). However, studies show that the surveillance system presents flaws and case underreporting that can be due to underdiagnosis, typing errors by the responsible professional, and lack of communication

among the health services.[8,9] Those inconsistencies might affect the quality of the data and information generated from it, which is deleterious for the planning and conduction of sanitary strategies.[9]

Thus, the identification, evaluation, and use of methodological resources for the analysis of data quality is a useful initiative to base the planning of actions for public policies for the control of TB and the co-infection TB-HIV. Therefore, the present study aimed to analyze the quality and timeliness of notification of TB and TB-HIV co-infection in SINAN (Notifiable Diseases Information System) in Espirito Santo State, from 2016 to 2018.

METHODS

This is a cross-sectional study of data quality analysis of SINAN-TB according to the quality attributes defined in the methodology proposed by the Centers for Disease Control and Prevention (CDC), United States of America.[10,11]

The data quality analysis is performed by checking the attributes of completeness and consistency of data.[10] Data consistency is defined as the percentage of cases with the date of notification higher than the date of diagnosis, using as a threshold greater than or equal to 70%. Yet the analysis of completeness aims at verifying the percentage of filling of variables, in order to identify the frequency of variables "ignored" or "blank". Completeness is considered satisfactory when the result of the analysis gets a value greater than or equal to 70% for essential variables and 100% of the fields for the mandatory variables (Figure 1).[10] Both attributes were categorized as great (≥ 90%), regular (between 70 and 90%) and poor (<70%).[12] Furthermore, the attribute timeliness of notification, from CDC guidelines, was used. It is the proportion of cases from which the time between the date of notification and the date of diagnosis is less than or equal to seven days.[10] All cases of TB and TB-HIV co-infection, notified

in SINAN-TB, from 2016 to 2018, of people residing in Espirito Santo State were included in the study. Both databases were made available by the State Health Secretariat (SESA). The time frame used in the study was chosen because of the inclusion of new variables in the version number five of the notification record for TB, such as special populations (persons deprived of freedom, homeless population, health care professionals and migrants), government benefit claimants, use of antiretroviral therapy (ART) during TB treatment, rapid molecular test for TB (RMT-TB), susceptibility testing, and, if it is a case of "transfer", inclusion of the destination, and the alteration in the variables "if extrapulmonary" (removal of the second option), "sputum-smear bacilloscopy" (withdraw of the second bacilloscopy), "associated diseases and illnesses" (inclusion of illicit drug use and smoking) and "follow-up sputum-smear bacilloscopy" (inclusion after the 6th month).[13]

Data analysis was carried out in five steps (figure 1): the first was the data quality analysis; the second was the records standardization; the third step was the duplicity analysis; the fourth step the linkage; and the fifth step was the anonymization of the data.

When considering the TB database in the first step, the analysis of the mandatory filling variables completeness was used, those variables whose field is considered mandatory to fill 100% of the records in any notification, such as: "Number of notification", "Illness/disease", "Date of current notification", "Municipality of current notification", "Current health unity", "Date of diagnosis", "Age", "Sex" (male, female), "Pregnant" (mandatory filling if patient is a female), "Current State of residence", and "Current municipality of residence", "Country", "Type of entry", "Form" (pulmonary, extrapulmonary or extrapulmonary plus pulmonary), "Sputum-smear bacilloscopy", "Sputum culture", "Susceptibility testing" (when the culture is positive), "HIV", "Total number of contacts identified".[13]

In addition to the mandatory variables analysis, the completeness of essential variables was evaluated. It was
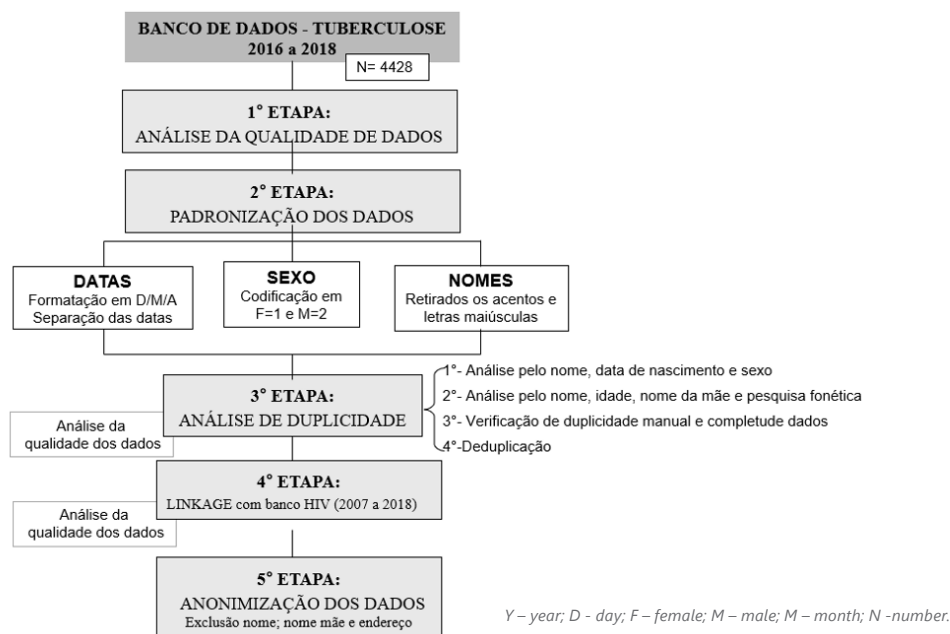

Figure 1. Flow chart about the methodology of the process for data quality analysis in SINAN, from 2016 to 2018.

considered those variables with filling in up to 70% of the records, such as: "Special populations" (persons deprived of freedom, homeless population, health care professionals and migrants), "Government benefit claimants", "Associated diseases and illnesses" (aids, alcoholism, diabetes, mental disorder, illicit drug use, smoking, and others), "ART during TB treatment", "RMT-TB", "Date of start of current treatment", "Bacilloscopy from the 1st to the 6th month", "Bacilloscopy after the 6th month", "Directly observed treatment (DOT) performed", "Total number of contacts assessed", "Closure situation", "If transferred", "Federation Unity" (State), "Municipality of residence", and "Date of closure".[13]

We searched to verify the completeness of the following additional variables: "Race/skin color" (yellow/Asian, white, indigenous, mixed, black, and ignored) and "Schooling" (illiterate, 1st to incomplete 4th grade of elementary school, complete 4th grade of elementary school, 5th to incomplete 8th grade of elementary school, complete elementary school, incomplete high school, complete high school, incomplete higher education, complete higher education, does not apply, and ignored).

In the second step, it was carried out the standardization of the variables "Patient name" and "Mother's name", with the removal of the accents and replacing the capital letters by the correspondent small letters. Following, the standardization of "Date of notification", "Date of diagnosis", "Date of birth", "Date of treatment start", "Date of closure" in the format day/month/year; and the codification of the variable "Sex" assigning the value 1 for "F" – female, and 2 for "M" – male (figure 1).

During the third step (figure 1), the duplicity analysis was performed in four stages. In the first stage, records were selected by searching for the name, date of birth and sex; the second stage included searching for the name, age, mother's name, and phonetic search, marking the duplicities; in the third stage, initially we checked the duplicity in the notification dates before carrying out the data linkage, if duplicity was identified, we generated a new record with the notification information and investigation of the first record, adding the information from the second record, complementing the missing data, and last we performed the deduplication, that is, the exclusion of duplicated records. [13] After the duplicity analysis, data quality analysis was carried out again, with regards to consistency and completeness as well as notification timeliness.

In the fourth stage, we performed the linkage with SINAN-HIV database for cases notified between 2007and 2018, with the purpose of identifying cases notified in SINAN-TB database without the diagnosis of the co-infection with HIV, but that were registered in SINAN-HIV database. After that, the exclusion of TB cases data with a negative diagnosis for HIV was done and solely the records of TB-HIV co-infection cases were kept. After that, analysis of completeness and data consistency of TB-HIV co-infection cases only was performed.

In the last step, we carried out the exclusion of identification data, which is called the data anonymization process, using technical means that are reasonable and available for preventing the possibility of direct or indirect association with the individual (figure 1).

During the methodological process we carried out a descriptive analysis of the data and the results were entered into frequency tables in the software STATA, version 16.

The study was approved by the Research Ethics Committee from the *Centro de Ciências da Saúde da Universidade Federal do Espírito Santo* (CEP/CCS/UFES) under the number CAAE: 05675618.4.0000.5060 and report number 4022892 in 12/05/2020, according to the resolution 466/12 from the Brazilian Nacional Health Council (CNS – *Conselho Nacional de Saúde*).

RESULTS

The analysis of 4,428 records from SINAN-TB database from Espírito Santo State was performed and 375 duplicated records were identified ad removed, resulting in a total of 4,053 cases. At the end of the five-step process of analysis of data treatment, a total of 332 cases presented TB-HIV coinfection, from which three cases were found in the SINAN-HIV database with negative serology for HIV in the SINAN-TB database. We identified that the timeliness of notification was regular, showing that around 25% of the cases were not notified in up to seven days after the confirmation of the disease.

Mandatory filling variables, that is, those with 100% completeness, in the first data quality analysis (1st step) in SINAN-TB, showed that from a total of 19 variables, 17 presented a completeness percentage of 100%, differently from the variable "Extrapulmonary type" with 17.2% completeness, and the variable "Total number of contacts identified" that presented 98.9% of filling. In the third data quality analysis, with the TB-HIV co-infection cases, the variable "Extrapulmonary type" presented an increase in the frequency of completeness to 33.8% when we considered solely the TB-HIV coinfection cases (table 1).

As for the completeness analysis of essential variables (with 70% of filling), in the first analysis, from 23 variables analyzed, a total of 21 variables presented a completeness percentage above 70%, except for the variables "Bacilloscopy 6th month", which presented 67.5% of completeness and the variable "Antiretroviral therapy during TB treatment", with 66.5% of filling.

In the second data quality analysis, after the exclusion of the duplicated cases, we observed an increase in the frequency of completeness for the variable "Bacilloscopy 6th month" to 71.1%. On the other hand, the variable "Antiretroviral therapy during TB treatment" remained presenting a low frequency of completeness after the deduplication (67.7%).

In the third data quality analysis, with the TB-HIV co-infection cases, we observed that the percentage of completeness of the variable "Antiretroviral therapy during TB treatment" reached 91.3% and a decrease in the completeness frequency in the variables of bacilloscopy per month, once it was possible to verify that from the second month the frequency of completeness was below 70% for those variables, as well as for the variable "Total number of contacts assessed", which also presented a reduction to 40.9% (table 2).

Table 1. Distribution of the frequency of completeness in mandatory variables performed before and after deduplication and after linkage of SINAN-TB database with SINAN-HIV database in Espirito Santo State, between 2016 and 2018.

Variable	Before deduplication N=4,428		After deduplication N=4,053		After linkage (TB-HIV coinfection only) N=325	
	n	%	n	%	n	%
Number of the notification	4,428	100	4,053	100	325	100
Illness/Disease	4,428	100	4,053	100	325	100
Date of notification	4,428	100	4,053	100	325	100
Municipality of notification	4,428	100	4,053	100	325	100
Health Unity	4,428	100	4,053	100	325	100
Date of diagnosis	4,428	100	4,053	100	325	100
Age	4,428	100	4,053	100	325	100
Sex	4,428	100	4,053	100	325	100
Pregnant	4,428	100	4,053	100	325	100
Federation Unity/State	4,428	100	4,053	100	325	100
Municipality of Residence	4,428	100	4,053	100	325	100
Country	4,428	100	4,053	100	325	100
Type of entry	4,428	100	4,053	100	325	100
Form	4,428	100	4,053	100	325	100
Extrapulmonary type	3,666	17.2	3,329	17.8	215	33.8
Sputum-smear bacilloscopy	4,428	100	4,053	100	325	100
HIV	4,428	100	4,053	100	325	100
Culture	4,428	100	4,053	100	325	100
Total number of contacts identified	4,383	98.9	4,014	99.0	317	97.0

Abbreviations: HIV - human immunodeficiency virus; N – number; TB – tuberculosis; SINAN – sistema de informação de agravos de notificação (Notifiable Diseases Information System)

Table 2. Distribution of the frequency of completeness in essential variables performed before and after deduplication an after linkage of SINAN-TB database with SINAN-HIV database in Espirito Santo State, between 2016 and 2018.

Variable	Initial completeness N= 4,428		Completeness after deduplication. N= 4,053		Completeness after linkage, (coinfection only) TB-HIV. N=325	
	n	%	n	%	n	%
Special populations - persons deprived of freedom	4,399	99.3	4,026	99.3	320	98.4
Special populations - homeless	4,392	99.1	4,020	99.1	320	98.4
Special populations – healthcare professionals	4,392	99.1	4,019	99.1	320	98.4
Special populations – migrants	4,390	99.1	4,017	99.1	320	98.4
Benefit claimants	4,327	97.7	3,961	97.7	315	96.9
Associated diseases and illnesses – aids	4,370	98.6	4,006	98.8	325	100
Associated diseases and illnesses – Alcoholism	4,392	99.1	4,021	99.2	322	99.0
Associated diseases and illnesses – Diabetes	4,390	99.1	4,025	99.3	322	99.0
Associated diseases and illnesses – Mental Disorder	4,380	98.9	4,016	99.0	322	99.0
Associated diseases and illnesses – Illicit drug use	4,390	99.1	4,025	99.3	324	99.6
Associated diseases and illnesses – Smoking	4,397	99.2	4,028	99.3	322	99.0
Associated diseases and illnesses – Others	3,909	88.2	3,600	88.8	297	91.3
Antiretroviral therapy during TB treatment	2,947	66.5	2,741	67.6	297	91.3
Date of current treatment start	4,310	97.3	3,944	97.3	313	96.3
Bacilloscopy 1st month	3,765	85.0	3,525	86.9	236	72.6
Bacilloscopy 2nd month	3,586	80.9	3,486	86.0	216	66.4
Bacilloscopy 3rd month	3,447	77.8	3,284	81.0	201	61.8
Bacilloscopy 4th month	3,308	74.7	3,170	78.2	189	58.1
Bacilloscopy 5th month	3,185	71.9	3,058	75.4	183	56.3
Bacilloscopy 6th month	2,993	67.5	2,882	71.1	173	53.2
Directly Observed Treatment	3,824	86.3	2,550	87.5	233	71.6
Contacts traced	3,919	88.5	3,644	89.9	133	40.9
Closure Situation	4,408	99.5	4,037	99.6	323	99.3

Abbreviations: aids - acquired immunodeficiency syndrome; HIV - human immunodeficiency virus; N – number; TB – tuberculosis; SINAN- sistema de informação de agravos de notificação (Notifiable Diseases Information System)

The additional variables "Race/skin color" and "Schooling", included in the study, presented a completeness of more than 70% in all three steps of evaluation (table 3).

In all the consistency analysis of the notification data, that is, the percentage of cases with the date of notification higher than the date of diagnosis was considered excellent, and most of the dates of notification were higher than the date of diagnosis in all the steps.

As for the analysis of timeliness of notification in SINAN-TB, which correlates the date of notifications with the date of diagnosis, we identified that among the 4,428 records assessed in the first analysis, 2,483 (56.0%) were notified within a minimum interval of one day, 815 (18.4%) up to seven days, totalling 3,298 (74.4%) records with the notification occurring in up to seven days, and records with more than seven days were 1,130 (25.6%).

In a second analysis of timeliness, performed during the step 3, from a total of 4,053 records analyzed, 2,317 (57.0%) were notified within an interval of one day, 755 (18.6%) in up to seven days, totalling 3,072 (75%), and 981 (24.4%) were notified more than seven days later. And in the analysis of opportunity of case notification in SINAN TB-HIV, 176 (54.2%) were identified and notified within an interval of one day, 74 (22.7%) were identified and notified in up to seven days, totalling 250 (76.9%) records with notification in up to seven days from the date of diagnosis, and 75 (23.1%) were notified with more than seven days.

Table 3. Distribution of the frequency of completeness in additional variables performed before and after deduplication and after linkage of SINAN-TB database with SINAN-HIV database in Espirito Santo State, between 2016 and 2018.

Variable	Initial completeness N= 4,428		Completeness after deduplication. N= 4,053		Completeness after linkage, (coinfection only) TB-HIV. N=325	
	n	%	n	%	n	%
Race/skin color	4,345	98.1	3,986	98.3	321	98.7
Schooling	4,059	91.6	3,744	92.3	313	96.3

Abbreviations: HIV - human immunodeficiency virus; N – number; TB – tuberculosis.

DISCUSSION

Timeliness of notification in SINAN-TB was considered regular in Espirito Santo State, from 2016 to 2018. When considering the methodological process of quality analysis of data from SINAN-TB, it was possible to verify an increase in the percentage of completeness after duplicity analysis and at the end of the steps from the study. When considering solely TB-HIV co-infection data, completeness of the variables related to TB treatment follow up was lower than the recommended. As for the data consistency, we observed that the majority of the notification dates were later than the diagnosis date in all steps.

The frequency of data completeness for most of the variables was higher than 70%, for both mandatory filling and the essential variables in the three steps evaluated. This can be considered a progress in the quality analysis process of health information systems since previous studies presented low completeness in the filling of mandatory and essential variables.[14-16] Low completeness of data can be deleterious to the surveillance system because it directly impacts the interventions and elaboration of public health policies for disease control.[9]

The variable "antiretroviral therapy" (ART) presented a completeness percentage lower than 70% among the cases of TB, but the percentage increased when we analyzed only TB-HIV co-infection cases. The early identification of the use of ART, during the diagnosis of TB, reduces the risk of complications related to the treatment, and the adherence difficulties due to personal matters or issues related to the health service. A study carried out in Brazil, from 2006 to 2016, found that early start of ART reduces in up to 94% the risk of dying of aids during the first six months.[10,17]

A filling percentage lower than 70% was also observed for variables related to the treatment follow-up among the TB-HIV co-infection cases. The low frequency of variables related to the treatment follow-up in people with TB and the co-infection TB-HIV is suggestive of a poor treatment follow-up and can compromise the surveillance of the cases following the guidelines of the Ministry of Health (MoH) as an effective strategy for the control of the disease's chain of transmission, with the performance of a monthly bacilloscopy as from the second month of treatment. Furthermore, contact tracing allows the early detection of a case, and consequently, minimizes the chance of evolving to a severe form of the disease and drug resistance, in addition to create an opportunity to screen for latent infection with Mtb (LTBI) and the prescription of the TB preventive treatment.[16,19]

A retrospective cross-sectional study, including 354 individuals, carried out in Ethiopia during 2016 and 2017, highlighted the importance of case follow-up for the treatment success and the consequent reduction in the mortality rate among TB-HIV coinfection cases.[19] Besides the reduction of the unfavorable outcome "death", with a proper follow-up it is possible to minimize the treatment dropout and the recurrence of the disease. And that is because the risk of unfavorable outcomes is three times more likely to occur in people with TB-HIV co-infection when compared to patients without the co-infection.[15,21]

The notification flow occurs by case recording in the notification record by the healthcare professional using the laboratory and clinical-epidemiologic criteria, filling

the record with precise identification information from the user, from the service, and clinical and epidemiological data. This data can be collected by direct interview with the user, from TB record books and case follow-up or via medical record, or else, using other systems such as the Mortality Information System (SIM - *Sistema de Informações sobre Mortalidade*), the Hospital Information System (SIH - *Sistema de Informação Hospitalar*) or the Laboratory Environment Manager (GAL - *Gerenciador de Ambiente Laboratorial*).[13,19]

After the notification process, the municipality epidemiologic surveillance division generates a monthly report called the "Follow-up Report" (*Boletim de acompanhamento*), in which the cases notified with closure date blank and under treatment for 30 days after the date of diagnosis are listed by health unity. The report is forwarded to the health services for the updating of the data and return for the feedback of the information in the system. Then, the municipality epidemiologic surveillance division consolidates the data and forwards to the State epidemiologic surveillance division, that after its evaluation, will forward it to the federal level, which will then be made available in SINAN.[13,19]

The health surveillance is responsible for the investigation of cases suspected of having TB, the notification of confirmed cases and assuring the generation of treatment and follow-up data of confirmed cases up until their outcome, so as to plan and implement the actions needed for the control of TB and HIV/aids. The data quality assurance is also dependent on the correct typing, analysis, case follow-up and data evaluation by the surveillance professionals in the municipality, with the aim of reaching the targets established in the State and federal levels.[9,8,15]

For achieving that, it is needed training, qualification and to sensitize the healthcare professionals involved in the process of notification, in addition to the correct filling of the forms, the improvement of the surveillance and the data evaluation, once the information generated is essential for the planning and monitoring of the actions and services related to the control of TB.[16,21-23]

The timeliness of TB data notification was considered satisfactory according to the CDC[10] guidelines, once more than 70% of the notifications occurred in up until seven days after the diagnosis. It differs from the findings of other studies carried out in the country, in which the timeliness of notification was classified as regular and poor for cases of TB and HIV co-infection. [12,15,24]

The study presents a few limitations, such as not considering separately for analysis the cases that had multiple notifications. As well as using guidelines for the evaluation of general health information systems, not a specific one for TB, and that are outdated (from 2001). In addition to the indiscriminate use of different analysis attributes of the database, without taking into consideration the importance of the data preparation or treatment process for the evaluation. In many circumstances, the easiness of use of the attribute limits the interpretation and comparability of the results.

Despite those limitations, the data quality analysis from TB-HIV coi-nfection cases registered in SINAN may guide the strategies for the improvement in the notification process and TB-HIV case follow-up and favor the interruption of the chain of transmission. The present study showed that the methodological process used was effective to improve the quality and timeliness of the data.

It is noteworthy that most of the information systems already perform some methodological procedures, but some inconsistencies are not identified in those processes.[16]. For that, an improved elaboration of methodological paths for the data evaluation is necessary, databases integration, in addition to publicize the results of this yearly analysis of the performance indicators from the information systems, as well as expanding the partnership with the academia, aiming to generate improvements and facilitate the analysis process.[16]

We recommend broadening the dialogue among managers, the health services[25] and the academia for the revision of technical documents, classification of mandatory variables in SINAN, professional qualification, and the implementation of strategies in the methodological processes of qualified information production, searching to minimize unfavorable outcomes with the aim of contributing to the control and elimination of TB.

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AUTHOR'S CONTRIBUTIONS

Karllian Kerlen Simonelli Sozres data interpretation and manuscript elaboration. **Wilian Hiroshi Hisatugu** conceptualization and study design. **Thiago Nascimento do Prado** conceptualization, study design, data analysis and critical review of the manuscript. **Romildo Luiz Monteiro Andrade e Ana Paula Rodrigues Costa** project conceptualization, data collection and relevant critical review of the intellectual content. **Fernanda Mattos de Souza** data analysis and critical review of the manuscript**. Ethel Leonor Noia Maciel** project conceptualization and relevant critical review of the intellectual content. All authors approved the version to be published and agreed to be accountable for all aspects of the study, including the assurance of its accuracy and integrity.

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ORIGINAL ARTICLE

Spatial and temporal dynamics of neglected tropical diseases in the Marajó Archipelago, Amazon-PA

Dinâmica espacial e temporal das doenças tropicais negligenciadas no Arquipélago do Marajó, Amazônia-PA

Dinámica espacial y temporal de enfermedades tropicales desatenidas en el Archipiélago de Marajó, Amazonia-PA

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ABSTRACT

Background and objective: the self-styled population of Marajoara is vulnerable due to the neglect of basic services governed by the constitution, such as basic sanitation, health and education. Therefore, the search and mapping of epidemiological data are necessary in order to have a real dimension of how certain diseases behave in the region. Therefore, this study aimed to analyze the space-time distribution of neglected tropical diseases and their relationship with socio-environmental indicators in the Marajó Archipelago, Pará, Amazon. **Methods:** this is a descriptive and ecological study, with a time series, with a quantitative approach, which assessed the incidence rate of neglected tropical diseases in the 16 municipalities that make up Marajó from 2007 to 2016. Analyzes of socioeconomic and population data were carried out, extracted from the Federation of the Industries of the State of Rio de Janeiro (FIRJAN System) and the Brazilian Institute of Geography and Statistics. **Results:** according to the survey, American cutaneous leishmaniasis, dengue and tuberculosis were the most reported diseases in total. All municipalities had at least one disease in the period. The spatial distribution of the numbers of cases of tropical diseases in all the municipalities that make up the Archipelago between 2007 and 2016 was carried out. **Conclusion:** the anthropization of the environment has favored the proliferation of vector agents and, consequently, the incidence of diseases related to inadequate basic sanitation, whose configuration is the result of a disorganized urbanization process and historically exclusive development, with a lack of investment, making this damage even more dramatic for the population.

Keywords: Neglected Diseases. Basic Sanitation. Dengue.

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RESUMO

Justificativa e objetivo: a população autodenominada de marajoara encontra-se em vulnerabilidade devido às negligências de serviços básicos regidos na constituição, como saneamento básico, saúde e educação. Logo, a busca e o mapeamento de dados epidemiológicos são necessários para que se tenha uma dimensão real de como se comportam determinados agravos na região. Diante disso, o estudo objetivou analisar a distribuição espaço-temporal das doenças tropicais negligenciadas e sua relação com indicadores socioambientais no Arquipélago do Marajó, Pará, Amazônia. **Métodos:** este estudo é do tipo descritivo e ecológico, de série temporal, com abordagem quantitativa, que avaliou a taxa de incidência das doenças tropicais negligenciadas nos 16 municípios que compõem o Marajó no período de 2007 a 2016. Foram realizadas análises de dados socioeconômicos e populacionais extraídos da Federação das Indústrias do Estado do Rio de Janeiro (Sistema FIRJAN) e do Instituto Brasileiro de Geografia e Estatística. **Resultados:** de acordo com o levantamento, a leishmaniose tegumentar americana, a dengue e a tuberculose foram os agravos de maior notificação no total. Todos os municípios apresentaram, ao menos, uma doença no período. Realizou-se a distribuição espacial dos números de casos de doenças tropicais em todos os municípios que compõem o Arquipélago entre 2007 e 2016. **Conclusão:** a antropização do ambiente vem favorecendo a proliferação de agentes vetoriais e, consequentemente, a incidência de doenças relacionadas ao saneamento básico inadequado, cuja configuração é fruto de um processo de urbanização desordenado e desenvolvimento historicamente excludente, com ausência de investimentos, tornando esse prejuízo ainda mais dramático para a população.

Palavras-chave: Doenças Negligenciadas. Saneamento Básico. Dengue.

RESUMEN

Justificación y objetivo: la población autodenominada marajoara es vulnerable debido a la desatención de los servicios básicos regulados en la constitución, como saneamiento básico, salud y educación. Por lo tanto, la búsqueda y el mapeo de datos epidemiológicos son necesarios para tener una dimensión real de cómo se comportan ciertas enfermedades en la región. Por lo tanto, el estudio tuvo como objetivo analizar la distribución espacio-temporal de las enfermedades tropicales desatendidas y su relación con los indicadores socioambientales en el Archipiélago de Marajó, en el estado de Pará, Amazonas. **Métodos:** se trata de un estudio descriptivo y ecológico, con serie temporal, con enfoque cuantitativo, que evaluó la tasa de incidencia de las enfermedades tropicales desatendidas en los 16 municipios que componen el Marajó de 2007 a 2016. Se realizaron análisis de datos socioeconómicos y poblacionales extraídos de la Federación de Industrias del Estado de Rio de Janeiro (Sistema FIRJAN) y del Instituto Brasileño de Geografía y Estadística. **Resultados**: según la encuesta, la leishmaniasis cutánea americana, el dengue y la tuberculosis fueron las enfermedades más notificadas en total. Todos los municipios presentaron al menos una enfermedad en el período. La distribución espacial de las cifras de casos de enfermedades tropicales en todos los municipios que conforman el Archipiélago se realizó entre 2007 y 2016. **Conclusión:** la antropización del medio ambiente viene favoreciendo la proliferación de agentes vectores y, consecuentemente, la incidencia de enfermedades relacionadas con saneamiento básico inadecuado, cuya configuración es fruto de un proceso de urbanización desordenado y desarrollo históricamente excluyente, con ausencia de inversiones, lo que hace aún más dramática esta pérdida para la población.

Palabras clave: Enfermedades Desatendidas. Saneamiento Básico. Dengue.

INTRODUCTION

Neglected tropical diseases (NTDs) are morbidities that affect an economically poor population, lacking basic health services and living in precarious sanitation conditions.[1] In Latin America, Brazil represents the highest rates of occurrence of NTDs, with the Amazon being the Brazilian epicenter of important epidemiological findings for a variety of pathogenic agents.[2]

The health and disease situation in the Amazon is conditioned both to changes in the socioeconomic scenario and to the geographic reality, since the difficult access in some municipalities becomes a justification for the lack of investments and the absence of public management policies in the region.[3] Interest in the Amazon territory comes from a historical context, and from the 1960s onwards, it became more intense, under the argument of providing technological advancement for the place, accelerated population growth, the result of the intense migratory process related to favorable economic prospects in the Amazon.[4]

This in turn presents populous urban centers at the same time that there are small isolated cities with unfavorable living conditions and socioeconomic and health indicators, such as the Marajó Archipelago.[3] Due to geopolitical aspects, Marajó is not included in the state's large enterprises because it is far from the road axes that cross the Amazon, making even more economic and infrastructure investments unfeasible.[5] For this, space-time analysis in the peri-urban study in the Amazon is essential to understand the spatial dynamics, as the region brings together unequal and differentiated spatial times.[5]

Formerly called the "Geographical Mesoregion of Marajó", the Archipelago is a region formed by sixteen municipalities, with a rate equivalent to about 6% of the population of Pará, with growth similar to the rest of the state, although it has one of the lowest demographic densities in the country.[6]

These municipalities are characteristic for presenting precarious socioeconomic conditions, with Municipal Human Development Indexes (MHDI) lower than the national average, since in the ranking of the 100 municipalities with the highest degree of social exclusion, 19 are in the state of Pará, eight of which are in Marajó.[7]

With regard to public policies, the self-styled population of Marajoara are vulnerable due to the neglect of basic services governed by the constitution, such as basic sanitation, health and education.[7] In the context, the search and mapping of epidemiological data are necessary in order to have a real dimension of how certain diseases behave. That said, this study aimed to analyze the space-time distribution of NTDs and their relationship with socio-environmental indicators in the Marajó Archipelago, in the state of Pará, Amazon.

METHODS

Study design

This is a descriptive and ecological study, with a time series with a quantitative approach, which assessed the incidence rate of NTDs in the 16 municipalities that make up the Marajó Archipelago, Pará, from 2007 to 2016. Evolution analyzes were carried out on socioeconomic and population data, extracted from the Federation of Industries of the State of Rio de Janeiro (FIRJAN System - *Federação das Indústrias do Estado do Rio de Janeiro*) and the Brazilian Institute of Geography and Statistics (IBGE - *Instituto Brasileiro de Geografia e Estatística*).

Study area

Marajó is made up of 16 municipalities, such as Afuá, Anajás, Bagre, Breves, Cachoeira do Arari (C. Arari), Chaves, Curralinho, Gurupá, Melgaço, Muaná, Ponta de Pedras (P. Pedras), Portel, Salvaterra, Santa Cruz do Arari (S.C.Arari), São Sebastião da Boa Vista (S.S.B.V.) and Soure, the capital, as shown in figure 1.

Breves is the most populous municipality in the region, with more than 100,000 inhabitants, followed by Portel, which had a population growth of 30% between 2007 and 2016, and Muaná, with a population of over 40,000 inhabitants. Santa Cruz do Arari, in turn, is the municipality with the smallest population (approximately 10,000 inhabitants).[8]

Study characterization

The NTD mapping data are of a secondary nature and were obtained by consulting the Reporting Disease Information System (SINAN - *Sistema de Informações de Agravos de Notificação*) database, made available by the Unified Health System Department of Informatics (DATA-SUS - *Departamento de Informática do Sistema Único de*
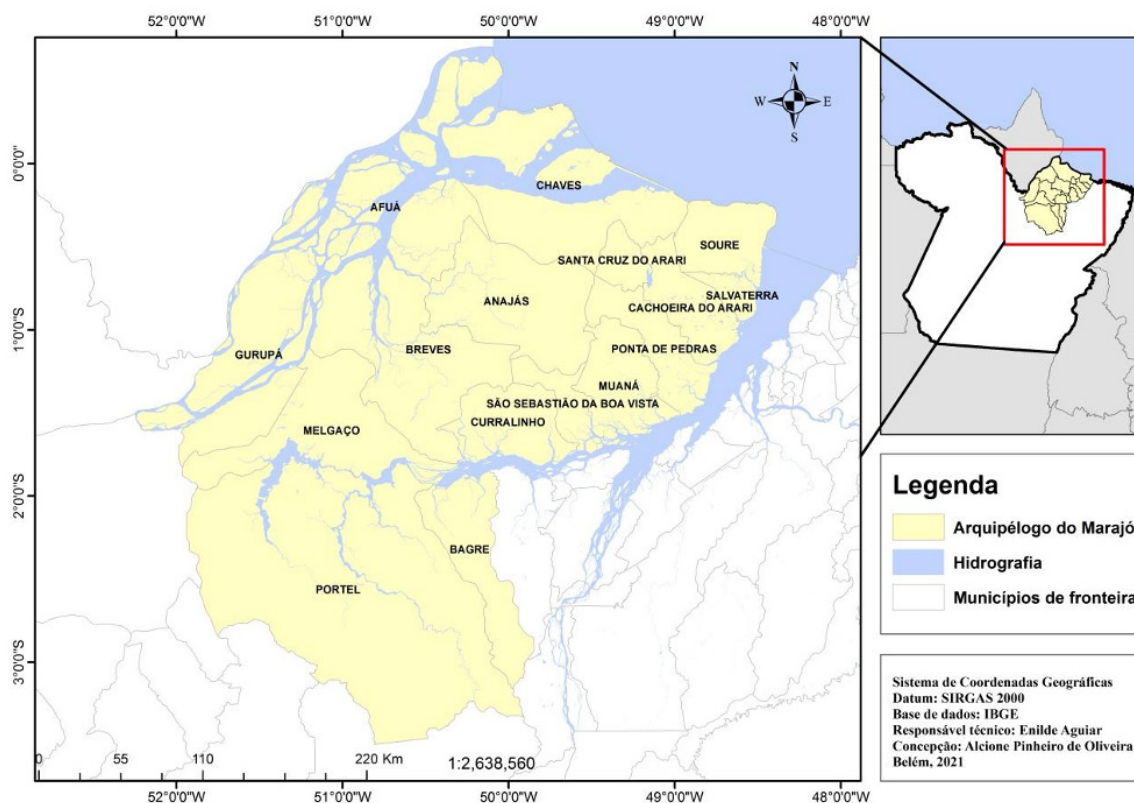
Figure 1. Geographic location of the municipalities in the Marajó Archipelago, Pará.
Source: authors.

Saúde) at the electronic address: http://www.datasus.gov.br. The diseases raised for this study were visceral leishmaniasis (VL), American cutaneous leishmaniasis (ACL), dengue, tuberculosis (TB) and Chagas disease (CD).

The FIRJAN Municipal Development Index (IFDM - Índice FIRJAN de Desenvolvimento Municipal) was used to analyze the municipalities' socioeconomic evolution in the study area. The IFDM assimilates data on employment, income, health and education as a metric for municipal development. Its index ranges from 0 to 1, divided into four development categories: low (from 0 to 0.4); fair (from 0.4 to 0.6); moderate (from 0.6 to 0.8); and high (from 0.8 to 1).[9]

All extracted data were used in Excel to create tables and graphs, and to carry out the mapping, free software QGis 2.18 was used. From the intensity of the colors presented, it was possible to analyze the spatial distribution of the reported disease with the number of cases in each municipality. The darker the color, the greater the number of cases reported in this location.

RESULTS

FIRJAN Municipal Development Index

In table 1, it is possible to observe that 9 municipalities, such as Afuá, Bagre, Breves, Cachoeira do Arari, Melgaço, Muaná, Ponta de Pedras, Santa Cruz do Arari and São Sebastião da Boa Vista, showed low development until around 2008/2009. From 2009 onwards, they moved to regular development IFDM, just as Chaves, Curralinho, Gurupá, Portel, Anajás and Salvaterra underwent this transition from 2011. Soure has, since 2008, presented growth in the IFDM from 0.4 to 0.5, being classified as regular development.

Basic sanitation

As for the water supply system, there is great disparity between the study sample, with emphasis on the capital Soure, which has the greatest hydrographic network coverage (Table 2). It is also possible to observe that only Afuá, Anajás, Breves, Cachoeira do Arari, Ponta de Pedras, Salvaterra and Soure present complete data for the period, leaving gaps in the information provided by the competent bodies.

Regarding Marajó's sewage services, this presents an even more aggravating situation when compared to the deficient water supply, since only Santa Cruz do Arari and Chaves have data available for this service, referring to 2014 and 2015.

Spatial distribution of neglected tropical diseases in the Marajó Archipelago

According to the survey, ACL, dengue and TB were the most reported diseases in total. All municipalities had at least one NTD in the period. Figure 2 shows the spatial distribution of the numbers of cases of tropical diseases in all the municipalities that make up the Marajó Archipelago, between 2007 and 2016.

It is noted that, although Salvaterra was the municipality with the highest record for VL, neighboring municipalities also have a discreet record, with this endemic having a lower incidence. ACL was the second most reported disease throughout the Marajoara territory, with records in 13 of the 16 municipalities, with emphasis on Portel and Bagre. Only Chaves, Ponta de Pedras and Santa Cruz do Arari did not present any cases.

With regard to dengue, TB and CD, illustrated in Figure 3, it is possible to observe that the municipalities with the highest number of reported dengue cases (Figu-

Table 1. IFDM of Marajó Archipelago municipalities, Pará, between 2007 and 2016.

Municipalities	Period (years)									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Afuá	0.35	0.38	0.39	0.41	0.44	0.47	0.49	0.48	0.46	0.45
Anajás	*	*	*	0.39	0.46	0.46	0.45	0.44	0.44	*
Bagre	0.39	0.37	0.43	0.34	0.36	0.38	0.39	0.4	0.42	0.49
Breves	0.43	0.42	0.44	0.47	0.5	0.51	0.5	0.46	0.47	0.46
C. Arari	0.38	0.36	0.39	0.44	0.44	0.47	0.47	0.46	0.43	0.47
Chaves	0.41	0.36	0.42	0.39	0.43	0.44	0.47	0.52	0.48	0.56
Curralinho	0.39	*	0.4	0.42	0.41	0.44	*	0.42	0.41	0.46
Gurupá	0.29	0.39	0.4	0.39	0.42	0.43	0.4	0.39	0.44	0.49
Melgaço	0.28	0.36	0.35	0.42	0.42	0.44	0.43	0.49	0.44	0.49
Muaná	0.33	0.36	0.39	0.4	0.4	0.4	0.42	0.37	0.47	0.48
P. Pedras	0.34	0.38	0.43	0.42	0.43	0.47	0.46	0.47	0.47	0.5
Portel	0.41	0.41	0.43	0.41	0.4	0.41	0.37	0.5	0.49	0.52
Salvaterra	0.4	0.36	0.37	0.38	0.4	0.43	0.47	0.47	0.5	0.51
S. C. Arari	0.34	*	*	0.36	0.39	0.41	0.45	0.43	0.45	0.54
S. S. B. V.	0.35	0.35	0.39	0.4	*	0.42	0.46	0.47	0.51	0.53
Soure	0.38	0.41	0.44	0.48	0.49	0.52	0.54	0.51	0.5	0.54

*data not available.

Table 2. Percentage of water supply service provision in the Marajó Archipelago, Pará, between 2007 and 2016.

Municipalities	Period (years)									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Afuá	15.8%	15.7%	15.7%	14.9%	13.1%	12.9%	12.0%	12.6%	12.4%	12.4%
Anajás	5.3%	5.1%	5.9%	6.6%	6.3%	6.6%	6.4%	7.3%	7.2%	6.5%
Breves	32.6%	31.7%	30.6%	33.5%	26.8%	27.2%	26.7%	26.5%	26.2%	26.0%
C. Arari	18.5%	18.7%	19.4%	18.7%	15.0%	14.2%	12.1%	11.8%	11.6%	11.9%
P. Pedras	35.0%	35.3%	35.6%	36.1%	29.1%	29.8%	31.6%	32.3%	31.7%	31.2%
Portel	7.3%	7.2%	7.5%	3.4%	2.6%	3.0%	3.0%	3.2%	3.1%	2.9%
Salvaterra	26.8%	27.2%	29.1%	27.2%	21.0%	21.5%	19.5%	23.5%	24.3%	14.4%
Soure	65.4%	72.0%	80.8%	82.4%	71.0%	74.7%	75.2%	75.0%	76.3%	77.8%
S. C. Arari	44.70%	45.4%	49.2%	39.5%	73.9%	76.8%	*	45.7%	44.6%	64.5%
Bagre	36.3%	37.9%	48.3%	45.2%	50.0%	30.8%	*	*	*	*
Curralinho	*	*	*	*	*	33.5%	38.2%	41.1%	49.1%	*
Melgaço	*	*	*	*	*	*	13.8%	13.8%	15.4%	18.7%
Muaná	*	58.3%	63.1%	51.0%	*	*	*	*	*	*
Gurupá	*	*	*	36.9%	*	31.6%	30.8%	*	*	*
S. S. B. V.	*	*	*	23.7%	*	*	*	*	*	5.9%
Chaves	*	*	*	*	*	*	*	11.3%	*	*

data not available.
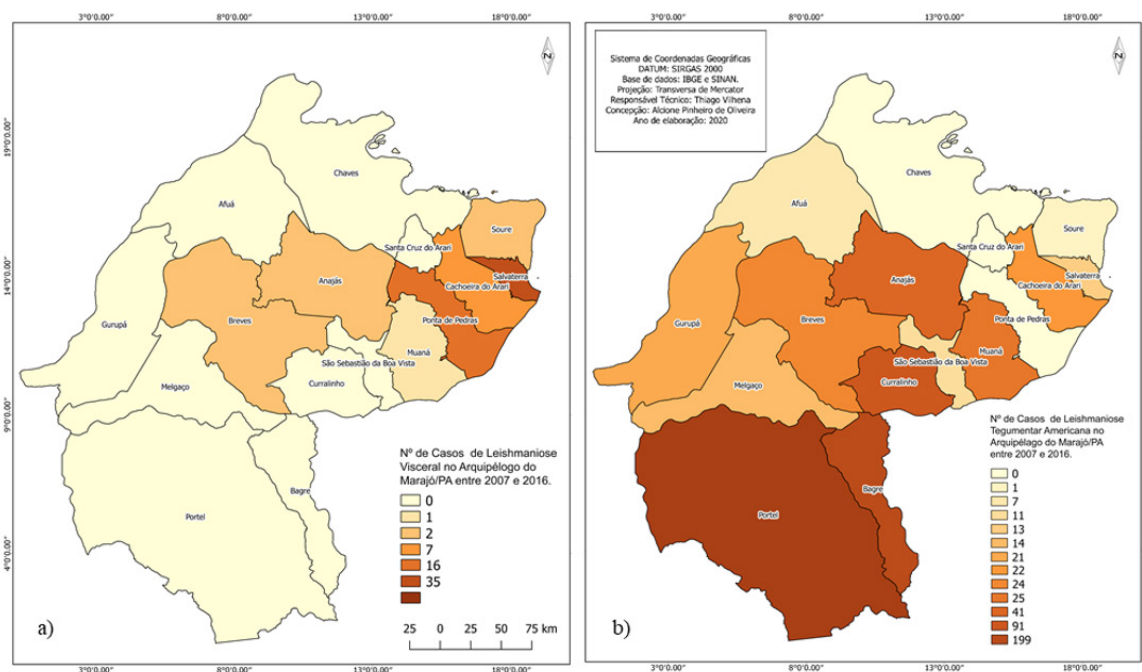
Figure 2. Spatial distribution of the number of cases of: a) visceral leishmaniasis; and b) American cutaneous leishmaniasis in Marajó Archipelago municipalities, Pará, between 2007 and 2016.

re 3a) are not neighboring municipalities, namely Breves, Ponta de Pedras, Portel and Soure. In total, it was the most reported disease with records in 12 municipalities.

In Figure 3b, it is possible to observe that TB was present in all locations, in addition to being third in number of cases, with emphasis on Breves, Portel and Soure. Chaves and Santa Cruz do Arari were the only municipalities that presented data only for TB. Despite many confirmed cases of CD, the highest numbers were in Breves and Gurupá (Figure 3c).
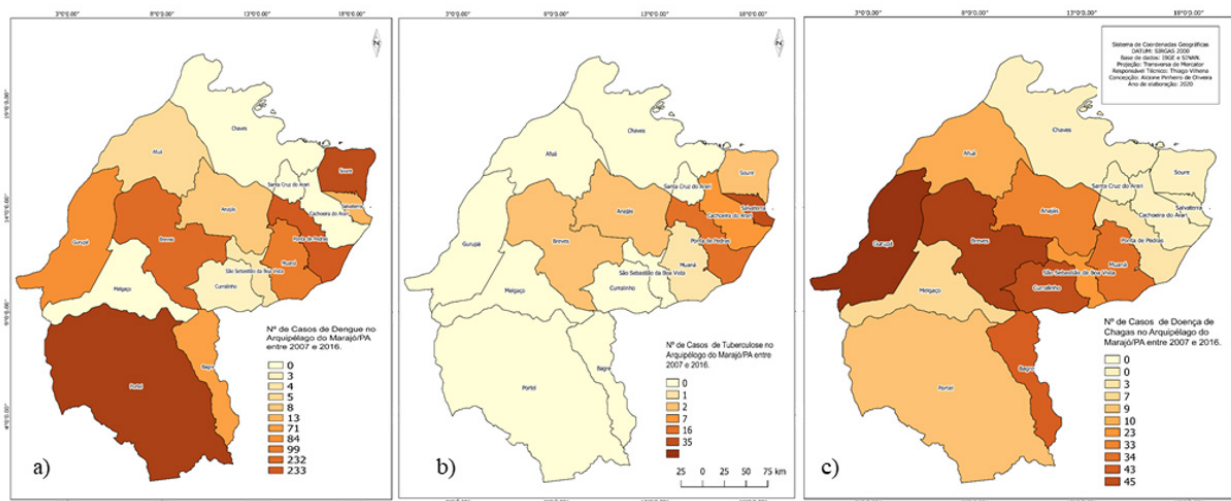
Figure 3. Spatial distribution of the number of cases: a) dengue; b) tuberculosis; and c) Chagas disease in Marajó Archipelago municipalities, Pará, between 2007 and 2016.

DISCUSSION

It was possible to verify that, throughout the Marajoara territory, ACL was the second most reported disease, present in 13 of the 16 municipalities, with emphasis on Portel and Bagre. In total, dengue was the most reported with records in 12 municipalities, with a high rate in Breves, Ponta de Pedras, Portel and Soure.

Breves is considered an important Marajoara city, whose economic base for a long time was focused on the extraction of natural resources, such as wood, *açaí* (fruit) and heart of palm exploitation.[10] Currently, the municipality concentrates a consolidated trade and with service offer in the most diverse areas, in addition to hosting various public bodies.[11] The municipality has low population growth due, in part, to the evasion of many families to other locations, due to the search for alternatives for better living conditions, a consequence of the closure of many logging companies that impacted the local dynamics and economy.[11]

In table 1, Anajás is presented as the municipality with the worst socioeconomic indices, considering that in some years (2007, 2008, 2009 and 2016) data were not available, making a deeper analysis impossible. Breves and Soure are the municipalities with the highest IFDM in this region, however, far from ideal. The IFDM was created with the aim of understanding and monitoring the level of human development of municipalities in socioeconomic aspects over the years.[12] In general, Marajó Archipelago's IDHM has shown a slight evolution in terms of its classification in most municipalities.

The low IFDM in Breves is related to the decay of logging activities, although the activity may be linked to social segregation in the municipality.[13] However, the low index both in Breves and the other municipalities may be associated with the absence of public policies and investments in infrastructure.[14]

Despite not presenting data for the entire analyzed period, in table 2, it is possible to observe that Santa Cruz do Arari, Bagre, Curralinho and Muanáhave hydrographic network coverage in more than 40% of households; despite having deficit, it is still one of the largest in the region. Cachoeira do Arari, Melgaço and Chaves do not reach 20% of homes.

In municipalities such as Anajás, Cachoeira do Arari, Salvaterra and Portel, the access network is less than 40%, which highlights worrying rates.[15] Of these, only the capital Soure exceeds the coverage of the service by 60%, however below 85%, foreseen by the country's basic sanitation companies.

As for the sewage service, it was found that only the municipality of Santa Cruz do Arari, between 2014 and 2015, and the municipality of Chaves, in 2014, provided data on coverage. The North region has the worst sanitary percentages in Brazil, as only 14.36% of sewage is treated, with a total service rate of only 7.88%.[16]

These data affect the IFDM calculation in the Marajoara region, since not even 50% of the population is contemplated with the provision of these services, and priority must be given to the universalization of sanitation so that IFDM evolution actually occurs. Basic sanitation services are essential to ensure a better quality of life for the population, being essential for health care and maintenance.[14]

Non-availability of data warns about a worrying reality for the Marajoaras, inferring that the population's basic rights are being neglected not only due to low supply, but also due to the lack of information or the service itself, an act that violates human dignity. Investments in health in the Amazon region were deficient, resulting in a neglected population, especially rural/riverside populations, a situation that has not improved significantly over time and remains similar in 2019.[3]

As can be seen in figures 2 and 3, the spatial distribution of NTDs in the municipalities of Marajó reveals that, from 2007 to 2016, the number of cases of VL, ACL, dengue, TB and CD is not consistent with the region's socioeconomic data. It was expected that these diseases would present more alarming data, since the region in question does not have adequate sanitary conditions or IFDM, which opens the door to a discussion about underreporting or the lack of medical assistance to the resident population.

Figure 2 a and b shows the distribution of leishmaniasis caused by protozoa of the genus *Leishmania*. These are endemic diseases in the Amazon, where anthropic actions directly compromise environmental spaces.[17] Researching ATL in Marajó, studies identified that Portel, Anajás and São Sebastião da Boa Vista have high rates of the disease, compatible with those found in the present study.[18]

All highlighted diseases are considered serious public health problems compatible with precarious sanitation conditions and difficult access to health services.[1] With the exception of TB, the others are of a vector nature, with a direct correlation to environmental impacts, especially deforestation and fires, with loss of habitat for species that until then lived isolated from urban and peri-urban areas.[18]

Figure 3a shows the distribution of dengue in Marajoara municipalities. Dengue is a viral infectious disease transmitted by the *Aedes aegypti* mosquito that spreads rapidly worldwide, with morbidity and mortality.[19] The dengue index is higher in municipalities with low socioeconomic indicators, whose lack of registration in Afuá, Cachoeira do Arari, Curralinho, Gurupá, Melgaço and Santa Cruz do Arari culminated in divergences with exposed data.[20]

TB in Figure 3b was the only disease reported in all Marajoara municipalities. TB is an infectious and contagious disease of important epidemiology in Amazonian capitals such as Belém and Manaus, with high coefficients associated with socioeconomic vulnerability issues, among other factors.[21]

Despite several municipalities reporting the disease, CD (Figure 3c) had a relatively low number of cases. CD is an anthropozoonosis caused by the parasite *Trypanosoma cruzi* and transmitted by the vector *Triatoma brasiliensis*, popularly known as kissing bug. Its contamination can be acquired through blood transfusion, organ transplantation and orally and vertically.[22]

The consumption of açaí (*Euterpa oleracea*) *in natura* is a cultural factor in the region that is related as a means of contamination for CD, considering that most of the so-called "açaí beaters" do not use the bleaching technique, a practice that prevents contamination, for pulp production.[23] Another preponderant factor would be the material with which many houses are still built in the region, with the use of clay and wood, which facilitates vector installation in these constructions.[24]

Breves, Portel and Soure were the municipalities that had the most reports regarding at least two of the five identified tropical diseases. Breve stood out for dengue, TB and CD; Portel stood out for ACL, dengue and TB; and Soure stood out for dengue and TB. Breves and Portel are municipalities that have similar socioeconomic aspects, since both had logging as their main economic activity, which, for a long time, was the economic base that led to changes in environmental, socioeconomic and territorial aspects.[13]

This epidemiological reality in the Marajó Archipelago is due, mainly when talking about the rates of ACL, TB and dengue, to the fact that, historically, the diseases considered endemic for the Amazon region are linked to conditions and life behavior of this region.[18,20,21] The anthropization of the environment resulted in these changes, favoring the proliferation of vector agents and, consequently, the incidence of diseases related to inadequate basic sanitation, whose configuration is the result of a disorganized urbanization process and historically exclusive development.[25]

The Marajó Archipelago is geographically positioned in an area where difficult access to some of its municipalities is used as a justification for the lack of investment, making this damage even more dramatic for the population.[3] The socioeconomic dynamics in the cities of Marajó has peculiar characteristics. Studying the cities and the way this dynamic take place is essential for understanding the spatial distribution of diseases in the Amazonian context.[25]

ACKNOWLEDGMENTS

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AUTHORS' CONTRIBUTIONS

Alcione Pinheiro de Oliveira and **Altem Nascimento Pontes** – study conception and article design; **Alcione Pinheiro de Oliveira** and **Enilde Santos de Aguiar** – data collection and analysis and article writing; **Alcione Pinheiro de Oliveira** and **Marcelo Coelho Simões** - article design and article writing; **Enilde Santos de Aguiar**, **Marcelo Coelho Simões** and **Altem Nascimento Pontes** – article review; **Altem Nascimento Pontes** – article review and final approval.

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

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ORIGINAL ARTICLE

Access to tuberculosis diagnosis in a municipality of the Western Amazon: health professionals' perspective

Acesso ao diagnóstico da tuberculose em um município da Amazônia Ocidental: ótica dos profissionais de saúde

Acceso al diagnóstico de tuberculosis en un municipio de la Amazonia occidental: perspectiva de los profesionales de la salud

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ABSTRACT

Background and Objective: identifying the factors that weaken access to tuberculosis diagnosis allows assessing the actions and surveillance strategies of Primary Health Care (PHC), in addition to ensuring follow-up and monitoring of cases. This study aimed to analyze the dimension of access to diagnosis in PHC from health professionals' perspective in a municipality in the Western Amazon. **Methods:** this is a descriptive survey-type study, carried out in a cross-sectional way and with a quantitative approach in Porto Velho with professionals who work in PHC in the urban area through interviews with the Primary Care Assessment Tool questionnaire, validated for Brazil and adapted for tuberculosis care. Only the access to diagnosis dimension of the version for health professionals was considered, which has twelve variables and presents categories of responses according to the Likert scale. Data were analyzed using descriptive statistics, after complying with ethical precepts. **Results:** a total of 266 professionals were interviewed, and the mean score was classified as regular as well as they almost always have difficulty obtaining information over the phone; sometimes they use motorized transport; have costs with public transport to travel to the health unit; and sometimes they miss a work shift or appointment for the appointment. **Conclusion:** it is essential to reflect on the role with PHC insertion and resolvability as well as adequate clinical conduct, considering the epidemiological data that remain challenging in the municipality.

Keywords: Tuberculosis. Health Personnel. Diagnosis. Health Services. Primary Health Care.

RESUMO

Justificativa e Objetivo: identificar os fatores que fragilizam o acesso ao diagnóstico da tuberculose permite avaliar as ações e estratégias de vigilância da Atenção Primária à Saúde (APS), além de garantir acompanhamento

e monitoramento dos casos. Este estudo teve como objetivo analisar a dimensão do acesso ao diagnóstico na APS, sob a ótica dos profissionais de saúde em um município da Amazônia Ocidental. **Métodos:** estudo descritivo, do tipo inquérito, realizado de forma transversal e abordagem quantitativa em Porto Velho, com os profissionais que atuam na APS da zona urbana por meio de entrevistas com o questionário *Primary Care Assessment Tool*, validado para o Brasil e adaptado para a atenção à TB. Considerou-se apenas a dimensão acesso ao diagnóstico da versão para profissionais de saúde, que possui doze variáveis, apresentando como categorias de respostas segundo a escala tipo Likert. Os dados foram analisados a partir da estatística descritiva, após atender aos preceitos éticos. **Resultados:** foram entrevistados 266 profissionais, sendo que o escore médio foi classificado como regular, bem como quase sempre têm dificuldade para obter informação por telefone; às vezes utilizam transporte motorizado, possuem custos com transporte público no deslocamento à unidade de saúde; e às vezes perdem turno de trabalho ou compromisso para a consulta. **Conclusão:** é essencial a reflexão do protagonismo com inserção e resolubilidade da APS, bem como conduta clínica adequada, considerando os dados epidemiológicos que permanecem desafiadores no município.

Descritores: Tuberculose. Pessoal de Saúde. Diagnóstico. Serviços de Saúde. Atenção Primária à Saúde.

RESUMEN

Justificación y Objetivos: identificar los factores que debilitan el acceso al diagnóstico de tuberculosis permite evaluar las acciones y estrategias de vigilancia de la Atención Primaria de Salud (APS), además de garantizar el segui-miento y seguimiento de los casos. Este estudio tuvo como objetivo analizar la dimensión del acceso al diagnóstico en la APS, desde la perspectiva de los profesionales de salud en un municipio de la Amazonia occidental. **Métodos:** estudio descriptivo, del tipo encuesta, realizado en abordaje transversal y cuantitativa en Porto Velho con profesio-nales que actúan en APS en el área urbana a través de entrevistas con el cuestionario *Primary Care Assessment Tool*, validado para Brasil y adaptada para la atención de la TB. Se consideró solamente la dimensión acceso al diagnóstico de la versión para profesionales de la salud que tiene doce variables y se presenta como categorías de respuestas según la escala Likert. Los datos fueron analizados con base en estadística descriptiva, después de cumplir con los preceptos éticos. **Resultados:** se entrevistó a un total de 266 profesionales, y el puntaje promedio fue clasificado como regular, además de tener casi siempre dificultades para obtener información por teléfono; a veces utilizando transporte motorizado y teniendo costos de transporte público al desplazarse a la unidad de salud; a veces perdiendo turno de trabajo o cita para la consulta. **Conclusiones:** es esencial reflejar el papel del papel con la inserción y resolución de la APS, así como la conducta clínica adecuada, considerando los datos epidemiológicos que siguen siendo desafiantes en el municipio.

Palabras clave: Tuberculosis. Personal de Salud. Diagnóstico. Servicios de Salud. Atención Primaria de Salud.

INTRODUCTION

Tuberculosis (TB) is a serious public health pro-blem worldwide. In 2019, it is estimated that 10 million people fell ill with TB and 1.4 million died[1]. Among the priority countries with high disease burden and TB/HIV co-infection, Brazil reported 73,864 new cases and 4,532 were deaths, which is equivalent to a mortality rate of 2.2 deaths/100,000 inhab.[1,2]

That same year, Rondônia had 582 new cases and 19 deaths (1.1 deaths/100,000 inhab.), in addition to a low percentage of cures among those with the clinical pulmonary form (70.3%). Of the cases reported in the state, 43.5% (253 cases) were in Porto Velho, with 14 de-aths in the respective municipality (2.6 deaths/100 thou-sand inhab.), and in the country it is the second capital in percentage of abandonment (32.6%).[2]

These data represent the need to prioritize TB control measures, such as case tracking, diagnostic elu-cidation and care management with the provision and implementation of directly observed treatment (DOT) as well as the insertion and performance of community health workers (CHW), home visits for (ack)knowledge of the social determinants of health involving users, family and community, which can interfere with compliance and disease control actions.[3,4] Furthermore, it is essential to establish and strengthen a bond with greater leading role and resoluteness of Primary Health Care (PHC) as the organizer of the Health Care Network (RAS – *Rede de Atenção à Saúde*) and care coordinator.[5]

Studies indicate that users, most of the time, are diagnosed in reference services,[6] either due to organiza-tional and managerial weaknesses, which include lack of human and material resources, training, support network through the Expanded Center for Family Health and PHC units' opening hours, which hinder the longitudinality of care and comprehensiveness of assistance.[7]

Complementarily, there are other barriers that im-ply delay in diagnosis, such as the distance from home to the health service, especially in populations residing in rural areas, additional costs with transportation for dis-placement, lack of knowledge that leads to a mispercep-tion of signs and symptoms due to similarity with other comorbidities, in addition to stigma, self-medication, seeking alternative treatment, such as healers or spiritual places, and singularities of some populations, such as indigenous or immigrants in terms of approach due to different languages and cultures.[8]

In addition to this, the lack of integration between information systems and the non-reporting of cases generate a deficit of data, interfering with disease control actions, which intensifies failures in the care provided, delay in diagnosis and initiation of treatment, culminating in the severity of signs and symptoms, high percentages of abandonment and, consequently, continuity in the disease transmission chain.[6,7,9]

Considering the above, identifying the factors that weaken access to a TB diagnosis allows assessing PHC surveillance actions and strategies, in addition to ensuring follow-up and monitoring of cases. Thus, this study aimed to analyze the dimension of access to TB diagnosis in PHC, from health professionals' perspective in Porto Velho-RO.

METHODS

This is a descriptive survey-type study, carried out in a cross-sectional way from a quantitative approach in Porto Velho, capital of Rondônia. Currently, the municipality's PHC consists of 17 Basic Health Units (BHU) and 37 Family Health Units (FHU), totaling 54 PHC units, which are distributed in the urban (20) and rural (33) areas, subdivided into land (18) and riverside (15) units as well as a river mobile unit. In this study, only health establishments distributed in the urban area were considered.

TB care in the municipality is decentralized to PHC, which is responsible for carrying out actions to identify respiratory symptoms (RS), reporting cases in the Reporting Diseases Information System (SINAN - *Sistema de Informação de Agravos de Notificação*), follow-up TB cases undergoing treatment, identifying those who do not, offer DOT, investigate contacts, offer the HIV test, in addition to requesting diagnostic tests (sputum smear microscopy, Rapid Molecular Test for TB (TRM-TB) and chest X-ray) carried out in the municipal laboratory, in addition to sputum culture and sensitivity tests that are carried out in the state laboratory.

As a support network, at an outpatient level, the municipality has two specialized units, one for cases of extrapulmonary TB and childhood TB, and the other for those with TB/HIV co-infection. For cases of drug-resistant TB (DR-TB) and those that require hospitalization, the state has a hospital and an outpatient clinic located in this unit as a reference at the tertiary level.

The study population consisted of professionals working in PHC units in the urban area of Porto Velho-RO. Those who had been in their role for at least 12 months and who had dealt with at least one case of TB since their training were included. All those who were on vacation and/or leave during the data collection period were excluded. It is noteworthy that the delimitation of this study in the urban area occurred, to the extent that in these places there is a greater transmissibility of the disease, number of reported cases of TB and unfavorable outcomes when compared to the rural area. Thus, understanding access to diagnosis from professionals' perspective becomes essential.

To calculate the sample of professionals interviewed, the sample calculation formula with a finite population was used:

$$ n = \frac{z_{\frac{\alpha}{2}}^{2} * N * P * (1 - P)}{\varepsilon^2 * (N - 1) + z_{\frac{\alpha}{2}}^{2} * (1 - P)} $$

In this regard, a 5% error (ε) was considered, a 95% confidence interval (Z), 50% sample proportion (P) of the population (N=737). At least 253 professionals would be interviewed, of which 136 CHWs, 65 nursing technicians/assistants, 26 nurses and 26 physicians.

For data collection, the Primary Care Assessment Tool (PCATool)[10] questionnaire was used as an instrument, validated for Brazil[11] and later adapted for TB care.[12] To meet the objective of this study, only the access to diagnosis dimension of the version for health professionals was considered, which has twelve variables (Chart 1).

The response categories vary according to the Likert scale, with values between one and five, referring to the degree of preference or agreement with the statements (Chart 2).

Chart 1. Dariables related to the access to diagnosis dimension selected for this study.

Dimension	Variables
Access to diagnosis	Waiting time to have an appointment when they have signs/symptoms of TB.
	Number of times users need to go to the health unit to receive care when they have signs/symptoms of TB.
	Number of times users need to go to the health unit to receive care when they have signs/symptoms of TB.
	Time expected by diagnosis when users show signs/symptoms of TB.
	Search for the health unit closest to home for a TB diagnosis appointment.
	Waiting for more than 60 minutes to be seen when users look for the health unit with signs/symptoms of TB.
	Difficulty obtaining information by telephone at the health unit when users have signs/symptoms of TB.
	Difficulty making an appointment by telephone at the health unit when users have signs/symptoms of TB.
	Difficulty traveling to the health unit when users have signs/symptoms of TB.
	Use of motorized transport to travel to the health unit for the TB diagnosis appointment.
	Money spent on public transport to travel to the health unit during appointments for TB diagnosis.
	Loss of work shift or appointment at health services when users have signs/symptoms of TB.

Source: VILLA; RUFFINO-NETTO, 2009.

Chart 2. Professional response categories in the access to diagnosis dimension, from variables C1 to C12, according to the respective scores.

Variables	Response option				
C1	5 days or more	4 days	3 days	2 days	1 day - 24 hours
C2 and C3	5 times or more	4 times	3 times	2 times	1 vez
C4	5 or more weeks	4 weeks	3 weeks	2 weeks	1 week
C5	Never	Almost never	Sometimes	Almost always	Always
C6 to C12	Always	Almost always	Sometimes	Almost never	Never
Scores	0 to 1	1.1 to 2	2.1 to 3	3.1 to 4	4.1 to 5

Source: adapted from Villa & Ruffino-Netto (2009).

Data were collected between May 2018 and February 2019, then stored in Microsoft Excel. They were analyzed using descriptive statistics in the Statistica 13.4 software, from TIBCO. The mean score of the dimension listed for this study was determined, which corresponded to the sum of all the mean scores of the variables divided by the total of variables and, finally, a score for each variable that corresponds to the mean value obtained by the sum of the responses for each question and divided by the total number of participants.[12]

Subsequently, according to the instrument's Likert response scale, the mean scores were classified as unsatisfactory (0 to 1.6), regular (1.7 to 3.3) and satisfactory (3.4 to 5).

The matrix project entitled *"Dimensões organizacionais e de desempenho dos serviços de saúde para o manejo do cuidado aos doentes de tuberculose em Porto Velho-RO"* was approved by the Research Ethics Committee of the *Fundação Universidade Federal de Rondônia*, according to Opinion 2,585,934, meeting the recommendations of Resolution 466/12 of the Brazilian National Health Council.

The interviews took place after signing the Informed Consent Form (ICF) by health professionals at the health unit where they worked and a place that protected their privacy.

RESULTS

A total of 401 professionals were approached, of which 120 were excluded, 65 of which were CHW, 33, nursing technicians/assistants, 13, nurses and 9, physicians, considering that they had not dealt with at least one case of TB since their training (73). They were on vacation during the period of data collection (29), leave (14). They did not exercise their function for at least 12 months (4), in addition to 15 refusals, either due to unavailability of time, interruption of interview during questionnaire application, several attempts to approach without professional acceptance, desire to answer the questionnaire alone and affirmation that such research would not return to the service, totaling 266 health professionals interviewed.

The general mean score of the access to diagnosis dimension was classified as fair (3.3), which, regardless of the professional category, it also concerns that, with regard to users with signs and symptoms of TB, they almost always have difficulty obtaining information over the phone (1.71); sometimes they use motorized transport (3.02) and have public transport costs (2.96) to travel to the health unit; sometimes they miss a work shift or an appointment at the health services when they have signs/symptoms of TB (2.36) (Figure 1).

He presented a satisfactory score on the waiting time of one day to have an appointment (4.59), and they need to go to the health unit once to receive care (4.7) and twice for diagnosis (3.72), being that this occurs in two weeks (3.95). They always look for the closest unit to their home (4.32), almost never wait more than 60 minutes to be seen (3.54) and almost never have difficulty traveling to the unit (3.47). Moreover, they presented unsatisfactory appointment scheduling by telephone, considering that they almost always have difficulty (1.32) (Figure 1).
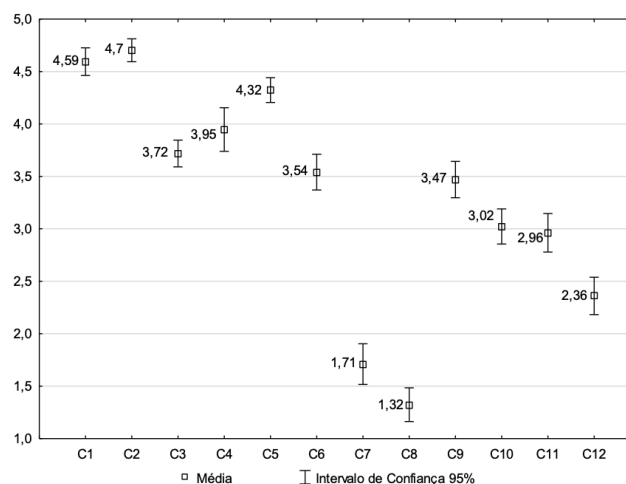
Figure 1. Graphic representation of the mean and confidence interval of health professionals' responses to interviews, according to the dimension access to diagnosis, in Porto Velho-RO, from July 2018 to February 2019.

Caption: C1 - Waiting time to have an appointment when they have signs/symptoms of TB. C2 - Number of times users need to go to the health unit to receive care when they have signs/symptoms of TB. C3 - Number of times users need to go to the health unit to receive care when they have signs/symptoms of TB. C4 - Time expected by diagnosis when users show signs/symptoms of TB. C5 - Search for the health unit closest to home for a TB diagnosis appointment. C6 - Waiting for more than 60 minutes to be seen

when users look for the health unit with signs/symptoms of TB C7 – Difficulty obtaining information by telephone at the health unit when users have signs/symptoms of TB. C8 - Difficulty making an appointment by telephone at the health unit when users have signs/symptoms of TB. C9 - Difficulty traveling to the health unit when users have signs/symptoms of TB. C10 - Use of motorized transport to travel to the health unit for the TB diagnosis appointment. C11 - Money spent on public transport to travel to the health unit during appointments for TB diagnosis. C12 - Loss of work shift or appointment at health services when users have signs/symptoms of TB.

However, when it was observed according to the professional category, there was a regular score from doctors' (3.0) and nurses' (3.23) perspective on waiting times of more than 60 minutes when users have signs and symptoms of TB as well as for the nursing team regarding the difficulty users have to travel to the health unit when they have signs/symptoms of TB. Finally, unsatisfactory score was identified for physicians (1.48) and nursing technicians/assistants (1.64) on the difficulty of TB suspects in obtaining information by telephone at the health unit when they present signs/symptoms of TB (Figure 2).
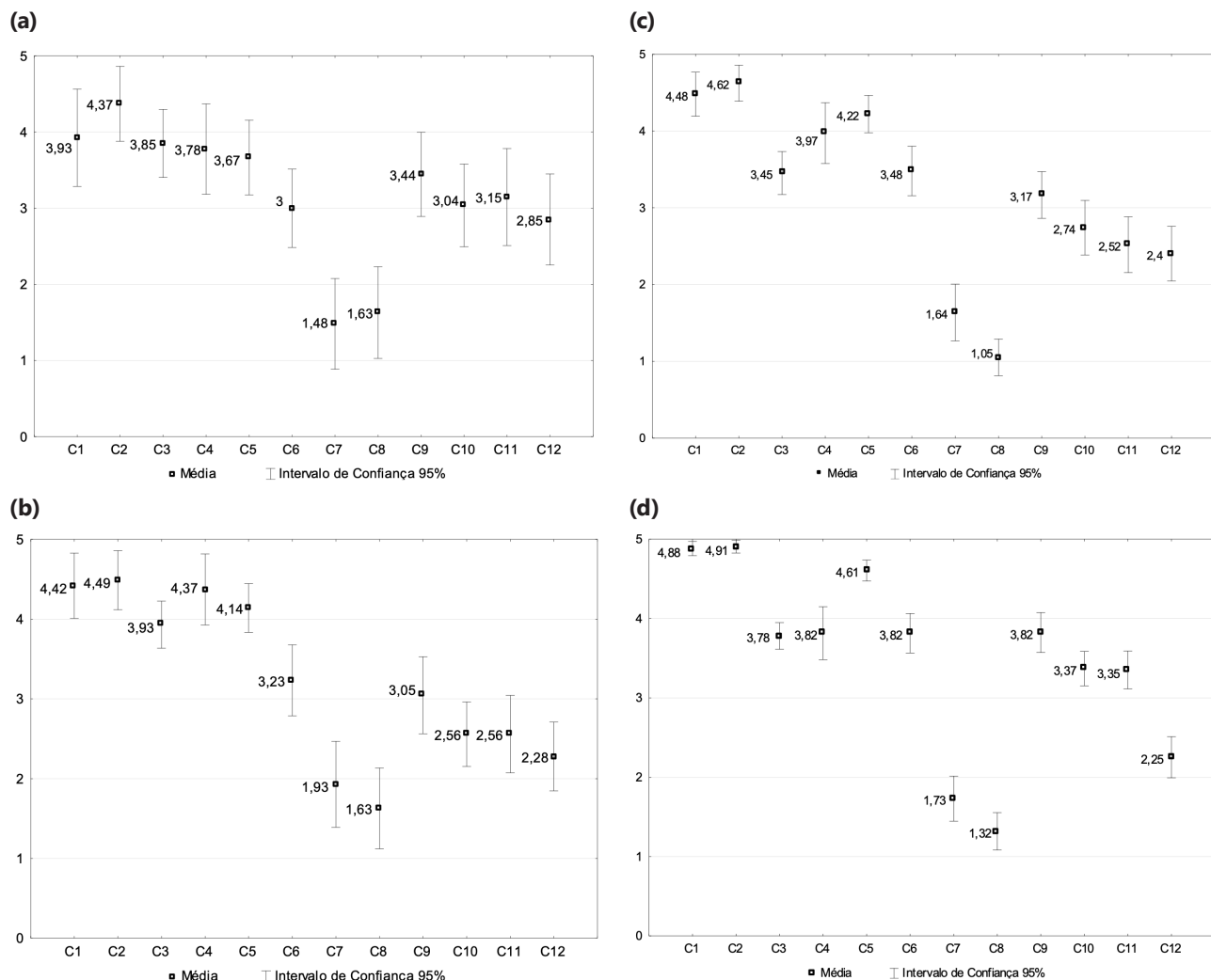
Figure 2. Graphic representation of the mean and confidence interval of the access to diagnosis dimension scores obtained by medical professionals (a), nurses (b), technicians and nursing assistants (c) and CHW (d) in the access to diagnosis dimension (variables C1 to C12), in Porto Velho-RO, from July 2018 to February 2019

Caption: C1 -Waiting time to have an appointment when they have signs/symptoms of TB. C2 - Number of times users need to go to the health unit to receive care when they have signs/symptoms of TB. C3 - Number of times users need to go to the health unit to receive care when they have signs/symptoms of TB. C4 - Number of times users need to go to the health unit to receive care when they have signs/symptoms of TB. C5 - Search for the health unit closest to home for a TB diagnosis appointment. C6 - Waiting for more than 60 minutes to be seen when users look for the health unit with signs/symptoms of TB C7 - Difficulty obtaining information by telephone at the health unit when users have signs/symptoms of TB. C8 - Difficulty making an appointment by telephone at the health unit when users have signs/symptoms of TB. C9 - Difficulty traveling to the health unit when users have signs/symptoms of TB. C10 - Use of motorized transport to travel to the health unit for the TB diagnosis appointment. C11 - Money spent on public transport to travel to the health unit during appointments for TB diagnosis. C12 - Loss of work shift or appointment at health services when users have signs/symptoms of TB.

DISCUSSION

Considering the findings found, it is important to reflect on the high number of professionals who stated that they had not dealt with any case of TB, considering that the municipality has a high incidence coefficient (66.7 cases/100 thousand inhab.) when compared to the country (54.7 cases/100 thousand inhab.) and abandonment,[2] which contributes to transmission chain perpetuation, regardless of whether it is an area covered by the Family Health team. Complementarily, could there have been contact with TB during the consultations, but the

Mycobacterium tuberculosis bacillus was not identified, referring to other levels of care for diagnostic elucidation and reflecting on the delay?

Furthermore, some professionals showed lack of motivation to participate in the research, which may be related to work overload and inability to perceive themselves as essential actors in the context of disease prevention and case control[13] as well as contributing to the identification of challenges and obstacles that still exist, and participating in the formulation of health policies and reorganization of actions and services.

The regular mean score represents challenges in accessing the diagnosis that still persist in PHC's resolvability and leading role, even though this level of care is the main entry point for RS and is responsible for the active search, early detection, diagnosis and treatment of cases of pulmonary TB, in addition to other actions involving health surveillance to control the disease in health territories.

In this regard, is it important to reflect on how PHC has been organized and structured to carry out home visits identifying early those who are characterized as RS for the diagnosis of active TB as well as those who have latent TB infection (LTBI)? How has health professionals' training and awareness about TB been carried out? How has the team been empowered and included all its members in the discussion of TB cases, whether in their health territory and/or in the area covered by the unit, aiming at actions to prevent and control this condition?

With regard to the mean regular score from the variables, not obtaining information by telephone may make it difficult to clarify doubts about the signs and symptoms of either the index case, contacts or people in the community who, at different times, need to use motorized transport or pay for public transport to travel from their homes to the health unit, even looking for the one closest to their residence. Such aspects characterize geographically extensive territories and centralization of units that have more than one team in the same physical structure and, consequently, distance from their territory, which can interfere with access to health services, delay in diagnosis, creation and strengthening of the bond as well as the approximation and effectiveness of actions by teams.

At the same time, the loss of a work shift or appointment to attend the unit, which, in turn, works only during business hours for the most part, had repercussions on fear of unemployment, which, aiming at the social determinants of health, leads to serious vulnerabilities for the onset of diseases, including TB.[8,14-16] At this point, it is also important to reflect on the "*Saúde na Hora*" Program, instituted by Ordinance 930 of May 15, 2019, with the expansion of PHC units' opening hours, although it is not clear about other aspects, such as infrastructure improvements, hiring of human resources and salary increase concomitantly with working hours. It should also be noted that, in Porto Velho, the teams work 30 hours a week, i.e., in the morning or afternoon, which can be characterized as an obstacle and even greater challenge in the search for care and access to health services.

It should also be noted that using the telephone to schedule an appointment, which was assessed as unsatisfactory as well as obtaining information through it, is a tool that requires reflection on its insertion in the work process, especially when we consider the aforementioned aspects of distance between residences and the health unit, costs for displacement, people residing in rural areas with inadequate roads and difficult access.

At the same time, the pandemic period itself, for example, in which there is a reorganization of health services, social distancing and isolation, in addition to other health recommendations, reduced the demand for care by users with symptoms other than those of COVID-19, at the same time that it overloaded the already scarce scenario, with regard to human, material and structural resources, making it if even more worrying.[8,17]

Studies point to a bureaucracy in the appointment scheduling system, disregarding risk stratification, care fragmentation and non-follow-up and monitoring of cases being treated by PHC, in addition to gaps in user guidance and health education actions, which only occur verbally and punctually.[14,18-20]

With regard to the search for the health unit closest to home for a TB diagnosis appointment, studies point out the search outside its coverage area due to the stigma of the disease that implies the fear that other people in the community know about their condition as well as weaknesses in knowledge of users and even professionals in relation to the RAS functioning, with repercussions on the late search and/or for a more distant unit, in addition to other levels of attention even for diagnostic elucidation.[14-21]

Although the variables on waiting time, demand for care and diagnosis were categorized with satisfactory scores, they raise reflections about the occurrence in practice, bearing in mind that early diagnosis is not enough, since the presence of trained professionals, inputs and a support network for carrying out the tests, implementing biosecurity measures and immediacy at the beginning of treatment is essential.[20,22,23]

Differences between the scores correlate with singularities in the work process of the different professional categories with regard to the provision of actions and services to access diagnosis. As a limitation of this study, it is important that the complement of users' point of view be inserted to understand how it is received and perceived by this user.

The results of this study point to difficulties in accessing diagnosis in PHC, which requires its leading role with its insertion and resolvability, aiming at controlling the disease, identifying the profile and vulnerabilities of the cases as well as adequate clinical conduct, considering the epidemiological data that still remain challenging in the municipality. The insertion of strategies that overcome the challenges can be characterized both in service performance and quality and in team motivation and integration when looking at the territory and acting according to the priorities, among them chronic conditions such as TB.

It is noteworthy that data collection took place in the period before the pandemic, whose changes in the health service a reorganization and focus on care make it even more worrying in the execution of strategies from

access to diagnosis to follow-up of cases, in view of the system overload and prioritization of COVID-19 control. Therefore, there is an urgent need to resume and improve TB control strategies and strengthen PHC with regard to adequate structure, improvement in surveillance actions, training and incentives for professionals to provide quality care and improve access.

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AUTHORS' CONTRIBUTIONS

Rebeca Sousa Braga contributed to the study conception and design, data analysis and interpretation, writing and critical review of the manuscript. **Melisane Regina Lima Ferreira** contributed to data collection and critical review of the manuscript. **Rafaele Oliveira Bonfim** contributed to the critical review of the manuscript. **Tatiane Cabral Siqueira** contributed to the data collection and critical review of the manuscript. **Nathalia Halax Orfão** contributed to the study conception and design, data analysis and interpretation, writing and critical review of the manuscript. All authors approved the final version of the manuscript to be published and are responsible for all aspects of the manuscript, including ensuring its accuracy and integrity.

Revista de Epidemiologia e Controle de Infecção

ORIGINAL ARTICLE

Analysis of the implementation of an AIDS mortality committee through municipal health indicators

Análise da implantação de um comitê de mortalidade por AIDS mediante indicadores de saúde municipais

Análisis de la implantación de un comité de mortalidad por SIDA a través de indicadores municipales de salud

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ABSTRACT

Background and objective: the acquired immunodeficiency syndrome (AIDS) has high rates of detection and death in the state of Rio Grande do Sul. In order to better understand such deaths, in December 2017, the Uruguaiana Municipal Department of Health implemented the AIDS Mortality Committee (CMaids). This study aimed to analyze the impact of an CMaids implementation in Uruguaiana through municipal health indicators. **Methods:** an ecological time-series study that used secondary data from the official platforms of the Ministry of Health from 2008 to 2020. **Results:** a reduction in the indicators number of deaths (from 28 in 2008 to 9 in 2020), mortality rate (from 22.0 in 2008 to 7.1 deaths/100,000 inhabitants in 2020), and fatality rate (from 46.74 in 2008 to 9.61 deaths/1,000 inhabitants in 2020) was observed. Moreover, trend lines were verified between 2017-2020 through the logarithmic regression model with join points. A relevant Annual Percent Change in mortality and fatality indicators was verified, with a reduction of 59.1% and 73.4%, respectively, in 2020, when comparing the observed and expected values. **Conclusion:** the findings enable us to conjecture that CMaids contributed to health indicator improvement, evidencing this as a relevant strategy to handle HIV/AIDS endemic at the local level.

Keywords: HIV. Aids. Mortality. Lethality. Health Indicators.

RESUMO

Justificativa e objetivo: a síndrome da imunodeficiência adquirida (aids) apresenta elevadas taxas de detecção e óbito no estado do Rio Grande do Sul. A fim de compreender melhor tais óbitos, em dezembro de 2017, a Secretaria Municipal de Saúde de Uruguaiana implementou o Comitê de Mortalidade por aids (CMaids). O objetivo deste estudo é analisar o impacto da implantação do CMaids de Uruguaiana por meio de indicadores de saúde municipais.

Métodos: estudo ecológico de série temporal, utilizando dados secundários das plataformas oficiais do Ministério da Saúde entre o período de 2008 a 2020. **Resultados:** observou-se redução dos indicadores número de óbitos (de 28 em 2008 para 9 em 2020), taxa de mortalidade (de 22,0 em 2008 para 7,1 óbitos/100.000 habitantes em 2020) e taxa de letalidade (de 46,74 em 2008 para 9,61 óbitos/1.000 habitantes em 2020). Ainda, verificaram-se linhas de tendência entre 2017-2020 por meio do modelo de regressão logarítmica com pontos de junção. Averiguou-se relevante mudança percentual anual nos indicadores de mortalidade e letalidade, com redução de 59,1% e 73,4%, respectivamente, em 2020, ao comparar-se o valor observado e o esperado. **Conclusão:** os achados permitem conjecturar que o CMaids contribuiu para melhorias dos indicadores de saúde, evidenciando essa como uma estratégia relevante para o enfrentamento do HIV/aids em nível local.

Descritores: HIV. Aids. Mortalidade. Letalidade. Indicadores de Saúde.

RESUMEN

Justificación y objetivo: el síndrome de inmunodeficiencia adquirida (sida) presenta altas tasas de detección y muerte en el estado de Rio Grande do Sul. Para entender mejor esas muertes, en diciembre de 2017, la Secretaría Municipal de Salud de Uruguaiana implementó el Comité de Mortalidad por SIDA (CMaids). El objetivo de este estudio es analizar el impacto de la implementación del CMaids de Uruguaiana a través de los indicadores de salud municipales. **Métodos:** estudio ecológico de series temporales, utilizando datos secundarios de las plataformas oficiales del Ministerio de Salud desde 2008 hasta 2020. **Resultados:** se observó la reducción de los indicadores de número de óbitos (de 28 en 2008 a 9 en 2020), tasa de mortalidad (de 22,0 en 2008 a 7,1 muertes/100.000 habitantes en 2020) y tasa de letalidad (de 46,74 en 2008 a 9,61 muertes/1.000 habitantes en 2020). Además, se verificaron líneas de tendencia entre 2017-2020 a través del modelo de regresión logarítmica con puntos de unión. Se verificó un cambio porcentual anual relevante en los indicadores de mortalidad y letalidad, con una reducción de 59,1% y 73,4%, respectivamente, en 2020, al comparar los valores observados y esperados. **Conclusión:** los resultados permiten conjeturar que el CMaids contribuye a mejorar los indicadores de salud, evidenciando que es una estrategia relevante para la lucha contra el VIH/SIDA a nivel local.

Palabras clave: VIH. Síndrome de Inmunodeficiencia Adquirida. Mortalidade. Letalidade. Indicadores de Salud.

INTRODUCTION

The first case of acquired immunodeficiency syndrome (AIDS) in Brazil dates back to 1983 in the state of São Paulo. At the time, the Ministry of Health (MoH) did not classify the disease as a public health problem, believing that the condition would not become an epidemic in the country.[1] Faced with the lack of effective policies at first, the human immunodeficiency virus (HIV) spread throughout the national territory and, in 2020, surpassed the mark of one million cases reported in the Reporting Diseases Information System (SINAN - *Sistema de Informação de Agravos de Notificação*).[2]

In this context, the South region accounts for 17.8% of national deaths from HIV/AIDS, surpassed only by the Southeast region (57.2%). Furthermore, Rio Grande do Sul (RS) was the state with the highest crude mortality rate from AIDS in 2020 (9.3/100,000 inhabitants), despite the 31.62% reduction in the indicator between 2010 and 2020.[3] In the context of RS, Uruguaiana, a city located in the west of the state, bordering Argentina, is listed as a priority in the fight against HIV/AIDS. The municipality ranked 6th in the national classification of the composite index in 2016, which is calculated taking into account the detection rates, mortality and first CD4 cell count of the last five years.[4] The years 2019 and 2020 were not considered in the ranking, as their composite index is below the hundredth municipality.[3,5] In 2020, the municipality had 26.8 new reported cases per 100,000 inhabitants and a crude mortality rate of 7.1 deaths

per 100,000 inhabitants.[6] Comparing the state of RS, the first municipal indicator is higher than the state, while the second has a lower value (RS data of 21.8 cases/100,000 people and 9.3 deaths/100,000 people). An even greater difference is verified when these rates are compared with the national ones, with 14.1 new infections per 100,000 inhabitants and a mortality of 4.9 deaths per 100,000 inhabitants.[6]

Amidst the local epidemiological situation of HIV/AIDS, in December 2017, the Municipal Department of Health (MDH) of Uruguaiana, based on the positive experiences of the initiative developed in Porto Alegre, implemented the AIDS Mortality Committee (CMaids). This proposal, endorsed by the MoH, aims to develop inter-institutional, intersectoral and multidisciplinary articulation strategies for death prevention.[7] CMaids is composed of health professionals from different levels of care, in addition to professionals from the scientific society, representatives of the movement of people living with HIV/AIDS (PLHIV) and educational institutions.[8]

The referred strategy for coping with HIV/AIDS in the municipal context still lacks further details about its effect, which is possible based on health indicators' temporal analysis. The verification of trends and distribution of health indicators has been used as evidence to demonstrate the effect of policies, programs and actions in public health.[9] Therefore, this study aimed to analyze the impact of CMaids implementation in Uruguaiana through municipal health indicators.

METHODS

This is a quantitative study, with a time series, using secondary data from the official MoH and MDH platforms, between 2008 and 2020, referring to the indicators of Uruguaiana, RS and Brazil.

Uruguaiana has an estimated population of 126,866 inhabitants. It is located in the Campanha Occidental micro-region, in the extreme west of Rio Grande do Sul, and has a Human Development Index (HDI) of 0.744, classified as high.[10] It is located in a free zone on the border with Argentina, connected to the city of Paso de Los Libres by the international bridge over the Uruguay River, hosting the largest dry port in Latin America. Because it belongs to a border region, it represents an important source of HIV transmission, due to the intense flow of people between the two countries. In the state of RS, the municipality is part of a group of fourteen cities that together account for 70% of reports of HIV/AIDS cases, being considered a priority for coping with the disease.[11]

The data used in the study were extracted from the electronic platform of the MoH's Department of Health Surveillance[6], and analyzed in context to the local situation. The information available comes from SINAN-AIDS and the Mortality Information System (SIM).[2]

Health indicators were analyzed in order to demonstrate potential influences of the CMaids training strategy in the municipal context on the HIV/AIDS situation, since these are instruments used to diagnose the community health scenario.[12,13] The indicators listed from 2008 to 2020 were the absolute frequency of AIDS deaths (number of AIDS deaths that occur annually) and the raw mortality coefficients (number of deaths from AIDS/resident population of the municipality) (x 100,000) and fatality from AIDS (number of deaths from AIDS/PLHIV) (x 1,000). Regarding fatality, this indicator is not presented in the aforementioned electronic addresses; however, information from SINAN-AIDS and SIM available on the MoH TABNET platform was used for its elaboration.[2]

In order to verify trends between the cited in-

dicators, a logarithmic regression model with joining points was used using the Joinpoint Regression Program 4.9.0.0 software. This software allows checking any changes in the trend of indicators over time and the statistical significance of this change. Also, the procedure uses the best fit in a fragmented way for the log-linear model in the indicator's trend analysis. The parameters resulting from the analysis were the Annual Percent Change (APC), with its 95% Confidence Interval, and the p-value for each trend, for which values less than or equal to 0.05 were considered statistically significant. A maximum of three inflection points were analyzed. Thus, we sought to identify trends in the period before and after CMaids implementation in the municipality. Also, the trend curves of the logarithmic regression model that preceded the creation of CMaids were used to estimate the expected values for 2020, allowing the comparison of observed and expected values for the year mentioned as well as the calculation of the proportional percentage change that occurred. Analysis allowed for a projection of what would have happened to the historical series if the measures to combat HIV infection had been maintained as in the period prior to CMaids implementation.

This study was developed with public domain data, with no possibility of identifying the research subjects. This research was approved by the Research Ethics Committee of the *Universidade Federal do Pampa* (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration (CAAE) 12237319.0.0000.5323).

RESULTS

The number of AIDS deaths in the municipality of Uruguaiana between 2008 and 2020 showed fluctuations, reaching the highest value in 2010, with 44 deaths (Figure 1). On the other hand, 2020 registered 9 deaths, indicating the lowest value in the series and
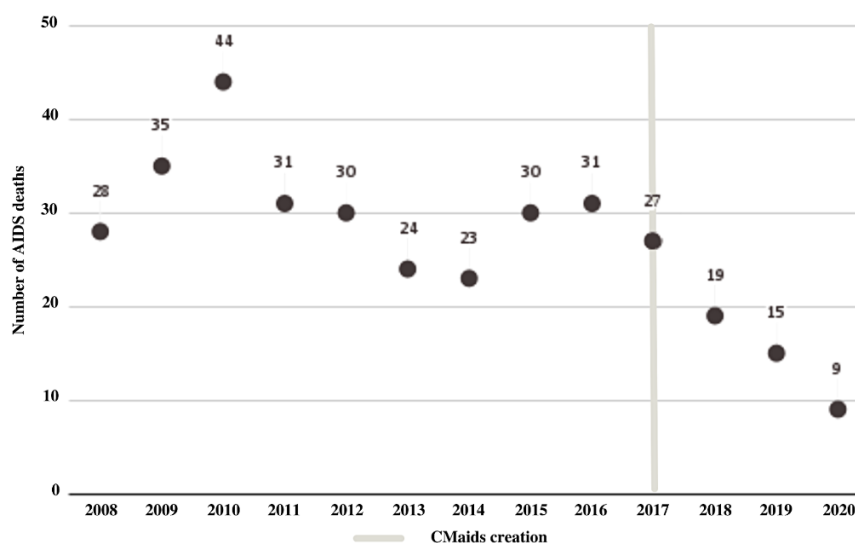
Figure 1. Number of AIDS deaths in Uruguaiana between 2008 and 2020.
Source: Ministry of Health (BR). Indicators and Basic Data on HIV/AIDS in Brazilian Municipalities. 2021. Accessed on 3 Jul 2021.

a ratio almost 5 times lower. During this period, the average number of deaths was 27.9 deaths per year, with a standard deviation (SD) equal to 7.8. Moreover, there are fluctuations in the indicator until 2016, when a downward trend is evident until 2020.

The AIDS-related mortality indicator had a general average of 20.9 deaths/100,000 inhabitants, with SD=7.1 (Figure 2). The maximum and minimum mortality values are, respectively, 35.1 in 2010 and 7.1 in 2020. Three segments of trends were observed: 1 - upward; 2 - downward; and 3 – downward. The model was not statistically significant for the three trends, and the corresponding APC were 12.4, -5.5 and -22.3 for trends 1, 2 and 3, respectively (Table 1). A reduction of 59.1% in 2020 can be seen between the observed value (7.1 deaths/100,000 inhabitants) and the expected value (17.4 deaths/100,000 inhabitants), according to projec-

tions based on trend 2 of the graph shown in figure 2.

The fatality indicator had a general average of 34.8 and SD=15.0, with the highest record in 2010, with 64.61 deaths/1,000 inhabitants, and the lowest, in 2020, with 9.61 deaths/1,000 inhabitants (Figure 3). The AIDS fatality indicator also shows three trends (1 - downward; 2 - stationary; and 3 - downward). For both indicators, mortality and fatality, there was a sharp drop in trend 3, after CMaids implementation. As per Table 1, this model did not demonstrate statistical significance for the three trends, and the APCs were -10.2 from 2008 to 2014, 2.1 from 2014 to 2017, and -32.8 from 2017 to 2020. There was a reduction of 73.4% in 2020, comparing the observed value (9.61 deaths/1,000 inhabitants) and expected value (36.13 deaths/1,000 inhabitants), based on projections according to trend 2 of Figure 3's graph.
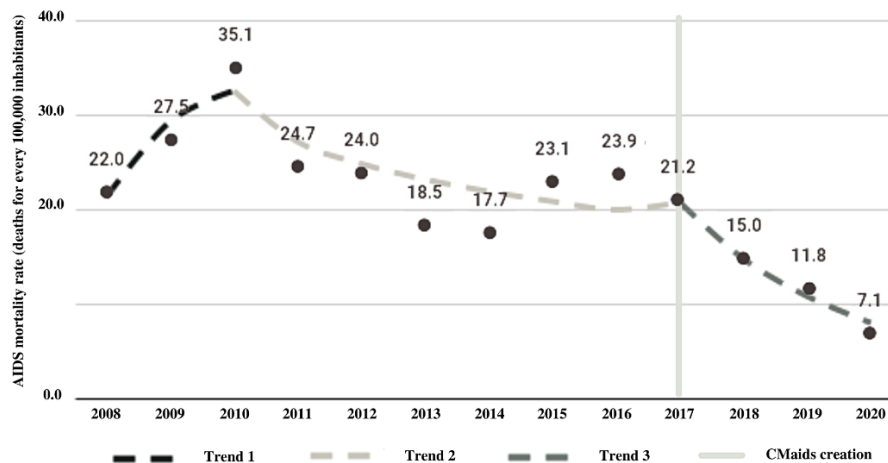
Figure 2. AIDS mortality rate (deaths/100,000 inhabitants) in Uruguaiana between 2008 and 2020. Analysis of trends observed for the indicator in the time series using a logarithmic regression model with join points.

SOURCE: Ministry of Health (BR). Indicators and Basic Data on HIV/AIDS in Brazilian Municipalities. 2021. Accessed on 3 Jul 2021.

Table 1. Comparative analysis of the trends observed in Uruguaiana, between 2008 and 2020, in each of the AIDS mortality and fatality indicators, applying a model of logarithmic regression with join points.

Indicator	Period	APC	Confidence Interval	P-value
AIDS death rate				
Trend 1	2008-2010	12.4	(–30.3 – 81.3)	0.556
Trend 2	2010-2017	-5.5	(–12.9 – 2.5)	0.133
Trend 3	2017-2020	-22.3	(–59.5 – 48.9)	0.364
AIDS fatality rate				
Trend 1	2008-2014	-10.2	(–21.1 – 2.2)	0.086
Trend 2	2014-2017	2.1	(–51.0 – 112.7)	0.944
Trend 3	2017-2020	-32.8	(–61.8 – 18.1)	0.130

APC = Annual Percent Change.
SOURCE: Ministry of Health (BR). Brazilian Health System Database – DATASUS. Accessed on 3 Jul 2021.
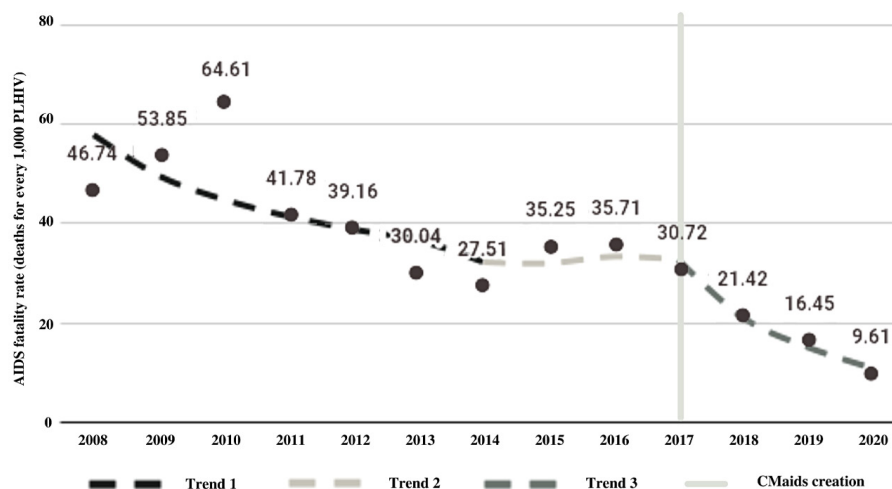
Figure 3. AIDS fatality rate (deaths/1,000 inhabitants) in Uruguaiana between 2008 and 2020. Analysis of trends observed for the indicator in the time series using a logarithmic regression model with join points

SOURCE: Ministry of Health (BR). Brazilian Health System Database - DATASUS. Accessed on 3 Jul 2021.

DISCUSSION

The findings of this research do not demonstrate, with statistical significance, that CMaids implementation in the municipality of Uruguaiana, from the end of 2017, influenced the reduction of indicators related to deaths from HIV/AIDS. However, it can be seen that the number of deaths from AIDS as well as the mortality and fatality indicators showed significant reductions, in addition to identifying downward trends in the post-CMaids period.

The number of deaths from AIDS and the coefficient of mortality from AIDS estimate the risk of death from this disease, and scale the magnitude of the disease as a public health cocnern.[12,14] The mortality data observed throughout the time series from 2008 to 2020 demonstrate that the city has significant values, reflecting the disease's epidemiological context. This corroborates the need for strategic actions to face HIV/AIDS by the municipality, which in 2015 signed the Paris Declaration, committing itself to advances in local epidemic's knowledge and response acceleration to the infection.[11]

The context of the investigated municipality still has the particularity of being located in a border region characterized by high HIV transmission due to the intense mobility of people, the high demand for sex workers and drug trafficking and use.[15,16] The displacement of individuals hinders the follow-up of care, and care for transient populations is carried out in times of emergency, making reception in primary care limited.[17] Therefore, HIV infection is facilitated both for residents and for those who just transit through the region, and treatment for individuals without a fixed address is made difficult, maintaining the transmission cycle.[16, 18]

It should be mentioned that AIDS mortality in Brazil tends to stabilize, which is evidenced by standardized death rates practically unchanged since 2007.[4] However, this scenario at the national level masks a complex and heterogeneous epidemiological situation, due to region-al and local contexts presenting specificities.[19] A study developed by Anderson *et al.* emphasizes, as one of its conclusions, that the definition of goals and assessment of indicators for the HIV/AIDS epidemic control must be carried out at the local level, in order to define more effective public policies.[20, 21]

Considering the above, one of the municipal programmatic actions is the implementation of committees for the investigation of deaths from HIV/AIDS, in order to reduce the occurrence of deaths from AIDS that are considered preventable, which has been carried out by the MDH in Uruguaiana.[7] This action aims to assess particularities of deaths from HIV/AIDS, making it possible to outline strategies for surveillance and assistance to PLHIV, in order to achieve a more satisfactory performance by the municipality in reducing deaths, with the integration of the sectors provided by CMaids, through the multidisciplinary discussion of the cases, enabling a better understanding of the weaknesses of comprehensive care actions for individuals with HIV.[22]

The scientific literature still lacks information on the benefit of the strategy of creating committees to investigate deaths from HIV/AIDS at the municipal level. Based on this, a temporal analysis of health indicators related to the disease under study was developed, and such a methodology is conducive to comparing cuts in different times and, consequently, the impact of CMaids.[9] Through the developed analyses, the AIDS mortality and fatality indicators point to the existence of distinct trends across the entire time series. Mortality data showed upward trends between 2008 and 2010, stabilization between 2010 and 2017, and a downward between 2017 and 2020. For fatality, there was a downward trend (2008-2014), stabilization (2014-2017) and sharp reduction (2017-2020).

Some strategies to combat HIV at the federal level, such as making available the rapid HIV test and "test and treat", which began in 2013 in Uruguaiana as well as local

health education and awareness campaigns about HIV, which have been contributing to the reduction of these indicators, may have influenced trends 1 and 2 observed in both indicators.[23,24] However, the aforementioned initiatives have shown increasing signs of exhaustion, especially in a context of inequality in the response to HIV.[25] This fact can be seen in trend 2, where APC for mortality is only -5.5, and, for fatality, 2.1, which shows braking movements of the reduction of the referred coefficients.

On the other hand, from 2017, the year CMaids was implemented, trend 3 changed drastically. The reductions verified in the number of deaths and in the mortality and fatality coefficients, from 2017, may reflect CMaids implementation and the execution of its activities over time. Some of the findings that corroborate this are: i) lower number of AIDS deaths occurred between 2018 and 2020, with successive reductions; ii) verification of trends with reduction of mortality and fatality indicators for the post-CMaids period (2017-2020), in which the most expressive negative values of APC are found; iii) reduction of 59.1% and 73.4% in 2020 between the observed and expected value, according to projections based on trend 2, for mortality and fatality, respectively.

Some of the limitations of this research include the use of secondary data available in the MoH and MDH databases. Although the official government platforms have high reliability in relation to the information made available, it is inherent to the information systems used and to health surveillance activities that there are some weaknesses, such as underreporting of records of cases and deaths due to HIV/AIDS. Another limitation worth mentioning is the period of time analyzed. Although the total time series is composed of 13 years, the gap after CMaids implementation is small, corresponding to 2017-2020 only. Therefore, this may have limited the power of the comparisons made. Finally, it is important to point out that a direct cause and effect relationship cannot be established between the activities carried out by CMaids and the best levels observed in the analyzed indicators. Several actions have been developed by the MDH to face HIV/AIDS. However, it is understood that CMaids was one of the factors that contributed to improvement the indicators, since the activities carried out by this collegiate promote a broad and longitudinal look at PLHIV care.

The findings of this study made it possible to analyze the potential contribution of CMaids implementation in a border municipality in its health indicators. The results referring to the number of deaths from AIDS and the expressive values APC in the mortality and fatality coefficients in the period 2017-2020 are evidence that allow conjecturing the influence of CMaids in coping with the problem in question. It should be noted that the aforementioned strategy was not applied in isolation, since other measures that make up combined prevention are developed in the local context. Future studies should explore the contribution of CMaids through the analysis of other health indicators, in addition to those already explored here, and for longer periods as well as the characterization and investigation of AIDS death

records. Finally, the creation of CMaids has been shown to be a relevant strategy for coping with HIV/AIDS at the local level, being one more element to be considered by health managers in municipalities with high rates of the aforementioned condition.

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Lucas Pitrez Mocellin, **Beatriz Herbst Sanday**, **Maria Eduarda Grutzmacher** and **Pedro Henrique Drehmer de Vargas** contributed to article planning and design, review and final approval;

All authors participated in the writing or critical review of the manuscript's intellectual content and approved the final version to be published. All authors declare responsibility for the elements of this work, including the guarantee of accuracy and completeness. All authors approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

Revista de Epidemiologia e Controle de Infecção

ORIGINAL ARTICLE

Factors associated with vertical transmission of syphilis in a city in the State of São Paulo

Fatores associados à transmissão vertical de sífilis em um município do Estado de São Paulo

Factores asociados a transmisión vertical de sífilis en una ciudad del Estado de São Paulo

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ABSTRACT

Background and Objectives: Syphilis is a sexually transmitted infection with low-cost and accessible treatment; however, it is considered a public health problem. Further studies are needed to improve knowledge about the factors that may contribute to the mother-to-child transmission of syphilis. Given its high detection rate in pregnant women and the possible adverse events of syphilis in Brazil, the objective was to evaluate the association of individual and clinical characteristics of syphilis with the incidence of congenital syphilis in pregnant women. **Methods**: This retrospective study was performed in a medium-size municipality in the State of São Paulo. Notification forms from the Notifiable Diseases Information System were used and the occurrence of congenital syphilis was the outcome of the study. Bivariate analyses and logistic regression were performed with variables that obtained *p values* <0.25. **Results**: Most pregnant women were 20-34 years old (62.2%) and had white skin (63.2%) and incomplete elementary schooling (35.4%). The occurrence of congenital syphilis was associated with the maternal syphilis diagnosis (p<0,001) and with not performing the treponemal test during the prenatal examination (*p* =0.014). There was a greater risk for the occurrence of congenital syphilis in cases with late diagnosis during pregnancy (OR=16.48; 95%CI 3.22-84.26) and tertiary/latent clinical classification (OR=7.62; 95%CI 1.40-41.54). **Conclusion**: Maternal diagnosis in the third trimester of pregnancy and tertiary/latent clinical classification were the main risk factors for the occurrence of congenital syphilis, reinforcing the importance of a quality prenatal examination performed timely.

Keywords: Sexually transmitted infections. Pregnancy. Congenital syphilis. Risk Factors. Public Health..

RESUMO

Justificativa e Objetivos: A sífilis é uma Infecção Sexualmente Transmissível, com tratamento de baixo custo e acessível; porém, ela é considerada um problema de saúde pública. Para aprimorar o conhecimento sobre os fatores

que podem contribuir para transmissão vertical da sífilis, mais estudos são necesários. Diante da elevada taxa de detecção em gestantes e dos possíveis eventos adversos da sífilis no Brasil, o objetivo foi avaliar a associação das características individuais e clínicas de sífilis com a incidência de sífilis congênita em gestantes. **Métodos:** Este esudo retrospectivo foi realizado em um município de médio porte no Estado de São Paulo. Foram usadas as fichas de notificação do Sistema de Informação de Agravos de Notificação e o desfecho do estudo foi a ocorrência de sífilis congênita. Foram realizadas análises bivariadas e regressão logística com as variáveis que obtiveram valores de *p*<0,25. **Resultados:** As maioria das gestantes tinha 20-34 anos (62,2%), era branca (63,2%), com escolaridade fundamental incompleta (35,4%). A ocorrência de sífilis congênita esteve associada ao diagnóstico de sífilis materno no terceiro trimestre de gestação (*p*<0,001) e com a não realização de teste treponêmico durante o pré-natal (*p*=0,014). Houve maior risco para a ocorrência de sífilis congênita os casos com diagnóstico tardio na gestação (OR=16,48; IC95% 3,22-84,26) e classificação clínica terciária/latente (OR=7,62; IC95% 1,40-41,54). **Conclusão:** Os principais fatores de risco para ocorrência de sífilis congênita foram o diagnóstico materno no terceiro trimestre de gestação e classificação clínica terciária/latente, reforçando a importância de um exame pré-natal de qualidade e em tempo oportuno.

Palavras-chave: Infecções sexualmente transmissíveis. Gravidez. Sífilis Congênita. Fatores de Risco. Saúde Pública.

RESUMEN

Justificación y objetivos: La sífilis es una Infección de Transmisión Sexual con tratamiento accesible y de bajo coste, sin embargo, es considerada un problema de salud pública. Se necesitan más estudios para mejorar el conocimiento sobre los factores que pueden contribuir a la transmisión maternoinfantil de la sífilis. Dada su alta tasa de detección en gestantes y los posibles eventos adversos de la sífilis en Brasil, el objetivo fue evaluar la asociación de las características individuales y clínicas de la sífilis con la incidencia de sífilis congénita en gestantes. **Métodos:** Estudio retrospectivo realizado en una ciudad de mediano porte del Estado de São Paulo. Fueran utilizados formularios de notificación obligatoria del Sistema de Información de Enfermedades de Declaración Obligatoria y el desenlance fue la ocurrencia de sífilis congénita. Se realizaron análisis bivariados y regresión logística con las variables que obtuvieron p-value<0,25. **Resultados:** La mayoría de las mujeres embarazadas tenían entre 20 y 34 años (62,2%), eran blancas (63,2%), con instrucción primaria incompleta (35,4%). La aparición de sífilis congénita se asoció con el diagnóstico de sífilis materna en el tercer trimestre del embarazo (p<0,001) y con la no realización de prueba treponémica durante el prenatal (p=0,014). Hubo un mayor riesgo de sífilis congénita en los casos diagnosticados tardíamente en el embarazo (OR=16,48; IC95% 3,22-84,26) y clasificación clínica terciaria/latente (OR=7,62; IC95% 1,40-41,54). **Conclusiones:** Los principales factores de riesgo de aparición de sífilis congénita fueron el diagnóstico materno en el tercer trimestre de gestación y la clasificación clínica terciaria/tardía, lo que refuerza la importancia de una atención prenatal de calidad y oportuna.

Palabras clave: Enfermedades de Transmisión Sexual. Embarazo. Sífilis Congénita. Factores de Riesgo. Salud Pública.

INTRODUCTION

Syphilis is a sexually transmitted infection (STI) caused by the bacterium *Treponema pallidum*; when syphilis affects pregnant women, vertical transplacental transmission can occur if it is inadequately treated or not treated.[1,2] Vertical transmission can occur throughout the gestational period; however, the more recent the infection, the greater the chances of transmission.[2] Syphilis in pregnant women (SPW) can result in adverse effects such as miscarriage, prematurity, stillbirth, and congenital syphilis (CS).[1,2]

In addition to the problem of treating patients with CS, late prenatal care or inadequately performed, failure to perform the indicated diagnostic tests, and non-treatment (or inadequate treatment) of sexual partners are risk factors.[3-5] Social and behavioral determinants of maternal health (such as low schooling, social exclusion, drug use, early initiation of sex life, early pregnancy, high number of sexual partners, presence of other STIs, and non-use of condoms during sexual practice) are also considered risk factors for the occurrence of CS.[6] In women smokers, an increase in the chance of vertical transmission of syphilis may occur because smoking affects the placental barrier.[7]

Syphilis is considered an infection that can be controlled in Primary Health Care (PHC); therefore, early access of pregnant women to prenatal care and preventive measures against CS are necessary. According to the Ministry of Health (MH), the serological screening for syphilis should be carried out with rapid treponemal and non-treponemal tests (VDRL) in the first and third trimesters of pregnancy and before delivery or curettage.[8] Although treatment for syphilis is inexpensive, the incidence and transmission rates of the disease remain high and increasing and CS is a serious global public health problem.[6]

A study evaluated the global prevalence of SPW and CS based on data from the World Health Organization and identified that in 2016 the total number of CS cases was 661,000, and 355,000 (53.7%) of them resulted

in adverse events.[9] In this scenario, Brazil also has a large number of cases, being among the countries considered a high priority for the control of CS.[10] According to the Health Surveillance Department in MS (2021), Brazil accounted for 74,095 notifications of SPW and 27,019 of CS, which resulted in 192 notifications of death from the infection.[8] Of this total, the State of São Paulo was responsible for 14,957 notifications of SPW and 3,926 of CS, which resulted in 28 death notifications.[8] As for the epidemiological profile, a higher incidence of CS occurred in babies whose mothers were mostly 20-29 years old and had incomplete primary education and brown skin.[8]

More studies are needed to improve knowledge about the factors that can contribute to vertical transmission of syphilis. Given the high detection rate of SPW and possible adverse events in Brazil, the objective of this study was to evaluate the association between individual and clinical characteristics of syphilis during pregnancy and the incidence of congenital syphilis.

METHOD

This retrospective study was performed based on secondary data found in SPW and CS notification forms available in the Notifiable Diseases Information System (SINAN).

This study was performed in a medium-size city in the State of São Paulo, whose health system was composed of 36 Health Units of APS (four Family Health Units and 32 Basic Health Units), divided into four Health regions. In addition, this city is equipped with a Test and Follow-up Center and eight outpatient services, including the Women's Health Outpatient Clinic and two public hospitals. According to a study performed, an increase in the number of reported cases of SPW and CS occurred in the period 2013-2017;[11] according to DATASUS, the city notified 19 cases of SPW and 20 of CS in 2021.[12]

The study population consisted of all cases of SPW and CS (including abortions, deaths from CS, and stillbirths) reported in the city from January 2013 to December 2017, and the presence/absence of CS notified by SINAN was considered as the outcome. In this period, notification of abortion due to syphilis did not occur in the city. All patients living in the city confirmed by an investigation by the Epidemiological Surveillance (ES) and registered in the SINAN database were included. Patients who did not live in the city, those discarded by the ES after investigation, and/or without final classification/evolution were excluded from the sample. Figure 1 shows the database composition and the final sample size after applying the exclusion criteria.
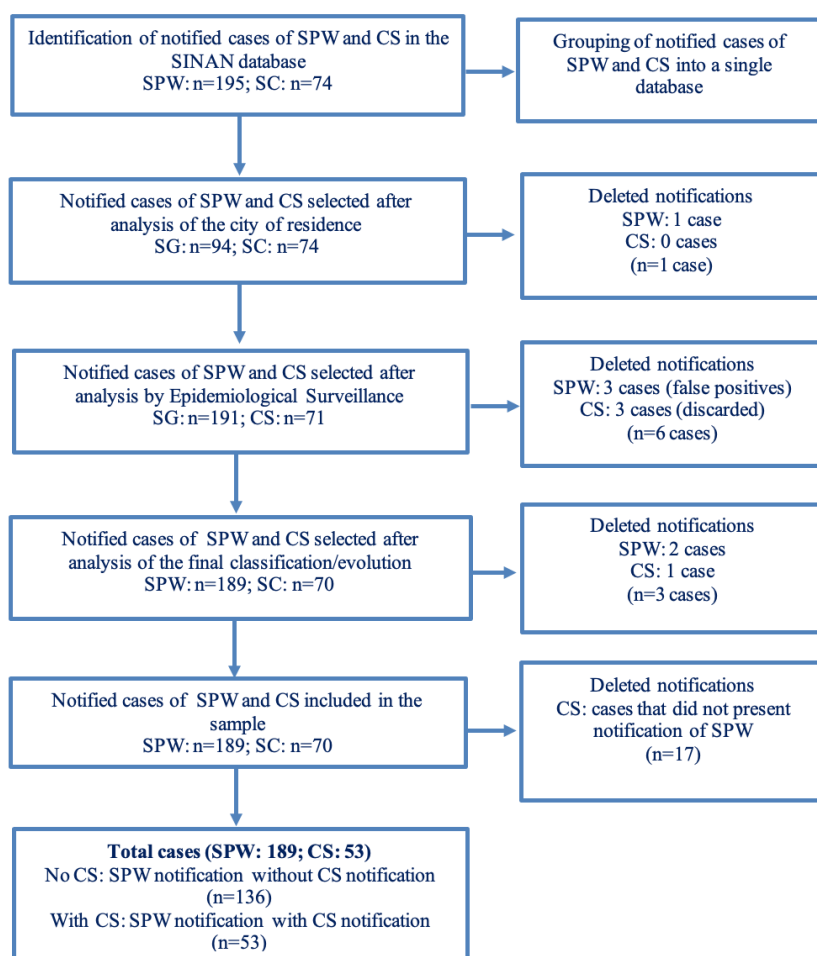

Figure 1. Flowchart of composition of the database used in the study from the SINAN notification forms and final sample size after applying the exclusion criteria (2022).

Data were collected by a researcher at the Department of Epidemiological Surveillance of the city. To facilitate data collection from the notification forms, Microsoft Access® forms were used with sociodemographic information referring to the diagnosis and follow-up of the reported cases of SPW and CS. Based on the CS cases notification forms, we sought maternal data that would allow us to merge the notification information into a single database, containing the SPW cases that had resulted in a CS case notified to the ES. To ensure the confidentiality of participants, merging was carried out in the same place of data collection; personal information that made it possible to identify the cases was not collected.

The presence of CS (dependent variable) was considered as an outcome of the study. According to the MH, the following items were considered CS cases: (i) infant, miscarriage, or stillbirth of a mother with clinical evidence and/or non-treponemal serology reactive for syphilis (under any titration, in the absence of confirmatory treponemal testing performed prenatally, curettage, or delivery) that has not been treated or the treatment has been inadequate; (ii) children under 13 years of age who presented a reactive non-treponemal test after six months of age and/or with ascending titers and/or non-treponemal test with a titer higher than the maternal titer, and (iii) evidence of *Treponema pallidum* in the placenta, umbilical cord and/or lesion sample, biopsy, or necropsy from the miscarriage, stillbirth, or infant.[8]

The independent variables used are presented in table 1.

For logistic regression analysis, the independent variables were grouped into (i) sociodemographic (maternal age and race/skin color of the pregnant woman) and (ii) clinical (gestational age, clinical classification, treponemal test in the pre-birth period, and partner treatment) variables.

Initially, descriptive analyzes were performed to identify the epidemiological profile of the reported cases of CS and SPW. Then, bivariate analysis was performed between the study outcome and the independent variables related to reported cases of SPW (chi-square and Fisher's exact tests). In the bivariate analysis, variables with $p \leq 0.25$ were included in the logistic regression model. For regression modeling, the sociodemographic and clinical blocks were considered; however, the literature[6,11] highlights that skin color (brown or black) is part of the cases of syphilis in pregnant women; therefore, we considered this variable in the analyzed models, even when it did not show statistical significance in the crude regression analysis.

The odds ratio (OR) was the measure of association obtained; a confidence interval of 95% (CI 95%) and a significance value of 5% were adopted. All analyzes were performed using the *Statistical Package for the Social Sciences* (SPSS, v.20.0) *software*. The 17 cases of CS without notification of SPW were excluded from the other (bivariate and logistic regression) analyses and the notification data were considered only for the epidemiological profile of CS.

Following the Ethical Norms and Guidelines of the National Health Council (Resolution 466/2012) of the MH, the study was approved by the Research Ethics Committee (09/27/2017; opinion 2,301,436; CAAE 74247317.5.0000.5418).

Table 1. Independent variables of reported cases of syphilis in pregnant women (SPW) and congenital syphilis (CS) used in the statistical analysis.

Variables	Categories	Notification sheets
Maternal age (years)	14-19, 20-34, ≥35	Pregnant woman
Gestational period	1st, 2nd, and 3rd trimesters	Pregnant woman
Pregnant woman's skin color	White and Non-White (Brown/Black/Yellow/Indigenous)	Pregnant woman
Schooling	Incomplete elementary school (1st-4th grades incomplete, 1st-4th grades completed, and 5th-8th grades incomplete); complete elementary school (5th-8th grades completed and incomplete secondary education), and completed secondary education (complete secondary education, incomplete higher education, and completed higher education)	Pregnant woman
Clinical classification	Primary, secondary, tertiary, latent	Pregnant woman
Non-treponemal test in the prenatal period	Reactive, non-reactive	Pregnant woman
Titer	< 1/8, 1/8 - 1/32, >1/64	Pregnant woman
Treponemal test in the prenatal period	Reactive, non-reactive, not performed	Pregnant woman
Treated partner	Yes, no	Pregnant woman
Age as reported (days)	0-2, 3-10, >10	Congenital
Sex	Male, female	Congenital
Child' skin color	White and Non-white (Brown/Black/Yellow/Indigenous)	Congenital
Mother underwent prenatal examination	Yes, no	Congenital
Diagnosis of maternal syphilis	During the prenatal period, at delivery/curettage	Congenital
Maternal treatment	Adequate, inadequate, not performed	Congenital
Evolution of the case	Alive, death due to congenital syphilis, stillbirth	Congenital

Source: Ministry of Health[8]

RESULTS

The epidemiological profile of reported cases of SPW was composed of women aged 20-34 years, white race/skin color, incomplete primary education, and diagnosed with syphilis in the first trimester of pregnancy. A large number of cases was observed with tertiary/latent clinical classification, reactive non-treponemal test in prenatal examination (with titer up to 1/32), and reactive treponemal test in prenatal examination. Partner treatment was not performed in 43.0% of cases.

In the bivariate analysis, the occurrence of CS was associated with maternal diagnosis performed in the third trimester of pregnancy ($p<0.001$) and non-performance of the treponemal test in the prenatal period ($p=0.014$) (Table 2).

During the study period, the city had 70 cases of CS; however, SPW reports were not identified in 17 cases. Of the 189 SPW cases notified during the study period, 53 pregnant women had CS notification as the outcome.

The epidemiological profile of reported cases of CS was composed of white male children and mothers who underwent prenatal care diagnosed with syphilis during the prenatal period and were inadequately treated (Table 3).

From the adjusted logistic regression, it was possible to observe that diagnosis of syphilis in the third trimester and tertiary/latent clinical classification in reported cases of SPW presented a higher risk for the CS outcome (Table 4).

Table 2. Profile distribution of syphilis in pregnant women cases notified in a city in the State of São Paulo and factors associated with congenital syphilis (CS) outcome in the period 2013-2017.

Variables	Total* n (%)	Without CS n (%)	With CS n (%)	p
Maternal age (years)				
14-19	50 (26.6)	36 (26.7)	14 (26.4)	0.101[1]
20-34	117 (62.2)	88 (65.2)	29 (32.9)	
≥35	21 (11.2)	11 (8.1)	10 (18.9)	
Gestational Period				
First trimester	78 (48.1)	69 (58.5)	9 (20.5)	<0.001[1]
Second trimester	35 (21.6)	25 (21.2)	10 (22.7)	
Third trimester	49 (30.2)	24 (20.3)	25 (56.8)	
Skin color				
White	96 (63.2)	72 (66.1)	24 (55.8)	0.238[1]
Non-white	56 (36.8)	37 (33.9)	19 (44.2)	
Education				
Incomplete Elementary	29 (35.4)	21 (33.9)	8 (40.0)	0.808[1]
Complete Elementary	28 (34.1)	21 (33.9)	7 (35.0)	
Complete medium or higher	25 (30.5)	20 (32.3)	5 (25.0)	
Clinical classification				
Primary	42 (40.4)	35 (44.9)	7 (26.9)	0.113[2]
Secondary	13 (12.5)	11 (14.1)	2 (7.7)	
Tertiary/Latent	49 (47.1)	32 (41.0)	17 (65.4)	
Non-treponemal test in the prenatal period				
Reactive	184 (97.9)	130 (97.0)	54 (100.0)	0.580[2]
Non-reactive	4 (2.1)	4 (3.0)	0 (0.0)	
Non-treponemal test titre (prenatal)				
≤1/32	96 (52.2)	69 (53.1)	27 (50.0)	0.704[1]
>1/32	88 (47.8)	61 (46.9)	27 (50.0)	
Treponemal test (prenatal)				
Reactive	122 (78.2)	95 (84.1)	27 (62.8)	0.014[2]
Non-reactive	8 (5.1)	4 (3.5)	4 (9.3)	
Not performed	26 (16.7)	14 (12.4)	12 (27.9)	
Treated partner				
Yes	81 (57.0)	61 (61.6)	20 (46.5)	0.095[1]
No	61 (43.0)	38 (38.4)	23 (53.5)	

*Source: survey data. *Some variables did not total n=189 due to ignored (9: notification form) or incomplete information 1 Independent chi-square test;2 Fisher's exact test (p<0.05).*

Table 3. Sociodemographic and clinical characteristics of congenital syphilis (CS) cases notified in a city in the State of São Paulo in the period 2013-2017 (n=70).

Variables	Frequencies *	%
Child's age (days)		
0-2	24	35.3
2-10	16	23.5
>10	28	41.2
Child's gender		
Masculine	36	51.4
Feminine	34	48.6
Child's skin color		
White	28	62.2
Black	3	6.7
Yellow	1	2.2
Brown	13	28.9
Mother performed prenatal		
Yes	59	92.2
No	5	7.8
Maternal diagnosis		
During prenatal exam	52	82.5
Childbirth/curettage	11	17.5
Maternal treatment		
Adequate	2	3.2
Inappropriate	48	76.2
Unrealized	13	20.6
Case evolution		
Alive	54	83.1
Death from syphilis	5	7.7
Stillbirth	6	9.2

*Source: survey data. * Some variables did not total n=70 due to missing information (9: notification form) or not completing it.*

DISCUSSION

The epidemiological profile of SPW was composed of pregnant women aged 20-34 years, incomplete primary education, and white skin color; the CS profile was composed of white children, with mothers who underwent prenatal care, and had treatment considered inadequate. The occurrence of CS was associated with maternal diagnosis performed in the third trimester of pregnancy and presence of a reactive treponemal test during pregnancy; from the adjusted analysis, however, late maternal diagnosis (third trimester of pregnancy) and tertiary/latent clinical classification were the main associated factors.

In this study, sociodemographic variables (age group, education, and skin color) were not statistically associated with the occurrence of CS. Even so, the predominant age group was similar to that found in other Brazilian studies;[13-15] this may reflect vulnerability related to "age and emotional immaturity" (especially with 20-24 years old), influence of social groups, early onset of sexual life, and not using condoms during sexual intercourse.[16] As for education, the lack of association with the outcome may be a consequence of the number of forms without information (or with ignored information), as well as the sample size. Data from the study "Born in Brazil"[15] point to low education as a risk factor for CS; according to a study preformed in Rio de Janeiro,[17] the risk of having a baby with syphilis doubled among women with incomplete primary education. Furthermore, a lower educational level is related to lower access to information and understanding of IST prevention measures during pregnancy.[16]

In the bivariate analysis, an association between non-white skin color and the occurrence of CS was observed. Data presented by the MH,[8] studies conducted in Itapeva,[18] and national studies[14] identified that the profile of women affected by syphilis during pregnancy was predominantly composed of women with black or brown skin color. These data reinforce the importance of considering racial inequalities and their influence on health determinants, which may reflect racial inequalities in health along with schooling. In this context, both health professionals responsible for prenatal care and managers should pay attention to these variables, as well as to their impact on health, especially in the CS outcome.

Most of the notified pregnant women were diagnosed with syphilis in the first trimester of pregnancy, but the occurrence of CS was associated with the maternal diagnosis in the third trimester of pregnancy. These results agree with a study conducted in Joinville (SC), which used data from the Informatics Department of the Unified Health System (DATASUS) and identified a high percentage of pregnant women with diagnosis and notification of SPW in the third trimester of gestation.[19] According to the authors, this situation may be related to greater demand by pregnant women for health services at this stage of pregnancy and often in the late start of prenatal care or an insufficient number of consultations in the prenatal period.[19] Although the delineation of the present study does not allow inferring that the late diagnosis identified is related to the late start of prenatal care (information such as date of start of the prenatal examination, gestational age at the first consultation, and number of consultations performed are not present in the SPW and CS notification forms), we reinforce the importance of a quality prenatal exam at the beginning of pregnancy to avoid cases of CS. Furthermore, this finding reinforces the importance of planning and adopting strategies by health services not only for uptake and early diagnosis of syphilis during pregnancy but also for adequate treatment and follow-up, thus reducing the risk of vertical transmission and the occurrence of adverse events.[16,20]

Many pregnant women were notified with tertiary/latent clinical classification followed by the primary classification, as occurred in the study performed in Campo Grande;[21] this study also identified that most women had this clinical classification. A study performed in Goiás[22] found a high percentage of cases classified as primary cases; their authors highlighted that their data suggest a possible failure in the classification due to the difficulty in performing the primary diagnosis of syphilis, especially

Table 4. Logistic regression of sociodemographic and clinical factors for the congenital syphilis outcome in a city in the State of São Paulo in the period 2013-2017.

Variables	Not adjusted OR (IC 95%)	p	Adjusted (Model 1) OR (IC 95%)	p	Adjusted (Model 2) OR (IC 95%)	p	Adjusted (Model 3) OR (IC 95%)	p	Adjusted (Final model) OR (IC 95%)	p
AGE (years)										
14-19	2.11 (0.53-8.35)	0.288	0.79 (0.13-4.62)	0.794	-	-	-	-	-	-
20-34	2.29 (0.63-8.34)	0.207	0.59 (0.11-3.11)	0.532	-	-	-	-	-	-
≥35	1	-	-	-	-	-	-	-	-	-
AGE (years)										
1st trimester	1	-	1	-	-	-	1	-	1	-
2nd trimester	2.99 (1.09-8.18)	0.034	7.96 (2.15-29.45)	0.002	-	-	2.54 (0.45-14.23)	0.290	2.12 (0.46-9.80)	0.335
3rd trimester	8.10 (3.32-19.76)	0.000	19.70 (5.36-72.40)	0.000	-	-	8.04 (1.27-50.91)	0.027	16.48 (3.22-84.26)	0.001
MOTHER'S SKIN COLOR										
White	1	0.253	1	-	-	-	1	-	1	-
Brown/Black/Indigenous	1.52 (0.74-3.11)	-	3.11 (1.17-8.30)	0.023	-	-	5.64 (1.23-25.84)	0.026	3.04 (0.85-10.89)	0.088
CLINICAL CLASSIFICATION										
Primary	1	-	-	-	1	-	-	-	1	-
Secondary	0.90 (0.16-5.03)	0.913	-	-	0.91 (0.12-6.87)	0.924	17.08 (0.89-328.68)	0.060	3.87 (0.41-36.51)	0.237
Tertiary/Latent	2.65 (0.97-7.24)	0.056	-	-	2.27 (0.59-8.75)	0.234	15.46 (1.40-169.79)	0.025	7.62 (1.40-41.54)	0.019
PRENATAL TREPONEMIC TEST										
Non-reactive	1	-	-	-	1	-	-	-	-	-
Reactive	0.35 (0.09-1.41)	0.142	-	-	0.38 (0.06-2.22)	0.281	-	-	-	-
Not performed	1.07 (0.23-4.92)	0.929	-	-	1.03 (0.13-8.24)	0.980	-	-	-	-
TREATED PARTNER										
Yes	1	-	-	-	1	-	-	-	-	-
No	1.80 (0.87-3.70)	0.111	-	-	0.89 (0.29-2.79)	0.848	0.73 (0.16-3.36)	0.691	-	-

Source: survey data

OR: Odds Ratio adjusted for variables with p<0.25

Model 1: maternal age, gestational age, and maternal skin color (p<0.05)

Model 2: clinical classification, antenatal treponemal testing, and partner treatment (p< 0.05)

Model 3: gestational age, maternal skin color, clinical classification, and partner treatment (p<0.05)

Final model: gestational age, maternal skin color, and clinical classification (p<0.05)

in pregnant women. The diagnosis of primary syphilis during pregnancy is rare because this clinical classification depends on the presence of hard chancre, which has a short duration;[23] thus, we believe that most diagnoses occur in the latent or late phase.[19,23,24] In the present study, 38.8% of the notification forms had the clinical classification field "no information or ignored" (data not shown). This lack of information on the clinical classification was also evidenced in the literature,[13,19,21,22] showing the importance of adequate classification and correct completion of the notification forms, thus contributing not only to the treatment definition but also to research and follow-up of reported cases.

A high proportion of untreated partners was observed; although the above association was not statistically significant, the adoption of strategies in health services to welcome and monitor partners during the prenatal period is fundamental. Some studies[13,19,20] observed considerable percentages (41, 61, and 83%, respectively) of untreated partners. Although the percentage found in the present study was lower than that found in the literature, our data reinforce that the treatment of sexual partners is an important obstacle to the reduction of CS cases, as there is a risk of reinfection in those who were not treated (or treated inappropriately) even with early diagnosis and treatment of pregnant women.[16]

The maternal epidemiological profile data present in the CS notification forms showed that 90% of the women underwent prenatal care and the diagnosis was made at that time; however, most of them presented a treatment considered inadequate. This fact conflicts with the studies carried out in Joinville (SC)[16] and Goiás[22] and draws attention, as it was not effective in preventing the CS outcome even when the diagnosis was made during the prenatal period. It is worth remembering that the CS outcome is a prenatal care marker; thus, further studies in the city to assess the quality of care and identify the reasons and/or gaps in this assistance are necessary.

This study presented the identification of the CS outcome only from the notifications made to the ES and the use of secondary data obtained from the SPW and CS notification forms as limitations; they presented many unfilled fields or fields with ignored information, reducing the number of information important for the study. Despite these limitations, the results obtained evidenced the need to identify the risk factors and health conditions, and determinants of pregnant women, so that planning actions involving the population, health professionals, and managers be possible, especially in APS.

The findings pointed to the diagnosis of syphilis in the third trimester of pregnancy and the tertiary/latent clinical classification as the main risk factors for the occurrence of CS. Therefore, investment in actions and policies that include not only early diagnosis and treatment during pregnancy but also actions that involve investigations even during pregnancy and/or maternity is essential to reduce cases of CS so that possible gaps and points for improvement in prenatal care are better understood and can be discussed with teams and managers.

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AUTHOR CONTRIBUTIONS

Natália Caroline Serra Santana and **Carolina Matteussi Lino** contributed to the conception, design, analysis, writing, and final acceptance of the manuscript. **Andréa Tenório Correia da Silva** contributed to the design, review, and final acceptance of the manuscript. **Marília Jesus Batista** contributed to the planning, design, review, and final acceptance of the manuscript.

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

REVIEW ARTICLE

Alcohol preparation consumption for hand hygiene in outpatient clinics and Day Hospitals: an integrative review

Consumo de preparação alcoólica para higienização das mãos em ambulatórios e Hospitais-Dia: revisão integrativa

Consumo de preparados alcohólicos para higiene de manos en Hospitales-Día y ambulatorios: revisión integradora

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ABSTRACT

Background and Objective: the alcoholic preparation consumption indicator is a measure that can help monitor compliance with hand hygiene, however there is no guidance regarding the profile for application of consumption reference published by the World Health Organization for many health institutions. Thus, the study sought information available in scientific literature to support the definition of alcohol preparation consumption for hand hygiene in outpatient clinics and Day Hospitals. **Method:** an integrative review for the period between 2010 and 2021, conducted in the Scopus, Web of Science, SciELO, PubMed/MEDLINE, Cumulative Index to Nursing and Allied Health Literature, Database on Nursing and Latin American and Caribbean Literature on Health Sciences databases, through the Virtual Health Library. Five articles were selected, being divided into two categories: Milliliters of alcoholic preparation for each hand hygiene, identifying the expected average volume of 3 ml, and Consumption of alcohol-based hand rub per patient-day, observing the prevalence of studies in general hospitals. A study brought the perspective regarding consumption in a Nursing Home. **Conclusion:** in the review, no articles related to outpatient clinics and Day Hospitals were found. The selected studies demonstrate that alcohol preparation consumption for hand hygiene is different depending on the profile of the sector and the patient treated and that both the minimum volume for each hand hygiene and the opportunities are not considered for analysis of the indicator.

Keywords: Hand Hygiene. Local Anti-Infections. Ambulatory Care. Day Care, Medical. Health Status Indicators.

RESUMO

Justificativa e Objetivo: o indicador de consumo de preparação alcoólica é uma medida que pode auxiliar

no monitoramento da adesão à higienização das mãos, entretanto não existe direcionamento quanto ao perfil para aplicação da referência de consumo publicada pela Organização Mundial da Saúde para muitas instituições de saúde. Assim, o estudo buscou analisar as informações disponíveis na literatura científica para subsidiar a definição do consumo de preparação alcoólica para higienização das mãos em instituições ambulatoriais e Hospitais-Dia. **Método**: revisão integrativa referente ao período entre 2010 e 2021, realizada nas bases de dados Scopus, *Web of Science*, SciE-LO, PubMed/MEDLINE, *Cumulative Index to Nursing and Allied Health Literature*, Banco de Dados em Enfermagem e Literatura Latino-Americana e do Caribe em Ciências da Saúde, através da Biblioteca Virtual em Saúde. Foram selecionados cinco artigos que abordam o tema, sendo divididos em duas categorias: *Mililitros de preparação alcoólica para cada higienização das mãos*, identificando-se o volume médio previsto de 3 ml, e *Consumo de preparação alcoólica por paciente/dia*, observando-se a prevalência de estudos em hospitais gerais. Um estudo trouxe a perspectiva referente ao consumo em uma Instituição de Longa Permanência. **Conclusão**: na revisão, não foram encontrados artigos relacionados a ambulatórios e Hospitais-Dia. Os estudos selecionados demonstram que o consumo de preparação alcóolica é diferente dependendo do perfil do setor e do paciente atendido e que tanto o volume mínimo para cada higienização das mãos quanto as oportunidades geralmente não são considerados para análise do indicador.

Descritores: Higiene das Mãos. Anti-Infecciosos Locais. Assistência Ambulatorial. Hospital-Dia. Indicadores Básicos de Saúde.

RESUMEN

Justificación y Objetivos: el indicador de consumo de preparados alcohólicos es una medida que ayuda a monitorear la adherencia a la higiene de manos, pero no existe una orientación respecto al perfil de aplicación de la referencia publicada por la Organización Mundial de la Salud para muchas instituciones de salud. Así, el estudio buscó información disponible en la literatura científica para sustentar la definición del consumo de preparados alcohólicos en instituciones ambulatorias y Hospitales Día. **Método:** una revisión integrativa para el período comprendido entre 2010 y 2021, realizada en bases de datos Scopus, *Web of Science*, SciELO, PubMed/MEDLINE; *Cumulative Index to Nursing and Allied Health Literature*, Base de Datos de Enfermería y Literatura Latinoamericana y del Caribe en Ciencias de la Salud, a través de la Biblioteca Virtual en Salud. Se seleccionaron cinco artículos que abordaban el tema y se dividieron en dos categorías: Mililitros de preparación alcohólica para cada higiene de manos, identificando el volumen promedio esperado de 3 ml, y Consumo de preparación alcohólica por paciente-día, observando la prevalencia de estudios en hospitales generales. Un estudio trajo la perspectiva sobre el consumo en una Institución de Larga Estancia. **Conclusión:** en la revisión, no se encontraron artículos relacionados con ambulatorios y Hospitales Día. Los estudios seleccionados demuestran que el consumo de preparados alcohólicos para la higiene de manos es diferente según el perfil del sector y del paciente tratado y que tanto el volumen mínimo como las oportunidades no suelen ser considerados para el análisis del indicador.

Palabras clave: Higiene de Manos. Antiinfecciones Locales. Atención Ambulatoria. Centros de Día. Indicadores de Salud.

INTRODUCTION

Healthcare-associated infections (HAIs) increase patient morbidity and mortality and are the object of attention by the Hospital Infection Control Commissions (HICC).[1] Hand hygiene (HH) is directly associated with a reduction in infection rates, and it is a relatively simple measure. Despite this, there is not great compliance by professionals, which is a challenge for infection control.[2-4] Since 2004, the World Health Organization (WHO) has identified HAI as a patient safety issue, launching the "Clean Care is Safer Care" campaign in 2005,[5] and in 2009, the Multimodal Strategy was defined and disseminated to encourage compliance with HH,[2] ratifying the use of alcoholic preparations as a standard solution for hand antisepsis.[6]

Since then, one of the nine main WHO recommendations on HH in health services is the provision of access for health professionals to alcohol preparation at the point where care is provided,[6] guidance that was regulated in Brazil by RDC 42 of October 25, 2010,[7] and later by Technical Note 01/2018 GVIMS/GGTES/ANVISA.[8]

The use of alcoholic preparations is widely recommended, due to the ease of their distribution in the institution, and some studies indicate that their use increased health professionals' compliance with HH.[6] This increase may be related to advantages such as: elimination of most microorganisms (including viruses); short period of time to sanitize hands (20 to 30 seconds); product availability at the service point; good skin tolerability; no need for any special infrastructure, such as a clean water supply network, washbasin, among others.[9,10]

Furthermore, alcoholic preparations act quickly and have excellent bactericidal and fungicidal activity when compared to other agents used in HH. For these reasons, when alcohol-based hand rub is available, it should be adopted as the first choice product (when there is no visible dirt on the hands), being, in short, a recommendation with level of evidence IB in the WHO Guidelines on Hand Hygiene in Healthcare Services Health.[6] However, the elimination of the microbial load after HH with alcoholic preparation is directly related to the correct technique.[10-12]

The Multimodal Strategy also makes it mandatory to monitor HH practices through indicators, providing employees with feedback on performance and results.[13] In Brazil, the Protocol for the Practice of Hand Hygiene in Health Services, which is based on the Multimodal Strategy, defines the following indicators for measuring compliance: mandatory indicators: a) consumption of alcohol-based hand rub: monitoring of the volume of alcohol-based hand rub used for every 1,000 patients/day; b) soap consumption: monitoring the volume of liquid soap with or without antiseptic used for every 1,000 patients/day. Recommended indicator: c) percentage (%) of compliance: number of HH actions carried out by health professionals/number of opportunities for HH, multiplied by 100.[13] Measuring the degree of professionals' compliance with processes based on scientific evidence is necessary to demonstrate whether the efforts undertaken by the organization led to significant changes in the performance scenario. Monitoring makes health care more transparent as well as providing information to direct improvement initiatives.[14]

Monitoring the volume of alcohol preparation is an indirect method that helps institutions to monitor professionals' compliance with HH associated with direct observation, which is considered the gold standard.[15] It must be calculated using the formula: amount of alcoholic product used in the month in milliliters (ml) divided by the number of patients/day.[13,16] As for the ideal minimum consumption, the WHO, in the document Hand Hygiene Self-Assessment Framework 2010, brings in item 3.3c of the assessment and feedback questionnaire the following question: alcohol consumption for hands is at least 20 L per 1,000 patients/day?[17] Since then, health services have used the reference 20 ml per patient/day as a minimum goal to be achieved, as seen in studies related to the subject.[15, 18]

In 2014, the Collaborating Center for Quality and Patient Safety (Proqualis)[18] published the "Alcoholic Hand Preparation Consumption Sheet". In it, we can find the definition of patient/day as the patient care provided by a hospital day.[19] Therefore, the Standardization of Hospital Census Nomenclature manual, published by the Ministry of Health, defines "hospital day" as a 24-hour period between two consecutive hospital censuses. The censuses, in turn, are the counting and registration, each hospital day (24 hours), of the number of occupied and vacant beds in inpatient units and hospital services.[20] Regarding outpatient clinics, they are not considered hospital beds, since patients are treated on a non-hospitalization basis.

Given the fact that, currently, there is no guidance regarding the profile for application of the reference published by the WHO for many health institutions, the study sought to analyze information available in the scientific literature to support the definition of alcoholic preparation consumption for HH in outpatient institutions and Day Hospitals.

METHOD

This is an integrative review (IR) study, following the steps: 1) theme identification and research question selection; 2) establishment of criteria for inclusion and exclusion of studies; 3) definition of the information to be extracted from the chosen studies; 4) assessment of included studies; 5) interpretation of results; 6) review presentation.[21, 22]

The PICo (Problem, Interest and Context) strategy was used, where P: ideal consumption volume of alcoholic preparation for HH; I: evidence available for determination; Co: outpatient clinics and Day Hospitals. Thus, the research question was defined: what evidence is available in the scientific literature to define the value of alcohol consumption for HH in outpatient clinics and Day Hospitals?

To carry out the search in the databases, the following keywords were chosen, according to the structured and multilingual vocabulary of Descriptors in Health Sciences (DeCS): "*Segurança do Paciente*", "*Higiene das Mãos*", "*Anti-Infecciosos Locais*". The following Medical Subject Headings (MeSH) descriptors were also used: "Hand Hygiene"[Mesh], "Patient Safety"[Mesh], "Anti-Infective Agents, Local"[Mesh], "Infection Control"[Mesh]. Articles in Portuguese, English and Spanish, with content available in full, online and free of charge, published between 2010 and 2021, which were in accordance with the pre-established theme, were included. The choice of this period was due to the launch of the Multimodal Strategy to improve compliance with HH practices by the WHO. Editorials and news as well as articles in other languages, not available in full or free of charge, and that did not have thematic significance for the objectives of work, were excluded.

Materials published in events/conferences, technical materials and articles from the following journal databases of the Coordination for the Improvement of Higher Education Personnel (CAPES - *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*) were selected (www.periodicos.capes.gov.br) as follows: Scopus; Web of Science; SciELO; PubMed/MEDLINE; Cumulative Index to Nursing and Allied Health Literature (CINAHL); BDENF - Nursing Database (BDENF); and Latin American and Caribbean Literature on Health Sciences (LILACS), through the Virtual Health Library: VHL (BIREME). The search strategies used were organized with the help of a librarian and are described in Chart 01.

Searches in the databases were carried out by two researchers independently, between May and June 2021, and resulted in a total of 1069 articles. For selection, the analysis criteria shown in Flowchart 01 were used.

This process was carried out through a thorough reading of titles and abstracts, so that the studies that met the defined inclusion criteria, in addition to meeting the proposed objective, were selected for the final selection. For the final selection of the articles, a critical and detailed analysis was carried out in which we sought to identify what information was used to define the value of alcoholic preparation consumption for HH and the amount of ml used on average to perform an HH.

Chart 1. Search strategy applied in databases.

Database	Search Key
PubMed/MEDLINE	("Hand Hygiene"[Mesh] OR "Hand Hygiene"[All Fields]) AND ("Patient Safety"[Mesh] OR "Patient Safety"[All Fields] OR ("patient safety"[MeSH Terms] OR ("patient "[All Fields] AND "safety"[All Fields]) OR "patient safety"[All Fields] OR ("patient"[All Fields] AND "safeties"[All Fields]))) AND ("Anti-Infective Agents , Local"[Mesh] OR "Anti-Infective Agents, Local "[All Fields] OR "Antiseptics"[All Fields] OR ("anti-infective agents, local"[Pharmacological Action] OR "anti-infective agents, local" [MeSH Terms] OR ("anti-infective"[All Fields] AND "agents"[All Fields] AND "local"[All Fields]) OR "local anti-infective agents"[All Fields] OR ("local"[All Fields] AND " anti-infective "[All Fields] AND "agents"[All Fields])) OR "Topical Anti-Infective Agents"[All Fields] OR "Topical Anti Infective Agents"[All Fields] OR ("anti-infective agents, local"[Pharmacological Action] OR "anti-infective agents, local"[MeSH Terms] OR ("anti-infective"[All Fields] AND "agents"[All Fields] AND "local"[All Fields]) OR "local anti-infective agents"[All Fields] OR ("topical"[All Fields] AND " anti-infective "[All Fields] AND "agents"[All Fields])) OR "Local Anti-Infective Agents"[All Fields] OR "Local Anti-Infective Agents"[All Fields] OR "Infection Control"[Mesh] OR "Infection Control"[All Fields])
Scopus	ALL(("Hand Hygiene") AND ("Patient Safety" OR "Patient Safeties") AND ("Antiseptics" OR "Local Anti-infective Agents" OR "Topical Anti-Infective Agents" OR "Topical Anti Infective Agents" OR "Topical Anti-infective Agents" OR "Local Anti--Infective Agents" OR "Local Anti-Infective Agents" OR "Infection Control")) AND (LIMIT-TO (OA,"all ")) AND (LIMIT-TO (PUBYEAR,2021) OR LIMIT- TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2011)) AND (LIMIT--TO (LANGUAGE,"English ") OR LIMIT-TO (LANGUAGE,"Spanish "))
Web of science	(("Hand Hygiene") AND ("Patient Safety" OR "Patient Safeties") AND ("Antiseptics" OR " Local Anti-infective Agents" OR "Topical Anti-Infective Agents" OR "Topical Anti-Infective Agents" OR "Topical Anti-infective Agents " OR "Local Anti-Infective Agents" OR "Local Anti-Infective Agents" OR "Infection Control"))
CINAHL	(("Hand Hygiene") AND ("Patient Safety" OR "Patient Safeties") AND ("Antiseptics" OR " Local Anti-infective Agents" OR "Topical Anti-Infective Agents" OR "Topical Anti-Infective Agents" OR "Topical Anti-infective Agents " OR "Local Anti-Infective Agents" OR "Local Anti-Infective Agents" OR "Infection Control"))
VHL (LILACS/BDENF)	("Hand Hygiene " OR "Higiene de las Manos" OR "Hand Hygiene") AND (" Patient Safety "OR" Patient Safeties " OR " Security del Patient" OR "Patient Safety") AND (" Anti-Infective Agents , Local " OR " Antiseptics " OR " Local Anti-infective Agents " OR "Topical Anti-Infective Agents " OR "Topical Anti Infective Agents " OR "Topical Anti-infective Agents " OR "Local Anti-Infective Agents " OR "Local Anti-Infective Agents "OR " Anti-infective Locales " OR "Local Antiinfectives " OR "Local Antiinfective Agents" OR "Topical Antiinfective Agents" OR "Antiseptic Agents" OR "Topical Antiinfective Drugs" OR "Antiseptics " OR "Local Antiinfective Drugs" OR "Local Microbicides" OR "Topical Microbicides" OR " Infection Control " OR " Infection Control " OR "Infection Control" OR "Infection Control ")
ScieLO	("Hand Hygiene " OR "Higiene de las Manos" OR "Hand Hygiene") AND (" Patient Safety "OR" Patient Safeties " OR " Security del Patient" OR "Patient Safety") AND (" Anti-Infective Agents , Local " OR " Antiseptics " OR " Local Anti-infective Agents " OR "Topical Anti-Infective Agents " OR "Topical Anti Infective Agents " OR "Topical Anti-infective Agents " OR "Local Anti-Infective Agents " OR "Local Anti-Infective Agents "OR " Anti-infective Locales " OR "Local Antiinfectives " OR "Local Antiinfective Agents" OR "Topical Antiinfective Agents" OR "Antiseptic Agents" OR "Topical Antiinfective Drugs" OR "Antiseptics" OR "Local Antiinfective Drugs" OR "Local Microbicides" OR "Topical Microbicides" OR " Infection Control " OR " Infection Control " OR "Infection Control" OR "Infection Control ")

Flowchart 01. Study selection process

RESULTS AND DISCUSSION

Five articles that address the theme were selected, but no article was found that specifically addressed outpatient clinics or Day Hospital. The English language was predominant, being presented in all publications. Two studies took place in a research environment in Hungary, and the others were conducted in other countries, covering Europe and Asia. As for the databases, one study was published in VHL, one in Scopus, one in CINAHL, and two in PubMed, with publications beginning in 2010 (1), and the others in 2013 (1), 2015 (2) and 2020 (1).

Subsequently, a synoptic table (Table 01) was elaborated, in order to synthesize the main information, and the articles were divided according to the variables related to the objective of this review, as ml of alcoholic preparation for each HH and consumption of alcoholic preparation per patient/day.

Although the studies do not contemplate contexts similar to Day Hospital and/or outpatient care, they provide relevant information to support the definition of alcoholic preparation consumption for HH and which were divided into two variables: ml of alcoholic preparation for each HH and alcoholic preparation consumption per PD. Of the five articles, two contained information related to both analytical categories: one only about the number of milliliters to be used for proper HH and two only about the alcoholic preparation consumption for HH identified in the institutions.

Through the analysis of the three articles that mention the amount of ml of alcoholic preparation for each HH, it was identified that the average volume predicted for a correct procedure is 3 ml,[22,23,24] however there is a caveat that for large hands this volume may be inadequate.[25,26] This brings a responsibility for professionals to judge, at the end of the HH technique, whether the amount of alcoholic preparation used was sufficient to cover the entire hand. If not, care should be taken to use a larger amount than that commonly available in dispensers. The NHSScotland National Infection Prevention and Control Manual states that the volume of alcohol preparation used should, in the absence of manufacturer instructions, be approximately 3 ml to ensure full coverage. The authors state that this volume is based on a series of experimental and observational studies, however the

Table 1. Articles surveyed in databases.

Authors and journal	Data base/ Year	Article title	Institution profile	Study objective	Main results	
					ml of alcoholic preparation for each HH	Consumption of alcoholic preparation per patient/day
Bánsághi S, Soule H, Guitart C, et al. Antimicrobial Resist infect Control	VHL (2020)	Critical Reliability Issues of Common Type Alcohol-Based Handrub Dispensers	Not directed to an institutional profile.	Investigate the dispensing performance of wall-mounted alcohol preparation dispensers commonly used in hospital environments.	They mention that both the European standard EN 1500 and the North American standard ASTM E-1174 require the application of 3 ml twice to wash hands.	
Reichard C, et al. J Hosp Infect	CINAHL (2013)	Three years of national hand hygiene campaign in Germany: what are the key conclusions for clinical practice?	No -ICU and ICU including pediatric.	Assess the impact of the multimodal strategy of in Germany after 3 years.	They also refer to a study that showed that at least 2 ml of alcoholic solution are needed to completely cover the entire surface of the hands, but 3 ml may be insufficient in the case of large hands, and that, definitely, a volume of ml cannot cover the entire surface of the hand.	The 2009 median across 543 ICUs was 83 ml per patient/day (PD), with a range of 43 to 141 ml/PD between the 10th and 90th percentiles. Median consumption in 3339 non-ICU was 18 ml/PD, with a range of 10 to 38 ml/PD between the 10th and 90th percentiles. The highest consumption was found in pediatric ICUs with a median of 99 against 68 ml/PD in other ICUs. They cite a few studies, one being where ICUs started at a baseline of 63.07 ml/PD and non-ICUs at 43.69 ml/PD. Another, in which baselines were 65.8 ml/PD for ICU and 14.7 ml/PD for non-ICU. (to be continued...) However, soap consumption was also recorded. Another measured a baseline intake of 66.6 ml/PD in a pediatric ICU. Another measured a median of 87 ml/PD in five different ICUs, with a range of 57 to 102 ml/PD.
Sakamoto F, et al. Am J Infect Control	PubMed / Medline (2010)	Increased use of alcohol-based hand sanitizers and successful eradication of methicillin-resistant Staphylococcusaureus from a neonatal intensive care unit: A multivariate time series analysis	NICU	Assess the relationship between infection incidence density rates, amount of alcohol-based hand sanitizers per patient-nurse, and bed occupancy rates.		The combined average of alcohol-based hand sanitizers used (milliliters) for 1 patient per day during the study period was 11.6 ml. The monthly value stayed below 10 ml per PD until it rose sharply to 22.0 ml per PD one month after the MRSA incidence, and reached its highest level of 25.9 ml per 1000 PD. After that, the amount remained around 15.0 ml per PD.
Szabó R., et al. Antimicrob Resist Infect Contro	PubMed / Medline (2015)	Use of hand hygiene agents as a surrogate marker of compliance in Hungarian long-termcare facilities: first nationwide survey	Nursing Homes (NH)	Provide an overview of the first base-line data collected on alcohol-based hand sanitizers and antiseptic soap consumption as surrogate markers for HH compliance by health workers in Hungarian NH.	3 ml is the recommended amount of alcohol-based hand sanitizer for one HH. 5 ml is the recommended amount of antimicrobial soap for one hand wash.	In total, the average annual consumption of alcohol and antimicrobial soap was 2.2 ml (interquartile range (IQR), 0.4 -9.1 ml) and 12.1 ml (IQR, 0.7 - 32.8 ml) per HH by health professionals, respectively.
Hansen S, et al. Clin Microbiol Infect.	Scopus (2015)	Provision and consumption of alcohol-based hand rubs in European hospitals	General Hospital, ICU and Non-ICU	Assess the provision and consumption of alcohol-based hand care products in European hospitals.	Average volume of 3 ml of alcoholic preparation for each hand hygiene action.	Mean consumption of 21 ml (IQR 9 – 37 ml) per PD (PD) at hospital level; 66 ml/PD (IQR 33 –103 ml/PD) at the ICU level; and 13 ml/PD (IQR 6 –25ml/PD) at the non-ICU level.

same study demonstrated that, in practice, the volume of alcoholic preparation used per HH opportunity in the National Health Service (NHS) is probably closer to 1 ml.[27]

In a multimodal intervention in South Africa, the reference of 3 ml per HH opportunity was also used for measurement[28] and, likewise, in the context of Primary Care in the Faranah region, Guinea. In this analysis, a clear underutilization was identified, with an average of 0.77 ml per consultation, compared to the recommended minimum amount of 3 ml per HH[29]. The authors inferred that, as low consumption was accompanied by relatively high compliance in terms of the number of HH actions, the most plausible explanation for the general underuse of alcoholic solution was due to the use of a small amount of alcoholic solution per HH action, and not a few HH actions per consultation, which could be explained by the lack of knowledge of the required amount or the desire not to 'waste', for fear of interruption of supply[30]. This point evokes the need for greater disclosure of the minimum amount of alcoholic preparation for effective HH and its relationship with the assessment of the representativeness of consumption measured by the HICC.

When assessing the findings on the average alcoholic preparation consumption per PD, it is noticed the prevalence of studies in general hospitals in ICU and non-ICU, which may be related to the fact that patients of greater complexity demand more care and interventions. Only one study brought a different perspective, related to alcoholic preparation consumption in a Hungarian NH, but the measurement used different markers, being by "health professional" and not by "PD". It is worth mentioning that none of the authors mentioned the goal of 20 ml PD, published by the WHO in the document Hand Hygiene Self-Assessment Framework 2010 (HHSAF).[17]

Analyzing other studies on alcoholic preparation consumption, it was identified that, in the Neonatal Intensive Care Unit (NICU) of the largest maternity hospital in the state of Bahia, the monthly average use of alcoholic preparation for HH was 16.341 ml. The authors report that the HICC carried out the monthly calculation of the minimum expected consumption in ml, according to WHO criteria, and the value 46.640 ml was used as a reference parameter,[17] however, they did not explain the method they used to define this reference higher than that predicted by the WHO, but we can infer that, in this sector, the opportunities for HH are greater than in the others.

In a pre-hospital emergency service in Goiás,[30] a consumption of 2.071 ml of alcoholic preparation was found for an average of 750 occurrences assisted, about 2.76 ml per service provided, slightly below the amount of ml minimum for a proper HH. After the educational activity proposed in the referenced article, there was an increase to about 6.02 ml of alcoholic preparation per visit, suggesting the performance of two HH. However, considering that emergency medical service professionals work minimally in pairs, the "5 moments for HH" and the goal published by the WHO, we can infer that compliance with HH by professionals is low, which may be related to the challenges due to the structural conditions of ambulances and the service profile. As in the case of outpatient clinics and Day Hospitals, this report makes us reflect on how assertively the WHO consumption reference is applicable to the most diverse health services, since HH opportunities differ according to the type of service and complexity.

In 2007, a voluntary electronic surveillance tool was introduced in German healthcare institutions to record alcoholic preparation consumption and determine consumption trends between 2007 and 2018. Thus, 75.2% of intensive care hospitals in Germany (N = 1,460) participated. In 2018, the average consumption results obtained were: in the ICUs (n =1,998), 137.4 ml per PD; in intermediate care units (N = 475); 70.6 ml per PD; and in the wards, 32.6 ml per PD.[31] It is noticed that, the greater the complexity of care, the more opportunities for HH there are, reflecting on the increase in alcoholic preparation consumption by PD.

In a retrospective analysis comparing the results of two surveillance systems implemented (WHO HHSAF and alcoholic solution consumption) in 40 hospitals in the Piedmont region of Italy, there was a positive correlation between the HHSAF score and the chance of belonging to the high alcohol consumption group, mainly for cut-offs of 19 to 23 ml per PD. Two alcohol solution consumption peaks were identified at approximately 10 and 22 ml per PD, corresponding to median scores of 353.75 and 375 points, respectively.[32]

The maximum score considered for the HHSAF is 500 points. The article makes us reflect on authors' assertion that both surveillance systems are consistent and that the HHSAF score "may function as a reasonable predictor of compliance with HH in health settings".[32]

In the African study, carried out between 2020 and 2021 on a multimodal intervention in a NICU, the baseline volume of alcoholic preparation use was 70 ml per PD, about 23 HH actions per PD and 73 ml per PD after the intervention. The initial HHSAF score was 165, classifying the unit as a "basic" level, evolving to 262.5, becoming classified as an "intermediate" level".[27] This shows us that a high score level on the HHSAF does not necessarily reflect on compliance with HH.

Still, thinking about the HHSAF's education pillar, a study conducted at NHO Shimoshizu national hospital, with 440 beds, located in Chiba, Japan, identified that the 5-year initiative implemented resulted in an eightfold increase in alcoholic solution consumption, from 4.2 to 34.4 ml per PD.[33] Even if the HHSAF is not a tool that correctly explains professionals' compliance, its application is essential as a strategic basis to generate a favorable environment and culture for this to happen, which is its main purpose.[17]

Assessing the final consumption achieved after the initiative, three other studies corroborate the result, showing an average consumption of approximately 35 ml per PD in Japanese intensive care services,[34] 32 ml per PD in three ICUs of a private hospital in Minas Gerais[35] and 36.4 ml per PD in a Sub-Intensive Care Unit of an Italian general hospital.[36]

In the same context, an analysis carried out at Faranah Regional Hospital to assess the WHO HH improvement strategy's feasibility and effectiveness in this resource-poor setting, identified that the mean monthly alcohol consumption for the entire hospital increased after the intervention, from 2.2 L at baseline to 28.0 L at follow-up.[37] A total of 24 months of HH data were reviewed, and converted to liters per 1000 PD. The total consumption of alcoholic solution was 18,693 L, ranging from 30.1 to 72.6 ml per PD per ward.[38] The Multimodal Hand Hygiene Improvement Strategy is clearly a way to encourage the creation of a HH culture in health organizations.[6]

The heterogeneity of alcoholic preparation consumption in the different sectors of health establishments is evident (lower consumption identified in studies: 2.76 ml per service provided; higher consumption identified in the studies: 137.4 ml PD), and even in those that reach better levels, it is not possible to state that consumption is adequate. There is a latent need to define the minimum consumption of alcoholic solution expected in all types of health services based on the "5 moments for HH", in order to make the correlation of these data with practice more and more reliable. This logic was applied in a study carried out at The Ottawa Hospital, in Ontario, which aimed to estimate the total volume of alcoholic preparation needed for HH during a year, based on the estimated number of HH indications at each point of care.[38] The definition of opportunities was carried out through the number of HH indications signaled in the audits and through interviews with frontline professionals, bringing more reliable data for comparison between current and ideal consumption. In another article, researchers reported that, in France, the alcoholic preparation consumption index is calculated considering the actual HH expected per day and per patient category, and, based on a volume of 3 ml per HH, an expected annual consumption is calculated.[39] Measuring volumetry in isolation, without a reference that considers the minimum HH opportunities expected during a given service, does not add real value to practice. Through this data, it is possible to understand where one is, but not where one intends to go and how far away we are. In this way, the identification of the expected minimum consumption of alcohol preparation can contribute to greater assertiveness in the planning of actions to increase the compliance of professionals with HH in all health services, including outpatient clinics and Day Hospitals. Moreover, investments in infrastructure, provision of alcohol preparation at the point of care, training and adequate sizing of employees are necessary. It is possible that the results presented by health institutions are less than ideal, due to the imbalance between these crucial factors.

CONCLUSION

Alcoholic preparation consumption for HH is still a controversial subject. when discussing the minimum consumption by health services, and with scarce information, when it comes to outpatient clinics and Day Hospitals.

The study sought to analyze the information available in the literature to support the definition of alcoholic preparation consumption for HH in these institutions, but no articles were found in relation to this specific context. However, the data identified on the minimum amount of ml of alcoholic preparation for each HH pave the way for further research on the subject, which can be associated with the mapping of HH opportunities in each care situation.

This need is evident, especially in the outpatient and Day Hospital scope, since the published studies are commonly related to general hospitals and concentrated in sectors with a higher risk of infection. However, less complex environments also present risks and require evidence to support best practices, subsidizing the critical analysis of the success of implemented infection prevention actions, such as HH.

The main limitation of this study was the use of restricted descriptors, which may have interfered with the findings. However, we understand that this text brings up an important discussion for assistance in health services in general, not just for outpatient clinics and Day Hospital, opening doors for primary studies. Therefore, it is suggested that studies relating the type of health unit, the profile of patients and the "5 moments for HH" be carried out, bringing assertiveness and reliability regarding the minimally expected alcoholic preparation consumption, allowing institutions to better measure the efforts necessary for its achievement.

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AUTHORS' CONTRIBUTIONS

Thalita de Souza Santos and **Roberta Costa** contributed to the article conception, design, article analysis and writing;

Thalita de Souza Santos and **Roberta Costa** contributed to the article planning and design, article review and final approval;

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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REVIEW ARTICLE

Compliance and barriers to hand hygiene practice among professionals during the COVID-19 pandemic: an integrative review

Adesão e barreiras à prática de higienização das mãos entre profissionais na pandemia de COVID-19: revisão integrativa

Adherencia y barreras a la práctica de la higiene de manos entre profesionales en la pandemia de COVID-19: revisión integradora

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ABSTRACT

Background and objectives: compliance and barriers to hand hygiene practice remains a challenge in health services, especially during the COVID-19 pandemic. This preventive measure needs to be encouraged at all levels of care to reduce health problems. This article aimed to identify the reasons for compliance and main barriers to hand hygiene practice among health professionals during the COVID-19 pandemic. **Content:** an integrative review, performed in the MEDLINE via PubMed, Scopus, Wiley Online Library, Western Pacific Region Index Medicus, LILACS, IBECS, BDENF and SciELO databases. To interpret the results, Nola Pender's theoretical perspective was used. The sample consisted of 13 articles, allowing the stratification of six themes: health professionals' attitude and behavior during the pandemic; assessment of the five moments in hospitals during the pandemic period; availability, use and types of resources; barriers and facilitators; team compliance before and during the COVID-19 pandemic; and technique quality and glove use considering the need for hand hygiene. **Conclusion:** hand hygiene practice needs to be expanded and encouraged among team members, as there were barriers that hindered compliance during the COVID-19 pandemic.

Keywords: Hand Hygiene. COVID-19. Health Personnel. Pandemics. Patient Care. Review.

RESUMO

Justificativa e objetivos: adesão à prática de higienização das mãos permanece um desafio nos serviços de saúde, principalmente durante a pandemia de COVID-19. Essa medida preventiva necessita ser estimulada em todos os níveis de assistência para redução de agravos à saúde. Este artigo teve por objetivo identificar os motivos de adesão e principais barreiras à pratica de higienização das mãos entre profissionais de saúde durante a pandemia de COVID-19.

Conteúdo: revisão integrativa, realizada nas bases de dados MEDLINE via PubMed, Scopus, *Wiley Online Library*, *Index Medicus* do Pacífico Ocidental, LILACS, IBECS, BDENF e SciELO. Para interpretação dos resultados, utilizou-se a perspectiva teórica de Nola Pender. A amostra foi constituída por 13 artigos, possibilitando a estratificação de seis temas: atitude e comportamento dos profissionais de saúde durante a pandemia; avaliação dos cinco momentos em hospitais no período pandêmico; disponibilidade, utilização e tipos de recursos; barreiras e facilitadores; adesão da equipe no antes e durante a pandemia de COVID-19; e qualidade da técnica e utilização de luvas diante da necessidade de higienização das mãos. **Conclusão:** a prática de higienização das mãos precisa ser ampliada e incentivada entre a equipe, visto que houve barreiras que dificultaram a adesão durante a pandemia de COVID-19.

Descritores: Higiene das Mãos. COVID-19. Pessoal de Saúde. Pandemias. Assistência ao Paciente. Revisão.

RESUMEN

Justificación y objetivos: la adherencia y las barreras para la práctica de la higiene de manos sigue siendo un desafío en los servicios de salud, especialmente durante la pandemia de COVID-19. Es necesario fomentar esta medida preventiva en todos los niveles de atención para reducir los problemas de salud. Este artículo tuvo como objetivo identificar las razones de la adherencia y las principales barreras para la práctica de la higiene de manos entre los profesionales de la salud durante la pandemia de COVID-19. **Contenido:** revisión integradora, realizada en bases de datos MEDLINE vía PubMed, Scopus, *Wiley Online Library*, *Western Pacific Region Index Medicus*, LILACS, IBECS, BDENF y SciELO. Para interpretar los resultados se utilizó la perspectiva teórica de Nola Pender. La muestra estuvo compuesta por 13 artículos, lo que permitió la estratificación de seis temas: actitud y comportamiento de los profesionales de la salud durante la pandemia; evaluación de los cinco momentos en los hospitales durante el período de pandemia; disponibilidad, uso y tipos de recursos; barreras y facilitadores; adherencia del equipo antes y durante la pandemia de COVID-19; y calidad de la técnica y uso de guantes ante la necesidad de higiene de manos. **Conclusión:** la práctica de la higiene de manos necesita ser ampliada y fomentada entre el equipo, ya que hubo barreras que dificultaron la adherencia durante la pandemia de COVID-19.

Palabras clave: Higiene de las Manos. COVID-19. Personal de Salud. Pandemias. Atención al Paciente. Revisión.

INTRODUCTION

On the world stage, the beginning of 2020 was marked by an outbreak of non-specific respiratory infections caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) virus, known as the Coronavirus Disease (COVID-19). It is responsible for causing Severe Acute Respiratory Syndrome (SARS), and can be transmitted through droplets, secretions, aerosols and/or fomites of infected individuals.[1,2]

Due to the high transmissibility rate of the virus, the World Health Organization (WHO) recommended preventive measures, especially in health services, which included hand hygiene with an alcoholic preparation and/or liquid soap, safe distancing and effective personal protective equipment (PPE) use.[3,4] Health professionals represent one of the risk groups for COVID-19, due to direct contact with patients with a confirmed diagnosis.[5-7]

In this context, hand hygiene (HH) in patient care is referred to as one of the main measures to reduce incidents and transmission of SARS-CoV-2.[4,7] It is considered simple, low cost and of paramount importance in healthcare-associated infection (HAI) prevention and control. The WHO recommends five recommended moments for HH, namely: 1) before touching a patient; 2) before clean/aseptic procedure; 3) after body fluid exposure risk; 4) after touching a patient; 5) after touching patient surroundings.[8]

The HH protocol must have full applicability, especially during the COVID-19 pandemic, due to virus proliferation in health services.[1,7,8] Among the complications generated by the lack of this preventive measure, the increase in HAI and the spread of microorganisms among patients, professionals and/or environments. It is observed that HH practice, in addition to avoiding accelerated transmission and disease outbreaks, reduces the risk of infection caused by SARS-CoV-2 by 36% and a 23% decline in other respiratory tract infections.[9]

A study on the subject also shows that health professionals' compliance remains below expectations, needing to be encouraged at all levels of care to reduce health problems.[6] The low performance of this preventive measure, where there is patient care, in addition to its repercussions attributed to team members' knowledge, attitude and behavior, were not found at the same time in research, being the main gap that justified this review.[1,3,6,8,9] Furthermore, the identification in the literature of effective strategies to improve compliance and reduce barriers, especially in times of public health crisis, such as the COVID-19 pandemic.

This study becomes relevant for revealing the practices of professionals who work in patient care, verifying in the light of the literature whether there were (or not) changes in the multidisciplinary team in the face of the pandemic, identifying challenges and gathering information that will allow directing actions and interventions to improve compliance in relation to HH.

Therefore, the objective was to identify the reasons for compliance and the main barriers to HH practice among health professionals during the COVID-19 pandemic.

METHODS

This is an integrative review, which covered six stages: establishment of the hypothesis or research question; sampling or literature search; categorization of studies; assessment of studies included in the review; interpretation of results; and synthesis of knowledge.[10] The elaboration of the methodological stages of this study was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[11]

To establish the research question, the PICO strategy was used: (P) Population = health professionals; (I) Intervention = HH; (C) Comparison = practices among health team members during the COVID-19 pandemic; and (O) Outcome = repercussion and compliance regarding HH practice. This tool makes it possible to guide the elaboration of a research problem based on the best evidence.[12] The following guiding question was elaborated: what were the repercussions on HH practices and their respective compliance among health professionals, including students who were working in health services, during the COVID-19 pandemic?

The search strategy was carried out in the following databases: Medical Literature Analysis and Retrieval System Online (MEDLINE) via PubMed; Scopus; Wiley Online Library; Western Pacific Region Index Medicus (WPRO); Latin American and Caribbean Literature in Health Sciences (LILACS); *Índice Bibliográfico Español en Ciencias de la Salud* (IBECS); *Banco de Dados de Enfermagem* (BDENF); and the Scientific Electronic Library Online (SciELO) portal. The DeCS/MeSH descriptors were: Sars Virus, COVID-19, Hand Hygiene, Hand Disinfection, Cross Infection, Healthcare Workers and Health Personnel. Boolean operators (AND and OR) were adopted for crossing, and the use of quotation marks was disregarded, to avoid the loss of articles (Table 1).

Full-type articles, published between January 2020 and May 2022, in Portuguese, English and Spanish, were included. Reflection studies, reviews, books, editorials, other research that were not submitted to the Ad hoc peer review process and did not answer the research question were excluded. To assess duplicate articles, the Mendeley® software was used.

The selection of double-blind articles, carried out by two researchers, independently, took place in June 2022, aiming at maintaining methodological rigor during the search strategy. Subsequently, data were checked simultaneously. Concluding the review trajectory, a synoptic table was built to systematize knowledge, defining the following variables: authors' names and year of publication; delineation and scenery; level of evidence as recommended by the Agency of Healthcare Research and Quality (AHRQ); and the purpose of selected studies.[13]

Data were analyzed using simple descriptive statistics to present absolute and relative values referring to the characterization of studies and stratification of research topics.

The interpretation of results obtained was carried out using the theoretical perspective of Nola Pender's Health Promotion Model. Although it is used for nursing actions that encourage self-care for a certain public, the theory allows the recognition of healthy behaviors regarding HH during the COVID-19 pandemic, through the analysis of personal characteristics and experiences; feelings and knowledge about the health promotion behavior that one wants to achieve; and results of team conduct. The articles found in this review were organized into these categories, making it possible to construct the health promotion diagram.[14] All theoretical aspects proposed by Pender were directly applicable to the present study.

Due to the nature of an integrative review of this study, the approval of Research Ethics Committee (REC) was not required. It is important to emphasize that the

Table 1. Article search strategy in the databases selected for the study. Juiz de Fora, MG, Brazil, 2022.

Database	Search crossing	Articles found
MEDLINE via PubMed	(Sars Virus OR COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers OR Health Personnel)	66
Scopus	(Sars Virus OR COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers.	10
Wiley Online Library	(Sars Virus OR COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers OR Health Personnel)	49
WPRO	(Sars Virus OR COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers OR Health Personnel)	01
LILACS	(Sars Virus OR COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers OR Health Personnel)	02
IBECS	(Sars Virus OR COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers OR Health Personnel)	02
BDENF	(Sars Virus OR COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers OR Health Personnel)	02
SciELO	(COVID-19 AND Hand Hygiene OR Hand Disinfection AND Cross Infection AND Healthcare Workers OR Health Personnel)	07

methodology used was selected with the intention of exploring a wide range of studies, contemplating different theoretical approaches and research methods to qualitatively synthesize and interpret the findings. In this regard, the authors chose to carry out an integrative review instead of a systematic review.

RESULTS

Thirteen articles (100%) indexed in the MEDLINE (84.6%), Scopus (7.7%) and Wiley Online Library (7.7%) databases were selected (Figure 1). The temporal delimitation obtained little variation, due to theme topicality. As for the language, 10 (84.6%) studies were published in English, with the countries of origin being Ethiopia (18%) and Spain (18%). All searches were attributed to the health area (100%).

With regard to the design, the studies are cross-sectional and descriptive, which had as their field of analysis HH practice in hospitals during the COVID-19 pandemic (92.3%). Most studies were classified with a level of evidence equal to 6 (76.9%) (Table 2).

From reading and analyzing the articles, it was possible to stratify the contents into six themes: health professionals' attitude and behavior during the pandemic; assessment of the five moments in hospitals during the pandemic period; availability, use and types of resources; barriers and facilitators; team compliance before and during the COVID-19 pandemic; and technique quality and glove use considering the need for HH.

Figure 2 shows the elaboration of the Nola Pender diagram applied to HH practices in the COVID-19 pandemic. Among the articles included in this review, it is noteworthy that expanding and encouraging compliance among multidisciplinary team members during and after the pandemic may be associated with HH promotion behavior in health services.
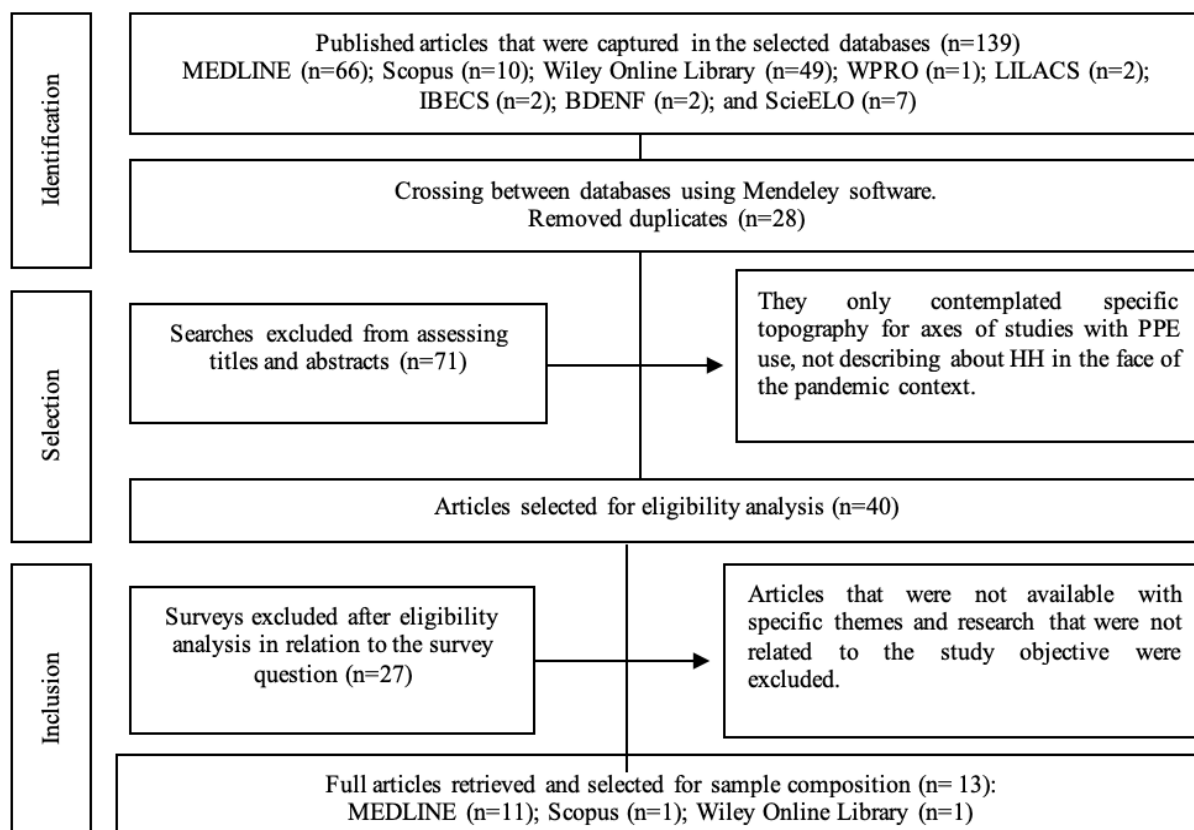

Figure 1. Prism of studies included in the integrative review. Juiz de Fora, MG, Brazil, 2022

Table 2. Description of research included in the integrative review. Juiz de Fora, MG, Brazil, 2022.

Authors and year	Design and setting	Level of evidence	Study sample	Main results
Sandbol et al., 2022[15]	Observational, prospective study	Level 4	A total of 150 team professionals participated before the COVID-19 pandemic and 136 during the pandemic.	Compliance with HH practices was higher before the COVID-19 pandemic, when compared to the assessed pandemic period.
Casaroto et al., 2022[16]	Observational, prospective study	Level 4	An electronic HH monitoring system was used that investigated compliance for 45 months. However, the article did not mention the number of professionals included in the survey.	Workload, lack of training and work leave due to mental health may have negatively affected HH quality.
Sandbekk, et al., 2022[17]	Observational, descriptive study	Level 6	There were 105 nursing students who performed 7,316 HH observations in 20 wards.	Nursing students had the highest compliance, followed by nurses. Of the professionals who wore gloves, 64.7% did not perform the HH.
Barcenilla-Uitard et al., 2022[18]	Observational, descriptive and cross-sectional study	Level 6	The study sample consisted of 716 participants who answered a questionnaire via WhatsApp® and Telegram®.	Females are associated with the highest number of attitudes and best practices related to HH. Age, as it increases, positively influences practices and attitudes.
Keleb et al., 2021[19]	Cross-sectional study	Level 6	A total of 489 health professionals who worked in public hospitals participated.	Feedback to health professionals, training on COVID-19 prevention and perception of the risk of infection were factors related to good HH indicators and PPE use.
Wang et al., 2021[20]	Cross-sectional, descriptive study	Level 6	The online survey reached 786 health professionals.	It is noteworthy that 25% of assessed professionals did not perform HH. Low compliance with preventive behaviors was due to misinformation about COVID-19 origin, severity and prevention, making it necessary to encourage health education.
Berman et al., 2021[21]	Cross-sectional study	Level 6	This study obtained a sample of 250 health professionals.	Several barriers influenced HH: scarcity of inputs, ineffective training, minimal presence of the infection control team and high workload. The pandemic did not significantly influence the increase in HH compliance.
Fernández et al., 2021[22]	Cross-sectional and descriptive study	Level 6	The researchers looked at 4,560 opportunities. However, the article did not mention the number of professionals included in the survey.	The pandemic has increased HH rates. However, previous contact with patients was the moment that maintained low compliance. It is necessary to expand HH among nursing technicians.
Huang et al., 2021[23]	Descriptive study	Level 6	The sample consisted of 162,334 entries and exits related to HH, recorded by an automatic monitoring system.	Health professionals have modified their behaviors during the pandemic. However, compliance upon entering the patients' room remained low. It is necessary to train the team regarding using gloves and HH, as their use does not replace carrying out this measure.
Zhou et al., 2021[24]	Cross-sectional study	Level 6	There were 1,734 participants from 17 health services.	Burnout was negatively associated with HH. Acting on this psychic disorder improves the team's behavior in relation to HH, aiming at infection prevention and control.
Vatan et al., 2021[25]	Observational and descriptive study	Level 6	A total of 400 health professionals working in the Emergency Medical Care Service (SAMU - Serviço de Atendimento Médico de Urgência) were included.	Among respondents, 36% were unaware of the correct technique for HH.
Roshan et al., 2020[26]	Observational and descriptive study	Level 6	The researchers observed all time points for HH over six months. However, the article did not mention the number of professionals included in the survey.	A reduction in the number of infections related to care was observed after the pandemic, being associated with HH improvement in recent months.
Derksen et al., 2020[27]	Observational, prospective study	Level 4	A total of 267 behavioral observations were made in two German hospitals.	The researchers highlight that compliance with UM recommendations increased from 47% before the COVID-19 pandemic to 95% shortly before implementing the lockdown.

1. Personal characteristics and experiences

2. Feelings and knowledge about the health promotion behavior that one wants to achieve

3. Results of conduct

Hand hygiene benefits:
Professionals perceive a reduction in care-related infections and a decrease in patient hospitalization as a benefit when carrying out the action.

Barriers to action:
Misinformation about COVID-19; scarcity of inputs; ineffective training; minimal presence of infection control staff; high workload; glove use without prior HH.

Immediate requirements:
Quality of the HH technique, requiring the proper execution of the procedure.

Preferences:
Appropriate health education and infrastructure combined with quality inputs and monitoring of HH compliance.

Previous behavior:
Health services had low compliance with HH during patient care.

Perceives self-efficacy:
Female professionals were associated with a greater number of attitudes, feedback, training on COVID-19 and perception of risk of infection.

Health promotion behavior:
Expand and encourage HH compliance among the multidisciplinary team during and after the COVID-19 pandemic.

Feelings:
Fear of becoming infected and/or spreading the microorganism to the community.

Commitment to an action plan:
Interventions such as burnout prevention influence compliance with HH, in order to prevent and control infections. In addition, it is important to ensure adequate infrastructure.

Personal factors:
There were changes in the team's behavior regarding the need to prevent the infection caused by SARS-CoV-2, with the pandemic being the main self-motivation for compliance. Education contributed to HH in health services.

Interpersonal influences:
Organizational barriers: insufficient supervision and the minimal presence of the infection control team in the sectors.

Situations that influence hand hygiene:
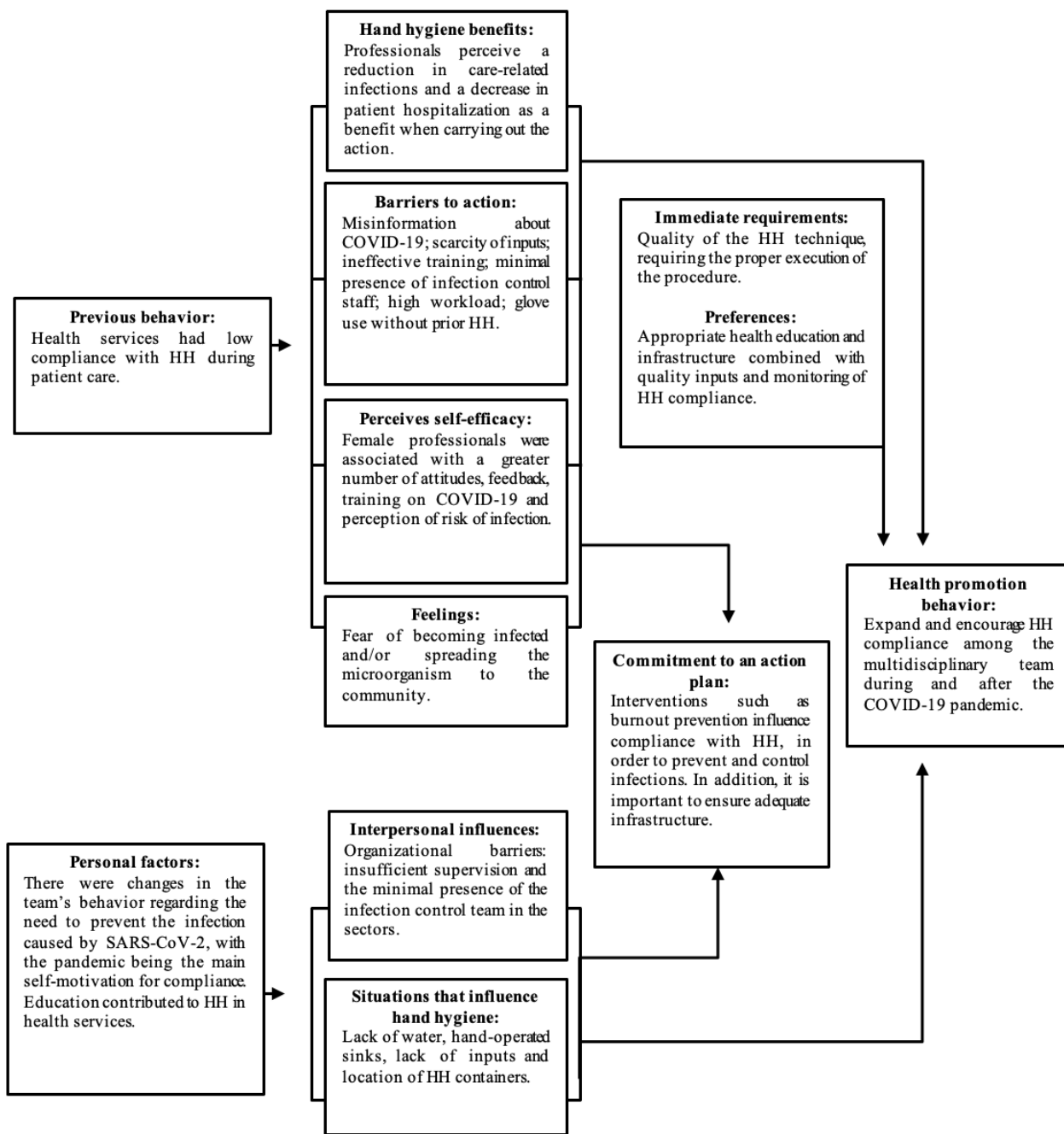Lack of water, hand-operated sinks, lack of inputs and location of HH containers.

Figure 2. Nola Pender's Health Promotion Model applied to hand hygiene in relation to professionals' behavior and attitude during the COVID-19 pandemic. Juiz de Fora, MG, Brazil, 2022.

DISCUSSION

It was possible to analyze that all articles selected for this review addressed health professionals' practices in relation to HH during the pandemic.[15-27] Using Nola Pender's theoretical perspective, the studies showed some improvements of this preventive measure in health services, such as greater concern in preventing the spread of the virus and the execution of the correct technique in the five moments recommended by the WHO. However, excellent compliance is still far from ideal among multidisciplinary team members.

Attitude and behavior were two variables that can directly influence HH when there is high patient demand, work overload and lack of specific training.[15-17,21,24] Two studies elucidated that there was greater compliance in the pre-COVID period when compared to the pandemic.[15,16] In this case, it is inferred that this fact may have been influenced by misinformation regarding the origin of the virus, its severity and forms of prevention, especially at

the beginning of its worldwide dissemination.[1,28,29]

With the evolution of the state of public emergency, health professionals adapted their behavior to the need to prevent infections caused by SARS-CoV-2 and the fear of becoming infected and/or spreading the microorganism to the community.[22,23] The literature states that HH after contact with patients stood out against the five moments recommended by the WHO,[22,23] attributing this fact to the need for professional self-protection.[29,30]

In this context, after the first year of the pandemic, health professionals sanitized their hands in a lower percentage before contact with patients. It appears that the change in behavior and attitude did not show significant changes during COVID-19 when compared to the previous period.[23] This fact may be mainly related to the increased demand for services caused by the high volume of hospitalized patients and the unavailability of supplies close to the assistance points.[25-27]

The main barrier to meeting the five moments of HH recommended by the WHO is related to the increase in the workload and the volume of patients during the pandemic.[15,16] Allied to this are the team's professional exhaustion and mental health in the face of increased COVID-19 attendances, which directly reflects on reduced HH actions.[24]

Sociodemographic aspects such as sex and age also influenced the team's behavior and attitude towards HH. Studies have found that health professionals who are female have greater compliance.[18] Moreover, the age group influences the practice, highlighting recent graduates as those who obtained more actions considering the opportunities assessed for HH.[17,24]

When it comes to technique quality, it is important to mention that several professionals self-reported good procedure execution in health services. Despite performing the technique properly, the recommended execution time (40 to 60 seconds) was not followed in multicenter research.[18] In this case, it is very common to observe failures in procedure execution in relation to the time recommended in the literature in clinical practice. It is therefore recommended to distribute visual reminders emphasizing this aspect next to sinks and dispensers of alcoholic preparations and/or liquid soap.

Most health professionals who participated in a survey conducted in Spain reported having sufficient knowledge about how to properly clean their hands, and most received training and/or had prior knowledge regarding the procedure's basic steps.[18] Among the assessed professional categories, the nursing team had the best performance.[17,19,28] However, the assessment methodology may have influenced HH indicators, attributing a change in professionals' behavior when being observed (Hawthorne effect).[23,25]

It was possible to perceive in this review that the resources attributed to service structure influenced HH, such as water scarcity, hand-operated sinks, lack of inputs, location of containers and burnout associated with work overload. It is added that difficulty in accessing materials and psychological disorders caused by the pandemic directly influenced compliance, being important factors that must be worked on by health managers.[22]

Furthermore, the ineffective structure was not the only weakness found by the selected studies. The authors reinforced that the mere existence of COVID-19 management protocols, in isolation, is not enough to improve compliance, and it is necessary to disseminate the main results among the care team.[19] Feedback to health professionals was reported as a key factor in increasing HH indicators.

The discussion presented so far shows that professionals modify their behavior and attitude based on the risks they are exposed to, in the same way that patient care site, the availability of inputs and the offer of training favor HH. This fact can be evidenced in the Health Promotion Model used in this study. On the other hand, it was possible to verify that there are factors that weaken the HH process in hospitals, highlighting organizational barriers, such as insufficient supervision and minimal presence of an infection control team in care sectors.[21]

It is worth noting that a difficult point still present in several hospitals is related to glove use as an option to replace HH.[17] They are considered one of the effective PPE in the context of biosecurity that guarantee protection during health care.[1,4] But it is known that its use without prior HH is directly related to a greater spread of microorganisms among patients, professionals and/or environments.[17,19,23,28-31]

As limitations of this study, the time frame stands out, as the theme is current and emerging in the literature and, thus, new studies are constantly published and may reflect on the results presented in this review. It is important to mention the low level of evidence in the selected studies and weaknesses in the method used, with most cross-sectional studies.

Through subsidized results from the perspective of Nola Pender's Health Promotion Model, this study strengthens discussions between managers and nurses in relation to clinical practice and encouragement of HH compliance by their collaborators, following WHO protocols.

CONCLUSION

In this context, it was possible to analyze HH practices among health professionals during the COVID-19 pandemic. The articles included in the review elucidated several improvements of this preventive measure in health services, but compliance with the five moments recommended by the WHO still needs to be expanded and encouraged among multidisciplinary team members.

It is concluded that COVID-19 enabled a new look at HH, with a focus on infection prevention, care demands, inputs used, the importance of training and indicator monitoring. For this reason, in addition to professional self-protection, HH can directly contribute to patient care quality.

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LETTER TO THE EDITOR

Obesity and COVID-19: Impact on Immunity, Infection and Vaccination

Obesidade e COVID-10: Impacto na Imunidade, Infecção e Vacinação

Obesidad y COVID-10: Impacto en Inmunidad, Infección y Vacunación

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Obesity is a complex and multifactorial pathology that has been increasing significantly in recent decades, becoming a serious public health problem. It can be characterized by an energy and metabolic imbalance that compromises the health of individuals. Obesity can be complicated by other diseases or be associated with the development of comorbidities, such as diabetes mellitus, cardiovascular disease, hypertension, dyslipidemia, hepatic steatosis, in addition to various types of cancer.[1]

It is important to say that obesity also causes dysregulation of the immune system, which impairs the response of innate and adaptive immunity cells, alteration in the phenotype of macrophages and T lymphocytes, dysregulation in the production of cytokines and chemokines, cellular senescence, and alteration in the production of immunoglobulins. Another aspect to highlight is that obese individuals are at greater risk of developing bacterial, fungal, and viral infections, or are associated with a worse prognosis. This greater susceptibility may be associated with the modulation of the immune response, as well as anatomical and physiological changes in the respiratory system, and changes in the healing process, which contributes to an increased risk of post-surgery infections.[2]

Due to the large number of obese people in the world, their susceptibility to infections and the COVID-19 pandemic, several studies have shown that various diseases such as diabetes, kidney, and cardiovascular diseases, as well as obesity are related to a greater risk of developing more severe symptoms of SARS-CoV-2 infection. Thus, it has been shown that obese patients have a higher mortality rate and are associated with a longer stay in intensive care units (ICU).[3] A systematic review of several studies indicated that 32% of patients with cases of reinfection were obese, showing that obesity can be a contributing factor to the severity and reinfection of SARS-CoV-2.[4]

Besides the effects during the symptomatic phase, several individuals had chronic post-COVID-19 syndrome, such as cases of pain, chronic fatigue, weakness, mental disorders such as sleep disturbance and depression. During the pandemic, a reduction in physical activity was also observed, which is accompanied by loss of muscle mass and an increase in central adipose tissue, contributing to insulin resistance and dyslipidemia. In addition to the biological effects of COVID-19, the physical, emotional, and social aspects also contributed to a change in lifestyle and an increase in cases of obesity. Those obese individuals who required surgical treatment were also harmed by the reduction in the number of bariatric

surgical procedures.[5]

Obesity is characterized as a low-grade inflammatory state, which may contribute to the development of more severe forms of COVID-19. The relationship between disease severity and obesity can be explained because ACE2 is highly expressed in adipocytes and adipocyte-like cells found in lung tissue. Furthermore, in murine experimental studies, it was demonstrated that obese mice had a higher expression of ACE2 and TMPRSS2 in the trachea and lungs, which may facilitate the entry of the virus into cells.[6,7] This chronic low-grade inflammation associated with the immune response due to cell activation and production of pro-inflammatory cytokines may contribute to the amplification and worsening of the disease caused by the "cytokine storm".[6]

Furthermore, obese individuals have an accumulation of leptin-induced M1 macrophages (hormone produced by adipose tissue), neutrophils with impaired microbicidal activity, and a reduction in NK cells, in addition to an increase in the production of TNF-α, IL-6, IL- 12, IL-1β and TGF-β. Interestingly, obesity can lead to depletion of CD8+ T cells, a decrease in B lymphocytes and differentiation of helper T cells.[6]

Vaccination against COVID-19 has been shown to be effective, with an increase in the humoral immune response and a reduction in severe cases of the disease. Obesity is associated with a low immune response to tetanus, influenza, and hepatitis B vaccines. When comparing obese and non-obese individuals, it was shown that despite being effective, obese individuals had a lower rate of anti-SARS-CoV-2 neutralizing antibodies, and after 90 days, they had reduced specific antibodies, showing even more the importance of doses of reinforcement, especially for this group of people.[8]

A population-based cohort study from England showed that the first and second doses of COVID-19 vaccines were effective for obese and normal individuals, but not for those with low BMI. However, this research also showed that individuals with lower or higher BMI present a greater risk of developing severe cases of COVID-19, even after two doses of the vaccine.[9]

In obesity, the decrease in immunogenicity to long-term vaccination can be explained in different ways. For example, inhibition of thymopoiesis, leading to a reduction in the T lymphocyte repertoire; a reduction in memory T and B cells, which may be associated with a decrease in telomeres; an increase in the expression of PD-1 and PD-L1, inducing the exhaustion of these cells. In addition, long-term humoral immunity induced by vaccination may also be impaired, due to reduced antibody class switching and depletion of memory B cells. However, most studies of mechanisms of action are based on influenza vaccination.[10]

Thus, it is possible to observe the great complexity of obesity and its impact on several diseases, such as COVID-19. Interestingly, obesity can modulate the immune response of individuals, compromising a protective response against SARS-CoV-2 infection or the response to vaccines. However, more studies need to be performed to elucidate the mechanisms of low long-term

immunogenicity for SARS-CoV-2 and the different types of vaccines and doses.

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