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Profile of hepatitis the municipality of Belém, Pará, Brazil

Perfil da hepatite A no município de Belém, Pará, Brasil

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ABSTRACT

Introduction: Hepatitis A is a serious public health problem in the world; although it has shown a drop in its incidence rates in the state of Pará, northern Brazil, the incidence has remained high. **Objective:** The sociodemographic and epidemiological profiles of hepatitis A in the city of Belém, were determined. **Method:** The research was carried out with data from the records of the Information System of Diseases and Notification of cases of hepatitis from 2007 to 2016. To obtain the sociodemographic profile, the variables age, sex, race and schooling were used, which were associated to the number of cases through chi-square analysis in software R. In determining the epidemiological profile, the variables vaccine for hepatitis A, institutionalized in, final classification and probable source were used. **Results:** The frequency of hepatitis A was higher in men, children, persons declared brown and in people without a fixed institution. The cases are diagnosed by laboratory tests and have as main source of infection contaminated food and water. **Conclusions:** The profiles show the groups with the highest risk and factors that most corroborate for hepatitis A infection in the individuals of the city of Belém. Investments are necessary, in the area of sanitation so that there is an effective reduction of the cases in this municipality.

KEYWORDS: Hepatitis; Public Health; Waterborne Diseases

RESUMO

Introdução: A hepatite A é um grave problema de saúde pública no mundo. Embora tenha apresentado queda em suas taxas de incidências nacionais, no estado do Pará, Região Norte do Brasil, a incidência tem se mantido alta. **Objetivo:** Determinar os perfis sociodemográfico e epidemiológico da hepatite A no município de Belém. **Método:** A pesquisa foi realizada com os dados das fichas do Sistema de Informação de Agravos e Notificação dos casos de hepatite período de 2007 a 2016. Para a obtenção do perfil sociodemográfico utilizou-se as variáveis idade, sexo, raça e escolaridade, que foram associados ao número de casos através da análise de qui-quadrado no *software* R. Na determinação do perfil epidemiológico, usaram-se as variáveis: vacina para hepatite A; institucionalizado em; classificação final; e provável fonte. **Resultados:** A frequência da hepatite A foi maior em homens, crianças, pessoas declaradas pardas e em pessoas sem instituição fixa. Os casos são diagnosticados por testes laboratoriais e têm como fonte de infecção principal a água e alimentos contaminados. **Conclusões:** Os perfis evidenciam os grupos de maior risco e os fatores que mais corroboram para a infecção da hepatite A nos indivíduos do município de Belém. São necessários investimentos na área de saneamento para que haja uma efetiva diminuição dos casos nesta área.

PALAVRAS-CHAVE: Hepatites; Saúde Pública; Doenças de Veiculação Hídrica

INTRODUCTION

Viral hepatitises are systemic infections caused by viruses that have primary liver tropism and whose pathophysiology is based on the liver's inflammatory response to the virus[1]. Although they cause similar symptoms, viral hepatitises are distinct diseases, each with its own epidemiological, clinical, laboratory characteristics and specific etiological agents[2]. The main etiological agents of human viral hepatitis are the viruses of hepatitis A (HAV), B (HBV), C (HCV), D (HDV) and E (HEV)[3].

Hepatitis A (HAV) is believed to be an ancient disease that has afflicted mankind since the first humans began to live in groups large enough to enable the transmission of the causal agent[4]. However, it was only discovered in 1973 by American researchers[5]. Transmission occurs via fecal-oral route through the ingestion of contaminated food and water or directly from person to person[6,7,8].

In Brazil, the incidence rate of HAV progressively increased until 2005, with 11.7 cases per 100,000 inhabitants. Ever since then, it has had a downward trend: in 2016, the rate was of 0.6 cases per 100,000 inhabitants[9]. However, Rodrigues et al.[10] observed that, in the state of Pará (PA), Northern Brazil, the incidence of HAV has remained high over the years. This high index demonstrates the need for us to better understand the epidemiological and sociodemographic profile of hepatitis A in this region. According to Morais and Oliveira[11], knowledge of these profiles corroborates the development of primary prevention strategies and infection control, thus reducing the risk of disease transmission.

Silva et al.[12] considered the Information System for Notifiable Diseases (Sinan) to be relevant in the monitoring and study of diseases. The system consists of a set of standardized forms addressing the list of diseases of mandatory notification, including hepatitis A. The list contains much epidemiological and sociodemographic information, in addition to information about the patients. Sinan's objective is to record, process and communicate data on diseases across the Brazilian territory. These data are routinely generated by the Epidemiological Surveillance System and the analysis of this information can help the investigation process and support the analysis of epidemiological surveillance information on diseases of mandatory notification.

Given the above, the objective of the research was to determine the sociodemographic and epidemiological profile of hepatitis A in the municipality of Belém, Pará, Brazil, from 2007 to 2016.

METHOD

Type of study

The research was of the descriptive type, which, according to Hochman et al.[14], in an epidemiological context, addresses the characterization of the disease aspects. This type of research aims at learning more about the health problem, studying its distribution over time. Taking into account individual particularities, it aims to find an association with factors like gender, age, ethnicity, socioeconomic conditions, among others. It may contain reports and even population studies that are also known as ecological studies.

Study area

The study area comprised the municipality of Belém, capital of the state of Pará, located in northern Brazil (Figure). According to the Brazilian Institute of Geography and Statistics (IBGE)[15], this municipality has a territorial area of 1,059,458 km^2, an estimated population of 1,485,732 inhabitants in 2018 and a Human Development Index (HDI) of 0.746. The municipality has 71 neighborhoods in eight administrative districts.

Data collection

Cases of hepatitis A from 2007–2016 were obtained from the Sinan notification/investigation forms (http://portalsinan.saude.gov.br/hepatites-virais), made available by the Belém Municipal Health Department (Sesma). Any piece of information that could identify the patients was hidden, in order to ensure the confidentiality of the research.

Data on the total population with sanitary sewage in the municipality were obtained through the National Sanitation Information System (SNIS) of the National Sanitation Department.

Data processing

To analyze the hepatitis A database, the following requirements were considered: only confirmed cases of hepatitis A; patient living in the municipality of Belém; and full address information (neighborhood, street, number etc.). This was done through Microsoft Excel (2007).

The incidence rates were calculated based on the absolute number of confirmed hepatitis A cases, divided by the population of the municipality of Belém (estimated by IBGE per year) and multiplied by 100,000 inhabitants. The incidence rate was calculated for variables of the sociodemographic profile, considering the population by class according to the 2010 IBGE census.

Sociodemographic variables

The information used in the Sinan form (2007 to 2016) was: age, gender, ethnicity, and education, all contained in the individual notification section. The age range variable used in the data analysis was determined based on age data and categorized into five age groups: child (0-11 years), teenager (12-18 years), young adult (19-29 years), adult (30 to 59 years old) and elderly (≥ 60 years old).

The age range of children and teenagers was established as defined by the Brazilian Child and Adolescent Statute from

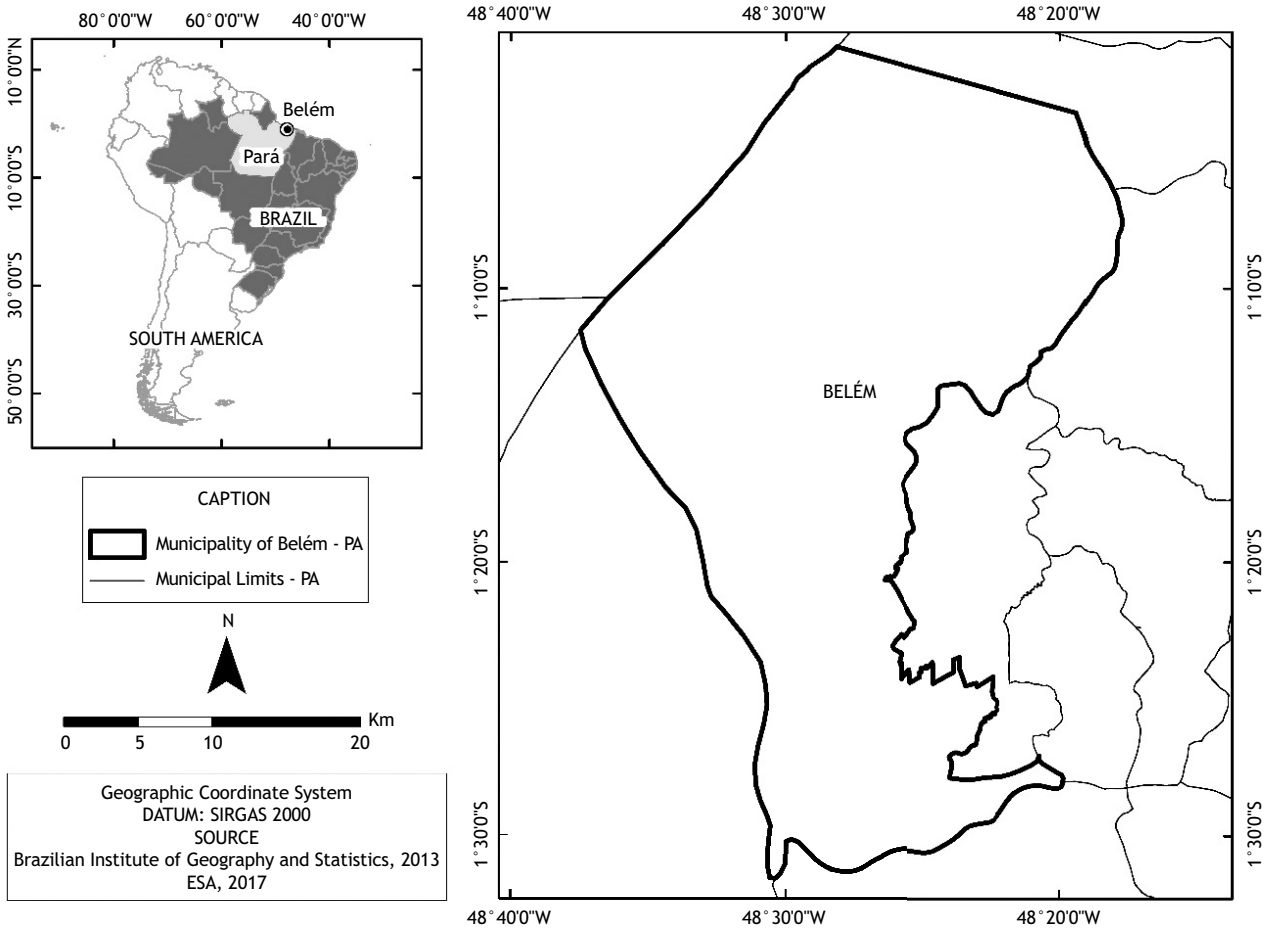

Figure. Location of the municipality of Belém, state of Pará, Brazil.

1990[16]. The young adult range was determined in accordance with the 2013 Youth Statute[17]. This law considers as young people those aged between 15 and 29. However, the Child and Adolescent Statute applies to teenagers aged 15 to 18 so that there are no conflicts with the rules of integral protection of children and adolescents. For this reason, the young adult range was established only from 19 to 29 years. The elderly range was determined according to the 2003 Senior Citizen Statute[18]: persons aged 60 or more. The stipulated adult range was the interval between the young adult and elderly ranges, i.e. 30 to 59 years old.

In the variable of gender, female and male fields were used. The fields white, black, yellow, brown and indigenous were used for the ethnicity variable. Indigenous and yellow ethnicities were grouped together because they presented only a few cases. For educational level, we chose to group some fields together, as follows: elementary school (complete and incomplete), high school (complete and incomplete), higher education (complete and incomplete), and the "not applicable" option. "Not applicable" was checked when the notified case was under 7 years old[19]. The illiterate field was not used due to the absence of notifications.

An association test was done between the number of cases and sociodemographic variables, which were tested using the chi-square analysis. Whenever necessary, Yates correction was applied. It was not possible to analyze the association of the education variable due to the lack of thorough data on the educational level of the population of Belém. Association analyses were done using R software.

Epidemiological variables

For epidemiological variables, as well as sociodemographic variables, we considered only the fields that had non-zero value and that had a relationship with hepatitis A, considering that the Sinan form has information on all types of hepatitis (A, B, C, D and E).

Thus, the blocks used to determine the epidemiological profile were: hepatitis A vaccine; institutionalized in; final classification and likely source. The following fields were used for each epidemiological variable: hepatitis A vaccine - complete, incomplete, unvaccinated; institutionalized in - day care, school, elderly home, company, prison, hospital/clinic, others, non institutionalized and unknown; final classification - laboratory confirmation and clinical and epidemiological confirmation; likely sources of

hepatitis A infection - home, dental treatment, contaminated food/water and others.

It is noteworthy that no statistical analyses were done for the association of the epidemiological profile with the population, since data from the Belém population were not obtained for this type of variables. Nevertheless, the analyses had satisfactory results to obtain the epidemiological profile.

RESULTS AND DISCUSSION

We obtained 577 confirmed cases of hepatitis A from 2007 to 2016 in the municipality of Belém, PA. However, when clearing the data, we noticed some discrepancies in the information. Of all cases, 124 had home addresses in another municipality and 25 had incomplete addresses, so we could not locate them. As a result, we had 428 confirmed cases of hepatitis A in Belém.

In 2007, 2009 and 2010, the annual incidence rate of hepatitis A per 100,000 inhabitants in Belém was 9.4; 6.1 and 3.9 respectively. These values were higher than the national rates presented by the Health Surveillance Department[20] (7.1 - 2007; 5.7 - 2009 and 3.9 - 2010), as shown in the chart below.

The chart shows that there has been a steady decrease in incidence in Belém, with sharp declines in 2008, 2011 and 2016. This is similar to what was observed in the 2017 viral hepatitis bulletin[9] from the Ministry of Health, when the Northern Region of Brazil had higher rates and variations although the incidence was decreasing. It is also noted that as sanitary sewage coverage grows over the years, there is a decrease in the incidence of hepatitis A in the municipality, and in 2014 there was a substantial increase in sanitation and a substantial decrease in incidence. According to Van Effelterre, Marano and Jacobsen[21], field studies and meta-analyses have shown over time that there is a significant association between decreased incidence of hepatitis A and improved socioeconomic status and basic sanitation.

The latest IBGE census showed an increase in Belém's socioeconomic indices, as shown by the municipal HDI of 0.746, which has grown in comparison to 1991 (0.562) and 2000 (0.644). In this improvement of the local HDI, longevity, income and education levels stand out[22]. Regarding sanitation, the Belém metropolitan area has shown an increase in the percentage of sewage coverage from 69.17% in 2012 to 95% in 2016. Households with water supply grew from 70.51% in 2012 to 72.54%. in 2016, and households with garbage collection grew from 97.58% in 2012 to 98% in 2016[23], thus contributing to the decrease in the incidence of hepatitis A in Belém. Macedo et al.[1] pointed out that the incidence of hepatitis A has been decreasing due to vaccination. However, the National Immunization Plan (NIP) only introduced the adsorbed hepatitis A vaccine (inactivated) in 2014, and only for children from 1 to 2 incomplete years of age. It is noteworthy that the vaccine is not available to children over 2 years old and to those who have taken it in private clinics[24].

The chart also shows two surges in incidence, in 2009 with 6.1 and 2013 with 2.9. However, during these years, extreme rain events occurred in the area. According to Loureiro et al.[25], in 2009 the municipality of Belém had values above the climatologic average of 540 mm, and in 2013 showed the highest rainfall index of 3,776 mm in a series from 2001 to 2015[26]. Floods affect the water supply network[27] and consequently undermine the supply to households, creating shortage of safe drinking water for the population and a scenario of risk of infection for various diseases[28], especially hepatitis A, since contaminated water is one of its transmission routes[29].

Sociodemographic profile

After the statistical analysis we found that the variables of gender, age and ethnicity had a statistically significant association with hepatitis A, as shown in Table 1.

In terms of gender, we observed that the frequency of hepatitis A in males is higher than expected: 57.24% (p <0.001) (Table 1).

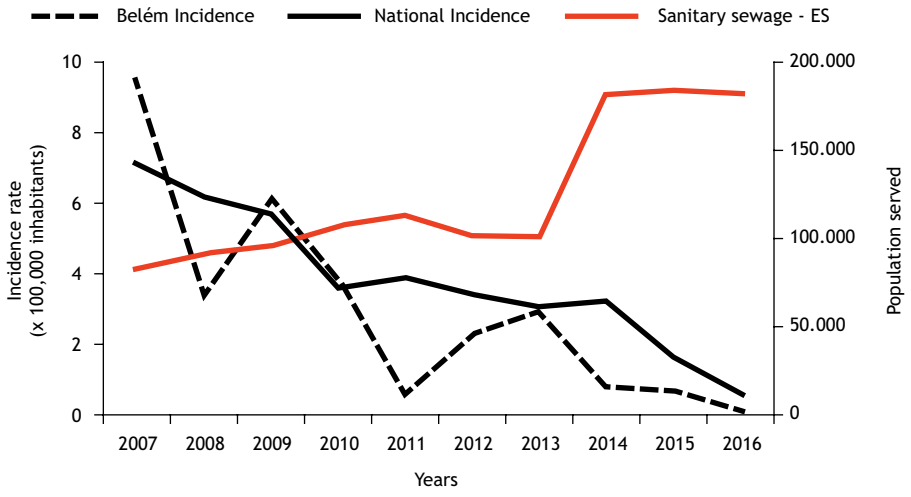

Chart. Ratio of the incidence of hepatitis A Brazilwide and in the municipality of Belém, associated with the population served by sewage collection from 2007 to 2016.

Table 1. Sociodemographic profile of individuals with confirmed hepatitis A in the municipality of Belém, 2007-2016.

Sociodemographic Profile	Frequency		Incidence (%)	p-value
	N	%		
Gender				
Female	183	42.76	13.13	<0.001
Male	245	57.24	17.58	
Age Range				
Child	137	32.01	9.83	
Teenager	100	23.36	7.18	<0.001
Young adult	132	30.84	9.47	
Adult	56	13.08	4.02	
Elderly	3	0.70	0.22	
Color/Ethnicity				
White	61	14.25	4.38	
Black	8	1.87	0.57	<0.001
Brown	350	81.78	25.12	
Yellow/Indigenous	9	2.10	0.65	
Level of Education				
Elementary School (complete/incomplete)	158	36.92		
High School (complete/incomplete)	115	26.87		
Higher Education (complete/incomplete)	49	11.45		
Not applicable	106	24.77		

Source: Sinan, 2007 to 2016.

This is also observed in the incidence, in which males account for 17.58% and females for 13.13%. In a study by Silva et al.[12] on the epidemiological pattern of hepatitis A and the association of socioenvironmental variables in Rio de Janeiro, a similar situation was found: the proportion of men with hepatitis A was higher than that of women.

Schmutz, Mäusezahl and Jost[29] emphasized that, in an area of high endemicity, men represent a high-risk group for HAV infection due to male homosexual intercourse. According to Paula et al.[30], this type of infection has been occurring frequently. It was found that 69.4% of identified male cases in Belém were within the permitted sexually active life range, according to art. 217-A of the Penal Code (Decree-Law n. 2,848 of December 7, 1940)[31].

Regarding age group, the frequency of the disease was higher in children (32.01%), young adults (30.84%) and teenagers (23.36%). It was lower in adults (13.08%) and elderly citizens (0.7%) (p <0.001) (Table 1). The incidence followed the frequency pattern of 9.83% in children, 9.47% in young adults and 7.18% in teenagers. The adult range accounted for about 36% of the population of Belém, whereas children accounted for 14%.

In a study conducted in the Brazilian state of Paraná, Babinski et al.[32] observed that the prevalence of HAV is higher in males aged between 1 and 14 years old (children and teenagers), which is a similar profile to that observed in this study. The elderly group showed the lowest frequency, 0.70%, and incidence of 0.22%. This is because after infection, patients usually acquire lifelong immunity against HAV[33]. In places where endemicity is average, the most affected individuals are in the range of teenagers and adults, whereas in high endemicity areas where sanitary conditions are poor, most people are infected early in childhood and these infections are usually asymptomatic[34,35]. Several studies have stated that the entire Northern region of Brazil has high endemicity for HAV[36,37], which is corroborated by the data found in this study.

The frequency in the brown population was higher, at 81.78% (p <0.001) (Table 1). However, the majority of the population of Belém is brown, that is, about 64% of the inhabitants of the municipality[38]. The incidence was lower (14.25%) among white individuals, who account for 26% of the population. In a study by Araújo, Mayvane and Gonçalves[39], on the epidemiological profile of viral hepatitis in the Brazilian state of Pernambuco, they observed that the ethnicity with the highest proportion of reported cases of hepatitis A was brown, with 60.70%. Mantovani et al.[40], in their study on socioeconomic inequalities and HAV infection in children of the Brazilian Western Amazon, found that 67.00% of the proportion of children studied was black or brown. Almeida et al.[41], in a study conducted in the Brazilian state of Bahia, found a higher number of cases of hepatitis A in

black people. This highlights that the ethnicity is more consistent with the miscegenation of the Brazilian population.

The most frequent educational level of hepatitis A patients was complete or incomplete elementary school (36.92%). Considering Law n. 11.274 of February 6, 2006[42], which establishes the guidelines and bases of Brazilian education and provides for mandatory enrollment in elementary schools of individuals from 6 to 14 years of age. This includes the groups of children and teenagers; together, they represented 55.37% of the frequency of people infected with hepatitis A during the study period.

However, a study conducted in 2014 in Bahia has shown that one of the factors associated with hepatitis A was complete and incomplete elementary school[41]. Low levels of education bear close relationship with the health-disease process, since it is proportional to the level of knowledge of individuals. In view of that, Souza, Santos and Jacinto[43] stated that people with higher education are more informed and that such knowledge contributes to them having better health conditions.

Epidemiological profile

The variables used to characterize the epidemiological profile lacked some information, since much was filled in as unknown, which is the case of hepatitis A vaccine fields, with 169 unknown cases, institutionalized as 136 unknown cases (Table 2). However, these are classified as mandatory fields by the Ministry of Health. According to the instructions to fill out the Sinan form, mandatory fields are those where absence of data prevents the inclusion of the notification or investigation in Sinan[44]. The field of probable source/mechanisms of infection is defined as an essential field, which, albeit not mandatory, records data that are necessary for the investigation of the case or the calculation of epidemiological or operational indicators[44]. Nonetheless, we found 31 unfilled cases in this field.

Table 2. Epidemiological profile of individuals in hepatitis A cases in the municipality of Belém, 2007-2016.

Epidemiological Profile	Frequency	
	N	%
Hepatitis A Vaccine		
Complete	9	2.10
Incomplete	7	1.64
Not vaccinated	243	56.68
Unknown	169	39.58
Institutionalized in:		
Day care	5	1.17
School	74	17.29
Elderly home	1	0.23
Company	10	2.34
Hospital/clinic	15	3.50
Others	24	5.61
Not institutionalized	163	38.08
Unknown	136	31.78
Final classification		
Laboratory confirmation	362	84.58
Epidemiological clinical confirmation	66	15.42
Likely source/mechanism of infection		
Home	9	2.10
Dental treatment	6	1.40
Contaminated water/food	380	88.79
Others	2	0.47
Not filled	31	7.24

Source: Sinan, 2007 to 2016.

It was found that 56.78% of individuals had not received hepatitis A vaccine. Although the vaccine is available at private vaccination clinics, it is only distributed by the Ministry of Health through the PNI at the Reference Centers for Special Immunobiologicals (CRIE) to the immunization of higher risk individuals[45]. In 2014, the vaccine also became available to children between 1 and 2 incomplete years of age[24]. Only eight children aged 1 to 2 years were found to have hepatitis A in the entire historical series studied. All were diagnosed in years prior to 2014 and presented as unvaccinated.

Only 1.64% of subjects received the vaccine incompletely. According to the Ministry of Health[45], after the first dose of the vaccine, 90 to 100% of vaccinees respond with antibody titers that can be considered protective. It was also observed that 39.58% of cases were unknown, which makes it impossible to know the actual situation of these individuals. However, according to Sinan's records, nine individuals confirmed for hepatitis A had taken the full vaccine. Nevertheless, according to the Ministry of Health[24], 100% of people who take hepatitis A vaccine develop protective levels of antibodies against the virus within one month after a single dose of the vaccine. Before exposure, the vaccine prevents 85% to 95% of cases when performed one to two weeks after exposure and may prevent or alleviate the disease, but after two weeks of contact, it is not effective[46]. Sousa et al.[47] found that, after a survey on filing mandatory notification in healthcare services, there are many obstacles in filling out the form, usually associated with work overload and misunderstanding of the notification importance. Moreover, proof of vaccination card was required to complete the "vaccinated" field[44].

Non-institutionalized individuals had a higher frequency of hepatitis A, with 38.08% of the cases. However, according to the World Health Organization[48], in relation to the general population, institutionalized people are more exposed and therefore more vulnerable to viral hepatitis. Still, according to Arrellas et al.[49], non-institutionalized people had lower rates of vaccination coverage due to lack of information.

Those institutionalized in schools had a frequency of 17.29%. In a hepatitis A outbreak investigation study in the Brazilian state of Minas Gerais, Oliveira et al.[50] found that there was a

concentration of cases in the local public school. When they visited the school, they found poor sanitary conditions and the permanent availability of mugs and drinking fountains for common use by all students. This is a favorable situation for the disease contagion chain. For Guerriero, Ayres, and Hearst[51], the institutional component is connected with different situations of vulnerability.

It was observed that 84.58% of the cases were diagnosed by laboratory confirmation, while only 15.42% were confirmed by clinical and epidemiological confirmation. This fact is related to the diagnostic difficulties that, in some cases, lead professionals to choose confirmation through serological tests[39]. It is noteworthy that clinical and epidemiological confirmation is only applicable to suspected cases of hepatitis A that have an epidemiological link with a confirmed case of hepatitis A through specific laboratory tests[45]. This contributes to the smaller amount of this diagnosis.

Considering the likely source and mechanism of hepatitis A infection in Belém, 88.79% were through contaminated water or food. According to Lee, Lee, and Know[52], one of the most common forms of transmission of hepatitis A is through ingestion of contaminated food or water. This was also found by Barbosa et al.[53] in the Brazilian state of Piauí, where the prevalent origin of the infection was viral transmission through contaminated water or food, a similar situation identified by Almeida et al.[41]. Guedes et al.[54] emphasized that the lack of sanitation and hygiene is common in many places, and various diseases can be prevented with access to adequate water resources. According to the Belém City Administration[55], diseases related to poor sanitation, such as infectious and parasitic diseases, are the third main reason for hospitalization in the municipality, corresponding to 11.8% of all hospitalization episodes. In this context, Siqueira et al.[56] emphasized that the lack of sanitation eventually harms individual health and increases public and private health spending on disease treatment.

As indicated above, the analyses indicated that in Belém HAV affects the age group of children, male, brown, with complete/incomplete elementary school, not vaccinated, without a fixed institution. Laboratory tests are commonly done for diagnosis and the main source of infection was contaminated water or food. For Sartori et al.[35], an adequate and comprehensive childhood immunization program is necessary for us to achieve a good outcome on hepatitis A epidemiology. In the United States, hepatitis A vaccination has been available since 1995-1996 to individuals aged 1 year and older[57]. Ever since its implementation, the incidence has decreased by about 95%[58]. Thus, global vaccination would be the ideal measure to progressively decrease the incidence of HAV[59].

Ferreira, Gonçalves and Gonzaga[60] stated that the biggest challenges in the study of viral hepatitis using Sinan are underreporting and lack of fulfillment of several fields in the mandatory notification forms, which hinders the preparation of a thorough database. The study also found errors in fulfillment and missing information. For Vieira et al.[61] these limitations hamper reliable estimates of true infection rates in the population, since most cases of hepatitis A are oligosymptomatic, especially in children, and may be confused with a common cold. It is therefore difficult to estimate its incidence based on case notifications[8]. For Azevedo et al.[62], the weakness of the surveillance system results in the absence of homogeneous notifications. Pinheiro, Andrade and Oliveira[63] stated that this underreporting makes it difficult to fully understand the epidemiological scenario and affects the planning for interventions aimed at better control. In a study conducted in Minas Gerais, from 2005 to 2014, significant changes were found in the epidemiological scenario, when there is enforcement of public policies to prevent viral hepatitis, significantly reducing the incidence[60].

CONCLUSIONS

The analysis of hepatitis A in Belém has shown that, although a decrease in incidence over the time series was observed, in some years the incidence rate of the disease was higher than the Brazilian average. This shows that the analysis of the sociodemographic and epidemiological profile is fundamental to support hepatitis A prevention programs.

The profiles have evidenced the highest risk groups in the municipality and the factors that most corroborate the infection of these individuals, like lack of sanitation system and lack of information about the transmission of the disease. This study has shown that investment in sanitation is key to improve public health and that sanitation policies play a significant role in the control and effective reduction of diseases related to inadequate environmental sanitation.

Because of the importance of the information contained in health information systems, the pursuit of strategies that prepare healthcare professionals for the correct and continuous fulfillment of reporting forms is necessary, as well as the obvious need for joint hepatitis A vaccination programs and campaigns to raise awareness and prevent the disease in the municipality of Belém.

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