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ORIGINAL ARTICLE

Viral hepatitis caused by occupational accidents: distribution of cases in Brazil, 2007-2014

Hepatites virais por acidentes de trabalho: distribuição dos casos no Brasil, 2007-2014

Hepatitis viral por accidentes de trabajo: distribución de casos en Brasil, 2007-2014

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Corresponding Author:
Técia Maria Santos Carneiro e Cordeiro
teciamarya@yahoo.com.br

Praça Conselheiro Almeida Couto, Largo do Terreiro de Jesus, s/nº, Centro Histórico, Salvador, BA, Brasil.

Técia Maria Santos Carneiro e Cordeiro [1]
Argemiro D'Oliveira Júnior[2]
Tânia Maria de Araújo[1]

[1] *Universidade Estadual de Feira de Santana, Feira de Santana, Bahia, Brazil*
[2] *Universidade Federal da Bahia, Salvador, Bahia, Brazil.*

ABSTRACT

Background and Objectives: to analyze the distribution of cases of viral hepatitis due to occupational accidents in Brazil from 2007 to 2014. **Methods:** this is an ecological study of a descriptive nature of notifications of viral hepatitis registered in the Information System for Notifiable Diseases. **Results:** they point out that the mean incidence of viral hepatitis due to occupational accidents in Brazil was 2 cases/1,000,000 of the economically active and employed population. There was an increasing trend in the Midwest region (p=0.02), among women (p=0.01) and those aged 38 to 49 years and 50 and older (p=0.01). The decreasing time trend was observed among those up to 37 years old and for non-black race/skin color (p=0.04). **Conclusion:** the temporal distribution was stationary in most regions and states in Brazil, increasing among female workers over 38 years old and decreasing among non-black women and under 37 years old.

Keywords: *Spatio-Temporal Analysis. Hepatitis, Viral, Human. Communicable Diseases. Accidents, Occupational. Disease Notification.*

RESUMO

Justificativa e Objetivos: analisar a distribuição dos casos de hepatites virais por acidentes de trabalho no Brasil de 2007 a 2014. **Métodos:** trata-se de um estudo ecológico de natureza descritiva das notificações de hepatites virais registradas no Sistema de Informação de Agravos de Notificação. **Resultados:** apontam que a incidência média de hepatites virais por acidentes de trabalho no Brasil foi de 2 casos/1.000.000 da população economicamente ativa e ocupada. Houve tendência de aumento na região Centro-Oeste (p=0,02), entre as mulheres (p=0,01) e entre 38 a 49 anos e 50 anos ou mais (p=0,01). A tendência temporal decrescente foi observada entre aqueles com até 37 anos e para raça/cor da pele não preta (p=0,04). **Conclusão:** a distribuição temporal foi estacionária na maioria das regiões e estados do Brasil, aumentando entre as trabalhadoras acima de 38 anos e diminuindo entre as mulheres não negras

e com menos de 37 anos.

Palavras-chave: *Análise Espaço-Temporal. Hepatite, Viral, Humana. Doenças Transmissíveis. Acidentes de Trabalho. Notificação de Doenças.*

RESUMEN

Justificación y Objetivos: analizar la distribución de los casos de hepatitis viral por accidentes de trabajo en Brasil de 2007 a 2014. **Métodos:** se trata de un estudio ecológico de carácter descriptivo de las notificaciones de hepatitis viral registradas en el Sistema de Información de Enfermedades de Declaración Obligatoria. **Resultados:** señalan que la incidencia media de hepatitis viral por accidente de trabajo en Brasil fue de 2 casos/1.000.000 de población económicamente activa y ocupada. Hubo una tendencia creciente en la región del Medio Oeste (p=0,02), entre las mujeres (p=0,01) y las de 38 a 49 años y 50 y más (p=0,01). La tendencia temporal decreciente se observó entre los de hasta 37 años y para raza/color de piel no negra (p=0,04). **Conclusión:** la distribución temporal fue estacionaria en la mayoría de las regiones y estados de Brasil, aumentando entre las trabajadoras mayores de 38 años y disminuyendo entre las mujeres no negras y menores de 37 años.

Palabras clave: *Análisis Espacio-Temporal. Hepatitis Viral Humana. Enfermedades contagiosas. Accidentes de Trabajo. Notificación de enfermedades.*

INTRODUCTION

Viral hepatitis are communicable infectious diseases with a variable distribution pattern among different countries and regions. Hepatitis B is more common worldwide and its chronic form affects about 250 million people.[1] Hepatitis C approaches 170 million people[2] and hepatitis A varies with age. The number of cases of hepatitis A decreases with age and increases with younger age and greater low socioeconomic and hygiene conditions.[3]

In Brazil, viral hepatitis are endemic diseases and their distribution follows the same pattern as the world: in 2019, the detection rate for hepatitis C was 10.8 per 100,000 inhabitants, and hepatitis B and A, 6.6 and 0.4/100 thousand inhabitants, respectively.[4] All types of viral hepatitis can occur in the development of work activities, being strongly related to the situation of commitment to biosafety standards and working conditions for the performance of work.

Viral hepatitis and occupational accidents are diseases and events of compulsory notification in Brazil, i.e., they must be notified by health professionals or those responsible for public and private health services that provide patient care.[5] These notifications are registered in the Notifiable Diseases Information System (SINAN - *Sistema de Informação de Agravos de Notificação*) through individual notification/investigation forms. This system needs to be operated properly and with quality data to guarantee coverage of essential data for decision-making and contribute to improving workers' health situation.[6]

Studies point to the risk of acquiring hepatitis B and C by occupational accidents with biological materials among health workers,[7,8] general services,[9] household and health waste collectors,[10,11] garbage collectors,[12] domestic workers[12] and mid-level technicians in the biological and health sciences.[13] Although the studies pay greater attention to health workers, other categories are also exposed to occupational accidents and, as a result, infectious diseases.

The justification for this study is due to the need for an investigation into viral hepatitis caused by occupational accidents, using records from SINAN notifications, and with a temporal distribution, which allows evaluating the disease occurrence over time. This is very relevant for the necessary preventive measures. In Brazil, studies of certain regions and in a specific period are observed, therefore, it strengthens the relevance of data of national scope, and these data can subsidize the actions of health surveillance of communicable diseases and workers' health in the country.

Given the above, this study aimed to analyze the distribution of cases of viral hepatitis by occupational accidents in Brazil, from 2007 to 2014.

METHODS

This is an ecological study of a descriptive nature, which allows evaluating the distributions of aggregated data in time and space. Data from viral hepatitis notifications registered in SINAN, provided by the Health Surveillance Department of the Ministry of Health, were used. Only cases in which the source of infection were occupational accidents were included, as this is a field that is understood to establish a causal link.

All cases reported in Brazil from 2007 to 2014 were evaluated, considering that there were changes in the notification forms before 2007 and 2014, as it was the last year that was available to researchers.

The variables analyzed were: year of notification (2007 to 2014); the regions (South, Southeast, North, Midwest and Northeast) and the states of residence (the 27 that make up the country); sex (female and male); age categorized by tertile (up to 37 years, 38-49 years and 50 years and over); education (up to elementary school, high school and higher education); race/skin color (black and non-black); exposure to injectable drugs, occupational accidents with biological materials (OABM), contaminated water and food, multiple sexual partners; etiological classification (Virus A, B and C); and occupa-

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tion, according to the Brazilian Occupation Classification (CBO - *Classificação Brasileira de Ocupação*).

Incidence coefficients were calculated by year, sex, state and region, using viral hepatitis cases by occupational accident as the numerator, and the Economically Active and Employed Population (EAEP) per year as the denominator. Mean incidence coefficients for the period (2007-2014) were also estimated, considering in the numerator the mean of cases in the period and in the denominator, the mean of EAEP for 2010 and 2011, representing the mid-period EAEP. The EAEP was obtained by the Brazilian National Household Sample Survey (PNAD - *Pesquisa Nacional por Amostra de Domicílios*) and by the Demographic Census, both at the Brazilian Institute of Geography and Statistics (IBGE - *Instituto Brasileiro de Geografia e Estatística*).

To describe the cases by the variables analyzed, relative frequencies per year of notification were calculated. The Proportional Percentage Variation (PPV) was estimated for all incidences and relative frequencies of each variable, to verify the variation of the time series analyzed with the following formula: {[(end year-start year)/start year]*100}.

The analysis of the temporal distribution of the variables in proportions was verified by the linear chi-square test. For the incidence coefficients, Simple Linear Regression was performed, considering incidence as a dependent variable, incidence and calendar years as an independent variable (2007-2014). The temporal distribution was classified as increasing when the regression coefficients and PPV are positive, decreasing when negative, and stationary if coefficients do not show a statistically significant difference (p>0.05), when comparing the occurrence of cases from 2007 to 2014.[14]

The spatial distribution analysis was carried out together with the temporal analysis through assessment by clusters, i.e., the data grouped by the five regions and the twenty-seven states of Brazil. Incidence was stratified according to sex for the country, Brazil and its regions.

Data were processed using Microsoft Office Excel 2007 and SPSS version 17.0. This study was approved by the Institutional Research Ethics Committee with Opinion 1,249,977/2015, in compliance with Resolution 466/2012.

RESULTS

In Brazil, 1,493 cases of viral hepatitis by occupational accident were reported in the period from 2007 to 2014, with a mean incidence of 2 cases per 1,000,000 of EAEP and stationary temporal distribution. Among the regions of Brazil, there was an oscillation in the incidences from year to year with negative variation in the time series in the North (PPV= -42.3%) and Southeast (PPV= -27.8%) regions, and positive in the Northeast (PPV= 140.0%), South (PPV= 16.0%) and Central-West (PPV=133.3%), showing an increasing temporal trend in the Midwest region (p=0.02) (Table 1).

The states also showed oscillation in the distribution of viral hepatitis incidences in the period under study. Acre was the state that presented the highest incidence year by year and the mean incidence with 13.1 cases per 1,000,000 of EAEP, but with stationary trend. Tocantins (p=0.03) and Sergipe (p=0.04) followed a decreasing temporal trend (Table 1).

Regarding sex, women had higher incidences year after year in Brazil and its regions, with an increasing temporal trend only in the Midwest region (P=0.01), and men showed a stationary temporal trend in Brazil and its regions (Figure 1).

As for the characteristics of the total number of reported cases, during the study period, those up to 37 years old (36.9%), non-black race/skin color (60.1%), with high school education (47.0%), exposed to OABM (68.5%) and with hepatitis B virus (HBV) (49.2%) and hepatitis C virus (HCV) (49.4%) prevailed. There was a decreasing temporal trend for those aged up to 37 years, an increasing trend from 38 to 49 years and 50 years and over (p=0.01), and decreasing trend for non-black race/skin color (p=0.04) (Table 2).

According to occupations, mid-level technicians predominated (36.3%), service workers, salespeople in stores and markets (24.3%), maintenance and repair workers (16.0%) and science and arts professionals (12.7%). Mid-level technicians (PPV=-25.9%), service workers, salespeople in stores and markets (PPV=-13.8%) showed a negative variation in the time series, and maintenance and repair workers (PPV=69.9%) and science and arts professionals (PPV=48.8%) have a positive variation.

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Table 1. Incidence coefficient (per 1,000,000) of viral hepatitis by occupational accidents in Brazil, regions and states, 2007-2014.

Regions and states	Raw Incidence								PPV	Mean incidence (2007-2014)	*p-value	TT
	2007	2008	2009	2010	2011	2012	2013	2014				
North	2.6	2.0	2.8	2.5	2.7	2.1	2.5	1.5	-42.3	2.4	0.23	S
Rondônia	3.9	2.5	7.2	3.9	4.8	4.6	7.1	2.3	-41.0	4.7	0.85	S
Acre	15.9	18.9	9.0	6.6	17.5	16.7	12.9	5.8	-63.5	13.1	0.35	S
Amazonas	0.0	0.0	2.7	3.4	0.6	1.9	1.9	2.9	290.0	1.7	0.16	S
Roraima	9.9	5.1	5.1	0.0	8.9	4.7	0.0	0.0	-100.0	4.2	0.08	S
Pará	1.5	0.6	0.9	1.3	1.4	0.6	1.7	0.3	-80.0	1.0	0.61	S
Amapá	4.0	3.7	0.0	3.4	3.8	0.0	0.0	3.0	-25.0	2.2	0.33	S
Tocantins	3.0	2.8	4.1	3.2	1.4	0.0	0.0	1.4	-53.3	2.1	0.03	D
Northeast	0.5	0.9	0.9	1.0	1.0	1.0	0.8	1.2	140.0	0.9	0.06	S
Maranhão	0.3	1.8	1.4	0.8	1.0	1.7	2.0	1.9	533.3	1.5	0.08	S
Piauí	0.6	0.0	0.0	0.0	0.6	0.0	0.7	0.0	-100.0	0.3	0.98	S
Ceará	0.3	0.5	1.0	0.5	0.5	0.8	0.5	0.5	66.7	0.6	0.80	S
Rio Grande do Norte	0.0	2.7	0.0	0.0	0.7	1.4	2.0	2.0	200.0	1.2	0.30	S
Paraíba	0.6	0.6	0.0	1.2	1.2	0.6	0.6	0.5	-16.7	0.7	0.84	S
Pernambuco	0.0	0.5	0.6	0.3	1.7	1.1	0.5	0.8	80.0	0.7	0.23	S
Alagoas	0.8	3.2	0.0	0.0	0.8	0.8	0.0	0.8	0.0	0.8	0.38	S
Sergipe	4.3	3.2	0.0	1.1	0.0	0.0	0.0	0.9	-79.1	1.2	0.04	D
Bahia	0.5	0.3	1.6	2.1	1.3	1.3	0.6	1.8	260.0	1.2	0.33	S
Southeast	1.8	1.8	2.1	1.7	2.3	2.2	1.7	1.3	-27.8	1.8	0.50	S
Minas Gerais	2.1	0.4	1.1	2.0	2.0	1.4	0.9	1.0	-52.4	1.4	0.63	S
Espírito Santo	2.3	1.6	0.5	0.5	3.2	1.5	1.6	1.0	-56.5	1.5	0.79	S
Rio de Janeiro	1.1	1.4	2.0	1.7	1.1	1.4	0.8	1.6	45.5	1.3	0.73	S
São Paulo	1.7	2.7	2.7	1.8	2.8	2.9	2.3	1.4	-17.6	2.3	0.76	S
South	2.5	3.3	3.2	3.8	3.9	4.4	3.8	2.9	16.0	3.5	0.29	S
Paraná	2.5	1.8	1.3	3.0	4.0	2.6	2.1	2.8	12.0	2.5	0.46	S
Santa Catarina	3.0	3.6	6.0	3.4	3.5	4.0	3.9	3.0	0.0	3.8	0.75	S
Rio Grande do Sul	2.3	4.4	3.2	4.8	3.9	6.3	5.5	3.1	34.8	4.2	0.29	S
Midwest	1.8	1.7	2.7	1.8	1.5	2.8	4.5	4.2	133.3	2.6	0.02	I
Mato Grosso do Sul	1.6	0.8	6.4	0.8	0.8	1.5	3.0	2.1	31.3	2.2	0.99	S
Mato Grosso	0.7	3.3	1.3	1.3	1.9	3.8	9.7	2.4	242.9	3.1	0.18	S
Goiás	2.0	1.6	1.0	2.2	1.6	1.2	2.8	5.1	155.0	2.2	0.10	S
Federal District	2.6	0.8	4.9	2.1	1.5	6.7	4.3	6.2	138.5	3.6	0.09	S
Brazil	1.6	1.8	2.0	1.9	2.2	2.3	2.1	1.8	12.5	2.0	0.19	S

Source: SINAN/Health Surveillance Department/Ministry of Health, 2015.

*Caption: PPV: Proportional Percentage Variation; TT: Temporal Trend; S: Stationary; D: Decreasing; I: Increasing. *p-value referring to Simple Linear Regression.*

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Table 2. Distribution of viral hepatitis by occupational accident according to sociodemographic and clinical variables, Brazil, 2007 to 2014.

Variables	Distribution per year (%)								PPV	TOTAL	*p-value
	2007	2008	2009	2010	2011	2012	2013	2014			
Age											
Up to 37 years	42.2	43.5	32.1	30.4	38.5	33.9	35.5	33.0	-21.8	35.9	0.01
38 to 49 years	34.0	30.0	40.5	28.2	28.8	33.5	28.0	34.7	2.1	32.2	
50 years and older	23.8	26.5	27.4	32.7	32.7	32.6	36.5	32.4	36.1	31.9	
Race/skin color											
Non-black	60.6	64.6	62.2	65.6	60.1	56.5	58.2	54.7	-9.7	60.1	0.04
Black	39.4	35.4	37.8	34.4	39.9	43.5	41.8	45.3	15.0	39.9	
Education**											
Up to elementary school	46.4	38.7	41.4	35.3	32.2	39.1	34.1	33.3	-28.2	37.3	0.11
High school	38.4	45.3	42.0	52.9	51.3	41.4	53.0	50.0	30.2	47.0	
Higher education	14.3	15.3	15.9	11.8	16.4	19.5	11.6	15.9	11.1	15.2	
Exhibitions											
Injectable medication administration	34.0	35.4	33.7	38.0	40.6	40.0	41.5	35.8	5.3	37.6	0.17
Accidents with biological materials	65.7	69.2	71.8	70.8	65.1	67.1	63.9	75.5	14.9	68.5	0.78
Contaminated water and foods	8.3	5.8	7.8	4.3	8.3	4.4	8.6	6.8	-18.1	6.8	0.95
Several sexual partners	19.9	12.0	14.6	16.9	11.5	15.8	15.4	15.5	-22.1	15.1	0.78
Etiological classification											
Virus A	3.0	1.2	1.7	1.2	0.0	2.0	1.7	0.6	-80.0	1.4	0.69
Virus B	43.3	55.3	49.1	41.8	51.0	49.0	48.6	54.4	25.6	49.2	
Virus C	53.7	43.5	49.1	57.0	49.0	49.0	49.7	45.0	-16.2	49.4	
Brazilian Occupation Classification											
0	0.0	0.0	0.9	0.0	0.0	0.7	0.7	0.0	0.0	0.3	0.31
1	1.1	1.9	0.0	3.7	1.5	0.0	2.2	1.6	45.5	1.5	
2	8.0	16.5	16.2	12.1	12.3	13.2	10.9	11.9	48.8	12.7	
3	46.0	36.9	33.3	37.4	41.5	28.7	35.8	34.1	-25.9	36.3	
4	2.3	1.0	0.9	1.9	0.8	4.4	1.5	3.2	39.1	2.0	
5	27.6	16.5	28.2	18.7	21.5	29.4	27.0	23.8	-13.8	24.3	
6	1.1	1.0	0.0	1.9	1.5	2.2	1.5	1.6	45.5	1.4	
7	2.3	5.8	4.3	3.7	2.5	4.4	5.1	5.6	143.5	4.7	
8	1.1	1.9	0.9	0.0	0.8	0.7	0.7	0.8	-27.3	0.8	
9	10.3	18.4	15.4	20.6	14.6	16.2	14.6	17.5	69.9	16.0	

Source: SINAN/Health Surveillance Department/Ministry of Health, 2015.

Caption: PPV: Proportional Percentage Variation. 0: armed forces, police and firefighters; 1: senior members of the public power, directors of public interest organizations and companies and managers; 2: science and arts professionals; 3: mid-level technician; 4: administrative service workers; 5: service workers, salespeople in stores and markets; 6: agricultural, forestry, hunting and fishing workers; 7: industrial goods production and service workers I; 8: industrial goods production and service workers II; 9: maintenance and repair workers.

**p-value referring to the linear chi-square. **Illiterate: 2007 – 0.9%, 2008 – 0.7%, 2009 – 0.7%, 2013 – 1.3% and 2014 – 0.8%.*

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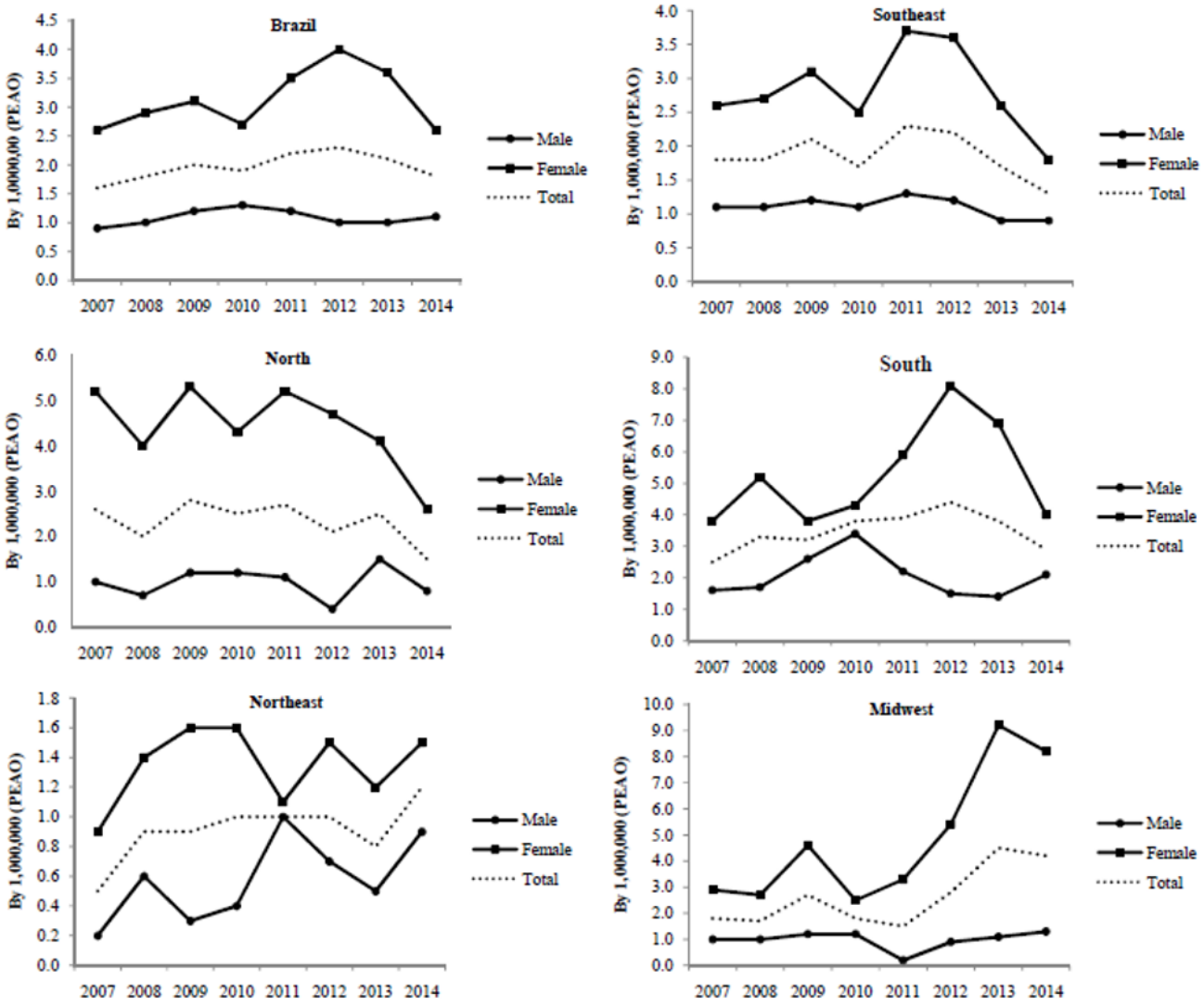

Figure 1. Incidence of viral hepatitis due to occupational accident by sex, Brazil and Regions, 2007 to 2014.

DISCUSSION

Viral hepatitis incidence by occupational accident in Brazil, regions and states were very low; however, the data can be considered underestimated due to under-reporting by several intervening factors. But, as it is an event in which the forms of prevention, in most cases, are easily accessible, it is considered a worrying information for Brazilian workers' health and also for the expenses generated by the health services with the treatment of these infections.

Viral hepatitis viruses of types A, B and C can be caused in the development of work activities, although HBV and HCV are present in greater proportions both in the general population and in workers. In the work environment, accidents with biological materials are responsible for exposure to HBV and HCV in different occupations that are exposed in daily life to blood, fluids and blood products and, mainly, contact with sharps.[8,10,11]

Viral hepatitis indicators, due to occupational accidents, varied according to the occupation in studies carried out, but frequencies were low, corroborating the present study. For HCV, in the adult population, it was 4.52%,[15] among health waste collectors, 3.3%,[11] household waste collectors, 0.9%,[11] health workers, 0.5%[8], cases reported in the state of Amapá/Brazil, 1.0%[9] and cases reported in the state of Bahia/Brazil, 0.1%.[13] For HBV, among waste collectors, it was lower than 0.05%,[11] firefighters, 6.5%,[9] cases reported in the municipality of Santa Cruz/Rio Grande do South, 0.5%,[12] health workers, 0.8%[7] and 0.6%,[8] cases reported in the state of Amapá/Brazil, 1.6%[9] and cases reported in the state of Bahia/Brazil, 0.2%.[13] Frequencies were low, as in the present study, and the proportion between occupations are similar, although some professional categories have not been studied.

There was an increase in incidence indicators in the Midwest region. When comparing the sexes, female

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workers grew more in the Midwest region and by age group among those over 38 years old. The decreasing trend of incidence was observed in the states of Sergipe and Tocantins and also in the age group up to 37 years and in the group of workers of non-black skin color.

The Midwest and Northeast regions have low to moderate prevalence of hepatitis B.[16] Between 2008 and 2019, the detection rates of hepatitis type B in the population of the Midwest Region increased, hepatitis C did not change, and hepatitis A decreased. In the states of Sergipe and Tocantins, there was a slight increase in detection rates between 2008 and 2019 for HCV and a reduction for HBV and hepatitis A virus (HAV).[4] These data from the general population portray the findings in the present study as most cases are HBV and HCV. The greater the number of cases of accidents with biological materials, the greater the risk and contamination for HBV and HCV.

The state of Acre, in the present study, had the highest incidences of viral hepatitis compared to other states in the country. A study with health professionals in Rio Branco/Acre showed a high prevalence of HCV of 4.8% and was related to long-term exposure, older age and residents of the city for a longer period of time,[17] when considering the high endemicity of hepatitis B in this state.[16] Other factors related to the increase in notifications of accidents with biological materials in Acre were the implementation of a Reference Center for Occupational Health (CEREST - *Centro de Referência em Saúde do Trabalhador*), adequate physical infrastructure, training of professionals from the sentinel networks and teams compatible with demand.[18] These factors may also be related to the greater number of reported cases of viral hepatitis in the state, screening programs developed for riverside populations, continuing education for professionals, which contributes to a quality health surveillance service.

Women have been the group with the highest occurrence of OABMs that expose workers to viral hepatitis in different countries.[8,13,19] This may be linked to the occupation developed by women with greater exposure as technicians in the health sector. Age is also a major factor, the older the age, the longer the length of service, the greater the risk of OABM and, consequently, hepatitis occurrence,[11-13,15] when considering that these workers develop self-confidence and lose the discernment of precaution. The non-black skin color showed a reduction due to greater social inclusion of the black race in the labor market and, with that, greater exposure and risk for viral hepatitis.

The highest frequencies of notifications during the period under analysis were observed among workers with complete high school and high school technical occupation and service workers, with agreement between these characteristics, since OABMs are responsible for most cases of viral hepatitis occurring between mid-level and health[20] workers.[8,13,19-21] Mid-level technicians include technicians and assistants in nursing, laboratory, oral health, medical and dental equipment, clinical pathology, among others. Other occupational groups are also at risk such as manicures and pedicures,[22] domestic workers and garbage collectors,[12] household and health waste collectors,[11] police officers[23] and maritime officers.[24]

Service workers, market and store trade vendors include those who perform laundry services, domestic servants, chamberlains/housekeepers, street sweepers, healthcare and household waste collectors, community health workers, health laboratory assistants, beautification and hygiene, caregivers, funeral services, firefighters, police officers, sex workers, among others, are related to service work, which also expose workers to biological material or sexual activity. Studies indicate the occurrence of accidents with biological materials and hepatitis B and C in household and health waste collectors,[11] garbage collectors[12], domestic workers,[12] as well as police officers[23] and maritime officers[24] are different occupations, but with risks to contact with biological materials.

In exposure to accidents with biological materials, there was a higher frequency of hepatitis. Studies indicate that contact with blood and fluids results from accidents with sharps, due to improper disposal and recapping of needles.[7,8,10,11,15,20,23] The risk of acquiring HCV from exposure to biological material is 3 to 10% and HBV is 40%.[20]

The frequency of viral hepatitis in the present study, according to type, was higher for HBV and HCV infection, considering the period. This may be related to the most frequent occupations, the forms of exposure of these occupations that contribute to the risk of transmission of these viruses, to workers who do not follow biosafety standards or are not trained to follow them, and also due to institutions' working conditions. In studies with health workers, oral health teams, household and health waste collectors and firefighters, HBV and HCV[7,8,11,15,19] were mainly assessed, which confirms the relationship between occupation, exposure and type of viral hepatitis.

The data from this study show that workers from technical activities in health care and support services were those with the highest frequency of cases of viral hepatitis, and this is because they are constantly exposed to pathogens in the development of their work activities. These data are relevant for epidemiological surveillance to expand prevention actions such as HBV vaccination that is available to all adults in health services in Brazil and anti-HBs serology testing to verify immunity, as studies indicate frequencies of non-immunized workers ranging from 14-45.3%.[8,11,19] Moreover, worker health protection should be considered by identifying the different risk situations at work for interventions to be effective.

Among the limitations of this study, we can highlight the underreporting of cases of hepatitis by professionals or public and private health services and the incompleteness of the information in the notification form, in particular the source of infection (only 45.8% of the fields were filled in) and occupation (with 63.2% of the fields filled in);[25] the seven-year period that the data were made available for analysis; the non-standardization of incidences to maintain the analysis of frequencies of other variables; trend analysis verified only by distribution in the period, with no analysis of seasonality and autocorrelation; and

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scarcity of studies on the temporal trend of viral hepatitis due to occupational accidents to compare data, thus using studies of accidents with biological materials.

It is concluded that the temporal distribution of viral hepatitis due to occupational accident in Brazil was stationary in the country and in most regions and states. The Midwest region showed growth and the states of Sergipe and Tocantins decreasing incidences. Women, aged over 38 years, maintenance and repair workers and science and arts professionals showed an increase in cases in the time series.

However, these data may be underreported, requiring greater investments in training for professionals and health services both for diagnosis and establishment of the epidemiological technical nexus and for filling in all mandatory and essential fields of the notification form.

As it is an event that can be prevented in the work environment, greater investment is needed in actions to apply biosafety standards in the daily work, in addition to vaccination and guaranteeing immunity, as strategies to protect workers' health. Employers should contribute to this process by forming the Internal Commission for Accident Prevention (CIPA - *Comissão Interna de Prevenção de Acidentes*), carrying out training, checking the vaccination card of all workers in the admission and periodic evaluation and, mainly, providing the work environment with safety, through collective protection measures.

Furthermore, intervention actions are needed to monitor workers' health in different work environments such as the health sector and those of services and maintenance and repair, which differ in terms of the work process, but cases of viral hepatitis are occurring.

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REFERENCES

1. Cangelosi Q, Means SA, Ho H. A multi-scale spatial model of hepatitis-B viral dynamics. PLoS ONE. 2017; 12 (12): e0188209. doi: 10.5281/zenodo.1043833
2. Sharma G, Raheja H, Das S. Hepatitis C virus: enslavement of host factors. IUBMB Life. 2018; 70 (1): 41-9. doi: 10.1002/iub.1702
3. Gripenberg M, D'Cor NA, L'Azou Maina, Marsh G, Druelles S, Nealon J. Changing sero-epidemiology of hepatitis A in Asia Pacific countries: A systematic review. Int J Infect Dis. 2017; 29 (68): 13-7. doi: 10.1016/j.ijid.2017.12.021
4. Ministério da Saúde (BR). Boletim epidemiológico – Hepatites virais. Número especial. Brasília: Ministério da Saúde; 2020 [citado 2021 maio 11]. Disponível em: http://www.aids.gov.br/pt-br/pub/2020/boletim-epidemiologico-hepatites-virais-2020
5. Brasil. Portaria nº 264 de 17 de fevereiro de 2020. Altera a Portaria de Consolidação nº 4/GM/MS, de 28 de setembro de 2017, para incluir a doença de Chagas crônica, na Lista Nacional de Notificação Compulsória de doenças, agravos e eventos de saúde pública nos serviços de saúde públicos e privados em todo o território nacional. Diário Oficial da União, Brasília (DF), 2020 fev 19 [citado 2020 set 17]; Seção 1 (35): 97. Disponível em: https://www.in.gov.br/en/web/dou/-/portaria-n-264-de-17-de-fevereiro-de-2020-244043656
6. Brasil. Hepatites Virais. In: Brasil. Guia de vigilância em saúde. 3. ed. Brasília: Ministério da Saúde; 2019: 263-75. [citado 2021 maio 05]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/guia_vigilancia_saude_3ed.pdf
7. Soares RZ, Schoen AS, Benelli KRG, Araújo MS, Neves M. Analysis of reported work accidents involving healthcare workers and exposure to biological materials. Rev Bras Med Trab. 2019; 17 (2): 201-208. doi: 10.5327/Z1679443520190341
8. Souza HP, Otero UB, Silva VSP. Profile of healthcare workers involved in accidents with exposure to biological materials in Brazil from 2011 through 2015: surveillance aspects. Rev Bras Med Trab. 2019; 17 (1): 106-118. doi: 10.5327/Z1679443520190305
9. Santos Junior GT, Araújo MHM, Araújo GS, Santos BEF, Costa Junior RR. Characterization of occupational accidents occurred at the Occupational Health Referral Center of the state of Amapá between 2007 and 2016. Rev Bras Med Trab. 2021; 19 (1): 35-42. doi: 10.47626/1679-4435-2020-526
10. Costa MD, Rapparini C, Schmaltz CAS, Tuyama M, Lauria LM, Saraceni V, et al. Danger in the streets: exposures to bloodborne pathogens after community sharp injuries in Rio de Janeiro, Brazil. Braz J Infect Dis. 2017; 21 (3): 306-11. doi: 10.1016/j.bjid.2017.03.003
11. Mol MPG, Gonçalves JP, Silva EA, Scarponi CFdO, Greco DB, Cairncross S, et al. Seroprevalence of hepatitis B and C among domestic and healthcare waste handlers in Belo Horizonte, Brazil. Waste Manag Res. 2016; 34 (9): 875-83. doi: 10.1177/0734242x16649686
12. Bertelli C, Martins BR, Krug SBF, Petry AR, Fagundes PS. Occupational accidents involving biological material: demographic and occupational profile of affected workers. Rev Bras Med Trab. 2020; 18 (4): 415-424. doi: 10.47626/1679-4435-2020-534
13. Cordeiro TMSC, Carneiro Neto JN, Cardoso MCB, Mattos AIS, Santos KOB, Araújo TM. Acidentes de trabalho com exposição a material biológico: descrição dos casos na Bahia. R Epidemiol Control Infec. 2016; 6 (2): 50-6. doi: 10.17058/reci.v6i2.6218
14. Antunes JLF, Cardoso MRA. Uso de análise de séries temporais em estudos epidemiológicos. Epidemiol. Serv. Saúde. 2015; 24 (3): 565-76. doi: 10.5123/S1679-49742015000300024
15. Gheorghe L, Csiki IE, Iacob S, Gheorghe C, Smira G, Regep L. The prevalence and risk factors of hepatitis C virus infection in adult population in Romania: a nationwide survey 2006-2008. J Gastrointestin Liver Dis. 2010; 19 (4): 373-9.

16. Souto FGD. Distribution of hepatitis B infection in Brazil: the epidemiological situation at the beginning of the 21st century. Rev Soc Bras Med Trop. 2016; 49(1): 11-23. doi: 10.1590/0037-8682-0176-2015

17. Paraná R, Paiva T, Leite MR, Oliveira FN, Kali N, Lobato C, et al. Infection with hepatitis C vírus among health care workers in the Brazilian Western Amazon Region (Rio Branco, State of Care). Am J Trop Med Hyg. 2007; 76 (1): 165-9. doi: 10.4269/ajtmh.2007.76.165

18. Galdino A, Santana VS, Ferrite S. Os Centros de Referência em Saúde do Trabalhador e a notificação de acidentes de trabalho no Brasil. Cad Saúde Pública 2012; 28 (1): 145-59. doi: 10.1590/S0102-311X2012000100015

19. Vargas SC, Oliveira CF, Renner JDP, Krug SBF, Possuelo L. Prevalence of occupational infectious diseases among primary oral health care teams and prevention measures. Rev Bras Med Trab. 2020; 18 (2): 149-157. doi: 10.47626/1679-4435-2020-546

20. Goel V, Kumar D, Lingaiah R, Singh S. Occurrence of needlestick and injuries among health-care workers of a tertiary care teaching hospital in North India. J Lab Physicians. 2017; 9 (1): 20-5. doi: 10.4103%2F0974-2727.187917

21. Goniewicz M, Wloszczak-Szubzda A, Niemcewicz M, Witt M, Marciniak-Niemcewicz A, Jarosz MJ. Injuries caused by Sharp instruments among healthcare workers – international and Polish perspectives. Ann Agric Environ Med. 2012; 19 (3): 523-7.

22. Garbaccio JL, de Oliveira AC. Adherence to and knowledge of best practices and occupational biohazards among manicurists/pedicurists. Am J Infect Control. 2014; 42 (7): 791-5. doi: 10.1016/j.ajic.2014.03.018

23. Mittal ML, Beletsky L, Patiño E, Abromavitz D, Rocha T, Arredondo J, et al. Prevalence and correlates of needle-stick injuries among active duty Police officers in Tijuana, Mexico. J Int AIDS Soc. 2016; 19 suppl 3: 20874. doi: 10.7448/ias.19.4.20874

24. Poulsen TR, Burr H, Hansen HL, Jepsen JR. Health of Danish seafarers and fishermen 1970-2010: what have register-based studies found? Scand J Public Health. 2014; 42: 534-45. doi: 10.1177%2F1403494814534538

25. Cordeiro TMSC, D'Oliveira Júnior A. Data quality of the reporting of viral hepatitis caused by work-related accidents, Brazil. Rev Bras Epidemiol. 2018; 21: E180006. doi: 10.1590/1980-549720180006

AUTHORS' CONTRIBUTIONS

Técia maria Santos Carneiro e Cordeiro contributed to study conception and design, data analysis and interpretation, writing and critical review of relevant intellectual content.

Argemiro D'Oliveira Júnior contributed to data analysis and interpretation, writing and critical review of relevant intellectual content.

Tânia Maria de Araújo contributed to the writing, critical review of relevant intellectual content.

All authors have approved the final version of the manuscript and are responsible for all aspects of it, including ensuring its accuracy and integrity.