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Distribution and spatial density of viral hepatitis cases in Brazil due to occupational accidents

Distribuição e densidade espacial dos casos de hepatites virais por acidentes de trabalho no Brasil

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ABSTRACT | Introduction: Viral hepatitis, an infectious disease endemic to Brazil, can be transmitted by occupational accident. **Objectives**: To analyze the distribution and spatial density of viral hepatitis due to occupational accidents in Brazil from 2007 to 2014. **Methods**: This ecological study of multiple groups used data from the Brazilian *Sistema de Informação de Agravos de Notificação* (Disease Information Notification System). Spatial analysis of cluster detection and point density was performed using kernel techniques and estimates. **Results:** The recorded cases were concentrated in the southeastern (40.6%) and southern regions (28.1%), and a small increase occurred between 2011 and 2014 (53.9%). The etiological classification was predominantly hepatitis C virus (45.3%) and B virus (45.1%). **Conclusions:** Reports of viral hepatitis due to occupational accidents have increased in Brazil in recent years, with a higher density in the southeastern and southern regions, especially viruses B and C. Thus, occupational health surveillance must be intensified, including vaccination cards for worker admission to the public or private companies.

Keywords | spatial analysis; disease notification; communicable diseases; hepatitis, viral, human; occupational accidents.

RESUMO | Introdução: As hepatites virais são doenças infecciosas, silenciosas e endêmicas no Brasil e podem ser transmitidas por acidentes de trabalho. **Objetivos:** Analisar a distribuição e a densidade espacial dos casos de hepatites virais por acidentes de trabalho no Brasil no período de 2007 a 2014. **Métodos:** Estudo ecológico de múltiplos grupos com dados do Sistema de Informação de Agravos de Notificação. Foram realizadas análises espaciais de detecção de aglomerados e de densidade de pontos pelas técnicas e estimativas de Kernel, respectivamente. **Resultados:** A distribuição e a densidade dos casos de hepatites virais por acidentes de trabalho no Brasil de 2007 a 2014 se concentraram nos estados das regiões Sudeste (40,6%) e Sul (28,1%), com pequeno aumento nos registros no período de 2011 a 2014 (53,9%). A classificação etiológica foi predominante para os vírus C (45,3%) e B (45,1%). **Conclusões:** As notificações de hepatites virais por acidentes de trabalho no Brasil aumentaram nos últimos anos, com maior densidade de notificações nos estados das regiões Sudeste e Sul, pelos vírus B e C. Assim, é necessário intensificar as intervenções da vigilância em saúde nos campos de trabalho, e o cartão de vacina deve ser um passaporte para admissão do trabalhador na empresa pública ou privada.

Palavras-chave | análise espacial; notificação de doenças; doenças transmissíveis; hepatite viral humana; acidentes de trabalho.

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INTRODUCTION

Viral hepatitis, an infectious disease endemic to Brazil, is responsible for significant morbidity and mortality worldwide.[1,2] The mode of transmission varies according to the virus and can include fecal-oral, person-to-person, parenteral, or sexual, all of which primarily affect the liver.[3]

In occupational environments, viral hepatitis can be contracted through accidents while performing work activities with or without due precaution and with or without the use of individual/collective protective equipment. It can also be contracted by non-vaccination or non-immune response and by work rhythm or overload, damaging the physical and mental integrity of workers. In addition, infection can also be facilitated by a lack of individual protection among informal workers.

Strategies for controlling and preventing viral hepatitis range from mandatory notification, rapid screening tests, laboratory tests, and identifying viral agents for vaccinations. In Brazil, disease notification was first systematized in 1975 through the National Epidemiological Surveillance System (*Sistema Nacional de Vigilância Epidemiológica*); the most recent update of its list of diseases and conditions was in February 2020.[4]

The highest concentration of viral hepatitis cases in Brazil between 1999 and 2016 was for hepatitis B virus (HBV; 37.8%), followed by hepatitis C virus (HCV; 32.5%), hepatitis A virus (29%), and hepatitis D virus (0.7%).[5] Although hepatitis is endemic to Brazil, its incidence varies among and within regions. Its frequency varies according to occupational class, e.g. household waste collectors (0.09% for HCV and 5.6% for HBV),[6] health care waste collectors (3.3% for HCV and 9.8% for HBV),[6] recyclable material collectors (1.6% for HCV),[7] health professionals (0.9% for HCV),[8] and workers (0.2% for HBV and 0.1% for HCV).[9]

Viral hepatitis prevention requires vaccination for hepatitis A virus and HBV and direct measures to prevent infection by HCV, hepatitis D virus, and hepatitis E virus. In Brazil, the hepatitis A vaccine is indicated for adults in a 2-dose schedule (0-6 months) only in the private health network.[10] The National Immunization Program (*Programa Nacional de Imunizações*) makes this vaccine available for children aged 15 months to < 5 years in a single dose.[11] The National Immunization Program recommends the HBV vaccine for everyone, regardless of age, in a 3-dose schedule (0, 1, and 6 months).[11] However, to confirm immunity, anti-HBs test must be performed after the vaccination schedule is complete: anti-HBs levels ≥10 UI/mL[12] are considered reactive, while levels ≥ 100 IU/mL represent an excellent response.

Considering the need to avoid/prevent viral hepatitis due to occupational accidents and the scarcity of published data to guide national health surveillance, this study aimed to analyze the distribution and spatial density of viral hepatitis cases due to occupational accidents in Brazil from 2007 to 2014.

METHODS

This ecological, descriptive, multi-group study was developed using secondary data on viral hepatitis in Brazil. The country consists of 27 states and the Federal District, which are grouped in into five geographical regions: the southeast, south, northeast, north, and midwest.

All viral hepatitis cases due to occupational accidents confirmed between 2007 and 2014 were included in the analysis. Access to the Disease Information Notification System (Sistema de Informação de Agravos de Notificação) database was granted by the Ministry of Health's Health Surveillance Secretariat. The selected variables were the state (27 plus the Federal District) and the etiological classification (virus A, B, or C).

The data were spatially analyzed considering clusters (municipalities/states) as the unit of analysis; thus, the latitude and longitude of each case were entered. Data pattern analysis was then performed, representing points through the distribution (absolute frequency)

of cases of viral hepatitis due to occupational accidents between 2007 and 2014 according to the selected variables.

Subsequently, cluster detection and point density analyses were performed using kernel techniques and estimates, respectively. Time intervals were defined for data comparison: the overall period (2007-2014) and two subperiods: 2007-2010 and 2011-2014. The density of points according to kernel estimates was classified as very low, low, medium, high, or very high, based on the homogeneity of the points in each cluster. Microsoft Office Excel 2007 and ArcGis version 10.3 were used for data processing.

This study was approved by the Research Ethics Committee of the Bahia School of Medicine, Federal University of Bahia (opinion 1.249.977/2015, in compliance with Resolution 466/2012).

RESULTS

Between 2007 and 2014, 1,493 cases of viral hepatitis due to occupational accidents were reported in Brazil. In descending order, the regions with the highest percentage of the cases were the southeast (40.6%), south (28.1%), northeast (11.9%), midwest (10.4%), and north (9.1%). The states with the highest percentage of cases were São Paulo (26.1%), Rio Grande do Sul (13.3%), Paraná (7.6%), Minas Gerais (7.4%), Santa Catarina (7.1%), Rio de Janeiro (5.5%), Bahia (4.4%), Goiás (3.8%) and Acre (2.3%). The cities with the most cases were São Paulo (7.6%), Porto Alegre (3.9%), Brasília (2.6%), Curitiba (2.5%), Rio de Janeiro (1.9%), São José do Rio Preto (1.8%), Belo Horizonte (1.5%), Caxias do Sul (1.4%), and Canoas (1.3%).

The number of reported cases fluctuated during the study period, with the most reports occurring in 2012 (14.8%). Between 2007 and 2014, the case density was very high in the state of São Paulo and high overall in Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Rio de Janeiro, and Minas Gerais. However, in some parts of these states, as well as in parts of Goiás and Espírito Santo, density was average. The density was low in the states of the northeast region (Bahia, Sergipe, Alagoas, Pernambuco, Paraíba, Rio Grande do Norte and Maranhão), as well as in the states of Mato Grosso do Sul, Rondônia, and Acre (Figure 1).

Comparing 2007-2010 (46.1%) and 2011-2014 (53.9%) with the overall study period, the density was very low in the states of Rondônia and Maranhão and low in the state of Pará between 2007 and 2010 (Figure 2A). Between 2011 and 2014, the states of Santa Catarina and Paraná had average density, while Rondônia, Mato Grosso, and Amazonas had low density (Figure 2B).

Regarding etiological classification, HCV (45.3%) and HBV (45.1%) predominated, with HBV being more frequent in most states (50.5-100%) except Maranhão, Ceará, Rio Grande do Norte, Paraíba, Minas Gerais, Rio de Janeiro, São Paulo, Santa Catarina, Rio Grande do Sul and Mato Grosso do Sul, where HCV predominated (51.6-74.1%). Hepatitis A virus was the least reported type (1.3%), occurring in only 13 states and ranging from one to three cases in each of these states (Figure 3).

DISCUSSION

The distribution and density of viral hepatitis due to occupational accidents in Brazil from 2007 to 2014 were concentrated in the southeastern and southern regions, with a small increase between 2011 and 2014. The distribution was greater for HBV and HCV.

For a country such as Brazil, the reported rate of viral hepatitis due to occupational accidents in this 8-year period was within expectations, although these data are underestimated, since only 45.8% of the "source of infection" fields were filled out, and the number of diagnosed cases was certainly underreported. Studies indicate that accidents with biological materials[13,14] and viral hepatitis[15] are underreported because workers tend to oversimplify these kinds of accidents and do not seek health services, this results in fewer reported cases. However, given that occupational accidents are

preventable among health care workers and that viral hepatitis is a highly transmissible infectious disease which can become chronic, producing costs for health services and society, in addition to being vaccine-preventable, these data are relevant for the development of interventions by health surveillance agencies.

The southeastern and southern regions have the most jobs, a greater variety of occupations, and a higher number of workers at risk of occupational accidents. Although these regions are classified as having low endemicity,[15,16] they nevertheless had the highest rates of HBV and HCV in the country.[5] Thus, greater investment is needed in occupational risk/accident prevention programs in these regions.

The number of reported cases increased in the last analyzed period. In Poland[17] and Barcelona,[18] the viral hepatitis rates are also high and are associated with non-immunization of workers.[14] In addition, a lack of continuing education programs for health professionals and/or those responsible for the diagnosis, causal attribution, notification, and follow-up of reported cases may have contributed to this increase. Moreover, worker carelessness must also be considered among potential factors.

HBV and HCV are more likely to be transmitted by the percutaneous and sexual routes and can have greater complications for affected workers. Studies indicate that the occurrence of HBV has increased among workers,[15] with a higher frequency than HCV in some occupational groups.[6] The difference between rates of HCV and HBV infection in the present study was small, even though HCV infection has increased in the Brazilian population in recent years.[5] The HBV infection rate should be lower than that of HCV

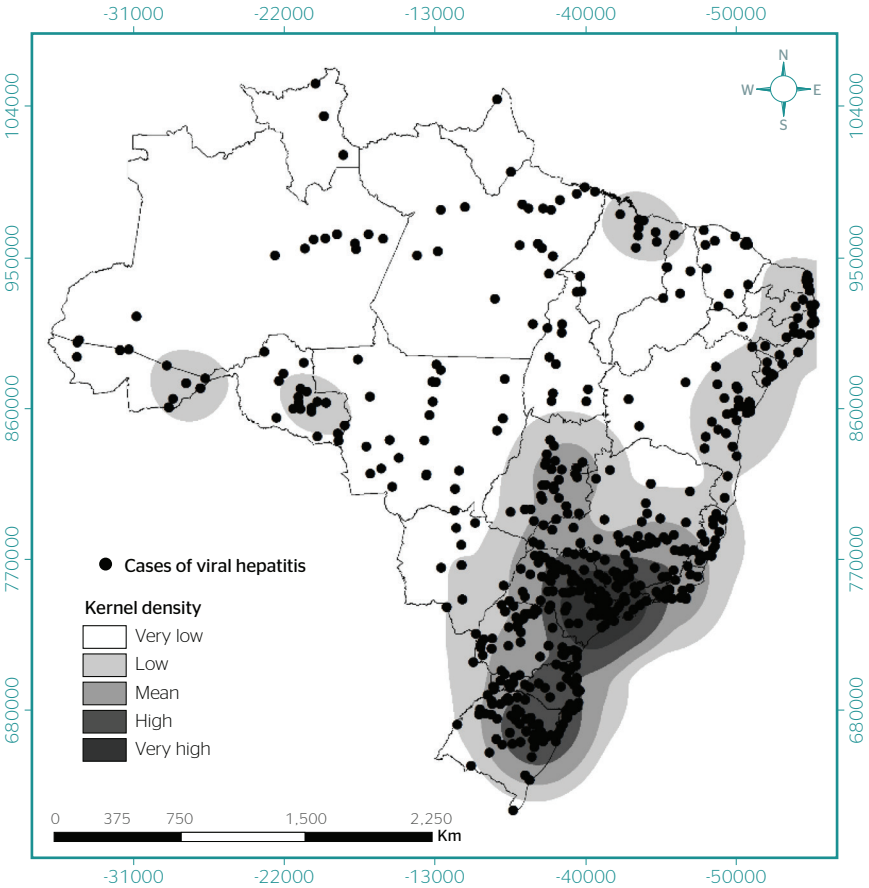

Figure 1. Distribution and kernel density of cases of viral hepatitis due to occupational accidents in Brazil, 2007 to 2014.

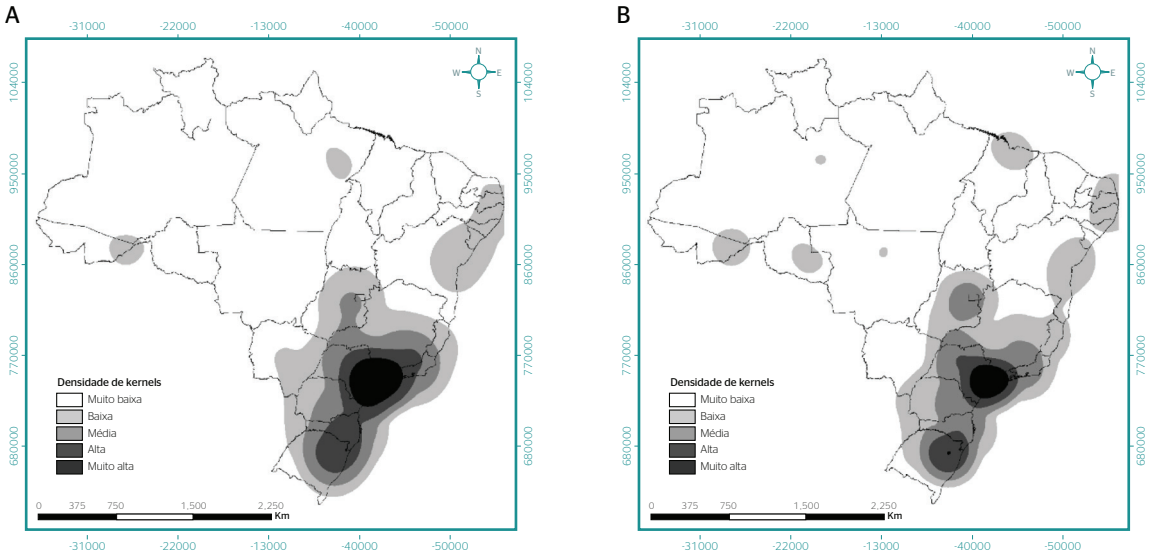

Figure 2. Kernel density of viral hepatitis cases due to occupational accidents in Brazil from 2007 to 2010(a) and 2011 to 2014(b).

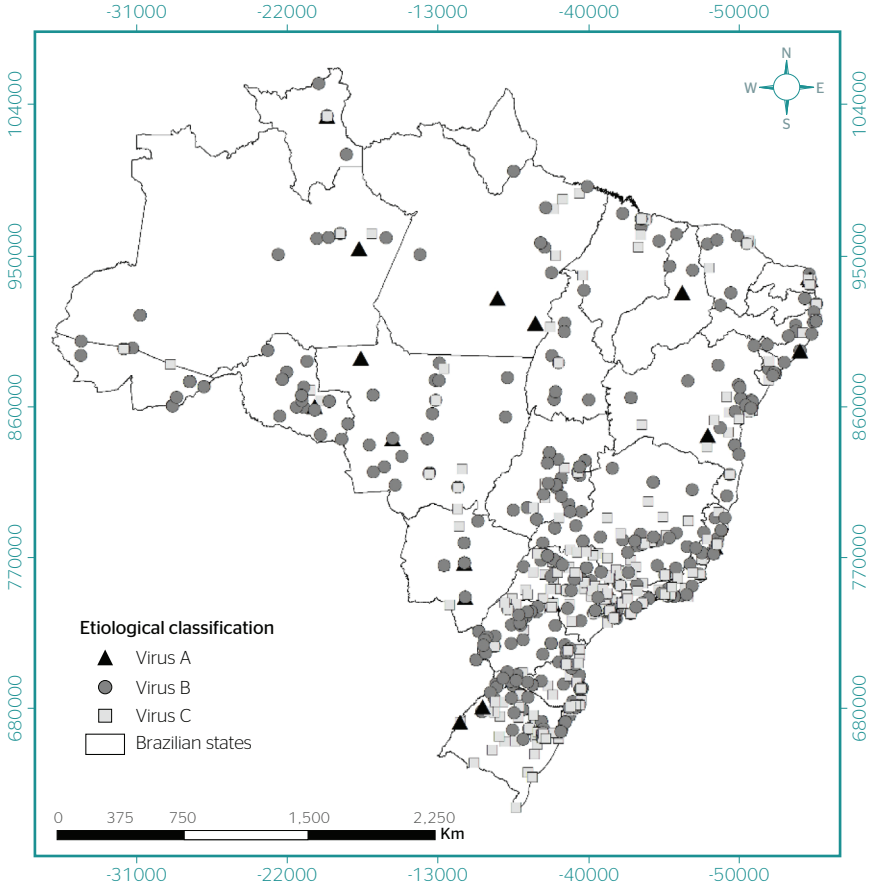

Figure 3. Distribution of cases of viral hepatitis due to occupational accidents according to etiological classification, Brazil, 2007 to 2014.

since the vaccine is accessible to the entire Brazilian population regardless of age or risk group.

Prevention through vaccination against HBV and greater precaution against accidents with biological materials are essential. It is also important to seek health services after accidents with biological materials for post-exposure prophylaxis, as well as for the notification and follow-up of diagnosed cases.[14] In São Paulo, only about 25% workers who sought health services after an accident with biological material returned for prophylaxis follow-up; telephone reminders have increased this number to approximately 50%.[19] Workers must be educated about the relevance of prophylactic measures after exposure to biological materials.

This study is limited by its use of secondary data, including forms which may have been filled in by several people, given that there are no ongoing training programs regarding the forms and, thus, the data may have been incomplete or inconsistent.[20] As a cross-sectional study, no causal links can be established or conclusions drawn regarding population density. The scarcity of similar studies for comparison is a further limitation. However, even with these limitations, these data can help improve the reporting, collection, and analysis of data so that surveillance actions become more effective in each geographical and political unit.

CONCLUSIONS

Periodical training should be performed for health professionals and/or clerical personnel who fill out the notification forms for the Disease Information Notification System, and the forms themselves should also be reviewed, limiting them to essential fields that can contribute to health surveillance analyses and interventions. Reported cases of viral hepatitis (particularly HBC and HCV) due to occupational accidents in Brazil have increased in recent years, with a higher density of reported cases in the southeastern and southern regions. Thus, health surveillance interventions should be developed for the workplace, aiming at primary prevention of occupational accidents with biological materials. Continuing education about biosafety and precautionary norms are necessary, and vaccination against HBV should be encouraged. Vaccination cards should be used as passports for worker admission to public or private companies.

Author contributions

TMSCC participated in the study conceptualization, methodology, formal analysis, investigation, and writing – original draft and review & editing of the manuscript. TMA participated in the formal analysis and writing – review & editing of manuscript. ADOJ participated in the methodology, formal analysis, and writing – review & editing of the manuscript. All authors have read and approved the final version submitted and take public responsibility for all aspects of the work.

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