Influence of socioeconomic factors in spatial distribution of hepatitis B and hepatitis C incidence in a Brazilian city located in the triple border region of Brazil, Paraguay and Argentina.

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BACKGROUND

Hepatitis B virus (HBV), transmitted by vertical, parenteral or sexual contact, affects around 240 million people worldwide. There are about 600.000 deaths per year in the world[1]. Therapy for definitive cure is not available, but the vaccine is effective. Hepatitis B has a wide genomic variety and some variants are associated with therapeutic viral response, vaccine escape, diagnostic failure, liver fibrosis and development of hepatocellular carcinoma[2]. Infection represents a heavy social burden in low and middle-income countries, due to the prevalence and association with complications. According to data from the last epidemiological bulletin of Paraná, the detection rates accumulated per 100,000 inhabitants in the state are higher in Foz do Iguaçu and other cities in this region[3], although in Brazil, data show epidemiological change due to improvement in quality of life and systematic vaccination programs[4]. Hepatitis C virus (HCV) is one of major causes of morbidity and mortality in general population and affects around 185 million people worldwide[5]. There are about 700.000 deaths per year in the world[6]. The HCV vaccine is not yet available, however, current treatments with modern DAAs (Directly Acting Antivirals) lead to healing in more than 90% of cases[6]. The transmission of HCV is predominantly parenteral. Brazil presents regions of high prevalence of viral hepatitis, which includes Foz do Iguaçu, located in Paraná State and in an international border with Argentina and Paraguay. This study aimed to analyse the incidence of hepatitis B and C, according to spatial variation, in Foz do Iguaçu, between 2010 and 2015.

Figure 1. Map of mean incidence of smoothed rate of hepatitis B cases occurred in Foz do Iguaçu during 2010 to 2015, according to census sectors.

METHODS

It's an ecological, retrospective, cross-sectional study using spatial analysis techniques. Data of Hepatitis B and Hepatitis C cases, from period of 2010 to 2015, were obtained from the public Clinic of Viral Hepatitis of Foz do Iguaçu, Paraná, Brazil. The demographic and socioeconomic data of the census sectors of Foz do Iguaçu were obtained from Brazilian Institute of Geography and Statistics, according to the 2010 demographic census. The spatial data geolocation, considering 327 census sectors of the municipality, were performed using QGIS software. Univariate global and local Moran I and bivariate analysis were performed using Geoda software. We identified vulnerable social groups through a spatial approach, producing an integrated analysis between the occurrence of cases of hepatitis B and C, with the selected socioeconomic indicators. According to the 2010 Demographic Census for Foz do Iguaçu, the independent variables selected were: per capita income; degree of education; type of housing; basic sanitation and garbage collection services and number of residents per household. For the exploratory analysis of spatial data (AEDE), we applied: 1) Empirical Bayesian Estimator, to reduce the instability of small areas or rare events within the census tracts; 2) Moran Global Index, for analysis of spatial autocorrelation, using the queen configuration; 3) Local Indicator of Spatial Analysis (LISA), to identify groups according to the incidence rates of hepatitis B and C; 4) Bivariate analysis of Moran Global, for the analysis of the correlation between the dependent variable of the polygon and the independent variable of the neighboring polygons. For the analyzes it was considered to define the level of significance α = 0.05. For the final construction of the maps QGIS program was used.
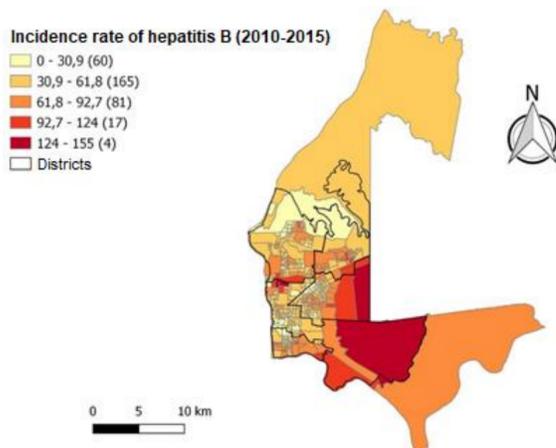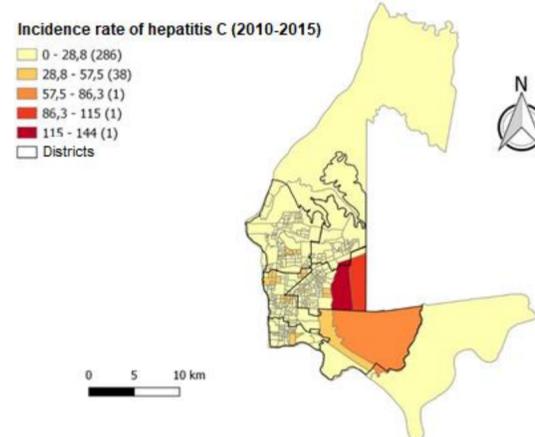

Figure 2. Map of mean incidence of smoothed rate of hepatitis C cases occurred in Foz do Iguaçu during 2010 to 2015, according to census sectors.

RESULTS

In Foz do Iguaçu, Paraná, 525 cases of HBV were reported between 2010 and 2015, 270 (51.4%) were men and 255 (48.6%) were women, and involved predominantly the group of 20 to 49 years-old (71.6%).The highest incidence rates of HVB occurred in 21 census sectors, ranging from 92.7 to 155 cases per 100.000 inhabitants (Figure 1). According to Global Moran analysis, there was a significant positive spatial correlation (Moran´s = 0.595) The high-high pattern census sectors clusters occurred in the eastern, wester and southern districts of the municipality. With regard to hepatitis C, in the same period, there were 177 cases, 110 (62.1%) were men and 67 (37.9%) were women, and involved predominantly the group of 35 to 64 years-old (73.4%). 285 census sectors showed HCV incidence rates up to 57.7 cases per 100.000 inhabitants and the highest rates were found in 3 census sectors, with rates varying from 57.5 to 144 cases per 100.000 inhabitants (Figure 2). According to Global Moran analysis, there was a significant positive spatial correlation (Moran's I = 0,479). In the cluster map, the high-high pattern was identified in the east and south regions of the municipality. Bivariate Moran's I analysis indicated that the factors associated mainly with high incidence rates of HBV were low and middle-income households, lack of proper water supply and garbage collection. Differently, HCV incidence rate were significantly and positively associated with low and middle-income households and diverse sanitary conditions (Table 1).

Table 1 - Global Moran Bivariate Analysis between the hepatitis B and C incidence rate and socioeconomic and demographic variables, Foz do Iguaçu, 2010-2015.

Variable	Hepatitis B		Hepatitis C	
	Moran' I	p value	Moran' I	p value
Own house	-0,0044344	0,406	-0,0823957	0,001
Rented house	-0,0368828	0,060	0,0271855	0,15
Others	0,0502681	0,027	0,00180376	0,457
Literacy of the responsible	0,00220036	0,484	-0,0378757	0,055
Water supply network	-0,02403	0,16	-0,0881066	0,001
Well water	0,0895589	0,001	0,0716841	0,014
Water others	0,073936	0,003	0,129236	0,001
No bathroom	0,0674125	0,002	0,0400248	0,043
3 residents	0,0308438	0,101	-0,0574276	0,007
5 residents	0,0834178	0,001	-0,043046	0,041
8 residents	0,024871	0,138	-0,0754921	0,002
10 residents	-0,0117206	0,318	-0,00755981	0,001
Garbage collection	-0,00133919	0,496	-0,062486	0,003
Garbage on the wasteland	0,0574656	0,01	-0,0328069	0,06
Garbage others	0,109712	0,001	0,137479	0,002
Per capita income ½ a 1 MW	0,0578247	0,005	-0,0972014	0,001
Per capita income 1 a 2 MW	-5.67123e-0,05	0,484	0,0076298	0,353
Per capita income 2 a 3 MW	-0,040344	0,05	0,071543	0,006
Per capita income 3 a 5 MW	-0,061541	0,004	0,0613951	0,008
Per capita income 5 a 10 MW	-0,061541	0,004	0,0661069	0,008
Per capita income >10 MW	-0,049883	0,018	0,0233525	0,149
No declared income	-0,0385852	0,047	-0,0716852	0,002

CONCLUSIONS

This study indicate that HBV and HCV incidence rates in the census sectors presents spatial dependence in Foz do Iguaçu and that social and economic factors significantly determines its distribution. The high rates of hepatitis B were related to census tracts with lower income and higher population density, whereas with hepatitis C, there was a greater socioeconomic variability, including high income populations. The present study contributes to the spatial identification of cases of hepatitis B and C in an Brazilian municipality located in a international triple border region, opening new lines of epidemiological investigation, and stimulating reflection about healthcare, prevention and surveillance of viral hepatitis in this region. In addition, it increases the possibility of diagnosing more cases and contribute to greater control of infections in this region of international border.

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CONFLICTS OF INTEREST

The authors state that there is not any conflicts of interest.

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