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Major Article

Incidence of hepatitis C in Brazil

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ABSTRACT

Introduction: Hepatitis C is a public health problem of global dimensions, affecting approximately 200 million people worldwide. The main objective of this study was to estimate the incidence rate of hepatitis C in Brazil during the period between 2001 and 2012. **Methods:** An epidemiological, temporal, and descriptive study was performed using data from the Information System for Reportable Diseases. **Results:** Between 2001 and 2012, a total of 151,056 hepatitis C cases were recorded, accounting for 30.3% of all hepatitis notifications in Brazil. The average gross coefficient for the analysis period was 6.7 new cases per 100,000 inhabitants. The regions with the highest rates were the Southeast region (8.7 new cases/100,000 inhabitants) and the South (13.9 new cases/100,000 inhabitants). There was a predominance of men with respect to the incidence rate (8.0 new cases/100,000 inhabitants) compared to women (5.5 new cases/100,000 inhabitants). Injection drug use was the most common source of infection, and members of the white race, residents of urban areas, and those aged 60 to 64 years had the highest incidences. **Conclusions:** Over the last 10 years, the incidence of hepatitis C in Brazil has increased, mainly in the South and Southeast. The adoption of fast, accurate diagnostic methods, together with epidemiological awareness, can facilitate early intervention measures for adequate control of the disease.

Keywords: Brazil. Epidemiology. Hepatitis C. Incidence rate.

INTRODUCTION

Hepatitis C is a worldwide public health concern. It is estimated that 3% of the global population is infected by the virus, corresponding to approximately 200 million people[1] [2]. This is 5 times the rate of infection with human immunodeficiency virus (HIV)[3]. In Brazil, it is estimated between 2.5% and 4.9% of the population is infected with hepatitis C virus[4].

The prevalence of hepatitis C is low, at 0.5-2%, in most European countries, and 0.2-0.5% in the Americas, Australia, and South Africa. A higher prevalence rate is reported in the Middle East, India, and Brazil; Egypt has had the highest prevalence of hepatitis C in the world in recent years, corresponding to approximately 20% of the population[5]. Hepatitis C is caused by inflammation of the liver due to infection by hepatitis C, resulting in acute hepatitis. Its presentation is often subclinical, and it may develop into a chronic condition[6]. Progression to the acute chronic stage occurs in approximately 85% of cases, and 70% of individuals develop chronic liver pathologies[7]. Approximately 80 million people live with chronic hepatitis C, and in 2013, it was estimated that 700,000 people died of hepatitis C worldwide[8].

Hepatitis C result in high morbidity and mortality, with serious comorbidities and high costs of treatment. Furthermore, infected individuals develop chronic forms of the disease and may develop complications such as cirrhosis, hepatocellular carcinoma, hepatic steatosis, or fibrosis[9] [10]. Some data suggest that approximately 500,000 deaths per year worldwide are caused by such complications[11], which can also cause a significant reduction in the quality of life and well-being of afflicted individuals[12].

Worldwide, the most common route of transmission of hepatitis C virus is intravenous drug use (IDU)[13]. In Brazil, the main risk factors additionally include invasive therapies with contaminated equipment[14]. Other risk factors for hepatitis C include perinatal infection, sexual transmission, and activities involving potential exposure to blood, such as tattooing and piercing[15]. Moreover, the residual risk of transmission during the immunological window period cannot be ignored[16]. No vaccine against hepatitis C is available, and treatment for hepatitis C varies according to the characteristics of each individual[17].

In this context, the present study aimed to estimate the incidence rate of hepatitis C in Brazil in an effort to better understand the incidence of this disease in the country.

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METHODS

This investigation was a temporal, descriptive, and epidemiological study that was approved by the Ethics Committee for Research Involving Human Subjects (protocol number 924,172/2014). We used the tenth edition of the International Statistical Classification of Diseases and Related Health Problems (CID 10) to search for diseases coded B18.2, representing viral hepatitis C.

The study population consisted of all hepatitis C patients recorded in the Information System of Reportable Diseases of the Ministry of Health (SINAN/MS) during the period between 2001 and 2012 in Brazil. Population data were obtained from a census conducted by the Brazilian Institute of Geography and Statistics (IBGE). Patient data were compiled for the years 2001-2012 as that was the time period for which there were available notifications of hepatitis C in the SINAN/MS, as provided by the Department of Informatics of the Unified Health System (DATASUS).

Ages were stratified according to the following groups adopted by SINAN/MS[18]: under 1 year; 1 to 4, 5 to 9, 10 to 14, 15 to 19, 20 to 39, 40 to 59, 60 to 64, 65 to 69, and 70 to 79 years; and 80 years or older. Both men and women were included in the study. Zones of residence were categorized into peri-urban/rural and urban. Schooling was stratified according to the years of study: none, 1 to 3 years, 4 to 7 years, 8 to 11 years, and 12 or more years completed. All 26 Brazilian states plus the Federal District were included in the study, in addition to the five regions of Brazil: North, Northeast, Southeast, South, and Midwest. Concerning race/skin color, we used the following categories adopted by SINAN/MS[18]: white, black, brown, yellow, and indigenous. Furthermore, the following classifications were used for source of infection: sex, IDU, transfusion, mother-to-child transmission, and industrial accidents.

Due to differences in categories used by the SINAN/MS prior to 2007 versus from that year on, we decided to combine the records associated with rural and peri-urban zones. There were also differences in categories related to schooling, and we chose to classify illiterate individuals under *none* in terms of years of study completed; those who began a particular year in the next-higher range category but did not complete it were classified in the lower-range category of years completed (e.g., those who had started 4th grade without completing it were included in the *1 to 3 years completed* category.

The absolute and relative frequencies of all variables were determined. The crude incidence coefficient was calculated by dividing the number of reported cases by the resident population in the same place and time and multiplying the result by 100,000.

We calculated the proportional incidence coefficient and standardized it according to the federative unit, region, residential area, sex, and age because these variables represented available data in both the SINAN/MS and IBGE.

Access to the SINAN/MS and tabulation of the data were achieved using the TabNet software (DATASUS, Brasília, Distrito Federal, Brazil), available online at the DATASUS web site (http://datasus.saude.gov.br/). The indicators were calculated using Excel 2013 (Microsoft Corp., Redmond, Washington, United States) and statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM, Armonk, New York, United States) and Tab Win version 3.6 (DATASUS, Brasília, Distrito Federal, Brazil).

RESULTS

During the period between 2001 and 2012, 151,056 hepatitis C incidences were recorded in Brazil. The average gross coefficient for this period was 6.7 new cases per 100,000 inhabitants, with a gradual increase in rates being observed until 2004, and some fluctuations occurring in later years.

Descriptive profiles of the studied population are shown in **Tables 1** and **2**. The Brazilian state showing the highest average coefficient for hepatitis C was Rio Grande do Sul (21.3 new cases/100,000 inhabitants), followed by Acre (17.7 new cases/100,000 inhabitants), Santa Catarina (12.7 new cases/100,000 inhabitants) and São Paulo (12.2 new cases/100,000 inhabitants), while the lowest rates were found in the States of Piauí (0.5 new cases/100,000 inhabitants) and Pará (0.9 new cases/100,000 inhabitants).

The geographic regions with the greatest average coefficients were the Southern and Southeast regions (13.9 and 8.7 new cases/100,000 inhabitants, respectively). The lowest average coefficient was found in the Northeast (1.7 new cases/100,000 inhabitants) **(Figure 1)**. The residence zone that showed the higher average coefficient was the urban zone (6.3 new cases/100,000 inhabitants), while the rural and peri-urban areas accounted for an average of 0.3 new cases/100,000 inhabitants.

Furthermore, there was a predominance of new cases of hepatitis C in men, who showed an average coefficient of 8.0 new cases/100,000 inhabitants, while women had an average coefficient of 5.5 new cases/100,000 inhabitants **(Figure 2)**.

Figure 3 shows that the racial category with the predominant incidence rate was that of white individuals, representing 70.3% (n=84,230) of new cases, followed by brown individuals (21%; n=26,816). Upon analysis by age, the 40 to 49 years age group average coefficient of hepatitis C predominated (16.7 new cases/100,000 inhabitants), followed by the 60 to 64 years group (15.2 new cases/100,000 inhabitants).

The most common source of infection was hypodermic needles used for injection drugs, corresponding to 46.1% (n=57,358) of new cases, followed by blood transfusion, which increase up to the year 2006 and declined in later years, accounting for an average of 22.5% (n=15,203) of new hepatitis C cases.

DISCUSSION

The present study revealed that, between 2001 and 2012, 151,056 incidents of hepatitis C were reported, accounting for 30.3% of all notifications of hepatitis in Brazil.

TABLE 1 - Descriptive profile of the population - proportional.

	Variable									
Total	2001-2003 n=25,028		2004-2006 n=37,302		2007-2009 n=43,039		2010-2012 n=45,687		2001-2012 n=151,056	
	n	%	n	%	n	%	n	%	n	%
Region										
North	979	4.0	1,003	2.7	1,370	3.2	1,607	3.5	4,959	3.3
Northeast	1,529	6.1	2,371	6.4	2,952	6.8	3,550	7.7	10,402	6.8
Southeast	13,000	51.3	20,537	54.9	25,087	58.4	24,180	53.0	82,804	54.4
South	7,883	31.9	11,358	30.6	11,506	26.7	14,456	31.6	45,203	30.2
Midwest	1,637	6.7	2,033	5.4	2,124	4.9	1,894	4.1	7,688	5.3
Sex										
man	15,595	62.5	22,330	59.8	24,903	57.9	25,405	55.7	88,233	59.0
woman	9,419	37.5	14,971	40.2	18,128	42.1	20,264	44.3	62,782	41.0
Area of residence										
urban	23,621	97.6	34,853	96.6	40,214	96.6	42,427	96.4	141,115	96.8
peri-urban	585	2.4	1,220	3.4	1,405	3.4	1,597	3.6	4,807	3.2
Age group (years)										
< 1	100	0.4	170	0.5	180	0.4	247	0.5	697	0.5
1 to 4	53	0.2	70	0.2	56	0.1	43	0.1	222	0.2
5 to 9	80	0.3	114	0.3	68	0.2	51	0.1	313	0.2
10 to 14	93	0.4	94	0.2	115	0.3	86	0.2	388	0.3
15 to 19	430	1.8	530	1.4	396	0.9	404	0.9	1,760	1.3
20 to 39	9,859	39.7	12,846	34.3	11,661	27.1	10,226	22.4	44,592	30.9
40 to 59	11,626	46.2	18,959	50.9	23,541	54.7	24,940	54.6	79,066	51.6
60 to 64	1,151	4.5	1,956	5.2	3,176	7.4	4,358	9.5	10,641	6.7
65 to 69	760	3.0	1,276	3.5	1,908	4.4	2,690	5.9	6,634	4.2
70 to 79	660	2.6	1,067	2.9	1,562	3.6	2,149	4.7	5,438	3.5
≥ 80	195	0.8	201	0.5	350	0.8	479	1.0	1,219	0.8
Race										
white	10,427	75.4	22,685	72.4	25,920	68.2	25,198	65.2	84,230	70.3
black	958	6.6	2,378	7.6	2,936	7.7	3,331	8.6	9,603	7.6
yellow	115	0.9	256	0.8	322	0.8	317	0.8	1,010	0.8
mulatto	2,424	17.0	5,937	19.0	8,735	23.0	9,720	25.1	26,816	21.0
indigenous	16	0.1	42	0.1	97	0.3	83	0.2	238	0.2
Education (years)										
none	494	3.0	727	2.7	511	1.7	604	2.0	2,336	2.3
1 to 3	1,651	9.2	3,320	12.1	3,397	11.1	3,504	11.6	11,872	11.0
4 to 7	7,270	43.8	10,205	37.1	9,478	30.9	9,453	31.3	36,406	35.8
8 to 11	5,286	30.8	9,288	33.8	7,569	24.7	6,421	21.2	28,564	27.6
≥ 12	2,280	13.2	3,969	14.4	9,720	31.7	10,271	33.9	26,240	23.3
Source of infection										
sexual	1,787	22.5	3,600	24.0	1,355	3.1	1,594	3.5	8,336	13.3
transfusion	2,834	36.6	5,884	38.8	2,943	6.8	3,542	7.7	15,203	22.5
injection drug use	2,802	38.4	5,193	34.6	25,141	58.5	24,222	53.0	57,358	46.1
vertical transmission	63	0.7	157	1.1	11,496	26.7	14,453	31.6	26,169	15.0
work accident	148	1.8	219	1.5	2,104	4.9	1,876	4.1	4,347	3.1

TABLE 2 - Descriptive profile of the population according to rates (incidence per 100,000 individuals).

	Variable									
	2001-2003		2004-2006		2007-2009		2010-2012		2001-2012	
	n	rate	n	rate	n	rate	n	rate	n	rate
Region										
North	979	2.4	1,003	2.3	1,370	3.0	1,607	3.3	4,959	2.8
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10 to 14	93	0.2	94	0.2	115	0.2	86	0.2	388	0.2
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65 to 69	760	6.7	1,276	10.5	1,908	14.3	2,690	18.4	6,634	12.5
70 to 79	660	4.5	1,067	6.7	1,562	8.9	2,149	11.3	5,438	7.8
≥ 80	195	3.4	201	3.0	350	4.3	479	5.3	1,219	4.0
Federative unit										
Rondônia	147	3.4	245	5.3	192	4.1	137	2.9	721	3.9
Acre	321	18.2	321	16.2	378	18.3	402	18.0	1,422	17.7
Amazonas	267	3.0	101	1.1	276	2.7	555	5.2	1,199	3.0
Roraima	36	3.5	53	4.5	50	4.0	31	2.3	170	3.5
Pará	91	0.5	139	0.7	239	1.1	327	1.4	796	0.9
Amapá	41	2.6	60	3.4	108	5.8	73	3.6	282	3.8
Tocantins	76	2.1	84	2.1	127	3.2	82	1.9	369	2.4
Maranhão	125	0.7	306	1.7	459	2.4	523	2.6	1,413	1.9
Piauí	49	0.6	23	1.7	29	0.3	96	1.0	197	0.5
Ceará	259	1.1	363	1.5	370	1.5	400	1.6	1,392	1.4
Rio Grande do Norte	34	0.4	101	1.1	225	2.4	215	2.2	575	1.5
Paraíba	35	0.3	95	0.9	126	1.1	209	1.8	465	1.0
Pernambuco	443	1.8	549	2.2	443	1.7	596	2.2	2,031	2.0
Alagoas	141	1.6	122	1.4	168	1.8	142	1.5	573	1.6
Sergipe	88	1.6	108	1.8	135	2.2	175	2.8	506	2.1
Bahia	355	0.9	704	1.7	997	2.3	1,194	2.8	3,250	1.9
Minas Gerais	815	1.5	1,568	2.7	2,171	3.6	2,380	4.0	6,934	3.0
Espírito Santo	349	3.6	667	6.5	448	4.3	328	3.1	1,792	4.4
Rio de Janeiro	3,406	7.7	3,044	6.6	3,087	6.5	4,816	10.0	14,353	7.7
São Paulo	8,430	7.3	15,258	12.6	19,381	15.6	16,656	13.3	59,725	12.2
Paraná	1,139	3.9	2,333	7.6	2,378	7.5	2,806	8.9	8,656	7.0
Santa Catarina	1,411	8.5	2,644	15.0	2,403	13.2	2,693	14.2	9,151	12.7
Rio Grande do Sul	5,333	17.1	6,381	19.6	6,725	20.5	8,957	27.8	27,396	21.3
Mato Grosso do Sul	492	7.6	719	10.6	644	9.2	583	7.8	2,438	8.8
Mato Grosso	76	1.0	152	1.8	344	3.9	450	4.9	1,022	2.9
Goiás	765	4.9	636	3.8	578	3.3	389	2.1	2,368	3.5
Federal District	304	4.7	526	7.5	558	7.3	472	6.0	1,860	6.4
Brazil	**25,028**	**4.8**	**37,302**	**6.8**	**43,039**	**7.5**	**45,687**	**7.9**	**151,056**	**6.7**

FIGURE 1 - Incidence of hepatitis C per Federative Unit in Brazil.

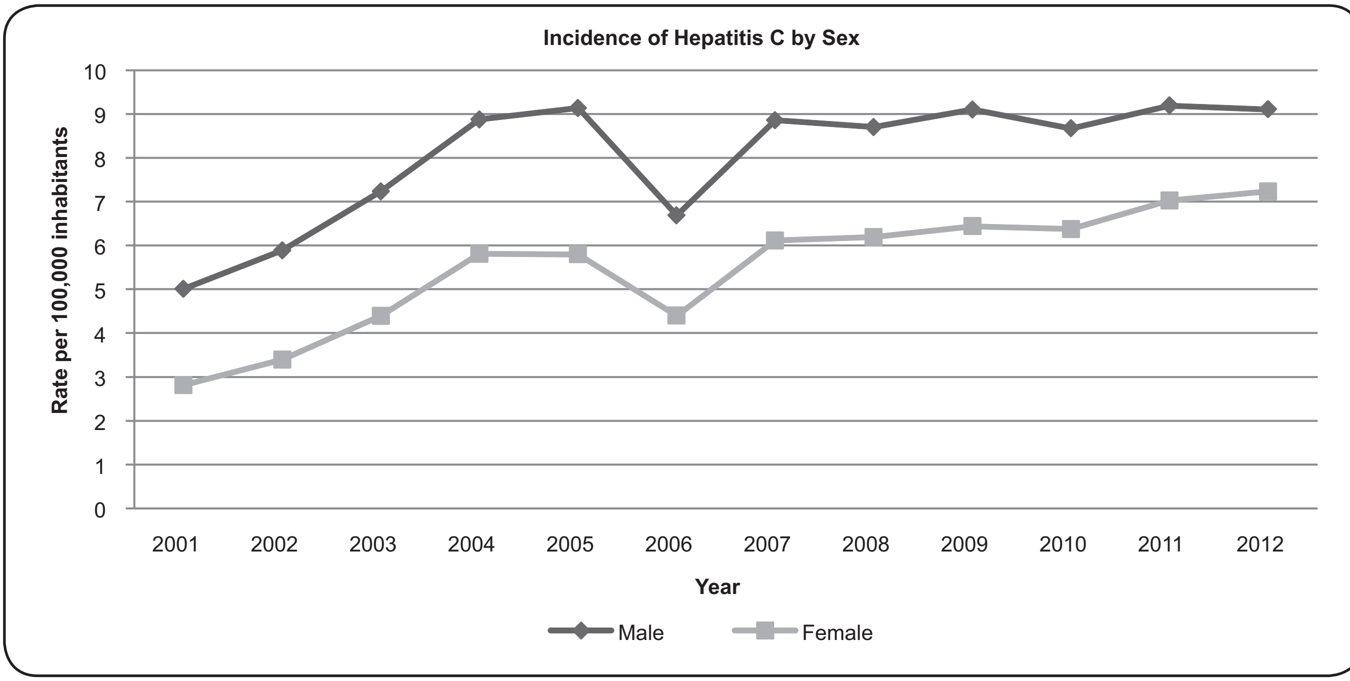

FIGURE 2 - Incidences of hepatitis C infection by sex.

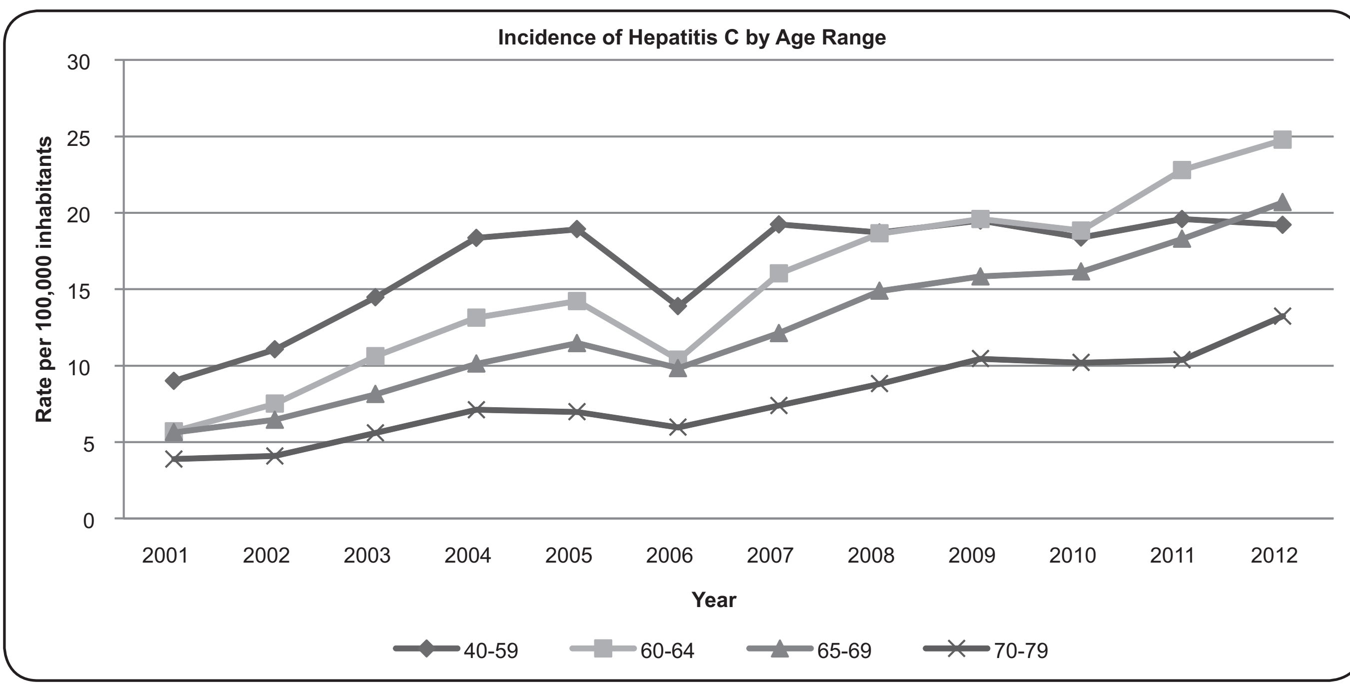

FIGURE 3 - Incidences of hepatitis C by age range. Numbers ranges indicate *years old*.

A review study reported in 2014 showed that the detection rate of hepatitis C in Brazil was 5 new cases per 100,000 inhabitants in 2011, with higher rates being observed in the South and Southeast regions corresponding to 8.5 and 7.4 new cases per 100,000 inhabitants, respectively[19]. These findings are consistent with our study. The burden of infection in Brazil, in absolute terms, shows an unequal geographical distribution, with the highest concentrations in the South and Southeast, compared to lower rates in the North, Northeast, and Midwest, between 2003 and 2009[20]. A likely explanation for the higher incidence rates in the South and Southeast may be better access to the health care systems in these regions, which are more organized[21]. Another factor that could explain the high rates of hepatitis C in southern and southeastern Brazil is the high rate of IDU, as this factor presents a strong association with hepatitis C positivity[22]. The northern region of the country is the location of the Amazon forest, as well as built-up areas, traditional indigenous populations, and a low population density; providing access to adequate medical care in these areas is difficult, and preventative measures are not very well accepted. Most urbanized areas, however, have better access to health programs and adoption of preventative measures; such areas are concentrated in the South and Southeast regions[23], and these factors may contribute to the higher rates of hepatitis C recorded in urbanized areas.

The reported cases of hepatitis C in Canada have decreased in recent years[24] [25]. In 2009, a survey investigated 11,357 cases of hepatitis C among individuals who were documented in the Canadian Notifiable Disease Surveillance System, and revealed that the rate of new cases was 33.7 new cases per 100,000 inhabitants, whereas the rate in 2005 had been 40.5 new cases per 100,000 inhabitants[24] [25]. In 2011, the rate of hepatitis C in the European Union was 7.9 new cases per 100,000 inhabitants, corresponding to 30,373 new cases reported that year[26]. A study conducted in Italy between 1996 and 2006 estimated the trends in hepatitis C for different age groups using the joinpoint regression method. During this period, a total of 6,806 cases of hepatitis C were recorded, and a strong reduction in incidence rates was observed in all age groups, decreasing from 2.02 new cases per 100,000 inhabitants in 1996 to 0.55 new cases per 100,000 inhabitants in 2006[27]. The opposite situation occurred in Brazil, as our findings revealed an increase in the incidence rates of hepatitis C during our analysis period. This may be due to the underreporting of hepatitis C by some surveillance systems, which has been a topic of discussion in Europe and the United States[20].

A study developed in Poland sought to assess the epidemiological situation of hepatitis C in 2011 and compare it to previous years. A descriptive analysis was performed based on data extracted from the Compulsory Routine Surveillance System. It was found that in the years 2005-2009, the incidence of hepatitis C was 7.22 new cases per 100,000 inhabitants, while in 2011, the rate was 5.58 new cases per 100,000 inhabitants. It was further revealed that the rates were twice as high in urban areas compared to in the countryside (6.90 new cases per 100,000 inhabitants versus 3.54 new cases per 100,000 inhabitants, respectively). These findings may have been influenced by access to diagnostic logs, as the lowest rates in the aforementioned study were recorded in rural areas, again revealing a predominance among men in relation to women (6.42 new cases per 100,000 inhabitants versus 4.80 new cases per 100,000 inhabitants, respectively)[28]. These data are similar to ours. The significantly lower incidence of hepatitis C in rural compared to urban populations might be explained by the lack of access to diagnostic tests; therefore, it may not be possible to determine the actual epidemiological situation in these regions[29].

According to an epidemiological study conducted in 2010, the incidence of hepatitis C in Europe in 2006 was 6.7 new cases per 100,000 inhabitants, with a predominance among men; moreover, the 25-44 years age group was the most affected. In the Eastern Mediterranean region and in Southeast Asia, the incidence rates have also been found to be higher in men[30].

In a prospective cohort investigated between 2005 and 2011, the rate of hepatitis C was greater among men in the 40-59 year age group, while it was higher in women among younger people aged 15-24 years[13]. Another 2014 survey that investigated the relationship between sex and hepatitis C revealed that hepatitis C disproportionately affects men. The study suggested that this difference was associated with the fact that women are more likely to eliminate the virus spontaneously and less prone to exhibit disease progression if they are chronically infected because of the protective function that estrogen exerts on hepatic cells[31].

An analytical, retrospective study conducted in São Paulo in 2010 showed that hepatitis C rates are higher in men; however, women had a higher incidence of adverse events. Consequently, changes in doses of treatment were higher among women; moreover, men and women responded differently to the same treatment. Women have specific characteristics that potentially affect the course and outcome of antiviral therapy. However, in spite of studies on the treatment of hepatitis C, little is known about the actual impact of sex on the characteristics that influence the efficacy and safety of treatment for hepatitis C[32]. In a cross-sectional, multicenter study that sought to assess the factors related to exposure to hepatitis C among adults who attended 26 randomly selected health service centers between the years 2005 and 2007, the results revealed that the main risk factors associated with hepatitis C include an age greater than 40 years and IDU; men were common in both categories. These data corroborate the findings of our research[33].

Based on the Epidemiological Bulletin of Viral Hepatitis for the period between 1999 and 2010, hepatitis C detection rates were predominant in the brown race in the North, Northeast, and Center-West, and in the white race in the southeastern and southern regions. In this study, the white race was the most infected, which may be related to the European settlement of the southeastern and southern regions, where the incidence of hepatitis C was higher[34]. However, these regions may have higher rates of compulsory reporting practices and better public health systems compared to northern regions. For instance, hemodialysis, hemotransfusion, surgery, and IDU are much more common in the southeast due to political and economical development.

In a retrospective study, higher rates of hepatitis C were found among adults aged 35 to 59 years with a low level of schooling[35]. This investigation sought to estimate the rate of infection in individuals who attended the Veracruz State Blood Transfusion Center in Veracruz (Mexico) during the period between 2006 and 2010. These data are consistent with the findings of our study.

Despite the major advances in techniques for the detection and prevention of hepatitis C, the number of patients undergoing dialysis treatments who are infected by this virus in Brazil has increased in recent years[4]. There are estimates indicating that 34,366 individuals begin hemodialysis treatment in Brazil annually, including 5,963 new cases per year in the South.

Patients undergoing hemodialysis are currently one of the main groups at risk for hepatitis C[4].

Currently, the most common route of transmission of hepatitis C is needle sharing during IDU[36]. Approximately 50% to 90% of intravenous drug users are also positive for hepatitis C[37]. These findings are consistent with a study performed in Greece that followed hematology service facilities in the country during the years 1997-2006, and revealed that the vast majority of hepatitis C infected intravenous drug users were men with an average age of 33.7 years, and that hepatitis C had been acquired less than 20 years ago in one of every two such individuals. This study suggests that there will soon be a considerable increase in young patients with cirrhosis, liver failure, and hepatocellular carcinoma[38].

Co-infection of individuals with hepatitis C virus and HIV is very common[39]. Currently, up to 30% of all HIV-infected patients are involved in IDU, and 85% of intravenous drug users are infected with either HIV or hepatitis C virus. Because of the decline in national and global rates of mortality from AIDS, liver disease has become the leading cause of death in HIV-infected patients[39].

To summarize thus far, we can conclude that, in the last 10 years, the incidence of hepatitis C has increased in Brazil, mainly in the South and Southeast regions. Urban areas of the country present the highest rates of hepatitis C, and the highest incidences are observed in men, the white race, intravenous drug users, and those aged 60-64 years.

Although information from health information systems is a relevant source of secondary data, we suggest that attention be paid to the quality of the data recorded, particularly the reliability of the information and the completeness of the information. The reason for this is that information management in Brazil's health information systems is still not performed in an orderly and systematic fashion, and any adopted initiatives are more reliable and robust in the South and Southeast of the country[40]. It is important to develop further studies and conduct ongoing assessments of the quality of the data, and to press on all administrative officials to improve the quality of the available information regarding health indicators in Brazil[41].

On November 3, 2010, Decree 201 was enacted, which provides the parameters for monitoring the information provided to the SINAN and establishes that hepatitis C is a reportable disease. Although it is known that there are deficits in completing all the fields of the notification form, this has improved in recent years. The interpretation of the data recorded should take into account limitations, including the fact that they are based on secondary information from a passive surveillance system, and that the lack of completeness of information may lead to bias[42].

In some states, the doctor is obliged to provide a notification number in order to record the hepatitis C quantification results into the SINAN, and this could represent an important bias, as many doctors may not bother with this. However, even with the limitations mentioned, our study showed results that were consistent with the literature and that ought to be useful for supporting public policies, especially those related to service organization[42].

Hepatitis is a major problem for health service providers, because of not only its high incidence but also its negative impact on the quality of life of affected individuals. Thus, epidemiological surveillance is an important tool for improving the investigation and reporting of hepatitis C as well as determining the risk of infection and the profile of infected patients, thus enabling the adoption of measures to prevent and control the spread of hepatitis C. Based on such knowledge, it is possible to implement actions to promote guidance campaigns as well as hasten the prevention, control, and diagnosis of hepatitis C. This may involve individual and/or collective efforts to provide up-to-date information that can contribute to the reduction of hepatitis C in the population. We also recommend that predictive models based on time series be used in future research.

CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

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