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Hospital expenses and liver disease in Brazil

Gastos hospitalares e doença hepática no Brasil

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ABSTRACT

Objective: This study aims at describing the values and morbimortality of hospital admissions for liver disease in the Brazilian public health system. **Methods:** The study was carried out in the DATASUS, for a period of five years. The number, causes, time, mortality rate and values of hospitalizations in the period were investigated. **Results:** In five years, there were 67,561,584 hospitalizations, of which 461,431 were due to liver diseases. The value of hospitalizations in the period was US$ 23 billion, and liver diseases accounted for US$ 384 million, which corresponds to 76 million per year. In liver diseases, the mean length of hospital stay was 8 days whereas for other hospitalizations the mean time was 5 days. The mortality rate from liver diseases was 14% while the general mortality rate was 4%. The average cost of hospitalizations was US$ 531 for liver diseases and US$ 84 for other causes of hospitalization. **Conclusion:** In the Brazilian public health system, liver diseases have a higher average value, a longer average hospital stay, and a higher mortality rate when compared to all causes of hospitalization.

Palavras-chave:
custos do cuidado de saúde, custos hospitalares, doença hepática

RESUMO

Objetivo: Este estudo tem como objetivo descrever os valores e a morbimortalidade das internações por doenças hepáticas no sistema público de saúde brasileiro. **Métodos:** O estudo foi realizado no Sistema de Informações Hospitalares do Datasus, por um período de cinco anos. Foram investigados o número, as causas, o tempo, a taxa de mortalidade e os valores das internações no período. **Resultados:** Em cinco anos houve 67.561.584 internações, das quais 461.431 foram por hepatopatias. O valor das internações no período foi de US$ 23 bilhões, e as doenças do fígado representaram US$ 384 milhões, o que corresponde a 76 milhões por ano. Nas hepatopatias, o tempo médio de internação hospitalar foi de 8 dias, enquanto para outras internações o tempo médio foi de 5 dias. A taxa de mortalidade por doenças do fígado foi de 14%, enquanto a taxa geral de mortalidade foi de 4,0%. O custo médio das hospitalizações foi de US$ 531 para doenças do fígado, enquanto para outras causas de hospitalização foi de US$ 84. **Conclusão:** No sistema público de saúde brasileiro, as hepatopatias têm maior valor médio, maior tempo de internação e maior mortalidade quando comparadas a todas as causas de internação.

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Introduction

Liver diseases affect the lives of millions of people in the world, leading to a lower quality of life and productivity (Malekzadeh *et al*., 2015; Peery *et al*., 2015; Sepanlou *et al*., 2015; Nader *et al*., 2014). It is estimated that 2% to 3% of the world's population is infected with the hepatitis C virus and that 60% to 79% of the patients will develop chronic liver disease requiring specialized and highly complex health care (Polaris, 2017; Petruzziello *et al*., 2016; Castro *et al*., 2015).

The non-alcoholic fatty liver disease (NAFLD) and damage caused by alcohol ingestion also contribute to the progression of the severity and chronicity of liver diseases (Goh, 2017; Cotrim *et al.,* 2016; Liang *et al.,* 2011). Malignant neoplasms of the liver and intrahepatic bile ducts represent, together, the third leading cause of cancer death in the world, ranking fifth among the most common types in men and seventh in women. Alcohol consumption, hepatitis B and C viral (HBV and HCV) infections and liver cirrhosis are considered to be the most important risk factors for hepatic neoplasms (Are *et al.,* 2017; Amorim & Merchán-Hamann, 2013).

In Brazil from 1999 to 2015 there were 514,678 confirmed cases of viral hepatitis with hepatitis A (31.4%), hepatitis B (38.2%), hepatitis C (29.7%) and hepatitis D (0.7%) being reported (Brasil, 2016a). The prevalence of obesity related to the metabolic syndrome has increased in Brazil, which has resulted in a higher frequency of non-alcoholic fatty liver disease. In addition, obesity has been of increasing interest since its association with the high potential for progression of the severity of cirrhosis and hepatocellular carcinoma (HCC) was observed (Cotrim *et al.,* 2016).

Between 1979 and 2008 liver cancer ranked seventh among the causes of cancer death in women while in men it rose from eighth in the period from 1979 to 1983 to sixth between 2004 and 2008. In subsequent years, 2009 and 2010, the number of deaths recorded was 7,521 and 7,721, representing 4.4% and 4.3% of deaths among all malignant neoplasms in Brazil (Amorim & Merchán-Hamann, 2013).

Due to the chronicity and evolution of the disease, individuals with liver diseases tend to develop complications requiring hospitalization, which has a negative impact on the costs of the disease. In Brazil data from the Hospitalization System of the Unified Health System ("Sistema de Internações Hospitalares do Sistema Único de Saúde" – SIH/SUS) allow the analysis of hospital morbidity and mortality, mapping hospitalizations of hired hospitals within the SUS (Brasil, 2016b). The SUS is a universal and integral health system, that is, it covers the whole population and is financed entirely with public resources. Given this scenario, the data seek to support the importance of health policies aimed at the prevention of liver diseases.

The goal of this study was to describe the values and morbimortality of hospitalizations for liver disease in the Brazilian public health system from 2011 to 2016.

Methods

The study was carried out in the database of the Department of Informatics of the Unified Health System (Datasus), selecting the period from January 2011 to December 2016. Data were analyzed from the Hospital Information System of SUS (SIH/SUS), managed by the Brazilian Ministry of Health. Hospital units participating in the SUS (either public or accredited private units) send the information of hospitalizations through the Hospital Admittance Authorization ("Autorização de Internação Hospitalar", AIH) (Brasil, 2016b). The information refers to the periods from January 2008, when the Table of Procedures, Medications, Orthoses and Prostheses and Special Materials of the Unified Health System – SUS was established by administrative rule GM/MS nº 321 of 08 February 2007 (Brasil, 2007).

The number, causes, length, mortality rate and costs of hospitalizations in the period were investigated according to the variables described below:

- **Hospital admissions:** it refers to the number of AIHs approved in the period, not considering the extensions (long stays). This is an approximation of the number of hospital admissions, as transfers and readmissions are computed here.
- **Hospital morbidity:** the cause informed for admission according to the international disease code as the main diagnosis, defined as the one that caused the hospitalization. The conditions referring to liver diseases were selected.
- **Average length of stay:** average hospitalization length corresponding to the approved AIH, computed as admittances in the period; not computing the periods in which the patient was in the intensive care unit (ICU).
- **Mortality rate:** ratio between the number of hospital deaths registered and the number of AIHs approved, computed as hospital admittances in the period, multiplied by 100.
- **Total value:** value corresponding to the AIHs approved in the period.
- **Value of hospital services:** amount for hospital services (HS) corresponding to the AIHs approved in the period.
- **Value of professional services:** amount for professional services (PS) corresponding to the AIHs approved in the period.

In the present study liver diseases were selected from the List of Morbidities of the International Code of Diseases (ICD-10, 2018), including: acute hepatitis B, other viral hepatitis (included in Chapter I), malignant neoplasms of the liver and intrahepatic bile ducts (included in Chapter II), alcoholic liver disease, other liver diseases including toxic liver disease, liver failure, chronic hepatitis, fibrosis and cirrhosis, other inflammatory diseases of the liver, other diseases of the liver,

disorders of the liver, diseases classified elsewhere (included in Chapter XI).

Values were converted from Brazilian reals (R$) to US dollars (US$), considering the exchange rate of July 2016 (1 US$ = 3.27 Brazilian R$).

The results are presented descriptively, with absolute and relative values, in form of tables and figures.

This study does not need approval from the research ethics committee as it uses public data available at the Datasus (Brasil, 2016b; Brasil, 2016c).

Results

In 2016 the population of Brazil was over 207 million people (Brasil, 2016c). According to data from Datasus, in the period from 2011 to 2016 a total of 67,561,584 hospital admissions were registered in the public health system (Brasil, 2016b), with liver diseases totaling 461,431 admissions, which represents 0.7% of the total. Total hospitalization values for the period amount to US$23.49 billion, and the value of hospitalizations for liver diseases represented 1.6% of the total of this value (Figure 1).

In the period under scrutiny, the average value of hospitalization was US$347 while the average value of hospitalization for liver disease was US$531. Considering the number of hospitalizations over 5 years, there was a slight decrease in hospitalizations for all causes while the hospitalizations for liver diseases remained practically stable. On the other hand, the average value of hospitalizations was not only larger but also showed a greater increase (Figure 2).

Table 1 shows the number of hospitalizations, the mean hospital stay in days and the mortality rate according to the ICD-10 chapter classification, with emphasis on related hepatic conditions.

The average length of hospital stay was 5.7 days and the mortality rate was 4%. The longest stay was related to mental and behavioral disorders (40.4 days) and diseases of the nervous system (13.6 days). The mean length of stay for alcoholic liver disease and other liver diseases was twice as long as the average duration of digestive diseases. In hospitalizations for liver diseases, the average length of hospital stay was 7.1 days and the mortality rate was 14.9%, which represents a mortality rate 3.74 times greater than that for general causes. When compared to the overall mortality rate of neoplasms, liver and biliary tumors had a nearly threefold higher mortality rate. Alcoholic liver disease and other diseases of the liver, when compared to diseases of the digestive tract, showed a five times greater mortality.

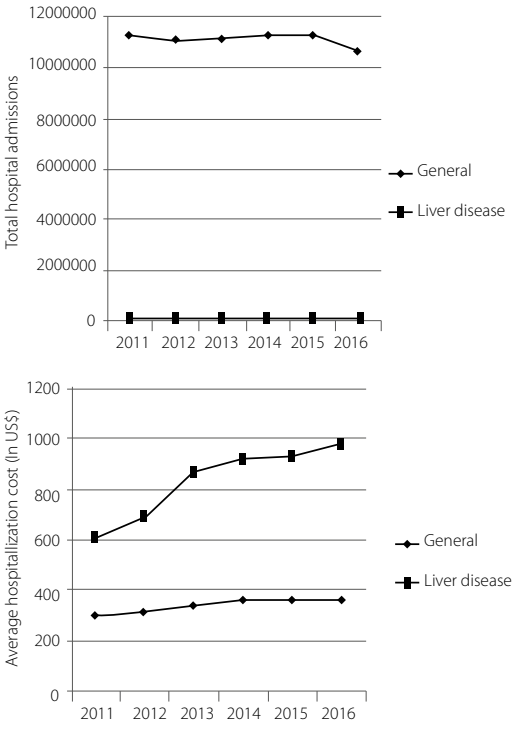

Figure 2. Number and average value of hospitalizations for all causes and for liver diseases in Brazil (in US$) in the period from January 2011 to December 2016 according to data from Datasus.

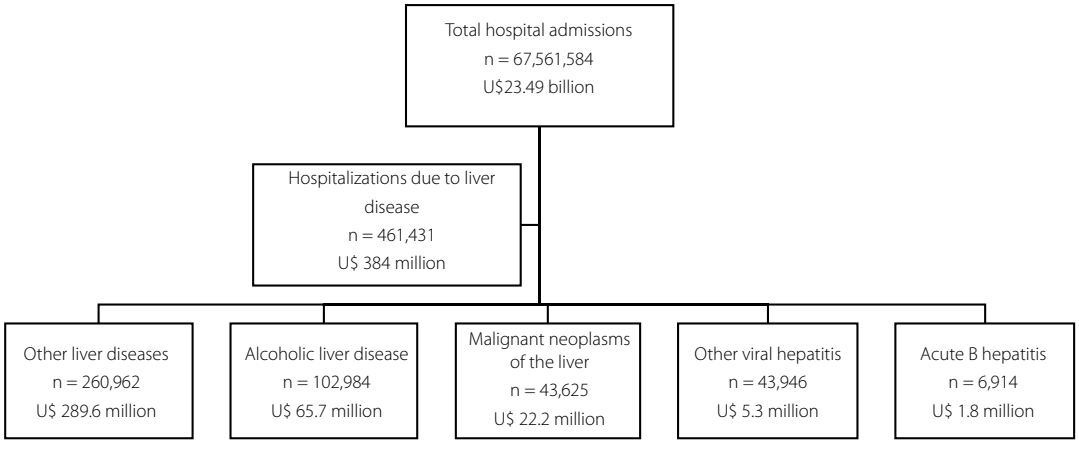

Figure 1. Number and value of hospitalizations for all causes and for liver diseases in Brazil (in US$) from January 2011 to December 2016.

Liver diseases represented only 5.7% of the hospitalizations related to diseases of the digestive system and were responsible for 20.2% of the total value. In addition, the mean value of hospitalization for liver disease was three times higher than the average for diseases of the digestive tract. The number of hospital admissions and total and average cost of hospitalizations for any cause and for liver diseases grouped according to the related ICD-10 Chapter can be seen in Table 2.

Table 1. Distribution of hospital admissions by ICD-10 chapter with number, length of stay and in-hospital mortality rate, from January 2011 to December 2016, in Brazil (Brasil, 2016c)

ICD-10 Chapter	Number and percent of hospital admissions	The average length of stay (days)	In-hospital mortality rate
Pregnancy, birth, and puerperium	14,100,421 (20.87%)	2.5	0.03
Diseases of the respiratory system	7,674,415 (11.36%)	5.4	6.89
Diseases of the circulatory system	6,824,447 (10.10%)	6.6	7.87
Injuries, poisoning, and some other consequences of external causes	6,385,539 (9.45%)	5.3	2.44
Diseases of the digestive system	6,351,678 (9.40%)	4.1	3.36
Alcoholic liver disease	102,984 (0.15%)	8.6	17.46
Other liver diseases	260,962 (0.38%)	8.8	16.73
Some infectious and parasitic diseases	5,108,711 (7.56%)	6.6	8.48
Acute hepatitis B	6,914 (0.01%)	9.3	11.93
Other viral hepatitis	43,946 (0.06%)	5.2	3.78
Diseases of the genitourinary system	4,694,584 (6.95%)	4.1	2.45
Neoplasias (tumors)	4,224,857 (6.25%)	5.4	8.05
Malignant neoplasia of liver and intrahepatic bile ducts	46,625 (0.07%)	6.8	23.08
Nutritional and metabolic endocrine diseases	1,620,048 (2.39%)	5.6	5.87
Mental and behavioral disorders	1,500,845 (2.22%)	40.4	0.48
Some conditions originating in the perinatal period	1,408,174 (2.08%)	10.0	4.82
Skin and subcutaneous tissue diseases	1,394,773 (2.06%)	5.1	1.44
Contacts with health services	1,278,834 (1.89%)	1.6	0.65
Osteomuscular and connective tissue diseases	1,219,154 (1.80%)	5.6	0.69
Diseases of the nervous system	1,077,928 (1.59%)	13.6	5.02
Symptoms, signs and abnormal findings in clinical and laboratory tests	961,007 (1.42%)	4.7	7.59
Diseases of the eye and appendages	584,546 (0.86%)	0.7	0.02
Diseases of the blood and hematological organs, and immune disorders	544,133 (0.80%)	5.9	4.82
Congenital malformations and deformities, and chromosomal abnormalities	476,035 (0.70%)	5.3	2.52
Diseases of the ear and mastoid process	113,454 (0.17%)	2.4	0.11
External causes of morbidity and mortality	18,001 (0.03%)	7.5	3.48
Grand total	67,561,584 (100.00%)	5.7	4.0
Liver diseases total	461,431(0.68%)	7.1	14.9

Table 2. Number of hospital admissions, total and average cost of hospitalizations for any cause and for liver diseases grouped according to the related ICD-10 Chapter. In the period from January 2011 to December 2016, in Brazil (Brasil, 2016c)

	Number of hospital admittances		Total value of hospitalizations (US$)		Average value of hospitalizations (US$)	
ICD-10 morbidity list	General	Liver	General	Liver	General	Liver
Some infectious and parasitic diseases	5,108,711	50,860	1,646,857,323	7,140,710	322.36	140.40
Neoplasms (tumors)	4,224,857	46,625	2,346,999,907	22,200,701	555.52	476.15
Diseases of the digestive system	6,351,678	363,946	1,751,920,666	355,388,063	275.82	976.48
Total	15,757,246	461,431	5,745,777,896	384,729,475	366.32	833.77

Discussion

The present study provides an overview of the burden of liver disease in Brazil in terms of mortality and hospital values from the SUS perspective. Regarding all causes of hospitalization, liver diseases have a higher average value, a higher average length of hospital stay and a higher mortality rate. This study is based on data from tertiary health care, where there is a concentration of disease complications.

Regarding the proportion of hepatic diseases in relation to all causes of hospitalization (0.7%), the data found in the present study are similar to those of the Brazilian study (Nader, *et al*., 2014) performed in the previous period (2001 to 2010).

Alcoholic disease represented 22.3% of hospitalizations due to liver disease. The burden of liver cirrhosis attributable to alcohol is high and totally preventable. Interventions to reduce consumption are recommended as a priority, having as preventive actions the increase of taxation on alcoholic beverages and treatment for alcohol abuse (Rehm *et al*., 2013). In the United Kingdom between 1979 and 2005 hospital admission rates and liver diseases mortality have been rising, two-thirds of these deaths are related to alcohol consumption (Thomson *et al*., 2008). In a study carried out in Portugal, cirrhosis caused mainly by alcohol abuse was the main cause of hospitalization (Vitor *et al*., 2016).

Another major emerging problem is the increase in cirrhosis secondary to non-alcoholic liver disease (NALD), especially in developed countries, where there is an increasing rate of risk factors such as overweight, type 2 diabetes, and metabolic syndrome, contributing to a possible increase in the burden of liver disease on the health system (Vitor *et al*., 2016; Gidding *et al*., 2011; Zamin *et al*., 2009). Some studies estimate that on average 20% of the population are carriers of NALD (Falck-Ytter *et al*., 2001).

Even with the great advance in diagnosis and treatment, one should not have the false idea that hepatitis, especially hepatitis C, will decrease its mortality and disease burden in the near future, as it is estimated that new challenges will arise such as access to technologies and difficulties in preventing infection. Therefore, if this reality still seems far from the developed countries, this will continue to be a challenge for the health systems in poorer countries (Pawlotsky, 2016).

In Brazil, treatments for hepatitis B and C have been provided since 2002 and are guided by protocols that have been modified and updated over the years and establish the criteria for diagnosis, the treatment flow chart with the respective doses and mechanisms for clinical monitoring of the disease (Brasil, 2017). Access to chronic hepatitis C treatment is covered by the public health system, but by 2017 current treatment was only offered to patients with more advanced disease, with total treatment being one of the main barriers to access (Castro *et al*., 2015; Brasil, 2017). Intense negotiations with the pharmaceutical industry allowed the expansion of access to treatment for all those infected, as it was considered that the high burden of accumulated comorbidities and the development of cirrhosis and hepatocellular carcinoma would have a high future impact on the health system (Mesquita *et al.,* 2016).

While liver diseases represent 0.7% of total admissions in numbers, in terms of values they represent 1.5% of the total. The average value of hospitalization for liver disease is 1.5 times higher than other causes of hospitalization. Another fact worth mentioning is that in the period evaluated, despite the decrease in the number of hospitalizations, the average number of hospital admissions for hepatic diseases increased. This higher average value and increased values may be associated with the progression of liver diseases that impact resource consumption (Nader *et al*., 2014). This may indicate a greater complexity of cases and greater investment in technologies and treatment of liver diseases.

In relation to specific liver diseases, alcoholic liver disease accounted for 17% of hospitalization values for liver diseases, while neoplasms accounted for 5.8%. A study conducted in Portugal using the basis of the Portuguese National Health Service ("*Serviço Nacional de Saúde*") and including hospital admissions in 97 public hospitals between 2000 and 2008 found results somewhat different as alcoholic cirrhosis accounted for 42.6% of hospitalization values for liver diseases, followed by liver neoplasia (15.5%) (Vitor *et al*., 2016). Patients with decompensated cirrhosis have high rates of readmission to hospital, particularly those with ascites and/or hepatic encephalopathy. Recurrent hospital admissions are associated with considerable morbidity and mortality as well as high healthcare costs (Aspinall, 2018).

The length of hospital stay due to liver disease (7 days) was greater than the average time of hospitalization for any cause, and this longer hospital stay represents an increase in total values. When the mean length of hospital stay specific for liver diseases was analyzed the following figures were found: alcoholic liver disease, 8.6 days, other diseases of the liver, 8.8 days, and neoplasms, 6.8 days. In the study carried out in Portugal in 2008 the mean hospitalization length for hepatic diseases was 10 days, with alcoholic cirrhosis 8 days, non-alcoholic cirrhosis 10 days, HCC 11 days, and viral hepatitis 5 days (Vitor *et al*., 2016).

The in-hospital mortality rate for liver diseases found in the present study was 14.9%, which is slightly higher than the rate found in Portugal in 2008, at 13.1%. The mortality rates due to hepatic neoplasms (23.8%), alcoholic liver disease (17.4%) and non-alcoholic cirrhosis (16.7%) found in the study follow a distribution similar to that found in the Portuguese study, which was of 22.6%, 14.9%, and 13.4%, respectively. The data may indicate greater severity of liver diseases and directly affect the value of hospitalization.

In a Canadian study an overall analysis of the disease burden found that alcohol-attributable liver cirrhosis accounted for 493,300 deaths, representing 0.9% of all deaths, in addition to 47.9% of all liver cirrhosis deaths. Alcohol-attributable hepatocellular carcinoma was responsible for 80,600 deaths (Rehm *et al*., 2013). In a study that analyzed the American continent alcohol accounted for 4.8% of all deaths, in Mexico alcohol was the main responsible for the high mortality rate of liver diseases (Rehm & Monteiro, 2005).

China has the world's highest burden of liver disease, leading the number of deaths from liver disease in the global context. It is estimated that 300 to 400 thousand people in China die of liver disease each year. In addition to being extremely populous, China has high rates of viral hepatitis infection and is estimated to account for about half the population of NALD patients worldwide. Poverty and the difficulty of access to the health system are important factors in this process, but the rates of viral hepatitis infection have decreased over the years, after a great governmental effort (Wang *et al*., 2014).

Nguyen and contributors (2018) estimated the annual burden and costs of hospitalization in patients with chronic gastrointestinal and liver diseases in a nationally representative sample. Patients with inflammatory bowel diseases (n = 47,402), chronic liver diseases (n = 376,810), functional gastrointestinal disorders (n = 351,583), gastrointestinal hemorrhage (n = 190,881), or pancreatic diseases (n = 98,432) hospitalized at least once spent a median of 6 to 7 days in the hospital each year (total for all diseases). They conclude that a small fraction of high-need and high-cost patients contribute disproportionately to hospitalization costs.

The report of the Lancet Standing Commission on Liver Disease in the UK data relating to recommendations that aim to reduce the harmful consequences of excessive alcohol consumption, obesity, and viral hepatitis showed that alcoholic liver disease would shortly overtake ischemic heart disease with regard to years of working life lost. The increasing prevalence of overweight and obesity, affecting more than 60% of adults in the UK, is leading to an increasing liver disease burden. New direct-acting antiviral drugs for the treatment of chronic hepatitis C virus infection have reduced mortality and the number of patients requiring liver transplantation, but more screening campaigns are needed for the identification of infected people in high-risk migrant communities, prisons, and addiction centers. Sixty-three thousand preventable deaths are estimated over the next 5 years (Williams *et al*., 2018).

The present study featured an overview of the burden of hepatic diseases in Brazil in terms of mortality and hospital values, but it has some limitations. The data source researched provides secondary data, which is subject to the quality of completion of notifications. In addition, these data are from the Brazilian Unified Health System, which, as previously mentioned, refers to the number of AIHs approved in the period, and this approximates to the number of hospital admissions. The values analyzed refer to the amounts paid by the SUS to the institutions, whose values may differ from the actual values of each hospitalization.

In the value analysis, the values of transplantation and out-patient medicines that may contribute to the increase in values related to liver diseases were not considered. Transplants have a specific costing program and the procedure has a fixed value used for all expenses involved, according to the Table of Procedures, Medications, Orthoses, Prostheses and Special Materials of the Unified Health System – SUS (Brasil, 2007).

This work presented some limitations. Although Datasus is the official database of the Brazilian single health system, its data may not represent the reality of health in the country. The quality of filling in the AIHs directly influences the system's data supply and, consequently, the representativeness of the Brazilian reality. The quality of information is directly linked to the local differences in material and human resources of those that handle these databases. On the other hand, the results highlight the importance of databases as a surveillance and health management tool, as well as an important source of information on the occurrence of hospitalizations, events and health problems, covering all regions of the country.

Despite this, the data can demonstrate the impact of liver diseases in relation to other diseases regarding the value and hospital morbimortality in Brazil. The results have shown a considerable social and economic impact of hepatic diseases on the health system in Brazil since they present a higher average value, a longer average hospital stay and a higher mortality rate when compared to all causes of hospitalization.

Conclusion

The burden of liver disease is also significant in other parts of the world. Collective health actions are important because the provision of care continues to be worse in regions with the greatest socioeconomic deprivation, and deficiencies exist in training programmers in hepatology for specialist registrars. Firm guidance is needed for primary care on the use of liver blood tests for the detection of early disease and specialist referral. Regulatory and fiscal actions are required in the food industry in an attempt to decrease metabolic syndrome. Liver disease is considered silent and progressive and is often diagnosed only after hepatic injury has occurred. Some of the most prevalent etiologies are considered public health problems such as alcoholism, viral hepatitis infection and metabolic syndrome, which could be controlled with prevention and treatment. In view of this, the actions of prevention and early diagnosis can reduce comorbidities and associated complications, contributing to attenuate the burden caused by the disease.

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