

Disease burden in Brazil: an investigation into alcohol and non-viral cirrhosis

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Abstract Alcohol use/dependence are an important risk factor for cirrhosis of the liver. The article aims to describe and conduct a comparative analysis of Disability Adjusted Life Years (DALY), Years of Life Lost (YLL) and Years Lived with Disability (YLD) of alcohol use disorders and non-viral cirrhosis in Brazil in 2008. DALY was calculated as the sum of YLL and YLD. For YLL estimates, the mean number of deaths from 2007-2009 in the country was considered. After revision of epidemiological data, prevalence of each disease was modelled with the DisMod tool, which generated incidence data for YLD estimates. Alcohol and non-viral cirrhosis were responsible for 3% and 1% of total DALYs, respectively. In both diseases, men contributed to a greater proportion of DALYs. Among the first ten causes of DALYs, alcohol use disorders occupied the second, third and sixth positions at the ages of 15-29, 30-44 and 45-59, respectively. Non-viral cirrhosis was the eighth cause of DALY in the 30-44 age group in men; the fifth, in the 45-59 group and the eighth, in the 60-69 group. Age distribution suggests that interventions directed against alcohol use/dependence would have effects on the burden of alcoholic cirrhosis in the country.

Key words Burden of disease, Cirrhosis, Alcohol abuse

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Introduction

The abuse of, or dependence on, alcohol (“alcohol use/dependency”) is an important risk factor for many diseases and disabilities that can threaten a person’s health. It is responsible for approximately 2.5 million deaths per year. Between 20% and 50% of the incidence of liver cirrhosis, epilepsy, poisoning, traffic accidents, violence, and several types of cancer was caused by alcohol consumption¹.

Globally, it has been estimated that approximately 11.5% of those who drink are in the category heavy episodic drinking (consumption of 60 grams or more of pure alcohol in the last seven days); for the American continent, this prevalence is 12%, of which 17.9% is for men and 4.5% for women¹. In the study entitled Global Burden of Disease (GBD) 1990² the value for Disability Adjusted Life Years (DALY) attributed to alcohol use/dependence was 248/100,000 which corresponded to 0.5% of the total world DALY value. In the same study for 2010, the figure increased by 3.4%, to 256/100,000 (0.7% of the total world DALY value). In Brazil, the situation is also a cause for concern. In 2003, the World Health Organization estimated that 19.1% of men and 4.1% of women in Brazil were in the category heavy episodic drinking. When analyzing only those who drank, these values rose to 32.4% for men and 10.1% for women³. In relation to the DALY value for Brazil, the alcohol abuse rate was 938/100,000 (2.5% of DALY) in 1998, of which 740/100,000 for men and 198/100,000 for women⁴.

Among the disabilities attributable to alcohol use/dependence, liver cirrhosis was singled out as a major cause of fatalities from chronic morbidity⁵. At a global level, in 2010, an average of 2% (1.4% for women and 2.4% for men) of all deaths and 1.2% of DALY were attributed to cirrhosis^{2,6}. It was estimated that 48% of fatalities and 47% of DALY for cirrhosis was attributed to alcohol consumption⁶. In addition there was a relationship between the amount of alcohol consumed and the risk of developing the disease. Men who consumed more than 60 grams of alcohol per day, had a relative risk of 5.0, while those who consumed from 48 to 60 g/day had a risk of 2.3⁷.

In the study of the disease burden in Brazil for 1998 (ECDB-98), liver cirrhosis accounted for 2.6% of deaths; 2.8% of years of life lost due to premature death (YLL) and 1.5% of DALY⁴. In this study, however, the different etiologies of the disease were not evaluated separately, and so it did not establish the percentages of mortality

and morbidity attributed to alcohol. The burden of disease study for the year 2008 (ECDB-2008), in turn, incorporated methodological changes that permitted the calculation of estimates for cirrhosis by etiological categories.

The purpose of this article is to describe and comparatively analyze the value of DALY in terms of its components, YLL and YLD, for alcohol use/dependence and the non-viral etiology of cirrhosis, a category that includes alcoholic cirrhosis, in the Brazilian study of the disease burden for 2008, broken down by gender and age range.

Data sources and methodology

The ECDB 2008 evaluated about 100 types of disabilities, which were classified into the three broad groups defined by the GBD: infectious and parasitic diseases, maternal causes, perinatal causes and nutritional deficiencies (Group I); chronic non-communicable diseases (Group II); and external causes (Group III). Alcohol use/dependence and liver cirrhosis were included in the study and classified in Group II.

The analysis in this study was conducted using the DALY indicator, a summary measure that aims to capture the effect of morbidity and mortality in the health condition of populations. The DALY is the sum of two other indicators: the YLL and YLD⁸.

The estimates for YLL, fatalities from cirrhosis and alcohol/use dependence (according to the classification described below), in the period from 2007 to 2009, were obtained from the Mortality Information System [Sistema de Informação de Mortalidade (SIM)], using the average number of fatalities during the period. They were adjusted for the under-reporting of fatalities for each Brazilian state, for gender and age range, and also a national adjustment of 28% for those less than 1 year old and 13% for those more than 1 year old. In accordance with the traditional methodology used in the GBD study⁹, fatalities with inadequately defined causes (7.4% of deaths in Brazil in 2008), and those defined as being incorrectly coded (10.5% of deaths) were redistributed proportionally by gender, age range and cause of death in each Brazilian state¹⁰.

The ICD-10 codes used to identify deaths for alcohol use/dependence were F10.1 and F10.2. In relation to fatalities from cirrhosis, a meeting among Brazilian hepatologists¹¹ defined the ICD-10 codes that corresponded to deaths from the disease and distributed them into four etiologic

categories: “hepatitis C”, “hepatitis B”, “alcohol” and “other causes of cirrhosis.” Specifically for the etiologies studied in this article, and based on the above-mentioned expert consensus¹¹, the ICD-10 code descriptions were as follows: “alcohol” (K70) and “other non-viral causes of cirrhosis” (K71.1, K71.7, K74.3, K74.4, K74.5, K75.4, K76.0). Additionally, the codes K72.1, K73.9, K74.0, K74.1, K74.2, K74.6 and K76.7 were redistributed proportionally among the four etiological categories. And, for the codes K72.9 and K76.9 it was decided that 70% of the fatalities for adults over 40 years old would be attributed to liver cirrhosis^{11,12}.

The YLD component was calculated from estimates of the frequency of occurrence, the duration and the severity of the disability, the latter being defined according to a standardized table in the GBD⁸ study. Given the lack of parameters for the frequency of alcohol use/dependence and liver cirrhosis in Brazil, estimates were made of the prevalence of such disabilities. These estimates, together with the data on remission and mortality, were input into the Dismod II program, which has been made available publicly by the World Health Organization (WHO). The use of this program enabled a model to be built that facilitated the obtaining of estimates of the frequency and duration of both disabilities.

For the disability from alcohol use/dependence, the data on such prevalence adopted for Brazil was that presented in the GBD-2000 study¹³. It was assumed that such prevalence rates would correspond to those found in the Southeast region of Brazil. Adjustment factors for the other regions were calculated, based on the data of Naranjo et al.¹⁴. The prevalence parameters for the Southeast region were then modeled in the Dismod II program, together with the data on remission and relative risk of death from the GBD-2000 study already cited¹³. The frequency rate for people below five years of age was considered to be zero. Adjustment factors were applied to the frequency rates generated to determine the parameters to be used in the model for the other regions. The durations generated in the modeling process were adjusted in order to maintain a longer time period for the disabilities for men¹⁵.

In order to estimate the viral etiology of cirrhosis we used the prevalence rates for hepatitis B and C reported in the “Study of Population-based Prevalence of infections by hepatitis viruses A, B and C in the Brazilian state capitals”, conducted in 2008, the only national population-based study on viral hepatitis¹⁶.

The consensus meeting of hepatologists mentioned above established that of all the HBsAg positive cases in this study, 6% referred to cirrhosis cases. Furthermore, for those patients who tested positive for anti-HCV, the percentage with cirrhosis patients would be 14%¹¹. In the ECDB study, in 2008, such frequencies were applied to the Brazilian population at that time to estimate the prevalence of cirrhosis derived from hepatitis B and C. A survey conducted by the Brazilian Society of Hepatology of the etiology of cirrhosis in Brazil in 2001¹⁷ found that approximately 37% of the cases of cirrhosis in Brazil were derived from hepatitis C and 11% from hepatitis B.

Thus, it was considered that the viral etiology of cirrhosis represented 48% of all cirrhosis cases, with the remainder (52%) being due to the etiologies of alcohol and other causes of cirrhosis. The distribution by gender and age range of the category “cirrhosis due to alcohol and other causes of cirrhosis” was based on the distribution of fatalities from alcoholic cirrhosis from the SIM, in 2008, since no other data could be found in the Brazilian literature. The remission of the disability was considered to be zero and the frequency rates generated after shaping the Dismod II for the age range of 80 years and above were eliminated¹².

Regarding the ethical aspects of this study, the data in SIM was obtained from the internet site of DATASUL/MS, and the data on the hepatitis survey was made available by the Secretariat of Health Surveillance. The ECDB-2008 study was approved by the Committee on Ethics in Research of the Sergio Arouca National School of Public Health (ENSP).

In the present article we have presented our estimates for DALY, YLL and YLD for alcohol use/dependence and for the non-viral etiology of cirrhosis, that is, cirrhosis attributed to alcohol and other causes. A discount rate of 3%, as proposed in the GBD methodology, was incorporated in the calculations for mortality (YLL) and morbidity (YLD) for these two disabilities.

Results

Table 1 shows the DALY for each large group of disabilities (I, II and III) for the various regions of Brazil for 2008. It can be observed that over 70% of disease burden in Brazil was attributed to Group II effects, which was also the situation in all regions. The table also presents the DALY for “alcohol use/dependence” and “cirrhosis due

Table 1. DALY ^a - Absolute number and percentage by Brazilian region and disease group, 2008.

Region	DALY Total	DALY Group I	DALY Group II		DALY Group III
				%	
North	2,728,319.97	18%	1,949,395.08	71%	10%
Northeast	11,142,080.51	16%	8,391,663.22	75%	9%
Southeast	15,487,347.64	11%	12,310,421.98	79%	9%
South	5,177,988.94	11%	4,071,152.11	79%	10%
Center-West	2,421,925.03	12%	1,825,057.22	75%	12%
Brazil	36,957,662.09	13%	28,547,689.61	77%	10%

Região	Alcohol abuse and alcohol dependence			Cirrhosis due to alcohol and other causes		
	DALY	% DALY/ total	% DALY/ Group II	DALY	% DALY/ total	% DALY/ Group II
Norte	87,224.66	3%	4%	29,895.16	1%	2%
Nordeste	360,111.59	3%	4%	173,533.59	2%	2%
Sudeste	461,870.49	3%	4%	227,041.53	1%	2%
Sul	145,499.22	3%	4%	75,639.89	1%	2%
Centro Oeste	87,420.79	4%	5%	30,058.35	1%	2%
Brasil	1,142,126.75	3%	4%	536,168.52	1%	2%

^a DALY (Disability Adjusted Life Years).

to alcohol and other causes”, with the respective percentages of the total. Alcohol use/dependence was responsible for a DALY value of 1.1 million for Brazil, representing 3% of the country’s total disease burden. The same proportion was observed in all the regions except the Center-west, where the DALY due to alcohol was 4%. The DALY value for cirrhosis due to alcohol and other causes was approximately 536 thousand for Brazil, representing 1% of the country’s total disease burden for 2008. The Southern region was the region with the highest absolute DALY value, followed by the Northeast.

Considering the first ten most frequent causes of DALY for men, alcohol was ranked second, third and sixth in the age ranges of 15-29, 30-44 and 45-59, respectively (Figure 1). Cirrhosis due to alcohol and other causes, in turn, is one of the top ten causes of DALY in men in the age ranges 30-44; 45-59 and 60-69 years (ranked eighth, fifth and eighth, respectively). The ranking for women was not presented since the disabilities in question were not among the top ten causes of DALY in females in any of the age ranges.

Figure 2 shows the YLD, YLL and DALY per 100,000 of population by age for the two disabilities. For the YLD, higher rates were observed for alcohol use/dependence, especially in the age range 15 to 29 years. For cirrhosis derived from

alcohol, higher values of YLD were found in the age range of 45-59 years, decreasing thereafter. With respect to the YLL, higher rates were observed for cirrhosis due to alcohol. In both situations, the age range with the highest rates of YLL was that for 45-59 years. By analyzing the DALY figures, one can see that the higher rates relate to alcohol use/dependence in the younger age ranges, mainly from 15 to 29 years, being overtaken by cirrhosis in the age range of 45-59 years. Thus, from the age of 45 onwards, the highest DALY rates were attributed to alcoholic cirrhosis.

Figure 3 shows that the major contribution of the disease burden from alcohol use/dependence is from the YLD component (83%), which occurred for all age ranges. It was observed, however, an increase in the participation of the YLL component with increasing age. In relation to age range, the DALY for alcohol had a greater impact on the age range of 15-29 years (47.5%), followed by 30-44 years (27.4%) and 44-59 years (19.4%) of the DALY value. With regard to distribution by gender, we observed that men have higher values of DALY, with little variation by age range (male: female ratio of 2.3).

Cirrhosis derived from alcohol and other causes has the largest percentage of DALY represented by the YLL component (75%), which was also the case for all age ranges (Figure 4).

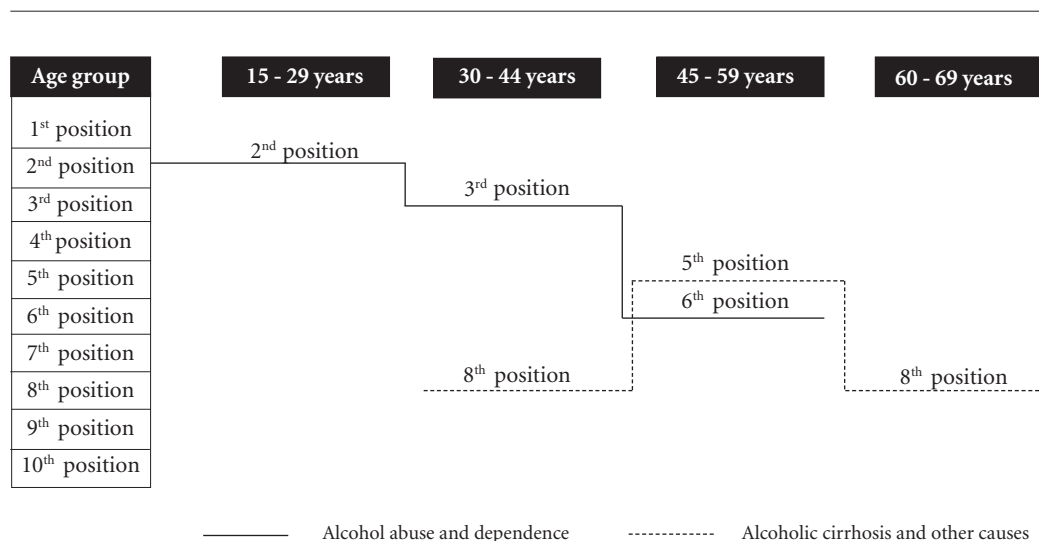


Figure 1. Ranking of the 10 leading causes of disease burden (DALY a) for alcohol abuse and dependence and alcoholic cirrhosis and other causes for males in the age range 15-69 years, Brazil, 2008.

^a DALY (Disability Adjusted Life Years).

The impact of cirrhosis on the age range of 15-29 years was small (4.4%), while the group of 44-59 years had the highest impact (40.2%), followed by the age ranges 30-44 years and 60 years or older (27.4% and 20.4%, respectively). For cirrhosis, as for alcohol dependence, higher percentages of DALY were observed among men (male: female ratio of 4.6).

Discussion

In the ECDB-2008 study, the non-communicable diseases (Group II) accounted for the largest share of DALY in Brazil (77%). In recent years, the phenomenon of the epidemiological transition has resulted in a change in the pattern of morbidity and mortality in the Brazilian population¹⁸. One can see, for the population, a reduction in infectious and parasitic diseases and an increase in non-communicable diseases. Neuropsychiatric diseases, for example, accounted for 18.6% of the DALY for Brazil in 1998¹⁸, and rose to 27.8% by 2008¹⁰. This group includes the incidence of alcohol use/dependence, which in this study was responsible for 3% of the national DALY value, with regional variations of 3-4%; compared to the 0.7% observed in the GBD-2010² study. For the global ranking of DALY in

2010, alcohol use/dependence was ranked 35th overall and 17th for the category *Tropical Latin America*, which included Brazil and Paraguay². In Brazil, in 1998, alcohol was ranked 11th⁴, then in 2008, for men it was ranked 3rd, and for women 13th.

In relation to liver cirrhosis, the ECDB-2008 study introduced an important methodological change, by evaluating the disabilities in etiological categories. This made it difficult to compare the ranking in this study to that of the previous study for 1998, which had been prepared using the traditional GBD methodology⁴ and which ranked liver cirrhosis in 17th for both genders. The current article deals only with the category "cirrhosis derived from and other causes of cirrhosis". It does not cover viral etiologies of cirrhosis. The etiological category in question was responsible for 1% of the Brazilian DALY value and is one of the top 20 causes for men only, being ranked 11th. On the other hand in the GBD-2010² study, cirrhosis derived from alcohol was responsible for 0.6% of the total DALY.

It is noteworthy that in the ECDB-2008 study there was no separation between cirrhosis attributed to alcohol or to other causes. Such other causes include, for example, metabolic, genetic and auto-immune diseases, many of which have epidemiological behaviors different from the

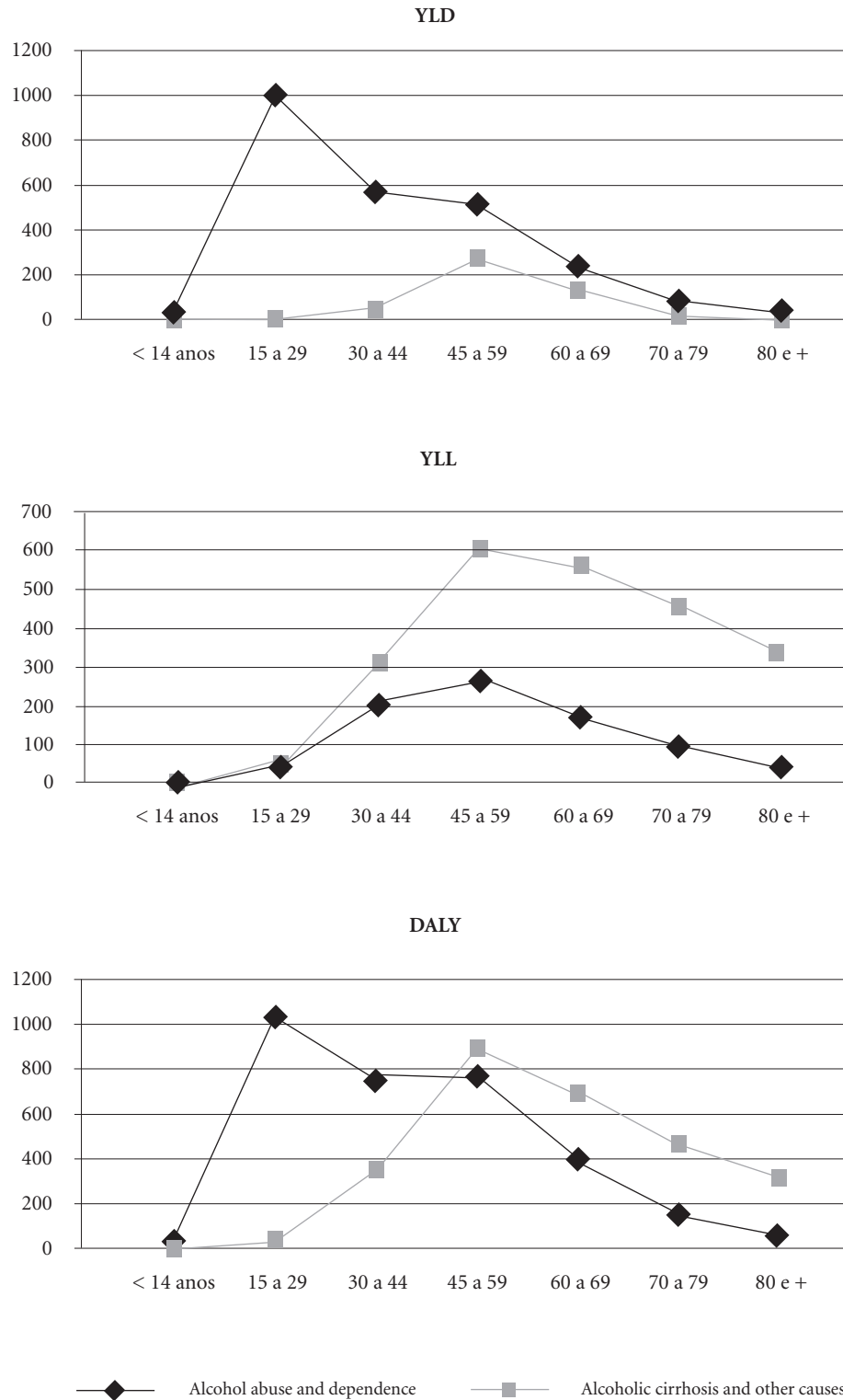


Figure 2. Rates of YLD, YLL and DALY a for alcohol abuse and dependence and alcoholic cirrhosis and other causes by age ranges, Brazil, 2008.

^aDALY (Disability Adjusted Life Years), the YLL (Years of Life Lost) and the YLD (Years Lived with Disability).



Figure 3. Proportion of YLD, YLL and DALY a for alcohol abuse and alcohol dependence by gender, Brazil, 2008.

^a DALY (Disability Adjusted Life Years), the YLL (Years of Life Lost) and the YLD (Years Lived with Disability).



Figure 4. Proportion of YLD, YLL and DALY a cirrhosis due to alcohol and other causes, by gender, Brazil, 2008.

^a DALY (Disability Adjusted Life Years), the YLL (Years of Life Lost) and the YLD (Years Lived with Disability).

hepatopathy derived from alcohol. It was not possible to use an approach to separate them into categories due to the lack of national data on the prevalence of alcoholic cirrhosis. One of the

few data sources available was the survey made by the Brazilian Society for Hepatology in 2001, in which alcohol accounted for approximately 60% of the non-viral causes of cirrhosis¹⁷. Thus,

for the category investigated in this study, alcoholic cirrhosis probably represented the largest percentage of the cases. In this context, the percentage of the DALY value attributed to alcoholic cirrhosis in Brazil could be close to the global percentage (0.6%)⁶, unlike that for alcohol use/dependence, which indicated highest percentages for Brazil compared to the global average, as shown earlier.

Both alcohol use/dependence to alcohol and liver cirrhosis are known to be more frequent disorders in males^{2,7,14}. According to WHO, 6.2% of fatalities for men was attributed to alcohol, while for women this percentage was 1.1%¹. In 2010, fatalities from cirrhosis derived from alcohol accounted for 0.9% of all deaths worldwide, of which 0.7% for women and 1.2% for men¹⁹. Furthermore, in 2010, alcoholic cirrhosis accounted for 0.8% of the total DALY value for men and 0.4% of the total DALY for women⁶. The data from the present study reinforced this male prevalence, since both harmful effects were among the top ten causes of DALY in men but not in women. For this reason, the data was presented only for men, thus it represents the higher risk group for both disabilities.

Moreover, the analysis of the DALY distribution curves by age range in the present study revealed that the disease burden of alcohol has a greater impact on the younger age ranges, while the greatest impact of cirrhosis comes later, in the age range of 45 to 59 years. In the GBD-2010 study, the disorders related to alcohol use had a higher disease burden between the ages of 25-50 years, declining gradually thereafter²⁰. As for cirrhosis, the global curve also showed a greater impact of the disease for the age range of 45-59 years, with a more marked decline thereafter². The similarity of the curves for Brazil and the global study is probably related to the underlying reasons for the disabilities: alcohol is considered an important risk factor for cirrhosis, with a relationship between its consumption and the development of liver damage⁷. Thus, the higher incidence of alcohol usage in the younger age ranges would be reflected by more cases of alcoholic cirrhosis in older age ranges.

For alcohol, the YLD was the component with the highest percentage impact on the DALY value while for cirrhosis, YLL was the principal factor. This distribution was also observed in the GBD-2010 study²⁰. Samokhvalov *et al.*²¹ conducted a systematic review of the literature on disabilities related to alcohol abuse. Although they found a degree of heterogeneity in the studies,

they observed that changes in emotional state, social relationships and memory were significant disability attributes. When assessing alcohol as a risk factor for cirrhosis, Rehm *et al.*⁷ found that its consumption was associated with a higher impact on mortality from liver disease than on morbidity.

There are few published epidemiological studies on alcohol use/dependence and liver cirrhosis in Brazil. By producing estimates of YLL, YLD and DALY for Brazil and its regions, this study helped to characterize the morbidity and mortality profiles and, therefore, the impacts of these disabilities on the population. Furthermore, they also facilitate comparative analysis, due to the distribution by gender and age range, of alcohol use/dependence and cirrhosis, typifying this disease process in Brazil, as well as providing information for government actions.

On the other hand, certain limitations should be highlighted. Firstly, there was a lack of population studies on the subject, requiring the use of parameters from various studies for the construction of indicators. Besides this, the studies used for the estimation of parameters such as the hepatitis survey¹⁶, were conducted in the Brazilian state capitals and then extrapolated to the rest of the country, which could mean that they do not adequately portray the other cities.

Another point to note was the absence of data on the age range distribution for the prevalent cases of cirrhosis in the population, which led to the use of the distribution of this disease from the SIM system. Finally, the absence of specific data for alcoholic cirrhosis did not permit the breakdown of the data for the category of "alcohol and others". Thus, despite the greater proportion of this category being due to alcohol, one should emphasize that there was also the influence of other liver diseases that could have an epidemiological behavior different from that of alcoholic cirrhosis.

Alcohol use/dependence is a major concern of the health service, since today its use at increasingly earlier age ranges has been observed and which is often associated with risk situations, such as driving under the influence of alcohol¹⁴. Thus, the present study provides information to enable preventive actions against alcohol abuse, by demonstrating the higher values for DALY in the age range of 15-29 year, and indicating the importance of adopting specific actions for this age range. Generally, in this age range there are constant changes in people's lives, such as going to university, more socializing with friends

(compared to before when the social circle was based on the family environment) and entry into the labor market. These situations can generate sources of stress which may be associated with the increased use of alcohol^{22,23}. Thus, preventive actions in these age ranges, such as limiting the sale of alcoholic beverages, higher taxation and restrictions on the places/hours could help reduce the alcohol use/dependence²⁴.

On the other hand, cirrhosis due to alcohol and other causes presented higher rates in the age range of 45-59 years. This data suggested that actions to reduce alcohol consumption in the earlier age ranges could minimize the impact of this disease in the older age ranges, given the underlying reason for these diseases. Also, it should be emphasized that there is the need to equip the health service system to allow the early diagno-

sis and appropriate treatment of alcohol dependence in order to prevent the subsequent effect of cirrhosis on patients' lives.

Finally, this study pointed to some developments. Given that alcohol use is an important risk factor for liver disease²⁵, it is necessary to calculate the total percentage of cirrhosis attributable to alcohol, aiming at understanding its influence on the population disease burden and proposing preventive actions. Another point to note is the lack of population-based studies, as well as those of a longitudinal nature in order to obtain a better understanding of the disease profile from these causes among the population. We also suggest that investments be made in cost-effectiveness studies, in which the impact of different interventions in these diseases is assessed.

Collaborations

FB Portugal, MR Campos, JR Carvalho, LS Flor, JMA Schramm and MFS Costa participated equally in all stages of preparation of the article.

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