

# Public knowledge and attitudes toward liver diseases and liver cancer in the Brazilian population: a cross sectional study



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## Summary

**Background** Little is known about the knowledge of the Brazilian population regarding prevention/screening/diagnosis of cirrhosis and hepatocellular carcinoma (HCC). We aimed to investigate the public knowledge/attitudes toward liver diseases in Brazil.

**Methods** A cross-sectional survey was conducted in which 1.995 adults were prospectively interviewed regarding knowledge about cirrhosis/HCC and attitudes toward vaccination and viral hepatitis (VH) testing.

**Findings** Most of the Brazilian subjects believe that alcohol abuse (63%–87%), NAFLD (29%–53%) and smoking (31%–47%) are the leading causes of cirrhosis/HCC. VH were less often linked to both diseases. Brazilians agreed that NAFLD is a risk factor for cirrhosis, cancer and cardiovascular diseases; 66%, 48% and 40% were submitted to hepatitis B vaccination and hepatitis B and C testing, particularly those with older age, higher level of education and income.

**Interpretation** VH was not considered by the majority of the Brazilians as an important cause liver disease, leading a large proportion of those subjects to neglect hepatitis B vaccination and hepatitis B and C testing.

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**Keywords:** Awareness; Knowledge; Cirrhosis; Hepatocellular carcinoma; Hepatitis B; Hepatitis C; Non-alcoholic fatty liver disease

## Introduction

Cirrhosis and hepatocellular carcinoma (HCC) are responsible for 1.16 million and 788.000 deaths worldwide, respectively. Altogether, they are responsible for more than 3.5% of all deaths, making them the 11th and the 16th top cause of mortality around the globe.<sup>1</sup> In the Brazilian public health system (SUS), liver diseases were considered to be the eighth leading cause of mortality and a significant cause of premature death and disability.<sup>2,3</sup> Despite a slight decrease in age-standardised mortality over the years,<sup>4</sup> cirrhosis and HCC remain a significant health problem in the country.<sup>2,3</sup> Nowadays, more than 2.000 liver transplantations (LT) are performed each year in Brazil, mainly due to decompensated cirrhosis and/or HCC within Milan criteria.<sup>5</sup> However, this transplantation activity is far

lower than required and mortality in the awaiting list is unacceptably high due to a shortage of organs and late referral of eligible subjects from primary and intermediary care. On the other hand, HCC is usually diagnosed in Brazil in late stages, not amenable to therapies that ought to improve survival.<sup>6</sup> The most common causes of cirrhosis and HCC in Brazil are viral hepatitis (VH), mainly hepatitis C, alcoholic liver disease and non-alcoholic fatty liver disease (NAFLD). In order to reduce morbidity and mortality of liver diseases and achieve hepatitis elimination,<sup>7</sup> all steps in the continuum of care (CoC) of VH are funded by the public health system, including hepatitis A and B vaccination, hepatitis B (HBV) and C (HCV) viruses testing in at-risk population groups, hepatitis B screening in pregnant women and diagnosis and treatment of VH with current

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### Research in context

#### Evidence before this study

The most common causes of cirrhosis and hepatocellular carcinoma (HCC) in Brazil are viral hepatitis (VH), mainly hepatitis C, alcoholic liver disease and non-alcoholic fatty liver disease (NAFLD). Due to their silent and indolent course, most of the patients with liver disease do not suspect the presence of cirrhosis and HCC until decompensation or development of symptoms due to advanced cancer. In the Brazilian public health system (SUS), liver diseases were considered to be the eighth leading cause of mortality and a significant cause of premature death and disability. Despite the burden of liver diseases in Brazil, little is known about public knowledge of the Brazilian population regarding prevention, screening and diagnosis of the most common aetiologies of cirrhosis and liver cancer.

#### Added value of this study

Our study revealed that most people in Brazil attribute cirrhosis and liver cancer to alcohol abuse neglecting the burden of VH. Nearly half of the population reported prior full-dose vaccination for hepatitis B, previous testing for hepatitis B and C or performance of some test or procedure to evaluate liver health. The majority of them is aware that free

of charge hepatitis B virus (HBV) and C (HCV) viruses testing are available in Brazil. Despite access to HBV and HCV testing, many subjects lack interest or motivation to do so or feel that VH testing is unnecessary. An unexpected high level of knowledge was observed among Brazilians regarding liver-related and systemic consequences of NAFLD, including cirrhosis, cancer, cardiovascular disease and overt type 2 diabetes.

#### Implications of all the available evidence

Despite its significant association with liver disease, VH was not considered by the majority of the Brazilians as an important cause liver disease, leading a large proportion of those subjects to neglect hepatitis B vaccination and hepatitis B and C testing. Strategies of the Brazilian Government for the elimination of viral hepatitis include full coverage for all steps of the continuum of care (CoC) of hepatitis B and C. Inadequate knowledge about cirrhosis and HCC is considered a critical factor in population's commitment toward HBV vaccination and testing, HCV screening and VH treatment which may impact the Brazilian viral hepatitis elimination plan in the near future.<sup>7</sup>

recommended therapies.<sup>7,8</sup> Likewise, Brazilian health authorities also recommend screening cirrhosis and HCC in those subjects with VH.<sup>7,9</sup> Public policies regarding prevention, screening, diagnosis and treatment of alcoholic liver disease and NAFLD are, on the other hand, less structured in Brazil. Due to their silent and indolent course, most of the patients with liver disease do not suspect the presence of cirrhosis and HCC until decompensation or development of symptoms due to advanced cancer. We hypothesize that a large proportion of the Brazilian population could neglect recommended strategies for prevention and screening of liver diseases. The purpose of this study is to investigate the public knowledge and attitudes toward prevention and screening of liver diseases in the Brazilian population.

### Methods

In August 2021, The Brazilian Liver Institute requested the DataFolha Research Institute, to conduct a cross-sectional survey of a sample representative of the Brazilian population older than 18 years.<sup>10</sup> The study was conducted between September 8th and September 15th, 2021, accepting at most one sampling error of  $\pm 2\%$  points, taking into consideration a 95% confidence interval. For 0.5% or lower estimates, zero was assumed. Sample bases lower than 30 cases were not considered for statistical analysis. As previously described,<sup>11–13</sup> the sample design was based on data from National

Household Sample Survey 2019<sup>10</sup> to be representative of the Brazilian population over 18 years of both genders, all socioeconomic strata and education levels. The sampling method sought to select respondents at random, in order to better represent the Brazilian population, while keeping the characteristics of the defined extracts (region, type of municipality, gender and age).

The questions were divided into two blocks comprised of socioeconomic and demographic variables and specific questions regarding the knowledge, awareness and perception of liver diseases and their risk factors.

Socioeconomic and demographic variables included were age, gender, the geographic region in Brazil where data were collected (North, Northeast, Southeast, Middle West or South), education level (up to elementary school, up to high school and higher education), social class according to average household income per month in US dollars (USD)<sup>9</sup>; A/B, above 2.286 USD; C, between 914 and 2.286 USD and D/E, below 914 USD; member of the economically active population (EAP) and alcohol consumption. US Dollar values were based on current rates as of January 2022. Alcohol consumption was graded as the number of drinks per day. One drink was considered as intake of any alcoholic beverage containing approximately 14 g of pure alcohol. Economically active population was considered as employed or unemployed people, but looking for a job or available to start work. To be part of EAP, one should be part of the nation labour force.

The specific questions (Q) regarding the subject of the study were:

- Q1 In your opinion, what are the leading causes of a) liver cancer and b) cirrhosis? The possible answers (alcohol abuse, NAFLD, smoking, heredity, hepatitis B, hepatitis C, improper nutrition, unspecified hepatitis, use of medications, excessive fat intake, other, do not know) were disclosed to all interviewers in a designed chart derived from the results of a pilot study involving 50 subjects. The most common answers to Q1a and Q1b, potential inconsistencies of the questionnaire and the amount of time necessary to conduct the survey were all tested in this pilot study. More than one response was allowed for Q1a and Q1b.
- Q2 Have you ever a) been vaccinated with three doses of hepatitis B vaccine? b) tested for hepatitis B virus? c) tested for hepatitis C virus? d) done any laboratory or imaging test to assess your liver? The possible answers were yes, no or do not know.
- Q3 Are you aware that hepatitis B and C testing can be performed free of charge in the Brazilian public health system?
- Q4 For which reasons have you not performed a) hepatitis B and b) hepatitis C testing? The possible answers (felt unnecessary, lack of interest or motivation, not recommended by a general practitioner, lack of time, never heard about, lack of access, no money to pay the test, unavailability at SUS, already vaccinated, others, do not know) were disclosed to all interviewees in a designed chart derived from the results of the pilot study as mentioned above. More than one response was allowed for Q4a and Q4b.
- Q5 In which level of agreement or disagreement with the following statements are you (totally agree, agree in part, neither agree nor disagree, disagree in part, totally disagree, do not know): NALFD increases the risk of a) cancer, b) myocardial infarction or stroke, c) cirrhosis and d) diabetes.

The average length of each interview was 15 min. They were carried out face to face by non-healthcare workers using a tablet hired by DataFolha Institute in highly frequented road intersections sideways chosen randomly from a large Datafolha Institute database. The respondents were selected according to age and gender quotas at each determined selected intersection.

All participants were informed about the topic of the survey as well as its importance to current knowledge. Informed consent was obtained from all subjects before each interview. The study was conducted in accordance with Helsinki Declaration. It was approved by the Ethical Committee from Portuguese Hospital (number 062846).

### Statistical analysis

To ensure that our sample was representative of the Brazilian population over 18, data were weighted by demographics such as geographic region, gender as perceived by the interviewer, age, socioeconomic class and level of education.<sup>11–13</sup> Briefly, the sampling weight was performed in order to equalise the distribution of the sample with the distribution of the desired Brazilian population. To evaluate the proportions (% of positive responses), in the different categories of the profile variables, the Z test of proportion was applied. Univariate analysis was tested using  $\chi^2$  test or the Fisher exact probability test when appropriate. *P* values  $\leq 0.05$  were considered to be significant. For multiple comparisons between groups, *P* values were adjusted according to the Bonferroni correction method. Statistical analyses with weighted data were performed with the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA), version 21.0 for Windows.

### Role of the funding source

Study funders did not have any role in study design, data collection, data analysis, interpretation, writing or decision to submit.

### Results

1995 subjects (1048 women, mean age 44 years) from 129 municipalities from all Brazilian regions were interviewed. The demographic features of those participants are depicted in [Table 1](#) and represent the Brazilian population over 18 years. As expected, most of the subjects were from the Southeast Region, the largest region in the country. A little more than half of them were women. Education level was up to high school in 1556 (78%) of them. Most of them were part of the EAP and from the C or D/E class ([Table 1](#)). The mean household income was 685 USD. 1356 (68%) of them have children, with a mean of 2.5 children per participant.

The responses regarding perception about causes of liver cancer and cirrhosis revealed that most of the Brazilian population attributed liver cancer to alcohol abuse [1256 (63%)], NAFLD [1057 (53%)] and smoking [937 (47%)], whereas few associated heredity [578 (29%)], hepatitis C [458 (23%)] and B [438 (22%)] to HCC. Other causes, such as improper nutrition and hepatitis (unspecified), were rarely reported ([Fig. 1](#)). Lack of knowledge about the subject was reported by 119 (6%) of the participants. The mean number of responses regarding risk factors for liver cancer was  $2.6 \pm 1.4$  per participant. Similarly, alcohol abuse, smoking, NAFLD and heredity were recognized as risk factors for cirrhosis, respectively, by 1735 (87%), 618 (31%), 578 (29%) and 319 (16%) of the subjects, whereas hepatitis B or C were considered as causes for cirrhosis by only 299 (15%) of the participants. Few believed that other causes such as improper nutrition could be related to cirrhosis

	All participants (n = 1995)	
	Unweighted	Weighted (%)
<b>Gender</b>		
Male	947	945 (47)
Female	1.048	1.050 (53)
<b>Age (years)</b>		
18–24	297	275 (14)
25–34	412	396 (20)
35–44	391	399 (20)
45–59	505	499 (25)
60 or more	390	427 (21)
<b>Geographical region</b>		
South	299	302 (15)
Southeast	848	873 (44)
Middle West	163	155 (8)
Northeast	524	510 (26)
North	161	155 (8)
<b>Education level</b>		
Elementary school	625	666 (33)
High school	964	889 (45)
Higher education	406	441 (22)
<b>Socioeconomic class</b>		
A/B	493	487 (24)
C	965	935 (47)
D/E	537	574 (29)
<b>Place of living</b>		
Metropolitan area of state capitals	877	832 (42)
Countryside small cities	1.118	1.163 (58)
<b>Occupation</b>		
EAP	1.447	1.426 (71)
Non EAP	548	570 (29)
<b>Children</b>		
Yes	1.343	1.358 (68)
No	652	638 (32)
<b>Alcohol consumption</b>		
Yes	1.096	1.093 (55)
No	899	903 (45)
<b>Alcohol consumption (drinks per day)</b>		
Up to two	398	403 (20)
More than two	685	677 (34)

EAP, economically active population.

**Table 1: Demographic data of all participants.**

(Fig. 1). Lack of knowledge about the subject was reported by only 39 (2%) of them. The mean number of responses was 2.0 ± 1.3 per participant.

Responses regarding attitudes related to prevention and early diagnosis of viral hepatitis and/or cirrhosis revealed that 2/3 of the subjects claimed to have received full doses of HBV vaccination and less than half had been tested for hepatitis B [957 (48%)], hepatitis C [798 (40%)] or had performed any evaluation to assess liver health [817 (41%)] (Fig. 2a).

Complete vaccination for hepatitis B was significantly more common in women (1.7 times more likely to be vaccinated than men—odds ratio = 1.7), in subjects between 25 and 44 years (2.3 times more likely than others—odds ratio = 2.3) when compared to younger subjects or participants older than 60 years, or in subjects with higher levels of education (odds ratio = 1.7) or income (odds ratio = 1.4) (Table 2). On the other hand, testing for hepatitis B was more frequent in older age groups, in participants with a higher level of education (odds ratio = 1.9) or income (odds ratio = 1.4) and in alcohol drinkers of up to two drinks of alcohol per day (odds ratio = 1.3) (Table 3). In contrast, testing for hepatitis C was less common in younger subjects (odds ratio = 0.5), in alcohol drinkers of two or more drinks of alcohol per (odds ratio = 0.5) and in participants from socioeconomic class C and D/E (respectively odds ratio = 1.0 and 0.6) (Table 4).

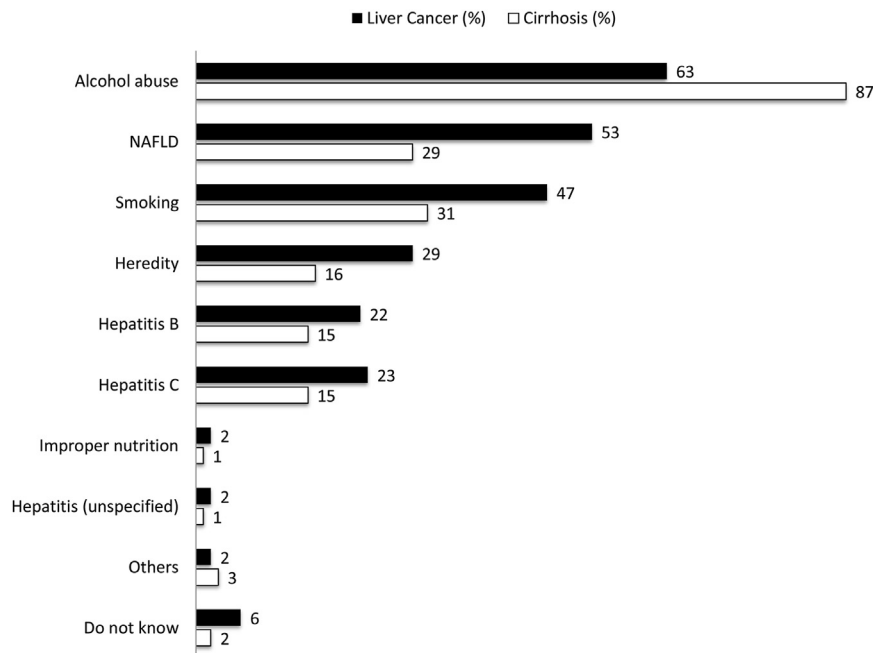
On the contrary, evaluation of liver health was more commonly reported by older subjects (odds ratio = 2.0), by participants with higher education (odds ratio = 2.0) or higher income (odds ratio = 2.2) and in subjects who do not drink alcohol at all (odds ratio = 1.2) (Table 5). In general, responders from Northeast and North regions had lower frequencies of hepatitis B vaccination (respectively odds ratio = 0.6 and 0.8), hepatitis B and C testing and liver health evaluation when compared to their counterparts from other regions of Brazil (Tables 2–5).

Awareness of the availability of hepatitis B and C testing at SUS free of charge was confirmed by 1536 (77%) of the subjects. The remaining responders either did not know 319 (16%) or were unaware 139 (7%). The reasons for not being tested for hepatitis B and C are depicted in Fig. 2b. Almost half of the subjects felt that those tests were unnecessary. Other reasons for not testing were lack of interest or motivation or no recommendation by a general practitioner (Fig. 2b).

Interestingly, concerning the consequences of NAFLD, 1037 (52%) and 399 (20%) of the interviewees agreed totally or in part that fatty liver could lead to cirrhosis. On the other hand, 199 (10%), 219 (11%) and 179 (9%) disagreed in part or totally or had no opinion about the subject. When asked about their point of view concerning a causal relationship between fatty liver and type 2 diabetes, MI or stroke and cancer, 997 (50%), 1097 (55%) and 1256 (63%) of them, respectively, agreed totally; 399 (20%), 359 (18%) and 458 (23%) agreed in part; 418 (21%), 379 (19%) and 199 (10%) disagreed in part or totally; whereas, 159 (8%), 139 (7%) and 79 (4%) had no idea about either one of the subjects.

## Discussion

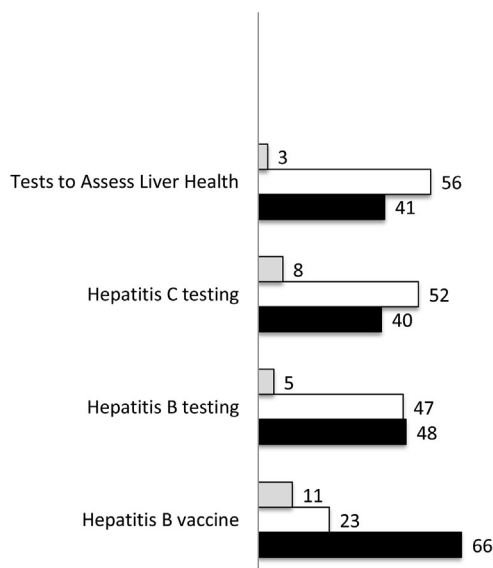
The present study evaluated the knowledge of Brazilians about the most frequent causes of cirrhosis and liver cancer, awareness about access free of charge of HCV



**Fig. 1:** Responses to Q1: In your opinion, what are the main causes of a) liver cancer and b) cirrhosis? The possible answers were alcohol abuse, fatty liver (NAFLD), smoking, heredity, hepatitis B, hepatitis C, improper nutrition, unspecified hepatitis, improper nutrition, others and do not know. Mean number of responses to Q1a (liver cancer) and Q1b (cirrhosis) were, respectively 2, 6± and 2, 0± per participant.

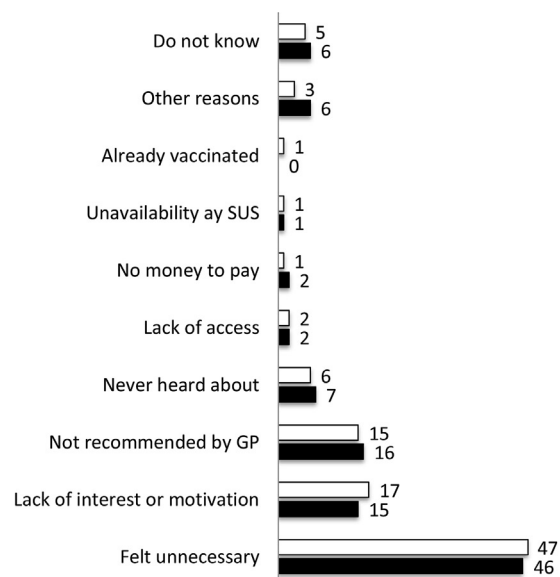
**a Evaluation of Liver Diseases (%)**

□ Do not Know □ No ■ Yes



**b Reasons for not being tested (%)**

□ Hepatitis B ■ Hepatitis C



**Fig. 2:** a) Responses to Q2: Have you ever a) been vaccinated with three doses of hepatitis B vaccine? b) tested for hepatitis B virus, c) tested for hepatitis C virus, d) done any laboratory or imaging test to assess your liver? The possible answers were yes, no or do not know. b) Responses to Q4: For which reasons, you have not performed a) hepatitis B and C testing? The possible answers were felt unnecessary, lack of interest or motivation, not recommended by general practitioner (GP), lack of time, never heard about, lack of access, no money to pay the test, unavailability at the Unified Public Health System (SUS), already vaccinated, others, do not know) were disclosed to all interviewees in a designed chart derived from the results of the aforementioned pilot study.

Variables	All participants (n = 1.976)			95% CI		
	Unweighted	Weighted (%)	Yes (%)	SE	LL	UL
<b>Gender</b>						
Male	947	945 (47)	(61)	1.093	59	63
Female	1.048	1.050 (53)	(71)	1.017	69	73
<b>Age (years)</b>						
18–24	297	275 (14)	(60)	1.099	58	61
25–34	412	396 (20)	(73)	0.999	71	74
35–44	391	399 (20)	(76)	0.952	75	78
45–59	505	499 (25)	(65)	1.065	64	67
60 or more	390	427 (14)	(56)	1.112	54	58
<b>Geographical region</b>						
South	299	302 (15)	(68)	1.044	66	70
Southeast	848	873 (44)	(70)	1.022	69	72
Middle West	163	155 (8)	(63)	1.081	61	65
Northeast	524	510 (26)	(59)	1.102	57	61
North	161	155 (8)	(66)	1.061	64	68
<b>Education level</b>						
Elementary school	625	666 (33)	(57)	1.107	55	59
High school	964	889 (45)	(70)	1.028	68	71
Higher education	406	441 (22)	(72)	1.005	70	74
<b>Socioeconomic class</b>						
A/B	493	487 (24)	(71)	1.011	70	73
C	965	935 (47)	(67)	1.054	65	69
D/E	537	574 (29)	(60)	1.095	59	62
<b>Place of living</b>						
Metropolitan area of state capitals	877	832 (42)	(66)	1.057	65	68
Countryside small cities	1.118	1.163 (58)	(66)	1.062	64	68
<b>Occupation</b>						
EAP	1.447	1.426 (71)	(67)	1.051	65	69
Non EAP	548	570 (29)	(63)	1.079	62	65
<b>Children</b>						
Yes	1.343	1.358 (68)	(68)	1.043	66	70
No	652	638 (32)	(62)	1.089	60	63
<b>Alcohol consumption</b>						
Yes	1.096	1.093 (55)	(67)	1.053	65	69
No	899	903 (45)	(65)	1.067	63	67
<b>Alcohol consumption (drink per day)</b>						
Up to two	398	403 (20)	(67)	1.054	65	69
More than two	685	677 (34)	(67)	1.054	65	69

CI, confidence interval; LL, lower limit; UL, upper limit; SE, standard error; EAP, economically active population.

**Table 2: Full vaccination for hepatitis B according to demographics.**

and HBV testing in the public health system and their attitudes toward HBV vaccination, HBV and HCV testing and evaluation of liver health using a sample designed to be representative of the Brazilian population from all regions according to age, gender, level of education and income.

Despite data showing that viral hepatitis, particularly hepatitis C, is the leading cause of cirrhosis and HCC in Brazil,<sup>5</sup> alcohol abuse is still considered the main cause of liver disease by most Brazilians. After alcohol abuse, NAFLD, smoking and hereditary factors were described

as significant risk factors for liver diseases. Interestingly, HBV and HCV infection ranked as the fifth to sixth most commonly identified cause of either HCC or cirrhosis, demonstrating that most of the Brazilian population neglect viral hepatitis as a significant cause of liver disease. This is important since inadequate knowledge about cirrhosis and HCC is considered a critical factor in awareness concerning attitudes toward prevention, HBV vaccination and testing, HCV screening and viral hepatitis treatment,<sup>14</sup> which may impact the Brazilian viral hepatitis elimination plan in

Variables	All participants (n = 1.976)			95% CI		
	Unweighted	Weighted (%)	Yes (%)	SE	LL	UL
<b>Gender</b>						
Male	947	945 (47)	(46)	1.116	44	48
Female	1048	1050 (53)	(50)	1.119	48	52
<b>Age (years)</b>						
18–24	297	275 (14)	(32)	1.042	30	33
25–34	412	396 (20)	(50)	1.119	48	52
35–44	391	399 (20)	(55)	1.113	53	57
45–59	505	499 (25)	(52)	1.118	51	54
60 or more	390	427 (21)	(46)	1.116	44	48
<b>Geographical region</b>						
South	299	302 (15)	(54)	1.117	52	55
Southeast	848	873 (44)	(52)	1.118	51	54
Middle West	163	155 (8)	(44)	1.110	42	45
Northeast	524	510 (26)	(40)	1.097	38	42
North	161	155 (8)	(47)	1.117	45	49
<b>Education level</b>						
Elementary school	625	666 (33)	(43)	1.109	41	45
High school	964	889 (45)	(46)	1.115	44	48
Higher education	406	441 (22)	(61)	1.092	59	63
<b>Socioeconomic class</b>						
A/B	493	487 (24)	(56)	1.112	54	57
C	965	935 (47)	(48)	1.118	46	50
D/E	537	574 (29)	(43)	1.107	41	44
<b>Place of living</b>						
Metropolitan area of state capitals	877	832 (42)	(51)	1.119	49	53
Countryside small cities	1.118	1.163 (58)	(46)	1.116	44	48
<b>Occupation</b>						
EAP	1.447	1.426 (71)	(49)	1.119	47	51
Non EAP	548	570 (29)	(47)	1.117	45	49
<b>Children</b>						
Yes	1.343	1.358 (68)	(51)	1.119	49	52
No	652	638 (32)	(43)	1.109	41	45
<b>Alcohol consumption</b>						
Yes	1.096	1.093 (55)	(49)	1.119	47	51
No	899	903 (45)	(47)	1.118	46	49
<b>Alcohol consumption (drink per day)</b>						
Up to two	398	403 (20)	(54)	1.116	52	56
More than two	685	677 (34)	(46)	1.116	44	48

CI, confidence interval; LL, lower limit; UL, upper limit; SE, standard error; EAP, economically active population.

**Table 3: Testing for hepatitis B according to demographics.**

the near future.<sup>7</sup> In this regard, knowledge about transmission, natural history and consequences of HCV<sup>15–17</sup> and HBV<sup>17–20</sup> infection in the general population from different parts of the world was reported to be inadequate even in hyperendemic areas of hepatitis B in Asia.<sup>18–20</sup> Due to its indolent course and lack of knowledge, many HBV- and HCV-positive patients were shown not to have confirmation of active infection or treatment to achieve sustained virological response,<sup>21,22</sup> many of them with advanced fibrosis or cirrhosis.<sup>21</sup> In Brazil, most patients with newly diagnosed HCC had

advanced cancer due to previously not recognised viral hepatitis.<sup>6</sup> In agreement with our findings, other authors have reported that HCC was the most common neoplasm associated with alcohol in the general population,<sup>22,23</sup> even though viral hepatitis is the most common cause of liver cancer worldwide.<sup>24</sup> On the other hand, it is noteworthy that up to now, many subjects still believe that cirrhosis is solely caused by alcohol abuse.<sup>25</sup> However, contrary to previous studies,<sup>26,27</sup> a high level of knowledge was observed among the Brazilian population regarding liver-related and systemic consequences

	All participants (n = 1.976)			95% CI		
	Unweighted	Weighted (%)	Yes (%)	SE	LL	UL
<b>Gender</b>						
Male	947	945 (47)	(39)	1.091	37	41
Female	1.048	1.050 (53)	(41)	1.103	40	43
<b>Age (years)</b>						
18–24	297	275 (14)	(25)	0.963	23	26
25–34	412	396 (20)	(43)	1.108	41	45
35–44	391	399 (20)	(47)	1.117	45	49
45–59	505	499 (25)	(43)	1.109	42	45
60 or +	390	427 (21)	(38)	1.084	36	39
<b>Geographical region</b>						
South	299	302 (15)	(46)	1.115	44	48
Southeast	848	873 (44)	(45)	1.114	43	47
Middle West	163	155 (8)	(40)	1.096	38	42
Northeast	524	510 (26)	(30)	1.028	29	32
North	161	155 (8)	(35)	1.065	33	36
<b>Education level</b>						
Elementary school	625	666 (33)	(34)	1.058	32	35
High school	964	889 (45)	(40)	1.095	38	41
Higher education	406	441 (22)	(51)	1.119	49	53
<b>Socioeconomic class</b>						
A/B	493	487 (24)	(48)	1.119	46	50
C	965	935 (47)	(40)	1.097	38	42
D/E	537	574 (29)	(33)	1.057	32	35
<b>Place of living</b>						
Metropolitan area of state capitals	877	832 (42)	(42)	1.106	40	44
Countryside small cities	1.118	1.163 (58)	(39)	1.090	37	40
<b>Occupation</b>						
EAP	1.447	1.426 (71)	(40)	1.099	39	42
Non EAP	548	570 (29)	(39)	1.094	38	41
<b>Children</b>						
Yes	1.343	1.358 (68)	(42)	1.106	40	44
No	652	638 (32)	(36)	1.072	34	37
<b>Alcohol consumption</b>						
Yes	1.096	1.093 (55)	(41)	1.099	39	42
No	899	903 (45)	(40)	1.095	38	41
<b>Alcohol consumption (drink per day)</b>						
Up to two	398	403 (20)	(45)	1.114	43	47
More than two	685	677 (34)	(38)	1.088	36	40

CI, confidence interval; LL, lower limit; UL, upper limit; SE, standard error; EAP, economically active population.

**Table 4: Testing for hepatitis C according to demographics.**

of NAFLD, including cirrhosis, cancer, cardiovascular disease and overt diabetes. Those findings may be due to recent social media and mass media campaigns about awareness of NAFLD due to the uprising of diabetes and obesity in the Brazilian population sponsored by several medical societies, including the Brazilian Society of Hepatology or more likely due to methodological reasons. In the present study, all participants were asked to endorse closed-ended questions and it is undisputed that this may lead people to answer more promptly and with no doubts than when asked freely in an open-ended

format. This may explain the discrepancy of people who were completely unaware of the cause of cirrhosis in the present study when compared to Ghevariya et al.,<sup>26</sup> who reported that 85% of North Americans are unaware of the causes of cirrhosis.

Strategies of the Brazilian Government for the elimination of viral hepatitis include full coverage for all steps of the CoC of hepatitis B and C with a focus on universal HBV vaccination, HBV and HCV testing of at-risk subjects and all pregnant women, in addition to HCV testing of all Brazilians over 40 years. Previous



	All participants (n = 1.976)			95% CI		
	Unweighted	Weighted (%)	Yes (%)	SE	LL	UL
<b>Gender</b>						
Male	947	945 (47)	(41)	1.100	39	43
Female	1.048	1.050 (53)	(41)	1.103	40	43
<b>Age (years)</b>						
18–24	297	275 (14)	(20)	0.888	18	21
25–34	412	396 (20)	(33)	1.049	31	34
35–44	391	399 (20)	(41)	1.100	39	42
45–59	505	499 (25)	(49)	1.119	47	51
60 or +	390	427 (21)	(54)	1.116	52	56
<b>Geographical region</b>						
South	299	302 (15)	(45)	1.114	43	47
Southeast	848	873 (44)	(41)	1.103	40	43
Middle West	163	155 (8)	(47)	1.117	45	48
Northeast	524	510 (26)	(38)	1.086	36	40
North	161	155 (8)	(36)	1.077	35	38
<b>Education level</b>						
Elementary school	625	666 (33)	(42)	1.103	40	43
High school	964	889 (45)	(34)	1.062	32	36
Higher education	406	441 (22)	(54)	1.115	53	56
<b>Socioeconomic class</b>						
A/B	493	487 (24)	(56)	1.112	54	57
C	965	935 (47)	(37)	1.081	35	39
D/E	537	574 (29)	(35)	1.071	34	37
<b>Place of living</b>						
Metropolitan area of state capitals	877	832 (42)	(43)	1.109	41	45
Countryside small cities	1.118	1.163 (58)	(40)	1.095	38	41
<b>Occupation</b>						
EAP	1.447	1.426 (71)	(39)	1.094	38	41
Non EAP	548	570 (29)	(46)	1.115	44	47
<b>Children</b>						
Yes	1.343	1.358 (68)	(44)	1.111	42	46
No	652	638 (32)	(35)	1.070	34	37
<b>Alcohol consumption</b>						
Yes	1.096	1.093 (55)	(39)	1.089	37	40
No	899	903 (45)	(44)	1.112	42	46
<b>Alcohol consumption (drink per day)</b>						
Up to two	398	403 (20)	(42)	1.104	40	44
More than two	685	677 (34)	(36)	1.078	35	38

CI, confidence interval; LL, lower limit; UL, upper limit; SE, standard error; EAP, economically active population.

Table 5: Evaluation of liver health according to demographics.

data from the Ministry of Health have already shown that HBV vaccination is suboptimal in subjects older than 20 years,<sup>28</sup> but there is no data concerning the frequency of hepatitis B and C testing in the general population. The present study has shown that 2/3 of the Brazilian population claimed to have received three doses of HBV vaccines. As previously reported, a higher frequency of complete vaccination was disclosed in women and younger subjects,<sup>28</sup> probably reflecting the Brazilian policy of vaccination of all vulnerable women submitted to HBV screening during pregnancy and

implementation of HBV vaccination in the early nineties with subsequent expansion of vaccination to older subjects only in 2015. Education level and/or income were significantly associated not only to attitudes toward HBV vaccination but also toward HBV and HCV testing and evaluation of liver health, which may be related not only to better access to healthcare but also to increased awareness and health literacy as previously highlighted by other reports.<sup>17,29</sup> Overall, 41%–48% of the Brazilians have performed either testing for viral hepatitis, liver enzymes or any diagnostic imaging test

to assess liver health. The frequency of the Brazilian population already tested for HBV and HCV seems to be higher when compared to other populations.<sup>17,30,31</sup> However, it is important to point out that approximately 100 million hepatitis B or C rapid tests have been distributed at SUS free of charge by the Brazilian Ministry of Health to primary care since 2011 in the effort to achieve viral hepatitis elimination.<sup>28</sup> Those tests were prioritized to particular population groups, including at-risk subjects<sup>9,10</sup> and pregnant women, and, regarding HCV, all Brazilians over 40 years, which nowadays correspond roughly to 36% of the Brazilian population.<sup>12</sup> Most Brazilians are aware that free HBV and HCV testing are available at SUS, particularly those underprivileged with lower income and education who usually rely solely on SUS. Despite access to HBV and HCV testing free of charge, many subjects lack interest or motivation to do so or feel that viral hepatitis testing is unnecessary. This is probably due to the asymptomatic course of liver diseases and the false assumption that alcohol abuse instead of viral hepatitis is the main trigger of cirrhosis and HCC in Brazil. Surprisingly, non-drinkers or alcohol users who drink moderately were more concerned about liver health and screening for hepatitis B and C when compared to their counterparts who are either alcohol drinkers or drinkers of more than two units of alcohol per day. This may be due to stigma linking cirrhosis and HCC overtly to alcohol abuse or even lack of awareness about liver-related consequences of alcohol abuse and heavy drinking.

Brazil is a huge and heterogeneous country comprising 47% of the territory of South America with striking regional differences human development index, GDP per capita as well as in access to education and healthcare. Therefore, it was not unexpected to encounter lower levels of hepatitis B vaccination, hepatitis B and C testing and liver health evaluation in the poorer Northeast and North regions, which may reflect disparities in access to education and healthcare.

To limit response bias, this survey was designed to provide clarity, objectivity and anonymity, but social desirability bias always remains an issue in self-reports with potential effects in the reliability of our results. Another limitation of present survey was lack of external validation of the questions employed. Our results also may be representative of the knowledge and attitudes of the general population from Brazil toward liver diseases, but no extrapolation can be made concerning other populations, even those from neighbouring Latin American countries.

In summary, this study is one of the few population-based surveys regarding knowledge and attitudes of the general population toward prevention and early diagnosis of liver diseases. Our results indicate that most people attribute cirrhosis and HCC to alcohol abuse neglecting the burden of liver diseases associated with

viral hepatitis and proper attitudes toward prevention, screening and early diagnosis of HBV and HCV.

#### Contributors

P.L.B. and L.C. conceived and designed the research; H.F.C. made the statistical analysis. L.C. and M.L.G.F. interpreted the results. M.L.G.F. and P.L.B. drafted and revised the manuscript. P.L.B. had final responsibility for the decision to submit for publication.

#### Data sharing statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. Researchers who are interested in using the data should contact Dr. Paulo Lisboa Bittencourt (mail to: [plbbr@uol.com.br](mailto:plbbr@uol.com.br)).

#### Declaration of interests

Paulo Lisboa Bittencourt, Liana Codes, Heloisa Furia Cesar and Maria Lucia Gomes Ferraz declared that they have no conflicts of interest.

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