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Alcohol abuse and involvement in traffic accidents in the Brazilian population, 2013

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Abstract *This article aims to analyze alcohol abuse and frequent consumption according to sociodemographic characteristics and investigate the risk of greater involvement in traffic accidents, using data from the National Health Survey (PNS), 2013, Brazil. Events investigated were alcohol abuse and frequent consumption and if the individual was involved in a traffic accident and sustained an injury in the last 12 months. We investigated both events according to sociodemographic characteristics and assessed the association among them through multivariate logistic regression. The prevalence of alcohol abuse and frequent consumption was 6.1% for the population aged 18 years and over, 8.9% among men and 3.6% among women. The prevalence of involvement in traffic accidents was 3.1% in the general population and 6.1% among those who reported alcohol abuse. After controlling for sociodemographic factors, alcohol abuse and frequent consumption was significantly associated with traffic accidents. Considering a higher risk of involvement in traffic accidents among individuals who reported alcohol abuse and frequent consumption, monitoring blood alcohol concentration of drivers becomes a strategic possibility of intervention.*

Key words *Health survey, Alcoholic beverages, Traffic accidents, Brazil*

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Introduction

Alcohol is a widely used drug classified as a lawful drug and known for its psychotropic characteristics that promote sociability and integration among individuals. Moreover, in many cultures, its consumption is promoted during social events, celebrations, religious ceremonies, among other occasions[1,2]. According to recent data from the World Health Organization published in the Global Status Report on Alcohol and Health 2014[3], alcohol is consumed practically all over the world. It is estimated that individuals aged 15 years or older consumed, in 2010, about 6.2 liters of pure alcohol, equivalent to about 13.5 g daily[3]. While countries like Brazil, Argentina and Venezuela have a relatively high proportion of individuals who do not consume alcohol (over 40% of the population over 15 years), the per capita consumption of those who consume was considerably higher than the global average in 2010 (Brazil 8.7 liters, Argentina 9.3 liters and Venezuela 8.9 liters)[3,4]. In Brazil, estimated consumption among men is 13.6 liters and 4.2 liters among women[3].

Alcohol consumption has become a serious public health problem since it is a risk factor for chronic noncommunicable diseases and causes other issues, such as problems at work and with family, involvement in accidents and violence, causing, sometimes, legal losses[5-7].

In small quantities, alcohol consumption causes a state of euphoria and disinhibition. However, high blood alcohol concentrations cause a decreased attention, false speed perception, euphoria, increased reaction time, sleepiness, decreased peripheral vision and neuromotor changes, which in varying levels result in loss of capacity of driving a motor vehicle and becomes an important specific cause of death among traffic accidents victims[8-11]. To check the effect of the substantial and frequent intake, the Centers for Disease Control and Prevention (CDC) established the "heavy drinking" indicator, which considers a weekly intake greater than or equal to 8 doses of alcoholic drinks for women and 15 doses for men by week[12].

Studies in recent decades point to a clear trend of increased risk for the occurrence of traffic accidents among drunk drivers compared to those who do not drink alcohol when about to drive[9,10,13], which led Brazil to adopt, since 2008, a law known as the *Lei Seca* (Prohibition), which stated that motor vehicle drivers would commit offense and receive a traffic ticket if they were caught in the breathalyzer test driving with more than 0.1 milligrams of alcohol per liter of air in the body, and also determined it would be a crime if the level of milligrams of alcohol per liter of air in the body was equal to or greater than 0.34 ml[14]. In 2013, the law became stricter, with zero tolerance for the level of alcohol in the body, that is, drivers who are caught driving with any quantity alcohol in the body are fined. However, crime-characterizing alcohol concentration remained at 0.34 milligrams of alcohol per liter of air[15].

The monitoring of the alcohol abuse and frequent consumption is necessary to the extent that it seeks to understand these patterns of consumption and most vulnerable population segments, which are some of the key aspects to subsidize public health promotion and risk behavior prevention policies[16,17].

Thus, we intended to analyze alcohol abuse and frequent consumption according to sociodemographic characteristics and investigate the risk of greater involvement in traffic accidents, using data from the National Health Survey (PNS) held in 2013 in Brazil.

Methodology

The National Health Survey (PNS) is a national household-based research carried out by the Oswaldo Cruz Foundation and the Ministry of Health, in partnership with the Brazilian Institute of Geography and Statistics (IBGE). The study was approved in June 2013 by the National Research Ethics Commission (CONEP) under Opinion No 328.159 and fieldwork was carried out between August 2013 and February 2014.

The PNS is part of the Integrated IBGE Household Surveys System and uses a subsample of IBGE's Master Sample[18], with the same stratification of the primary selection units (PSUs), consisting of one or more census tracts. We selected one sample per cluster in three stages. In the first, we selected the PSUs in each stratum. In the second stage, we randomly selected a fixed number of households in each PSU. In the third stage, we randomly selected one adult resident (18 years or older) in each household. In total, we visited 81,254 households; of these, 69,994 were occupied. We conducted 64,348 household interviews and 60,202 with the selected resident. Other details about the research, the process of sampling and data weighting are available in previous publications[18,19].

In the present study, we analyzed the relationship between alcohol abuse and frequent consumption and traffic accidents. Both events were obtained by applying the individual PNS questionnaire conducted with adult residents selected in the household. To characterize alcohol abuse and frequent consumption, we used the "heavy drinking" indicator proposed by CDC, which considers the weekly intake greater than or equal to 8 doses for women and 15 doses for men[12]. We considered two PNS issues to calculate this indicator: "How many days a week do you usually drink some alcohol beverages?" and "In general, when you actually drink, how many alcoholic beverages do you consume? (*1 dose of alcohol is equivalent to one can of beer, 1 glass of wine or 1 shot of cachaça, whiskey or other distilled spirits*)." The results of the two questions were multiplied, and to characterize alcohol abuse and frequent consumption, we considered outcomes greater than or equal to 8 doses a week for women and 15 doses a week for men.

Regarding traffic accidents, we used the question: "In the last 12 months, were you involved in a traffic accident in which you have suffered bodily injury (injuries)?" Besides investigating the traffic accident in the general population, in the present study, we investigated this event in the population who reported alcohol abuse and frequent consumption.

We also investigated the individual's condition at the time of the accident: Car/van, bus, truck, motorcycle or bicycle driver; car/van, bus, truck, motorcycle or bicycle passenger; pedestrian; or other status. In addition, we investigated the prevalence of involvement in a traffic accident in the general population and among individuals who reported alcohol abuse and frequent consumption by Federal Unit.

Regarding sociodemographic analysis, we considered the following characteristics: gender (male, female); age group (18-29; 30-39; 40-49; 50-59; 60-69; 70+ years); level of schooling (incomplete secondary school, complete secondary school and over); skin color/race (white, brown, black); and marital status (single, married, separated/divorced, widower/widow). We performed bivariate logistic regressions with a confidence level of 95% between each of the sociodemographic variables and the corresponding dependent variable, either alcohol abuse and frequent consumption or traffic accident event.

For multivariate analysis, we used logistic regression model with 95% confidence level, using the dependent variable of traffic accidents events in the last 12 months prior to the survey and age, gender, schooling level, color skin/race, marital status and alcohol abuse and frequent consumption as independent variables.

We performed analyses using the statistical SPSS version 21.0[20], taking into account the impact of the sampling plan.

Results

We analyzed 60,202 interviewed individuals in the PNS. The prevalence of alcohol abuse and frequent consumption was 6.1% for the population aged 18 years and over and 8.9% among males and 3.6% among females. The highest incidence of alcohol abuse and frequent consumption were among younger men (8.1% - 18-29 years old). Regarding females, there was a statistically significant gradient in the distribution of the prevalence of alcohol abuse and frequent consumption, with higher rates among younger women, decreasing with age (Table 1).

Results by level of schooling show that there was no difference in the prevalence of alcohol abuse and frequent consumption among men. However, among women, there was a statistically significant difference at 5%, and the highest prevalence of alcohol abuse and frequent consumption was 4% among those who have completed secondary school and over. (Table 1).

With regard to skin color/race, the highest prevalence of alcohol abuse were among individuals who reported having black skin (12.4% for males and 5.9% for females). Odds ratios indicated that both men and women who reported having white skin are less likely prone to alcohol abuse and frequent consumption. In the analysis by marital status, regardless of gender, the highest prevalence was among single individuals: 11.4% among men and 6.1% among women. Both the results for married or widowed men and women have indicated a protective effect for alcohol abuse and frequent consumption (Table 1).

The proportion of people who were involved in traffic accidents with injuries in the last 12 months prior to the survey in Brazil was 3.1% in the general population and almost double among individuals who reported alcohol abuse (6.1%). Most of those involved in traffic accidents were male, with a prevalence of 4.5% in the general population and 7.5% among those who reported alcohol abuse and frequent consumption. Younger age groups had higher prevalence of involvement in traffic accidents both in the

Table 1. Prevalence of abuse and frequent alcohol consumption and their respective odds ratios by sociodemographic characteristics. PNS, Brazil, 2013.

Sociodemographic characteristics	Alcohol abuse and frequent consumption					
	Male			Female		
	%	OR	p-value	%	OR	p-value
Total	8.9	-	-	3.6	-	-
Age group						
18 to 29 years	10.3	1.745	0.000	6.0	4.229	0.000
30 a 39 years	10.0	1.689	0.000	4.3	2.945	0.000
40 a 49 years	10.7	1.823	0.000	3.5	2.414	0.000
50 years and over	6.2	1.000	-	1.5	1.000	-
Schooling level						
Incomplete secondary school	9.4	1.000	-	3.2	1.000	-
Secondary school completed and over	8.3	0.880	0.099	4.0	1.241	0.021
Skin color/race						
White	7.6	0.594	0.000	2.6	0.464	0.000
Brown	9.6	0.766	0.015	4.2	0.762	0.054
Black	12.4	1.000	-	5.9	1.000	-
Marital status						
Married	6.6	0.555	0.000	1.7	0.265	0.000
Separated/Divorced	9.7	0.841	0.274	4.9	0.804	0.199
Widower/Widow	5.5	0.451	0.009	0.9	0.142	0.000
Single	11.4	1.000	-	6.1	1.000	-

[*] Odds ratio (OR) estimated by bivariate logistic regression between the prevalence of alcohol abuse and frequent consumption with each of the sociodemographic variables.

general population and among those with alcohol abuse and frequent consumption. Regarding the analysis by age group, in the general population, the prevalence of involvement in a traffic accident decreases with age (Table 2).

With regard to schooling level, there was no statistically significant difference among men, both in the general population and among individuals who reported alcohol abuse and frequent consumption. However, women who had completed secondary school and over had greater involvement in traffic accidents. Among individuals who reported alcohol abuse and frequent consumption, the only statistically significant difference was among white men over black men. Single men were the ones who were involved the most in traffic accidents in the general population. Separated or divorced women did not show statistically significant differences in relation to single in the general population with respect to involvement in traffic accidents. However, among those who reported alcohol abuse and frequent consumption, this relationship was significant and with lower odds of involvement than single women (Table 2).

Of the people who were involved in traffic accidents, 45.2% were motorcycle drivers and, among those who reported alcohol abuse, this percentage increases to 54% (Table 3).

In the analysis of the prevalence of traffic accidents per Federal Unit, we observed that, for most FUs, prevalence rates were higher among those who reported alcohol abuse than for the general population, except in Pará, Maranhão, Espírito Santo, Paraná and the Federal District. The highest prevalence rates among individuals with alcohol abuse were in Roraima (14.6%), Mato Grosso (14%) and Santa Catarina (11.7%). In the general population, these percentages reached 8.7% in Roraima and 5.7% in Piauí and Mato Grosso. The states with lower traffic accident prevalence rates in the general population were Rio de Janeiro and Rio Grande do Sul, both with a prevalence of 1.9%, and among those with alcohol abuse, Espírito Santo (0.4%) (Figure 1).

Results of multivariate logistic regression

Table 2. Prevalence of involvement in a traffic accident with injuries in the last 12 months preceding the survey and their respective odds ratios by general population and individuals who reported alcohol abuse and frequent consumption by sociodemographic characteristics. PNS, Brazil, 2013.

Sociodemographic characteristics	Traffic accidents					
	General population					
	Male			Female		
	%	OR*	p-value	%	OR*	p-value
Total	4.5	-	-	1.8	-	-
Age group						
18 to 29 years	7.1	4.491	0.000	3.1	4.655	0.000
30 a 39 years	6.1	3.847	0.000	2.2	3.180	0.000
40 a 49 years	3.7	2.278	0.000	1.7	2.411	0.000
50 years and over	1.7	1.000	-	0.7	1.000	-
Schooling level						
Incomplete secondary school	4.2	1.000	-	1.5	1.000	-
Secondary school completed and over	4.9	1.171	0.140	2.2	1.489	0.001
Skin color/race						
White	3.9	0.737	0.071	1.5	0.802	0.330
Brown	4.9	0.925	0.643	2.1	1.069	0.744
Black	5.5	1.000	-	1.9	1.000	-
Marital status						
Married	3.2	0.502	0.000	1.4	0.575	0.000
Separated/Divorced	2.8	0.444	0.000	1.7	0.663	0.112
Widower/Widow	2.3	0.354	0.006	0.7	0.266	0.000
Single	6.1	1.000	-	2.5	1.000	-

Sociodemographic characteristics	Traffic accidents					
	Individuals who reported alcohol abuse and frequent consumption					
	Male			Female		
	%	OR*	p-value	%	OR*	p-value
Total	7.5	-	-	2.8	-	-
Age group						
18 to 29 years	12.0	4.830	0.002	4.3	5.179	0.014
30 a 39 years	8.2	3.166	0.025	2.7	3.148	0.103
40 a 49 years	5.1	1.911	0.280	1.4	1.583	0.540
50 years and over	2.8	1.000	-	0.9	1.000	-
Schooling level						
Incomplete secondary school	8.5	1.000	-	1.9	1.000	-
Secondary school completed and over	6.1	0.699	0.164	3.6	1.911	0.027
Skin color/race						
White	5.8	0.447	0.041	2.6	1.107	0.763
Brown	7.6	0.590	0.117	3.2	1.396	0.351
Black	13.1	1.000	-	1.8	1.000	-
Marital status						
Married	6.1	0.644	0.133	1.6	0.442	0.037
Separated/Divorced	2.7	0.273	0.038	0.6	0.161	0.006
Widower/Widow	0.4	0.044	0.003	0.0	0.000	0.739
Single	9.1	1.000	-	3.6	1.000	-

Odds ratio (OR) estimated between the occurrence of traffic accidents or between the general population, or between individuals who reported abusive and frequent alcohol use with each of the sociodemographic variables.

model shown in Table 4, with the dependent variable of involvement in a traffic accident with bodily injury in the last 12 months preceding the survey show that, after controlling for sociode-

Table 3. Condition in the most serious traffic accident occurred in the last 12 months prior to the survey and their respective confidence intervals of 95% second general population and individuals who reported alcohol abuse and frequent consumption. PNS, Brazil, 2013.

Condition in the accident	General population (n = 1,840)		People who reported alcohol abuse and consumption (n = 223)	
	%	CI95%	%	CI95%
Car/van driver	19.0	(16.0-22.4)	17.3	(10.5-27.1)
Bus driver	0.7	(0.3-1.5)	0.0	-
Truck driver	0.8	(0.4-1.6)	1.7	(0.4-5.9)
Motorcycle driver	45.2	(41.1-49.4)	54.0	(43.8-63.8)
Bicycle driver	3.9	(2.7-5.7)	6.5	(3.4-11.9)
Car/van passenger	8.0	(6.2-10.2)	5.8	(2.1-14.8)
Bus passenger	2.0	(1.3-3.1)	2.2	(0.7-6.3)
Truck passenger	0.0	-	0.0	-
Motorcycle passenger	12.9	(10.4-15.8)	8.6	(5.1-13.9)
Bicycle passenger	1.8	(0.6-4.6)	1.4	(0.3-5.7)
Pedestrian	4.8	(3.7-6.3)	2.5	(1.1-5.4)
Other	0.9	(0.5-1.7)	0.0	-

mographic factors, alcohol abuse and frequent consumption show statistically significant association with the outcome.

Discussion

In this work, we used the PNS information held in 2013 to investigate the association of alcohol abuse with the prevalence of traffic accidents with bodily injury in the last 12 months prior to the survey. First, we investigated these two events according to sociodemographic characteristics, and we verified the association between them by multivariate logistic regression.

With regard to alcohol abuse, according to sociodemographic characteristics, the highest prevalence rates were among young single black men. Generally speaking, the same sociodemographic pattern was observed for individuals who were involved in a traffic accident and who reported alcohol abuse and frequent consumption. Also with regard to traffic accidents, among men, prevalence rates were higher when subjects reported alcohol abuse and frequent consumption when compared to men in the general population.

These findings corroborate results of a study conducted with 138,100 U.S. adults who responded to the National Survey on Drug Use and Health from 2009 to 2011, in which the prevalence of alcohol abuse (in the last month before the survey) was higher among men aged 18-24 years[21]. In the same study, abuse prevalence of 10.2% alcohol was found in general (CI 95%, 9.8-10.6), 10.9% (CI 95%, 10.3-11.5) among men and 9.2% (CI 95%, 8.6-9.8) among women, greater than those found in this study

In Brazil, in a study conducted by the Ministry of Health in the country's state capitals and called Vigitel (Chronic Diseases Risk and Protective Factors Surveillance Telephone Survey), in 2010, alcohol abuse stood at 16.4% (CI 95%, 15.7-17.0), where study defined abuse as the consumption of 5 or more doses for men and 4 for women on a single occasion in the last 30 days[6]. However, both measures were taken through indicators with different settings than the adopted in this paper, in which prevalence was lower (6.1%), because the weekly frequency of intake of large alcohol amounts was considered abuse.

Traffic accidents are a major public health problem, since the bodily injury caused by them are a leading cause of injuries and deaths worldwide. According to the WHO[13], every year, about 1.2 million people die and millions are injured or become disabled from traffic accidents, especially in low- and middle-income countries. In addition to the limitations that injuries cause to the individuals involved, complications caused by traffic accidents generate a heavy burden on health services and the economy of nations. According to the WHO Global Report on Road Safety[22], traffic accidents will rise from ninth cause of death

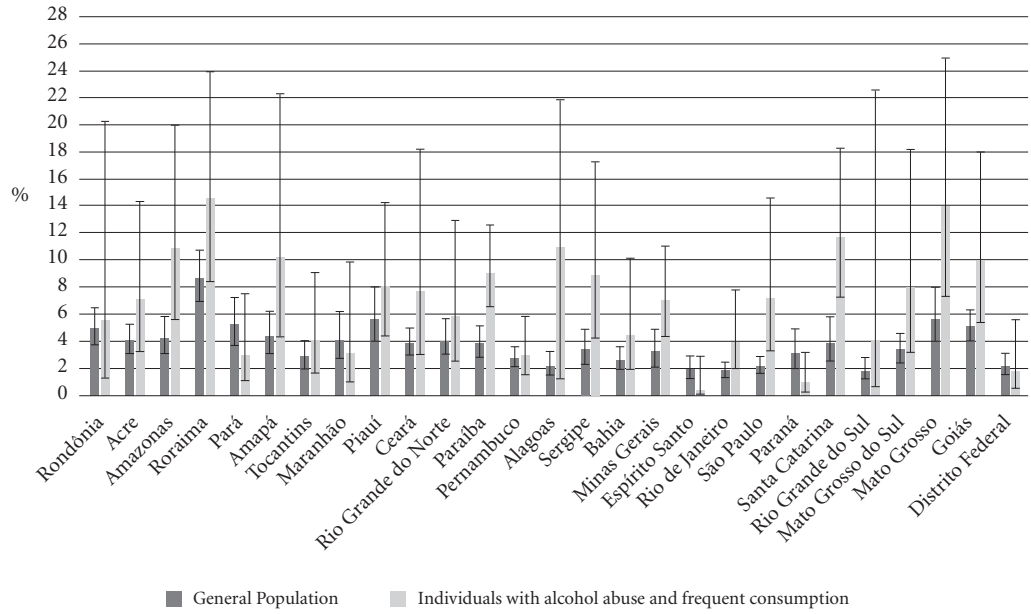

Figure 1. Prevalence (%) of involvement in traffic accidents in the 12 months prior to the survey and their respective 95% confidence intervals according to the general population and individuals who reported excessive and frequent consumption of alcohol by Federal Unit. PNS, Brazil, 2013.

Table 4. Bivariate and multivariate analysis of association between the study variables and the traffic accident. PNS, Brazil, 2013.

Variables	Adjusted odds ratio (OR)*	Confidence interval (95%)	p-value
Gender			
Male	2.408	(2.029-2.858)	0.000
Female	1.000	-	-
Age group			
18 to 29 years	3.943	(3.029-5.133)	0.000
30 a 39 years	3.324	(2.567-4.304)	0.000
40 a 49 years	2.193	(1.645-2.922)	0.000
50 years and over	1.000	-	-
Schooling level			
Incomplete secondary school	1.000	-	-
Secondary school completed and over	1.013	(0.854-1.201)	0.884
Skin color/race			
White	0.805	(0.617-1.051)	0.111
Brown	0.921	(0.706-1.200)	0.541
Black	1.000	-	-
Marital status			
Married	0.845	(0.708-1.008)	0.061
Separated/Divorced	0.934	(0.670-1.303)	0.689
Widower/Widow	0.829	(0.510-1.348)	0.449
Single	1.000	-	-
Alcohol abuse and frequent consumption			
Yes	1.563	(1.187-2.059)	0.001
No	1.000	-	-

* OR estimated by multivariate logistic regression.

worldwide in 2004 to fifth in 2030, second only to heart, cerebrovascular, chronic pulmonary diseases and lower respiratory infections.

In the United States, a major cause of premature mortality is alcohol abuse. A study aiming at updating national estimates of deaths attributable to alcohol in the United States found that, among adults of working age, 9.8% of all deaths in the country between 2006 and 2010 were attributable to excessive alcohol consumption, and motor vehicle traffic accidents accounted for 36% of all deaths attributable to alcohol consumption[23]. In this paper, results showed alcohol abuse potentiation on traffic accidents. In the general population, the prevalence of traffic accidents was 3.1% (CI 95%, 2.8-3.3); among individuals who reported alcohol abuse, this prevalence was nearly twice (6.1 % - CI 95%, 4.9-7.4).

It is essential to broaden the debate about the sociodemographic characteristics of the groups with higher prevalence of involvement in traffic accidents with bodily injuries. Males are in evidence when compared to women, both compared to the general population and to subjects who reported alcohol abuse. However, one must be attentive to young people as focus of public policies needs on the issue of traffic accidents and alcohol abuse.

The level of schooling can also influence the consumption of alcoholic beverages and the traffic accidents. According PNS data analysis with regard to the general population, slightly higher prevalence rates were in those strata with complete secondary school and over, which shows a greater purchasing power for the use of private motor vehicles. When we refer to individuals who reported alcohol abuse, men with incomplete secondary education have the highest prevalence, reversing this fact when dealing with women. Black skin color and race also has the highest prevalence compared to white / brown skin color and race.

Regarding the condition of the accident, we wish to emphasize that, among those involved in accidents, 45% in the general population and 54% in those with alcohol abuse and frequent consumption were motorcycle riders. Given that these are more likely to suffer car accidents with injuries, campaigns regarding the importance of helmet use and more focused interventions for this type of driver could help reduce accident rates.

In Thailand, 70% of deaths from traffic accidents are associated with the use of motorcycles. A study on approximately one thousand motorcycle accidents revealed that alcohol consumption was a determining factor in 36% of cases. Drunk bikers were five times more likely of dying than riders who had not consumed alcohol. The greatest risk of accidents among motorcyclists who were under the influence of alcohol were exponentially increased in the following situations: driving at night, driving on curves and out of roads crossing zones, losing control, skidding off the road, not stopping at red traffic lights and not paying attention[24].

There is a clear trend of increased risk of accidents among drunk drivers compared to those who do not consume alcohol before driving[13]. This gave rise to the need to enact and implement nationally Law Nº 11.705, also known as Prohibition Law, which was later updated in 2013, establishing zero tolerance for the level of alcohol in the blood of motor vehicle drivers, and even criminalizing and penalizing drivers with 6 decigrams or more of alcohol per liter in the blood or 0.34 ml or more of alcohol in the body, measured by the breathalyzer test[9,14,15,25].

Nationally, when the analysis of traffic accidents was performed comparing the Federal Units, the state of Rio de Janeiro stood out with low prevalence of traffic accidents: 1.9% for the general population, and 4% among individuals with alcohol abuse. These figures may reflect the functionality of Prohibition, which is extensively mainly in the municipality of Rio de Janeiro, punishing drivers who are driving under the influence of alcohol. International accounts of a law that entered into force in Japan also show the success of this type of legislation regarding the most effective measures on the control of alcohol consumption in relation to traffic accidents[26-28].

As one of the limitations of this study, we emphasize that the PNS considered only traffic accidents with bodily injuries and, therefore, accidents may be underestimated. Moreover, it was not possible to assess whether the accident occurred when the individual was under the influence of alcohol, and if so, how many doses were consumed. In conclusion, we showed that alcohol abuse and frequent consumption remained significantly associated with the involvement in traffic accidents with bodily injuries, even after controlling for sociodemographic variables. Given the increased risk of traffic accidents, monitoring the blood alcohol concentrations of drivers becomes a possible intervention to oversee alcohol consumption and, above all, the age groups with a higher level of vulnerability to this consumption.

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Collaborations

Paper conception: GN Damacena, LR Sisinno and CL Szwarcwald. Text writing: GN Damacena, LS Ribeiro and CL Szwarcwald. Data review: GN Damacena, LS Ribeiro, PRB Souza Júnior, WS Almeida and CL Szwarcwald. Discussion on results: GN Damacena, LS Ribeiro, CS Boccolini, DC Malta and CL Szwarcwald. Critical review: GN Damacena, CS Boccolini, DC Malta and CL Szwarcwald.

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