

## ORIGINAL ARTICLE

# Factors associated with recurrence of alcohol-related traffic violations in southern Brazil

Aurinez R. Schmitz,<sup>1</sup> José R. Goldim,<sup>2</sup> Luciano S. P. Guimarães,<sup>1</sup> Fernanda M. Lopes,<sup>3</sup> Felix Kessler,<sup>1</sup> Tanara Sousa,<sup>1</sup> Veralice M. Gonçalves,<sup>1</sup> Flavio Pechansky<sup>1</sup>

<sup>1</sup>Center for Drug and Alcohol Research (CPAD), Hospital de Clínicas de Porto Alegre (HCPA), Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil. <sup>2</sup>Laboratory of Bioethics and Ethics Research, HCPA, Porto Alegre, RS, Brazil. <sup>3</sup>Institute of Psychology, UFRGS, Porto Alegre, RS, Brazil.

**Objective:** To analyze variables associated with recurrence of blood alcohol content (BAC)-related traffic violations among drivers in southern Brazil.

**Method:** This cross-sectional study included 12,204 driving-under-the-influence (DUI) offenders according to data provided by the Rio Grande do Sul state Transportation Department. Sociodemographic characteristics, license duration, license category, and psychological assessment results were analyzed. Drivers convicted of DUI more than once in 2009/2010 were considered recidivists. Variables were evaluated using descriptive statistical analysis and Poisson regression, adjusted by sex, age, and education level.

**Results:** A total of 538 (4.41%) drivers were considered recidivists. The following variables showed the strongest associations with recidivism: being aged 41-50 years (prevalence ratio [PR] = 3.41), being licensed for  $\geq 12$  years (PR = 1.86), being licensed for motorcycles, cars and trucks (PR = 1.36), having a license with psychological restrictions (PR = 1.33), and driving a truck or a similar vehicle at the moment of notification (PR = 1.08).

**Conclusions:** In the age group with the highest risk for recurrence, drivers showed a higher probability of having a diagnosis of alcohol dependence and other psychiatric comorbidities that hinder the control of alcohol use. Psychological assessments seem to be important in predicting repeat offenses, especially when limited aptitudes are suspected, and should therefore be better investigated.

**Keywords:** Alcohol; driving-under-the-influence, traffic violations

## Introduction

For decades, studies have warned against the combination of drinking and driving, mainly because of the resulting increase in the risk of accidents, severe injuries, and mortality.<sup>1</sup> Alcohol consumption impairs the abilities required for driving a vehicle: reflexes, perception of speed and obstacles, ability to control the vehicle, and visual acuity. Other effects include impaired judgment and more impulsive and aggressive behaviors.<sup>2</sup> Each 2 dg/L of alcohol present in the blood causes a two-fold increase in the likelihood of a driver being involved in a fatal accident.<sup>3</sup> The chance of dying in a traffic accident is 4 to 10 times greater when the blood alcohol content (BAC) is between 5 and 7 dg/L, and a driver involved in an accident and showing a BAC of 10 dg/L has a 90% of probability of being responsible for the act.<sup>4</sup>

In Brazil, as in many other countries, traffic accidents are considered a public health problem. The mortality rate due to road traffic accidents is 22.4 per 100 thousand

inhabitants; among young adults, traffic-related deaths are the second cause of violent deaths.<sup>5</sup> The severe consequences of drinking and driving, or driving under the influence (DUI) of alcohol have led to changes in the new Brazilian law system: since 1997, the penalty for recidivists with a positive BAC test includes an expensive fine and suspension of the license to drive for 12 months, plus the requirement to attend a refresher driving course and forfeiture of the Brazilian driver's license after all defense instances. In a study conducted in Brazilian national highways to analyze the impact of alcohol and drugs on traffic accidents, 4.8% of 3,398 offenders tested positive for BAC.<sup>6</sup> Among offenders reporting drinking and driving behaviors, one particular subgroup deserves special attention: repeat DUI offenders.

The increased rates of traffic injuries and deaths are partly attributed by this type of behavior.<sup>7</sup> Evidence has suggested that recidivists are apparently oblivious to the sanctions and penalties for drunk driving.<sup>8</sup> Typically, DUI recidivists are known to be predominantly young males aged between 18 and 29 years.<sup>9,10</sup> A study examining drunk driving rates in 12 U.S. states found that 12% of the drivers involved in fatal crashes had at least one prior DUI conviction in the three years preceding the accident. These drivers showed a four-times greater risk of being in

Correspondence: Aurinez R. Schmitz, Centro de Pesquisa em Álcool e Drogas, Rua Professor Alvaro Alvim, 400, CEP 90420-020, Porto Alegre, RS, Brazil.  
E-mail: aurinezrs@gmail.com

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a fatal accident when compared to drivers without a conviction.<sup>11</sup>

In the U.S., recidivists account for about one third of all DUI arrests and convictions.<sup>11</sup> Studies have identified that recurrence rates vary according to the period of time assessed and also according to geographic location. For example, in Sweden, DUI relapse rate was 16% in two years and 14% in four years<sup>12</sup>; in the U.S., the recurrence rate found in 6 years was 15.5%.<sup>13</sup>

One of the strategies used to identify drivers with a potential to adopt high-risk behaviors, e.g., in Spain, Portugal, and France, is psychological assessment.<sup>14-16</sup> In Brazil, it precedes and complements the medical examination required for issuance of the first national driver's license and for license renewal among professional drivers.

Some Brazilian studies have attempted to describe the personality traits of offending drivers. For example, predominant features of opposition and an increased presence of aggressiveness and difficulty in controlling emotions have been identified.<sup>17</sup> It has also been pointed out that one third of the drivers who commit traffic violations are aware of their mistakes and do not regard them as serious offenses.<sup>18</sup> Some Brazilian studies have also focused specifically on the drinking and driving behavior, highlighting the importance of this issue,<sup>19,20</sup> but little is known about the risk factors associated with DUI recidivism. To the best of the authors' knowledge, no Brazilian study has so far attempted to describe the profile of repeat offenders convicted of drinking and driving.

Therefore, the objective of this study was to analyze the variables associated with recurrence of alcohol-related traffic violations in southern Brazil.

## Method

We conducted a cross-sectional study with all drivers licensed in the state of Rio Grande do Sul, Southern Brazil. Data provided by the Rio Grande do Sul state Transportation Department (DETRAN-RS) for 3,949,693 licensed drivers were analyzed from January 2009 to December 2010 to identify DUI offenders as defined in Article no. 165 of the Brazilian National Traffic Act (DUI of alcohol or any other psychoactive drug causing dependence). Drivers convicted of DUI more than once over a 24 months' period were considered recidivists.

The following data were collected from the DETRAN-RS database: sex, age, license category, vehicle type at the moment of notification, professional driving, education level, license duration, and psychological assessment results. In the Brazilian system, drivers can be licensed in one or more categories, ranked from A to E, according to vehicle type, as follows: A, motorcycles, scooters or mopeds; B, C, D, and E, other motor vehicles, with categories reflecting increasing numbers of passengers and/or cargo. Higher-level categories include the former ones, except for category A. The type of vehicle being driven at the time of notification was classified into four categories: motorcycle, scooter or moped; car or

utility-vehicle; truck, van, pickup, semitrailer, motor home or tractor; and bus or minibus. Professional use of the driver's license, listed as a specific feature in the database, was also recorded. Finally, the psychological assessment conducted at license issuance or renewal. Only the final result of the assessment was used in the present analysis, i.e., whether drivers were classified as able to drive (presence of the abilities necessary to drive) or as able to drive with psychological restrictions (presence of disorders or psychological impairments currently under control, but with reassessment required). Variables were assessed by means of descriptive statistical analysis and by Poisson regression to obtain prevalence ratios (PR). Results were adjusted for sex, age, and education level. The characteristics of DUI recidivists were compared with those of non-recidivists. The following reference categories were considered: male sex, age between 18 and 20 years, elementary school, being licensed for 2 years, having a B license category (cars), not being a professional driver, and using a car at the time of notification. Reference categories were determined based on their representativeness, except for age and license duration, which were determined according to the database received. Reference categories were assigned PR = 1. All analyses were performed using the SPSS version 18.0.

This study was approved by the Research Ethics Committee of Hospital de Clínicas de Porto Alegre. All investigators involved in the study signed a confidentiality agreement to ensure information privacy and driver anonymity.

## Results

Of all the 3,949,693 drivers licensed in the state of Rio Grande do Sul, 12,204 (0.3%) had been convicted of DUI in the past two years (approximately 3 per 1,000 drivers). Of these, 11,666 (95.59%) had committed one violation, and 538 (4.41%) were recidivists.

Among DUI offenders, the variables studied allowed to establish the characteristics of recidivists and non-recidivists. Psychological assessment results were from 8,646 of the cases in the DETRAN-RS database (missing cases n=3,558; 29.2%). After PR adjustment for sex, age, and education level, all variables showed similar distribution patterns, with no significant associations resulting from the small changes in the values presented.

Sample characteristics are shown in Table 1.

PR values for license category ranged from 0.76 for category E (trucks weighing  $\geq$  6,500 kg) to 1.36 for category AC (motorcycles and trucks between 3,500 and 6,000 kg) (reference category: B). Category A (motorcycles) showed a PR of 0.92, and category C (midsized trucks), of 1.14; individual categories showed lower PRs when compared with combined categories.

When comparing psychological assessment results and professional driver status among recidivists, both professional and non-professional drivers showed a similar distribution of psychological assessment

**Table 1** Sociodemographic characteristics of recidivists and non recidivists in the state of Rio Grande do Sul

Years 2009-2010	Recidivists	Non recidivists	PR	Adjusted PR*
	(n=538)	(n=11,666)		
	n (%)	n (%)		
Sex				
Male	529 (4.45)	11 (95.55)	1	
Female	9 (2.86)	306 (97.14)	0.64	
Age range				
18 to 20	12 (1.83)	643 (98.17)	1	
21 to 30	111 (2.86)	3,769 (97.14)	1.56	
31 to 40	138 (4.88)	2,691 (95.12)	2.66	
41 to 50	177 (6.25)	2,657 (93.75)	3.41	
51 to 60	79 (5.17)	1,449 (94.83)	2.82	
Above 61	21 (4.39)	457 (95.61)	2.40	
Age, mean $\pm$ SD	41 $\pm$ 11.2	37 $\pm$ 12.5		
Education				
Elementary education	361 (5.18)	6,609 (94.82)	1	
High school education	140 (3.28)	4,124 (96.72)	0.63	
Under graduate education	33 (3.54)	899 (96.46)	0.68	
Information missing/not available	4	34		
Time of licensure (years)				
Up to 2	70 (3.09)	2,196 (96.91)	1	1
3 to 5	49 (2.83)	1,681 (97.17)	0.92	0.96
6 to 8	55 (3.98)	1,328 (96.02)	1.29	1.33
9 to 12	58 (3.86)	1,446 (96.14)	1.25	1.28
> 12	306 (5.75)	5,015 (94.25)	1.86	1.81
Time of licensure, mean $\pm$ SD	16 $\pm$ 10.7	13 $\pm$ 10.9		
Vehicle type				
Automobile/utility	435 (4.41)	9,438 (95.59)	1	1
Motorcycle/motor scooter/moped	62 (4.33)	1,369 (95.67)	0.98	0.93
Pickup/vans/trucks/motor-home/semi-trailer/tractors	31 (4.52)	655 (95.48)	1.03	0.96
Buses and mini-buses	1 (2.56)	38 (97.44)	0.58	0.54
Information missing/not available	9	166		
Professional driver				
Yes	137 (4.25)	3,087 (95.75)	0.95	0.91
No	401 (4.47)	8,579 (95.53)	1	1
Psychological evaluation (n=8,646)				
Apt	301 (3.73)	7,762 (96.27)	1	1
Apt with restrictions	29 (4.97)	554 (95.03)	1.33	1.23

PR = prevalence ratio; SD = standard deviation.

Reference categories have prevalence ratio (PR) = 1.

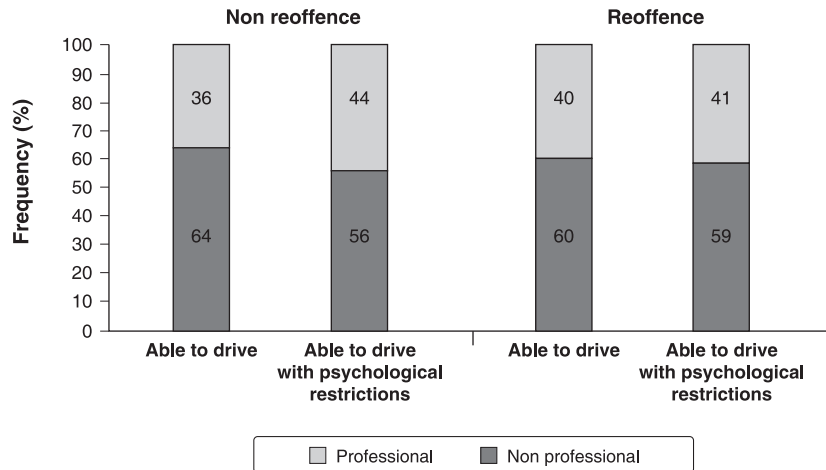
\* PR adjusted for age, sex and education.

outcomes (able or able with psychological restrictions). Among non-recidivists, an 8% higher number of professional drivers were considered able to drive with psychological restrictions vs. those considered able to drive. Among non-professional drivers, the same percentage difference was found, however in an opposite direction. Among professional recidivist drivers, there was a 1% higher number of drivers considered able to drive with psychological restrictions vs. those able to drive (Figure 1).

## Discussion

To the best of our knowledge, this is the first Brazilian study to evaluate factors associated with recurrence of alcohol-related traffic violations. Our findings showed similarities but also some important differences related

to sociodemographic profiles described in previous national and international studies, especially regarding age, professional driving status, and psychological assessment results, which highlights this serious public health problem.<sup>9,21</sup> The predominance of males among both DUI recidivists (98%) and non-recidivists (97%) was nearly absolute. These results are similar to those reported in Sweden, where the prevalence of males among offenders ranged from 88 to 93%,<sup>15</sup> and in U.S., 81%.<sup>22</sup> This high percentage of males may reflect alcohol consumption patterns among men, which exceed female consumption in quantity, frequency, and intensity, even when driving motor vehicles.<sup>23</sup> Also, considering that there were twice as many men as women in the general registry of licensed drivers in the database assessed, this result could also express a very small concern of men in relation to drinking and driving when compared to women.



**Figure 1** Psychological assessment of professional and non professional drivers.

An association between delinquent behavior and male sex has also been previously suggested. A study conducted in Israel investigated differences in the motivations of men and women to abide by the traffic laws in relation to perceived gains or losses while driving. The sample comprised 181 male and female offenders and found that men were less motivated to comply with traffic laws, often highlighting perceived gains with the commission of violations, for example travel time vs. speed; women, in turn, tended to commit violations by mistake, showing a greater perception of danger.<sup>24</sup> Considering that the number of licensed men was double the number of licensed women, and that recurrent and non-recurrent DUI violations were almost 100% committed by males, being female could be seen as a protective factor against alcohol-related offenses.

Regarding age, international studies have shown that people aged from 18 to 25 years show higher drinking and driving recidivism rates.<sup>7,21</sup> A study conducted in Finland found that the driving style of middle-aged people was more associated with alcohol dependence; conversely, among youngsters, DUI violations were more associated with risk-taking behaviors, characteristic of this age group.<sup>25</sup> Furthermore, a Brazilian study investigated drinking and driving in the 27 Brazilian capitals and found that 2,410 of a total of 3,398 drivers interviewed had used alcohol over the past 12 months; of this subgroup, most were male (93.4%), drove cars or motorcycles, had a mean age of 36 years, and had completed high school.<sup>26</sup> With relation to alcohol consumption, 4.2% tested positive for BAC, and this number increased to 7.4% when the 6 hours preceding the interview were analyzed.<sup>6</sup> Our results are consistent with the aforementioned Brazilian studies. The majority of our DUI recidivists were aged between 41 and 50 years; this age group was also the only one with a higher relative frequency of recidivists (33%) than non-recidivists (23%). Moreover, when the age groups with the highest recidivism prevalence rates were combined, the 31-50-year age range presented the highest frequency (59%), lower than that observed in the same range among

non-recidivists (46%). One possible explanation for this could be the fact that these drivers were trained in the old system, and that enrollment in courses or tests to adapt to the new system were not enough to prevent this type of behavior. The new Brazilian law system, effective since 1997, requires enrollment in theoretical and practical courses for the issuance of the first license and has reduced illegal BAC limits, reflecting a concern with this topic.

In the context of Brazil's new traffic code, a study investigating DUI risk profiles and predictors in a sample of pre-driving Brazilian youth was conducted with a sample of 2,166 driver's license candidates.<sup>20</sup> They found that drinking and driving expectation was predicted by higher current use of alcohol, more experience riding with a drunk driver, and general prevention measures, like having more friends that drive under the influence, having less friends that disapprove of DUI, and considering higher amounts of alcohol intake as safe to drive, e.g., having more friends that drive under the influence, having less friends that disapprove of DUI, and considering higher amounts of alcohol intake as safe to drive.<sup>20</sup> Most individuals showed a low level of knowledge about the laws, and few believed that the penalties would actually be enforced for those engaging in DUI (most did not know anybody subjected to financial penalties, license suspension, or prison as a result of DUI).<sup>20</sup> Taken together, these findings evidence a weak control of drinking and driving in Brazil, especially among youth. The authors suggest that changes in DUI laws in Brazil should be accompanied by media campaigns and national coverage of law enforcement in order to enhance the levels of knowledge and credibility of the sanctions.<sup>20</sup>

When analyzing license duration and driver's age independently, the present study found that drivers licensed for over 12 years were the most common recidivists, reinforcing the hypothesis raised earlier about drivers trained in the old traffic regulation system. Another possible assumption is that, as older age tends to be related to higher family income and financial independence, the application of fines may not have the

necessary impact to prevent drinking and driving behaviors in this population (there is not an actual financial burden on the recidivist). Also, the recurrence rate of DUI violations found in our study was lower than the rates reported in other international studies,<sup>13</sup> probably as a result of a poor enforcement of traffic laws in Brazil; this scenario generates a sense of impunity among drivers and thus contributes to maintaining the delinquent behavior.<sup>27</sup> Once again, this finding underscores the need to enforce stricter laws, with mass media campaigns and news coverage to help reduce the widespread perception of impunity after drinking and driving.<sup>20</sup> In this sense, the recently approved amendment that has almost doubled the fine for DUI offenses and has doubled the value for recidivists over a 12-month period, as well as recent efforts to improve law enforcement, may finally yield positive results in inhibiting BAC-related delinquent behaviors. Conversely, beyond the law, measures should be taken to ensure that the authorities responsible for enforcing the law will do so properly.<sup>20</sup>

Another hypothesis for the higher recidivism rates found among drivers licensed for over 12 years in our sample is that older drivers would be at a greater risk for being diagnosed with alcohol dependence disorder, leading to an increased consumption, the need to use it, and loss of control, regardless of the risks involved.<sup>24</sup> In addition, older individuals come from a culture where drinking and driving was socially accepted, and could have a greater resistance to accept changes in the current legislation. Finally, another intervening factor in the assessment of this variable is the lack of clarity in the sampling criteria used in audits, so there may be a bias related to the age distribution of licensed drivers.

Educational data collected for our DUI offenders were similar to those reported in international studies, suggesting an association between low education levels and drinking and driving behavior.<sup>21-27</sup> Combining the results obtained for license duration and education level, and assuming that these drivers have undertaken refresher driving courses, which specifically address drinking and driving, it can be inferred that these courses have not been effective enough to change the drivers' behaviors and to avoid recidivism. It would probably be necessary to implement preventive policies through psychoeducational campaigns aimed at the less educated population, as observed in other countries such as Australia (Transport Accident Commission, TAC; <http://tac.vic.gov.au/>). In the U.S., a curriculum reform in education programs aimed at offenders has been implemented (similar to refresher courses in Brazil), focusing on driving skills, preventive actions, and consequences of drunk drinking, and has successfully reduced relapse rates.<sup>28</sup>

Considering license categories, our data indicate that categories A, E, and AE were protective factors against DUI when compared to other categories. This can be partially explained by the perceived potential risk associated with these vehicle types, namely motorcycles and large/heavy vehicles: motorcycles show a higher risk for motorcyclist injuries.<sup>29</sup>

Regarding the type of vehicle being driven at the time of notification, buses and minibuses were considered a protective factor in relation to other vehicles approached. Bus and minibus drivers were rarely convicted of DUI violations (1.9%), and almost none were recidivists (only 0.03%). This may be explained by the exposure factor and by DUI control measures performed by employers. Also, drivers of such vehicles are generally exposed to criticism and monitoring by the passengers, and some companies have developed specific programs directed to drivers aimed at preventing alcohol-related accidents. The 5% protection rate associated with professional driving may be explained by two reasons: the higher probability of being monitored and the impact of penalties on the driver's life. Professional drivers spend more time on the roads and therefore are more likely to being stopped by police. Moreover, the impact of compliance to penalties would affect the continuity of professional activity, which could cause damage to the drivers' livelihood and his family. Brazilian studies have also shown a lower alcohol intake among bus drivers (2.4%) and truck drivers (9.6%) when compared to car and motorcycle drivers (14.1 and 14.6%, respectively).<sup>19</sup>

The psychological characteristics of the recidivist driver can also influence the association between drinking and driving. The presence of comorbid psychiatric disorders among both DUI recidivists and non-recidivists is supported by research, and may include alcohol dependence, attention deficit hyperactivity disorder, conduct or antisocial personality disorders, generalized anxiety, post-traumatic stress disorder, and depression.<sup>30,31</sup> In our sample, most DUI recidivists were considered able to drive with psychological restrictions, i.e., had a license with psychological restrictions. These data suggest an important role of psychological assessments to detect the presence of psychological problems potentially related to drinking and driving, and underscore the need to investigate such assessments in more detail. This is also the case with non-recidivists, i.e., first-time DUI offenders (Figure 1). Experts have warned that drivers who commit a first DUI offense tend to repeat it.<sup>9,32</sup> In Brazil, once candidates are considered able to drive (at issuance of the first license), it is unlikely that they will ever undergo a new psychological assessment, precluding patient monitoring by expert psychologists. These data suggest that there should be a requirement to psychologically re-evaluate drivers charged with DUI in Brazil. This measure could improve control and allow to refer alcohol abusers to treatment and rehabilitation programs. The Brazilian government should therefore consider the planning and implementation of preventive strategies aimed specifically at drivers with a restricted license, in order to further minimize the risk of recurrence in this population. In Brazil, this strategy has not been foreseen by the current Brazilian traffic code. In the U.S., treatment of DUI offenders has achieved satisfactory results.<sup>13</sup>

This study presented limitations in the generalization of findings due to the study period and because it referred to only one state in Brazil. Moreover, it was not possible to identify the psychiatric comorbidities present in the

sample, which could have altered results. Finally, the research design adopted made it impossible to assess causal relationships. An important positive aspect, however, was the inclusion of all drivers licensed in the state.

In conclusion, our findings revealed that the main characteristics of DUI recidivists were being male, being aged 41 to 50 years, being licensed for over 12 years, having a low education level, and being considered able to drive with psychological restrictions (reassessment required). These new data on the profile of DUI offenders can help determine changes in strategic interventions aimed at the prevention, education, and rehabilitation of drivers, as no single measure will probably be able to reduce recidivism. For example, measures such as suspension/forfeiture of the Brazilian driver's license could be reinforced by the mandatory installation of ignition interlocks in the vehicles of DUI offenders, as a condition for license reinstatement in drivers arrested for DUI, as proposed by the U.S. National Transportation Safety Board.<sup>33</sup> A recent review has pointed to effectiveness rates 6 to 75% for ignition interlocks in reducing DUI recidivism.<sup>34</sup> Another rehabilitation measure that has been suggested is the mandatory treatment of alcohol users convicted of DUI, with interventions determined according to the level of alcohol intake. Finally, mandatory medical follow-up upon license reinstatement and mandatory participation in educational and driver rehabilitation programs are other possible interventions.<sup>35</sup> All these measures represent important epidemiological tools to assist in reducing drinking and driving.

Moreover, public policies could be developed based on specific behavioral strategies, as was the case with the zero-tolerance law for drinking and driving and prohibition of the marketing of alcoholic beverages on federal roadways in Brazil. In countries where the illegal BAC limit is 0.5, it has been recommended that this limit be reduced to 0.02 for professional and young or novice drivers,<sup>36,37</sup> based on the 4- to 10- fold higher relative risk of a driver with BAC between 0.05 and 0.07 becoming involved in a fatal accident when compared with a driver with a BAC of 0.00.<sup>38</sup> Furthermore, measures such as regulating the alcohol industry, increasing taxes, reducing opening hours of alcohol sales outlets, and alcohol marketing restrictions have all been implemented in the U.S. state of California, with promising results.<sup>39</sup> In this scenario, it is important to underscore that restrictions regulating alcohol advertising could also help reduce its consumption, especially among youngsters. Finally, the inspection, conviction, and penalization of DUI offenders is extremely important, as convicted offenders have been shown to be less prone to recidivism when compared with non-convicted ones.<sup>40</sup>

Given the seriousness of problems related to DUI recidivism, further studies should investigate the historical sequence of violations committed by recidivists, e.g., prior prosecutions or convictions and type of prior offense, in order to obtain the broadest results possible. Qualitative studies on alcohol consumption patterns while driving would also be useful to improve our overall understanding of the subject.

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## Disclosure

The authors report no conflicts of interest.

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