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The effect of the new traffic law on drinking and driving in São Paulo, Brazil☆

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ABSTRACT

Objective: To present data on drinking and driving in the city of São Paulo, Brazil, and the effects of the new traffic law (Law 11,705) introduced in 2008.
Methods: A cross-sectional study was performed using a questionnaire and passive breath test data to study the prevalence of drinking and driving and the association of drinking and driving with background characteristics and drinking patterns on two separate occasions. The data were gathered from 2007 to 2009 through roadside surveys conducted on busy public roads. Four thousand two-hundred thirty-four (4234) drivers were approached, before and after prohibition, from the south, north, east, and west regions of the city of São Paulo, located in southeastern Brazil, including cars, motorcycles, and utility vehicles. A total of 3854 (91%) consented to participate in the survey and answered the questionnaire. Out of this group, 3229 (84%) agreed to take the passive breathalyzer test.
Results: Logistic regression analyses controlling for gender and age was used to predict a positive breath test (above 0.2 g/l) and the impact of the new law. These analyses indicated that, after the passage of the new traffic law, there was a 45% decrease in driver behavior with positive breathalyzer results. Having a pattern of alcohol consumption of at least once a week and the habit of drinking and driving are risks for a positive breathalyzer.
Conclusions: Despite the decline in the frequency of motorists driving under the influence of alcohol, traffic-related injuries and deaths, after the new law, other measures for a public policy related to alcohol should be considered based on scientific evidence, consistency of action, clear goals, community support, and greater reliability in the laws.

1. Introduction

Alcohol is a major source of harm to public health and safety and should not be treated as an innocuous product and subject to the laws of the market (Caetano and Laranjeira, 2006). It could be argued that widespread availability represents a fundamental component of public health and safety (Babor et al., 2010; Edwards et al., 1994). Contrary to the trend in economically developed countries, alcohol consumption has increased in developing countries (Room et al., 2002). The evolution of alcohol consumption per capita in 137 countries from 1970 through 1990, found that consumption increased 74.5% in Brazil (World Health Organization, 1999). In Brazil, it is not necessary to have a special license to sell alcoholic beverages. In 2005, the number of beverage points of sale was approx. 1 million in Brazil, which corresponded to 1 POS for every 170 inhabitants (Seligman, 2005). Research on alcohol policies suggests that alcohol supply at low prices has increased beverage availability in the most diverse environments. In the peripheries of large cities, bars have become the major socialization place for young people (Laranjeira and Romano, 2004). The result has been the trivialization of alcohol consumption, tolerance of violations, and an increase in traffic accidents (Caetano and Laranjeira, 2006). A recent study by the São Paulo Legal Medicine Institute on traffic fatalities and alcohol consumption in 2005 showed that almost one-half of the traffic accidents were associated with parties and bars, and took place from 12 am to 6 am on weekends (Ponce et al., 2011). In fact, traffic accidents related to alcohol consumption have become a serious public health problem in Brazil. As a control measure to the problems arising from market deregulation, new traffic laws have been created in our country.

In Brazil, studies on drunk driving are still scarce, having begun in the late 1990s after the traffic code of 1989 stipulated a limit blood alcohol concentration limit of 0.08 g/l for drivers. These early

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studies indicated a prevalence of 27% of drivers with BAC over the legal limit (Oliveira and Melcop, 1997; Nery et al., 1997). Later, this limit was reduced to 0.06 g/l by Act 9503 of 1997 (Ministério das Cidades, 1997). However, between 1998 and 2006, alcohol remained the main factor associated with traffic accidents and the prevalence of intoxicated drivers was between 23% and 38%, which led lawmakers to lower the tolerance of alcohol use by drivers (Duailibi et al., 2007; Campos et al., 2008). On June 19, 2008, a law was enacted that changed the 11,705 Brazilian Traffic Codes, stipulating the concentration limit of zero blood alcohol for motorists. This law became known at the outlets as "Prohibition". The new law sets forth the suspension of driving privileges for a concentration of 0.2 g/l (or 0.1 mg of alcohol per liter of exhaled breath), which can be obtained by consuming only one glass of beer. In this case, the law provides for fines, loss of license for 12 months, and seven points on the driver's license (a very serious offense). For alcohol concentrations from 0.6 g/l (0.3 mg/l in breath), the equivalent of two glasses of beer, the law also provides for the arrest of the driver who, criminally prosecuted, could wind up spending six months to three years in prison (Departamento Nacional de Trânsito, 2008).

This study presents an assessment of changes in 2008 in São Paulo, SP, and provides insight into the effectiveness/enforcement of traffic Act 11.705 ("Prohibition") based on the context of a deregulated alcohol market.

2. Methods

2.1. Sample size

Data collection was performed in 2007 and 2009, on Friday and Saturday nights, from 11 pm to 3 am. Four thousand two-hundred thirty-four (4234) drivers were approached, before and after prohibition, from the south, north, east, and west regions of the city of São Paulo, located in southeastern Brazil, including cars, motorcycles, and utility vehicles. A total of 3854 (91%) consented to participate in the survey and answered the questionnaire. Out of this group, 3229 (84%) agreed to take the passive breathalyzer test. Sample size was established using a 95% confidence interval, considering possible non-measurable errors, minor failures in the questionnaire application, or expected incorrect responses. A 2.5% margin of error was used.

2.2. Selection of research location

This study had a cross-sectional design and was based on the methodology of sobriety checkpoints, used in studies performed in other countries (Beirness and Beasley, 2009; Lacey et al., 2009; Voas et al., 1998). Basically, checkpoints were established along strategic, heavily trafficked public roads in the city of São Paulo. Checkpoints had been previously mapped by the agencies responsible for traffic inspection in that city.

2.3. Procedures and ethical considerations

Vehicles were randomly selected by the group coordinator, and drivers were stopped and detoured to the checkpoints by highway patrol officers. Next, the officers would move away from the vehicle and the researcher would then explain to each driver that this was an educational survey. Those who agreed to participate signed an informed consent form and received an educational flyer about problems associated with drinking and driving.

Some safety measures were adopted concerning drivers who agreed to undergo a breathalyzer test and revealed a blood alcohol level equal to or above the limit established by law ($\leq$0.2 g/l). Drivers were made available to drive interviewees back home if they had a blood alcohol level incompatible with driving. Those who refused help from an independent driver were guided to let a passenger become the driver – if that person fulfilled the legal requirements to drive a vehicle, or were advised to wait with the team, during which they were fed and hydrated until they were in better condition to drive the vehicle. As another alternative, drivers were advised to ask someone in perfect physical and legal conditions to come and drive the vehicle.

Research was carried out according to the standards of the Helsinki Declaration and approved by the Universidade Federal de São Paulo (UNIFESP/EPM – São Paulo Federal University) Ethics Committee, under No. 1409/05.

2.4. Instruments

All drivers who agreed to participate in the study answered an anonymous questionnaire, applied by qualified interviewers, about the following: (1) socioeconomic and demographic data (sex, age, marital status, level of education, employment, and family income); (2) previous involvement in traffic accidents; (3) opinion about traffic infractions; (4) pattern of consumption of alcoholic beverages (none, daily, weekly, or sporadically, amount, beverages consumed); (5) use of beverages on the interview day; (6) knowledge about laws on specific traffic issues; (7) drink driving behavior; and (8) opinion about the use of breathalyzer tests. In accordance with prior instructions regarding the signs and symptoms of alcohol and drug abuse, the interviewer recorded the driver's general condition: normal = no sign of being under the influence of alcohol or drugs; Under the Influence of alcohol or other drugs, but not intoxicated = apparently normal, but realizes that would be under the influence of some substance, with decreased attention, emotional instability, but able to conduct the interview; clearly intoxicated = difficulties in speech, concentration, vertigo, imbalance, disturbances in sensation, and lack of muscle coordination, loss of critical judgment, and unable to be interviewed; type of vehicle, number of passengers, and use of safety belts. Drivers with clear signs of intoxication were excluded and safety procedures were adopted. The questionnaire took approximately 5 min to complete. Each driver was subsequently invited to undergo the passive breathalyzer test (model: P.A.S. IV-Sniffer), without police involvement. Breathalyzer test results were noted down on the questionnaires, respecting the driver's anonymity.

2.5. Statistical analysis

We used SPSS version 15 for data analysis. Initial descriptive analyses were performed to ascertain the respondents' socio-demographic characteristics, driving behavior, attitudes, and alcohol consumption (Tables 1 and 2). Logistic regression was used to investigate the relationship between having a positive breathalyzer test computed using a dichotomized measure as blood alcohol concentration (BAC) $\leq$ 0.2 g/l and BAC > 0.2 g/l and the socio-demographic characteristics, driving behavior, attitudes, and alcohol consumption. For the purposes of these analyses, the variables were dichotomized, such as: marital status (other and single), income (less than 1 minimum wage (MW) and more than 1 MW), attitude toward the breathalyzer test (unfavorable and favorable), driving after drinking (no driving after drinking and driving after drinking), traffic infraction (other and drinking and driving rated as the most serious traffic infraction), pattern of consumption (no pattern and at least weekly) and year (2007 and 2009). Because of the relatively large number of predictor, the analyses were carried out in three steps. First, we checked the tolerances of all the predictor' variables. Only the variables that yielded a tolerance $p < 0.05$ were retained in the model. Second, based on the statistical significance of the bivariate tests, potentially confounding factors (gender and age) were considered

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Table 1
Socio-demographic data of the sample in both periods (2007 and 2009).

Variable		2007 *n* (%)	2009 *n* (%)
Sex	Female	407 (21.8)	385 (19.5)
	Male	1458 (78.2)	1585 (80.5)
Age	18–19	144 (7.7)	106 (5.4)
	20–30	976 (52.2)	1009 (51.5)
	31–40	407 (21.8)	452 (23.0)
	41–50	224 (12.0)	251 (12.8)
	51 or more	117 (6.3)	143 (7.3)
Marital status	Single	1209 (64.7)	1145 (57.9)
	Married	486 (26.0)	682 (34.5)
	Cohabiting	31 (1.7)	23 (1.2)
	Separated	132 (7.1)	111 (5.6)
	Widowed	11 (0.6)	17 (0.9)
Level of education	Grade school dropout	1 (0.1)	10 (0.5)
	Elementary	120 (6.4)	175 (8.8)
	High school	611 (32.8)	674 (34.1)
	Some college	438 (23.5)	357 (18.0)
	College graduate	695 (37.3)	762 (38.5)
Employment	Formal	994 (54.3)	1109 (56.7)
	Informal	196 (10.7)	267 (13.7)
	Self employed	440 (24.0)	397 (20.3)
	Unemployed	73 (4.0)	77 (3.9)
	Student	104 (5.7)	81 (4.1)
	Retired	24 (1.3)	25 (1.3)
Family income [a] MW, minimum wage	Less than 1 MW	22 (1.2)	43 (2.2)
	1–3 MW	435 (23.6)	201 (10.4)
	4–7 MW	485 (26.3)	616 (31.8)
	More than 8 MW	899 (48.8)	1080 (55.7)

[a] The minimum wage (MW) in effect at the time of the study = 2007 (R$380.00), and 2009 (R$465.00).

as controls. Third, non-significant predictor was dropped from the analysis. On this basis, marital status, income, attitude toward the breathalyzer test, driving after drinking, traffic infractions, consumption pattern, and year were retained in the final model.

3. Results

3.1. Socio-demographic characteristic

The data in Table 1 show the characteristic of the sample in two periods. Overall, there were four males for every female in the sample. More than half of the interviewees were single and 30 years of age or younger. More than half of the interviewees had completed some form of higher education, had a formal job, and had an income over eight times the established monthly minimum wage.

3.2. Behavior of drivers, attitudes, and alcohol consumption

Table 2 shows that, before and after the new law, more than two-thirds of the drivers reported never having been involved in a traffic accident and considered drunk driving as the most serious traffic infraction, and more than ninety percent were in favor of using the

Table 2
Driver behavior, attitudes, and alcohol consumption for both periods.

Variable		2007 *n* (%)	2009 *n* (%)
Involved in a traffic accident	Yes	591 (31.9)	617 (31.2)
	No	1262 (68.1)	1360 (68.8)
Drinking alcohol on the research day	Yes	498 (26.8)	281 (14.5)
	No	1361 (73.2)	1660 (85.5)
Drinking frequency/week	None	496 (26.9)	868 (44.5)
	Weekly	668 (36.2)	1039 (53.3)
	Daily	47 (2.6)	42 (2.2)
	Sporadically	632 (34.3)	0 (0.0)
Traffic infraction	Red light violation	162 (8.8)	264 (13.9)
	Speeding violation	224 (12.2)	292 (15.3)
	Drunk driving	1315 (71.6)	1251 (65.7)
	Not using seat belt	45 (2.4)	23 (1.2)
	Improper passing	59 (3.2)	53 (2.8)
	Improper stopping	7 (0.4)	6 (0.3)
	Driving substandard vehicle	25 (1.4)	15 (0.8)
Driving after drinking	After consuming alcohol, drive after drinking coffee	122 (8.7)	29 (2.7)
	Alcohol consumption & driving is not a problem	241 (17.2)	43 (3.9)
	Drives better after alcohol consumption	42 (3.0)	29 (2.7)
	Does not drive (after consuming alcohol takes a taxi/bus, ride)	333 (23.8)	368 (33.6)
	Asks someone else to drive	587 (41.9)	493 (45.1)
	Drives under the speed limit	77 (5.5)	57 (5.2)
	Seldom consumes much alcohol	0 (0.0)	75 (6.9)
Attitude toward Breathalyzer test	Yes	1745 (94.0)	1807 (91.8)
	No	111 (6.0)	161 (8.2)

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Table 3
Predicting positive breathalyzer tests: [a]logistic regression results.

Predictor	[b]OR crude (95% [c]CI)	$P < 0.05$	Adjusted OR[b] (95% [c]CI)	$P < 0.05$
Marital status				
Other	1		1	
Single	0.549 (0.422–0.715)	0.000	0.552 (0.423–0.719)	0.000
Income				
Less 1 MW	1		1	
Over 1 MW	0.305 (0.141–0.661)	0.003	0.308 (0.142–0.667)	0.003
Attitude toward breathalyzer test				
Unfavorable	1		1	
Favorable	0.256 (0.176–0.374)	0.000	0.248 (0.170–0.363)	0.000
Driving after drinking				
No	1		1	
Yes	1.603 (1.274–2.017)	0.000	1.650 (1.309–2.079)	0.000
Traffic infraction				
Other	1		1	
Serious	0.686 (0.545–0.863)	0.001	0.699 (0.555–0.880)	0.002
Consumption pattern				
No pattern	1		1	
At least weekly	1.958 (1.528–2.509)	0.000	1.920 (1.496–2.465)	0.000
Year				
2007	1		1	
2009	0.547 (0.481–0.622)	0.000	0.550 (0.484–0.626)	0.000

[a] Model controlled by gender and age.
[b] OR, odds ratio.
[c] CI, confidence interval.

breathalyzer test a way to prevent traffic accidents. After the new law, more drivers avoided driving after drinking and resorted to other means of transportation such as taking a taxi, a bus, or riding with someone who had not consumed alcohol on that occasion. Before the new law (2007), 26.8% of the drivers reported having used alcohol, and after the new law (2009), the frequency of these drivers dropped to 14.5%. The consumption pattern was weekly for both periods.

3.3. Breathalyzer results

A total of 3229 drivers submitted to the breathalyzer test. The positive test results (>0.2 g/l) for 2007 were 27% and for 2009, 11%. Breathalyzer results showed that, across the combined before and after samples, 19% of drivers were driving with a blood alcohol concentration (BAC) above the legal limit 0.2 g/l (DENATRAN, 2008).

Table 3 shows the final model from the logistic regression analyses controlling for gender and age used to predict a positive breath test (above 0.2 g/l). These analyses indicated that, being single (OR = 0.552, 95% CI = 0.423, 0.719), having an income above the minimum wage (OR = 0.308, 95% CI = 0.142, 0.667), being in favor of the use of the breathalyzer (OR = 0.248, 95% CI = 0.170, 0.363), having the opinion that drunk driving is the most serious infraction (OR = 0.699, 95% CI = 0.555, 0.880) are protective against a positive breathalyzer result, while having a pattern of alcohol consumption at least once a week (OR = 1.920, 95% CI = 1.496, 2.465) and the habit of driving after drinking (OR = 1.650, 95% CI = 1.309, 2.079) are risks for having a positive breathalyzer result. After the new traffic law, there was a 45% decrease in the odds that driver had a positive breathalyzer result (OR = 0.550, 95% CI = 0.484, 0.626).

4. Discussion

The results show that the number of positive breath tests decreased (45%) significantly after the introduction of Law No. 11705 in Brazil. The introduction of the Dry Act had a positive effect, and has spared and will spare lives, either directly or indirectly. Such effects are significant in countries like Brazil, which lack policies for the social control of alcohol consumption and abuse, and in which the alcohol market has rapidly increased over the past few decades. This result is consistent with data from the State Health Department and traffic control agencies. In the first month following the Dry Act, the number of ambulatory care demands decreased by half in the hospitals, including the University Hospital of São Paulo, the largest in Latin America, the demand at emergency units and of the mobile urgency service (SAMU) dropped, and traffic deaths decreased by 63% downtown and 14% on the roads. This is a significant contribution to safety and savings in public health (Dualibi et al., 2010). Even temporarily, the increased law enforcement around the country, the application of a more strict law and the media coverage may have contributed to reducting traffic deaths (Andreuccetti et al., 2011; Madruga et al., 2011).

Descriptive data herein reported on drivers' social demography, behavior, attitudes, and alcohol consumption indicate that weekend-night drivers are usually 20-to-30-year-old males with high educational and socio-economic level. About one-third of them have already been involved in traffic accidents. Most drivers in this group agree that driving drunk is the most severe traffic infraction, and they are thus in favor of using breath tests as a measure to control alcohol consumption and driving (Tables 1 and 2). Several factors can be associated with the profile of those who drink and drive, namely: being male, 22–45 years old (Hingson and Winter, 2003) and having previously been involved in traffic accidents (Albery and Guppy, 1996). Data from the first representative household survey conducted in Brazil found that people who reported misusing alcohol and driving are usually males who have been involved in traffic accidents due to alcohol consumption, have abused alcohol in the previous year, and/or have negative opinions regarding policies (Pechansky et al., 2009). However, other factors can also be involved in drivers' beliefs and behavior that account for their driving after drinking. To test this hypothesis ($p < 0.05$), we carried out a logistic regression controlling for gender and age (Table 3) to assess how social demography, behavior, attitudes, and drivers' alcohol consumption (Tables 1 and 2) relate to positive breath tests (>0.2 g/l). The results indicate that: the probability of positive breath tests is more than one-and-a-half times greater for those who usually drive after drinking and almost double for those who usually drink alcohol at least once a week. The effect of alcohol on the brain, even in small doses, implies reduced driving performance, in spite of drivers' belief that this performance has improved (Edwards et al., 1994). International studies have shown that accident risks are high at night when drivers' vision and

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reaction times are reduced because of alcohol consumption (Shults et al., 2001) and are twice as high when the alcohol blood level increases from 0 to 0.2 g/l (Ross, 1992; Zador, 1991). Our findings suggest that drivers who participated in our research and undertook breath tests may believe that alcohol consumption does not affect their driving, and may believe that there will be no enforcement or penalty for drink driving after the initial social commotion caused by the Dry Act's introduction. A survey based on telephone interviews' data provided by VIGITEL (a monitoring system of Risk Factors and Protection against Chronic Diseases maintained by the Brazilian Ministry of Health) shows that in the first few months after the new law (Act 11705.2008), the frequency of adults who drove after drinking an excessive amount of alcoholic beverages dropped from 2.2% to 0.9% in the first two months after the law, and increased again to 2.8% in 2009 (Moura et al., 2009).

In Brazil, fatal traffic accidents are in second place in the ranking of external causes (Ministério da Saúde, 2005): expenses resulting from traffic accidents amount to R$28 billion annual, and the number of deaths, 34,000/year, corresponding to one death every 15.45 min (ANTP, 2007). Thus, the laws to control alcohol consumption and traffic accidents have been increasingly stringent to reduce the frequency of motorists driving drunk and, therefore, the number of accidents they cause. Despite the positives effects of these preventive measures, the effects may be short-lived without a policy to control the availability of alcohol. The importance of preventive measures is highlighted in a study conducted in Ontario by Stoduto and Adlaf (1996). These authors point out that the downward trend in drinking and driving between 1977 and 1991 was discontinued after 1991 when, due to more flexible regulation in sales and in advertising of alcoholic beverages, there was an increase in its availability.

Despite the increasingly severe legislation, both society and courts have been increasingly tolerant with alcohol abuse and drunk drivers, which has resulted in impunity and trivialization of the law. The reason is that the law in Brazil allows drivers to refuse to submit to breath tests as a means of not producing evidence against themselves. Pinsky et al.'s (2001) survey on driver's license candidates in the City of São Paulo showed that the lack of enforcement and training compromises the credibility of traffic legislation punishments. According to the first national survey on the patterns of alcohol consumption conducted between 2005 and 2006 before the adoption of the new law in 2008 (Law 11,705 – "Dry Law") only 40% of drivers had been stopped at highway checkpoints during their lifetimes (Pechansky et al., 2009). However, other factors may be involved in drunk driving behavior.

Our findings suggest that beverage availability in an unregulated market may be contributing to drivers' alcohol consumption regardless of their risks in traffic to themselves and others. "There are a number of ways to control alcohol distribution: by regulating opening days and hours, and density of points of sale, urban zoning laws, minimum age for purchasing alcoholic beverages. Controlling availability is a highly effective, low cost strategy for reducing alcohol abuse and related problems" (Laranjeira and Romano, 2004). Popular support for the laws, surveillance upkeep and improvements in public transportation may be crucial to enable the change in attitudes toward drinking and driving (Madruga et al., 2011).

This study is not without limitations. First, results may be underestimated because of drivers not being obliged to take breath testing. However, the compliance rate was 84% of the drivers required to take the test. Second, the characteristics between those who accepted the breathalyzer test and those who refused it were not compared and there are probably differences between the populations. However, the objective of this study was to evaluate the effectiveness of the breathalyzer test as a preventive measure to control the public association of drinking and driving, and the test was spontaneous and in accordance with the ethical principles adopted in this research. Third, the places selected for this study might have influenced the results (e.g., areas of high bar/restaurant concentration, climate changes, meteorology, duration, and day of data collection). We tried to reduce the impact of such variables by defining date, hour, and collection procedures (Friday and Saturday from 11 pm to 3 am) and by repeating the same methodology in the same city sites and regions. Finally, sites were selected based on mapping provided by the City Traffic Department as a means to ensure researchers' safety. The vehicles were picked out randomly, and a meaningful number of drivers were interviewed in several regions of the city.

The data of this study cannot be generalized to the entire country because of the social, economical and cultural aspects unique to the Municipality of São Paulo. Nonetheless, the methodology herein described can be used in future studies to monitor the prevalence of drinking and driving behavior in other cities and regions of the country, as well as the impact of public alcohol policies.

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