If You Drink, Don't Drive: Drunk Drivers in Guadalajara and León, México

Arturo Cervantes Trejo[1] and Iwin Leenen[2]*

[1]Instituto Nacional para la Evaluación de la Educación (INEE), México and Faculty of Health Sciences, Universidad Anáhuac, México, D.F., [2]Secretary of Medical Education, Faculty of Medicine, Universidad Nacional Autónoma de México, México, D.F.

Abstract

Objectives: *To estimate the percentage of drivers circulating under the influence of alcohol on Thursday, Friday and Saturday nights in Guadalajara and León metropolitan areas, in Mexico, together with their alcohol blood levels and to assess the impact of the Mexican Initiative for Road Safety (IMESEVI, phase I) in this regard.* **Material and Methods:** *Drivers pulled over in roadblocks installed by police authorities during the nights of the three above mentioned days underwent a blood alcohol test, in addition to a survey where sociodemographic and context variables were recorded. A pre-post design was used, collecting information at the start of the IMESEVI (June 2008) and a year and a half later (February 2010), in both mentioned metropolitan areas. Blood alcohol tests were applied to a random sample of 1,229 (pre) and 2,226 (post) drivers. Data was analyzed with a hierarchical logistic model for ordinal variables.* **Results:** *In the pre measurement, between 17 (Zapopan) and 29% (León) of drivers had a positive result on the blood alcohol test. Between 1 and 3% exceeded the legal limit of 0.08 g/dl for blood alcohol concentration (BAC). The probability of producing a positive result varies depending on the night of observation, presence of other passengers in the vehicle and marital status and sex of the driver. In the post measurement, the probability decreased down to a third of the pre measurement probability.* **Conclusions:** *In light of the evidence on the deleterious effect of alcohol in motor vehicle accidents, programs that are successful in the prevention of driving under the influence of alcohol have the potential for significantly contributing to road safety in Mexico.* (Gac Med Mex. 2014;150:543-52)

Corresponding author: Arturo Cervantes Trejo, acervantes@inee.edu.mx

KEYWORDS: *Alcoholic beverages consumption. Mexico. Road safety.*

Introduction

Each year, more than 1.2 million of persons in the world die due to injuries caused by traffic accidents and, among people aged from 5 to 25 years, traffic is the second main cause of death[1-3]. One of the factors markedly affecting the probability of suffering a traffic accident is driving under the influence of alcohol. Numerous studies[4-7] have shown the deleterious effects of alcohol on tasks involving alertness, time of reaction and split attention, functions precisely intervening when driving a motor vehicle. Additionally, time series analyses that for a certain region associate the number of traffic accidents with the introduction of legislative initiatives that reduced the allowed BAC level, suggest that increased risk for suffering an accident is evident even at very low doses[8,9]. Specifically, a U.S.A. study found a larger reduction of accidents in states that had a zero tolerance policy implemented for young drivers compared with those that had introduced a BAC limit of 0.02 g/dl[10].

Ninety-six percent of the countries have ratified laws regulating driving under the influence of alcohol[1]. In Mexico, laws do not allow driving if BAC exceeds

Correspondence:
*Arturo Cervantes Trejo
Instituto Nacional para la Evaluación de la Educación
Av. Barranca del Muerto, 341
Col. San José Insurgentes, Del. Benito Juárez
C.P. 03900, México, D.F.
E-mail: acervantes@inee.edu.mx

This work was provided with technical and financial support by the Panamerican Health Organization, thanks to a funding from Bloomberg Philantropies granted to the World Health Organization (WHO) and, when it was conducted, the main author was serving as Technical Secretary of the Consejo Nacional para la Prevención de Accidentes (CONAPRA).

Modified version reception: 15-10-2013
Date of acceptance: 25-10-2013

0.08 g/dl. (Please note that Mexican laws regulating the alcohol rate for drivers are passed at state level; in larger metropolitan areas of the country, the 0.08 g/dl limit for BAC was imposed. It is important mentioning that, after the present study was conducted, the legislation changed; for example, in Jalisco, current limit is 0.05 g/dl.) However, confirming laws is not enough *per se.* Equally important are measures to instill their compliance. In this regard, several studies[11,15] have shown positive effects of awareness campaigns and installation of control posts close to nocturnal entertainment centers where the police applies blood alcohol tests. An example of an initiative developed according to this policy in Mexico is the "Drive without alcohol" program *(Conduce sin alcohol)*[16], which during the first three years following its introduction entailed a reduction to half on deaths due to motor vehicle accidents in the Distrito Federal (D.F.)[16].

In the year 2008, the Mexican Ministry of Health, through the National Center for Prevention of Accidents (CENAPRA – *Centro Nacional de Prevención de Accidentes),* with support of the Panamerican Health Organization, started up the Mexican Initiative for Road Safety and Prevention of Traffic Injuries (IMESEVI – *Iniciativa Mexicana de Seguridad Vial y Prevención de Lesiones en el Tránsito)*[18]. This initiative was implemented in four of the main metropolitan areas of the Mexican Republic: León (in the state of Guanajuato), Guadalajara (Jalisco), Monterrey (Nuevo León) and Mexico City (Distrito Federal). Within the assessment framework of the project's impact, extensive data collection was made on each one of the participating metropolitan areas, during two different periods: a few months before the start of the project ("pre" measurement) and a year and a half after the project was initiated ("post" measurement).

In this article, we present an analysis of data collected to assess the impact of the IMESEVI on driving under the influence of alcohol. The presented results include only the Guadalajara and León metropolitan areas, Monterrey and Distrito Federal were omitted for reasons described in the "Procedure" section.

This research has two objectives: first, there is interest in estimating the percentage of drivers circulating on public roads under the influence of alcohol on leisure nights in both the Guadalajara and León metroplitan areas, as well as the blood alcohol level these drivers are exposed to and, second, through a comparison between pre and post measurements, we attempt to assess the impact of the IMESEVI on the drinking and driving risky behavior in this areas.

Methods

Sampling

The study included the Guadalajara, Zapopan and León municipalities. Although Guadalajara and León metropolitan areas include parts of other municipalities, those selected cover most part of the respective metripolitan areas[19]. For each of the three municipalities, a two-level hierarchical sampling procedure was applied:

- Level 1: control posts sample. Police authorities of each municipality suggested a list of places where to install a blood alcohol inspection operative. Two important criteria for a place to be eligible were relative proximity to nocturnal entertainment centers and safety of the personnel involved in the organization of the operative. Although the procedure to select control sites did not meet the requirements of random sampling, the chosen places covered the most relevant zones of the municipality (with special focus on areas with more nocturnal leisure activities). Total sample for the pre measurement included 39 control sites, distributed between the three nights and the three municipalities. It should be mentioned that this sample does not include the originally selected sites for Saturday night in Guadalajara and Zapopan, since data collection was cancelled due to an electric storm. For the post measurement, there were 27 control sites available (Table 1). The number of control sites at each municipality depended on the available personnel for the different nights. Additionally, in León, the teams in charge of the operatives changed sites during the night, and each new place was considered another control post.
- Level 2: sample of drivers. At each control site, a random sample of drivers approaching the road block was selected in order for them to take the blood alcohol test and answer a brief survey. The entire sample included 1,316 drivers in the pre measurement and 2,274 in the post measurement. Table 1 shows the descriptive statistics of the drivers' sample, and figure 1 shows a histogram of the blood alcohol test results for each municipality.

Design

The described sampling leads to a pre-post design, without a control group, with different samples at both moments; Shadish et al. characterize it as

Table 1. Number of observations and descriptive statistics*

	Total		Guanajuato		Jalisco			
			León		Guadalajara		Zapopan	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Sample sizes								
Control sites	39	27	24	12	9	6	6	9
Drivers	1,316	2,274	558	1,218	380	314	378	742
Alcohol tests	1,299	2,226	553	1,207	371	299	375	720
Subsequent interviews	1,292	2,194	548	1,181	369	298	375	715
Variables								
Observation night								
Thursday	41%	23%	30%	27%	48%	22%	50%	16%
Friday	43%	34%	31%	29%	52%	37%	50%	42%
Saturday	16%	43%	39%	44%	–	41%	–	42%
Type of vehicle								
Taxi	9%	12%	3%	16%	19%	6%	7%	8%
Sedan car	59%	58%	64%	54%	47%	69%	64%	62%
Family van	18%	15%	15%	12%	23%	13%	18%	21%
Light freight	14%	14%	18%	18%	12%	12%	11%	9%
Age of vehicle								
Older than model 2000	43%	35%	58%	45%	35%	36%	29%	17%
Model 2000 or newer	57%	65%	42%	55%	65%	64%	71%	83%
Occupant number								
1 (driver)	40%	44%	36%	44%	43%	49%	44%	42%
2	33%	32%	32%	32%	30%	27%	38%	33%
3	13%	12%	14%	11%	13%	12%	11%	13%
4 or more	14%	12%	18%	13%	14%	12%	7%	12%
Driver's age								
16-25	30%	38%	33%	29%	24%	44%	32%	53%
25-35	37%	31%	35%	33%	38%	33%	37%	27%
35-50	24%	26%	24%	32%	27%	22%	22%	16%
50+	9%	5%	8%	6%	11%	1%	9%	4%
Driver's marital status								
Without partner	49%	52%	45%	42%	44%	59%	59%	69%
With partner	51%	48%	55%	58%	56%	41%	41%	31%
Driver's sex								
Woman	11%	9%	11%	7%	10%	9%	14%	11%
Man	89%	91%	89%	93%	90%	91%	86%	89%

*Los porcentajes se calcularon relativos al número de pruebas de alcoholemia realizadas. Los valores faltantes se excluyeron en el cálculo de los porcentajes. En Jalisco se canceló la toma de datos en la noche del sábado de la medición pre debido a una tormenta eléctrica. Aunque en México la edad mínima para conducir es 18 años, la muestra incluyó a cinco conductores menores de edad.

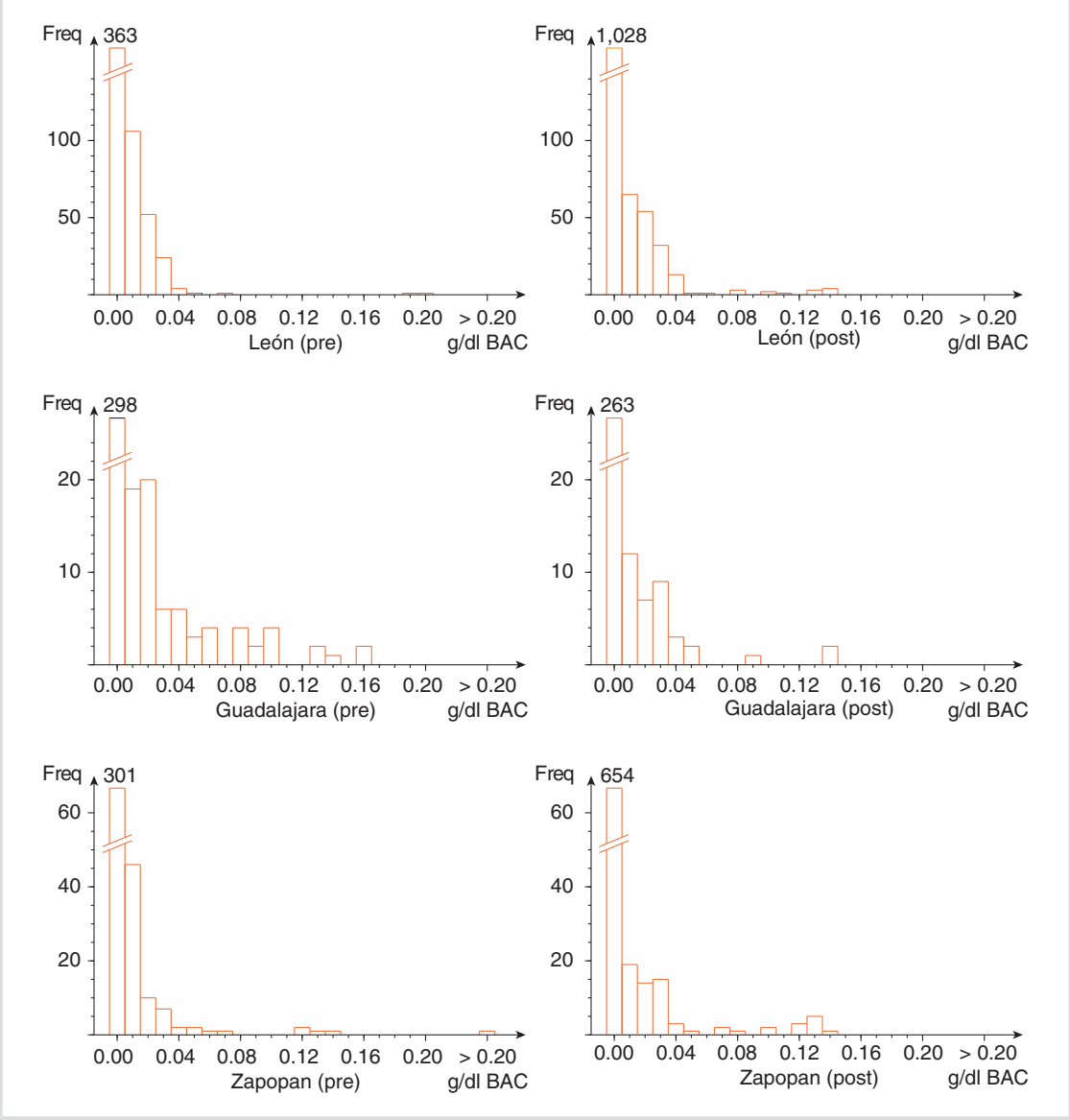

Figure 1. *Historiograms of results frequency on the blood alcohol test applied to drivers pulled over in León, Guadalajara and Zapopan. The bar corresponding to the negative result is appears with an incision; exact frequency appears at the top of the bar.*

quasi-experimental[32]. The pre measurement was carried out on June 2008, and the post, on February 2010.

Activities of the Mexican Initiative for Road Safety focused on decreasing driving under the influence of alcohol

The first activity corresponds to component 5 of the IMSEVI initiative: to supply police corporations with breathalyzers, together with training on the strategy (date of execution: June 10, 2008). From the same initiative, the second activity corresponds to component 3: supplying hospitals with breathalyzers (June 10, 2008). The third activity involved installing blood alcohol supervision operatives on risky intersections, which started on July 7.

Materials

The Alco-Sensor FST® (Intoximeters Inc.) is an approved instrument for evidential use that receives samples of breath either directly or passively. The passive

test does not require a mouthpiece, but to blow into the sensitive area of the device, and it provides a binary result (positive or negative); with the direct test, the subject blows through a mouthpiece and the obtained result is the level of alcohol in breath (BrAC) in milligrams per liter of air. Technical characteristics indicate that the Alco-Sensor FST® detects BrAC levels from 0.00 up to 2.00 mg/l, with ± 0.015 mg/ml accuracy; the sensor is alcohol-specific (does not respond to acetone or other substances present in human breath).

Procedure

General considerations

Although the exact procedure varied in details between both metropolitan areas – legally, police authorities were ultimate responsible for the operatives and, therefore, the IMSEVI investigators were not able to impose a procedure –, two elements were considered essential to the validity of the study: that the procedure for the selection of vehicles to be pulled over ensured that drivers undergoing the test were a random selection of all drivers approaching the road block, and that blood alcohol tests were applied to all detained drivers. This last requirement was added in view of evidence that police officers, by taking external signs as a basis to decide on application of the blood alcohol test, failed to identify 50% of drivers with BAC higher than 0.08 g/dl and 90% of drivers with BAC higher than 0.05 g/dl[10,21]. Failure to comply with one or both requirements was the primary reason for the exclusion of data collected in Nuevo León and Distrito Federal. Of note, the same reasons prevented the use of data collected by the police during their usual blood alcohol controls in the present study.

It is important mentioning that the agents and doctors in charge of the operatives were the same who participate in usual blood alcohol controls. They received particular instructions for the research in an informative session held at the station before joining their respective operatives.

Selection of vehicles

With regard to the first requirement, basic procedure was to let the next vehicle or vehicles enter until the supervision area was full. The person responsible for the operative decided, at the beginning of the night, the maximum number of vehicles allowed in the road block (between three and five, depending on the characteristics of the observation area and the size of the team in charge of data collection). Only taxis, sedan cars, family vans and light freight vehicles (pick-ups and station wagons) were allowed to enter. When the number of vehicles in the road block reached its maximum, it was closed until one or more vehicles had completed the procedure and left the road block.

Data collection of detained drivers

The procedure applied to vehicles detained on the road block involved three steps. First, a policeman/woman informed the driver on the purpose of the action. Second, the physician of the operative administered the alcohol test: in the pre measurement, the direct test was immediately applied to all drivers and, in the post measurement, in order to reduce the use of mouthpieces, the passive test was applied to every driver and, in case of a positive result, the direct test was also applied. As a third step, a survey taker (collaborator of the IMESEVI project) recorded information on the vehicle and the driver, and asked the driver to participate in a brief survey (less than 1 min). Specifically, the type of vehicle (taxi, sedan car, family van, light freight vehicle) and its age (older than model 2000 vs. 2000 or newer), number of occupants in the vehicle and the driver's birth year, sex and marital status (without partner vs. with partner) were recorded. In case the driver refused to participate (less than 2% of drivers undergoing the test), the survey taker wrote it down, and non-observable variables (birth year and marital status) were left blank.

Time schedule

Generally, activities started at 11 p.m. and lasted until 4 or 5 a.m. (the exact hour was decided by the responsible for the operative at each site). In some places of the pre measurement, data collection concluded before the scheduled hour because they ran out of mouthpieces.

Data analysis

As a first step, we transformed the BrAC level results into BAC level by applying a conversion rate of 1:2,000. This transformation, together with the direct relationship between both variables, allows for the breathalyzer results to be interpreted in terms of blood alcohol level.

Considering the hierarchical structure of the data, we employed multilevel models for its analysis[22,23]. We

Table 2. Adjusted probabilities of surpassing different BAC thresholds for the three municipalities and the two moments of measurement*

	Threshold 1 0.00 g/dl		Threshold 2 0.02 g/dl		Threshold 3 0.05 g/dl		Threshold 4 0.08 g/dl	
	Prob.	IC 95%	Prob.	IC 95%	Prob.	IC 95%	Prob.	IC 95%
León								
Pre	0.288	(0.231-0.352)	0.050	(0.034-0.074)	0.004	(0.001-0.012)	0.002	(0.001-0.010)
Post	0.116	(0.078-0.170)	0.043	(0.027-0.068)	0.008	(0.004-0.016)	0.007	(0.004-0.015)
Guadalajara								
Pre	0.194	(0.134-0.271)	0.094	(0.059-0.145)	0.049	(0.028-0.085)	0.035	(0.019-0.064)
Post	0.063	(0.031-0.124)	0.026	(0.011-0.058)	0.006	(0.002-0.019)	0.004	(0.001-0.016)
Zapopan								
Pre	0.173	(0.117-0.249)	0.046	(0.026-0.080)	0.020	(0.009-0.041)	0.011	(0.004-0.028)
Post	0.049	(0.028-0.085)	0.027	(0.014-0.049)	0.010	(0.005-0.022)	0.008	(0.004-0.018)

*The 95% IC denotes the 95% confidence interval. The two probabilities appearing in same box differ significantly from each other ($p < 0.01$).

defined a new variable with five blood alcohol categories: (i) BAC = 0.00, (ii) 0.00 < BAC ≤ 0.02, (iii) 0.02 < BAC ≤ 0.05, (iv) 0.05 < BAC ≤ 0.08 and (v) BAC > 0.08. The new variable was entered as dependent variable in a logistic regression multilevel analysis for ordinal variables.

The model allowed for thresholds to differ between municipalities and between pre and post measurements. On the other hand, the remaining fixed effects were restricted in order to be equal between municipalities, although they were allowed to differ between both measurements. A random effect was associated with each control site. Models were estimated using the PROC NLMIXED procedure of the SAS 9.2 software[24].

Results

Tables 2 and 3 show the main results of the analysis. Table 2 presents the adjusted probabilities (derived under model assumptions) for a typical driver of the different municipalities to surpass certain limit of blood alcohol concentration level at each measurement. Table 3 shows the odds ratios (OR) for other factors included in the analysis for both measurements (pre and post). Additionally, based on the model parameters estimates, the average of adjusted probabilties of driving under the influence of alcohol (i.e., with BAC higher than 0.00 g/dl) in the three municipalities was calculated for different types of drivers, which are graphically presented in figure 2.

Going back to the first research question, the percentage of people driving under the influence of alcohol is estimated to range between 17 (Zapopan) and 29% (León) at first measurement. The probability for a driver to surpass the BAC legal limit of 0.08 g/dl ranges between 0.01 (Zapopan) and 0.03 (Guadalajara).

Among the factors that are significantly related with driving under the influence of alcohol (Table 3 and Fig. 2), stand out the night of observation (Saturday is more probable finding drivers that have ingested alcohol), the type of vehicle (lower probabilities for taxi and freight vehicles drivers), the number of passengers in the vehicle (in the first measurement data, adjusted probabilities rise almost linearly as a function of the number of passengers in the vehicle) and marital status and sex of the driver (males without a parner have the highest probability of driving under the influence of alcohol). This study does not provide evidence of blood alcohol levels differing between drivers belonging to different age groups.

When the probabilities associated with the measurement made a few months prior to the IMESEVI implementation and the probabilities corresponding to the subsequent measurement are compared (Table 2 and Fig. 2), a considerable difference is observed: on each one of the municipalities, the pre probability is decreased by approximately a third. Noteworthy, in León and Zapopan this reduction is primarily on low blood alcohol levels, i.e., in the post measurement, a slightly

Table 3. Odds ratios (OR*) for factors included in the statistical model for driving under the influence of alcohol

Factors	Pre measurement OR (95% CI)	Post measurement OR (95% CI)
Observation night		
Thursday†	1.00	1.00
Friday	1.12 (0.7-1.7)	2.02 (0.9-4.5)
Saturday	1.87 (1.1-3.3)	2.19 (1.0-4.8)
Type of vehicle		
Taxi†	1.00	1.00
Sedan car	16.23 (3.9-67.6)	22.98 (5.4-97.7)
Family van	19.66 (4.6-83.3)	22.32 (5.1-97.8)
Light freight	11.62 (2.7-50.2)	25.19 (5.8-110)
Age of vehicle		
Older than model 2000	0.69 (0.5-0.9)	0.83 (0.6-1.1)
Model 2000 or newer	1.00	1.00
Number of occupants		
1 (driver)†	1.00	1.00
2	1.06 (0.8-1.5)	1.41 (1.0-1.9)
3	1.49 (1.0-2.3)	0.97 (0.6-1.5)
4 or more	1.61 (1.1-2.4)	0.78 (0.5-1.2)
Driver's age		
16-25	1.13 (0.6-2.0)	0.75 (0.3-1.8)
25-35	0.78 (0.5-1.2)	1.12 (0.7-1.7)
35-50	1.15 (0.8-1.6)	1.21 (0.9-1.7)
50+†	1.00	1.00
Driver's marital status		
Without partner†	1.00	1.00
With partner	0.72 (0.5-1.0)	0.71 (0.5-1.0)
Driver's sex		
Woman†	1.00	1.00
Man	1.34 (0.9-2.0)	2.11 (1.2-3.7)

*Compared with the reference category.
†Reference category.

positive result (less than 0.02 g/dl) is (much) less frequent, whereas in the highest blood alcohol levels, the difference between both moments is not statistically significant. In Guadalajara, conversely, a significant reduction is observed in the probability for the blood alcohol test result to surpass it, at each one of the four thresholds considered in this study.

Discussion

Driving under the influence of alcohol is a factor that not only affects the probability of being involved in a traffic accident, but also the severity of injuries sustained as a consequence. Therefore, it is important to have reliable data that allow for the impact of initiatives

intended to reduce this risky behavior and that contribute, with valuable information, to design tailored campains for the most exposed groups, to be assessed. The results of this study show that, prior to implementation of the IMESEVI in Guadalajara and León metropolitan areas, about one out of each five drivers circulating on public roads on Thursday, Friday and Saturday nights, was under the influence of alcohol. Although in the vast majority of cases the driver did not exceed the legal blood alcohol limit, any alcohol level can still be a significant factor in transit accidents, considering evidence provided by other studies[4,5] on the deleterious effect of alcohol, even at small doses.

In many aspects, the results of this study confirm previous findings or put them into other perspective. For example, data from the Statistics and Geography National Institute[25] indicate that, when Thursdays, Fridays and Saturdays are compared, the latter is the day associated with more traffic accidents, and the trend increases when only accidents with alcohol involved are examined. With regard to the number of occupants in the vehicle, there are interesting studies[26,28] showing that young drivers accompanied by one or more passengers are relatively more involved in traffic accidents. An additional analysis of our data reveals that, in this group of drivers, it is significantly less common driving under the influence of alcohol, suggesting that the risk of suffering an accident is due to young drivers' lack of experience, increased by the presence of passengers. Finally, the different attitudes of men and woman towards risky behavior in general, and driving under the influence of alcohol in particular, have been widely reported; specially, single or separated men seek risk more frequently[29,30]. Our study confirms the existence of this tendency in Mexican drivers.

When interpreting the results, the low number of persons with extreme results on the blood alcohol test has to be taken into account: in only 22 (1.7%) of 1,299 tests at the pre measurement and 28 (1.3%) out of 2,226 tests at the post measurement, a result exceeding 0.08 g/dl was observed. Consequently, with regard to the population of drivers exceeding the legal limit, the present study deals with relatively inaccurate estimates and low power to detect an impact of the IMESEVI. To increase accuracy and power of future studies, including a larger sample of drivers undergoing the test is suggested.

The comparison of June 2008 and February 2010 results suggests a possible positive impact of the IMESEVI on one of the most relevant risk factors for road safety. A strong fall was observed in the number o positive alcohol blood tests on both metropolitan areas where the study was conducted. The effect is clearer on low blood alcohol levels, which suggests that, at the post measurement, more drivers did not ingest any alcohol at all (as compared with the pre measurement, where driving under the effects of one or two drinks was more common). This change is important, since alcohol affects psychological functions involved with driving a vehicle even at low doses. As we just mentioned, the low number of drivers with high levels of blood alcohol entails a reduced power to draw conclusions on the possible impact of the IMESEVI in this regard, although the result in Guadalajara, where a statistically significant reduction was observed on tests with results exceeding the 0.08 g/dl BAC, suggests that the IMESEVI initial efforts should be extended to more states of the Republic.

The IMESEVI project and its results have served as a precursor for the 2011-2010 Road Safety National Strategy, which is an agreement signed by the National Conference of Governors in Mexico[31]. In this agreement, the governors express their willingness to take actions to reduce by 50% the rate of injuries, disabilities and deaths due to traffic accidents before the year 2020, thus joining the Decade of Action for Road Safety, proclaimed by the United Nations General Assembly in 2010[32].

Limitations to this study

There are some inconveniences of the present study that are worth mentioning. The most important limitation is probably the design to assess the effect of the IMESEVI[33]. Due to the lack of a control group, the design does not allow for the impact of the intervention to be separated from other possible influences between both measurements, neither does it allow for momentaneous or circumstancial factors that might have affected data collection in one of the measurement moments to be excluded. For example, the different pre and post measurement periods of the year could have entailed different behaviors that affect driving under the influence of alcohol. In this sense, it is important mentioning that the dates in both periods did not include holidays or vacation periods. Obviously, the adoption of an experimental design that includes a randomly assigned control group might solve the problem; however, it would be a practical challenge finding a control group not exposed to the intervention and at the same time comparable to the experimental group in every other aspect.

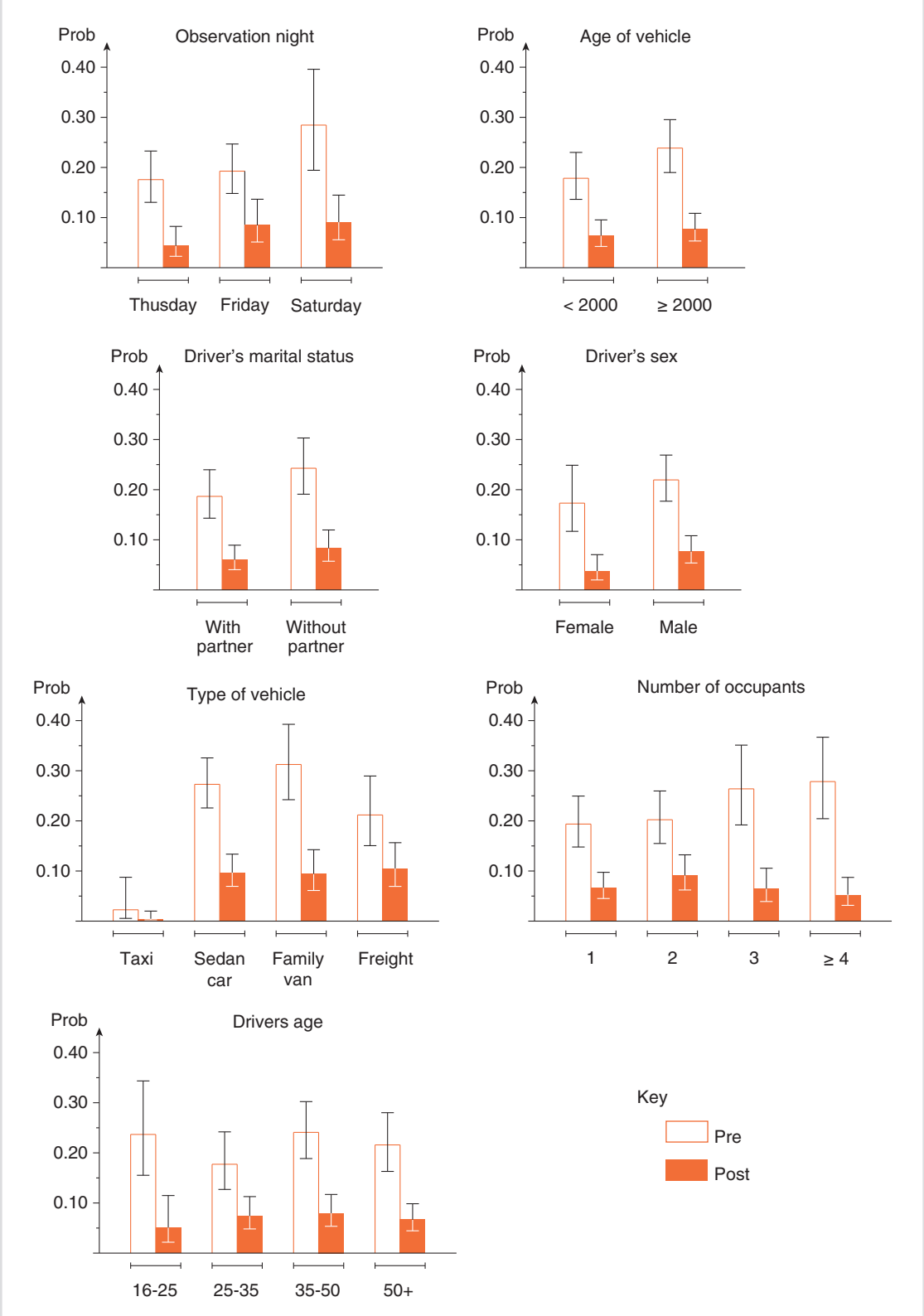

Figure 2. *Graphic representation of adjusted average probabilities at the three municipalities for a driver to produce a positive result (> 0.00 g/dl) on the blood alcohol test, as a function of the observation night and characteristics of the driver and the vehicle involved.*

As public road users warn others about the location of blood alcohol controls (by cell phone or at social networks), the figures presented in this study might be an underestimate of the real problem of driving under the influence of alcohol. At the same time, it is plausible for this factor to have affected data similarly at both measurement moments, and for the differential to have been relatively unaffected.

The supervisions of the data collection process, performed by those in charge of this study, reveal differences between the different control operatives in the degree of compliance with originally agreed procedures. Although this lack of adherence negatively affects validity, the supervisions carried out allow assuming that execution of the operatives was sufficient to be able to trust the conclusions of the study.

Acknowledgments

The authors thank the operative personnel of IMSEVI, which belongs to the Consejo Nacional para la Prevención de Accidentes, of the Secretaría de Salud Federal de México, for the support provided in the conduction of this study. Additionally, we wish to express our special gratitude to the personnel at the Consejos Estatales de Prevención de Accidentes, of the Jalisco and Guanajuato Ministries of Health, who supported the field work.

References

1. Organización Mundial de la Salud. Global status report on road safety. [Internet]. Ginebra: Organización Mundial de la Salud; 2009. Consultado el 11 de marzo de 2012. Disponible en: http://whqlibdoc.who.int/publications/2009/9789241563840_eng.pdf.
2. Organización Mundial de la Salud. Informe mundial sobre prevención de los traumatismos causados por el tránsito: Resumen. [Internet] Ginebra: Organización Mundial de la Salud; 2004. Consultado el 11 de marzo de 2012. Disponible en: http://www.paho.org/spanish/dd/pub/resumen_informe_mundial_traumatismos.pdf.
3. Organización Mundial de la Salud. World health statistics 2008. [Internet] Ginebra: Organización Mundial de la Salud; 2008. Consultado el 11 de marzo de 2012. Disponible en: http://www.who.int/whosis/whostat/EN_WHS08_Full.pdf.
4. Drew GC, Colquhoun WP, Long HA. Effect of small doses of alcohol on a skill resembling driving. Br Med J. 1958;2(5103):993-9.
5. Ferrara SD, Zancaner S, Giorgetti R. Low blood alcohol concentrations and driving impairment: A review of experimental studies and international legislation. Int J Leg Med. 1994;106(4):169-77.
6. Meda SA, Calhoun VD, Astur RS, Turner BM, Ruopp K, Pearlson GD. Alcohol dose effects on brain circuits during simulated driving: An fMRI study. Hum Brain Mapp. 2009;30(4):1257-70.
7. Harrison ELR, Fillmore MT. Alcohol and distraction interact to impair driving performance. Drug Alcohol Depen. 2011;117(1):31-7.
8. Shults RA, Elder RW, Sleet DA, et al. Reviews of evidence regarding interventions to reduce alcohol-impaired driving. Am J Prev Med. 2001;21 suppl 4:66-88.
9. Zwerling C, Jones PJ. Evaluation of the effectiveness of low blood alcohol concentration laws for younger drivers. Am J Prev Med. 1999;16 suppl 1:76-80.
10. Hingson R, Heeren T, Winter M. Lower legal blood alcohol limits for young drivers. Publ Health Rep. 1994;109(6):738-44.
11. Elder RW, Shults RA, Sleet DA, et al. Effectiveness of mass media campaigns for reducing drinking and driving and alcohol-involved crashes: A systematic review. Am J Prev Med. 2004;27(1):57-65.
12. Elder RW, Nichols JL, Shults RA, et al. Effectiveness of school-based programs for reducing drinking and driving and riding with drinking drivers: A systematic review. Am J Prev Med. 2005;28 suppl 5:288-304.
13. Rothschild ML, Mastin B, Miller TW. Reducing alcohol-impaired driving crashes through the use of social marketing. Accid Anal Prev. 2006;38(6):1218-30.
14. Peek-Asa C. The effect of random alcohol screening in reducing motor vehicle crash injuries. Am J Prev Med. 1999;16 suppl 1:57-67.
15. Fell JC, Lacey JH, Voas RB. Sobriety checkpoints: Evidence of effectiveness is strong, but use is limited. Traffic Inj Prev. 2004;5(3):220-7.
16. Secretaria de Seguridad Pública del Distrito Federal. Programa conduce sin alcohol. [Internet] México: Gobierno D.F. Consultado el 11 de marzo de 2012. Disponible en: http://www.ssp.df.gob.mx/ProgPreventivos/Pages/Conduce-sin-alcohol.aspx.
17. Aviña Valencia JA, Mondragón y Kalb M, Hernández García A, Hernández Aureoles E. Los accidentes viales, un grave problema de salud en el Distrito Federal. Acta Ortop Mex. 2009;23(4):204-8.
18. Centro Nacional de Prevención de Accidentes. Esto no es un accidente: La memoria de IMESEVI. [Internet] México: CENAPRA; 2009. Consultado el 11 de marzo de 2012. Disponible en: http:// www.cenapra.salud.gob.mx/interior/Materiales_CONAPRA/Libros/1._Esto_no_es_un_accidente_1.pdf.
19. Secretaría de Desarrollo Social, Consejo Nacional de Población, Instituto Nacional de Estadística y Geografía. Delimitación de las zonas metropolitanas de México 2005. [Internet] México: Secretaría de Desarrollo Social; 2007. Consultado el 11 de marzo de 2012. Disponible en: http://www.inegi.org.mx/prod_serv/contenidos/espanol/bvinegi/productos/geografia/publicaciones/delimex05/DZMM_2005_0.pdf.
20. Wells JK, Greene MA, Foss RD, Ferguson SA, Williams AF. Drinking drivers missed at sobriety checkpoints. J Stud Alcohol. 1997;58(5):513-7.
21. Brick J, Erickson CK. Intoxication is not always visible: An unrecognized prevention challenge. Alcohol Clin Exp Res. 2009;33(9):1489-507.
22. Raudenbush SW, Bryk AS. Hierarchical linear models: Application and data analysis methods. 2.ª ed. Thousand Oaks, CA: Sage; 2002.
23. Snijders TAB, Bosker RJ. Multilevel analysis: An introduction to basic and advanced multilevel modeling. Londres: Sage, 1999.
24. SAS Institute Inc. SAS/STAT 9 user's guide (Vol. 1-3). Cary, NC: SAS Institute Inc; 2002.
25. Instituto Nacional de Estadística y Geografía. Estadística de accidentes de tránsito terrestre en zonas urbanas y suburbanas (base de datos en línea). [Internet] México: INEGI. Consultado el 11 de marzo de 2012. Disponible en: http://www.inegi.org.mx/est/contenidos/Proyectos/registros/economicas/accidentes/default.aspx.
26. Preusser DF, Ferguson SA, Williams AF. The effect of teenage passengers on the fatal crash risk of teenage drivers. Accid Anal Prev. 1998;30(2):217-22.
27. Chen LH, Baker SP, Braver ER, Li G. Carrying passengers as a risk factor for crashes fatal to 16- and 17-year old drivers. JAMA. 2000;283(12):1578-82.
28. Rice TM, Peek-Asa C, Kraus JF. Nighttime driving, passenger transport, and injury crash rates of young drivers. Inj Prev. 2003;9:245-50.
29. Smith PF, Remington PL. The epidemiology of drinking and driving: Results from the behavioral risk factor surveillance system, 1986. Health Educ Behav. 1989;16(3):345-58.
30. Bergdahl J. Sex differences in attitudes toward driving: A survey. Social Science J. 2005;42(4):595-601.
31. Conferencia Nacional de Gobernadores. Acuerdo por el que se da a conocer la Estrategia Nacional Sobre Seguridad Vial 2011-2020, acuerdo 7 de la XLI Reunión Ordinaria de la Conferencia Nacional de Gobernadores (27 de mayo de 2011).
32. Asamblea General de las Naciones Unidas, resolución 64/255 (10 de mayo de 2010).
33. Shadish WR, Cook TD, Campbell DT. Experimental and quasi-experimental designs for generalized causal inference. Boston, MA: Houghton Mifflin; 2002.