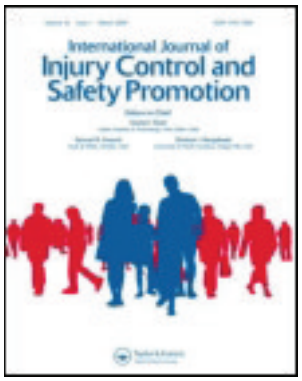

International Journal of Injury Control and Safety Promotion

Publication details, including instructions for authors and subscription information: http://www.tandfonline.com/loi/nics20

The use of seatbelts and child restraints in three Mexican cities

Ricardo Pérez-Núñez [a] , Aruna Chandran [b] , Martha Híjar [a c] , Alfredo Celis [d] , Ma. Socorro Carmona-Lozano [e] , Jeffrey C. Lunnen [b] & Adnan A. Hyder [b]

[a] Centro de Investigación en Sistemas de Salud del Instituto Nacional de Salud Pública , Cuernavaca , México

[b] International Injury Research Unit, Johns Hopkins Bloomberg School of Public Health , Baltimore , Maryland , USA

[c] Fundación Entornos A.C. , Cuernavaca , México

[d] Centro Universitario de Ciencias de la Salud de la Universidad de Guadalajara , Guadalajara , México

[e] Facultad de Medicina de la Universidad de Guanajuato , Campus León, Leon , México

Published online: 14 Jan 2013.

To cite this article: Ricardo Pérez-Núñez , Aruna Chandran , Martha Híjar , Alfredo Celis , Ma. Socorro Carmona-Lozano , Jeffrey C. Lunnen & Adnan A. Hyder (2013) The use of seatbelts and child restraints in three Mexican cities, International Journal of Injury Control and Safety Promotion, 20:4, 385-393, DOI: 10.1080/17457300.2012.754477

To link to this article: http://dx.doi.org/10.1080/17457300.2012.754477

International Journal of Injury Control and Safety Promotion, 2013
Vol. 20, No. 4, 385–393, http://dx.doi.org/10.1080/17457300.2012.754477

The use of seatbelts and child restraints in three Mexican cities

Ricardo Pérez-Núñez[a], Aruna Chandran[b*], Martha Híjar[a,c], Alfredo Celis[d], Ma. Socorro Carmona-Lozano[e], Jeffrey C. Lunnen[b] and Adnan A. Hyder[b]

[a]*Centro de Investigación en Sistemas de Salud del Instituto Nacional de Salud Pública, Cuernavaca, México;* [b]*International Injury Research Unit, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA;* [c]*Fundación Entornos A.C., Cuernavaca, México;* [d]*Centro Universitario de Ciencias de la Salud de la Universidad de Guadalajara, Guadalajara, México;* [e]*Facultad de Medicina de la Universidad de Guanajuato, Campus León, Leon, México*

(*Received 31 May 2012; final version received 22 November 2012*)

Seatbelts and child restraints can reduce deaths resulting from road traffic crashes, and are one of the risk factors being targeted by the Road Safety in 10 Countries project in Mexico. This study quantifies the prevalence of restraint use in two of the intervention sites (Guadalajara-Zapopan and León) and one comparison site (Cuernavaca). Three rounds of roadside observations were conducted between November 2010 and January 2012. The overall prevalence of seatbelt use was 45.0% (95% CI = 44.3–45.7) amongst all occupants ≥10 years of age in the three cities. Child restraint use in children <5 years of age ranged from 7.9 to 17.4%. Two rounds of surveys were administered to all road traffic injury (RTI) victims presenting at a tertiary hospital in each city; RTI victims had lower seatbelt use than the general population (31% vs 42%, $p = 0.037$). This study demonstrates the need for further targeted intervention to increase use of these highly efficacious safety devices in Mexico.

Keywords: road safety; seatbelts; child restraints; Mexico; LMICs; injury

Introduction

Road traffic crashes are an important cause of mortality, resulting in nearly 1.3 million deaths and between 20–50 million injuries worldwide each year. According to the World Health Organization (WHO), in the region of the Americas there were approximately 140,000 road traffic fatalities in 2006. The majority of these road traffic fatalities occurred in three countries: the United States (42,642); Brazil had the second highest number of road traffic fatalities (35,155); and Mexico (17,003) (Organización Panamericana de la Salud, 2009). A recent study highlights the fact that the already high official number of fatalities associated with road traffic injuries in Mexico is likely underestimated by 18 to 45 percent (Hijar et al., 2012).

Studies have shown that wearing a seatbelt reduces the risk of fatality from a road traffic crash by 40–50% among front seat passengers and 25–75% among rear-seat passengers (Elvik & Vaa, 2004; Zhu, Cummings, Chu, & Cook, 2007). Child restraints, if correctly installed and properly used, can reduce deaths from road traffic crashes by 70% in infants and 54–80% in small children (Zaza, Sleet, Thompson, Sosin, & Bolen, 2001). Previous studies carried out in Mexico have also shown that seatbelt use is associated with fewer and less severe injuries (Hijar-Medina, Flores-Aldana, & Lopez-Lopez, 1996; Peñuelas, Leo-Amador, & Ferniza-Mattar, 1989). The WHO's *Global Status Report on Road Safety* documents that although there are laws requiring seatbelt and child restraint use in Mexico, perceptions of utilization and enforcement are sporadic (World Health Organization, 2009). Since 2003, the Mexican Federal Law has mandated that all occupants of private or public transport cars must use seatbelts (Consejo de Salubridad General, 2003). However, there is very little systematically collected information on restraint use in Mexico; 2010 administrative data obtained for urban and suburban areas from police crash reports shows 0% use in Cuernavaca, 3% use in León and 24% use in Guadalajara-Zapopan (Instituto Nacional de Estadística y Geografía, 1999-2010). A one-month survey across four hospitals in Guadalajara during 2007 reported that 39% (95% CI: 30, 49) of traffic injury victims were wearing a seatbelt at the time of the crash (Author's unpublished data, methodology employed for this estimation has been published elsewhere (Pérez-Núñez et al., 2011)).

In 2008, the Mexican government launched a national road safety initiative funded by the Bloomberg Philanthropies called IMESEVI (*Iniciativa Mexicana de Seguridad Vial*). Both Guadalajara-Zapopan and León were among the four cities that were part of IMESEVI. In 2010, the Bloomberg Philanthropies funded an international

*Corresponding author. Email: archandr@jhsph.edu

consortium for a project entitled *Road Safety in 10 Countries* (RS-10), of which Mexico is a part (Hyder et al., 2012). Mexico chose Guadalajara-Zapopan and León among other cities as the initial sites and restraint use was selected as one of the targeted risk factors.

In order to assess the ongoing impact of the various implementation activities on restraint use prevalence, the Johns Hopkins International Injury Research Unit (JH-IIRU, Baltimore, USA) and the *Instituto Nacional de Salud Pública* (Cuernavaca, México) are conducting a series of observational studies in the two intervention cities (Guadalajara-Zapopan and León), as well as a third city (Cuernavaca) that is not specifically a target of the efforts funded by the Bloomberg Philanthropies. This paper provides an assessment of the prevalence of seatbelt and child restraint use in these three Mexican cities: Guadalajara-Zapopan, León and Cuernavaca, during the initial two years of the RS-10 project. Of note is that all three cities have sub-national legislation for obligatory use of seatbelts; the compulsory use of child restraint devices is only legislated in Guadalajara (Gobierno del Estado de Jalisco, 2010; Gobierno del Estado de Morelos, 2006; H. Ayuntamiento del Municipio de León, 2009; Ley de los servicios de vialidad, tránsito y transporte del Estado de Jalisco, 2010; Reglamento de Tránsito y transportes para el Estado de Morelos, 2006).

Material and methods

We present primary data obtained from two different sources: observational studies and a hospital survey of injured people attended for RTI. The methods utilized are described separately.

Observational study methodology

Three rounds of roadside observational studies were conducted in November–December of 2010, June–July of 2011 and December 2011–January 2012. The sample size was calculated using the registered vehicle fleet, 3% precision, and the expected prevalence of seatbelt use obtained from previous studies (CENAPRA, 2009; Hijar-Medina et al., 1996). From the list of all intersections containing functioning traffic lights in the municipalities of Guadalajara-Zapopan, León and Cuernavaca, a random sample of 3% was extracted. The estimated sample size was assigned proportionally to the number of selected sites. The order of site observations and the time of day in which the data were collected were determined randomly. Intersections at which observer safety would be compromised were eliminated from the list and replaced with another site (N = 1). There were a total of 49 observation sites in the cities of Guadalajara-Zapopan,17 in León and 15 in Cuernavaca. The direction of traffic to be observed was selected randomly upon arrival; it was the same for the three rounds of observations. Only two vehicles per traffic light were selected in a systematic manner, depending on the number of lanes: (a) on streets with one lane: the first and the third car; (b) on streets with two lanes: the first car of left lane and the second car in the right lane; (c) on streets with three or more lanes: the first car in the leftmost lane and the second car in the subsequent lane to the right. This selection method was applied consistently in all sites, cities and rounds of observation. In 25 cars (11 in the first, 5 in the second and 9 in the third round), observations were not possible due to tinted windows. No data from buses or cargo trucks were collected.

All observations were made by a single staff member trained in the study design and methodology, as well as the principles of human subjects research and ethics. Each site was staffed by a supervisor and one observer who worked for no more than 1.5 hours at a time to maximize attentiveness in reporting. The same observer collected data for all sites in each of the three cities and during all rounds of observations. Observations were done over the course of one week, on every day of the week and at different times throughout the day (only during daylight hours, from 08:35 to 18:50). The observer collected information on the observation sites (date, starting and ending time, weather conditions, number of lanes) as well as the automobile (number of passengers, headlights running, type) and the driver: sex, approximate age group (<5 years, 5–9 years and 10 or more) and use of seatbelt or child restraints. Pilot testing of the observational data collection form was done.

Hospital survey methodology

A hospital-based survey was administered at the primary hospital to which victims of most motor vehicle crashes and other trauma present in each of the three cities, as part of a pilot RT injury hospital surveillance program. A list of all road traffic crash victims who were brought to the emergency department for care over a two week period, 24 hours per day, was obtained for two different time periods, December 2010–January 2011 and July to October 2011. These individuals were approached and, after obtaining informed consent, were interviewed regarding basic demographics and risk factor behaviour immediately preceding the crash.

Data analysis

Analyses were conducted using STATA 12®. Univariate analysis was conducted to report summary measures for each city (frequencies and percentages for nominal and ordinal variables; dispersion and central tendencies for continuous variables). Analysis of road traffic injury victims' characteristics included the computation of Pearson's chi-squared test for equal proportions. The use

of Fisher exact test was calculated when small expected values (<5) were observed. Two logistic regression models were subsequently fitted in order to evaluate factors associated with both observed seatbelt use for those aged 10 or older and use of child restraints in children <10 years of age. A first model included all variables available from the occupant, the car and the sites that were thought to be related to seatbelt and child restraint use and found to be associated at the bivariate analysis with a *P*-value <.25 in order to control for possible confounding effects. Using a backwards elimination approach, the final model included all variables showing statistical significance and adjusted by sex. To identify multicolinearity of variables included in final models, the variance inflation factor test was evaluated. The final models were assessed in terms of their residuals and leverage.

Ethical issues

All studies were approved by the Institutional Review Boards of the Johns Hopkins Bloomberg School of Public Health in the USA and the *Instituto Nacional de Salud Pública* in Mexico, as well as the boards of the participating hospitals. For the hospital survey study, informed consent was obtained from all participants prior to data collection.

Results

Observational studies

A total of 12,064 four-wheeled motor vehicles were observed over 3 cycles: 50.1% were from Guadalajara-Zapopan (N = 6,040), 25.2% from Leon (N = 3,045) and 24.7% from Cuernavaca (N = 2,979). Of these, 60.0% were private cars, 11.0% taxis and 28.7% trucks or vans. Eight percent of vehicles were observed with their headlights running ($n = 970$). Seventy-seven percent of the vehicles were driven by a man ($n = 9{,}260$). A total of 55.8% (n = 6,728) of vehicles were occupied only by the driver, 29.8% ($n = 3{,}601$) by two occupants, and 14.4% ($n = 1{,}735$) by three or more individuals; on average, there were 1.6 occupants per vehicle. There were small differences in the vehicle profiles across the rounds of observations (Table 1); the first observation had a higher number of private cars and number of cars with daytime running headlights ($p = 0.000$).

The prevalence of restraint use (both seatbelt and child restraints) by round of observation is shown in Table 2. In general, seatbelt use has remained stable over time in all three cities. The prevalence of seatbelt use across all three rounds of observations for all vehicle occupants aged 10 or more was 40.0% (95% CI: 38.6, 41.4) in León, 43.5% (95% CI = 42.4, 44.5) in Guadalajara-Zapopan, and highest in Cuernavaca (52.9%; 95% CI = 51.5, 54.4). In all cities, seatbelt use was higher in drivers than passengers; 53.2% (95% CI = 51.4, 55.0) in León, 53.9% (95% CI = 52.7, 55.2) in Guadalajara-Zapopan, and 73.7% (95% CI: 72.1, 75.3) in Cuernavaca.

The proportion of children <5 years of age using any type of child restraint device was extremely low in all three cities: 10.6% (95% CI 6.7, 15.8) in León, 17.4% (95% CI: 13.5, 22.0) in Guadalajara-Zapopan, and 7.9% (95% CI: 3.7, 14.5) in Cuernavaca.

Regression analysis results showed that women, drivers, travelling by taxi and being in a car with daytime running headlights were associated with higher prevalence of seatbelt use (Table 3). When compared to the first round of observation, prevalence of seatbelt use increased during the second round of observation and returned to similar figures for the third round in Cuernavaca. A small decrease was observed in León for the second round that, again, returned to similar values in the third round when compared to the first. The odds of seatbelt use in Guadalajara-Zapopan increased slightly in the third observation round compared to the first ($p = 0.001$). Prevalence of seatbelt use was higher in Cuernavaca for all three measurements.

Factors associated with child restraint use were age (<5 years) and travelling in a car with running headlights. Travelling in a taxi was found to be negatively associated with child restraint use, as well as travelling at noon and in the afternoon, compared to those travelling in the morning. Child restraint use increased in Guadalajara-Zapopan for the third round of observation, however it decreased in Cuernavaca. The wide confidence intervals shown for Guadalajara-Zapopan and León in Table 3, as a result of small sample size, makes it difficult to reach any final conclusions.

Hospital survey

The demographic characteristics of the population surveyed at the hospitals in all three cities were similar in terms of sex, age, type of road user and outcome (Table 4). A total of 192 individuals were surveyed across the two rounds: 60 in León, 95 in Guadalajara-Zapopan and 37 in Cuernavaca. The prevalence of seatbelt use among road traffic injury victims presenting to the emergency rooms in the three hospitals over both two-week periods was 31.0% (95% CI: 15.3, 50.8) in León, 30.3% (95% CI = 15.6, 48.7) in Guadalajara and 31.3% (95% CI = 11.0, 58.7) in Cuernavaca. Importantly, the prevalence of seatbelt use among those injured in road traffic crashes was less than that observed in the general population.

Discussion

Overall, there is limited systematically collected risk factor information related to road traffic crashes in Mexico; our study is unique in that it is among the first to employ

Table 1. Vehicle and demographic characteristics of the sample of vehicles observed, by round of observation in México, 2010–2012, N (%).

	León				Guadalajara-Zapopan				Cuernavaca			
Variables	1st	2nd	3rd	*P*-Value	1st	2nd	3rd	*P*-Value	1st	2nd	3rd	*P*-Value
Vehicles with running headlights												
No	1,471 (89.04)	1,610 (93.33)	1,631 (91.94)	0.000	2,810 (86.86)	3,047 (93.10)	2,989 (93.06)	0.000	1,546 (92.57)	1,500 (95.79)	1,657 (95.89)	0.000
Yes	181 (10.96)	115 (6.67)	143 (8.06)		425 (13.14)	226 (6.90)	223 (6.94)		124 (7.43)	66 (4.21)	71 (4.11)	
Type of car												
Car	1,046 (63.32)	803 (46.6)	903 (51.07)	0.000	2,571 (79.45)	1,760 (53.89)	1,915 (59.69)	0.000	1,215 (72.93)	837 (53.52)	925 (53.59)	0.000
Taxi	164 (9.93)	163 (9.46)	171 (9.67)		194 (6.00)	248 (7.59)	199 (6.20)		299 (17.95)	335 (21.42)	365 (21.15)	
Truck or Van	442 (26.76)	757 (43.93)	694 (39.25)		471 (14.56)	1,258 (38.52)	1,094 (34.10)		152 (9.12)	392 (25.06)	436 (25.26)	
Sex												
Female	526 (31.82)	549 (31.86)	603 (34.13)	0.253	1,256 (38.80)	1,295 (39.55)	1,280 (39.99)	0.615	626 (37.55)	523 (33.40)	636 (36.85)	0.032
Male	1,127 (68.18)	1,174 (68.14)	1,164 (65.87)		1,981 (61.20)	1,979 (60.45)	1,921 (60.01)		1,041 (62.45)	1,043 (66.60)	1,090 (63.15)	
Age of passengers												
<5 years	75 (4.54)	71 (4.11)	52 (2.93)	0.001	128 (3.95)	104 (3.17)	89 (2.77)	0.052	32 (1.91)	34 (2.17)	48 (2.78)	0.309
5–9 years	59 (3.57)	107 (6.20)	95 (5.36)		137 (4.23)	162 (4.93)	140 (4.36)		45 (2.69)	32 (2.04)	46 (2.66)	
>9 years	1,519 (91.89)	1,548 (89.69)	1,627 (91.71)		2,975 (91.82)	3,017 (91.90)	2,985 (92.87)		1,597 (95.40)	1,500 (95.79)	1,634 (94.56)	
Position in the car												
Driver	1,015 (61.4)	1,016 (58.86)	1,014 (57.16)	0.006	2,015 (62.19)	2,011 (61.25)	2,014 (62.66)	0.049	1,001 (59.80)	975 (62.26)	1,003 (58.04)	0.057
Passenger, front seat	454 (27.47)	462 (26.77)	486 (27.40)		850 (26.23)	872 (26.56)	834 (25.95)		438 (26.16)	383 (24.46)	434 (25.12)	
Passenger, back seat (2nd row)	176 (10.65)	243 (14.08)	269 (15.16)		364 (11.23)	388 (11.82)	366 (11.39)		230 (13.74)	204 (13.03)	282 (16.32)	
Passenger, back seat (3rd row)	8 (0.48)	5 (0.29)	5 (0.28)		11 (0.34)	12 (0.37)	0 (0)		5 (0.3)	4 (0.26)	9 (0.52)	

Table 2. Prevalence of seatbelt and child restraint use in three Mexican cities, 2010–2012.

	León			Guadalajara-Zapopan			Cuernavaca		
Type of occupant	Observation 1	Observation 2	Observation 3	Observation 1	Observation 2	Observation 3	Observation 1	Observation 2	Observation 3
All occupants ≥10 years	**43.7 (41.2, 46.2)**	**38.2 (35.8, 40.7)**	**38.3 (35.9, 40.7)**	**43.1 (41.3, 44.9)**	**42.2 (40.4, 44.0)**	**45.2 (43.4, 47.0)**	**54.1 (51.7, 56.6)**	**56.2 (53.6, 58.7)**	**48.7 (46.2, 51.1)**
Males	44.7 (41.6, 47.8)	41.0 (38.0, 44.0)	40.8 (37.9, 43.8)	41.1 (38.8, 43.4)	41.5 (39.2, 43.8)	43.3 (40.9, 45.6)	62.8 (59.7, 65.8)	63.7 (60.6, 66.7)	58.4 (55.3, 61.4)
Females	41.4 (36.9, 46.0)	32.1 (28.0, 36.5)	33.2 (29.3, 37.3)	46.2 (43.3, 49.2)	43.2 (40.3, 46.1)	48.0 (45.1, 50.8)	39.4 (35.4, 43.5)	40.9 (36.5, 45.3)	31.4 (27.7, 35.4)
Drivers	**54.2 (51.1, 57.4)**	**52.5 (49.3, 55.6)**	**52.9 (49.8, 56.0)**	**52.5 (50.3, 54.7)**	**52.9 (50.7, 55.1)**	**56.4 (54.2, 58.6)**	**72.5 (69.6, 75.2)**	**77.4 (74.7, 80.0)**	**71.3 (68.4, 74.2)**
Males	51.6 (48.2, 55.0)	49.5 (46.1, 53.0)	50.5 (47.1, 54.0)	47.5 (44.9, 50.1)	48.6 (46.0, 51.2)	51.8 (49.1, 54.4)	72.3 (69.1, 75.4)	76.7 (73.6, 79.6)	72.6 (69.4, 75.7)
Females	67.7 (60.0, 74.7)	67.9 (60.1, 75.0)	63.6 (56.2, 70.5)	66.5 (62.3, 70.6)	64.1 (59.9, 68.1)	67.2 (63.3, 71.0)	73.4 (66.5, 79.6)	80.8 (74.3, 86.2)	65.9 (58.6, 72.7)
Front-seat passengers ≥10 years	**27.6 (23.2, 32.2)**	**14.7 (11.4, 18.6)**	**20.2 (16.5, 24.3)**	**28.6 (25.4, 32.0)**	**25.7 (22.6, 28.9)**	**27.1 (23.9, 30.4)**	**32.0 (27.5, 36.8)**	**23.1 (18.9, 27.8)**	**20.5 (16.7, 24.8)**
Males	18.7 (12.9, 25.8)	9.8 (5.8, 15.2)	12.8 (8.3, 18.6)	18.8 (14.4, 24.0)	18.8 (14.4, 23.9)	13.3 (9.6, 17.8)	29.4 (21.6, 38.1)	21.0 (14.9, 28.2)	14.7 (9.6, 21.3)
Females	33.2 (27.3, 39.5)	18.6 (13.7, 24.4)	25.6 (20.3, 31.5)	34.2 (30.0, 38.7)	29.7 (25.7, 34.0)	35.5 (31.2, 40.1)	33.2 (27.8, 39.0)	24.8 (19.0, 31.2)	24.1 (19.0, 29.9)
Rear-seat passengers ≥10 years	**2.9 (0.6, 8.1)**	**1.4 (0.2, 5.1)**	**0.0 (0.0, 2.0)***	**4.9 (2.4, 8.8)**	**5.4 (2.9, 9.1)**	**4.6 (2.2, 8.3)**	**4.3 (1.9, 8.3)**	**2.5 (0.7, 6.2)**	**0.0 (0.0, 1.6)***
Males	4.4 (0.5, 15.1)	0.0 (0.0, 8.0)*	0.0 (0.0, 5.0)*	3.7 (0.8, 10.3)	3.8 (1.0, 9.5)	4.7 (1.3, 11.5)	9.4 (3.5, 19.3)	1.7 (0.0, 9.2)	0.0 (0.0, 4.6)*
Females	1.7 (0.0, 8.9)	2.1 (0.3, 7.5)	0.0 (0.0, 3.3)*	5.7 (2.3, 11.4)	6.7 (3.1, 12.4)	4.5 (1.7, 9.6)	1.6 (0.2, 5.8)	2.9 (0.6, 8.2)	0.0 (0.0, 2.5)*
All passengers <10 years	**9.0 (4.7, 15.1)**	**7.3 (3.9, 12.2)**	**4.1 (1.5, 8.7)**	**14.7 (10.7, 19.6)**	**10.2 (6.8, 14.4)**	**14.8 (10.5, 20.1)**	**7.8 (2.9, 16.2)**	**15.2 (7.5, 26.1)**	**1.1 (0.0, 5.8)**
Males	6.2 (2.0, 13.8)	5.7 (2.1, 11.9)	2.2 (0.3, 7.9)	13.7 (8.6, 20.4)	12.9 (7.8, 19.6)	13.4 (8.4, 20.0)	8.9 (2.5, 21.2)	8.6 (1.8, 23.1)	2.3 (0.1, 12.3)
Females	13.2 (5.5, 25.3)	9.7 (4.0, 19.0)	6.9 (1.9, 16.7)	16.0 (9.9, 23.8)	7.1 (3.3, 13.1)	17.5 (9.9, 27.6)	6.3 (0.8, 20.8)	22.6 (9.6, 41.1)	0.0 (0.0, 7.0)*
All passengers <5 years	**16.0 (8.6, 26.3)**	**8.5 (3.2, 17.5)**	**5.8 (1.2, 15.9)**	**19.5 (13.1, 27.5)**	**13.5 (7.6, 21.6)**	**19.1 (11.5, 28.8)**	**6.3 (0.8, 20.8)**	**20.6 (8.7, 37.9)**	**0.0 (0.0, 7.4)***
Males	12.5 (4.2, 26.8)	7.7 (2.1, 18.5)	3.0 (0.1, 15.8)	18.4 (10.5, 29.0)	15.4 (6.9, 28.1)	14.9 (7.4, 25.7)	7.4 (0.9, 24.3)	11.8 (1.5, 36.4)	0.0 (0.0, 14.8)*
Females	20.0 (8.4, 36.9)	10.5 (1.3, 33.1)	10.5 (1.3, 33.1)	21.2 (11.1, 34.7)	11.5 (4.4, 23.4)	31.8 (13.9, 54.9)	0.0 (0.0, 52.2)*	29.4 (10.3, 56.0)	0.0 (0.0, 13.7)*

*One-sided, 97.5% confidence interval.

Table 3. Factors associated with restraint use in three Mexican cities, 2010–2012.

		Children <10 years					Passengers ≥10 years				
Variable		OR	95% CI			*P*-Value	OR	95% CI			*P*-Value
Sex	Women	1					1				
	Men	0.736	0.507	-	1.066	0.105	0.570	0.526	-	0.617	0.000
Age group	Aged <5 years	1									
	Aged 5–9 years	0.504	0.354	-	0.718	0.000					
Type of passenger	Driver						1				
	Front seat passenger						0.175	0.161	-	0.190	0.000
	Rear seat passenger						0.013	0.009	-	0.018	0.000
Cuernavaca	1st observation	1					1				
	2nd observation	1.970	0.605	-	6.418	0.261	1.202	1.008	-	1.432	0.040
	3rd observation	0.102	0.011	-	0.933	0.043	0.849	0.716	-	1.007	0.061
León	1st observation	1					1				
	2nd observation	0.388	0.091	-	1.659	0.201	0.772	0.605	-	0.985	0.038
	3rd observation	4.957	0.435	-	56.536	0.197	1.100	0.862	-	1.403	0.443
Guadalajara-Zapopan	1st observation	1					1				
	2nd observation	0.478	0.126	-	1.809	0.277	0.968	0.780	-	1.201	0.766
	3rd observation	13.638	1.351	-	137.687	0.027	1.431	1.155	-	1.772	0.001
Type of vehicle	Car	1					1				
	Taxi	0.122	0.017	-	0.888	0.038	1.449	1.297	-	1.619	0.000
	Truck or Van	1					0.711	0.655	-	0.773	0.000
Cars without running headlights		1					1				
Cars with running headlights		2.360	1.160	-	4.800	0.018	2.308	1.991	-	2.674	0.000
Weather	Rain						1				
	Dry						1.312	1.111	-	1.549	0.001
Road type	1–2 lanes						1				
	3–5 lanes						1.176	1.091	-	1.268	0.000
Day of observation	Weekend						1				
	Weekday						0.788	0.726	-	0.856	0.000
Time of observation	08:00–12:00	1					1				
	12:00–15:59	0.529	0.335	-	0.838	0.007	0.906	0.830	-	0.988	0.026
	16:00–19:00	0.339	0.170	-	0.675	0.002	0.712	0.624	-	0.811	0.000
MODEL FIT:	# Observations = 1,453							18,231			
	Prob > chi^2 = 55.910							2422.51			
	Pseudo R = 0.0856							0.1663			
	Log likelihood = −437.2969							−10457.189			

Table 4. Characteristics of road traffic injury victims, 2010–2011.

	Number (%)								
	León			Guadalajara-Zapopan			Cuernavaca		
Variables	Observation 1	Observation 2	*P*-value	Observation 1	Observation 2	*P*-value	Observation 1	Observation 2	*P*-value
Injury victims									
Sex									
Male	20 (62.5)	23 (82.1)	0.092	30 (61.2)	30 (65.2)	0.687	14 (77.8)	17 (89.5)	0.405*
Female	12 (37.5)	5 (17.7)		19 (38.8)	16 (34.8)		4 (22.2)	2 (10.5)	
Age Group									
0–9 years	1 (3.1)	2 (7.1)	0.877*	4 (8.2)	9 (19.6)	0.092*	0 (0.0)	0 (0.0)	0.048*
10–19 years	6 (18.75)	7 (25.0)		15 (30.6)	10 (21.7)		2 (11.1)	4 (21.1)	
20–34 years	17 (53.1)	13 (46.4)		6 (12.2)	13 (28.3)		13 (72.2)	5 (26.3)	
35–59 years	4 (12.5)	4 (14.3)		19 (38.8)	11 (23.9)		2 (11.1)	6 (31.6)	
60 and more years	4 (12.5)	2 (7.1)		5 (10.2)	3 (6.5)		1 (5.6)	4 (21.1)	
Road user									
Pedestrian	4 (12.5)	2 (7.1)	0.671*	12 (24.5)	9 (19.6)	0.123*	2 (11.1)	5 (26.3)	.803*
Cyclist	6 (18.8)	3 (10.7)		3 (6.1)	12 (26.1)		1 (5.6)	1 (5.3)	
Motorcyclist	7 (21.9)	9 (32.1)		11 (22.5)	8 (17.4)		5 (27.8)	4 (21.1)	
Car occupant	15 (46.9)	14 (50.0)		19 (38.8)	14 (30.4)		9 (50.0)	7 (36.8)	
Other - Non Specified	0 (0.0)	0 (0)		4 (8.2)	3 (6.5)		1 (5.6)	2 (10.5)	
Received medical attention prior to hospital arrival									
Yes	3 (9.4)	8 (28.6)	0.000*	39 (79.6)	38 (82.6)	1.000*	1 (5.6)	5 (26.3)	0.085*
No	27 (84.4)	8 (28.6)		6 (12.2)	5 (10.9)		15 (83.3)	13 (68.4)	
Don't know/no response	2 (6.3)	12 (42.9)		4 (8.2)	3 (6.5)		2 (11.1)	1 (5.3)	
Final disposition									
Discharged from ER	13 (40.6)	14 (50.0)	.366*	30 (61.2)	26 (56.5)	0.057*	5 (27.8)	8 (42.1)	0.348*
Hospitalized	19 (59.4)	13 (46.4)		9 (18.4)	18 (39.1)		10 (55.6)	11 (57.9)	
Died	0 (0.0)	1 (3.6)		3 (6.1)	1 (2.2)		0 (0.0)	0 (0.0)	
Other - Non Specified	0 (0.0)			7 (14.3)	1 (2.2)		3 (16.7)	0 (0.0)	
Only car occupants									
Position									
Driver	5 (33.3)	5 (35.7)	0.103*	2 (10.5)	6 (42.9)	0.047*	3 (33.3)	5 (71.4)	.205*
Front seat passenger	4 (26.7)	4 (28.6)		3 (15.8)	2 (14.3)		5 (55.6)	1 (14.3)	
Rear seat passenger	1 (6.7)	4 (28.6)		11 (57.9)	3 (21.4)		0 (0.0)	0 (0.0)	
Bed of pick-up truck	0 (0.0)	1 (7.1)		0 (0.0)	2 (14.3)		0 (0.0)	0 (0.0)	
Other - Non Specified	5 (33.3)	0 (0.0)		3 (15.8)	1 (7.1)		1 (11.1)	1 (14.3)	
Seatbelt use									
Yes	4 (26.7)	5 (35.7)	0.304*	4 (21.1)	6 (42.9)	0.258*	2 (22.2)	3 (42.9)	0.633*
No	8 (53.3)	9 (64.3)		11 (57.9)	4 (28.6)		5 (55.6)	4 (57.1)	
Don't know/no response	3 (20.0)	0 (0)		4 (21.1)	4 (28.6)		2 (22.2)	0 (0.0)	

Note: Percentage may not sum 100 due to rounding.
*P-value associated to Fisher exact test, otherwise Pearson's test was performed.

serial roadside observations using identical methodology in order to quantify restraint use prevalence over time. Official administrative records do not allow us to evaluate the extent of the problem since traditionally little attention has been paid to filling out restraint information on crash report forms correctly or completely. There is a need for systematic rigorous data collection both in police and medical records on seatbelt/child restraint use in order to monitor and evaluate trends in use over time.

The average prevalence of seatbelt and child restraint use was 42.2% (95% CI: 41.6, 42.9) in the three Mexican cities of León, Guadalajara-Zapopan and Cuernavaca. Our estimations for León and Guadalajara are consistent with what has been reported previously (CENAPRA, 2009). Only one study has estimated seatbelt use around Cuernavaca; it was for the highway that connects Cuernavaca with Mexico City (Hijar-Medina, Carrillo-Ordaz, Flores-Aldana, Anaya, & Lopez-Lopez, 1999). This report estimated a prevalence of 63.5% in 1994 and of 76.6% in 1996 which is slightly higher than what was found in our study. Interestingly, seatbelt use in our study is significantly higher than what has been reported for other Mexican cities such as Ciudad Juárez (22.6%) (Híjar-Medina & Vázquez-Vela, 2003).

The seatbelt use prevalence found in our study is lower than the figures reported for most of the countries in the American region (48–93%) according to the *Status Report on Road Safety in the Americas* (Organización Panamericana de la Salud, 2009). However, the prevalence is higher than recent reports from Argentina which estimate seatbelt use in the city of Santa Fe to be roughly 9% (Beltramino & Carrera, 2007). As expected, use prevalence is slightly higher in drivers as opposed to passengers; however the use is still remarkably low even in drivers.

There was a modest but statistically significant increase in the odds of seatbelt use in Guadalajara-Zapopan over the 18 month time period; however, no such improvement was evident in León or Cuernavaca. It will be important to see if the increase in Guadalajara-Zapopan is sustained over time, and if use prevalence changes in the other cities as well. The results documented in this study are of importance for policy makers at the national and local levels, particularly within the context of ongoing road safety initiatives. There is a substantial need for continued efforts to improve seatbelt use in these and other Mexican cities.

Furthermore, our study showed that only one out of ten children used a restraint during this time period; these figures are similar to what was reported by the Mexican Ministry of Health three years earlier (CENAPRA, 2009). There is an urgent need and substantial room for improvement in this area. It might be interesting to identify what are the strategies that authorities from Cuernavaca (i.e. level of enforcement) are employing in order to present higher prevalence of seatbelt use compared to León and Guadalajara-Zapopan.

As expected, our study showed a lower prevalence of seatbelt use among victims of road traffic injuries as compared with the general population. Long-term hospital based surveillance and larger sample size will be needed to assess this trend over time.

Our study had several limitations. First, the hospital surveys conducted over two separate two-week periods resulted in a very small sample size. Longer-term surveillance will be needed in order to accurately estimate the association between road traffic injuries and seatbelt use. Secondly, our roadside observations, for logistic and safety reasons, were restricted to daylight hours. It is likely that seatbelt use is even lower at night, when often the risk of road traffic crashes is higher. It would be important to assess the prevalence of night-time seatbelt/child restraint use in future studies. We will continue conducting serial roadside observations over the next 2 years of the Road Safety in 10 Countries project in these same target cities (Guadalajara-Zapopan and León) in order to assess over time the impact of large road safety initiatives on restraint use behavior. The low restraint usage rates observed in these three Mexican cities show the importance of strengthening the interventions being implemented in Guadalajara-Zapopan and León, as well as the need to start working in Cuernavaca and other Mexican cities in order to improve seatbelt/child restraint use with the potential to significantly impact road traffic safety across Mexico.

Acknowledgements

We acknowledge the hospital personnel and local and federal ministry officials who supported our work. We thank our observation team (Daniel Vera-López and Jose Carlos de la Peña) and our hospital interviewers (Vannessa F. Jacobo Zepeda, Édgar Turrubiates, Carolina López Rivas, Mariana Ambriz, Martha L. Castañeda Cediel, Marlene Serrano Almeida, Diego Hernández Díaz, Julio C. Soto Ríos, David J. Carrillo García, Laura C. Arenas Sandoval, David J. Carrillo García, Daynis N. Reyes Moreno). We also thank Elisa Hidalgo Solórzano for her advice, and Jorge M. Rodríguez-Hernández for coordinating part of the fieldwork in Cuernavaca. Finally, we would like to give very special thanks to all the injured patients that agreed to participate in this study, allowing us to learn from their experiences. This study was supported by the Bloomberg Philanthropies, New York, NY, USA, under the Road Safety in 10 Countries Project.

References

Beltramino, J.C., & Carrera, E. (2007). Traffic law compliance in the city of Santa Fe, Argentina. *Revista Panamericana de Salud Publica*, *22*(2), 141–145. doi: S1020-49892007000700009 [pii]

CENAPRA. (2009). *Iniciativa Mexicana de Seguridad Vial y Prevención de Lesiones en el Tránsito (IMESEVI). Construcción de Línea Base. Reporte final* (1a ed.). México, DF: Secretaría de Salud.

Consejo de Salubridad General. (2003). *ACUERDO por el que se establecen diversas medidas de protección tendientes a disminuir la ocurrencia y el impacto de los accidentes de tránsito*. México, DF.

Elvik, R., & Vaa, T. (2004). *The Handbook of Road Safety Measures*. Amsterdam: Elsevier Science.

Hijar-Medina, M.C., Carrillo-Ordaz, C.E., Flores-Aldana, M.E., Anaya, R., & Lopez-Lopez, M.V. (1999). Risk factors for injuries caused by traffic accidents and the impact of an intervention on the road. *Rev Saude Publica Revista de Saúde Pública*, *33*(5), 505–512.

Hijar, M., Chandran, A., Pérez-Núñez, R., Lunnen, J.C., Rodriguez-Hernandez, J.M., & Hyder, A.A. (2012). Quantifying the underestimated burden of road traffic mortality in Mexico: A comparison of three approaches. *Traffic Injury Prevention*, *13*(Suppl 1), 5–10. doi: 10.1080/15389588.2011.631065

Hijar-Medina, M.C., Flores-Aldana, M.E., & Lopez-Lopez, M.V. (1996). Safety belt use and severity of injuries in traffic accidents. *Salud Puública de Méexico*, *38*(2), 118–127.

Híjar-Medina, M., & Vázquez-Vela, E. (2003). *Foro nacional sobre accidentes de tránsito en México. Enfrentando los retos a través de una visión intersectorial* (Primera ed.). Cuernavaca, Morelos, México: Instituto Nacional de Salud Pública.

Hyder, A.A., Allen, K.A., Di Pietro, G., Adriazola, C.A., Sobel, R., Larson, K., & Peden, M. (2012). Addressing the implementation gap in global road safety: Exploring features of an effective response and introducing a 10-country program. *American Journal of Public Health*, *102*(6), 1061–01067. doi: 10.2105/AJPH.2011.300563

Instituto Nacional de Estadística y Geografía. (1999–2010). *Accidentes de Tránsito terrestre en zonas urbanas y suburbanas (ATUS) Anual*. México, DF: INEGI.

Ley de los servicios de vialidad, tránsito y transporte del Estado de Jalisco. (2010). Fracción VII del artículo 162 C.F.R.

Organización Panamericana de la Salud. (2009). *Informe sobre el Estado de la Seguridad Vial en la Región de las Américas* (1a ed.). Washington, DC: OPS.

Peñuelas, J.E., Leo-Amador, G.E., & Ferniza-Mattar, E. (1989). Effectiveness of seat belts in automobiles. *Salud Publica MexSalud Pública de México*, *31*(4), 469–472.

Pérez-Núñez, R., Avila-Burgos, L., Hijar-Medina, M., Pelcastre-Villafuerte, B., Celis, A., & Salinas-Rodriguez, A. (2011). Economic impact of fatal and non-fatal road traffic injuries in Guadalajara Metropolitan Area and Jalisco, Mexico. *Injury Prevention*, *17*(5), 297–303. doi: ip.2010.027995 [pii] 10.1136/ip.2010.027995

Reglamento de Tránsito Municipal de León. (2009). Fracción VII del artículo 7 C.F.R.

Reglamento de Tránsito y transportes para el Estado de Morelos. (2006). Artículo 69. C.F.R. § Capítulo V.

World Health Organization. (2009). *Global status report on road safety: Time for action*. Geneva: World Health Organization.

Zaza, S., Sleet, D.A., Thompson, R.S., Sosin, D.M., & Bolen, J.C. (2001). Reviews of evidence regarding interventions to increase use of child safety seats. *American Journal of Preventive Medicine*, *21*(4 Suppl), 31–47. doi: S0749379701003774 [pii]

Zhu, M., Cummings, P., Chu, H., & Cook, L.J. (2007). Association of rear seat safety belt use with death in a traffic crash: A matched cohort study. *Injury Prevention*, *13*(3), 183–185. doi: 13/3/183 [pii] 10.1136/ip.2006.012153