



## Seatbelt wearing rates in middle income countries: A cross-country analysis



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### ABSTRACT

In settings with low seatbelt use prevalence, self-reported seatbelt use estimates often lack validity, and routine observational studies are scarce. In this paper, we aim to describe the prevalence of seatbelt use and associated factors in drivers and front-seat passengers across eight sites in four countries (Egypt, Mexico, Russia, Turkey) using observational studies as well as to produce estimates of country-level and site-level variance. As part of the *Bloomberg Philanthropies Global Road Safety Program*, data on driver and passenger seatbelt use across four middle-income countries was collected between October 2010 and May 2011 ( $n = 122,931$  vehicles). Logistic regression and Intraclass Correlation Coefficient analyses for sites- and country-level clustering were performed. We found high variability of seatbelt wearing rates ranging from 4 to 72% in drivers and 3–50% in front-seat passengers. Overall, average seatbelt wearing rates were low (under 60% in most sites). At the individual level, older and female drivers were more likely to wear seatbelts, as well as drivers of vehicles transiting at times of increased vehicle flow. We also found that 26–32% and 37–41% of the variance in seatbelt use among drivers and front-seat passengers respectively was explained by differences across sites and countries. Our results demonstrate that there is room for improvement on seatbelt use in middle-income countries and that standardized cross-country studies on road safety risk factors are feasible, providing valuable information for prevention and monitoring activities.

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### 1. Introduction

Lack of seatbelt use is a major risk factor for road traffic injuries (RTI) in middle income countries (World Health Organization et al., 2009). Whereas four-wheeled vehicle use grows every year, seatbelt use remains relatively low, and the rate of seatbelt use is lagging behind vehicle ownership trends (World Health Organization et al., 2009). Middle income countries now have the largest proportion of global deaths from RTI and are starting to see that most traffic deaths occur in vehicle occupants as opposed to pedestrians (Peden et al., 2004). Among other risk factors such as speeding or drinking and driving, seatbelt use is an important determinant of fatality and injuries severity among car occupants. For example, 53% of drivers and passengers who died in the United States in 2009 were unrestrained, and current research shows that

the probability of dying or having a severe injury from a car crash for an unrestrained individual is twice that for a restrained person (Peden et al., 2004; NHTSA, 2010; Abbas et al., 2011). When properly worn, seatbelts provide protection by preventing contact of passengers with the interior of the vehicle or with each other; seatbelts also avoid the ejection of passengers out of the vehicle and distribute the energy of the impact over the body (Abbas et al., 2011). As a result, wearing seatbelts decreases the risk of dying in a crash by more than 60% (Peden et al., 2004; Crandall et al., 2001).

The *Bloomberg Philanthropies Global Road Safety Program* (BPGRSP) is an international initiative carried out by international and national partners from each one of the participating countries (Hyder et al., 2012). This project is funded by Bloomberg Philanthropies and aims to promote a group of evidence-based interventions on road safety in an effort to close the evidence to action gap in road safety (Hyder et al., 2012). The BPGRSP involves ten countries (Kenya, Brazil, Cambodia, China, Egypt, India, Mexico, Russia, Turkey, and Vietnam), which make up 50% of the global road traffic fatalities. Four of the ten countries worked on seatbelts: Egypt, Mexico, Russia and Turkey in eight different locations

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(Hyder et al., 2012). The Johns Hopkins Bloomberg School of Public Health's International Injury Research Unit ([www.jhsph.edu/IIRU](http://www.jhsph.edu/IIRU)) is responsible for monitoring and evaluation of the project in all sites.

Previous literature has demonstrated the advantage of observational studies on seatbelt use to assess its prevalence (Bendak, 2005; Iribhogbe and Osime, 2008; Routley et al., 2007). However, little data is routinely collected on seatbelt use in low and middle income countries, and self-reported seatbelt use is generally considered to be a low-validity metric, especially in low-prevalence settings (Hyder et al., 2012; Ozkan et al., 2012). For this reason, observational studies on seatbelt use have been proposed for assessing prevalence at national and local level. Whereas observational studies are important to explore national-level differences in seatbelt use that can result from different levels of traffic regulation, law enforcement, and other related factors, cross-country studies allow researchers to collect and analyze standardized data to provide comparable and valid estimations across countries. This is important for both BPGRSP and for monitoring the Global Decade of Action on Road Safety (World Health Organization, 2013; Hyder et al., 2013).

The BPGRSP provides an excellent platform to collect data on seatbelt use across several countries and this paper presents an initial comparison of those findings. Our goal is to describe the prevalence of seatbelt use and explore factors associated with its use in drivers and front-seat passengers across eight sites in four countries and establish a baseline measurement for future longitudinal assessments. We hope this data will also add value to focus national road safety initiatives on this risk factor for road fatalities and injuries.

## 2. Materials and methods

Seatbelt baseline observations were conducted at the start of the BPGRSP in eight sites in Egypt, Mexico, Russia and Turkey between October 2010 and May 2011. All sites were agreed upon with the respective governments which considered that seatbelt use should be monitored in these specific areas. A site is in all cases comprised a city or a metropolitan area. For example in Mexico we had three sites, each one of them corresponding to an entire city: León, Cuernavaca and Guadalajara-Zapopan. These observational studies were carried out using a standardized protocol and sites comprising specific province, districts and cities, chosen in consultation with national partners. Sample sizes were calculated for all sites using the expected prevalence of seatbelt use based on reported national estimates from Egypt, Russia, and Turkey (World Health Organization, 2009). City-specific estimates were obtained for the case of Mexico (Hijar-Medina et al., 1996; CENAPRA, 2009). Power calculations were made assuming a 5% alpha error level and 20% of beta error level.

All potential observation points (intersections with a functioning traffic light) within each site were systematically listed and a simple random sample was selected after discarding those that entailed safety concerns for observers. Each observation point involved one supervised trained observer who worked for a time slot of maximum 1.5 h. This slot was rotated at different times of the day during a one-week period of observation. Observers at each location captured seatbelt use and selected driver's (estimated age and gender) and vehicle characteristics of all vehicles transiting through the observation point during the 90-min slots.

Our standardized methodology was applied at all sites and allowed us to conduct cross-country analyses. We estimated means and proportions of our independent variables and seatbelt prevalence. Given expected differences in sample sizes between sites, we produced population weights and subsequently performed

bivariate logistic regression analyses with Huber/White clustered standard errors to explore the relationship between seatbelt use and associated factors (Wong and Mason, 1985). These included estimated driver's age group; peak time, defined as transit during the hours 8–10 and 16–18 h; National Gross Domestic Product (GDP) and population size. While we recognize that site-specific GDP would be more predictive of seatbelt use in the evaluated areas (rather than national GDP), obtaining this information from reliable sources proved to be challenging; however, we still include national GDP and look forward to include site-specific GDP in future studies. Driver's sex and age groups were estimated by each individual observer. Details on the observation study carried out in individual sites are described elsewhere (Perez-Nunez et al., 2013; Ma et al., 2012). Sociodemographic characteristics were not available for Turkish and Egyptian sites; in coordination with our partners, we hope to capture these data in further rounds (although we do not expect to significantly change over short periods of time).

Our regression analyses assessed the relationship between the independent variables mentioned and seatbelt use while accounting for the clustering effects of the province and country where the observations were carried out (Wooldridge, 2002). Furthermore, we estimated the Intraclass Correlation Coefficient (ICC) that represents the fraction of the variance of seatbelt use that is attributable to differences between countries and locations (Wong and Mason, 1985; Snijders and Bosker, 1999). This method has been previously used and recommended in the injury field to demonstrate how evaluating the impact of clustering in injury analysis improves the quality of the analysis and helps to understand the sources of variance (Bangdiwala, 2011).

The observational studies were reviewed and approved by the Institutional Review Board at Johns Hopkins School of Public Health. Also, the IRB of each of the implementing local institutions in each country reviewed and approved the research protocol.

## 3. Results

We surveyed 122,931 vehicles across 8 sites in four countries between October 2010 and May 2011. Site-specific samples ranged from 1000 to 40,000 vehicles per site. Most of our sample comprised male (83%) and middle-age drivers (64%). Almost half of our observations were done during weekdays and 25% of them were captured during peak hours. The average GDP per capita was I\$13,470; and the population size of our sites range from 700,000 to almost 7 million inhabitants (Table 1).

Overall, seatbelt prevalences are around 50% or lower in most of sites for both drivers and front-seat passengers. The prevalence of seatbelt use among drivers was higher than among front-seat passengers in all sites. We also found that front-seat passenger use of seatbelt was highly related to driver's seatbelt wearing. Mexican and Russian sites had the highest driver seatbelt use rates while lower prevalences were seen in Cairo and Afyon for both drivers and front-seat passengers (Table 2).

Logistic regression analysis showed that male and younger drivers were less likely to wear a seatbelt across all sites (Table 3). Front-seat passengers were also more likely to wear a seatbelt with older drivers. Vehicles observed during peak-time and weekdays were more likely to have drivers wearing seatbelts. Higher GDP per capita was consistently correlated with an increased likelihood of seatbelt wearing among both drivers and front-seat passengers.

The ICC coefficient results were important to explain variation in seatbelt use. We found that a considerable fraction of the variability in driver and front-seat passenger seatbelt use was explained by both differences across countries (32% of variability for drivers and 41% for front-seat passengers) and between sites

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