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The prevalence of seatbelt and mobile phone use among drivers in Riyadh, Saudi Arabia: An observational study☆

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ABSTRACT

Introduction: Road traffic injuries (RTIs) are the third leading cause of death in Saudi Arabia. Numerous factors may increase the likelihood of RTIs. The prevalence of risk factors associated with RTIs may vary due to several reasons. Because little is known about these risk factors locally, we examined the prevalence of mobile phone and seatbelt use and their association with spatial locations. *Methods:* This is an observational study conducted at major highways and inner intersections throughout Riyadh, the country's capital. Two observers captured seatbelt and mobile phone use among drivers. Logistic regression models were constructed to examine the association between real estate prices and mobile phone or seatbelt use. Observations were categorized as taken place in an affluent neighborhood if the average price per square meter was above 2500 Saudi Riyal. *Results:* A total of 1700 drivers were observed in 13 sites citywide. 13.8% of drivers were seen using mobile while driving and only a third of drivers (34%) were wearing seatbelts. Being at an affluent neighborhood was associated with close to three times higher odds of wearing seatbelts (OR = 2.7, 95% CI = 1.9–3.7) and also associated with 42% lower odds of mobile phone use among drivers (OR = 0.58, 95% CI = 0.36–0.92). *Discussion:* This study found a high prevalence of traffic violations among drivers in Riyadh. Based on our estimate, 660,000 drivers are roaming the street during daytime while using their phones and they are less likely to wear seatbelts. Unfortunately, this estimate might contribute to increasing RTIs. Despite existing regulations, seatbelt use among drivers is significantly lower than in developed countries (i.e. USA 94%). *Conclusion:* There is a pressing need to reduce traffic violations in Saudi Arabia. Interventions to improve traffic safety may use these findings to enhance awareness and test the impact of enforcement on traffic violations.

1. Introduction

Road traffic injuries (RTIs) pose a significant burden to global health (Peden et al., 2004). Every year, an estimated 1.3 million individuals die, and as many as 50 million are injured worldwide (Chan, 2013). In Saudi Arabia (SA), RTIs are the third leading cause of death, representing 11.7% of total mortality (Alrabea, 2012). A total of 9031 individuals lost their lives due to RTIs, and 40 thousand were injured in 2016 (Alswuaid, 2017). Last year, Riyadh, the largest city and the capital of the country, recorded over 141 thousand road traffic crash resulting in 1430 deaths (Alswuaid, 2017). Not surprisingly, the country has one of the highest death rates worldwide with an estimated 33.7 deaths per 100,000 population (Chan, 2013). Furthermore, patients injured in RTIs occupy one-third of hospital beds at the ministry of health's facilities (Ansari, Akhdar, Mandoorah, & Moutaery, 2000). Clearly, RTIs constitute a significant threat to population health in SA.

The Saudi Department of Traffic reports that distracted driving and speeding are among the leading causes of RTIs (Anonymous, 2009). In the past five years, mobile phone use has increased dramatically in SA, and it has been accompanied by an increase in traffic crashes (Alghnam et al., 2017). The literature suggests that distracted driving due to mobile phone use is associated with a fourfold increase in traffic crashes (Ouimet, Lee, & Dingus, 2014; Redelmeier & Tibshirani, 1997). Moreover, mobile phone use while driving has been linked to reduced reaction time among drivers (Caird, Willness, Steel, & Scialfa, 2008). There is an emerging evidence that mobile phone use is going to be a significant contributor to RTIs in SA (Albarqawi, 2017).

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Because smartphones play a significant role in the prevalent use of social media applications, they may contribute to increasing distracted driving. Between the years 2011 and 2014, broadband internet subscriptions for mobile phones increased from 11 million to 29 million (163% increase), according to the Saudi Communication and Information Technology Commission (Anonymous, 2014). Moreover, about 95% of Riyadh's population is using the internet according to the Commission.

Due to the emerging literature on the association between mobile phone use and RTIs, many countries have banned or restricted their use among drivers (Chase, 2014). Currently, mobile phone use while driving is considered a traffic violation in SA. Nevertheless, poor enforcement may have contributed to their continuous use among drivers (Carpenter, 2016). Therefore, understanding the prevalence of mobile phone use while driving may indicate to what extent distracted driving is an issue despite existing laws.

Seatbelt use is widely recognized as one of the most effective tools to reduce RTIs. It has been found to be associated with a 50% decrease in fatality and 55% decrease in serious injury (Forjuoh, 2012). There is a seatbelt law in effect since 2001; however, studies of self-reported use indicated that compliance rates are as low as 5% (El Bcheraoui et al., 2015). Unfortunately, this evidence is not conclusive and little is known about the actual compliance rate in SA as these studies are based on self-reported measures. This evidence, in turn, limits the ability to evaluate the need to increase awareness or to assess the protective impact of seatbelt use on the risk of mortality or disability.

Direct observation of traffic may provide more valid evidence of actual traffic violations than self-reported measures. Previous studies from developing countries suggest that individuals exaggerate their seatbelt use (Özkan, Puvanachandra, Lajunen, Hoe, & Hyder, 2012a). Therefore, other methods of ascertaining actual use, such as direct observation, may provide a more accurate estimate of these behaviors.

Several risk factors may increase the risk of sustaining RTIs, such as speeding, road conditions, mobile phone and seatbelt use. These modifiable factors need to be studied further, especially in the Saudi population. Learning about traffic violations among Saudi drivers can guide policymakers to alter modifiable behaviors and reduce preventable RTIs. Moreover, investigating the variation of traffic violations may better inform proposed solutions or awareness campaigns. Previous literature indicates that risk factors for RTIs may also vary with socioeconomic status (SES) (Vereecken, Maes, & De Bacquer, 2004). A proxy for SES is the geographical location, which may provide insights about differences in factors such as income, education or employment (Chen et al., 2010). Therefore, this study aims to examine seatbelt and mobile use and how they vary according to geographic locations in Riyadh.

2. Methods

This observational study was conducted in various locations within Riyadh. Observations were collected at major highways and in inner intersections. All drivers were inspected by a pair of trained observers for seatbelt and mobile phone use while driving. The principal investigator accompanied the observers to the observation site and ensured understanding of the study protocol. Next, observers were asked to start a pilot data collection of five vehicles and were provided feedback from the principal investigator. 200 vehicles were observed in each highway while 100 vehicles were observed at each inner intersection. Observations included all types of vehicles including sedan, family, luxurious, sport, or commercial vehicles. Also, they included governmental vehicles (ambulance, police, etc.). All data was captured by the observers without the use of any assistive devices, such as cameras or binoculars.

2.1. Highways

Riyadh has four main highways surrounding the city. Four spotting locations were selected along those highways that ensured the following: visibility, the safety of the observers, and distance from police checkpoints to avoid biased law adherence. The two observers recorded the observations while standing on a pedestrian cross-bridge over each highway. Drivers were observed for seatbelt and mobile phone use while driving. The procedure was conducted during weekdays (between 15:00 and 18:00 h). The observers would announce that they are planning to observe the third vehicle passing their way, specifying its features (i.e. color and type) to avoid mistakes. This approach was done to allow each observer to see both seatbelt and mobile use. To capture more variability of drivers' behaviors, the observers collected one observation per lane then moved to the next one (i.e. observe the third vehicle on the left lane, then move to the next lane).

2.2. Inner intersections

Riyadh can be split into nine main zones (Fig. 1). In each zone, ten intersections were selected based on size and average road users in each zone. Next, one intersection was selected from each zone at random using STATA 15 software. Safety of the observers and clarity of the vehicles were ensured at each of the selected intersections.

The observers selected corners at each of the nine intersections, where it was possible to inspect passing vehicles from all directions clearly. At each intersection, 100 drivers were observed for seatbelt and mobile phone use while driving. Data were collected during weekdays (between 15:00 and 18:00 h). Like what was conducted earlier, the observers gathered one observation per lane then moved to the next one. Agreement between observers was assessed using Kappa statistics (Viera & Garrett, 2005).

2.3. Real estate

The Ministry of Justice (MOJ) publishes reports on real estate sales in SA. In addition, the MOJ posts, on its official website, the monthly average prices of estates that were sold in each neighborhood in Riyadh. To allow classification of observation sites according to SES, neighborhoods' prices were obtained (Alkelya, 2017). In case the observed location was located between two neighborhoods, the average price was calculated and used. All prices are per square meters (m^2) in Saudi Riyal (SAR).

2.4. Statistical analysis

Statistical analysis was done using STATA 15 for Mac (STATA Corp., College Station, TX). Agreement levels between observers were assessed using Kappa statistics. Kappa statistic showed substantial agreement between the two observers ranging from 0.69 in mobile phone use to 0.83 in seatbelt use. One observer was selected at random and used for all analyses. The prevalence of seatbelt and mobile phone use was calculated with associated 95% confidence intervals. In addition, the prevalence of mobile phone use was compared to those who used or did not use a seatbelt.

The association between real estate price and traffic violation was assessed using a logistic regression model. The independent variable was whether the observation occurred in an affluent area, defined as an average price of 2500 SAR ($666) or above per m^2. The dependent variables were seatbelt and mobile use. A p-value of 0.05 or lower was used as a cut-off for statistical significance.

3. Results

A total of 1700 drivers were observed in this study. Observations were distributed over 13 sites (4 highways and 9 inner intersections) across Riyadh. The overall seatbelt compliance was 34.2% (95% CI = 31.7–36.2) while mobile phone use was 13.8% (95% CI = 12.2–15.5) (Table 1). Mobile use was significantly higher among individuals who did not wear seatbelts (17.7% vs. 6.2%, $P < 0.01$).

A higher prevalence of seatbelt use was observed at highway locations than the overall sample. 45.2% (95% CI = 41.8–48.7) of all drivers

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