

Assessing the Effects of Mobile Phone Use, Text Messages and Chatting On Social Media among Saudi and Non-Saudi Drivers

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Abstract

A self-administered survey assessing the use of mobile phones among Saudi and non-Saudi drivers, was distributed by hand to 520 male drivers [Saudis (70.2%), non-Saudis (29.7%)] aged between 16 – 61 years. 32% (Saudis) and 18% (non-Saudis) began driving at age < 16 years while 80.3% (Saudis) and 72.3% (non-Saudis) had a valid driver's license. 82.7% (Saudi) & 80.7% (non-Saudi) drivers use private vehicles. Age, nationality and use of social media while driving, were significantly associated with road traffic accident (RTA), while use of mobile phones and text messaging while driving showed the greatest odds (7x & 5x) of RTA risk. About 1 in 2 drivers aged 16-30 years had been involved in at least one RTA. Not being a Saudi, the use of cell phones, and text messaging, increases the risk of involvement in RTAs but the odds were greatest for making/receiving phone calls. The current regulations should consider a strict ban on mobile phone use while driving.

Key words: Road traffic Accident (RTA); Driving; Cell phone; Saudi Arabia; Text messaging.

Running Title: Cell-Phone Use & Saudi-Drivers.

1. Introduction

Road traffic accidents (RTAs) have globally grown to become an epidemic. It's estimated to be responsible for up to 2% of global mortality and morbidity (AlReesi et al. 2013) becoming a major cause of death at a rate which is on a level with heart disease and cancer (AlGhamdi 1998; National Committee for Traffic Safety, 1994) and greater than deaths due to malaria (Krug, 2002). Despite its global burden, the magnitude of RTAs is skewed towards certain regions of the world (AlReesi et al. 2013). A report by World Health Organization (WHO) in 2004 estimated the annual fatalities caused by RTA to be 1.2 million, and the non-fatal injuries to be 50 million (WHO, 2004). This figure is predicted to rise to 65% between 2000 and 2020 in developed countries, and by as much as 80% in developing countries with lower economic power (Murray and Lopez, 1997).

The progressive increase in RTAs in the Kingdom of Saudi Arabia (KSA) have been attributed to factors such as: the rapid expansion of road construction (Barrimah et al. 2012); increase in the number of registered vehicles; and the increase in the number of expatriates from different countries with different habits and culture who are unfamiliar with local driving conditions and requirements (Ansari et al. 2000). In the last 4 years, RTA accounted for about 15 deaths in every 100,000 population annually, taking into consideration only deaths that occur at the scene and excludes those who die while receiving treatment at hospitals (AlGhamdi 2003), while deaths in Ministry of Health hospitals due to RTA were estimated at 81% (Ministry of Health annual report, 1995). Among the world's young population (15 - 44 years), RTA is the second leading cause of death (Peden and Sminkey, 2004) spurring the United Nation to declare the years 2011 to 2020 as the 'decade of action for road safety' (Krug, 2012). Drivers aged 18 - 40 years were involved in about 65% of traffic accidents in Asir region of KSA (Tamimi et al. 1980), even as the vehicle ownership among this age group in the region reaches 90% (Koushi and Bustan, 2006).

Drivers' error is directly responsible for a large proportion of the total accidents due to RTA in KSA (Nafee and AlSaif, 1986; AlGhamdi, 1998; Schlag and Heger, 2002; Peden and Sminkey, 2004) while speeding and violation of traffic signals amount to 50% of the accidents (Murray and Lopez, 1997; AlKhaldi, 2006). The attitude of students of a health science college in Asser region was assessed in a survey (AlKhaldi, 2006). The study observed that, more than half of the 238 students have been involved in RTA as a result of high speed. Aba Hussein and El-Zobeir (2007) observed that 52% of 2469 drivers surveyed in Dammam, Alkhobar, Qateef and Jubail had been involved in RTA, and 60% of them used mobile phones while driving. On the other hand, the attitude and practice of drivers in KSA could differ depending on the population surveyed since the Kingdom's population of 29 million people as stated by the Central department of statistics and information (2012) comprises of a reasonable number of foreigners (9 million), from different countries with different habits. While limited research has been undertaken to investigate the relationship between specific types of driving behavior and subsequent RTAs in KSA, evaluating the driving behavior of the foreigners (non-Saudis) in relation to the locals (Saudis) is paramount in the strategic fight against RTA.

Also, a 2013 United Nations report, KSA was shown to have the largest number of mobile phone users worldwide with teenagers and children as young as nine years using mobile phones. This then could mean that people in this region make more phone calls and text messages, and often times these happens while driving. In spite of the scientific evidences from KSA (Tamimi et al. 1980; AlGhamdi 1998; Ansari et al. 2000; AlGhamdi 2003; AbaHussein and ElZobeir, 2007; Gharaibeh and Abu Abdo, 2011; Barrimah et al. 2012) and elsewhere (Murray and Lopez, 1997; Krug 2002; Mc Envoy et al. 2005; Klauer et al. 2006; Ishigami and Klein, 2009; AlReesi et al. 2013) implicating the use of cell phones as a cause of major distraction for drivers and thus, increases their risk of involvement in RTAs, there is currently no law limiting the use of cell phones while driving in KSA. As in any health problems, identification of the risk factors through scientific studies is essential, in preventing or reducing RTAs. The current study therefore aims to provide an insight into the driving behavior of Saudis and non-Saudis towards the use of cell phones, text messaging and hands-free devices, and their associated risk of RTAs.

2. Material and Methods

2.1 Recruitment and study design

A validated structured questionnaire shown in *table 1* was designed in both English and Arabic language to specifically address the purpose of this study. These questions were also checked for the similarity of the interpretation in both languages and to ensure that no misunderstanding of the questions had occurred in both languages. An approval for the study was obtained from the Traffic Police Department and the Research Ethics Committee of the University and study was performed in accordance with the Declaration of Helsinki of 1975, as revised in 2000.

The sample size for the population survey was estimated to assess a road traffic accident rate of 15%, and absolute precision of 3% and a confidence level of 95%. The required sample size was 344 individuals. The sample was multiplied by 1.5 to accommodate for the design effect since sample selection will be based on stratified sampling method. After allowing for a 5% non-response rate, the final sample size was increased to 520. Survey participants were selected from drivers in the following districts of KSA, between March and May, 2013: AR-Riyadh, AL-Ahsa and Ar-Deriyyah. It included only drivers visiting government and private health care institutions for any reason, government and private corporate institutions, shopping malls, and students and staffs of universities. No incentive was used to encourage participation and anonymity of respondents was ensured.

The questions addressed in the survey were key to determine whether drivers in KSA: 1) operate with a valid driver's license; 2), are aware of the category of their driver's license and/or any restrictions imposed on their licenses; 3) indulge in certain risky behaviors that could be a source of visual distraction while on the road such as making or receiving phone calls with or without a hands free device, reading or sending text messages and chatting or conversing on social media while driving, and how these could put the drivers at a potential risk for road traffic accidents.

2.2 Statistical analysis

Questionnaires were included in the analysis if they were completed by drivers residing in KSA and excluded if the drivers were temporary visitors, had obtained their driver's license less than 6 months prior to the commencement of the study, or had participated in the initial validation of this questionnaire.

All data were entered into a Microsoft Excel spreadsheet and analyzed after being overlaid to eliminate data errors and corrected, using the Graphpad InStat software (*version 3.00* – Graphpad Software Inc., San Diego, CA). A P value < 0.05 (α) was considered statistically significant. Comparison of responses obtained in Saudi and non-Saudi drivers were done using chi square and t-test while logistic regression analysis was performed to determine pertinent risk factors affecting the occurrence of RTAs. Confounding variables were identified from the literature and included in the adjusted regression models if they were significantly ($P < 0.2$) associated with the outcome measure (an RTA) after adjustment for age. Factors adjusted for were age, employment status, and education. Effect modification by age was examined for each of the main exposures.

The results were presented as frequencies and percentages descriptively and compared between Saudi and non-Saudi drivers, and only responses from those who completed the questionnaire were used. For each numerical grade in the questionnaire, the scoring system was performed so that a neutral response was scored as zero; other responses were positive numbers and the number increased with greater magnitude of feeling. For example, the last series of questions in table 1 allowed each respondent to express his opinion on certain risky behaviors while driving. Drivers were asked to circle any option that best describes their opinion or if they choose to remain neutral to the question asked. The choice of any of the following options: not at all, sometimes, always, resulted in a score of 1, 2 and 3 respectively, during the analysis. The full range of questionnaire was utilized for each item denoting high questionnaire sensitivity. Out of 575 questionnaires distributed five hundred and twenty (90.4% response rate) from drivers aged between 16 and 61 years met the inclusion criteria and were analyzed.

3. Results

3.1 Demographics

A total of 520 drivers comprising of three hundred and sixty-five (70.2%) Saudi and 155 (29.8%) non-Saudi male drivers participated in this study. On their level of education, about one-half (49.6%) of the Saudis were high school graduates or lower, 39.7% undergraduates, 8.8% post-graduates, 4.5% unspecified and for the non-Saudis, the corresponding values were: 25.8%, 31.6%, 38.1% and 1.9% respectively. The percentage distribution of the age groups of the respondents for Saudis and non-Saudis and the age at which they started driving has been shown in *figure 1*.

The figures showed that the majority of the respondents were between the age group 21-30 years. Regarding the level of occupation shown in *figures 2*, most of the non-Saudi drivers (66, 43%) were professionals with some 20 drivers who were unemployed (13%). For the Saudis, many were unemployed (142, 39%) and the least were the self-employed (44, 12%).

3.2 Questions of Driver's License

Figure 1 shows the distribution of driving age for Saudis and non-Saudis at the time of questioning. In sharp contrast to non-Saudis, more than one-half of the Saudis (59.7%) began driving between the ages of 16 - 20 years while the majority of non-Saudis (35.5%) started driving at ages 21 and 30 years. Below 16 years of age, a staggering number of Saudis (117, 32%) and only about 18% of non-Saudi drivers were already driving on major roads. In general, 405 drivers (77.9%) comprising of 293 Saudis (80.3%) and 112 non-Saudis (72.3%) were in possession of a valid driver's license while 115 drivers (22.1%) comprising of 72 Saudis (19.8%) and 43 non-Saudis (27.8%), had no valid license at the time of this study. The age at which the Saudis first obtained their driver's license was mostly before the age of 20 years (62.2% of the respondents), as compared to between 21 – 30 years for the non-Saudis (46.5%). Almost all licenses (337, 92.3%) except one (0.3%, from elsewhere) and 27 (7.4%) unspecified, of the Saudi divers were issued in the kingdom (337, 92.3%) as compared to the 54 non-Saudi drivers (34.8%) whose licenses were issued in the kingdom, while 90 non-Saudi drivers (58.1%) were using a foreign driver's license at the time of this study. Eleven drivers (7.1%) failed to specify where they obtained their driver's license.

Most driver's licenses were marked for use in driving private cars (82.7%, 80.7% Saudis and non-Saudis respectively), while a few were for public vehicles (8.5%, 11.0%; Saudis and non-Saudis). 88.2% and 78.7% of the Saudi and non-Saudi drivers respectively, had no restrictions such as use of hearing aid, prosthetic etc, and only about eight non-Saudis (5%) and six Saudis (1.6%) were restricted to driving with spectacles. In relation to RTA, 255 of the 520 drivers (49.0%) surveyed reported that, they have been involved in at least one RTA [2/3rd of the non-Saudi drivers (73.2%), ½ of the Saudi drivers (55.3%)] *figure 3*, and about 46.3% of them had had RTA between 2 to 5 times, with 73.9% of the RTAs occurring in the daytime, 36.1% nighttime, and 48.9% both times.

Of the 185 drivers in the age group 21-30 years, about 40%, and 2% had been involved in 2 – 5 RTAs and more than five RTAs, respectively, at the time of this study. The graphical representation of the age groups and the number of RTAs they have been involved in has been drawn in *figure 4*.

3.3 Driving Behavior

Figure 5(A & B) has been conducted to show the behavioral pattern of only the drivers who responded to one or all of the questions in the section. It can be deduced that the non-Saudi drivers (*Fig 5B*) displayed a more cautious but positive attitude while driving especially in areas such as: avoiding the use of social networks (Facebook, Tweeter, Whatsapp, Skype), and not reading or text messaging, while driving. In general, 53.9% (280/520) of the respondents (more non-Saudi than Saudi drivers) sometimes or always made/received phone calls, 38.5% (200/520) read or sent text messages while driving and majority did not use a hands-free device (58.8% non-Saudis, 55.1% Saudis).

3.4 Prediction of RTAs

A commonly used technique in the analysis of categorical data is the examination of odds ratios. Refer to Table 2. The odds ratio (non negative number) is also termed the cross-product ratio and the approximate relative risk. Analysis was based on whether or not a driver indulges in any of the behaviors and had been involved in a RTA or not (*figure 6*). We observed that there was a moderate positive linear trend (Pearson's $R = 0.5$) in the reduction in number of drivers involved in RTAs with increasing age which was statistically significant ($P = 0.01$). Regression analysis of factors associated with occurrence of RTA using a Chi square analysis is shown in *table 2*. It shows that, making/receiving phone calls and reading/sending text messages while driving increases the drivers' risk of involvement in RTA by 7 and 5 folds respectively. Surprisingly, the odds ratio of a Saudi driver being involved in a RTA is 0.5 times less than the odds of a non-Saudi driver being involved in a RTA. The odds ratio of a driver using a social media, not using a hands-free device or being an unlicensed driver and being involved in a RTA is 0.56, 0.59 and 0.07 respectively less than that of a driver not using a social media, using a hands-free device or driving with valid drivers' license and being involved in a RTA. *Table 2*.

4. Discussion

The response rate in the current study was quite high (90.4%) and similar to other surveys (AlKhalidi 2006; AlReesi et al. 2013; La et al. 2013). It signals the increased awareness in drivers to such sensitive issue of public health interest.

Our results showed that many of the Saudi drivers (32%) started driving on major roads at a much earlier age (below the legal driving age in Saudi Arabia) than the non-Saudi drivers (18%). *Fig1*. This is similar to reports in the region (AlGhamdi 1998; Barrimah et al. 2012; AlGhamdi 2003) and also, more Saudi than non-Saudi drivers obtained their 1st driver's license between the ages of 16 and 20 years. Whereas, the legal age for owning a driver's license in KSA is 18 years or above, the Saudi traffic police department does issue temporary driving permits to 17-year-olds as well. It is therefore possible that some of the respondents in this study may have obtained their 1st driver's license at an age lower than 17 years. The reason for this could be because, Saudi Arabia still remains the only country where women cannot drive and as such, most underage Saudis are being pressured to drive as a way of assisting their fathers and indeed the family in the normal day-to-day activities. In addition, some young Saudis drive in order to participate in unofficial car races with their peers as a leisure-time activity (Barrimah et al. 2012). Such imitation of inappropriate driving techniques coupled with the lack of experience in these drivers, is a key factor that could interact with other conditions to cause crashes (Ginsburg et al. 2008). Similar to previous reports (AlReesi et al. 2013, Peden and Sminkey, 2004; AlKhalidi 2006; AbaHussein and AlZobeir, 2007; La et al. 2013; Ginsburg et al. 2008), age was significantly associated with the occurrence of RTA (*fig. 4*).

Approximately one in every 2 drivers aged between 16 - 30 years had been involved in at least one RTA. This number regressed with increasing age as shown in *figure 4*. The prevalence of RTA among youngsters could be attributed to the fact that younger drivers take more risks. Overall, approximately one half of the drivers (49%) had been involved in at least a RTA, while 46.3% of the drivers report between 2 - 5 RTAs. It was also noted that 73.9% of the traffic accidents occurred in the daytime as opposed to 36.1% occurring in the nighttime (*Fig 3*). This figure is even higher than that reported in the Qassim region of KSA (Barrimah et al. 2012) and by the Insurance Institute for Highway Safety (IIFHS, 2013) in the USA, indicating that 51.2% and 48% of traffic accidents respectively occur during the day time.

Moreover, fatality rates are higher in daytime in KSA (Barrimah et al. 2012)), while they are in fact 5 times higher in night time than daytime in the USA (IIFHS, 2013). The reason could be that a smaller percentage of night travels by car occurs in KSA due to lack of night entertainment places. With a majority of the population residing in urban areas, the need to travel is minimized to only during weekends or holidays and particularly at night on intercrossing highways or to rural areas. Also, the mostly daytime-working attitude (work time is mostly between 8 a.m. and 4.00 p.m.), and social habits related to traditions are contributory factors.

A reasonable percentage of Saudi (19.8%) and non-Saudi (27.8%) drivers were unlicensed at the time of this study, perhaps due to the starting-age of driving which was earlier in our sample among Saudi drivers (younger than 16 years old), which is considered a violation of the traffic law in the Kingdom. Significant higher number of non-Saudi than Saudi drivers committed this violation ($P < 0.05$). Overall, 83.5% of all unlicensed drivers had been involved in at least one RTA. Generally, the large proportion of drivers who committed this violation is remarkably high and raises the questions about law enforcement measures for unlicensed drivers and raises attention towards the issue of age eligibility for obtaining drivers license.

The difficulty of youth unemployment faced by the Saudi population was highlighted in this study. Although this was not one of the major problems set out to address in this study, a significant number of Saudi drivers who participated were unemployed (142/365, 39%), in comparison to a few unemployed non-Saudi drivers (20/155, 13%) at the time of study. Since socioeconomic status is known to be a risk factor for RTA, and mortality/morbidity rates in vulnerable road users being reportedly higher in the lower social classes (Barrimah et al. 2012; Peden and Sminkey, 2004), addressing the issue of unemployment through skill acquisition could be beneficial in reducing the frustration faced by the unemployed youths. However, a cohort study from rural Vietnam did not find poverty either as a risk or protective factor for RTI and the middle income group was exposed to the highest risk of RTI (Thanh et al. 2005). Further studies into the association of socioeconomic factor with RTA are therefore needed.

4.1 Driving behavior and risk of RTA

In the current study, the relative risk of involvement in RTA in drivers who made or received phone calls while driving was about 7 times greater than drivers who did not (*table 2*). In other studies, cell phone conversation while driving was shown to increase collision risk in drivers by about 4 to 6 times (AlReesi et al. 2013; Aba Hussein and AlZobeir, 2007; Strayer and Drews, 2004). Cell phone conversations have negative effects on reaction time, lane keeping, car-following ability, and speed control while driving (Caird et al. 2013). Furthermore, distracted drivers are reported to accept suboptimal performance on driving tasks, like checking mirrors, in order to give attention to non-driving tasks (Young and Regan, 2007). All of these factors together contribute to a higher collision risk.

In this study, reading or sending text messages while driving was 5 times more likely to result in a RTA. More alarming results have been reported in a large-scale, naturalistic driving study in Virginia Tech Transportation Institute (2013) which found a 23.2 times increase in crash or near-crash risk when reading and sending text messages compared with driving without distractions (VTTI, 2013). In another stimulated experiment, it was shown that drivers who text message while driving display poorer car-following ability & lateral lane control (Reed and Robbins, 2008), and spend 400% more time with their eyes off the road when compared with baseline (Hosking et al. 2009).

Even drivers who used a hands-free mobile phone while driving in the current study were shown to be at a relatively but slightly greater risk of being involved in RTA in relation to drivers who did not use a hands-free device during phone calls, while driving (table 2). This is contrary to people's belief in the Kingdom (as I've had countless conversations with people who use hands-free devices), but agrees with previous reports. McEnvoy et al. (2005) reported that hands-free mobile phone while driving resulted in 4 times more likelihood of a serious crash that could lead to a hospital attendance while Ishigami and Klein (2009) showed that the use of hands-free device was rarely better than when using a handheld phone.

Other studies (Caird et al. 2004; Young and Regan, 2007) also showed that, the use of hands-free devices was just as dangerous as hand-held cell phone use. Lee and coworkers (Lee et al. 2013) therefore suggested that, it is the cognitive task of having the cell phone conversation that is distracting, regardless of the device. Hands-free devices are therefore not risk-free as many in the region believe, and can impair the driver's ability to react swiftly and safely because, there is still a mental distraction. In this study, the use of social network was also significantly associated with occurrence of RTA, though the calculated odds ratio was very low.

Interestingly, the odds of a Saudi driver being involved a RTA is 0.5% less than the odds of a non-Saudi driver being involved in a RTA (Table 2). Thus, being of Saudi origin are almost even protective from RTA.

Yet it should be perceived from fig 5 that, on the overall, non-Saudi drivers displayed a more cautious attitude as regards their involvement in many of the assessed aberrant driving behaviors (*figure 5*), but because, more non-Saudi's than the Saudi's make or receive phone calls while driving, their risk of involvement in a RTA was greater (Table 2). This may be attributed to the wide differences in their backgrounds, which may create traffic-safety related problems and therefore, raises the need for a unique educational and training program developed in cooperation with the diplomatic sector, for each nationality.

Table 2 also showed that the unlicensed drivers were not in any greater risk of being involved in RTA than the drivers who were licensed (odds ratio = 0.07), even though not possessing a drivers' license was significantly associated with occurrence of RTA ($P < 0.0001$). The Saudi police traffic department requires every driver to be in possession of a valid drivers' license which is issued on successful completion of series of driving tests. Disobedience to this regulation is considered an offence.

The current study is limited by various factors: Firstly, the data in this study was based on a self-reported measurement of driving behavior and thus the reliability of such reports is a major concern (Davey et al. 2007) However, the impact of such interpretations was shown to be minimal (Lajunen and Summala, 2003). Secondly, only male subjects participated in this study which on one hand reduces the number of confounding factors in the analysis, but also implies that caution should be taken in the interpretation and generalization of our findings. Males have been reported to be more likely involved in risky behavior while driving than females (Amirfakhraei et al. 2013). Another concern relates to the sample size of the current study which might not have adequately represented the population of KSA and not necessarily the overall driving population. However, this research is preliminary in nature, and thus further research is clearly needed. In regards to future research, a range of contributing factors in RTA need to be examined, including cultural aspects, speed driving, that impact not only on driving behavior but also the acceptance safety strategies designed to reduce RTAs. As highlighted in this study, the high rate of involvement in aberrant driver behavior, and lack of necessary action by the relevant authorities in KSA in comparison to other western countries, may have contributed majorly to the increased RTAs on our roads. There is need to revisit and revise the traffic regulations which as at today seem obsolete.

5. Conclusions

In summary, the continuous involvement of drivers of both Saudi and non-Saudi origin in aberrant behaviors such as cell phone use, reading or sending text messages, use of social networking sites while driving is very worrying and potentially threatens driving safety in KSA, and as such should not be condoned by the authorities. In January 2009, National safety commission USA called for a nationwide ban on all cell phone use while driving. Similar legislations are recommended in KSA if we are to improve the driving safety. While there is urgent need to revise existing traffic regulations, it is also recommended that traffic regulations and safety awareness through TV programs and school activities should start at an early stage and age. Educating the public on the existing laws and the risk of aberrant driving behaviors should be emphasized with an increase in the enforcement of traffic regulations.

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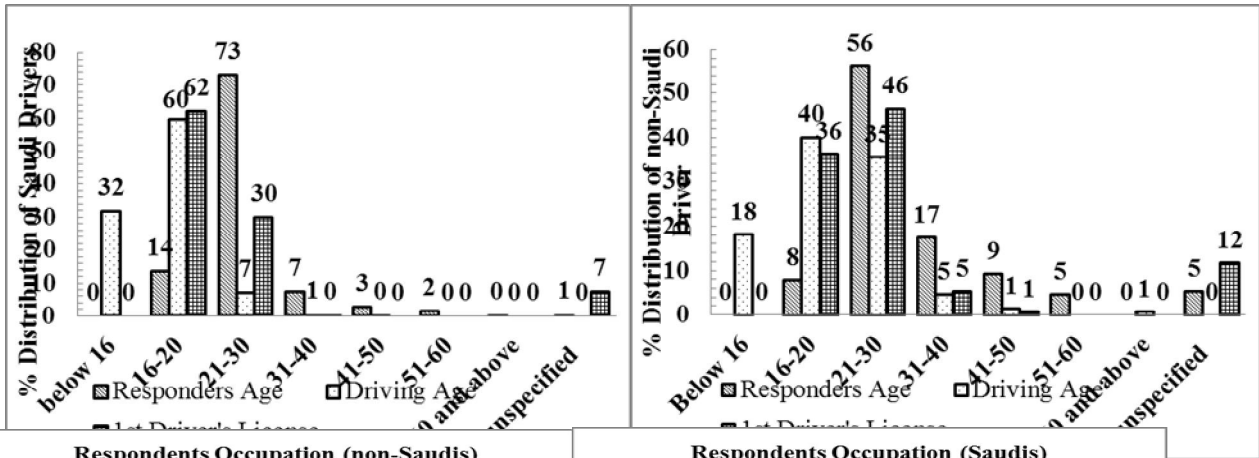
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Figures Legends

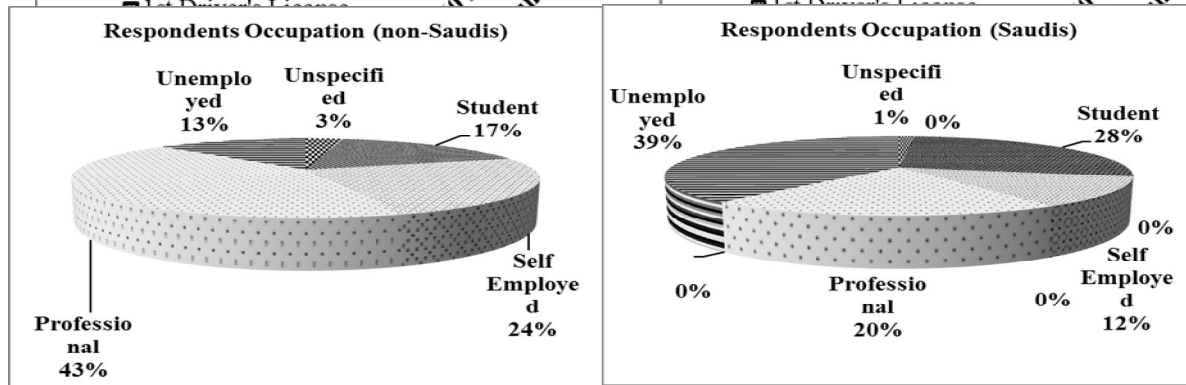
Figures

1. Age group distribution of drivers (n = 520) according to time of study (responders age), age at first driving (driving age) and age at which their first driver's license was issued (1st driver's license) for Saudis (right) and non-Saudis (left).
2. Distribution of Drivers (n = 520) according to occupation for Non-Saudis (left) and Saudis (right).
3. Frequency of occurrence of Road Traffic Accidents in non-Saudis (left) and Saudi (right) drivers, and the period of occurrence (night, day or both).
4. Distribution of the number of involvements in road traffic accidents (RTA) per age group for all drivers in Saudi Arabia (n = 255).
5. Percentage analysis of driving behavior for all drivers in Saudi Arabia who responded to each question (A) Saudis and (B) non-Saudis
6. Distribution of drivers (both Saudi and non-Saudis, n = 507) who indulge in any of the behaviors and had either been involved or not involved in a RTA accident.

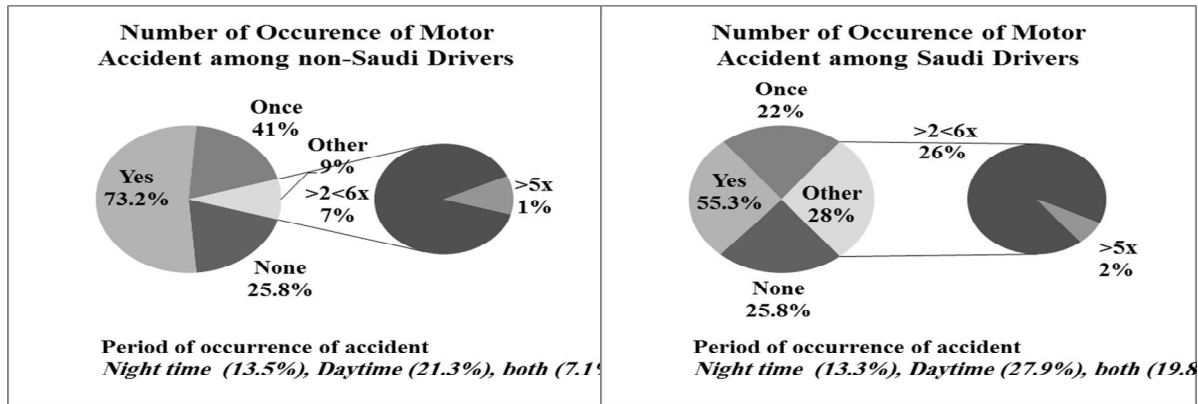
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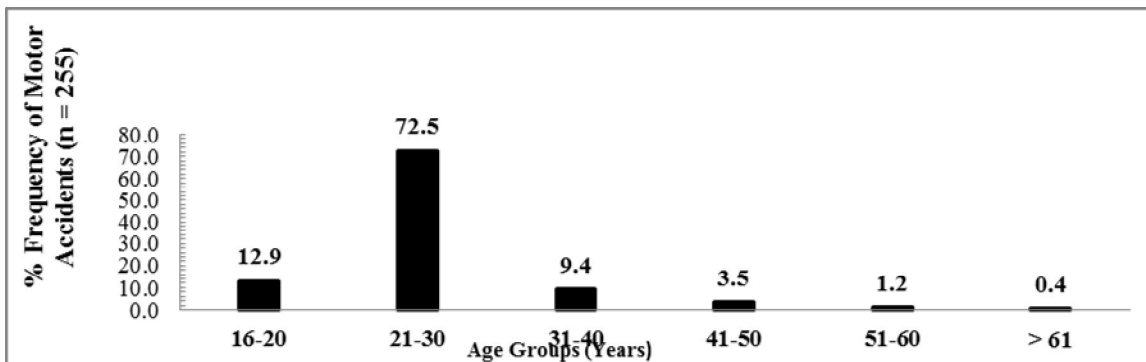
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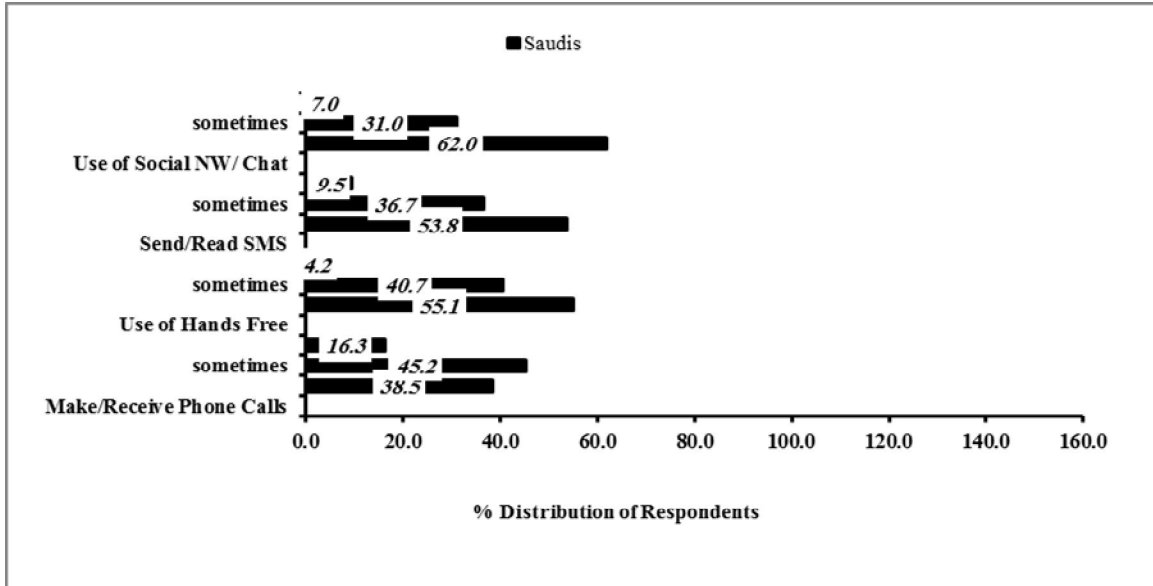
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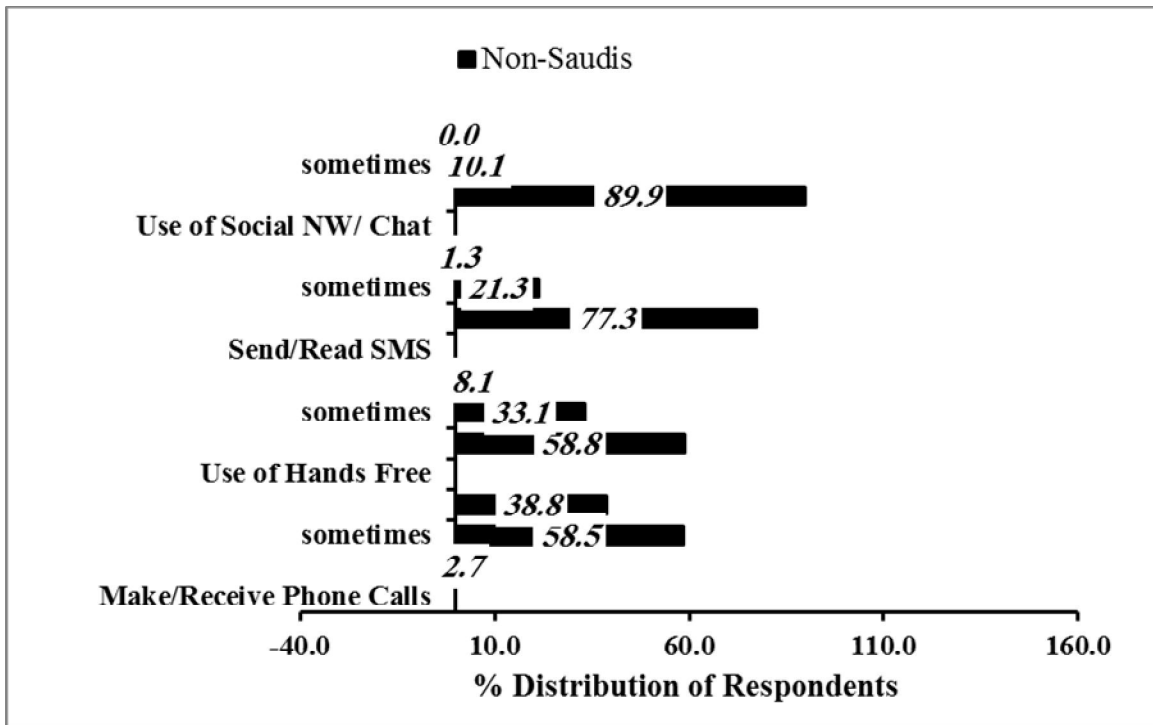
4.



5.(A)



5 (B)



6.

