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Investigating Cell Phone Use While Driving in Qatar

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Abstract

Traffic accidents are one of the most significant challenges of modern societies, placing a enormous humanitarian burden on individuals, families, communities and countries. In Qatar, road traffic accidents kill approximately 200 people every year and injure or disable many others. In 2011, road accidents resulted in 586 major injuries and 4,723 minor injuries in Qatar. Studies have shown that the use of cell phones while driving can impair driving performance, which can cause a serious traffic safety issue. Studies have also shown that with the increase in general use of cell phone, phoning while driving has also increased. The objective of this paper is to investigate the frequency of using cell phone while driving on Qatar's roads through an observational survey with a random sample of drivers to understand the magnitude of the problem. This study results a baseline rate of cell phone use in Qatar. This baseline rate will be critical in studying the effect of future plans or strategies that can help to minimize the impact of cell phone use while driving in Qatar, including new policies, enforcement, and public campaigns. This goal was achieved through a statistically representative observation sample of cell phone using behaviors from drivers on Qatar's roads.

Keywords: cell phone; traffic safety; observational survey

1. Introduction

Traffic accidents are one of the most significant challenges of modern societies. In Qatar, road accidents are responsible for approximately 18% of the total deaths in the country compared to approximately 2% in the USA. There is no doubt that traffic accidents cause social and economic problems and leave a direct impact on people. With respect to economic problems, traffic accidents constitute a substantial burden on society as a result of loss of life, injury and disability, and the increase in the amount of insurance and compensations. In Qatar, road traffic

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accidents kill approximately 200 people every year and injure or disable many others. In 2010, road accidents resulted 228 fatalities, 586 major injuries and 4,723 minor injuries in Qatar(1).

Studies show that the use of cell phones while driving can impair driving performance, which can cause a serious traffic safety issue. A study reported significant slowing in response to simulated traffic signals in cell phone users (2). Another study showed that phone use delayed driver reaction to the deceleration ahead (3). Hancock et al. (4) indicated that phone use seriously impaired crucial stopping decisions. De Waard et al. (5) found that looking up telephone numbers while holding the phone in one had showed a serious deterioration in driving performance in terms of lane control.

Studies have also shown that with the increase in cell phone general use, phoning while driving has also increased. It should be noted that Qatar currently has the highest cell phone penetration rates in the Middle East according to a recent study (6). The study attributed the continuous growth in cell phone in Qatar to the high purchasing power of consumers, which is proven by the level of consumer expenditure on telecommunications equipment and services, which is one of the highest in the Gulf Region. Another study showed that Qatar is one of the top 20 countries with the highest per capita cell phone use (seventh) with 1.4 million population and 2.5 million cell phone subscriptions (7). This high number of cell phone subscriptions may lead to a high cell phone use while driving in Qatar.

In order to reduce the growing number of accidents and reckless driving in Qatar, the Ministry of Interior (MOI) has introduced new traffic laws stipulating severe penalties related to cell phone use in October 2007. The new law stated that any driver using or holding a cell phone or any other device in hand while driving will pay a fine of approximately 500 Qatari Riyal (QR), which is equivalent to $137 and with no points. The MOI has changed the penalty for using cell phones while driving to become more severe. As part of the proposed changes, the violator will have to a pay a minimum fine of approximately $892 (QR3,000) and a maximum fine of $2,740 (QR10,000). The driver will be also liable to imprisonment up to one year. However, there is no clear method to study the impact of the new change.

A basic component to any research is understanding the extent of the problem. Without knowing how many people are engaging in a behavior, it is impossible to know how extensive the problem is and how well interventions work. The objective of the paper is to investigate the frequency of cell phone use while driving on Qatar's roads for the first time through an observational survey with a random sample of drivers, to understand the magnitude of the problem. This study will result a baseline rate of cell phone use in Qatar. This baseline rate will be critical in studying the effect of future plans or strategies that can help to minimize the impact of cell phone use while driving in Qatar including new policies, enforcement, and public campaigns. This goal will be achieved through a statistically representative observation sample of cell phone use behaviors from drivers on Qatar's roads. (10 pt) Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 10 pt. Here follows further instructions for authors.

2. Background

2.1. Effects of Using Cell Phone on Traffic Safety

Hedlund (8) suggests that cell phone use directly increases crash risk among U.S. drivers. Distractions, which include cell phone use, are responsible for between 15% and 25% of all crashes, including minor fender benders all the way up to fatal accidents. Redelmeier and Tibshirani. (9) used an epidemiologic method, the case-crossover design, to study whether using a cellular telephone while driving increases the risk of a motor vehicle collision. The study was conducted in Toronto with a population of 3 million people; they found that the risk of a collision when using a cell phone was four times higher than when it had not been used. In a similar study that

analyzed the cell phone use among drivers involved in crashes in Western Australia, the crash risk was found to be more than fourfold. The study also found a higher risk associated with using hands-free phones than with using hand-held phones. Later on, they found that the difference was not statistically significant in either case (10).

Additional study held by the University of Utah showed that talking with accompanying passengers while driving much safer than talking on a mobile phone. The study explained that because the passengers can see the road and are aware of its conditions more than the person over the phone that hampers the attention of the driver while driving (11). In addition to these studies, the Canadian Association of Emergency Physicians stated that cell phone use while driving negatively impacts cognitive functions, visual fields, reaction time, and overall driving performances. It was also found that cell phone use is as dangerous as driving under the influence of alcohol. As a result; vehicle crash rates were shown to be significantly higher when drivers used cell phones. Worldwide, there are over 50 countries that have already banned the use of cell phones while driving (12).

2.2. Cell Phone Use Rates

In Canada, Burns et al (13) conducted an observational survey study which record driver phone use while driving. The survey involved observation of about 41,137 vehicles in 249 sites in rural areas and around 92,440 vehicles in 270 urban areas with a total of 133,577 vehicles across Canada. The results showed that the use of cell phone at rural areas was 2.8%. At urban areas, the rate was significantly higher at 5.9%. The study also showed that older drivers were less likely to use their cell phone while driving. Drivers aged 50 years and above had a rate of 2.4% compared to the drivers below 25 years who had a rate of 6.7%.

In the United States, Cramer et al (14) conducted an observational survey study to identify cell phone use rate among college students. The researchers observed the use of cell phone while driving of around 3,650 drivers when the students exited the college parking at a major university in U.S. The results showed a rate of 11.1% of using cell phone while driving, which was significantly higher than a study done by a national survey which showed a rate of 8%. The study also found that female drivers used cell phones while driving 1.51 times more than men with a rate of (12.9%) females and (8.6%) male drivers. The drivers with passengers in their vehicles were 0.15 times more likely to drive while using cell phones than were solo drivers (1.8% vs. 12.1%).

Another study observed the use day time cell phones among drivers of passenger cars at controlled intersections in New York in U.S. at two different periods, before and after the application of the law that banned the use of cell phones while driving. The law was passed first by a warning period in the month of November 2001, and did not fine drivers for violating the law until March 2002. The study showed a significant decrease in the rate of users before and after the application of the law from a rate of 2.3% to 1.1% after the law was implemented. It, also showed the percentage of users in sports vehicle are the highest in terms of the types of vehicles and the age group above 60 years old had the lowest percentage used in the study (15).The objective of the paper is to investigate the frequency of cell phone use while driving on Qatar's roads for the first time through an observational survey with a random sample of drivers that represent the conditions of the real situation.

3. Data Collection

3.1. Survey Form

The survey form contained information about vehicle type, gender of the driver, age range of the driver categorized into three groups: under 25 years, between 25 to 50 years, and above 50 years, whether the driver's nationality is Qatari, Arab, Asian or American/European, and his/her cell phone use whether by hand, earphones, texting, or wireless connectivity. The study involved the drivers only, excluding the passengers and pedestrians. For the vehicle type, only two categories were used (Sedan and SUV). Vehicles that fall in categories other than

the two mentioned were assumed and put as either a sedan or a SUV, based on their size, making the process of data collection easier to conduct. For example, minivans were included under SUV's and pickup trucks were included under sedan. It should be mentioned that vehicles with obstructed views and/or dark tinted windows were excluded. The nationality of the drivers was included in the survey form due to the cultural diversity of the country and to categorize and filter the drivers, helping in later assessment of the results and giving indications to where the problem(s) might be falling.

3.2. Pilot Study

Prior to conducting the main survey, a pilot survey was administered. The trained observers were stationed at two different entrances to Qatar University (QU). The two locations were selected carefully to observe traffic, stopped at the main intersections leading to the university entrances. This strategy allowed for easy capturing of all data needed from all vehicles entering QU. The two locations consisted of a sample of 1,147 vehicles. Safety measures were strictly followed to ensure the safety of both the surveyors and drivers. During the pilot survey, issues such as location of the observer and angle of observation were tested. Based on the pilot study, it was decided not to include the vehicle's Bluetooth in the study since it was difficult to identify and thus, was neglected in the data analysis.

3.3. Site Selection

The next step was day and nighttime observations of drivers' use of handheld cell phones in Doha city and its suburbs were made. It should be noted that nighttime observations were made at locations with good lighting conditions. Observations were conducted on random week days or weekends with no fixed periods. Selection of sites excluded minor roads and collectors, in addition to roads suffering from a difficulty of finding suitable observation sites due to maintenance work and/or ongoing construction. The sites included signalized roundabouts, which are heavily used in Qatar and signalized intersections. The surveyors covered 14 different areas in Doha, generating a total of 39 surveys. Sticking to the procedures made in the pilot study, all but one intersection were observed until 200 samples were obtained. One had low traffic volume during the observation period and only 182 samples were possible to obtain, consisting to 7982 vehicles. Figure 3 shows the locations observed.

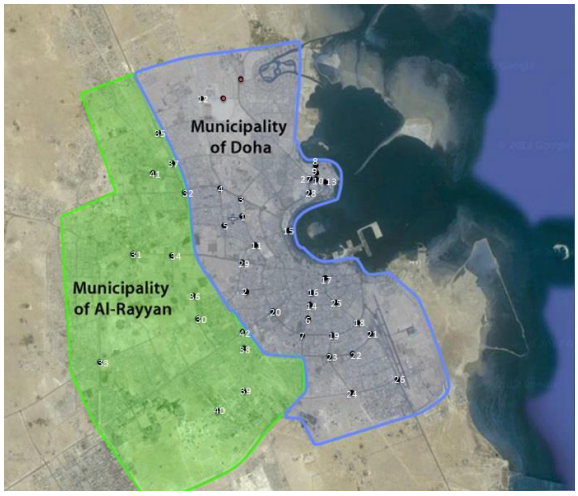


Fig. 1. Locations of Observed Sites

3.4. Procedure and Schedule of Observation

One approach was randomly selected from every intersection. Vehicles were observed at each location until 200 sample was achieved. The observations included all lanes in one traffic direction, as well as the left turn lanes. The observers were positioned at the roadside at or near the intersection, facing the approaching vehicles. The samples were collected during the period of red light stopping. Observers observed the junctions either from their parked cars or standing at the side of the road. Yellow reflecting vests were used at all times. During the observation, the observers filled the data sheets consisting of 40 vehicles a page, marking at the side of the sample's number if the view was obstructed by tinted windows. The observations were conducted during the months of January and February of 2013 when the weather is pleasant for outdoor activities in Qatar.

3.5. Data Entry

Using the data gathered from the sites, each observer was responsible of converting his surveys from their paper form to electronic sheets to further process them.

3.6. Quality Control

The survey papers and data entered were revised by team members that were not involved in the data entry process to ensure good quality. Furthermore, standardizing of data entry was implemented.

4. Analysis

The data of 7982 participants was collected. . Five variables were included in the survey; sex of respondent, type of phone use (holding in hand, texting, or earphone) or not using, the nationality, the car type and the age within three categories: under 25 years, 25-50 years and 50 years+. Around 91% of survey participants were males. Further, participants who were 25 to 50 years showed the highest rate (80.56%) compared with all other age groups. The vast majority of participants (88.5%) did not use the phone.

A total number of 7982 vehicles (male and female numbers) were observed at 40 intersections covering key parts of Doha. The methods of using cell phones that were considered during the observations were talking over the phone, texting and using earphones. Using the vehicle's Bluetooth and wireless devices were not considered since they were difficult to identify as explained in the pilot study section. The distribution of the survey sample is shown in Table 1.

Out of the 7982 drivers, 923 drivers were observed using their cell phones, which is equivalent to 11.48% of the total number of vehicles. Most of the drivers using their cell phones were male (89.8%), while the remaining 10.2% were female drivers. The study also included various nationalities such as, Qatari, Arab, Asian and Europe or American drivers. Figure 2 shows the distribution of cell phone use on nationality.

A major focus of the study is the age distribution of drivers who use their cell phones at intersections. During the observations, drivers were categorized into three age groups. The first group was drivers less than 25 years old, which was 12% out of the total number of vehicles observed. The second age group was drivers between 25 and 50 years old with a percentage of 81%. The third and last group was drivers older than 50 with a percentage of 7% out of the total number of vehicles.

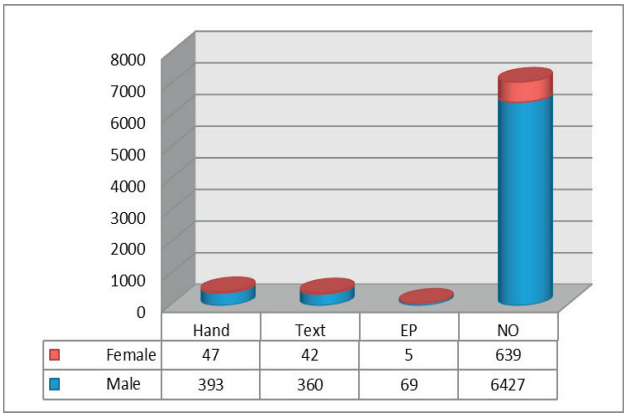
On the other hand, the observations showed that the type of vehicle slightly influences the phone usage. Vehicle's type was split into two categories; sedan and SUV's. It should be noted that Sedan drivers used their cell phones less than SUV drivers as shown in Figure 2.

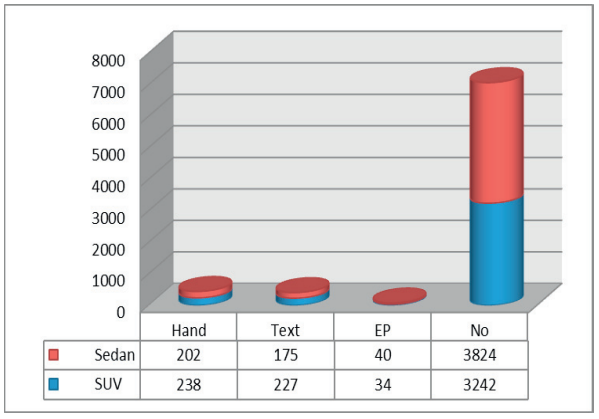
Table 1. Distributions of Survey Sample

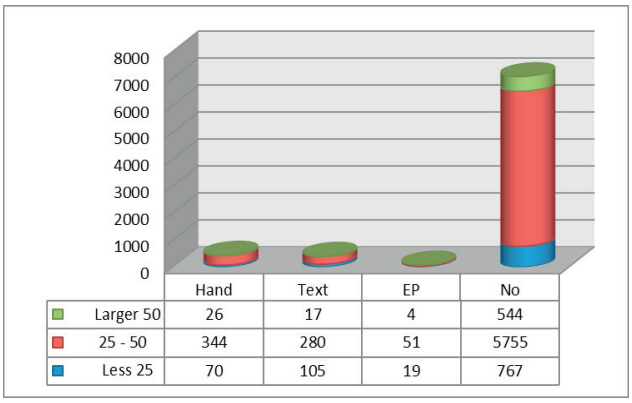
Variables	Categories	Number of	Percentages of
Gender	Male	7249	90.82
	Female	733	9.18
Phone Use	No	7066	88.52
	Hand	440	5.51
	Text	402	5.04
	EP	74	0.93
Nationality	Qatari	1367	17.13
	Arab	2122	26.58
	Asian	4026	50.44
	Europe/American	467	5.85
Car type	SUV	3741	46.87
	Sedan	4241	53.13
Age	Less 25	961	12.04
	25 - 50	6430	80.56
	Larger 50	591	7.40

The Pearson's Chi-square ($\chi 2$) was used to estimate the strength of the possible association between using and not using phone (hand, text, and earphone, or not use) within four categories: nationality, age, sex and car type. The Pearson Chi-square analysis was conducted using the SAS software with a level of significance of 0.05.

The association between phone use, car type, age and the nationality of the participants was all found statistically significant as per the results of the Pearson Chi-square test shown in Table 2. However, the results found no significant relationship between the using phones and the sex of respondents at the 5% significance level. Based on the results, the use of cell phone among drivers can depend on the age, nationality of the users, and vehicle type.







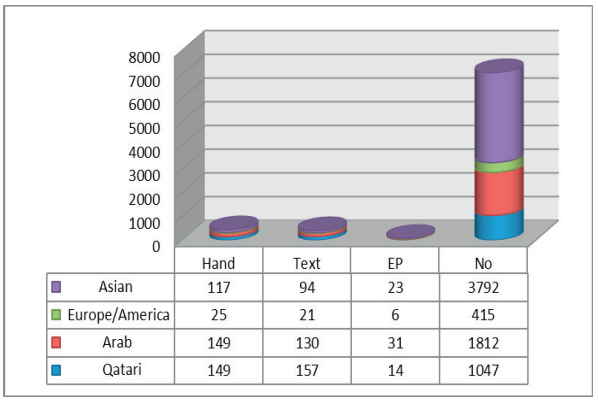


Fig. 2. Cell Phone Use by Gender, Age, Nationality, and Vehicle Type

Table 2. Characteristics of Phone Users and Non-users.

Characteristics	Phone users (n=916)						Non Phone users (n=7066)		P-Value[2] χ2 values
	Hand (440)		Text (402)		EP (74)				
	n	Col %	n	Col %	n	Col %	n	Col %	
Gender									
Male	393	5.42	360	4.97	69	0.95	6427	88.66	N.S
Female	47	6.41	42	5.73	5	0.68	639	87.18	χ2 =2.64
Nationality									
Qatari	149	10.90	157	11.94	14	1.02	1047	76.59	P<.0001
Arab	149	7.02	130	6.13	31	1.46	1812	85.39	χ2=358.60
European/America	25	5.35	21	4.50	6	1.28	415	88.87	
Asian	117	2.91	94	2.33	23	0.57	3792	94.19	
Car Type									
SUV	238	6.36	227	6.07	34	0.91	3242	86.66	P<.0001
Sedan	202	4.76	175	4.13	40	0.94	3824	90.17	χ2=26.88
Age									
Less than 25	70	7.28	105	10.93	19	1.98	767	79.81	P<.0001
25 - 50	344	5.35	280	4.35	51	0.79	5755	89.50	χ2=107.54
More than 50	26	4.40	17	2.88	4	0.68	544	92.05	

[2]Based on chi-square tests,N.S. = non-significant P-value.
For using seat belts based on logistic regression models integrating gender, nationality and car type.

5. Generalized Logit Model

The objective of the modeling phase is to identify the factors that may affect use phone. The response variable (phone use) has four modalities (text, hand, ear phone and no use). Thus, logistic regression was used in this study to estimate the effect of the statistically significant factors on phone use. Logistic regression can easily be extended to outcomes with multiple categories. Initially consider an outcome Y with values 0, 1,... ,r. Formulation of the generalized logit models for nominal response variables can be found in Agresti (*16*).

Let Y be the response variable with categories 1,…, r. Let $X = (x_0, x_1, \dots, x_p)'$ be a (p+1) vector of covariates, By choosing k as the reference category, the j[th] logit is given by

$$\log\left[\frac{P(Y=j/X)}{P(Y=k/X)}\right] = X'\beta_j 0 \le j \le r \; j \ne k \tag{1}$$

Where β_j is a (p+1) vector of the regression coefficients for the jth logit.

For the convenience of notation, consider the last response level to be the reference level. The response probabilities $\pi_1, \dots, \pi_r$ are given by

$$\pi_r = P(Y=r/X) = 1/(1+\sum_{l=1}^{r-1}\exp(X'\beta_l)) \tag{2}$$

$$\pi_j = P(Y=j/X) = \pi_r \exp(X'\beta_j) 1 \le j \le r-1 \tag{3}$$

When *r*= 2, this model is equivalent to the binary Logistic Regression model

As shown Table 3, two variables were found most significantly at the 5% significance level associated with the using phone or not. These variables are age and nationality. Finally, our model can be written in the following form:

$$Y = Phone\_Use = \begin{cases} Hand \\ Text \\ EP \\ NoUse \end{cases} \quad \text{and} \quad X = \begin{cases} X_1 = Gender \\ X_2 = Nationality \\ X_3 = Car\ Type \\ X_4 = Age \end{cases} \tag{4}$$

$$\log\left[\frac{P(Y=Hand/X)}{P(Y=NoUse/X)}\right] = -2.85 - 0.82*(X_2 = Asian) + 0.18*(X_2 = Arab) + 0.71*(X_2 = Qatar) - 0.37*(X_4 = larger\ 50) \tag{5}$$

$$\log\left[\frac{P(Y=Text/X)}{P(Y=NoUse/X)}\right] = -2.99 + 0.15*(X_1 = Male) - 0.89*(X_2 = Asian) + 0.15*(X_2 = Arab) + 0.81*(X_2 = Qatar) - 0.73*(X_4 = larger\ 50) \tag{6}$$

$$\log\left[\frac{P(Y=EP/X)}{P(Y=NoUse/X)}\right] = -4.69 - 0.71*(X_2 = Asian) + 0.31*(X_2 = Arab) - 0.58*(X_4 = larger\ 50) \tag{7}$$

Table 3. Estimated Model

Estimation using generalized logit model with Cell Phone Use = NoUse, Gender = Female, Vehicle Type=SUV, Nationality=ER.A and Age=less than 25 as the reference categories

Analysis of Maximum Likelihood Estimates							
Parameter		Phone Use	DF	Estimate	Standard	Wald	Pr>ChiSq
Intercept		Ep	1	-4.69	0.28	269.74	<.0001
Intercept		Hand	1	-2.85	0.11	661.93	<.0001
Intercept		Text	1	-2.99	0.12	591.36	<.0001
Gender	Male	Ep	1	0.37	0.23	2.51	0.1128
Gender	Male	Hand	1	0.09	0.08	1.38	0.2386
Gender	Male	Text	1	0.15	0.08	2.98	0.0840
Car Type	SL	Ep	1	0.02	0.12	0.03	0.8512
Car Type	SL	Hand	1	-0.02	0.05	0.16	0.6892
Car Type	SL	Text	1	-0.05	0.05	0.83	0.3596
Nationality	AS	Ep	1	-0.71	0.21	11.02	0.0009
Nationality	AS	Hand	1	-0.82	0.09	72.88	<.0001
Nationality	AS	Text	1	-0.89	0.10	71.21	<.0001
Nationality	AR	Ep	1	0.31	0.19	2.66	0.1026
Nationality	AR	Hand	1	0.18	0.08	4.28	0.0385
Nationality	AR	Text	1	0.15	0.09	2.69	0.1008
Nationality	QT	Ep	1	0.03	0.24	0.01	0.9022
Nationality	QT	Hand	1	0.71	0.09	58.80	<.0001
Nationality	QT	Text	1	0.81	0.09	70.11	<.0001
Age	25 - 50	Ep	1	-0.14	0.21	0.50	0.4765
Age	25 - 50	Hand	1	0.12	0.08	1.86	0.1722
Age	25 - 50	Text	1	0.007	0.10	0.01	0.9426
Age	>50	Ep	1	-0.58	0.34	2.81	0.0933
Age	>50	Hand	1	-0.37	0.14	6.71	0.0096
Age	>50	Text	1	-0.73	0.17	18.33	<.0001

6. Conclusions and Recommendations

The results of these surveys provide a snapshot of driver phone use in Qatar for the first time through an observational survey with a random sample of drivers to understand the magnitude of the problem. This study results a baseline rate of 11.48% of cell phone users in Qatar, which is considered high, compared to other countries such as 5.9% for Canada (13) and 8% for the United States (14).

The survey results also gave some indication of the patterns of phone use. Phone use varied significantly by age, gender, nationality, and vehicle type. Drivers aged 50 years and older (9.0%) were much less likely to use a cell phone than drivers 25 to 49 years old (10.5%) and drivers under 25 years (20.2%). A slightly greater proportion of women (12.8%) were on the phone than of men (11.3%). Phone use was higher among SUVs (13.3%) than in passenger cars (9.8%). This baseline rate will be critical in studying the effect of future plans or strategies that can help to minimize the impact of cell phone use while driving in Qatar, including new policies,

enforcement, and public campaigns. This goal was achieved through a statistically representative observation sample of cell phone use behaviors from drivers on Qatar's roads.

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