

Risk factors contributing to road traffic crashes in a fast-developing country: the neglected health problem

Hızlı gelişen ülkelerde karayolu trafik kazalarına katkıda bulunan risk faktörleri:
İhmal edilen sağlık sorunu

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BACKGROUND

The main objective of this study was to explore the patterns of road traffic crashes (RTCs) among drivers in Qatar and to examine the contributing factors involved.

METHODS

This study was a cross-sectional survey conducted from February to June 2009 at the Primary Health Care Centers in the State of Qatar. A random sample of 1675 Qatari drivers were approached, and 1228 of them responded and agreed to participate in this study, with a response rate of 74.6%. Face to face interview was conducted by well-trained research assistants based on a questionnaire covering sociodemographic information, driving history, type of vehicle, driver behavior, details of crashes, and accident pattern.

RESULTS

The study revealed that 26.6% of the studied Qatari drivers were involved in RTCs. 69.4% of the drivers with a history of RTCs were male. Drivers in the age group 25-34 years showed a higher risk of having a crash (31.2%). Drivers of cars (45.6%) and 4WD/SUVs (23.5%) were more frequently involved in RTCs. 23.5% of drivers who had RTC did not always wear their seat belt while driving. 37.9% of the drivers with RTC were engaged in eating and drinking and 41.9% were using their mobile phones while driving. More than half of the drivers with RTCs had traffic violations (57.2%), with 25.7% exceeding the speed limit. A highly significant difference was observed between the two groups (drivers with and without RTC) in terms of presence of traffic violation (<0.001) and exceeding the speed limit (<0.001). Most of the crashes happened during sunny days (84.7%) with fewer crashes on holidays (5.5%) and weekends (12.5%). Overturn skid (17.7%), angle collision (14.3%) and rear-end hit (10.7%) were the most frequently reported patterns of RTCs.

CONCLUSION

The study findings revealed the high risk of RTCs among drivers in the State of Qatar. Among the sociodemographic factors, male drivers and young drivers aged 25-34 years were found to have a higher accident involvement. Human behavior was identified as the main contributing factor of all RTCs, especially presence of traffic violations.

Key Words: Excessive speed; road traffic crashes; traffic violations; Qatar.

AMAÇ

Bu çalışmanın başlıca amacı, Katar'daki sürücüler arasındaki karayolu trafik kazalarının (KTK) paternini araştırmak ve KTK ile ilişkili faktörleri incelemektir.

GEREÇ VE YÖNTEM

Bu çalışma, Şubat-Haziran 2009 tarihleri arasında Katar Devleti Sağlık Merkezlerinde yürütülen kesitsel çalışmadır. Rastgele yöntemle seçilen 1675 Katarlı sürücüden oluşan grupla çalışıldı. Sürücülerin 1228'i %74,6'lık bir yanıt oranıyla soruları yanıtlayıp bu çalışmaya katılmayı kabul etti. İyi eğitilmiş araştırma asistanları tarafından yüz yüze görüşülerek; sosyodemografik bilgi, sürücülük öyküsü, araç tipi, sürücü tutumu, kazaların ve kaza şeklinin ayrıntılarını kapsayan bir anket yapıldı.

BULGULAR

Bulgular şöyleydi: Çalışma, Katarlı sürücülerin %26,6'sının KTK'ya karıştığını gösterdi. KTK öyküsü bulunan sürücülerin %69,4'ü erkek idi. 25-34 yaş grubundaki sürücüler, daha yüksek kaza riskini (%31,2) gösterdi. Arazi taşıtı ve spor amaçlı taşıt özelliğe sahip araçlarla (%23,5) sürücüler (%45,6), KTK'dan daha fazla etkilendi. Kaza geçiren sürücülerin %23,5'i, araç sürerken her zaman emniyet kemeri kullanmıyordu. Sürücülerin yarısından daha azı, araç sürerken yeme ve içme (%37,9) ve cep telefonu kullanmakta (%41,9) idi. Sürücülerin yarısından daha fazlası, trafik kuralı ihlali (%57,2) ve hız sınırını aşma (%25,7) ile trafik kazasına karıştı. Her iki grup (trafik kazası geçiren ve geçirmeyen sürücüler) arasında trafik kuralı ihlali (<0,001) ve hız sınırını aşma (<0,001) açısından ileri derecede anlamlı fark gözlemlendi. Kazaların çoğu güneşli günlerde (%84,7), daha azıysa tatiller (%5,5) ve hafta sonları (%12,5) oldu. Yana doğru savrulma (%17,7), açılı çarpışma (%14,3) ve arkadan çarpma (%10,7) en sık rapor edilen KTK şekli oldu.

SONUÇ

Çalışma bulguları Katar Devleti'ndeki sürücüler arasındaki yüksek KTK riskini ortaya koymuştur. Sosyodemografik faktörler arasında, erkek ve 25-34 yaş grubundan genç sürücülerin daha yüksek bir kazaya karışma durumuna sahip olduğu bulunmuştur. İnsan davranışlarının, bütün KTK ve özellikle de trafik kuralı ihlallerine katkıda bulunan asıl faktör olduğu belirlenmiştir.

Anahtar Sözcükler: Aşırı hız; karayolu trafik kazaları; trafik kuralı ihlalleri; Katar.

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Road traffic crashes (RTCs) are a major cause of death and disability globally, with a disproportionate number occurring in developing countries.^[1] The World Health Organization reported that RTCs are one of the leading causes of morbidity and mortality worldwide, accounting for 1 million deaths per year.^[2] Previous researches have shown that many developing countries have a serious road accident problem and that accident rates are higher than those of western industrial countries.^[3-6] Furthermore, in the Arabian Gulf countries, RTCs are increasingly being recognized as a growing public health problem.

In addition to the population structure and vehicle population, there are many other contributing factors in RTCs, like socioeconomic factors, road user behavior, the driver's ability and attitude, traffic engineering, vehicle characteristics, the roads, and the environment. A previous research done by Bener^[4] analyzing traffic crashes in Qatar indicated that human factors were the sole or a contributory factor in most RTCs. Among the socioeconomic factors, a few studies,^[6-10] revealed that age and education were found to be two of the most correlated with accident occurrence.

The state of Qatar has witnessed progressive development in infrastructure and economy during the last decade. The rapid transition in socioeconomic status since the discovery of oil in Qatar has changed many aspects of the population's lifestyle. Over the last two decades,^[11] the number of motor vehicles registered in 2007 (605,699 vehicles) showed a three-fold increase as compared with 1993 (205,852 vehicles). Over the same period, RTCs increased by 147% and the population of Qatar reached 1,226,210, an increase of 164%. The process of rapid urbanization and the huge growth in both the number of vehicles and the population have resulted in an alarming increase in the number of RTCs and morbidity and mortality owing to RTCs. Furthermore, a previous study^[4] performed in Qatar reported that the fatality rate per 100,000 vehicles in Qatar was much higher than in the developed countries like the United States and the United Kingdom. In Qatar, RTCs were the third leading cause of death after cardiovascular diseases and cancer.

The human factor appears in the literature^[12] as being the most prevalent contributing factor of RTC. This includes both driver behavior and impaired skills like inattention, fatigue and physical disabilities. Since most crashes are multifactorial, it is important to study and analyze the contributing factors along with the causes and circumstances that lead to crashes. Hence, this community survey aimed to explore the patterns of RTCs and the risk factors contributing to RTCs in Qatar.

MATERIALS AND METHODS

This is a cross-sectional study, carried out at the Primary Health Care Centers (PHCs) using their reg-

istry. The survey was conducted from January 2009 to June 2009 among Qatari drivers. After obtaining informed consent, each participant was interviewed by a pre-trained interviewer using a standard questionnaire covering sociodemographic information, driving history, type of vehicle, driver behavior, details of crashes, and accident pattern. The sample size was determined on a prior presumption that the prevalence rate of RTCs in Qatar would be more or less similar to rates found for several other countries in the Gulf, around 22%. Assuming the prevalence of RTC to be 22%, with the 95% confidence interval for an error of 2% at the level of significance, a sample size of 1646 would be required to meet the specific objectives of the study.

Out of 22 PHCs, nine health centers were located in urban and three in semi-urban areas of Qatar. The study included all Qatari men and women aged 18 years and above who attended these PHCs and were willing to participate in the study. During the study period, 1646 subjects were approached, of whom 1228 responded to the questionnaire, for a response rate of 74.6%. Non-Qataris, pregnant women, subjects with severe medical condition or mental disorder, those who did not meet the eligibility criteria, and those who were not willing to participate in the study were excluded from the analysis. A letter of consent was provided to the participants before the interview along with an explanation of the study. International Review Board exemption for the study was obtained from Weill Cornell Medical College in New York.

Student-t test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by non-parametric Mann-Whitney test. Fisher exact and chi-square tests were performed to test for differences in proportions of categorical variables between two or more groups. A level of $p < 0.05$ was considered as the cut-off value for significance.

RESULTS

Table 1 reveals the sociodemographic characteristics of the studied drivers who did or did not have crashes. Of the studied Qatari drivers, 26.6% were involved in crashes. The highest percentage of the RTCs occurred in the age group 25-34 years (31.2%), followed by 35-44 years (22.9%). The crashes were more common among male drivers (69.4%), with females accounting for 30.6% of the crashes. The frequency of RTCs was higher among drivers who were married (67.9%). The highest frequency of crashes occurred in drivers with university degree (32.7%).

Table 2 shows the vehicle characteristics and driving experience of the studied Qatari drivers according to the history of RTCs. Studied drivers with more

Table 1. Sociodemographic characteristics of the studied drivers according to the history of RTCs (n=1228)

Variables	Involved in RTAs		p
	Yes n=327 n (%)	No n=901 n (%)	
Age group			
18-24	56 (17.1)	124 (13.8)	0.401
25-34	102 (31.2)	293 (32.5)	
35-44	75 (22.9)	240 (26.6)	
45-54	67 (20.5)	164 (18.2)	
≥55	27 (8.3)	80 (8.9)	
Gender			
Male	227 (69.4)	679 (75.4)	0.036
Female	100 (30.6)	222 (24.6)	
Marital status			
Single	105 (32.1)	283 (31.4)	0.815
Married	222 (67.9)	618 (68.6)	
Household income			
<5000	41 (12.5)	77 (8.5)	0.122
5000-9999	111 (33.9)	321 (35.6)	
10000-14999	80 (24.5)	204 (22.6)	
>15000	95 (29.1)	299 (33.2)	
Education level			
Illiterate	20 (6.1)	43 (4.8)	0.386
Primary	30 (9.2)	114 (12.7)	
Intermediate	67 (20.5)	166 (18.4)	
Secondary	103 (31.5)	271 (30.1)	
University	107 (32.7)	307 (34.1)	

Table 2. Vehicle characteristics and driving experience of studied drivers according to the history of RTCs

Variables	Involved in RTCs		p
	Yes n=327 n (%)	No n=901 n (%)	
Driving experience			
<1 year	32 (9.8)	61 (6.8)	0.166
1-3 years	100 (30.6)	261 (29.0)	
3-5 years	70 (21.4)	183 (20.3)	
>5 years	125 (38.2)	396 (44.0)	
Owner of a vehicle			
Yes	218 (66.7)	709 (78.7)	<0.001
No	109 (33.3)	192 (21.3)	
Type of vehicle			
Heavy or light truck	23 (7.0)	40 (4.4)	0.019
Bus	29 (8.9)	52 (5.8)	
Minibus	29 (8.9)	75 (8.3)	
Pick-up	20 (6.1)	75 (8.3)	
Car	149 (45.6)	485 (53.8)	
4WD/SUV	77 (23.5)	174 (19.3)	

Table 3. Driver behavior and traffic violations according to the history of RTCs (n=1228)

Variables	Involved in RTC		p
	Yes n=327 n (%)	No n=901 n (%)	
Are you familiar with the new traffic law put into effect?			
Yes	227 (69.4)	654 (72.6)	0.276
No	100 (30.6)	247 (27.4)	
Do you use a seat belt while driving?			
Always	250 (76.5)	737 (81.8)	0.037
Sometimes	77 (23.5)	164 (18.2)	
Distracting habits while driving			
Smoking	41 (12.5)	137 (15.2)	0.241
Eating or drinking	124 (37.9)	277 (30.7)	0.018
Use mobile phone	137 (41.9)	382 (42.4)	0.875
SMS/Text	72 (22.0)	171 (19.0)	0.237
Do you follow traffic speed limit?			
Always	241 (73.7)	665 (73.8)	0.054
If radar/camera installed (sometimes)	77 (23.5)	183 (20.3)	
Never	9 (2.8)	53 (5.9)	
Traffic violations within a year			
Yes	187 (57.2)	398 (44.2)	<0.001
No	140 (42.8)	503 (55.8)	
Violations			
Red light violation	48 (14.7)	97 (10.8)	0.060
Exceeding speed limit	84 (25.7)	135 (15)	<0.001
Stop or yield violation	15 (4.6)	50 (5.5)	0.506
Parking violation	42 (12.8)	85 (9.4)	0.083

driving experience (>5 years) were more frequently involved in RTCs (38.2%), followed by 1-3 years (30.6%) and 3-5 years (21.4%) of driving experience. RTCs were more common among drivers who were owners of vehicles (66.7%), while it was lower among drivers who were not owners (33.3%). Drivers of cars (45.6%) and 4WD/SUVs (23.5%) were more affected by RTCs. A significant difference was observed between drivers who did and did not have crashes in terms of ownership of vehicle (<0.001) and type of vehicle (p=0.02).

Table 3 shows the driver behavior and traffic violations according to the history of RTCs. 23.5% of Qatari drivers who had crashes did not always wear a seat belt while driving. However, a higher proportion of seat belt usage was found among drivers who were not involved in crashes (81.8%). There was a statistically significant difference observed between the two

Table 4. Characteristics of RTCs of the studied drivers who had RTCs according to time and location of accidents (n=327)

Variables	Count	Percentage
Day of week		
Saturday	41	12.5%
Sunday	53	16.2%
Monday	51	15.6%
Tuesday	51	15.6%
Wednesday	59	18.0%
Thursday	48	14.7%
Friday	24	7.3%
On holidays (Eid, National)		
Yes	18	5.5%
No	309	94.5%
Weather - Temperature		
Very Hot	4	1.2%
Hot	245	74.9%
Moderate	78	23.9%
Weather - Sky		
Cloudy	15	4.6%
Dusty	24	7.3%
Sunny	277	84.7%
Rainy	11	3.4%
Accident location		
Main road	73	22.3%
Side road	30	9.1%
At the crossroad	39	11.9%
Roundabout	139	42.7%
Traffic light	22	6.7%
Alley	24	7.3%
Severity of damage to vehicle		
Mild	133	40.7%
Moderate	136	41.6%
Severe	58	17.7%

groups with respect to seat belt usage (p=0.04) and eating and drinking while driving (p=0.02). More than half of the studied drivers with a history of crashes had traffic violations (57.2%) especially in exceeding the speed limit (25.7%). A highly significant difference was observed between the two groups in traffic violations (<0.001) and exceeding the speed limit (<0.001).

Table 4 shows characteristics of RTCs of the studied drivers who were involved in RTCs according to time and location of crashes. Most of the crashes occurred during sunny days (84.7%) and at roundabouts (42.7%). Only 17.7% of the crashes resulted in severe damage to the vehicle.

Figure 1 reveals the pattern of RTCs according to RTC type. Overturn skid (17.7%), angle collision (14.3%) and rear-end hit (10.7%) were the most frequently reported patterns of RTCs.

DISCUSSION

RTCs are a large problem everywhere in the world. In the State of Qatar, the present study findings revealed that RTCs remain a neglected health problem, although many studies have been conducted in the past related to RTCs, fatalities and driver behavior.^[3,10,11,13] The present study explored the patterns of crashes and highlighted the contributing factors that are linked with an increased probability of road crashes.

Among the studied Qatari drivers, 26.6% of them were involved in RTCs. The distribution of the study subjects by age revealed that young drivers aged 25-34 years were more frequently affected (31.2%). In a previous study^[13] done in Qatar on the role of gender and driver behavior in RTCs in 2005, it was reported that 39.7% of the Qatari drivers with a history of RTCs were aged below 30 years (39.7%). A higher proportion was observed in a study^[14] done in a neighboring country, Saudi Arabia, in which 41% of the crashes involved drivers aged 25-35 years. In Kenya,^[15] 75% of RTCs were attributed to the young adult drivers aged 15-44 years. Furthermore, in Pakistan,^[16] the group aged 21-25 years had a higher risk of having crashes (18%), while only 2% of crashes involved older drivers aged 51-55 years. These study findings reveal that the high accident risk among young drivers is a worldwide problem.^[17]

It is very surprising to note that the rate of accident involvement among the studied drivers in Qatar increased in conjunction with the driver's level of education. Traffic crashes were more common in drivers with university degree (32.7%). In Qatar, a risk-taking behavior was observed among young drivers, as reported in a previous study,^[13] in which young Qatari drivers were shown to have a higher risk of having crashes because of their risk-taking behavior. Another research^[18] indicated an opposite result, in which accident involvement decreased with the driver's level of education.

Another contributing factor was the influence of driver gender on road crashes. In the present study,

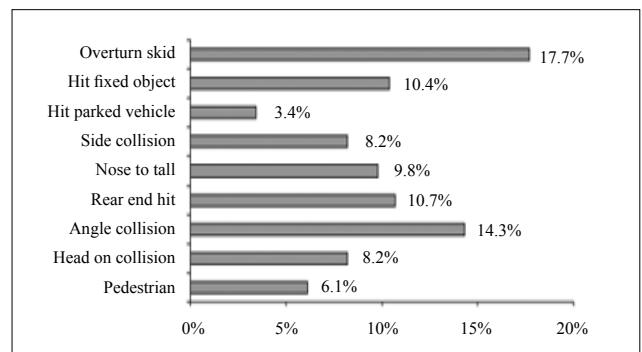


Fig. 1. Pattern of road traffic crashes according to type.

male drivers were the predominant victims (69.4%). In Pakistan,^[16] 76% of drivers with a history of crashes were male. In Middle Eastern countries, females are less active than men and generally remain indoors. Male drivers are more prone to accident involvement.

Human behavior is thought to be a major factor in most crashes. In a major study conducted by the National Highway Traffic Safety Administration,^[19] it was documented that nearly 80% of traffic crashes involved driver inattention. This was also true in the present study, which showed that 37.9% of the drivers with a history of RTCs were engaged in eating and drinking while 41.9% were using their mobile phone while driving. A recent cross-sectional survey^[10] conducted in a large sample of Qatari drivers reported a high frequency of mobile phone use while driving (73.2%). A few studies reported by Bener et al.^[3,10,11,20,21] have indicated impairments in driving performance due to mobile phone use, which increases the risk of a traffic collision and the distraction of drivers.

Driver's error was identified as the main contributing factor of all RTCs. More than half of the studied drivers had traffic violations (57.2%), especially in exceeding the speed limit (25.7%). Wong and his colleagues^[21] reported in their study that an increase in mean traffic speed by 1 km/h is found to increase accident frequency by 3%, and accident analysis shows that the higher the impact of speed, the greater the chance of serious or fatal injury. During the last three decades, excessive speed limits increased morbidity and mortality in the United Arab Emirates and Western countries.^[22] These results reveal that excessive speed is the most common contributory factor in RTCs.

Furthermore, most of the RTCs happened during sunny days (84.7%). In Saudi Arabia,^[14] it was reported that the majority of crashes were recorded in adverse weather conditions, with most of the crashes during sunny days occurring during the rush period of 12 noon to 3 p.m. This may be attributed to the fact that glaring sunlight can make driving more difficult. The most common reported patterns of RTCs were overturn skid (17.7%) and angle collision (14.3%). The risk factors contributing to RTCs explained in this study highlight the importance of community awareness programs to improve driver behavior and the high risk involved in driver errors.

In conclusion, the study findings revealed the high risk of RTCs among drivers in the State of Qatar. Male gender and young drivers aged 25-34 years demonstrated a higher risk of RTCs. Human behavior was identified as the main contributing factor of all RTCs. Nearly half of the drivers with a history of RTCs were distracted with eating, drinking and using their mobile phones while driving. Most of the drivers had traffic

violations, especially related to exceeding the speed limit. A well-planned and timed strategy should be launched against RTCs in Qatar.

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