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The Prevalence of Risky Driving Habits in Riyadh, Saudi Arabia

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Abstract: Road traffic crashes represent a substantial global public health issue. In Saudi Arabia, which is the focus area of this research, road traffic crashes kill over 130,000 people annually, accounting for almost 5% of deaths in that country. A cross-sectional study with 316 participants holding a valid Saudi driver's license was conducted via the internet from December 2019 to March 2020 to collect information about the prevalence of risky driving habits among Saudi drivers. The sample was predominantly men and aged between 20 and 39, which is representative of the population of drivers in Saudi Arabia. Drivers generally reported engaging in safe behaviors, although they did state that they drove above the legal speed limit, drove aggressively around slow drivers, and became distracted while driving with some frequency. Multivariate analyses suggested men took more risks than women and younger drivers took more risks than older ones. We conclude that the behavior among drivers in Saudi Arabia generally matches those in other cultures and countries, with men and young adults taking the most risks while driving. Preventative strategies should be developed and implemented in Saudi Arabia.

Keywords: road accidents; risky driving habits; behaviors; prevalence

1. Introduction

Road traffic crashes represent an emerging public health concern globally [1]. The burden imposed by traffic crashes and the subsequent injuries and deaths from those crashes are growing in magnitude as well as relative to the public health burden, resulting in substantial increases in mortality and disability-adjusted life years (DALYs) lost in several nations [1]. Globally, in 2019, road traffic injuries (RTIs) ranked as the ninth most common cause of DALYs lost for all age and gender categories [2].

Beyond public health impact, motor vehicle crashes have a substantial impact on the health care system. For example, the number of occupied hospital beds increases dramatically as a result of these traffic-related injuries, which in turn reduces hospitals' capacity to attend to other critically ill patients. Finally, road traffic injuries negatively impact national economies. According to a study conducted by Koustuv Dalal in 2013,

RTIs generate global losses that are "estimated to be 518 billion United States Dollars (USD) and cost governments between 1% and 3% of their gross domestic product (GDP)" [3]. The severity of this problem is expected to continue to rise in the near future. RTIs were estimated to rise from the tenth to eighth among the leading causes of the global burden of disease between 2002 and 2020 [4]. Preventive strategies are urgently needed.

Public health theorists conceptualize RTIs as occurring from the result of the following three factors: the environment, the vehicle, and human behavior [5]. Environmental causes include the road conditions, visibility, and weather [5]. Vehicle factors incorporate safety maintenance and vehicle engineering [5]. Human factors, which are the present focus, include behavior such as violations and risky driving habits [5]. Risky driving habits that can result in crashes include driving above the speed limit, illegal turns, blocking intersections, changing lanes without signaling, cutting in front of other drivers, driving through yellow or red traffic lights, and neglecting the use of seat belts [6].

Saudi Arabia, where the present research was conducted, has among the highest RTI mortality and morbidity rates in the world. According to the WHO, the number of deaths in Saudi Arabia due to RTI is 24.8 per 100,000 of the population (>130,000 deaths annually). RTI accounts for 4.7% of all deaths in the country [7,8]. In 2017, 460,488 traffic crashes were reported by the Saudi Ministry of the Interior and the police department [9]. As a result of those crashes, a total of 7489 deaths and 33,139 serious injuries were recorded [9]. The Ministry of Health hospital records found that 20% of hospital beds in the country were occupied by road traffic injury victims and 81% of mortalities in hospitals were due to RTIs [8].

Riyadh, Qassim, Makkah, Jeddah and Madinah are the Saudi cities with the most road traffic accidents (RTAs) on a national level [9]. Riyadh, which is the capital of the country and the most crowded city, has the highest rate. According to the latest traffic statistics issued by the Ministry of the Interior in 2010, the total number of crashes per year that resulted in death in Riyadh was 256 crashes, which is equivalent to a rate of almost 22 deaths per month. One study reported that 83.4% of the trauma admissions in Riyadh hospitals from 1984 to 1989 were a result of RTAs [9] and a retrospective study reported similar outcomes, with 80.1% of traumatic spinal cord injuries resulting from RTAs [10].

Unusual weather patterns also influence traffic safety in Riyadh [11]. Riyadh drivers face rainy days and dust/sandstorms on occasion. Many drivers are not accustomed to driving in poor weather conditions, which results in safety risks [12]. Previous research suggests environmental factors play a significant role in road crashes in Saudi Arabia [12,13].

Other factors that may influence RTI risk are human factors such as lifestyle and culture. Factors such as the acceptance of dangerous driving practices and non-compliance with traffic rules vary across cultures and countries [14]. Previous research in Saudi Arabia indicates considerable culture-based risk. For example, one study found that an alarmingly high percentage of males (43%) were driving without a valid driver's license [8]. The same study reported that "86% engaged in at least one risky behavior while driving", including "94.9% and 98.5% of the study sample who reported not wearing a seatbelt in the front and back passenger seats, respectively" [15]. In another report, only 34% of drivers in Riyadh were observed to be wearing seatbelts [16]. Furthermore, it has been estimated that approximately 660,000 Saudi drivers use their phones while driving [16].

Considerable efforts have been made by the Saudi government to improve the safety culture. The road safety center was established in 2018, which was part of the road safety projects within the National Transformation Plan 2020. Despite these efforts and plans, the percentage of road accidents deaths and injuries are high [17]. The lack of safety culture among Saudi drivers is an alarming concern. A cross-sectional study among 799 adolescents in Riyadh reported that almost 40% of the participants engaged in risky driving behavior called Tafheet, which involves very fast and swerving driving on public roadways [18]. Previous studies in the literature reveal that most crashes in Saudi Arabia were the result of non-compliance with safety rules [16,19].

Furthermore, attitudes and behaviors in general are established very early in life and are crucial for safe driving behavior. Adult role models and certain cultural factors may promote risky behaviors that contribute to unintentional injuries that result in premature death or lifelong impairment. Many young men in the Arab world treat driving as a hobby or a sport. It is not unusual to see teenage boys participate in Tafheet, or "Saudi drifting," with a crowd of spectators, for example.

The present study was designed to provide additional detailed evidence concerning culture and lifestyle factors that may influence road traffic safety in Riyadh. We examined these factors with the rationale that understanding cultural and behavioral factors associated with dangerous driving habits in a particular geographic region provides critical evidence to develop empirically driven and culturally appropriate strategies to prevent traffic crashes and injuries. Our analysis relied on items from the Driving Behavior Questionnaire (DBQ; [20]). The DBQ is a widely used and validated instrument to assess self-reported driving behavior and it has been used in many cultures worldwide [21,22]. There is limited research utilizing the DBQ in the Gulf States, although a few previous studies have been published [23–26].

The remaining sections of this manuscript are organized as follows. The second section presents the study's materials and methods and the third section presents the results. The fourth section discusses important findings and implications, followed by a discussion of recommendations and limitations. The last section concludes this study and offers suggestions for future research.

2. Materials and Methods

2.1. Study Design and Setting

A cross-sectional descriptive study was conducted by internet survey from December 2019 to April 2020. The study was conducted in Riyadh, the capital city of Saudi Arabia. Riyadh has a population of 6.5 million people living in an area of 3115 square kilometers [27]. Riyadh citizens represent one-sixth of the population of Saudi Arabia.

2.2. Study Participants

In total, 316 individuals aged 18 and over who were Arabic speakers with a Saudi driver's license and living in Riyadh city were approached and agreed to participate in the research. Participants were recruited from social media sources (WhatsApp, Twitter, and Snapchat) and completed the questionnaire online [28]. There are over 18 million users of social media in Saudi Arabia, which represents almost 60% of the population.

Written informed consent was obtained from the participants before collecting the data. Ethical approval was obtained from ethical committees at the King Saud University. Women were granted the opportunity to obtain driver licenses in Saudi Arabia beginning in September 2017 and there remains a greatly disproportionate percentage of male drivers in the country. Thus, our sample included many more men than women.

2.3. Study Variables

Independent variables included participant age, gender, education level, and driving experience. The dependent variables comprised self-reported risky driving habits, which are derived based on items from the validated Driver Behavior Questionnaire (DBQ; [17]). We adapted the full 50 item DBQ to Saudi culture by removing items that are not relevant to Saudi drivers, such as alcohol consumption and driving and handling vehicles with manual transmissions. The adapted 31 item survey was translated to Arabic by bilingual individuals using standard translation strategies.

2.4. Data Collection

The adapted DBQ survey included 31 items about the frequency of risky driving behavior, each answered on a 6 point scale: 1 for never; 2 for hardly ever; 3 for occasionally; 4 for quite often; 5 for frequently; and 6 for nearly all the time (20).

2.5. Study Size

The sample size was calculated using the following formula: $n = Z^2 [p (1 - P)]/d^2$. The variables in the formula are defined as follows: n = sample size; Z-score = 1.96 with confidence level 95%; P = expected proportion; and d = precision (margin of error). The conventional level of confidence was set at 95%. For this confidence level, the Z-value was set at 1.96. The estimate for P was made using data from a previously published study [15], which found that the proportion of drivers who were engaged in at least one risky behavior was 86.1%. Thus, P for the equation was estimated at 0.861 and the margin of error at 5%. The required sample size was N = 300 based on the calculated equation. The reflection of sample size calculation resulted in a large number of participants in the study with a variety of characteristics, generating a sample fairly representative of the population of drivers in Riyadh.

2.6. Statistical Analysis

Descriptive analyses were conducted first to examine self-reported risk taking while driving. Next, Cronbach's alpha was computed to evaluate the reliability of the questionnaire and the relative importance index (RII) method was applied to determine the relative importance of the items in the survey. Two sets of inferential statistics were then conducted. First, independent sample *t*-tests and ANOVA analyses were computed to examine differences in the prevalence of risky driving habits based on drivers' demographic characteristics. Second, multiple linear regression analysis was conducted to consider those factors. All analyses were conducted using SPSS v.25.

3. Results

3.1. Demographic Characteristics

Demographic data about the sample appear in Table 1. As shown, 77.8% of the participants were male and 22.2% were female, 58.2% of the participants were aged 20–29 years, and the highest percentage of individuals were university educated (53.8%). About three-fifths of the participants (60.8%) had 10 years or more driving experience and 94% reported they used a seatbelt while driving.

Table 1. Distribution of samples according to demographic characteristics (N = 316).

		Frequency	Percent
Gender	Male	246	77.8
	Female	70	22.2
Age	<20	6	1.9
	20–39	184	58.2
	40–49	56	17.7
	≥50	70	22.2
Education	High school or less	44	13.9
	Diploma	39	12.3
	University	170	53.8
	Higher education	63	19.9
Driving experience	<1 year	45	14.2
	2–5 years	38	12.0
	5–9 years	41	13.0
	10 years and above	192	60.8

3.2. Descriptive Statistics

Table 2 lists descriptive statistics for the self-report survey. On average, participants reported that they hardly ever (2) or occasionally (3) took the driving risks listed. The RII was used to rank the criteria according to their relative importance, based on the following formula:

$$RII = \Sigma W/(A \times N) (21) \quad (1)$$

where W signifies the weighting assigned by each respondent on a seven-point scale, with one implying the least and seven the highest; A signifies the highest weighting (6); and N signifies the total number of participants in the sample (316). The overall mean score of the prevalence of risky driving habits was 2.0 ± 0.66 and the RII was 33%, which indicates that, on average, the prevalence of risky driving habits in Riyadh, Saudi Arabia, was low.

Table 2. Descriptive statistics for participants' responses (N = 316).

Mean		SD	RII	Rank *
Check your speedometer and discover that you are unknowingly traveling faster than the legal limit.	3.60	1.34	0.60	1
Lock yourself out of your car with the keys still inside.	1.61	0.94	0.27	27
Become impatient with a slow driver in the outer lane and overtake on the inside.	3.44	1.32	0.57	2
Drive especially close or "flash" the car in front as a signal for that driver to go faster or get out of your way.	3.00	1.48	0.50	3
Forget where you left your car in a car park.	2.18	1.08	0.36	8
Distracted or preoccupied, realize belatedly that the vehicle ahead has slowed, and had to slam on the brakes to avoid a collision.	2.29	1.09	0.38	6
Intend to switch on the windscreen wipers, but switched on the lights instead, or vice versa.	1.66	0.93	0.28	21
Turn left on to a main road into the path of an oncoming vehicle that you have not seen or whose speed you had misjudged.	1.95	0.97	0.32	11
Misjudge the gap in a car park and nearly (or actually) hit an adjoining vehicle.	1.51	0.90	0.25	29
Stuck behind a slow-moving vehicle on a two-lane highway and so you are driven by frustration to try to overtake in risky circumstances.	1.95	1.08	0.33	13
Intending to drive to destination A, but instead you "wake up" to find yourself on route to B, where the latter is the more usual journey.	2.26	1.14	0.38	7
Take a chance and cross on lights that have turned red.	1.98	1.10	0.33	9
Angered by another driver's behavior, you give chase to give him/her a piece of your mind	1.64	1.01	0.27	25
Deliberately disregard the speed limits late at night or very early in the morning	1.98	1.21	0.33	10
Lost in thought, you forget that your lights are on full beam until "flashed" by other motorists.	1.77	0.91	0.30	18
Upon turning left, nearly hit a cyclist who has come upon your inside.	1.49	0.87	0.25	30
Have an aversion to a particular class of road user and indicate your hostility by whatever means you can.	1.66	1.10	0.28	22
Lost in thought or distracted, you fail to notice someone waiting at a zebra crossing.	1.64	0.92	0.27	23
Misjudge speed of oncoming vehicle when overtaking.	1.81	0.90	0.30	16
Hit something when reversing that you had not previously seen.	1.92	0.93	0.32	14
Fail to notice someone stepping out from behind a bus or parked vehicle until it is nearly too late.	1.59	0.89	0.26	28
Overtake a slow-moving vehicle on the right lane.	2.62	1.27	0.44	5

Table 2. *Cont.*

Mean		SD	RII	Rank *
Get into the wrong lane at a roundabout or approaching a road junction.	1.95	0.98	0.32	12
Fail to read the signs correctly and exited from a roundabout on the wrong road.	1.79	0.95	0.30	17
Fail to check your mirror before pulling out, changing lanes, turning, etc.	1.64	0.95	0.27	24
Attempt to overtake a vehicle that you had not noticed was signaling its intention to turn right.	1.89	0.98	0.31	15
Disregard red lights when driving late at night along empty roads.	1.67	1.10	0.28	20
Drive with only "half-an-eye" on the road while looking at a mobile map apps, changing a CD or radio channel, etc.	2.76	1.35	0.46	4
Fail to notice pedestrians crossing when turning into a side-street from a main road.	1.75	1.01	0.29	19
Get involved in unofficial races with other drivers.	1.38	0.92	0.23	31
Hit the brake too quickly on a slippery road.	1.61	0.90	0.27	26
Overall (prevalence of risky driving habits in Riyadh, Saudi Arabia).	2.00	0.66	0.33	

* Rank was according to the highest mean with the lowest standard deviation. Note: RII—Relative Importance Index; SD—Standard Deviation.

The highest-ranked risk was "check your speedometer and discover that you are unknowingly traveling faster than that the legal limit," which had a mean score of 3.60 ± 1.34 (3 signified occasionally and 4 quite often) and an RII of 60%. This was followed by "become impatient with a slow driver in the outer lane and overtake on the inside," with a mean score of 3.44 ± 1.32 and an RII of 57% and "drive especially close or 'flash' the car in front as a signal for that driver to go faster or get out of your way," with a mean score of 3.00 ± 1.48 and an RII of 50%. The least commonly reported risk behavior was "getting involved in unofficial races with other drivers," with a mean score of 1.38 ± 0.92 and an RII of 23%.

3.3. Reliability Test

Cronbach's alpha was 0.949 for the full 31 item questionnaire, which indicates excellent internal reliability (19).

3.4. Differences in Prevalence of Risky Driving Habits Based on Demographic Characteristics

Independent sample *t*-tests were conducted to examine group differences in the prevalence of risky driving habits in Riyadh, Saudi Arabia. A statistically significant gender difference was found, with males reporting riskier driving habits (mean = 2.08 ± 0.638) than compared to females (1.71 ± 0.691, $p < 0.01$). Additionally, a statistically significant difference was found concerning seatbelt use while driving; the participants who did not use a seatbelt while driving had riskier driving habits (mean = 2.36 ± 0.987) compared to the participants who reporting using one (1.98 ± 0.637, $p < 0.05$).

ANOVA models were computed to examine differences in risky driving habits based on participant age, education and driving habits. As shown in Table 3, younger individuals reported riskier driving habits, although those differences only trended toward statistical significance ($p = 0.076$). There were also no differences in risky driving based on education. A significant difference ($p < 0.01$) in risky driving habits did emerge based on driving experience; post-hoc comparisons showed that those with less than 1 year of driving experience had less risky driving habits compared to all three groups with more driving experience (2–5 years, 5–9 years, and 10 years and above).

Table 3. ANOVA test results (N = 316).

Demographic Characteristics	Group	N	Mean	SD	*F*	*p*
Age (years)	<20	6	2.23	0.63	2.308	0.076
	20–39	184	2.06	0.62		
	40–49	56	1.94	0.72		
	≥50	70	1.84	0.71		
Education	High school or less	44	2.02	0.78	0.614	0.606
	Diploma	39	1.87	0.47		
	University	170	1.99	0.62		
	Higher education	63	2.05	0.79		
Driving experience	<1 year	45	1.60	0.44	7.790	<0.001 *
	2–5 years	38	2.11	0.87		
	5–9 years	41	2.21	0.59		
	≥10 years	192	2.02	0.64		
Gender	Male	246	2.08	0.63	4.253	<0.001 **
	Female	70	1.71	0.69		

SD = Standard Deviation. **: $p < 0.01$; *: $p < 0.05$.

3.5. Consideration of Demographic Factors and Risky Driving Habits

Lastly, a multiple linear regression model was computed to consider how gender, age, education, driving experience, and using a seatbelt while driving predicted risky driving habits among the sample (Table 4). The dependent variable represented the mean score across the 31 item risky driving scale (M = 2.00, SD = 0.67). Model assumptions were met and the overall model was significant (F = 3.987, $p < 0.001$). The R^2 of 0.126 indicated that the model explained 12.6% of the variance in risky driving habits.

Table 4. Multiple regression results (N = 316).

Unstandardized Coefficients			Standardized Coefficients		
Model	**B**	**Std. Error**	**Beta**	***t***	***p***
(Constant)	1.97	0.47		4.21	<0.001 **
Gender	−0.37	0.17	−0.23	−2.12	0.035 **
Age					
20–39	0.16	0.29	0.12	0.56	0.58
40–49	0.04	0.30	0.02	0.13	0.89
50 or more	−0.14	0.29	−0.09	−0.47	0.64
Education					
Diploma	−0.15	0.14	−0.07	−1.07	0.28
University	−0.6	−0.11	−0.05	−0.56	0.58
Higher education	0.04	0.13	0.03	0.35	0.73
Driving Experience					
2–5 years	0.33	0.16	0.16	2.02	0.044 **
5–9 years	0.21	0.22	0.10	0.95	0.34
10 or more years	0.14	0.21	0.11	0.69	0.49
Using seatbelt	0.28	0.16	0.10	1.79	0.08

**: $p < 0.01$. Std = Standard. Gender was coded as 0 = male and 1 = female. Use of a seatbelt was coded 0 = no and 1 = yes. "From 20–39", "from 40–49", and "from 50 or more" are dummy variables representing age, where the reference category is the "<20" age group. "Diploma", "University", and "Higher education" are dummy variables representing education, where the reference category is the "High school or less" education group. "From 2–5", "from 5–9", and "from 10 or more" are dummy variables representing driving experience, where the reference category is the "<1 year" driving experience group.

The dependent variable represented the mean score across the 31 item risky driving scale (M = 2.00, SD = 0.67). Model assumptions were met and the overall model was significant (F = 3.987, $p < 0.001$). The R^2 of 0.126 indicated that the model explained 12.6% of the variance in risky driving habits. Two predictors, gender and the 2–5 years of driving experience group, were statistically significant in the model (Table 4). The strongest effect was for gender (Beta = −0.367; $t = -2.118$, $p < 0.05$); if gender changed from male to female, risky driving habits would decrease by 0.367. The 2–5 years of driving experience group dummy variable was also a significant factor in the model (Beta = 0.327, $t = 2.023$, $p < 0.05$); it indicated that participants with 2–5 years of driving experience scored 0.327 points higher on average than those with less than 1 year of driving experience.

4. Discussion

Understanding the cultural and behavioral factors associated with dangerous driving habits is crucial for developing empirically driven strategies to prevent traffic crashes and injuries [28–32]. Crash rates in Saudi Arabia are disproportionately high compared to other countries in the world and so this study was designed to consider rates of self-reported risky driving behaviors among a sample of licensed drivers in Saudi Arabia. We also considered the roles of age, gender, education level, driving experience, and seatbelt use in risky driving behaviors.

Overall, the sample reported a rather low prevalence of hazardous driving habits. Excessive speeding was the most prevalent risky driving behavior reported. This finding matches those from other cultures (e.g., in New Zealand [33–36]) and reflects a serious risk for crashes and injuries [37–40]. Driving aggressively around slow drivers was the second most commonly-reported behavior in our sample [39,40]. These results match those from a study conducted in Malaysia, which reported aggressive driving was related to crash-related conditions [41]. Finally, our survey of drivers in Riyadh, Saudi Arabia, found that distracted driving was the third most common risky behavior. Literature reviews suggest the use of mobile phones while driving are common, highly distracting, and result in crashes [42–45].

The fact that Riyadh is a crowded city with busy traffic and limited public transportation creates a challenging situation for safe driving, especially during rush hour. The Ministry of Interior is responsible for regulating traffic in Riyadh and has made efforts to improve road safety. Implementation of traffic camera systems (Saher), for example, had documented positive outcomes [38,46]. Similarly, a points system was enacted to record repeated traffic violations and ultimately result in the withdrawal of driver licenses in the case of repeated offenses [47].

Despite these and other regulations, the rate of road traffic injuries in Saudi Arabia remains high. Many attribute this trend at least in part to driver behavior, including the lack of patience and respect for traffic laws among Saudi drivers [48,49]. Both our findings and previous research suggest speeding, use of cellphones while driving, and violating red lights at intersections are common violations [17,18,50,51].

Replicating previous work [35], we found that men reported riskier driving habits than women. Various hypotheses are proposed to explain this pattern, which seems to transcend cultural and national boundaries. These explanations include emotional responses to driving situations and gender differences in anxiety, fear, and risk-taking tendencies [35,52–60]. In addition, the gender difference in our study may be attributed in part to local driving laws and social restrictions that were predominant on Saudi women in the past.

We found that drivers with 2–5 years driving experience took the most risks among our sample, along with the significant contribution of male gender. This apparent contradiction in driving experience and risk-taking replicates results from a French study [61]. There are two aspects to consider when interpreting this result. First, the influence on speeding intention decreases with experience [61]. However, the newest drivers, with less than

1 year driving experience, are still developing their driving abilities and therefore may be cautious with respect to avoiding potentially harmful behaviors [10,35,57–63].

5. Recommendations

Taken together, our findings indicate substantial preventable risk-taking occurs on Saudi roadways, a result consistent with the high rate of traffic crashes and traffic-related injuries and deaths in Saudi Arabia. Urgent action should be enacted to develop prevention strategies by increasing awareness through safety campaigns, especially among teenager and young adult populations. Moreover, having adequate supervised practice and safety preparation in poor weather conditions such as dust and rainstorms will limit the risk of crashes among newer and younger drivers. As discussed in the introduction, prevention efforts should also incorporate environmental and vehicle modifications as well as behavioral change. Environmental modifications to improve road safety are ongoing in Saudi Arabia and must continue [57]. Vehicle engineering continues to improve occupant safety worldwide [64–69].

Some of the behaviors we measured are likely to create more urgent risk of crash—and therefore might deserve more urgent attention—than others. Locking one's keys in the car, for example, or forgetting where one has parked in a carpark is a hassle, but does not usually create increased risk of crashes. Others have discussed the fact that some behaviors are more closely related to crashes than others and we reinforce that point in our recommendations to prioritize risky driving behaviors that are most likely to result in crashes [60].

In particular, our results indicate that behavior among Saudi drivers is sometimes risky and should form a third pillar of safety interventions to reduce traffic-related injuries and deaths in Saudi Arabia, along with environmental and vehicle change. Behavioral change of long-standing habits can be difficult, but in order to achieve improved road safety in places such as Saudi Arabia it must be attempted. Younger male drivers are, based on our findings, particularly at risk. Theory-driven programs to improve safety among that at-risk population are required. Enforcement of violations is also recommended [70].

We strongly recommend that policy-makers and decision-makers, designers, and planners should increase their level of coordination and cooperation to create a joint entity that unites their efforts in the development of traffic safety in the Saudi kingdom. Because of the size of the country, it is necessary to work on traffic issues at the national level and find solutions for each problem concerned. In addition, future studies should incorporate female drivers with respect to the new rules, established in 2018, that granted women in Saudi Arabia the right to drive.

Finally, our findings have implications for future research. In particular, longitudinal designs might be implemented to examine the pattern of risk-taking behavioral changes as young drivers transition from novice to experienced. Moreover, studies measuring the impact of the new regulations that allow women to drive and their impact on the prevalence of risky behaviors among Saudi drivers should be conducted. Finally, future research might consider the potential benefit of a multilevel systems approach to reduce risky driving behavior, especially among younger drivers, by incorporating the school system, workplaces, parents and other trusted adult family members, and law enforcement.

6. Limitations

This study has some limitations. First, we relied on self-report strategies, which suffer from potential biases in recall and the desirability of responding. Observational and simulated strategies overcome some barriers to self-reporting but also introduce other limitations. Second, we recruited participants through social media outlets online. Although distributing the survey online allowed us to reach a large and unique range of participants, it might have introduced some sampling bias. Third, the age group of <20 years was small (but does not significantly change the model fit) and a larger sample

size in future research may improve the fit of the model, offering more robust results. Finally, our study was implemented with a cross-sectional design.

Despite these limitations, the findings from this study provide a rich source of data on risky driving habits among the Saudi population and offer substantial implications for the prevention of road traffic crashes, injuries, and deaths in Saudi Arabia.

7. Conclusions

Risky driving behavior is a foremost cause of RTIs. Thus, this study assessed the prevalence and factors related to such behavior in Saudi Arabia and found a relatively low prevalence of self-reported risky driving habits but a handful of high-risk activities that were reported to occur with some frequency. Male gender and younger age were associated with higher risk-taking and the least experienced drivers reported the least amount of hazardous driving.

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References

1. Gopalakrishnan, S. A Public Health Perspective of Road Traffic Accidents. *J. Fam. Med. Prim. Care* **2012**, *1*, 144–150. [CrossRef]
2. Vos, T.; Lim, S.S.; Abbafati, C.; Abbas, K.M.; Abbasi, M.; Abbasifard, M.; Abbasi-Kangevari, M.; Abbastabar, H.; Abd-Allah, F.; Abdelalim, A.; et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study. *Lancet* **2020**, *396*, 1204–1222. [CrossRef]
3. Dalal, K.; Lin, Z.; Gifford, M.; Svanström, L. Economics of global burden of road traffic injuries and their relationship with health system variables. *Int. J. Prev. Med.* **2013**, *4*, 1442. [PubMed]
4. Chekijian, S.; Paul, M.; Kohl, V.P.; Walker, D.M.; Tomassoni, A.J.; Cone, D.C.; Vaca, F.E. The Global Burden of Road Injury: Its Relevance to the Emergency Physician. *Emerg. Med. Int.* **2014**, *2014*, 139219. [CrossRef]
5. Jafarpour, S.; Rahimi-Movaghar, V. Determinants of risky driving behavior: A narrative review. *Med. J. Islam. Repub. Iran* **2014**, *28*, 142. [PubMed]
6. Goniewicz, M.; Pawłowski, W.; Fiedor, P. Road accident rates: Strategies and programmes for improving road traffic safety. *Eur. J. Trauma Emerg. Surg.* **2015**, *42*, 433–438. [CrossRef]
7. World Health Organization. *Global Status Report on Road Safety*; World Health Organization: Geneva, Switzerland, 2015.
8. Transport injuries and deaths in the Eastern Mediterranean Region: Findings from the Global Burden of Disease 2015 Study. *Int. J. Public Health* **2018**, *63*, 187–198. [CrossRef]
9. Ministry of Interior—Kingdom of Saudi Arabia. Available online: https://www.moi.gov.sa (accessed on 28 June 2021).
10. Lee, S.M.; Al-Mansour, A.I. Development of a new traffic safety education material for the future drivers in the Kingdom of Saudi Arabia. *J. King Saud Univ. Eng. Sci.* **2020**, *32*, 19–26. [CrossRef]
11. Al-Ghamdi, A.S. Using logistic regression to estimate the influence of accident factors on accident severity. *Accid. Anal. Prev.* **2002**, *34*, 729–741. [CrossRef]

12. Jamal, A.; Rahman, M.T.; Al-Ahmadi, H.M.; Mansoor, U. The Dilemma of Road Safety in the Eastern Province of Saudi Arabia: Consequences and Prevention Strategies. *Int. J. Environ. Res. Public Health* **2019**, *17*, 157. [CrossRef]
13. Islam, M.; Alharthi, M.; Alam, M. The Impacts of Climate Change on Road Traffic Accidents in Saudi Arabia. *Climate* **2019**, *7*, 103. [CrossRef]
14. Ghaffar, U.B.; Ahmed, S. A Review of Road traffic accident in Saudi Arabia: The neglected epidemic. *Indian J. Forensic Community Med.* **2015**, *2*, 242. [CrossRef]
15. Traffic Accidents Site by Region in KSA. Available online: https://www.stats.gov.sa/ar/3465 (accessed on 22 June 2021).
16. Alghnam, S.; Alrowaily, M.; Alkelya, M.; Alsaif, A.; Almoaiqel, F.; Aldegheishem, A. The prevalence of seatbelt and mobile phone use among drivers in Riyadh, Saudi Arabia: An observational study. *J. Saf. Res.* **2018**, *66*, 33–37. [CrossRef] [PubMed]
17. KSA Traffic Accident Statistic. Available online: https://data.gov.sa/Data/en/dataset/traffic-accident-statistics-as-of-1439-h/resource/b3f75cc8-8d98-4b99-b699-9efb52014c45 (accessed on 28 June 2021).
18. Ramisetty-Mikler, S.; Almakadma, A. Attitudes and behaviors towards risky driving among adolescents in Saudi Arabia. *Int. J. Pediatr. Adolesc. Med.* **2016**, *3*, 55–63. [CrossRef] [PubMed]
19. Ageli, M.M. Road Traffic Accidents in Saudi Arabia: An ARDL Approach and Multivariate Granger Causality. Available online: http://www.ccsenet.org/journal/index.php/ijef/article/view/28424 (accessed on 27 June 2021).
20. Reason, J.; Manstead, A.; Stradling, S.; Baxter, J.; Campbell, K. Errors and violations on the roads: A real distinction? *Ergonomics* **1990**, *33*, 1315–1332. [CrossRef] [PubMed]
21. Lajunen, T.; Summala, H. Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transp. Res. Part F Traffic Psychol. Behav.* **2003**, *6*, 97–107. [CrossRef]
22. Stanojević, P.; Lajunen, T.; Jovanović, D.; Sârbescu, P.; Kostadinov, S. The driver behaviour questionnaire in South-East Europe countries: Bulgaria, Romania and Serbia. *Transp. Res. Part F Traffic Psychol. Behav.* **2018**, *53*, 24–33. [CrossRef]
23. Bener, A.; Verjee, M.; Dafeeah, E.E.; Yousafzai, M.T.; Mari, S.; Hassib, A.; Al-Khatib, H.; Choi, M.K.; Nema, N.; Özkan, T.; et al. A Cross "Ethnical" Comparison of the Driver Behaviour Questionnaire (DBQ) in an Economically Fast Developing Country: DBQ in Arab Gulf and South Asian countries. *Glob. J. Health Sci.* **2013**, *5*, 165. [CrossRef]
24. Soliman, A.; Alhajyaseen, W.; Alfar, R.; Alkaabi, I. Changes in Driving Behavior Across Age Cohorts in an Arab Culture: The Case of State of Qatar. *Procedia Comput. Sci.* **2018**, *130*, 652–659. [CrossRef]
25. Al Reesi, H.; Al Maniri, A.; Plankermann, K.; Al Hinai, M.; Al Adawi, S.; Davey, J.; Freeman, J. Risky driving behavior among university students and staff in the Sultanate of Oman. *Accid. Anal. Prev.* **2013**, *58*, 1–9. [CrossRef]
26. Lawton, R.; Parker, D.; Manstead, A.S.R.; Stradling, S.G. The Role of Affect in Predicting Social Behaviors: The Case of Road Traffic Violations. *J. Appl. Soc. Psychol.* **1997**, *27*, 1258–1276. [CrossRef]
27. Riyadh Urban Observatory. Available online: http://www.ruo.gov.sa/EN/RiyadhCity (accessed on 10 June 2021).
28. Ministry of Communications and Information Technology of KSA. Available online: https://www.mcit.gov.sa/en/media-center/news/89698 (accessed on 25 June 2021).
29. Messahel, F.; Seraj, M.; Al-Qasabi, Q.; El-Bakry, A.K. Trauma cases admitted to the surgical intensive care unit—Progress and outcome. *Middle East. J. Anaesthesiol.* **1996**, *13*, 585–591.
30. El Bcheraoui, C.; Basulaiman, M.; Tuffaha, M.; Daoud, F.; Robinson, M.; Jaber, S.; Mikhitarian, S.; Wilson, S.; Memish, Z.A.; Al Saeedi, M.; et al. Get a license, buckle up, and slow down: Risky driving patterns among Saudis. *Traffic Inj. Prev.* **2015**, *16*, 587–592. [CrossRef] [PubMed]
31. Bener, A.; Özkan, T.; Lajunen, T. The Driver Behaviour Questionnaire in Arab Gulf countries: Qatar and United Arab Emirates. *Accid. Anal. Prev.* **2008**, *40*, 1411–1417. [CrossRef] [PubMed]
32. Sohrabivafa, M.; Tosang, M.A.; Zadeh, S.Z.M.; Goodarzi, E.; Asadi, Z.S.; Alikhani, A.; Khazaei, S.; Dehghani, S.L.; Beiranvand, R.; Khazaei, Z. Prevalence of Risky Behaviors and Related Factors among Students of Dezful. *Iran. J. Psychiatry* **2017**, *12*, 188–193.
33. Fergusson, D.; Swain-Campbell, N.; Horwood, J. Risky driving behaviour in young people: Prevalence, personal characteristics and traffic accidents. *Aust. N. Z. J. Public Health* **2003**, *27*, 337–342. [CrossRef]
34. Blows, S.; Ameratunga, S.; Ivers, R.; Lo, S.K.; Norton, R. Risky driving habits and motor vehicle driver injury. *Accid. Anal. Prev.* **2005**, *37*, 619–624. [CrossRef] [PubMed]
35. Alghnam, S.; Towhari, J.; Alkelya, M.; Alsaif, A.; Alrowaily, M.; Alrabeeah, F.; Albabtain, I. The Association between Mobile Phone Use and Severe Traffic Injuries: A Case-Control Study from Saudi Arabia. *Int. J. Environ. Res. Public Health* **2019**, *16*, 2706. [CrossRef]
36. Rhodes, N.; Pivik, K. Age and gender differences in risky driving: The roles of positive affect and risk perception. *Accid. Anal. Prev.* **2011**, *43*, 923–931. [CrossRef]
37. Doecke, S.D.; Kloeden, C.N.; Dutschke, J.K.; Baldock, M.R.J. Safe speed limits for a safe system: The relationship between speed limit and fatal crash rate for different crash types. *Traffic Inj. Prev.* **2018**, *19*, 404–408. [CrossRef]
38. Alghnam, S.; Alkelya, M.; Alfraidy, M.; Al-Bedah, K.; Albabtain, I.T.; Alshenqeety, O. Outcomes of road traffic injuries before and after the implementation of a camera ticketing system: A retrospective study from a large trauma center in Saudi Arabia. *Ann. Saudi Med.* **2017**, *37*, 1–9. [CrossRef]
39. Dula, C.S.; Ballard, M.E. Development and Evaluation of a Measure of Dangerous, Aggressive, Negative Emotional, and Risky Driving. *J. Appl. Soc. Psychol.* **2003**, *33*, 263–282. [CrossRef]

40. Hernández-Hernández, A.M.; Siqueiros-García, J.M.; Robles-Belmont, E.; Gershenson, C. Anger while driving in Mexico City. *PLoS ONE* **2019**, *14*, e0223048. [CrossRef] [PubMed]
41. Sullman, M.J.; Stephens, A.N.; Yong, M. Driving anger in Malaysia. *Accid. Anal. Prev.* **2014**, *71*, 1–9. [CrossRef] [PubMed]
42. Kim, K.; Ghimire, J.; Pant, P.; Yamashita, E. Self-reported handheld device use while driving. *Accid. Anal. Prev.* **2019**, *125*, 106–115. [CrossRef]
43. Flaherty, M.R.; Kim, A.M.; Salt, M.D.; Lee, L.K. Distracted Driving Laws and Motor Vehicle Crash Fatalities. *Pediatrics* **2020**, *145*, e20193621. [CrossRef]
44. Mahfoud, Z.R.; Cheema, S.; Alrouh, H.; Al-Thani, M.H.; Al-Thani, A.A.M.; Mamtani, R. Seat belt and mobile phone use among vehicle drivers in the city of Doha, Qatar: An observational study. *BMC Public Health* **2015**, *15*, 937. [CrossRef]
45. AlKetbi, L.M.B.; Grivna, M.; Al Dhaheri, S. Risky driving behaviour in Abu Dhabi, United Arab Emirates: A cross-sectional, survey-based study. *BMC Public Health* **2020**, *20*, 1324. [CrossRef]
46. Al-Shammari, H.; Ling, C. Investigating the Effectiveness of a Traffic Enforcement Camera-System on the Road Safety in Saudi Arabia. In *Proceedings of the Advances in Intelligent Systems and Computing*; Springer Science and Business Media LLC: New York, NY, USA, 2018; pp. 660–670.
47. Sagberg, F.; Ingebrigtsen, R. Effects of a penalty point system on traffic violations. *Accid. Anal. Prev.* **2018**, *110*, 71–77. [CrossRef] [PubMed]
48. DeNicola, E.; Aburizaize, O.S.; Siddique, A.; Khwaja, H.; Carpenter, D.O. Road Traffic Injury as a Major Public Health Issue in the Kingdom of Saudi Arabia: A Review. *Front. Public Health* **2016**, *4*, 215. [CrossRef] [PubMed]
49. Ansari, S.; Akhdar, F.; Mandoorah, M.; Moutaery, K. Causes and effects of road traffic accidents in Saudi Arabia. *Public Health* **2000**, *114*, 37–39. [CrossRef]
50. Mohamed, M.; Bromfield, N.F. Attitudes, driving behavior, and accident involvement among young male drivers in Saudi Arabia. *Transp. Res. Part F Traffic Psychol. Behav.* **2017**, *47*, 59–71. [CrossRef]
51. Al alweet, R.; Nugali, A.; Amer, S.A. Using Cellphone While Driving Among Saudi Drivers in Saudi Arabia, Cross Section Study. *Ann. Public Health Epidemiol.* **2018**, *1*. [CrossRef]
52. Cordellieri, P.; Baralla, F.; Ferlazzo, F.; Sgalla, R.; Piccardi, L.; Giannini, A.M. Gender Effects in Young Road Users on Road Safety Attitudes, Behaviors and Risk Perception. *Front. Psychol.* **2016**, *7*, 1412. [CrossRef] [PubMed]
53. Ersan, Ö.; Üzümcüoğlu, Y.; Azık, D.; Fındık, G.; Kaçan, B.; Solmazer, G.; Özkan, T.; Lajunen, T.; Öz, B.; Pashkevich, A.; et al. Cross-cultural differences in driver aggression, aberrant, and positive driver behaviors. *Transp. Res. Part F Traffic Psychol. Behav.* **2020**, *71*, 88–97. [CrossRef]
54. Solmazer, G.; Azık, D.; Fındık, G.; Üzümcüoğlu, Y.; Ersan, Ö.; Kaçan, B.; Özkan, T.; Lajunen, T.; Öz, B.; Pashkevich, A.; et al. Cross-cultural differences in pedestrian behaviors in relation to values: A comparison of five countries. *Accid. Anal. Prev.* **2020**, *138*, 105459. [CrossRef]
55. Burgut, H.R.; Bener, A.; Sidahmed, H.; Albuz, R.; Sanya, R.; Khan, W.A. Risk factors contributing to road traffic crashes in a fast developing country: The neglected health problem. *Inj. Prev.* **2010**, *16*, A75. [CrossRef]
56. Arafa, A.; Saleh, L.H.; Senosy, S.A. Age-related differences in driving behaviors among non-professional drivers in Egypt. *PLoS ONE* **2020**, *15*, e0238516. [CrossRef]
57. Why Young Drivers Are at Risk and What Can Be Done about It [Internet]. Brake The Road Safety Charity. Available online: https://www.brake.org.uk/get-involved/take-action/mybrake/knowledge-centre/young-drivers (accessed on 11 June 2021).
58. KSA Unified National Platform. 2021. Available online: https://www.my.gov.sa/wps/portal/snp/main (accessed on 29 June 2021).
59. Warner, H.W.; Özkan, T.; Lajunen, T.; Tzamalouka, G. Cross-cultural comparison of drivers' tendency to commit different aberrant driving behaviours. *Transp. Res. Part F Traffic Psychol. Behav.* **2011**, *14*, 390–399. [CrossRef]
60. Özkan, T.; Lajunen, T.; Chliaoutakis, J.E.; Parker, D.; Summala, H. Cross-cultural differences in driving behaviours: A comparison of six countries. *Transp. Res. Part F Traffic Psychol. Behav.* **2006**, *9*, 227–242. [CrossRef]
61. Cestac, J.; Paran, F.; Delhomme, P. Young drivers' sensation seeking, subjective norms, and perceived behavioral control and their roles in predicting speeding intention: How risk-taking motivations evolve with gender and driving experience. *Saf. Sci.* **2011**, *49*, 424–432. [CrossRef]
62. Lam, L.T. Distractions and the risk of car crash injury: The effect of drivers' age. *J. Saf. Res.* **2002**, *33*, 411–419. [CrossRef]
63. Young, K.; Salmon, P. Examining the relationship between driver distraction and driving errors: A discussion of theory, studies and methods. *Saf. Sci.* **2012**, *50*, 165–174. [CrossRef]
64. Neyens, D.M.; Boyle, L.N. The effect of distractions on the crash types of teenage drivers. *Accid. Anal. Prev.* **2007**, *39*, 206–212. [CrossRef] [PubMed]
65. Vehicle Safety [Internet]. Europe, 2016. 16p. Available online: https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/ersosynthesis2016-vehiclesafety15_en.pdf (accessed on 27 June 2021).
66. Messnarz, R.; Much, A.; Kreiner, C.; Biro, M.; Gorner, J. Need for the Continuous Evolution of Systems Engineering Practices for Modern Vehicle Engineering. In Proceedings of the Programmieren für Ingenieure und Naturwissenschaftler, Ostrava, Czech Republic, 6–8 September 2017; Volume 748, pp. 439–452.
67. Pawłowski, W.; Goniewicz, K.; Schwebel, D.C.; Shen, J.; Goniewicz, M. Road traffic injuries in Poland: Magnitude and risk factors. *Eur. J. Trauma Emerg. Surg.* **2019**, *45*, 815–820. [CrossRef] [PubMed]

68. Abdullah, K.A.; Mourad, A.H.I.; Muhammad, A.U. Child passenger safety in the United Arab Emirates: A review. In Proceedings of the 2020 Advances in Science and Engineering Technology International Conferences (ASET), Dubai, United Arab Emirates, 9 April 2020; pp. 1–6.
69. Palmer Peterson, H.; Al Kassim, Z. A case study on perceptions of public transportation in the eastern province of saudi arabia. *Transp. Probl.* **2020**, *15*, 5–15. [CrossRef]
70. De Winter, J.C.; Dodou, D. The Driver Behaviour Questionnaire as a predictor of accidents: A meta-analysis. *J. Saf. Res.* **2010**, *41*, 463–470. [CrossRef]