

# Female Drivers' Attitudes and Behavior Regarding Traffic Regulations in Riyadh, Saudi Arabia.

Abdulrahman Bin Wahaq

King Saud bin Abdulaziz University for Health Sciences

Amen Bawazir (✉ [bawazir56@gmail.com](mailto:bawazir56@gmail.com))

King Saud bin Abdulaziz University for Health Sciences

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## Research Article

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# Abstract

**Background:** Road traffic injuries (RTIs) are of great concern, as they have the second-highest fatality rate in the world. This is also true in Saudi Arabia.

**Objectives:** This study aims to identify whether females in Riyadh commonly have aggressive, dangerous driving behavior.

**Methods:** A cross-sectional survey was used to collect data from female car drivers in Riyadh City. A validated Dulla index was used as the instrument to identify the level of aggressive, dangerous driving behavior among the study participants.

**Results:** The participants comprised 407 females. The majority were in the age group of younger than 30 years (44.5%), married (54.8%), at university (44.7%), house owners with personal property (64.1%), employees (63.6%), and with a middling monthly income (32.2%). The sum of the scores from the Dula Dangerous Driving Index (DDDI) was categorized into “inadequate” and “adequate”. The overall prevalence for the inadequate index was 48.4% for the negative cognitive/emotional driving (NCED) subscale, 42.3% for the aggressive driving (AD) subscale, and 48.2% for the risky driving (RD) subscale.

**Conclusion:** Generally, all of the females who participated in this study had reasonably good knowledge of traffic rules and regulations based on the DDDI. This research is essential for decision-makers to formulate and set priorities for enhancing adherence to traffic regulations for the safety of the community.

## Introduction

Road traffic injuries (RTIs) are a concerning issue that affects both developing and developed countries. The World Health Organization’s (WHO) 2018 report estimated that RTIs are the 8<sup>th</sup> cause of death globally among those aged 15–29 years, while it was the 10<sup>th</sup> in 1990 for the same group. It was also predicted that it would be the most common cause of premature death by 2020.[1, 2] Further, approximately 6 million deaths and 52 million disability-adjusted life-years annually occur globally due to injuries, making up approximately 15% of the global disease burden.[3] However, the 195 United Nations member states agreed in 2015 that by 2020, the number of global deaths and injuries from road traffic accidents would be halved as part of Sustainable Development Goal 3.6.[4]

RTIs are considered to be the 3<sup>rd</sup> leading cause of death in Saudi Arabia,[5] and among the G20 countries, it has been recorded that the highest death rate is from traffic accidents (28.8/100,000 people).[6] Some factors are considered as being among the top causes of this high rate of RTIs among Saudi Arabian youth, including having RD behaviors, driving speedily, denying or disrespecting traffic lights, getting distracted while driving, such as using a mobile phone while driving, and others.[5, 7–10] An additional dimension in the cause of the high RTIs is due to limited knowledge of and poor attitudes toward safety, mainly among drivers who are younger than 30 years.[11, 12]

In September 2017, the kingdom of Saudi Arabia ended the legal ban on women driving, opening the way for females to practice driving across the country.[13, 14] Many studies elsewhere have illustrated differences in gender accident rates, where males showed a higher rate of more fatal injuries and property-damaging accidents than females.[15] This gender difference is more obvious among the youngest age range of 16–20 years. Moreover, the use of safety devices, concerns about the risks, involvement in RD behaviors, acceptance of road violations, and justification of the consumption of alcohol are also factors that male drivers are more prone to than female drivers are.[16–18] All of these factors related to driving differences in gender have not yet been tested in Saudi Arabia. Therefore, this study

was conducted to assess the cognitive/emotional driving (NCED), aggressive driving (AD), risky driving (RD), and dangerous behavior attitudes of Saudi female drivers in Riyadh City.

## Methods

**Study design and data collection:** This was a cross-sectional study conducted in Riyadh City, the capital of Saudi Arabia, from April to June 2020.

**Participants:** The study involved Arabic-speaking female drivers aged 18 years and above who were living in Riyadh City during data collection. However, others were excluded, such as Arabic-speaking female drivers who were younger than 15 years old and non-Arabic-speaking female drivers. Since there is no previous study available in Saudi Arabia that describes female drivers' attitudes and behavior, the sample size was calculated with a prevalence rate of 50%, a confidence interval (CI) of 95%, and a margin of error of 5% to assume a calculated sample size of 384. However, to avoid non-respondents, 10% of the calculated sample was added to show the total targeted number of participants as 426.

All protocols are carried out in accordance with relevant guidelines and regulations. This survey was carried out after the approval of the Institutional Research Board at the King Abdulla International Medical Research Center (KAIMRC) at the Ministry of National Guard for health Affairs, Riyadh, Saudi Arabia (# SP 15/118). Moreover, the informed consent was obtained from all participants for the study where each participant was asked to click electronically with "YES" if accept to participate in the survey, however, very clear explanation was provided to them and placed at the first page of the survey.

**Data collection and tools used:** An electronic self-administered survey was disseminated during the time of the COVID-19 pandemic focusing on female drivers in Riyadh City using a convenient sampling technique. All participants were asked to join the survey voluntarily; they had full authority to accept or reject the invitation to participate. The original tool used was the English version of the Dula Dangerous Driving Index (DDDI) questionnaire.[19] It was translated to Arabic and then back-translated into English to test the consistency of the content. Moreover, a pilot test was conducted to test the internal consistency of the materials using 5% of the sample.

**Measurement and instruments:** The questionnaire was divided into 6 parts: demographic variables, such as age (30 years and younger, 31–40 years, and 41 years and older), marital status (married, others: single/divorced/widowed), education level (secondary education and below, diploma or bachelor's degree, postgraduate degree), house ownership (personal property, rented), employment (employee, non-employee), years of higher education, socio-economic status (SES; family monthly income was divided into 4 categories from lowest to highest, based on the Saudi Riyals (SR) earned [1 USD = 3.75 Saudi Riyals]; low was < 5,000 SR, low–middle was 5,000–9,999 SR, middle was 10,000–15,000 SR, and high was > 15,000 SR). Moreover, other driving-related variables were measured, such as the number of years that the person has been driving; the frequency of reading, initiating, and replying to a text message while driving ("How often do [did] you read [initiate or reply to] a text while driving?"); wearing a seat belt ("How often do [did] you wear a seat belt while driving?"); and driving over the posted speed limit ("How often do [did] you drive over the posted speed limit?"). These responses were rated on a five-point Likert scale ranging from 0 (*not at all*) to 2 (*some*) to 4 (*very much*). The score for wearing a seat belt was reversed such that a higher score indicated a less frequent occurrence of this dangerous driving behavior. The participants also answered questions on their driving record regarding traffic accidents ("How many accidents have you had since you got your driver's license?"; hereafter Accident), being ticketed ("How many times have you been ticketed for a moving violation?"; hereafter Ticketed), and being insured (not insured, totally insured, or partially insured). Questions related mainly to distracted driving were taken from the survey of

speeding, attitudes, and behaviors that the National Highway Traffic Safety Administration, USA (NHTSA), implemented.[20]

**The DDDI:** The DDDI comprises 21 items that measure the frequency with which individuals exhibit RD (12 items), NCED (9 items), and AD (7 items) by way of a five-point Likert-style scale ranging from 0 (*never*), 1 (*rarely*), 2 (*sometimes*), 3 (*often*), and 4 (*always*). Participants were attributed a total score, as well as specific scores for each of the 3 subscales, with a total score representing the overall likelihood for driving behavior. As the data was skewed to the right, the median was used as a cut-off point accordingly for each of the 3 main categories to indicate the adequacy of the driving behavior for RD, NCED, and AD (median = 62, 91.4, and 82.9, respectively). The DDDI demonstrated good internal reliability, with a total scale and subscale of the Cronbach alpha coefficients ranging from 0.75 to 81.

**Statistical analysis:** Data were cleaned and entered into Statistical Package for Social Sciences (SPSS) v20 (IBM, New York, USA). Initially, descriptive statistics (i.e., frequencies, percentages, and measures of central tendency and dispersion, where appropriate) were calculated for each item in the survey and all demographic variables (age, gender, years of experience, level of teaching). Uni-variant and multi-variant regression analyses were used to investigate the association between the sociodemographic factors and the DDDI domains.

A three-factor model consisting of the DDDI was used for logistic regression to estimate odds ratios and corresponding 95% CIs and to test the significance of the difference between the groups in the negative driving outcomes (adequate or inadequate). The binary logistic regression defined a statistically significant *p*-value of less than 0.05, which was produced from previously analyzed variables in this study after adjusting for some confounding factors, such as the age cohorts, driving exposure, and dangerous driving. The statistical significance level for all tests was set at 0.05. Finally, as the distribution of the data was skewed to the right, correlational analyses among the dangerous driving behaviors and the negative driving outcomes were performed by calculating Spearman correlation coefficients.

## Results

From a total sample of 426 participants invited to participate in this study, 407 female participants responded (a 95.5% positive response rate). Most female participants were in the age group of younger than 30 years (44.5%), married (54.8%), at university (44.7%), house owners with personal property (64.1%), employees (63.6%), and with a monthly income ranging from 10,000–15,000 Riyals (32.2%), as seen in table 1. The mean age of the female participants was 33 years (SD ± 7.8).

Out of the total participants (407), only 287 females were car drivers (70.5%), as can be seen in Table 2, which describes their personal driving experience and practice. Most of the participants had a car (82.9%), recently started to drive within the last 2 years (74.6%), had insurance (85.4%), drove daily (66.2%), and drove for approximately 2 hours per day (51.9%); however, approximately half of the participants owned a car (49.8%), and some of them had already committed a traffic violation (43.6%).

**Drivers' attitudes toward certain traffic regulations:** Table 3 illustrates female drivers' attitudes toward certain traffic regulations. Almost all of the female drivers adhered to using a seat belt while driving (89.5%), and more than half had not received a ticket for a traffic violation (56.4%). However, most of them used their mobile phones frequently while driving for making calls (62.7%), receiving calls (67.9%), answering calls while driving (80.5%), and having received a ticket for committing a mobile violation (80.8%).

Table 4 illustrates the overall comparison scores for each domain of the DDDI, namely NCED, AD, and RD. We divided the overall scale into inadequate and adequate using the media for each category: NCED = 58.0, AD = 91.4, and RD = 82.9. We found that the overall prevalence of inadequate versus adequate was as follows: NCE was 99.7% versus 0.3%; AD was 24.7% versus 75.3%, and RD was 60.3% versus 39.7%.

In table 5, the associations between female participants' NCED and sociodemographic statistics (age, marital status, education level, house ownership, employment, and monthly income) can be seen. In general, all of the mentioned characteristics did not have statistically significant relationships with NCED ( $p > 0.5$ ); therefore, this domain was excluded in the further regression analyses. Further testing was applied between the sociodemographic characteristics and AD. There was a strong association between inadequate AD and marital status and inadequate AD and house ownership ( $p = 0.018$  and  $p = 0.001$ , respectively). The other variables showed no significant association with AD. Moreover, almost all of the sociodemographic characteristics, such as education level ( $p = 0.001$ ), marital status ( $p = 0.034$ ), house ownership ( $p = 0.013$ ), employment ( $p = 0.016$ ), and monthly income ( $p = 0.003$ ) showed a significant association with the inadequate RD of the female participants except for the age category, which showed no significant association ( $p > 0.05$ ).

For the regression analysis models, as shown in table 6, only 2 models were implemented using the AD and RD subscales because the one related to NCED showed no association with any sociodemographic characteristics; therefore, it was excluded. For the backward multivariate analysis, after controlling for the sociodemographic factors, a strong association was found for inadequate AD between single/divorced/widowed participants (AOR: 1.692, 95% CI: 1.014–2.823,  $p = 0.044$ ) and married participants, those with rented houses (AOR: 2.528, 95% CI: 1.287–4.966,  $p = 0.007$ ) and those with their own property, and those with low and middle incomes (AOR: 3.105 and 2.269, 95% CI: 1.095–8.805 and 1.102–4.671,  $p = 0.033$  and  $0.026$ ). On the other hand, a strong association was found for inadequate RD between single/divorced/widowed participants (AOR: 2.261, 95% CI: 1.249–4.092,  $p = 0.007$ ) and married participants, employees (AOR: 0.475, 95% CI: 0.239–0.945,  $p = 0.034$ ) and students/retirees/freelancers, and those with low–middle income (AOR: 0.348, 95% CI: 0.148–0.818,  $p = 0.016$ ).

A Spearman correlation coefficient test was used first among the DDDI and then to correlate the DDDI with the independent sociodemographic variables. Findings from table 7, showed a significant positive correlation between NCED and AD and NCED and RD ( $r = 0.29$ ,  $p < 0.001$ ; and  $r = 0.1$ ,  $p = 0.04$ , respectively). In addition, AD was shown to have a significant positive correlation with RD ( $r = 0.19$ ,  $p < 0.001$ ). The sociodemographic independent variables of age, education level, marital status, employment, and monthly income were correlated with the 3 domains of the DDDI. A significant negative correlation was found between NCED and both education level and marital status ( $r = -0.24$ ,  $p < 0.001$ ; and  $r = -0.13$ ,  $p = 0.007$ , respectively). Moreover, RD was found to have a significant positive correlation with education level, employment, and monthly income ( $r = 0.16$ ,  $p = 0.001$ ;  $r = 0.9$ ,  $p = 0.047$ ; and  $r = 0.16$ ,  $p = 0.001$ , respectively).

## Discussion

Driver behavior is not a simple issue to analyze, as it integrates and interacts with many factors of the driver's knowledge, abilities, and skills of behaving adequately during driving and adhering to the related regulations. Sometimes, other factors such as mood, stress, and the overall mindset at the moment play a role in the adequacy of driving behavior. Various research methods have been used recently to describe such behaviors and identify their predictors. The present study focused on the assessment of driving behavior using electronic self-report questionnaires disseminated among female drivers in Riyadh City, KSA.

This study is original, as it is the first published work to focus on female drivers in Saudi Arabia, particularly after the legal permission that the Royal Decrees gave to female drivers across the country in 2018, thus ending the previous ban on women driving cars.[13] Many studies elsewhere have illustrated differences in gendered accident rates, where males showed higher rates of more fatal injuries and property-damaging accidents than females did.[15] The level of adherence to traffic regulations, involvement in RD behaviors, low concern about the risks, and the lack of using safety devices were shown to be the factors that males were prone to compared to females.[16–18] However, all of these factors have not yet been tested in Saudi Arabia. Therefore, this study aimed to offer an in-depth understanding of the attitudes and dangerous behaviors of female drivers in Riyadh City, Saudi Arabia. The use of the DDDI as an instrument to measure 3 main domains was found to be worthwhile in such a context, where NCED, AD, and RD needed to be tested elsewhere.[21]

Although the period since the legal liberation of female driving in the country has been brief (3 years), our findings in this study showed that adherence to good-quality driving is less likely for female drivers. Moreover, based on the method used (the DDDI), aggressive, dangerous driving behavior was found to be common among female drivers in Riyadh City, which is similar to findings from a study done in Mexico.[21]. However, some authors have attributed the occurrence of accidents with aggressive and speedy driving, but this has not been correlated with drivers' attitudes.[14] Similarly, another study from Qatar supported the idea that the most significant factor affecting the risk of a crash was in-vehicle distractions, as well as rash and dangerous driving.[22] Controversial findings were found regarding gendered RD and AD: Female drivers were more likely to exhibit passive-aggressive behavior.[23] However, another study by Wickens described that those females with a greater number of kilometers driven were more likely to have an increased risk of driver aggression.[24, 25]

Our investigation showed that the proportion of participants who were involved in RD behaviors in the previous 12 months was 60.3%. This result was lower than that of a study that Makonnen et al.[26] did in Ethiopia (79.4%) and New Zealand (90%)[27]. It also contradicts the results of some other studies that found much higher rates than those conducted in the UK (17.8 and 13.6% at different times).[25] This variation in the reported prevalence could be explained through a contextual interpretation of traffic rules and the level of enforced traffic policy across countries.

Our study tested the relation between various sociodemographic characteristics and the 3 main domains of the DDDI. Among the findings, employees were approximately 3 times more likely to behave aggressively or in a risky manner while driving than their counterparts, which could be explained as resulting from having to drive during rush hours. The age of drivers is another important factor that could affect involvement in RD behaviors. However, our study findings showed no association between age and any one of the DDDI domains, which contrasts with findings reported from Canada indicating that adolescent and young adult females were more involved in RD behavior and were more prone to traffic violations.[28]

Other participant characteristics included the level of monthly income. Those with a middling income were less likely to drive in a risky manner compared to their counterparts (AOR = 0.348, 95% CI = 0.148–0.818;  $p = 0.016$ ). Other studies elsewhere have shown the opposite, where drivers with a relatively high average monthly salary were 2.04 times more likely to behave in a risky manner while driving than those with a lower average monthly salary.[26] Moreover, regarding marital status, there was a difference between married and single/divorced/widowed females. The chance of behaving in a risky manner increased by 1.69 (95% CI = 1.01–2.82,  $p = 0.044$ ) for those who were single or divorced in comparison to those who were married.

Mobile phone distractions can be one of the most critical factors affecting or disturbing women while driving. A report released in 2017 suggested that smartphone addiction was significantly associated with the total prevalence of accidents, including falling/slipping and bumps/collisions.[29] Although our female drivers showed a high adherence

to the use of seat belts (89.5%), they also often received or made calls while driving (67.9% and 62.7%, respectively). A study from Qatar showed that only 39.6% of females use mobile phones while driving, which is much lower than our findings.[30] More than half of the participants (52.35%) had not had any accidents in the last 2 years, nor did they cause any accidents. Perhaps this was because the Saudi government did not allow women to drive on the road until 2 years before collecting this research. Thus, most of the women in Saudi Arabia had only 2 years of driving experience, and by default, this would have affected their knowledge, attitude, and practice regarding traffic violations, especially in terms of the speed limit. The findings in this study also agreed with findings from another study that found that women were less likely to drive at high speeds.[28]

## Limitations

This survey highlighted the area of female drivers in Saudi Arabia and their compliance with traffic regulations, in which there is a lack of previous research. Yet, the survey had some limitations that should be considered while interpreting the results. As the study was a descriptive cross-sectional survey conducted in only one city, the capital of Saudi Arabia, caution should be exercised when generalizing to other cities and regions in the country. Moreover, our use of an electronic self-administered questionnaire, which relies on the honesty and good faith of the respondents, could have affected the responses, as it may have been subject to respondent or recall bias. Despite the response rate being high according to the calculated sample size, any future studies should increase the sample size by up to 33% (the percentage of non-driver females) to ensure that they include the minimum required sample size of actual female drivers rather than just that of female participants. Even with the above limitations, this survey has significant implications for improving the adherence of female drivers to traffic regulations in the country and, thus, reducing road traffic accidents in the community.

## Conclusions

The involvement in aggressive and dangerous driving behavior was reported as a common feature among female drivers in Riyadh City. This is likely due to their low adherence to good-quality driving. Moreover, these features were noticeable among employees, those with a middling monthly income, and single/divorced/widowed people. The female drivers in this study showed a high adherence to the use of seat belts but were more likely to be affected by distracting factors such as using a mobile phone while driving to make or receive phone calls. The brief period in which females have been allowed to drive in the country may be indicative of their low driving experience; thus, more intensive educational programs should be launched to educate females on traffic regulations and adhering to them to avoid accidents. Further studies should be done in other areas of the country, as well as to compare these findings with those of male drivers.

## Declarations

**Ethical approval and consent to participate:** All protocols are carried out in accordance with relevant guidelines and regulations. This survey was carried out after the approval of the Institutional Research Board at the King Abdulla International Medical Research Center (KAIMRC) at the Ministry of National Guard for health Affairs, Riyadh, Saudi Arabia (# SP 15/118). Moreover, the informed consent was obtained from all participants for the study where each participant was asked to click electronically with “YES” if accept to participate in the survey, however, very clear explanation was provided to them and placed at the first page of the survey.

**Consent for publication** Not applicable

**Availability of data and materials:** The datasets used and/or analysed during the current study are available from the

corresponding author on reasonable request.

**Competing of interest:** None declared.

**Funding:** None.

**Author contribution:** Conceived and designed the experiments: AB. Performed the data collection: AW. Analyzed the data and writing the results: AB and AW. Wrote the paper: AB.

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**Authors' information:** Dr. Amen Bawazir is a professor of Public Health and Epidemiology in the College of Public Health and Health Informatics, KSAU-HS. Riyadh, Saudi Arabia. He is the corresponding author.

## References

1. Afghari AP, Hezaveh AM, Haque MM, Cherry C. (2020) A home-based approach to understanding seatbelt use in single-occupant vehicles in Tennessee: Application of a latent class binary logit model. *Accident Analysis & Prevention*;146:105743.<https://doi.org/10.1016/j.aap.2020.105743>.
2. WHO. (2018) Global status report on road safety 2018: Summary: World Health Organization; 2018. [<https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>]
3. Stewart BT, Yankson IK, Afukaar F, Medina MCH, Cuong PV, Mock C. (2016) Road traffic and other unintentional injuries among travelers to developing countries. *Medical Clinics*;100(2):331-343.<http://doi.org/10.1016/j.mcna.2015.07.011>.
4. UN. (2015) Sustainable Development Goals kick off with start of new year. <https://www.un.org/sustainabledevelopment/health/>
5. Alghnam S, Towhari J, Alkelya M, Alsaif A, Alrowaily M, Alrabeeah F, et al. (2019) The association between mobile phone use and severe traffic injuries: a case-control study from Saudi Arabia. *International journal of environmental research and public health*;16(15):2706.<https://doi.org/10.3390/ijerph16152706>.
6. Mansuri FA, Al-Zalabani AH, Zalat MM, Qabshawi RI. (2015) Road safety and road traffic accidents in Saudi Arabia: A systematic review of existing evidence. *Saudi medical journal*;36(4):418.<http://doi:10.15537/smj.2015.4.10003>.
7. El Bcheraoui C, Basulaiman M, Tuffaha M, Daoud F, Robinson M, Jaber S, et al. (2015) Get a license, buckle up, and slow down: risky driving patterns among Saudis. *Traffic injury prevention*;16(6):587-592.<https://doi.org/10.1080/15389588.2014.990090>.
8. Al Turki YA. (2014) How can Saudi Arabia use the decade of action for road safety to catalyse road traffic injury prevention policy and interventions? *International journal of injury control and safety promotion*;21(4):397-402.<https://doi.org/10.1080/17457300.2013.833943>.
9. Moradi-Lakeh M, El Bcheraoui C, Tuffaha M, Daoud F, Al Saeedi M, Basulaiman M, et al. (2016) The health of Saudi youths: current challenges and future opportunities. *BMC family practice*;17(1):26.<http://DOI:10.1186/s12875-016-0425-z>.
10. Ramisetty-Mikler S, Almakadma A. (2016) Attitudes and behaviors towards risky driving among adolescents in Saudi Arabia. *International Journal of Pediatrics and Adolescent Medicine*;3(2):55-63.<http://dx.doi.org/10.1016/j.ijpam.2016.03.003>.
11. AlSallum GA, Alwassel AA, Alshushan AM, Abaalkhail AK, Alhasoon MA, Aldamigh AS. (2019) Parent's knowledge, attitude, and practice about children car seats at Unaizah city, KSA. *Journal of family medicine and primary care*;8(3):805.[http://doi:10.4103/jfmpc.jfmpc75\\_19](http://doi:10.4103/jfmpc.jfmpc75_19).

12. Issa Y. (2016) Effect of driver's personal characteristics on traffic accidents in Tabuk city in Saudi Arabia. *Journal of transport literature*;10(3):25-29.<http://dx.doi.org/10.1590/2238-1031.jtl.v10n3a5>
13. Krane J, Majid F. (2018) Women Driving in Saudi Arabia: Ban Lifted, What are the Economic and Health Effects? *Issue Brief*;6 <https://www.bakerinstitute.org/research/impact-lifting-saudi-arabias-ban-women-drivers/>.
14. Al-Ghalib SJ, Salim AY, Al-Khalifah S, Dahlawi RA. (2018) Perceptions of women's driving in Saudi Arabia: Relationship with openness to experience and happiness. *Middle East Journal of Positive Psychology*;4(1):102-125 <https://www.middleeastjournalofpositivepsychology.org/index.php/mejpp/article/view/72>
15. Wayne NL, Miller GA. (2018) Impact of gender, organized athletics, and video gaming on driving skills in novice drivers. *PloS one*;13(1):e0190885.<https://doi.org/10.1371/journal.pone.0190885>
16. Cordellieri P, Baralla F, Ferlazzo F, Sgalla R, Piccardi L, Giannini AM. (2016) Gender effects in young road users on road safety attitudes, behaviors and risk perception. *Frontiers in psychology*;7:1412.<https://doi:10.3389/fpsyg.2016.01412>.
17. Jiménez-Mejías E, Prieto CA, Martínez-Ruiz V, del Castillo JdDL, Lardelli-Claret P, Jiménez-Moleón JJ. (2014) Gender-related differences in distances travelled, driving behaviour and traffic accidents among university students. *Transportation research part F: traffic psychology and behaviour*;27:81-89.<http://DOI:10.1016/j.trf.2014.09.008>.
18. Özkan T, Lajunen T. (2006) What causes the differences in driving between young men and women? The effects of gender roles and sex on young drivers' driving behaviour and self-assessment of skills. *Transportation research part F: Traffic psychology and behaviour*;9(4):269-277.<http://DOI:10.1016/j.trf.2006.01.005>.
19. Dula CS, Geller ES. (2003) Risky, aggressive, or emotional driving: Addressing the need for consistent communication in research. *Journal of safety research*;34(5):559-566
20. Schroeder P, Kostyniuk L, Mack M. (2013) National survey of speeding attitudes and behaviors: 2011. Washington, DC: National Highway Traffic Safety Administration (NHTSA); 2013. [<https://rosap.nhtsa.gov/view/dot/1960>]
21. Hernández-Hernández AM, Siqueiros-García JM, Robles-Belmont E, Gershenson C. (2019) Anger while driving in Mexico City. *PloS one*;14(9):e0223048.<https://doi.org/10.1371/journal.pone.0223048>.
22. Shaaban K, Gaweesh S, Ahmed MM. (2020) Investigating in-vehicle distracting activities and crash risks for young drivers using structural equation modeling. *PLoS one*;15(7):e0235325.<https://doi.org/10.1371/journal.pone.0235325>.
23. Mouloua M, Brill JC, Shirkey E. Gender differences and aggressive driving behavior: A factor analytic study. In: *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*; 2007: SAGE Publications Sage CA: Los Angeles, CA; 2007. p. 1283-1286.
24. Wickens CM, Mann RE, Stoduto G, Butters JE, Ialomiteanu A, Smart RG. (2012) Does gender moderate the relationship between driver aggression and its risk factors? *Accident Analysis & Prevention*;45:10-18.<https://doi.org/10.1016/j.aap.2011.11.013>.
25. Sheriff RJS, Forbes HJ, Wessely SC, Greenberg N, Jones N, Fertout M, et al. (2015) Risky driving among UK regular armed forces personnel: changes over time. *BMJ open*;5(9):e008434.<http://dx.doi.org/10.1136/bmjopen-2015-008434>.
26. Mekonnen TH, Tesfaye YA, Moges HG, Gebremedin RB. (2019) Factors associated with risky driving behaviors for road traffic crashes among professional car drivers in Bahirdar city, northwest Ethiopia, 2016: a cross-sectional study. *Environmental health and preventive medicine*;24(1):1-9.<https://doi.org/10.1186/s12199-019-0772-1>.
27. Fergusson D, Swain-Campbell N, Horwood J. (2003) Risky driving behaviour in young people: prevalence, personal characteristics and traffic accidents. *Australian and New Zealand journal of public health*;27(3):337-

342.<https://doi.org/10.1111/j.1467-842X.2003.tb00404.x>.

28. Vanlaar W, Simpson H, Mayhew D, Robertson R. (2008) Aggressive driving: A survey of attitudes, opinions and behaviors. *Journal of safety research*;39(4):375-381.<http://doi:10.1016/j.jsr.2008.05.005>.
29. Willemsen J, Dula CS, Declercq F, Verhaeghe P. (2008) The Dula Dangerous Driving Index: An investigation of reliability and validity across cultures. *Accident Analysis & Prevention* 40(2):798-806
30. Bener A, Verjee M, Dafeeah EE, Yousafzai MT, Mari S, Hassib A, et al. (2013) A Cross “Ethnical” Comparison of the Driver Behaviour Questionnaire (DBQ) in an Economically Fast Developing Country: DBQ in Arab Gulf and South Asian countries. *Global journal of health science*;5(4):165.<http://dx.doi.org/10.5539/gjhs.v5n4p165>

## Tables

**Table 1:** Sociodemographic characteristics of the female participants

Variables	Categories	No.	%
Age categories	≤30 years	181	44.5
	31-40 years	171	42.0
	≥41years	55	13.5
Educational Level	secondary & below	104	25.6
	diploma or bachelor	182	44.7
	postgraduate	121	29.7
Marital status	Married	223	54.8
	Widow/Singles/Divorced	184	45.2
House owner	Personal property	258	63.4
	Rent	149	36.6
Employment	employee	259	63.6
	Student/retired/ freelance	148	36.4
Monthly Income	Low	111	27.3
	Low middle	84	20.6
	Middle	131	32.2
	High	81	19.9

Low of < 5,000 Riyals, low middle= between 5,000-9,999 Riyals, Middle= Between 10,000 -15,000 Riyals, High=> 15,000 Riyals.

**Table 2:** Driving abilities and other driving experience.

Variables	Categories	No.	%
Have a car	Yes	238	82.9
	No	49	17.1
Years since start driving	< 3 years	214	74.6
	≥3 years	73	25.4
Frequency of driving	Daily	190	66.2
	Occasionally	97	33.8
Daily driving hours	<2 hours/day	149	51.9
	≥2 hours/day	138	48.1
Have insurance	Yes	245	85.4
	No	42	14.6
Owner of the car (256)	Yes	143	49.8
	Family/Rented	144	50.2

**Table 3:** Drivers attitude toward some traffic regulation

Variables	Categories	N	%
Adherence to seat belt	Not	30	10.5
	Yes	257	89.5
Received ticket on traffic violation	None	162	56.4
	≥One	125	43.6
Make calls while driving	Yes	180	62.7
	No	107	37.3
Receiving calls while driving	Yes	195	67.9
	No	92	32.1
Answer the call and keep driving	Yes	231	80.5
	No	56	19.5
If committed mobile violation	Yes	232	80.8
	No	55	19.2

**Table 4:** overall Dula Dangerous Driving Index (n=2870)

Variables		No.	%
Overall Negative Cognitive/Emotional Driving Subscale (NCE)	Not adequate	286	99.7
	Adequate	1	0.3
Aggressive Driving Subscale (AD)	Not adequate	71	24.7
	Adequate	216	75.3
Risky Driving Subscale (RD)	Not adequate	173	60.3
	Adequate	114	39.7

**Table 5.** Overall subscales of DULA indexes as not adequate with sociodemographic characteristics.

Variables	Categories	NCED			AD			RD		
		No.	%	<i>P</i> value	No.	%	<i>P</i> value	No.	%	<i>P</i> value
Age categories	≤30 years	126	44.1	0.573	32	45.1	0.870	75	43.4	0.916
	31-40 years	135	47.2		32	45.1		82	47.4	
	≥41years	25	8.7		7	9.9		16	9.2	
Educational Level	secondary & below	60	21.0	0.156	12	16.9	0.240	49	28.3	0.001
	diploma or bachelor	120	42.0		27	38.0		64	37.0	
	postgraduate	106	37.1		32	45.1		60	34.7	
Marital status	Married	143	50.0	0.318	27	38.0	0.018	78	45.1	0.034
	Widow/Singles/Divorced	143	50.0		44	62.0		95	54.9	
House owner	Personal property	184	64.3	0.181	57	80.3	0.001	101	58.4	0.013
	Rent	102	35.7		14	19.7		72	41.6	
Employment	employee	74	25.9	0.092	22	31.0	0.283	54	31.2	0.016
	Student/retired/freelance	212	74.1		49	69.0		119	68.8	
Monthly Income	Low	53	18.5	0.228	12	16.9	0.107	39	22.5	0.003
	Low middle	61	21.3		12	16.9		45	26.0	
	Middle	102	35.7		22	31.0		56	32.4	
	High	70	24.5		25	35.2		33	19.1	

Negative Cognitive /Emotional Driving Subscale (NCED); Aggressive Driving Subscale (AD); Risky Driving Subscale (RD)

**Table 6.** Regression analysis of the overall Aggressive Driving and Risky Driving Subscale and the demographic variables

Variables	Categories	Aggressive Driving			Risky Driving		
		AOR	95%CI	P value	AOR	95%CI	P value
Age categories	≤30 years	-	-	-	-	-	-
	31-40 years	-	-	-	-	-	-
	≥41years	-	-	-	-	-	-
Educational Level	secondary & below	-	-	-	-	-	-
	diploma or bachelor	-	-	-	-	-	-
	postgraduate	-	-	-	-	-	-
Marital status	Married	R	-	-	R	-	-
	Widow/Singles/Divorced	2.261	1.249-4.092	0.007	1.692	1.014-2.823	0.044
House owner	Personal property	-	-	-	-	-	-
	Rent	2.528	1.287-4.966	0.007	-	-	-
Employment	employee	-	-	-	0.475	0.239-0.945	0.034
	Student/retired/freelance	-	-	-	R	-	-
Monthly Income	Low	3.105	1.095-8.805	0.033	0.755	0.264-2.156	0.600
	Low middle	2.057	0.884-4.786	0.094	0.348	0.148-0.818	0.016
	Middle	2.269	1.102-4.671	0.026	0.786	0.406-1.523	0.475
	High	R	-	-	R	-	-

**Table 7.** Spearman correlation coefficient between DULA indexes and sociodemographic characteristics of the participants.

	Correlation	Age	Education	Marital status	employment	Monthly Income	NCE2	IAD2	IRA
Age	r	1.000	-.064	-.150	.095	.179	.022	-.017	-.016
	P	.	.195	.002	.056	.000	.660	.731	.744
Education	r	-.064	1.000	-.051	.277	.580	-.237	-.050	.164
	P	.195	.	.308	.000	.000	.000	.317	.001
Marital status	r	-.150	-.051	1.000	-.011	-.086	-.134	-.062	-.082
	P	.002	.308	.	.822	.082	.007	.209	.098
Employment	r	.095	.277	-.011	1.000	.501	-.085	.080	.098
	P	.056	.000	.822	.	.000	.086	.109	.047
Monthly Income	r	.179	.580	-.086	.501	1.000	-.120	-.063	.157
	P	.000	.000	.082	.000	.	.016	.202	.001
NCE	r	.022	-.237	-.134	-.085	-.120	1.000	.293	.104
	P	.660	.000	.007	.086	.016	.	.000	.036
AD	r	-.017	-.050	-.062	.080	-.063	.293	1.000	.185
	P	.731	.317	.209	.109	.202	.000	.	.000
RD	r	-.016	.164	-.082	.098	.157	.104	.185	1.000
	P	.744	.001	.098	.047	.001	.036	.000	.

R=Correlation Coefficient; p=significant 2-tailed p value