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*Original Article*

# A Case Study on Driving Behaviors, Traffic Safety, and Awareness Impacts on Traffic Accidents and Injuries in Ras Al Khaimah, UAE

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***Abstract -*** *With the increasing number of drivers and traffic accidents in the Emirates of Ras Al Khaimah (RAK), United Arab Emirates (UAE) and the implementation of stricter traffic violation schemes, it is crucial to assess the impact of such initiatives on drivers' behavior and traffic safety. Previous reports indicated that most drivers involved in traffic accidents in the UAE are young drivers aged 18-24. To address this, a survey was developed and administered to drivers in RAK, focusing primarily on this age group. The survey aimed to evaluate their understanding of traffic regulations, as well as their levels of awareness and driving behavior. The principal findings reveal that a significant percentage of participants do not wear seat belts while driving, more than half occasionally use mobile phones, and a considerable number claimed to adhere to traffic lights and speed limits consistently. Interestingly, few of the participants were found to lack knowledge of common traffic signs. Sensitivity analysis was done using Monte Carlo simulation to generate Tornado Plots and to conduct Extreme Tail Analysis to determine the impact of traffic violations on traffic accidents and resulting injuries, and fatalities. Results from the Sensitivity analysis showed that increasing traffic violations would lead to a reduction in traffic accidents and injuries and fatalities resulting from traffic accidents, particularly in cases involving the Use of Mobile Phone while driving, Not Yielding, Entering No Passing Zone, and Going the Wrong Way violations. However, violations like speeding and unsafe following distance were found to have minimal impact on traffic accidents and associated injuries and fatalities.*

***Keywords -*** *Drivers' Awareness, Traffic Accidents; Traffic Behavioral, Traffic Regulations, Traffic Safety.*

## 1. Introduction

Road traffic accidents continue to be a global concern, with an increasing number of fatalities and injuries reported each year [1]. It is speculated that having unified approaches that enforce effective measures for safety standards for roads and their users, ease of access for authorities (incl. paramedics), and regulations to prevent and reduce risky behaviors such as over speeding, will lead to lowering these numbers [2]. Reliable data and road traffic crash risks and fatalities are key to these approaches [3].Road crashes are the leading cause of death among the youth, according to public health reports. Unfortunately, in the Middle Eastern and North African (MENA) countries, road crashes are on the rise at an alarming rate [4]. Countries in the MENA region are some of the worst performers when comparing socio-economic factors such as loss of GDP, loss of healthy years as a result of road traffic crashes, and the fatality rates of road traffic crashes. Many studies have been conducted to investigate the causes of traffic accidents and solutions in the MENA region [5].

These studies concluded that driver characteristics have the highest impact on traffic accidents. Argued that drivers' mistakes and violations are considered the main contributors to road accidents [7]. Ansari et al. [8] reported that due to a significant increase in vehicles, expansion of road networks, driver errors, excess speed, violation of traffic signals, and road and vehicle safety conditions, traffic accidents were on the rise in Saudi Arabia. Most studies conducted in different countries emphasized that the solution for such large numbers of traffic accidents was public awareness, education campaigns, and strict law enforcement strategies [9-14]. It is reported that the United Arab Emirates (UAE) had 36,600 registered cars per 100,000 population in 2016, with about an estimated 18.2 fatalities per 100,000 population in 2016. UAE has seen rapid development and growth in recent years, with a population of about 9.65 million. The estimated rate of death, 18.2:100,000, is relatively high compared to the average road traffic crash fatality of the world population [15].

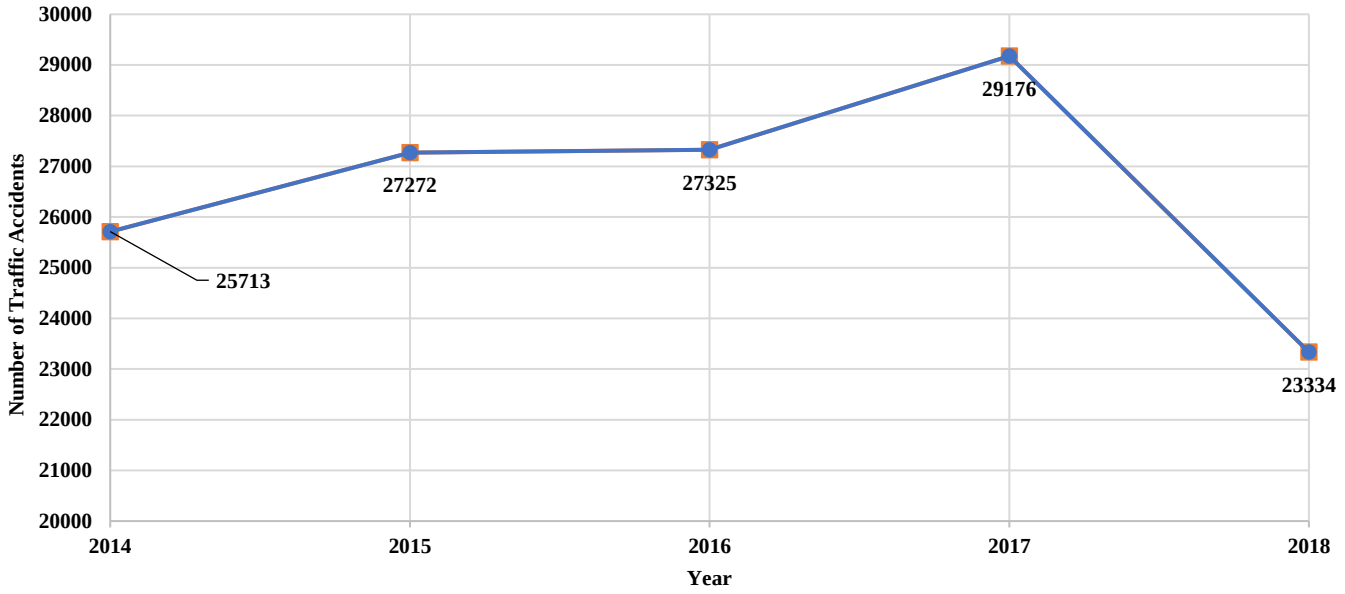



**Fig. 1 Traffic Accidents in RAK over the Period of 2014 to 2018**

Vehicular accidents are ranked as the second leading cause of death in Abu Dhabi, UAE, after cardiovascular disease. Alkheder [16] conducted a special safety survey targeting Abu Dhabi drivers. This study concluded that most traffic accidents occurred due to lack of experience, overspeeding, and other human factors. Across the UAE, regulators are working together on the reduction of road accidents by adopting and promoting the "Four Es" framework: Enforcement, Education, Engineering, and Emergency Medical Services [17].

Even though in late 2018, tougher traffic laws and fines schemes were implemented in UAE to curb traffic accident numbers, UAE officials increased activities in education and awareness in efforts to promote road safety knowledge by conducting road safety campaigns, road safety information days, community outreach programs, and social media outlets in hope to influence the attitudes and behaviours of all drivers [18]. In addition, different programs to reward safe driving were adopted in different emirates. Recently, the Emirates of Ras Al Khaimah (RAK) has undergone a development bloom in the tourism and industrial sectors, which has led to a big expansion in road networks and road safety measures. However, traffic accidents and injuries numbers have been rising in the last decades, as shown in Figures 1 and 2.

In the years 2017 and 2018, there was a big drop in the number of traffic accidents and injuries; it is believed that the drop was due to tougher traffic regulations enforcement, which is clearly shown by the increase in the number of recorded violations (Figure 3) with a jump of around 156% in 2018 in comparison to 2015. By comparing traffic data in Figures 1, 2, and 3, it could be speculated that the increase in recorded traffic violations influenced the reduction of traffic accidents and injuries resulting from these accidents [19, 20]. Furthermore, it was reported that 45% of traffic accidents in UAE have been caused by young drivers between the 18-24 years old age group. Thus, there is a need to evaluate young drivers' behaviour to be able to address them accordingly [21].

## 2. Objectives

The primary objective of this study is two-fold:

1. To assess the driving behavior of young drivers in RAK, UAE.
2. To investigate the effects of traffic laws and regulations on the reduction of traffic accidents and resulting injuries and fatalities.

## 3. Methodology

To achieve the objective of this study, the study was conducted in two phases. The first phase was to assess mainly young drivers' behaviour in RAK. The second phase was to conduct a sensitivity analysis on the impact of traffic violations on traffic accidents and resulting injuries and fatalities.

### *3.1. Survey*

To complete the first phase, which was to evaluate the behavior of young drivers in RAK, UAE, a survey was developed to evaluate driving behaviors, knowledge of traffic regulations, and the opinions of drivers. The survey was designed in three sections: the first section covered participant information (e.g., age, education level…etc.), the second section evaluated driving behavior and practices, and finally, the third section assessed the knowledge and awareness of traffic regulations. The sample was 271 (for a +100000 population, as shown in Table 1). Thus ensuring a confidence level of 90% with a low margin of error.

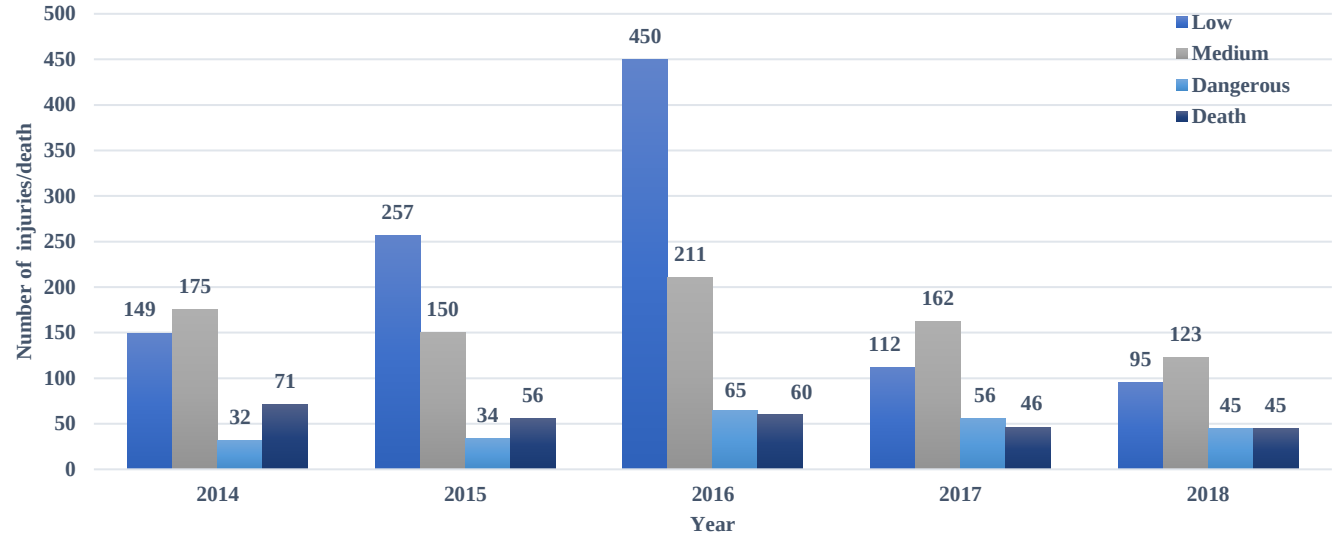



**Fig. 2 Injuries and Fatalities due to Traffic Accidents in RAK over the Period of 2014 to 2018**

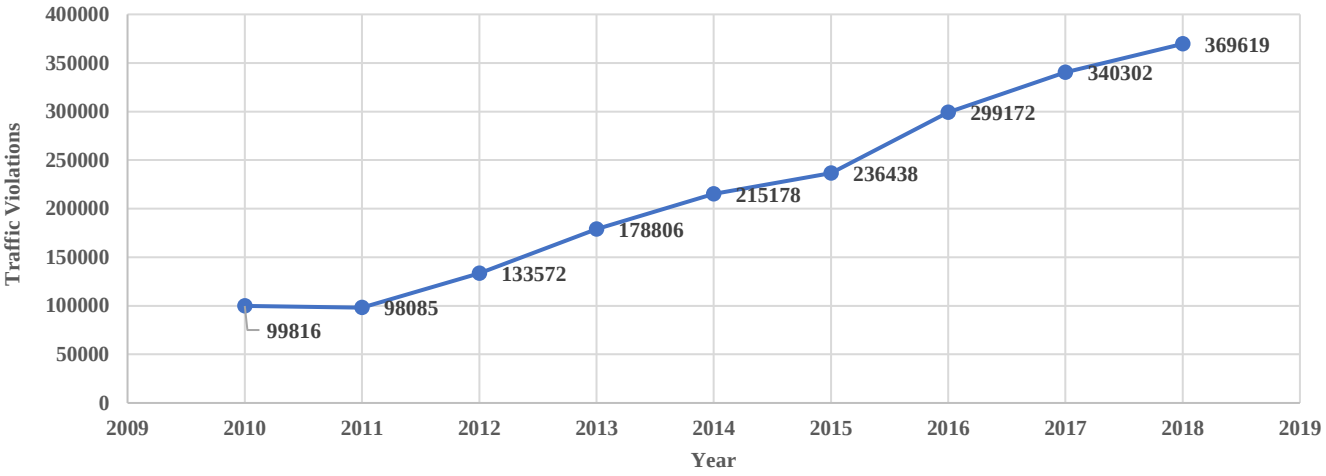



**Fig. 3 Yearly traffic violations for the period 2010 - 2018 in RAK**

**Table 1. Sample numbers and confidence levels [22]**

| Population | Margin of Error | | | Confidence Level | | |
|---|---|---|---|---|---|---|
| | 10% | 5% | 1% | 90% | 95% | 99% |
| 100 | 50 | 80 | 99 | 74 | 80 | 88 |
| 500 | 81 | 218 | 476 | 176 | 218 | 286 |
| 1000 | 88 | 278 | 906 | 215 | 278 | 400 |
| 10000 | 96 | 370 | 4900 | 264 | 370 | 623 |
| 100000 | 96 | 383 | 8763 | 270 | 383 | 660 |
| +100000 | 97 | 384 | 9513 | 271 | 384 | 664 |

**Table 2. Characteristics of the surveyed group**

| | |
|---|---|
| **Marital Status** | 64% Single; 36% Married |
| **Age group** | 52% (18-25); 15% (26-35); 17% (36-45); 16% (≥ 45) |
| **Education Level** | 12% High School; 72% Bachelor; 16% MS/PhD Degree |
| **Profession** | 36% Student; 30% Public Sector; 24% Private Sector |
| **Licensed Driver** | 92% Yes; 8% No |
| **Owning Vehicle** | 82% Yes; 18% No |
| **Conduct Regular Vehicle Maintenance** | 41% Periodically; 41% Sometimes; 18% Rarely |
| **Number of Accidents** | 38% (0); 45% (1-2); 17% (≥ 3) |

The characteristics of the surveyed group are shown in Table 2, who were mostly university students and employees. The majority surveyed were single, in the age group of 18-25, licensed drivers, owning vehicles, well educated, and were involved in at least one traffic accident.

### *3.2. Sensitivity Analysis*

To assess the impact of traffic laws and regulations on traffic accidents, injuries, and fatalities, as the second phase of the study, Sensitivity analysis was conducted by utilizing data on traffic violations, accidents, and causes, which were obtained from the Department of Statistics of RAK and the RAK Police and the Statistical Yearbooks (Studies & Statistics Administration 2014 and 2018). Sensitivity analysis is commonly used to assess the impact of model parameters (inputs) on its results (outputs) [23]. Common sensitivity analysis is conducted by changing one parameter in a model while keeping the other parameters constant, leading to the loss of the effect of the interaction between all parameters [24]. To avoid this shortcoming, Tornado Plots and Extreme Tail Analysis are utilized to evaluate the sensitivity of variables in models since these methods capture the effect of varying all parameters collectively on the output of the model [25]. By using the means and standard deviations of inputs, Monte Carlo simulation was utilized to generate 100,000 data points and used to develop Tornado Plots and the Extreme Tail Analysis. Tornado Plots are commonly used for easier visualization of the impact of an input parameter on the output of a model. These plots facilitate spotting and determining inputs that have the highest impact on the model output and which have the lowest impact. Thus, it can be removed from the model. In addition, using these plots, the nature of the impact can be found if increasing the value of the inputs will lead to a reduction of the output and vice versa. To generate the tornado plot, Spearman's rank coefficients (ρ) were determined using Equation 1:

$$\rho = 1 - \left(\frac{6\sum d_i^2}{n(n^2-1)}\right) \quad (1)$$

Where,
ρ: Spearman's rank correlation coefficient,
$d_i$: difference in the ranks between input and output values in the same data pair and
n: number of data pairs.

ρ values range between -1 and 1. As ρ closes to -1 or 1, the corresponding model parameter has a high impact on the output. However, when it is closer to zero, the effect is low. Furthermore, the mathematical sign of ρ values indicates if the output of the model is proportionally (+ve ρ value) or inversely proportional (-ve ρ value) related to the model parameters. Extreme Tail Analysis is considered a statistical method that systematically defines critical parameters in a model. To identify those parameters, the normalized variable α is determined (Equation 2). With $|\alpha| \geq 0.5$, the model parameters are significant and contribute to the extreme values of the model results. A positive significant value for an input indicates that extreme values of the input are one of the possible reasons for positive extreme output values and vice versa [24].

$$\alpha = \left(\frac{Median_{Group} - Median_{Total}}{\sigma_{Total}}\right) \quad (2)$$

Where,
$Median_{Group}$: median of the input in the group,
$Median_{Total}$: median of the input in the total simulation and
$\sigma_{Total}$: standard deviation of the input in the total simulations.

Mathematical models were developed that predicted traffic accidents and resulting injuries and fatalities as a function of traffic violations of identified major causes (i.e., Reckless Driving, Crossing Red Signal, Not using seat belt, use of mobile phone while driving, Speeding, Un-operational Headlights, Not Yielding, Unsafe Distance, Entering No Passing Zone, Going the Wrong Way, Under the Influence, and Unsafe Tires) for these accidents. A general model was developed (Equation 3) and covers three cases: the predictions of traffic accidents, the number of injuries resulting from traffic accidents, and the number of traffic accident fatalities, as shown in Table 3.

$$f(x) = a\left(\frac{1}{\sum x_i^{c_i}}\right)^b \quad (3)$$

Where,
f(x): Traffic accidents; resulting injuries; fatalities,
x: traffic violation, and
a, b, and $c_i$: regression constants (Table 3).

## 4. Data Analysis and Discussion

Collected data showed that 40% of participants rarely wore seatbelts, while 31% sometimes and 29% always wore seatbelts. However, the traffic fines issued in RAK for seat belt violations since 2016 increased quite significantly, but from the year 2010 to 2015, the fines issued were low, as shown in Figure 4.

This could be due to several reasons, such as law enforcement not strictly implementing traffic regulations. In contrast, in years after 2016, the fines issued spiked, which was likely due to stricter enforcement of traffic regulations and more usage of traffic cameras. When questioned on whether seat belts reduce injuries or not, data shows that 63% agreed that seat belts always reduce injuries, and 5% stated that they rarely reduce injuries.Mobile phones have become an essential part of our daily lives. The use of mobile phones while driving distracts drivers, as engaging in a call, texting, and handling the phone cause drivers to lose focus on driving. A study on the use of Mobile phones while driving in UAE showed that 11.3% of surveyed drivers were texting and 13.8% were talking [26]. Survey results showed that 64% agreed that the use of mobile phones while driving increases the chances of traffic accidents, 33% said sometimes, and 3% did not agree.

**Table 3. Details of Developed Models (Equation 3)**

| Models | a | b | c |
|---|---|---|---|
| | Traffic Accidents Predictions | Traffic Accidents Injuries | Traffic Accidents Fatalities |
| | | $f_2(x) = 3.12 \times 10^4 \left(\frac{1}{\sum x_i^{c_i}}\right)^{0.341912}$, $R^2 = 0.6128$ | $f_3(x) = 2.97 \times 10^5 \left(\frac{1}{\sum x_i^{c_i}}\right)^{0.341912}$, $R^2 = 0.6926$ |
| Reckless Driving | 0.13 | 0.12 | 0.12 |
| Crossing Red Signal | 0.55 | 0.15 | 0.16 |
| Not using the seat belt | 1.39 | 0.2 | 0.2 |
| Use of mobile phone while driving | 1.81 | 1.89 | 1.89 |
| Speeding | 0.12 | 0.12 | 0.13 |
| No Headlights at Night | 0.2 | 0.1 | 0.1 |
| Not Yielding | 0.07 | 0.07 | 0.07 |
| Unsafe Distance | 0.09 | 0.09 | 0.09 |
| Entering No Passing Zone | 2.21 | 2.2 | 1.91 |
| Going the Wrong Way | 0.02 | 1.3 | 1.58 |
| Under the Influence | 2.61 | 2.2 | 0.32 |
| Unsafe Tires | 0.06 | 0.06 | 0.06 |

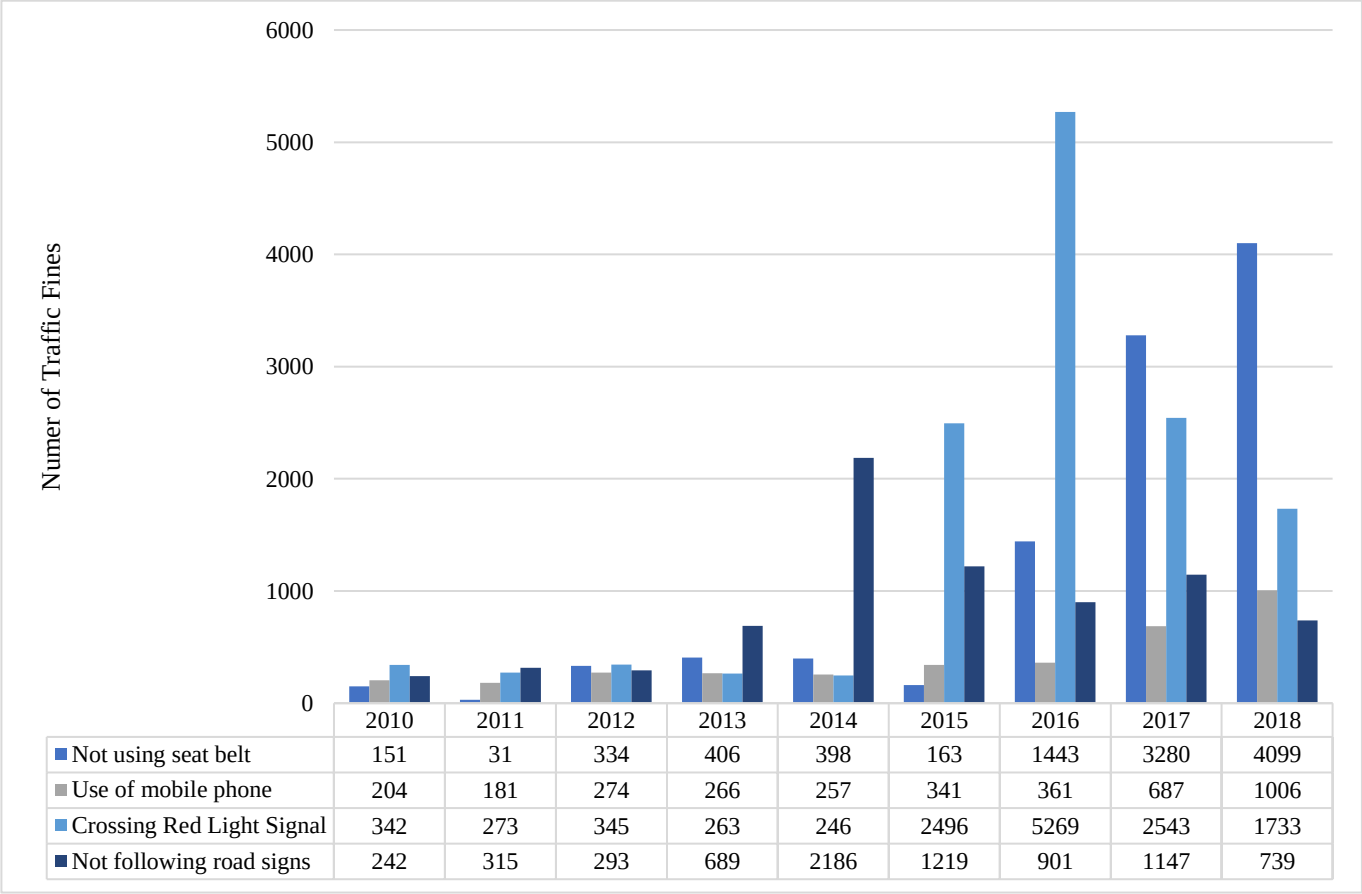



**Fig. 4 Number of traffic fines for not buckling up seatbelts, use of mobile phones while driving, and red light crossing for the period 2010 – 2018**

However, when asked if they used mobile phones while driving, 53% responded that they used them sometimes, 31% responded that they rarely used mobile phones, and 16% always used mobile phones while driving. Over the years, fines issued for using mobile phones have also increased.In 2018, more than 1000 fines were issued in RAK for mobile phone usage while driving (Figure 4). Driving while fatigued can be as dangerous if not worse than the use of a mobile phone while driving. Fatigue is caused either by lack of rest over extended periods of time, mental stress, deprivation from sleep, or other illnesses. Fatigue reduces the reaction time of the driver, which increases the chances of a road traffic accident.Furthermore, fatigue may cause drivers to sleep, which is extremely dangerous and has an elevated risk of fatality or injury resulting from an accident. Collected data showed the results of the survey question on whether they continued to drive when they felt exhausted; 51% of the participants answered they sometimes continue to drive when they feel exhausted, 20% always continue driving when exhausted, and 29% would rarely continue to drive when exhausted.Traffic signals do not only control traffic, but they also prevent road traffic accidents from taking place. It is quite common knowledge that crossing a red-light traffic signal can lead to serious accidents, which can lead to injuries and even fatalities. Participants responded to the question if participants adhered to traffic signals, 70% responded that they always adhere to the traffic signals, 24% would sometimes, and 6% said that they rarely adhere to traffic signals. Whereas from the year 2010 to 2014, the fines issued were low (Figure 4) but have since increased and spiked in the year 2016 with 5269 fines issued for crossing a red signal, but have reduced since, which is likely due to the implementation of modern technologies (traffic radars and cameras). Figure 5 represents the responses of the participants regarding the knowledge of common road signs. The results showed that many participants did not know signs like “No Entry” and “Yield” signs. In fact, it was quite surprising that even in these modern times, there are wrong responses to the most common road signs. This trend is alarming since these road signs are meant to control traffic, and if people do not adhere to these signs, traffic accidents may not be avoided. Whereas fines issued for not following traffic signs, as shown in Figure 4, spiked in 2016 with +2000 fines issued and since have decreased. A probable reason for the reduction in the fines issued for the violations could be due to the improvement in the driving schools and awareness programs conducted by RAK Police. The other major cause of accidents is exceeding the speed limit. Roads are designed for a particular speed, and going over the design speed limit may lead to a catastrophe. While driving, one of the most important skills that can prevent a crash is the reaction time of the driver. While speeding, the reaction time of the driver is affected quite significantly, which can lead to serious road traffic accidents. 62% of participants answered that they were always following the speed limit, 30% sometimes, and 8% responded that they rarely followed the set speed limit. However, the fines issued for violation of the speed limit have increased quite significantly. In the year 2010, more than 64,000 fines were issued for speed limit violations, and it kept increasing to 297,826 fines in 2018. The increase in fines could be for various reasons, such as the general increase in the population of the emirate, stricter enforcement, and wide usage and installation of speed traps and radars (Figure 6). Despite the high usage of the internet and social media outlets by youth nowadays, participants ranked the most effective traffic awareness programs that might assist in reducing traffic accidents was the regular media outlets and paper pamphlets as number one, educational lectures and workshops were ranked second, social media outlets were ranked third, and school activities were ranked last. It is speculated that since youth are in full control of their social media outlets and have the ability to filter out and block awareness campaigns, traffic awareness and safety programs via social media may not be effective and will not get through. On the other hand, the first two methods cannot be controlled or filtered; thus, participants ranked them as the most effective ways to convey traffic safety and awareness campaigns. Furthermore, more than 73% of participants agreed to include a traffic safety and awareness course and/or training in schools' and colleges’ curricula. Finally, upon conducting sensitivity analyses, Tornado Plots results showed that among the traffic violations, Driving Under the Influence, Entering No Passing Zone, and Use of Mobile Phone while driving violations had the largest impact on the reduction of predicted traffic accidents (Figure 7-a). As for injuries resulting from traffic accidents, Use of a Mobile Phone while driving, Not Yielding, and Entering No Passing Zone violations had the largest impact on the reduction of predicted injuries resulting from traffic accidents (Figure 7-b).The use of mobile phones while driving and not yielding violations led to lower numbers of predicted fatalities in traffic accidents (Figure 7-c). Similar to Tornado Plot results, Extreme Tail Analysis results showed that Use of Mobile Phone while driving, Not Yielding, Entering No Passing Zone violations contributed to the extreme values of predicted traffic accidents and resulting injuries and fatalities with $\alpha \geq |0.5|$, as shown in Table 4.

In addition, results showed that driving Under the Influence violations had an impact on the predicted traffic accidents and driving the Going Wrong Way influenced predicted fatalities caused by traffic accidents.Surprisingly, Speeding and Unsafe Following Distance violations had a minimum effect on predicted traffic accidents and resulting injuries and fatalities. It is believed that Speeding violations are committed by repeat offenders and do not have an impact on their driving behavior. Results were consistent with what was announced in the nearby Abu Dhabi and Dubai Emirates in UAE. An announcement was made by the Department of Traffic at the Dubai Police in a local newspaper “Using mobile phones while driving is now one of the principal causes of road accidents, mainly serious accidents. Such accidents have involved many serious injuries and deaths on the road” [27].

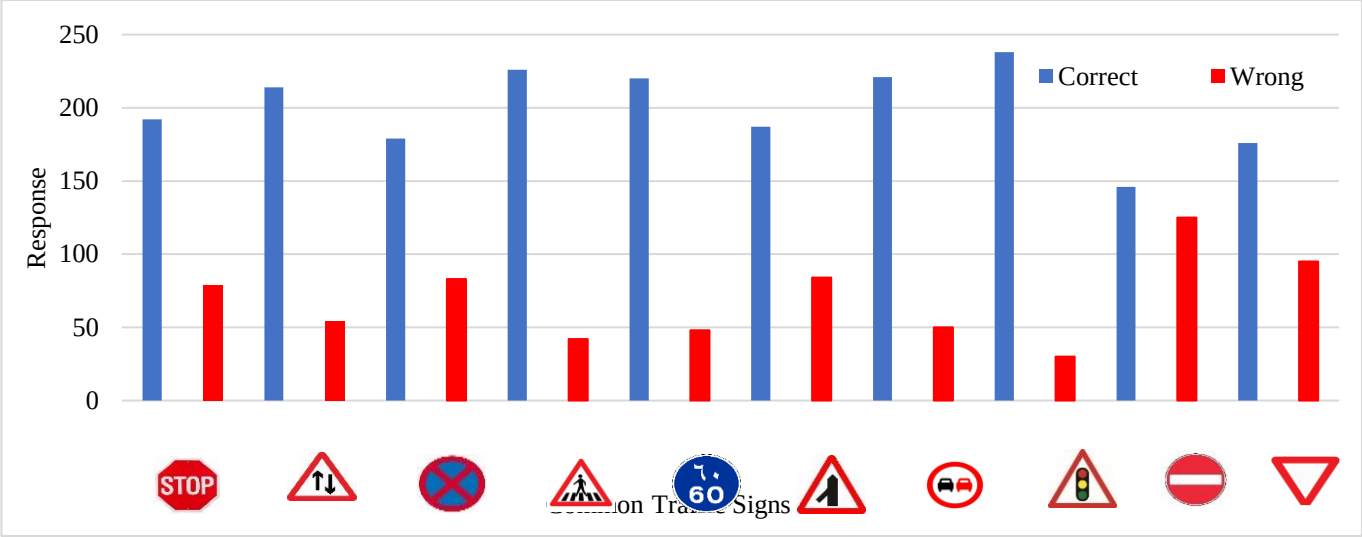



**Fig. 5 Knowledge of road signs**

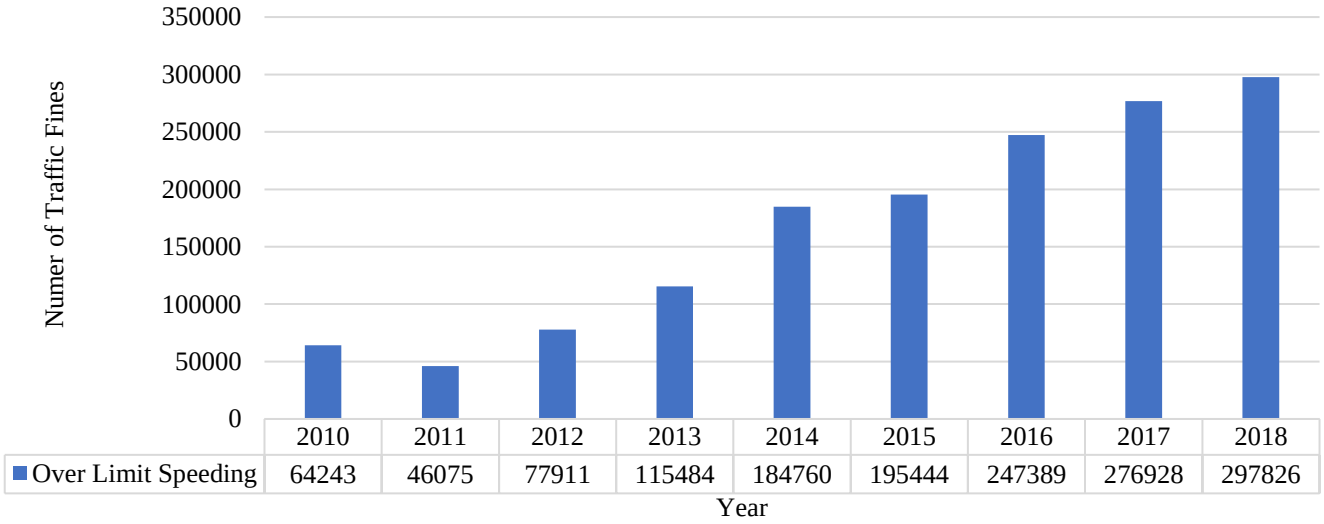
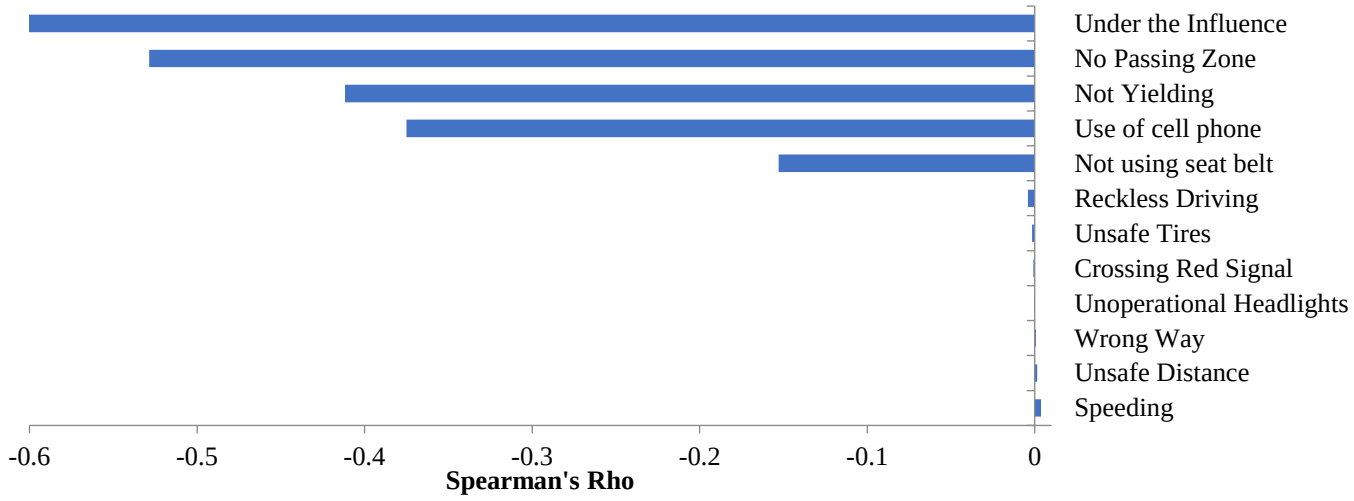
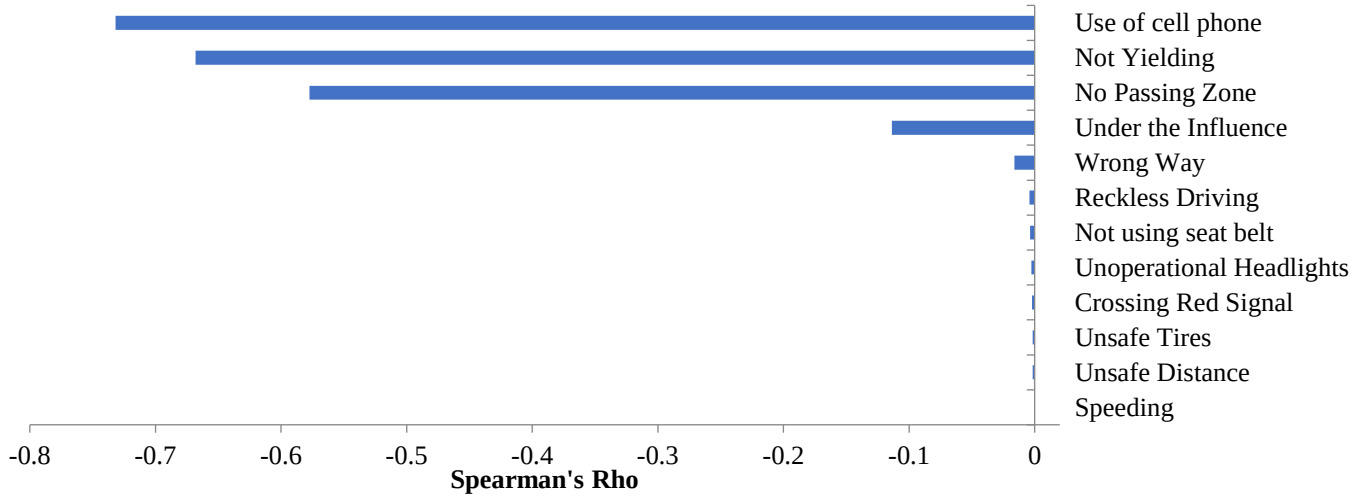


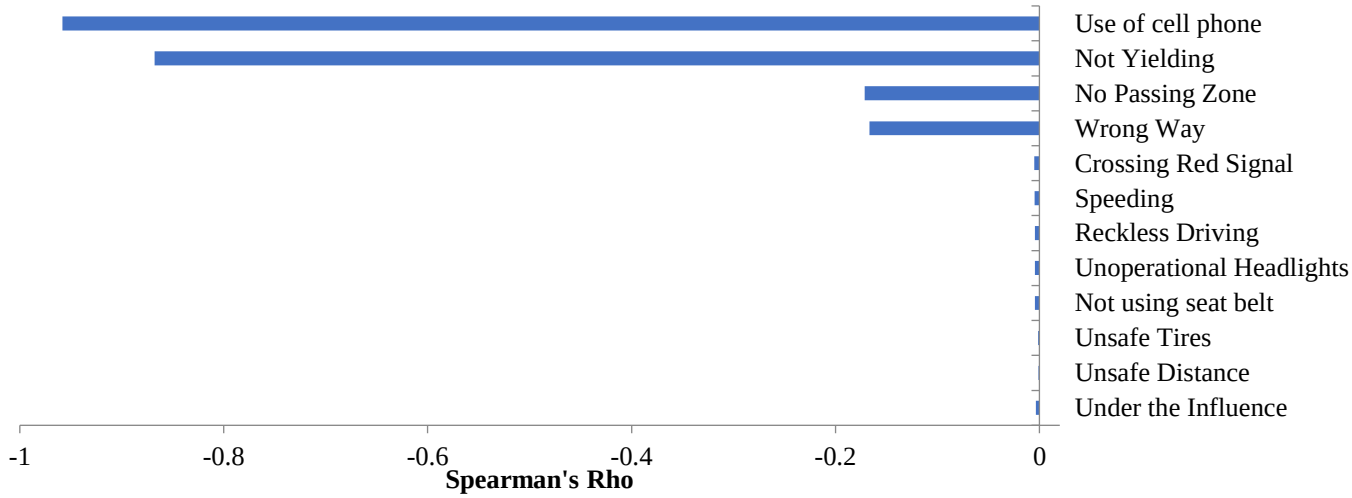

**Fig. 6 Number of traffic fines for speeding over the speed limit for the period 2010 - 2018**




**(a)**




**(b)**




**(c)**

**Fig. 7 Tornedo Plot analysis results: (a) Traffic accidents; (b) Injuries resulting from traffic accidents; (c) Fatalities resulting from traffic accidents**

**Table 4. Extreme tail analysis results**

| Traffic Violation | Accidents | | Injuries | | Fatalities | |
|---|---|---|---|---|---|---|
| | $\alpha$, Left Tail | $\alpha$, Right Tail | $\alpha$, Left Tail | $\alpha$, Right Tail | $\alpha$, Left Tail | $\alpha$, Right Tail |
| **Reckless Driving** | 0.023 | -0.023 | 0.015 | -0.015 | 0.012 | -0.020 |
| **Crossing Red Signal** | 0.011 | 0.013 | 0.050 | -0.024 | -0.008 | -0.013 |
| **Not using the seat belt** | 0.137 | -0.549 | 0.025 | -0.005 | 0.023 | -0.001 |
| **Use of Mobile Phone while driving** | 0.433 | -1.090 | 1.588 | -1.400 | 2.080 | -1.494 |
| **Speeding** | -0.035 | -0.018 | 0.040 | -0.005 | 0.034 | 0.011 |
| **Nonoperational Headlights** | 0.002 | -0.015 | 0.019 | -0.015 | 0.029 | -0.002 |
| **Not Yielding** | 0.457 | -0.890 | 1.787 | -0.899 | 2.546 | -0.928 |
| **Unsafe Distance** | 0.003 | -0.030 | -0.001 | -0.016 | -0.038 | -0.006 |
| **Entering No Passing Zone** | 1.245 | -0.909 | 1.878 | -0.967 | 0.231 | -0.659 |
| **Going the Wrong Way** | 0.048 | 0.029 | 0.037 | -0.061 | 0.179 | -0.817 |
| **Under the Influence** | 2.094 | -0.925 | 0.166 | -0.496 | 0.018 | 0.004 |
| **Unsafe Tires** | -0.005 | -0.003 | 0.004 | -0.019 | -0.020 | 0.001 |

The Traffic and Patrols Directorate at the Central Operations Sector in Abu Dhabi Police announced that 75-80% of traffic accidents, which led to death or severe injuries, were a result of inattentive driving and using mobile phones to browse the internet and social media [6].

## 5. Summary and Conclusion

The number of accidents over the years has been reduced in RAK because of awareness campaigns adopted and implemented by the RAK Police. However, the violations of the traffic regulations are still on the rise. Since most drivers involved in accidents are young drivers (18-24 years), this study was conducted with most surveyed participants falling within this age group. Results showed that 40% of participants rarely used seatbelts, while 31% sometimes and 29% always used seatbelts. 62% of participants responded that they always follow the speed limit, 30% sometimes, and 8% responded that they rarely follow the speed limit. However, the fines issued for speed limit violations have been on the rise quite significantly. Crossing red-light traffic signals is also a very serious issue as it can lead to serious accidents, which can lead to fatalities. Collected data showed that 70% of participants always adhered to traffic signals, 24% would sometimes and 6% said they rarely adhered to traffic signals. The fines issued for crossing red-light traffic signals spiked in 2016 with +2000 fines issued and since have decreased.Sensitivity analysis of traffic accidents in relation to traffic violations results showed that traffic violations had a reverse effect on predicted traffic accidents and injuries and fatalities resulting from traffic accidents, especially the Use of Mobile Phone while driving, Not Yielding, Entering No Passing Zone, and Going the Wrong Way violations. However, results showed that Speeding and Unsafe Following Distance violations had a low impact on predicted traffic accidents and injuries and fatalities resulting from traffic accidents.

Not Buckling Up Seatbelts violations had minimum effect on predicted injuries and fatalities resulting from traffic accidents. These results raise the question of the effectiveness of tougher traffic laws and harsher violation fines. It was clear that the recently adopted approach might be effective on some violations and not all. Even though there is a black-point system in place, a stricter approach should be developed to address and reduce the number of repeated violators and a white-point system, similar to a program recently implemented in the nearby Emirate of Dubai, which rewards safe driving. As per the findings of this study, it is recommended to intensify awareness campaigns among youth with an emphasis on consequences for violating traffic regulations. The use of social media and other technologies for awareness campaigns can be beneficial. Consider incorporating traffic safety in the educational process with the aid of the police force.

## Author Contribution Statement

All authors developed the survey. S. Bhatti and M. Shahin conducted the survey and data collection and cataloguing. All authors developed the figures and tables. A. Abu Abdo conducted the data analysis and wrote the manuscript. All authors read and approved the manuscript.

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## References

[1] Global Health Estimates, World Health Organization, 2018. [Online]. Available: https://www.who.int/data/global-health-estimates

[2] *Save Lives: A Road Safety Technical Package*, World Health Organization, pp. 1-60, 2017. [Google Scholar] [Publisher Link]

[3] Adnan A. Hyder et al., "Monitoring the Decade of Action for Global Road Safety 2011-2020: An Update," *Global Public Health*, vol. 12, no. 12, pp. 1492-1505, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[4] *The Global Burden of Disease: Generating Evidence, Guiding Policy – Middle East and North Africa Regional Edition, Human Development Network, The World Bank*, Institute for Health Metrics and Evaluation, pp. 1-13, 2013. [Google Scholar] [Publisher Link]

[5] Said Dahdah, and Dipan Bose, "Road Traffic Injuries: A Public Health Crisis in the Middle East and North Africa," *Transport Notes TRN-4*, pp. 1-8, 2013. [Google Scholar] [Publisher Link]

[6] Ashraf Gamal, 80% of "Fatal" Traffic Accidents in Abu Dhabi as a Result of Using Phones, UAE: Emirate Alyoum, Dubai Media Incorporated, 2020. [Online]. Available: https://www.emaratalyoum.com/local-section/accidents/2020-02-27-1.1312998

[7] Gunnar Meinhard, "Evaluation of the Effectiveness of a Primary Preventive Program "Clear Picture…!?" to Increase Traffic Safety," *Transactions on Transport Sciences*, vol. 11, no. 1, pp. 33-40, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[8] S. Ansari et al., "Causes and Effects of Road Traffic Accidents in Saudi Arabia," *Public Health*, vol. 114, no. 1, pp. 37-39, 2000. [CrossRef] [Google Scholar] [Publisher Link]

[9] Attiyah M. Al-Atawi, Ravindra Kumar, and Wafaa Saleh, "A Framework for Accident Reduction and Risk Identification and Assessment in Saudi Arabia," *World Journal of Science, Technology and Sustainable Development*, vol. 11, no. 3, pp. 214-223, 2014. [CrossRef] [Google Scholar] [Publisher Link]

[10] Darina Havlíčková et al., "The Role of Gender and Age in Autonomous Mobility: General Attitude, Awareness and Media Preference in the Context of Czech Republic," *Transactions on Transport Sciences*, vol. 10, no, 2, pp. 53-63, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[11] Salaheddine Bendak, "Seat Belt Utilization in Saudi Arabia and its Impact on Road Accident Injuries," *Accident Analysis and Prevention*, vol. 37, no. 2, pp. 367-371, 2015. [CrossRef] [Google Scholar] [Publisher Link]

[12] Marina Zanne, Aleš Groznik, and Elen Twrdy, "Assessment of Traffic Safety among Young People Aged 15 to 24 in Slovenia," *Promet-Traffic and Transportation*, vol. 25, no. 2, pp. 147-156, 2013. [CrossRef] [Google Scholar] [Publisher Link]

[13] Uchechukwu L. Osuagwu. OD, Bander Al-Aseeri, and Kelechi C. Oghuehi, "Assessing the Effects of Mobile Phone Use, Test Messages and Chatting on Social Media among Saudi and Non-Saudi Drivers," *International Journal of Applied Science and Technology*, vol. 3, no. 7, pp. 107-117, 2013. [Google Scholar] [Publisher Link]

[14] Vaman Kulkarni et al., "Awareness and Practice of Road Safety Measures among Undergraduate Medical Students in a South Indian State," *Journal of Forensic and Legal Medicine*, vol. 20, no. 4, pp. 226-229, 2013. [CrossRef] [Google Scholar] [Publisher Link]

[15] *Global Status Report on Road Safety 2018*, World Health Organization, pp. 1-419, 2019. [Google Scholar] [Publisher Link]

[16] Sharaf Alkheder, "Learning from the Past: Traffic Safety in the Eyes of Affected Local Community in Abu Dhabi City, United Arab Emirates," *Transportation Letters*, vol. 9, no. 1, pp. 20-38, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[17] Road safety initiatives, UAE Government Portal, The United Arab Emirates' Government portal, UAE, 2023. [Online]. Available: https://u.ae/en/information-and-services/justice-safety-and-the-law/road-safety/road-safety-initiatives

[18] Integrated Transport Centre, The Joint Committee for Traffic Safety Launches the Vision zero Strategy Development Project, ITC, Abu Dhabi, UAE, 2021. [Online]. Available: https://itc.gov.ae/en/news/the-joint-committee-for-traffic-safety-launches-the-vision-zero-strategy-development-project

[19] Studies & Statistics Administration, Statistical Yearbook 2014, RAK Department of Economic Development, 15th Issue; United Arab Emirates, 2014. [Online]. Available: https://www.scad.ae/Release%20Documents/SYB-2014_V1.1_EN.pdf

[20] Studies & Statistics Administration, Statistical Yearbook 2018, RAK Department of Economic Development, 19th Issue; United Arab Emirates, pp. 1-314, 2018. [Online]. Available: https://www.sti.gov.ae/documents/20122/2310860/SYB_2018_EN_9Sep%2520_Chart%2520Correction.pdf/ddfea2aa-263f-f7ea-b0f4-82bd370011c5?t=1684148666759

[21] 45% of Road Accidents in UAE Caused by Young Drivers, Khaleej Times, 2019. [Online]. Available: https://www.khaleejtimes.com/transport/45-of-road-accidents-in-uae-caused-by-young-drivers

[22] S. Smith, *Determining Sample Size: How to Ensure You Get the Correct Sample Size*, Qualtrics Online Sample, 2013. [Google Scholar]

[23] Andrea Saltelli, E.M. Scott, and K. Chan, *Sensitivity Analysis*, USA: John Wiley and Sons, pp. 1-475, 2000. [Google Scholar] [Publisher Link]

[24] Senthilmurugan Thyagarajan, "*Improvements to Strain Computation and Reliability Analysis of Flexible Pavements in the Mechanical-Empirical Pavement Design Guide*," Washington State University, pp. 1-24, 2009. [Google Scholar] [Publisher Link]

[25] David Vose, *Quantitative Risk Analysis: A Guide to Monte Carlo Simulation Modelling*, USA: John Wiley and Sons, pp. 1-328, 1996. [Google Scholar] [Publisher Link]

[26] Salaheddine Bendak et al., "Is the Use of Mobile Phones while Driving Reaching Alarming Rates? A Case Study," *Transportation Letters*, vol. 11, no. 10, pp. 535-541, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[27] Muhammad Fouda, Dubai Police Deters Reckless People with Advanced Control Devices and Technologies, UAE: Emirate Alyoum, Dubai Media Incorporated, 2019. [Online]. Available: https://www.emaratalyoum.com/local-section/accidents/2019-10-29-1.1267189