

A Brief Overview of Road Accidents and Recent Preventive Methodologies for Accident Hotspots in the United Arab Emirates

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Research Article

Keywords: road injuries, road crash data analysis, road safety policies, public health safety, autonomous vehicles

Posted Date: January 13th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1251649/v1>

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Abstract

This paper highlights major causes of road accidents in the United Arab Emirates (UAE) and explores the possibility of reducing them through modern in-vehicle control technologies. Mostly, road safety data from the Global Road Safety Facility (GSRF), Road Safety Polices and Regulations for UK and UAE have been reviewed for comparison and analysis. It contains a descriptive analysis of road accident data which was taken from Ministry of Interior (MOI) - UAE website. It shows how the Pareto Principle applies to most of the road accidents in the UAE with young males' poor driving habits and higher maximum speed limits being the major causes and, a systematic approach as per the Nilsson Power Model, to tackle these issues. It ends with the conclusion that, although high speed limits on urban roads and highways are some of the critical factors in causing dangerous road accidents but, it can be tackled with by implementing strict road safety policies and enforcing them with modern in vehicle technologies.

1. Introduction

While the whole world grappled with the sudden outbreak of coronavirus pandemic and most of the public transportation services, including international and local transit was at its minimum or completely halted, we saw a rapid increase in dangerous driving behavior, including over-speeding in the USA, UK, and UAE. Although, the road safety situation was quite improved, at this time, in most of the high-income countries. The middle to low-income countries were supposed to be at more risk of road traffic injuries, as predicted by the World Health Organization (WHO) in 2004 [8]. But the benefit of over-speeding on empty roads and mental stress due to lockdown gave rise to such behavior, in the high-income countries.

In order to tackle this dangerous situation, many local authorities in the USA, UK and Europe started to redesign their roads in order to accommodate safe cycling experience and pedestrian friendly spaces, famously known as Tactical Urbanism. This report includes a comparison of international road safety goals with the road safety regulations and policies of two high income countries, one in the Middle East (UAE) and one in Europe (Scotland). It also contains a comparison of international road accident data with the local databases of these countries, while focusing on the accident reporting and data collection issues. Finally, main causes of road accidents are discussed within the UAE and how they can be reduced further by doing the necessary changes in the local road safety policy, infrastructure, and driver's education curriculum.

2. Literature Review

It has been 10 years since UAE adopted the Vision 2021 and according to that, one of MOI's goal were to reduce the number of road deaths to 3 per 100,000 people by the year 2021. As we are almost at the end of this period, it will prove useful to review the UAE's road safety policy and compare it with international best practices to know if the policy has been properly implemented and it aligns with international road safety goals such as the safe system approach and Vision Zero. For this reason, UAE Vision 2021 and Road Safety Policy have been chosen to be compared with the Scottish Road Safety Framework to 2020

and 2030, in order to illustrate any discrepancies within the former and how well it has been adopted by the road users. In other words, how effective UAE Road Safety policy have been over the last 10 years in reducing road accidents.

Although, strict road safety legislative measures were taken by the UAE government, such as the Penalty and Rewards Point Systems [15] to enforce safe driving behavior but it did not have a great impact on changing the dangerous driving habits of young male drivers, resulting in a 12% increase in the number of road accidents in 2019 as compared to 2018 [7]. This proves that the current road safety guidelines are not sufficient to reduce road accidents in the country and they should be updated to address the local causes of road accidents so that the accident rate can be reduced to an acceptable level. Similarly, in Scotland, there has been a 23% increase in the number of road casualties resulting in death or serious injury, for the same time period, despite the well documented Scottish Road Safety Framework to 2020 which is based on the 5 E's methodology of Road Safety.

The road accidents statistics mentioned above gets a little confusing when we do a more detailed analysis, as not all seriously injured casualties are reported as killed, if death happens in the hospital, few days after the accident. In order to compensate for that, UAE has implemented electronic record system in all hospitals and coupled it with the next generation emergency response system to streamline the rescue and post-accident care process and also ensure clarity in data collection for enabling a more accurate data-driven approach in identifying accident hotspots and major causes of these accidents. In addition to that, all traffic accidents are recorded digitally by police officers through the in-vehicle telematics system (PIPS). All police vehicles were equipped with this technology in the year 2012 and it also proves useful in identifying over speeding vehicles, on the highway. Sometimes, Probe vehicles are also used to collect traffic data, but congestion data is collected through the traditional methodology of roadside or overhead traffic counters. While Scotland have a similar approach towards data collection (CRASH), still it is not very effective as the number of casualties reported by the police are not exactly the same as the people admitted in hospitals due to traffic injuries.

Generally, there have been extensive road safety campaigns, road infrastructural changes and updates to the driver's education curriculum carried out both in the Scotland and UAE but the main cause of death seems to be speeding either because of wheeling on motorcycles, in case of Scotland or with Sports Utility Vehicles (SUV), in case of UAE. Another major problem in the UAE causing hundreds of road fatalities per year is the lack of proper road safety legislation for the old model or poorly maintained in-service buses and vans for the transportation of laborers and tourist. Although, several years ago UAE decided to completely ban minibuses from roads as they were the main type of vehicles used by the tourist and construction companies for staff transportation but there has still been a somewhat moderate approach of turning it into a law, by the relevant authorities. There was also a traffic law introduced around 15 years ago to ban old model vehicles from driving on UAE roads as they were considered unsafe, as per international road safety standards.

Finally, the following information has been taken from international sources, including WHO and United Nations (UN) websites, regarding the current road safety policies in place, both in UK (Scotland) and UAE. As per WHO the UAE has good Drink Driving laws with a legal Blood Alcohol Content (BAC) limit of 0.01 g/dl as compared to UK having a much higher BAC legal limit of 0.08 g/dl. On the other hand, UAE does not have good speed limit laws for urban roads while the maximum speed limit in UK on urban roads is only 30 mph (48 kmph). Similarly, UAE does not have any good child restraint or helmet laws with the exception of a standard for child restraint and front seat child restriction, but UK have well documented laws on both child restraints and the use of helmet. Last but not the least, UK have implemented all 8 key vehicle standards, including electronic stability, frontal impact, pedestrian protection, and motorcycle ABS, while UAE have none. This comparison does not include the Scottish Road Safety Framework to 2030 as it has been very recently released and only contains some quick facts, Vision and Strategic goals instead of a well-documented road safety policy.

3. Methodology

To properly study the main causes of road accidents in UAE, an in-depth descriptive analysis of road accident data has been included which not only have been taken from international databases, such as the WHO and the World Bank Group (WBG). But the major source of road accident data in UAE is from MOI database which is available online on the bayanat.ae website. If we take a quick look at the graph below, taken from the WHO database, we can clearly see a gradual decline in mortality caused due to road accident per 100,000 population, since 2016. Although, it has been decreased to 8.9 deaths per 100,000 of the population in 2019 and it is quite low as compared to other Middle Eastern and African countries but still a little higher than the current rate for high-income countries. On the other hand, Table 1 shows a 12% increase in the total number of road casualties, as mentioned previously.

Table 1

Number of Road Casualties in UAE for the last 3 years, as per the severity level.

| | 2017 | 2018 | 2019 |
|------------------|------|------|------|
| Killed | 543 | 468 | 448 |
| Serious Injuries | 521 | 484 | 460 |
| Medium Injuries | 2793 | 2532 | 2756 |
| Slight Injuries | 2547 | 2114 | 2598 |
| Total | 6404 | 5598 | 6262 |

Source: This data has been taken from the UAE's MOI database which is available for download from the bayanat.ae website.

If we take a closer look at the Tables 2 and 3, we can clearly notice that mostly males in the age range of 18 to 30 years died in these fatal road accidents that occurred from 2017 to 2019. While the major type of road accident was Head-On collision in the state of Abu Dhabi, as shown in Table 4. As the state of Abu Dhabi occupies 10 times more area than the rest of UAE, therefore, naturally the number of road accidents are quite higher for it. This trend in fatal road accidents can be due to the lack of proper driving education, unlicensed driving, dangerous driving behavior such as speeding and reckless driving by young male drivers.

Table 2

Number of Fatal Road Accidents as per the Age range, for the last 3 years.

| | 1 – 7 | 8 – 17 | 18 – 30 | 31 – 45 | 46 – 60 | 60+ | Unknown |
|------|-------|--------|---------|---------|---------|-----|---------|
| 2017 | 17 | 23 | 227 | 184 | 64 | 27 | 1 |
| 2018 | 8 | 16 | 201 | 159 | 59 | 24 | 1 |
| 2019 | 9 | 11 | 182 | 156 | 74 | 16 | 0 |

Source: This data has been taken from the UAE’s Ministry of Interior database which is available for download from the bayanat.ae website.

Table 3

Percentage of Fatal Road Accidents as per gender, for the last 3 years.

| | 2017 | 2018 | 2019 |
|---|------|------|------|
| Male | 87% | 88% | 89% |
| Female | 13% | 12% | 11% |
| Source: This data has been taken from the UAE’s MOI database which is available for download from the bayanat.ae website. | | | |

Table 4

Number of Road Accident according to the accident type in the Emirate of Abu Dhabi, Dubai, and Sharjah for the year 2019.

| | Abu Dhabi | Dubai | Sharjah |
|---|-----------|-------|---------|
| Head-on Collision | 1264 | 925 | 293 |
| Roll Over | 215 | 100 | 31 |
| Run Over | 311 | 332 | 194 |
| Other | 8 | 3 | 3 |
| Source: This data has been taken from the UAE's MOI database which is available for download from the bayanat.ae website. | | | |

While the dangerous driving behavior in young male drivers remains by far the biggest cause of road accidents, following are some of the major causes of the road accidents in UAE, as per their occurrence.

Table 5

Percentage of Major causes of accidents as per their occurrence from 2015 to 2019.

| Main Causes of Accidents | Frequency |
|---|-----------|
| Over taking or Lane changing | 19% |
| Careless driving at junctions and jumping at the red signal | 15% |
| Tail gating | 14% |
| Not stopping at crosswalks. | 13% |
| Not obeying traffic rules | 1% |
| Source: This data has been taken from the UAE's MOI database which is available for download from the bayanat.ae website. | |

This categorization of road traffic accidents was done after an extensive study of the MOI's road accident database. Although, accidents caused due to Tail gating does not happens very frequently, but it is the major cause of multi-car road accidents on UAE highways, resulting in dozens of injuries and deaths. These types of road accidents mostly happen on Sheikh Zayed and Sheikh Mohammad Bin Zayed roads where maximum speed limits are higher than 100 kmph. Over-taking and changing lanes on these roads becomes quite difficult in rush hours, also some drivers try to overtake from right side which is prohibited by law and some drivers have to stop their vehicles in the middle of the road due to car breakdown.

Similarly, accidents at pedestrian crossings does not happen very frequently but they prove to be more lethal because there is less chances of survival, specifically, in school areas where children are involved. In addition to that, most of pedestrian and single vehicle accidents happen during the Islamic holy month of Ramadan, when all Muslims observe fasting and are in a rush in the evening peak hours to reach

home and share a meal with their families, after fasting for more than 15 hours. It also leads to jumping red signals and careless driving at the non-signalized junctions.

Finally, the most fatal road accidents in UAE happens due to over-taking of heavy vehicles and buses on the highways. These types of road accidents mostly include buses, vans and trucks that are being used by large manpower contracting companies for the transportation of their staff to construction sites or offices. As these vehicles are not well maintained due to lack of policy for the inspection of vehicles, they pose a much larger threat to the safe driving community, economy and people traveling in it. Which is why whenever such an accident happens, one of the reasons might be overturning of vehicle while changing lanes or slipping from carriageway at a bend, resulting in massive casualties and deaths. Also, truck drivers tend to stop vehicles dangerously on roadside for a quick snack, as they mostly travel long distances without any meals or rest. In addition to that, these vehicles produce a great amount of noise pollution and are mostly responsible for the GHG emissions due to transport.

4. Discussion

With the major causes of road accidents and issues in UAE Road Safety Policy already been discussed above, along with a critical analysis of road safety data and policy comparison. This section includes a systematic approach towards achieving the UAE Vision 2021 of reducing mortality caused due to road accidents to 3 per 100,000 of population and the international road safety goal of achieving zero deaths on roads before 2050 (Vision Zero). As we can see, from the above analysis of road accident data in UAE that almost 20% of dangerous road accidents occurs due to the Collision of heavy vehicles and the rest of the 80% of accidents might involve young male drivers, with the exception of inattentive driving in Ramadan.

Therefore, in order to implement a more effective road safety approach in UAE to reduce road accidents, first of all, we should focus more on the driving behavior of young male drivers and enact such rules and regulations to stop the usage of unsafe and outdated heavy vehicles and buses on roads. Secondly, standards for autonomous vehicles and vehicles with safety features must also be adopted. These standards can help in reduction of accident rates caused both due to the usage of unsafe heavy vehicles and loss of control or dangerous driving. These technologies are capable of taking partial to somewhat complete control of the vehicle and prohibits the drivers from over speeding or dangerously overtaking other vehicles. They also warn drivers for both sudden and upcoming hazards on the road ahead.

In addition to that, to make urban roads safer, moderate speed limits must be implemented that complies with international road safety standards. The current speed limit of 80 kmph on urban roads is not safe as there is 100% chance of getting killed while hit by a vehicle driven at that speed. Also, the speed limit of 160 kmph on UAE highways, such as the Sheikh Mohammad Bin Zayed and Sheikh Zayed roads where most of the dangerous accidents occurs, are much higher than the international road safety standards and there are not many vehicles available in the market that can be fully controlled while traveling at that speed.

The Nilsson Power Model suggests that a 5% decrease in average speed limit leads to 10% decrease in Injury accidents and 20% decrease in fatal accidents. Thus, a 15% decrease in speed limit on Sheikh Mohammad Bin Zayed and Sheikh Zayed roads can result in 70% reduction in fatal accidents and 50% reduction in non-fatal accidents. Similarly, this applies to urban roads as well. Although, it will prove quite challenging to effectively implement these necessary changes in the speed limit but if they are complemented with strict penalties and fierce advertisement campaigns promoting the benefits of driving at the reduced speed, it might accelerate the process of road users adapting to it.

5. Conclusion

To sum it all up, the maximum speed limit on UAE highways and urban roads remains the major issue in terms of road safety and mortality caused due to road accidents. In order for UAE roads to be safe and pedestrian friendly, the speed limits must be reduced to a more safe and acceptable level. But that is only one piece of the puzzle. In order to implement these adjusted speed limits, latest technologies should be adopted and complemented with strict traffic rules, to ensure the abidance of road users by these new road safety rules. Also, all heavy vehicles and buses that are in poor condition and not safe to carry goods and passengers must be completely banned on roads.

This paper included a detailed comparison of Scottish Road Safety Policy and Road Safety Framework to 2020 and 2030 with the UAE Road Safety Policy and Vision 2021 which was followed by a detailed descriptive analysis of UAE road traffic accident data. Major causes, and trends of road accidents on UAE roads were also discussed with an emphasis on the dangerous accidents that occurred on Sheikh Zayed and Sheikh Mohammad Bin Zayed Road. Lastly, a systematic approach for tackling these major causes was proposed.

6. Practical Applications

As discussed above, the best possible solution to avoid dangerous road accidents in UAE is to reduce speed limits on highways and urban roads. In addition to that, introducing autonomous and semi-autonomous vehicle technologies along with implementing safety standards and policies for them can also drastically reduce the number of fatal road accidents. The local traffic police departments can systematically introduce advisory Intelligent Speed Adaptation (ISA) technologies, in the first phase and later upgrade it to mandatory ISA once the driver get used to it. This must be closely monitored and penalized, in case of noncompliance.

Once these technologies have been successfully implemented, it will be easier for the local transport departments to enforce a reduction in the maximum speed limits on Urban Roads and Highways. These updated speed limits on Urban roads can also be effectively implemented through slight changes in the road geometry, such as speed humps and raised pedestrian crossings. Research shows that road humps are 68% effective in reducing accidents.

Another most important factor for reducing road accidents due to reckless driving is to educate young drivers in such a way that they become fully aware of the traffic rules and regulations, and the risks involved in driving at high speed. By nature, young male drivers do not like to abide by the traffic rules and does not follow them properly after obtaining their driving license. Also, in some cases young boys in their teen years take an interest in driving without knowing anything about traffic rules, resulting in a dangerous driving habit. In order to educate them, there must be a unique approach adopted to help them re-adjust their driving behavior according to the acceptable safe driving practices.

Lastly, one of the most important road safety measures adopted locally in UAE, to reduce the number of road accidents in Ramadan, is through free meal distribution campaign on accident hotspots so that the drivers does not have to overspeed or hit a pedestrian who are crossing the road, in haste. These campaigns take place every year, usually in mid Ramadan and volunteers from all local universities, schools, government departments, hospital staff, military, and police personal along with the red crescent authority participate in it. Temporary traffic control measures are implemented on all such places in order to slow down the vehicles and ensure the safety of volunteers.

Studies show that this practice have drastically reduced the number of accidents during this period. In addition to that, the traffic police department also sends warning through their mobile apps to drivers of possible road diversions, car breakdowns, adverse weather conditions and any other hazards. I think, it will be better to increase the frequency of these good practices in order to ensure no deaths or injuries occur on UAE roads.

Declarations

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declarations of interest: none

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Figures

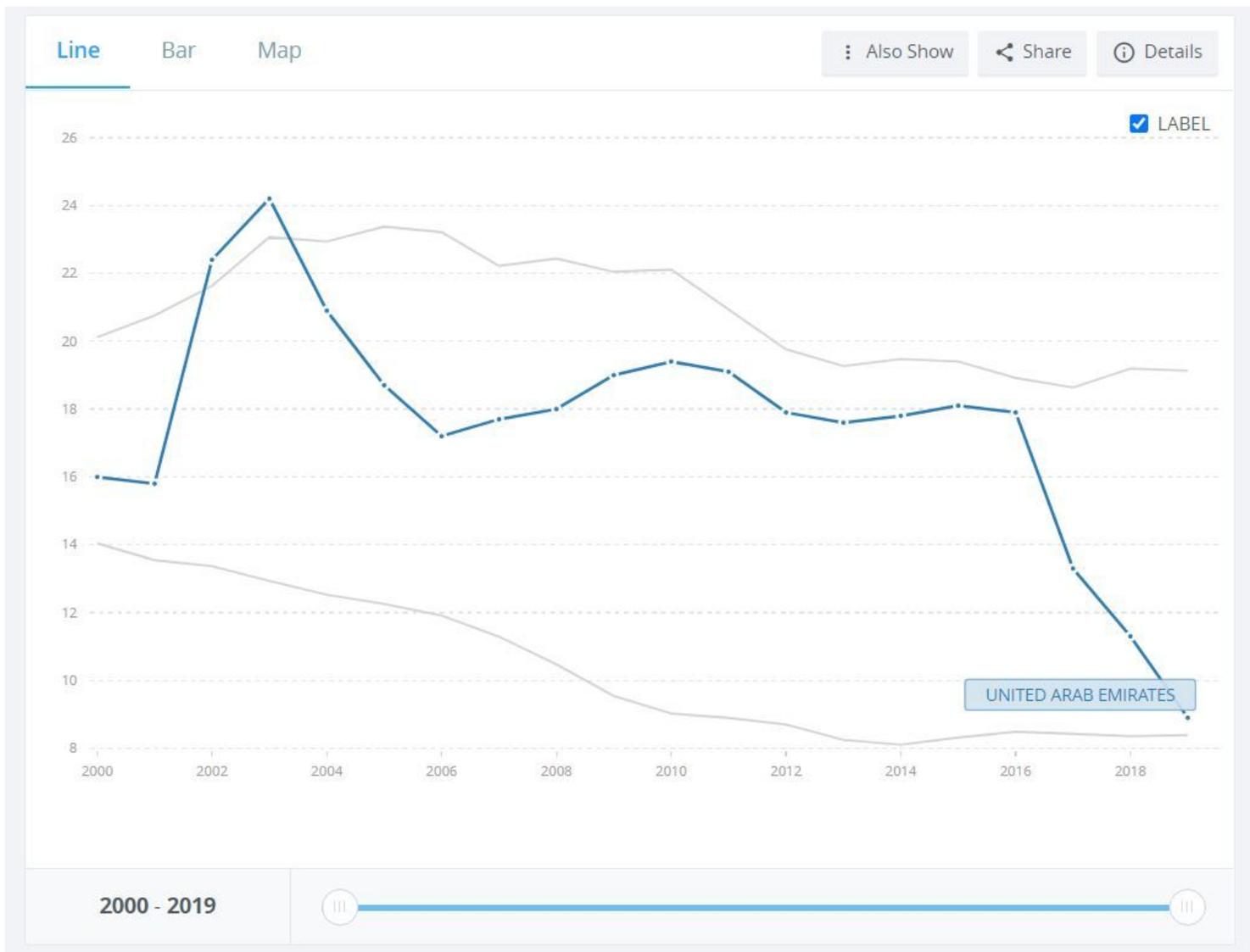


Figure 1

Screenshot taken from the Global Health Observatory (GHO) database of a line graph of mortality caused by road accident per 100,000 of population for UAE from the year 2000 to 2019.