Causes of Traffic Accidents among Pedestrians
In Abu Dhabi, United Arab Emirates

A. Hammoudi, G. Karani and J. Littlewood

Abstract—All Gulf Cooperation Council (GCC) countries have significantly higher traffic accident fatality rates compared with other high-income countries. According to the Ministry of Interior in the UAE, 826 people died and 9187 were severely injured as a result of traffic crashes in 2010. However, although the number of pedestrians who have died as a result of being hit by vehicles has increased in recent years, no recent studies have investigated the causes of accidents among pedestrians in the region. The aim of the study was to evaluate relevant factors related to traffic safety and accidents among pedestrians in Abu Dhabi. A self-developed questionnaire was piloted in the UK and UAE. There were two versions of questionnaires distributed, one in Arabic language and the second in English language. All respondents completed and signed a consent form which included information on their rights to withdraw from the study. In addition to the profile of the respondents’ including age, gender, monthly income, education and nationality, the questionnaire data has been analysed using SPSS to evaluate responses on questions related to traffic safety and accidents. The results highlighted a number of issues that require attention in order to reduce traffic accidents. It is hoped the results of the study will lead to developing a better understanding of issues related to traffic safety and accidents related to pedestrians. It has been proposed that collaboration between all traffic safety stakeholders, including community groups and organizations should continue to be encouraged during traffic safety awareness campaigns.

Key words—pedestrians, accident, safety.

I. INTRODUCTION

According to the World Health Organisation, by 2030 Road traffic accidents (RTAs) will constitute a fifth of all deaths in the world, with majority of deaths reported in developing countries. As a result, most governments are looking for ways to determine factors that are responsible for increased RTAs so as to develop targeted interventions to reduce the number of injuries and deaths. In urban areas, pedestrians are most at risk due to high levels of population and vehicle activities.

However, there are few studies that have reported on RTAs for pedestrians due to lack of quality data collected by authorities especially in developing countries. Estimated data indicate that a third of all traffic fatalities are pedestrians [1].

Studies from modelling and case studies data have listed a number of factors responsible for injuries and deaths among pedestrians, especially in urban areas, to include age, weather, time of day, vehicle speed, facing or walking with traffic, use of mobile phones, alcohol drinking, road infrastructure, gender, ethnicity and crossing at non-designated areas [2-6].

The aim of the study was to evaluate relevant factors related to traffic safety and accidents among pedestrians in Abu Dhabi.

II. CASE STUDY CITY: (ABU DHABI)

The latitude and longitude of Abu Dhabi, United Arab Emirates is: 24° 28’ 0” N / 54° 22’ 0” E Abu Dhabi is one of the most modern and richest cities in the world. It is the largest oil producer in the UAE. The Gross Domestic Product (GDP) was estimated in 2009, USD 150 billion [7] which is 60% of the United Arab Emirates GDP.

The population of Abu Dhabi was estimated in 2009 to be about 1.6 million; which is equal to a third of the total UAE population[7]. According to the Ministry of Interior statistics, in 2010 there were 668,830 vehicles in Abu Dhabi and the length of the Abu Dhabi highways is 2100 km.

According to the Directorate of Traffic and Patrons at Abu Dhabi Police Ministry of Interior, in the period between 2012 and 2011, pedestrian mortality accident rate reduced by 21 percent in the Emirate of Abu Dhabi [8]. In terms of nationalities, 65% of the pedestrian deaths were of Asian origin. Despite this reduction in mortality rate, the government would like to see a further reduction in RTA’s related to pedestrians on the UAE roads.

Most of the pedestrian injuries and accidents on the roads occurred in urban areas during morning (32%) and evening time (30%) while 16% of accidents were in the afternoon. 22% of accidents took place around noon time.

All pedestrian have the rights to cross the roads at places designed for pedestrian crossing and drivers must reduce speeds when approaching places designed for pedestrian crossing. In 2012, the Directorate of Traffic and Patrons increased the value of the fine from AED 50 to AED 200 for...
pedestrians who cross roads from non-designated areas. A driver who does not give priority to pedestrians in designated areas will be fined AED 500 and six traffic penalty points on their licence. Drivers who park vehicles on a pedestrian crossing will be fined AED 500.

The total number of pedestrian violations was 46,089, major violation was for pedestrians crossing the road at non-designated places [9], with 60% of violations in Abu Dhabi, Figure 1.

There were over 2000 drivers who were given a ticket for a violation of not giving way for pedestrians to cross the road, with over 65% violations reported in Al Ain.

III. METHOD

Quantitative data method has been used in the study. Pedestrian were chosen to identify relevant factors that contribute to the pedestrian accidents in Abu Dhabi.

A. Pilot Survey:
The questionnaire was previously pilot-tested randomly through participants in the UAE and Cardiff. The answers and comments from the respondents were used to complete the final questionnaire survey.

B. Sample Size:
Power calculation was used to calculate the survey sample size for the pedestrian in Abu Dhabi. 600 pedestrian questionnaires were distributed and 280 (47%) questionnaires were returned by 176 male and 104 female respondents.

C. Data Collection Process:
The data were collected through two field trips in Abu Dhabi by the first author in December 2011 and March to April 2012. The questionnaire was designed to obtain information regarding pedestrian behaviours and attitudes. There were two version of questionnaire surveys distributed, one in Arabic language and the second in English language.

All respondents completed and signed a consent form which includes information on their rights to withdraw from the study.

D. Plan for Data Collection:
Good planning is very important in research work to minimize errors during data gathering and permission to carry out the research was granted by the relevant authority.

E. Research Assistants
Two civilian staff -1 male 1 female- working in the Abu Dhabi police traffic department assisted in the data gathering. The two persons had experience on how to deal with the respondents and good interview techniques. They were trained as researchers on methods to use in the research work. They distributed the questionnaires and collected the questionnaires after they were completed by respondents and sometimes, if necessary, answered any questions raised by respondents.

The data has been analyzed using SPSS program.

IV. RESULTS AND DISCUSSION

Of the 280 pedestrian respondents 62.9% were male and 37.1% female, demographic features of pedestrian are indicated in Tables I-V. Most of pedestrians were under 35 years old and were married. Although 20% of pedestrians did not work, majority of those who worked earned less than AED 10,000 per month. The data shows that most of pedestrians are at least educated to high school level, with 10% holding a postgraduate qualification.

More than half of the pedestrians were non-Emirati an important factor to consider in traffic safety management in the country as majority of pedestrian deaths related to RTAs in Abu Dhabi is among non-Emirati. It is necessary to investigate whether there may be a difference in attitudes, perceptions, value in relation to traffic safety between Emiratis and Non-Emiratis as some studies have reported differences in pedestrian injuries and ethnicity [10-12].
There are very few published studies on RTA’s for pedestrians who migrate to other countries and it may be worth considering providing information on traffic rules and regulations to new arrivals in the country. Provision of information packs to new arrivals in a number of countries have been shown to aid in the integration of this group of people, and information on traffic rules and safety has been highlighted by pedestrians as necessary information to be included.

### TABLE I

<table>
<thead>
<tr>
<th>Age</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 18</td>
<td>2.2</td>
</tr>
<tr>
<td>18-25</td>
<td>39.6</td>
</tr>
<tr>
<td>26-35</td>
<td>33.1</td>
</tr>
<tr>
<td>36-50</td>
<td>19.4</td>
</tr>
<tr>
<td>51-65</td>
<td>5.7</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

### TABLE II

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Male Percent</th>
<th>Female Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>23.9</td>
<td>54.8</td>
</tr>
<tr>
<td>Married</td>
<td>71.0</td>
<td>40.4</td>
</tr>
<tr>
<td>Others</td>
<td>5.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### TABLE III

<table>
<thead>
<tr>
<th>Nationality</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emirati citizen</td>
<td>49.3</td>
</tr>
<tr>
<td>Gulf Cooperation Council, GCC, Countries</td>
<td>6.3</td>
</tr>
<tr>
<td>Other Arab nationality outside GCC</td>
<td>25.4</td>
</tr>
<tr>
<td>Asian</td>
<td>16.1</td>
</tr>
<tr>
<td>African</td>
<td>1.1</td>
</tr>
<tr>
<td>Other nationality</td>
<td>1.8</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

### TABLE IV

<table>
<thead>
<tr>
<th>Monthly income</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2000 AED</td>
<td>19.7</td>
</tr>
<tr>
<td>2000 to 5000 AED</td>
<td>15.8</td>
</tr>
<tr>
<td>5001 to 10000 AED</td>
<td>11.6</td>
</tr>
<tr>
<td>10001 to 20000 AED</td>
<td>19.5</td>
</tr>
<tr>
<td>More than 20000 AED</td>
<td>14.0</td>
</tr>
<tr>
<td>Don’t work</td>
<td>19.4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

### TABLE V

<table>
<thead>
<tr>
<th>Education</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No qualification</td>
<td>8.6</td>
</tr>
<tr>
<td>Less than High school</td>
<td>16.4</td>
</tr>
<tr>
<td>High school</td>
<td>35.8</td>
</tr>
<tr>
<td>Undergraduate degree</td>
<td>28.4</td>
</tr>
<tr>
<td>Post graduate degree</td>
<td>10.8</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

A. Involved in a traffic accidents as a pedestrian

Studies have shown that male pedestrians are killed or injured more often in road accidents than female pedestrians[13] and females obey traffic rules on the crossing areas, such as zebra crossings, more than their male counterparts.

From the results of the study 36% male and 31% female reported that they, or one their relatives, had been involved in accidents as pedestrians.

There was a statistically significant relationship between being involved in a traffic accidents as a pedestrian and monthly income (p=0.003) and education (p=<0.001). However, there was no statistically significant relationship between being involved in accidents and gender, age or nationalities.

On who was responsible for RTA’s involving pedestrians, 33% of respondents blamed the drivers, 8% pedestrian and 24% blamed both drivers and pedestrians. More than a third of respondents stated that no one was responsible for the RTA’s involving pedestrians. Further studies are needed to provide pedestrian injuries and mortality data so as to help improve road safety in the region.

B. Knowing the appropriate places designated for pedestrian crossing

Studies have shown that on the places designated for pedestrian crossing men are more focused on the incoming cars and watching the cars more than women. Women are more aware than men when crossing the road at traffic lights intersection [13]. Time to collision by vehicles when pedestrians do not use pedestrian crossing is shorter than when pedestrians use a pedestrian crossing [3] and a distance of two car lengths between a speed hump and the pedestrian crossing can improve the safety of pedestrians at a crossing[14]

From the results of the study, 84.6% male and 76.5% female reported that they knew places designated for pedestrian crossing. There was a statistically significant relationship between knowing the places designated for pedestrian crossing and education (p<0.001), monthly income (p<0.001). However, there was no statistically significant relation between knowing the places designated for pedestrian crossing and age, gender or nationalities.

C. Crossing the road from places not designated for pedestrian crossing

From the results of the study 50% male and 35% female reported that most of the time they crossed the road from places not designated for pedestrian crossing. This was surprising as most respondents had indicated that they knew the designated places for crossing the roads. It is proposed that this should be a key theme during traffic awareness campaigns.

There was a statistically significant relation between crossing the road from places not designated for pedestrian crossing and gender (p=0.01). However, there was no statistically significant relation between crossing the road from...
places not designated for pedestrian crossing and age, nationalities, education or monthly income.

D. Aware of a pedestrian ticket for crossing roads at an inappropriate place

From the results of the study 65% male and 54% female reported that they were aware of a pedestrian ticket for crossing roads at an inappropriate place. There was a statistically significant relationship between being aware of penalty as a pedestrian ticket for crossing roads at an inappropriate place and education (p=0.01) and monthly income (p<0.001). However, there was no statistically significant relationship between being aware of a penalty of pedestrian ticket for crossing roads at an inappropriate place and age, gender or nationalities.

From the results of the study 16.7% male and 11.8% female reported that they received a pedestrian ticket while in the UAE. There was a statistically significant relation between receiving a pedestrian ticket while in the UAE and age (p=0.02), education (p=0.002) and monthly income (p<0.001). However, there was no statistically significant relationship between receiving a pedestrian ticket while in the UAE and gender or nationalities. It is suggested that pedestrians should continue to be encouraged to obey the law on traffic safety and the police should increase patrols in urban areas to help address this problem of pedestrian crossing roads at inappropriate places.

E. Use a mobile phone while crossing the road

Using a mobile phone while crossing the road is one of reported unsafe behaviour among pedestrians. Pedestrians who crossed the road while talking on a mobile phone took longer to cross the road and results indicate that female are more likely than men to cross the road while using mobile phones[15]. It is important for pedestrians to be vigilant at all times when crossing the road[16] as using a mobile phone when crossing the road makes it harder for pedestrians to recognise and act on crossing opportunities[17]

From the study 65% male and 51% female admitted using mobile phone while crossing the roads. There was a statistically significant relation between using mobile phone while crossing and age (p=0.006), gender (p=0.005), education (p<0.001) and monthly income (p<0.001). However, there was no statistically significant relationship between using mobile phone while crossing the road and nationalities.

Despite the dangers of using mobile phone as a pedestrian while crossing the road, it was disappointing that such a high percentage of respondents admitted to this practice and traffic campaigns should continue to address this unsafe pedestrian behaviour not only during targeted traffic campaigns but throughout the year.

F. Crossing the road as a pedestrian while drunk

There are few studies that have examined the effects of alcohol and RTA’s among pedestrians. A study on the effect of alcohol impairment on road-crossing behaviour [18] reported that people who are drunk are likely to take longer than people who are not drunk to cross the road. Pedestrian alcohol consumption has been identified as a contributory factor in pedestrian deaths [19, 20].

From our survey 12% of male and 10% of female pedestrians admitted to crossing the road after drinking alcohol. 1% of males admitted to crossing the road more than three times in a month after drinking alcohol There was a statistically significant relationship between crossing the road after drinking alcohol and nationalities (p<0.001), education (p<0.001), monthly income (p<0.001) and gender p=0.001. However, there was no statistically significant relation between crossing the road after drinking alcohol and age.

It is proposed that stakeholders are made aware of this pedestrian behaviour to encourage coordinated effort among all concerned to educate pedestrians on dangers of crossing the roads after drinking alcohol

G. Traffic campaigns:

47% male and 37% female reported never to have heard about traffic campaigns in Abu Dhabi. 27% of males and 36% of females preferred TV as the main source of pedestrian traffic campaigns. This is an interesting finding and one that can be used to target specific groups with traffic campaign messages.

V. CONCLUSION

The results of the current study have highlighted a number of issues that require attention in order to reduce traffic related accidents among pedestrians. It is hoped the information from the study will lead to developing a better understanding of issues related to pedestrian accidents in the region and hopefully lead to a change in pedestrian unsafe behaviours.

Majority of traffic safety projects and strategies focuses on the prevention of car occupants from traffic accidents and only few studies focus on the prevention of vulnerable road users such as pedestrians.

The traffic departments need to intensified awareness programs and traffic campaigns to prevent pedestrian from crossing at places not designed for pedestrian crossing. In addition there is a need to increase traffic patrols to reduce the number of drivers who do not give priority to pedestrians at designated pedestrian crossing points and to reduce the number of drivers who park vehicles on pedestrian crossings.

It is suggested that consideration should be given on the development of information packs for new arrivals in the country on road traffic safety. Education traffic safety programs and awareness campaigns should also target children, pedestrians and specific road users such as young drivers. One of the most important things in developing such awareness programs is the collaboration between all traffic safety stakeholders including transport authority and health authority so as to make road environment safer for pedestrians.
ACKNOWLEDGEMENTS

The authors wishes to thank the pedestrians who completed the survey, the two assistants who helped with data gathering and the Traffic Department in Abu Dhabi for cooperating with the research team and providing data about traffic accidents.

REFERENCES


