

Causes and Strategies to Reduce Road Traffic Accidents in Abu Dhabi

Abdulla AL Hammoudi

BSc (Hons), MSc.

A thesis submitted in partial fulfilment of the requirements for the degree of PhD

June 2014

Supervisors

Prof. G Karani - Director of Study

Dr. J Littlewood

Cardiff School of Health Sciences, Cardiff Metropolitan University

DECLARATION

I hereby declare that this thesis together with work contained was achieved by myself, and contains no material that has been accepted for the award of any other degree or diploma in any university. To best of my knowledge and belief, this thesis contains no material previously published or written by another person except where due acknowledgement to others has been made.

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter library loan, and for the title and summary to be made available to outside organizations.

Abdulla AL Hammoudi

Signature.....

Date

ACKNOWLEDGEMENTS

First of all, I would like to thank my Director of Studies, Professor George Karani, for providing me with the opportunity to work as his PhD student at Cardiff Metropolitan University. I am also thankful to Professor Karani for his guidance, compassion and sincere efforts to raise my aspirations. I have been extremely lucky to have a supervisor who cared so much about my work, and who responded promptly to my enquiries.

I am also indebted to Dr John Littlewood, who, as my second supervisor, provided constructive comments and feedback during my period of research.

In addition, I would like to thank my parents, wife and children, who gave me constant love and support during my studies.

My gratitude is also due to the United Arab Emirates Government, His Highness, Lieutenant General Sheikh, Saif Bin Zayed Al Nahyan, Minister of Interior and Deputy Prime Minister, for the sponsorship of my PhD which provided me with a wonderful opportunity to study in the UK. Special thanks also to Major General Nasser La Khreibani Al Nuaimi, PhD, Secretary General of the Office of His Highness, the Deputy Prime Minister and Minister of Interior, who supported me throughout my course and enabled me to complete my PhD in the UK.

Finally, I wish to thank all the drivers and 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 Road Traffic Accidents.

ABSTRACT

Every year globally 1.3 million people lose their lives from road traffic accidents (RTAs). To date, there has not been a comprehensive evaluation of RTAs in the United Arab Emirates, and the results from this study would help in evaluating the issues related to RTAs. Relevant literature on factors related to RTAs was reviewed to inform the methods adopted for the study. Structured questionnaires were used to collect quantitative data among 291 drivers and 280 pedestrians in Abu Dhabi, while 41 key informant interviews with traffic managers provided qualitative data.

Draft recommendations on RTAs in Abu Dhabi that were derived from drivers, pedestrians and key informant interviews were discussed with appropriate stakeholders, traffic managers and policy makers in the country that resulted in the development of RTAs benchmark in the country.

The study has identified major causes of RTAs in Abu Dhabi, with young people between 18-25 years, the ones who are likely to cause RTAs in Abu Dhabi. Not wearing seat belt, using mobile phone and alcohol consumption were also identified as causes of RTAs. Aggressive driving behaviour was the most unsafe driving behaviours and included speeding, tailgating, not using indicators and jumping red traffic lights. Using a mobile phones as a pedestrian while crossing roads and crossing roads from undesignated places also contributed to RTAs.

The study has proposed methods to reduce RTAs in Abu Dhabi including traffic law enforcement, traffic campaigns and education traffic safety programs. The study further proposes that a welcome pack be provided for new arrivals to the country, with information on the importance of traffic safety and to explain the traffic law in the country as an appropriate method to reduce RTAs in Abu Dhabi. The study further proposes that governments should work with relevant stakeholders to address issues related to RTAs.

TABLE OF CONTENTS

DECLARATION.....	i
ACKNOWLEDGEMENTS.....	ii
ABSTRACT	iii
TABLE OF CONTENTS.....	iv
List of Figures:	ix
List of Tables	x
Publications and presentations	xi
Chapter One Introduction.....	2
1.1 Introduction.....	2
1.2 Research problem.....	3
1.3 Aim & Objectives	3
1.3.1 Aim	3
1.3.2 Objectives	3
1.4 Original Contribution:.....	4
1.5 Limitations	7
1.6 Research layout.....	7
Chapter Two Literature review	10
2.1 Introduction.....	10
2.2 Background	10
2.3 Case study city: (Abu Dhabi).....	11
2.3.1 The causes of RTAs in the UAE in 2011:.....	14
2.3.2 Abu Dhabi city:.....	15
2.3.3 Al Ain City:.....	17
2.3.4 The Western region:	19
2.4 Road accident classification and definitions:	21
2.5 Causes of road accidents:	22
2.5.1 The effect of human behaviour on RTA's	22
2.5.2 The consequences of speeding	23
2.5.3 The impact of drink driving	24
2.5.4 Road infrastructure:.....	25
2.5.5 The usefulness of traffic calming measures:	25

2.5.6	The role of high-risk vehicles in RTAs:.....	27
2.6	Road safety strategies around the world	29
2.7	The social and economic costs of road traffic injuries:.....	33
2.7.1	What does the value of a statistical life mean in general?	35
2.7.2	The costs of road casualties:	36
2.8	How to reduce the severity of injuries and prevents road accidents?	37
2.8.1	The influence of efficient and effective emergency services	37
2.8.2	Enforcement:.....	38
2.8.3	Providing valuable education on road safety issues:.....	39
2.8.4	Engineering the key for safer standards	40
Chapter Three Methodology		46
3.1	Introduction:.....	46
3.2	Data Collection	46
3.2.1	Qualitative and Quantitative methods:.....	47
3.2.2	Advantages and disadvantages of Qualitative and Quantitative methods:.....	47
3.3	Quantitative data methods for the project	48
3.3.1	Pilot survey:	49
3.3.2	Sample size:	49
3.3.3	Plan for data collection:	50
3.3.4	Data Collection Process	50
3.3.5	Research assistants.....	51
3.3.6	Questionnaire:	51
3.3.7	Drivers.....	52
3.3.8	Pedestrians	53
3.4	Qualitative data methods.....	54
3.4.1	Interviews.....	54
3.4.2	Pilot Interview Questions.....	55
3.4.3	Data Collection	55
3.4.4	Document interviews:	58
3.5	Stakeholder meeting to discuss recommendations from the study	58
3.5.1	The number and materials of focus groups.....	60
Chapter four Results and Discussions.....		63
4.1	Introduction:.....	63
4.2	Demographic characteristics of the drivers respondents.....	63
4.2.1	Drivers involved in RTAs.....	66
4.2.2	Using a seat belt.....	67
4.2.3	Using Mobile phone while driving	68

4.2.4	Alcohol Consumption and Driving	70
4.2.5	Aggressive driving behaviour	71
4.2.6	Unsafe driving behaviour	71
4.2.7	Traffic law Enforcement	72
4.2.8	Traffic campaigns	73
4.3	Demographic characteristics of the pedestrians respondents	74
4.3.1	Pedestrians involved in RTAs	77
4.3.2	Knowing the appropriate places designated for pedestrian crossing	78
4.3.3	Crossing the road from places not designated for pedestrian crossings	79
4.3.4	Awareness of a pedestrian ticket for crossing roads at an inappropriate place	80
4.3.5	Using mobile phone while crossing the road	81
4.3.6	Crossing the road as a pedestrian while under the influence of alcohol	81
4.3.7	Traffic campaigns	83
4.4	Traffic Manager Interviews	83
4.4.1	Causes of Accidents in Abu Dhabi:	84
4.4.2	Nationalities and ages of drivers	86
4.4.3	The number of Traffic Police Enforcement managers on the roads:	88
4.4.4	The experience of traffic police enforcers:	88
4.4.5	The age of police managers working in traffic department:	89
4.4.6	The types of training courses - Continuing Professional Development Course (CPD)	89
4.4.7	Traffic campaigns carried out in Abu Dhabi in 2011	90
4.4.8	The best way to create traffic awareness programs:	91
4.4.9	Difficulties facing the traffic departments in implementing traffic safety programs:	91
4.4.10	Decreasing the risk of RTAs:	92
4.4.11	Precautions to be taken to ensure traffic safety on Abu Dhabi's roads	92
4.4.12	Opinions about using traffic calming measures.	93
4.4.13	Manager's recommendations about traffic accident risk reduction:	94
4.5	Causes of RTAs in Abu Dhabi	94
4.5.1	Alcohol consumption for drivers and pedestrians	94
4.5.2	Using a seat belt whilst driving	95
4.5.3	Using mobile phone while driving or crossing roads	95
4.5.4	Aggressive driving behaviour	96
4.5.5	Age of drivers who cause RTAs	96
4.5.6	Nationalities of drivers and pedestrians who causes RTAs	96
4.5.7	Crossing roads at undesignated places	97
4.6	Methods to reduce RTAs	97

4.6.1	Traffic law Enforcement	97
4.6.2	Traffic campaigns	98
4.6.3	Education traffic safety programs	98
4.6.4	Traffic calming measures on roads	99
4.6.5	A welcome pack for new arrivals to the UAE	99
Chapter Five Stakeholder meetings to discuss recommendations from the study.....		103
5.1	Introduction.....	103
5.1.1	Not wearing a seat belt while driving.	114
5.1.2	Using mobile phone while driving.....	115
5.1.3	Drinking alcohol and driving	115
5.1.4	Knowledge of places designated for pedestrian crossings	116
5.1.5	Crossing the road at places not designated for pedestrian crossings.....	116
5.1.6	Awareness of penalty ticket for crossing roads at an inappropriate place	117
5.1.7	Using mobile phone while crossing roads	117
5.1.8	Crossing the road as a pedestrian while drunk.....	118
5.1.9	The use of a welcome pack as an appropriate method to reduce RTAs among non-Emirati	118
5.2	Recommendations to be incorporated in the Abu Dhabi road traffic strategy	119
5.3	Discussions with stakeholders on other issues relating to RTAs.....	121
5.3.1	Why speeding is the major cause of accidents in Abu Dhabi	122
5.3.2	What can we do to encourage our young people to be more careful on roads.....	123
5.3.3	How to be involved in planning for traffic campaigns	123
5.3.4	What practical steps to encourage better cooperation among the teams involved in RTAs	124
5.3.5	What are some practical ways to encourage collaboration between the police and stakeholders as regards traffic issues	124
5.3.6	Traffic Accident Investigation	125
5.3.7	Traffic Awareness Programs.....	125
Chapter Six Conclusion		128
6.1	Introduction.....	128
6.2	Further research	130
REFERENCES		131
APPENDIXES		151
7.1	Appendix 1 the translation of the correspondence between the author and Abu Dhabi Police GHQ.....	151
7.2	Appendix 2 Drivers questionnaires.....	153
7.3	Appendix 3 Pedestrians questionnaires.....	173
7.4	Appendix 4 Interview Questions.....	186

7.5	Appendix 5 Stakeholder meetings questions:	190
7.6	Appendix 6 An example of Chi-Square test tables:	193

List of Figures:

Figure 1: United Arab Emirates Map - adapted from (TopUAE movers.com, 2014)	11
Figure 2: Number of road casualties in Abu Dhabi between 2002 and 2010 (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011).....	13
Figure 3: Distribution of the total number of road fatalities in Abu Dhabi city between 2007 and 2010 according to age groups (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)	15
Figure 4: Distribution of the total number of road injuries in Abu Dhabi city between 2007 and 2010 according to age groups (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)	16
Figure 5: Distribution of the total number of road fatalities in Al Ain between 2007 and 2010 according to age group (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011).....	17
Figure 6: Distribution of the total number of road injuries in Al Ain between 2007 and 2010 according to age group (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011).....	18
Figure 7: Distribution of the total number of road fatalities in the Western region between 2007 and 2010 according to age group (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)	19
Figure 8: Distribution of the total number of road injuries in the Western region between 2007 and 2010 according to age groups (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)	20
Figure 9: An example of visibility splay- adapted from The Department of the Environment's planning (1999).	42
Figure 10.a: Commonly experienced aggressive driving behaviour that drivers commit on the road.....	72
Figure 10.b: Commonly experienced aggressive driving behaviour that drivers encounter on the roads.	73
Figure 11: Pie-chart of traffic managers' responses to the causes of RTAs in Abu Dhabi.	86
Figure 12: Pie-charts of traffic managers' response to the age of drivers who cause RTAs in Abu Dhabi.	87
Figure 13: Pie-chart of traffic managers' response to applying traffic calming measures ..	93

List of Tables

Table 1: Causes of RTA's in the UAE- (Ministry of Interior, 2011).....	14
Table 2: Road safety strategies around the world	30
Table 3: Speed limit zones introduced into Abu Dhabi in 2011-adapted from Abu Dhabi eGovernment Gateway (2013)	33
Table 4: Qualitative and Quantitative Comparisons (CCMTA, 2011; Ariën et al., 2013) ..	47
Table 5: The Section, the number of managers and the responsibilities of each section targeted.....	57
Table 6: Age of drivers	64
Table 7: Marital status of drivers	64
Table 8: Nationality of drivers	65
Table 9: Monthly income of drivers.....	66
Table 10: Education of drivers.....	66
Table 11: Age of pedestrians.....	74
Table 12: Marital status of pedestrians	75
Table 13: Nationalities of pedestrians.....	76
Table 14: Monthly income of pedestrians.....	76
Table 15: Education of pedestrian.....	77
Table 16: Draft suggestions from the study- Using a seat belt	105
Table 17 : Draft suggestions from the study- Using mobile phone while driving.....	106
Table 18: Draft suggestions from the study- Drinking alcohol and driving	107
Table 19: Draft suggestions from the study- Knowing the designated places for pedestrian crossings.....	108
Table 20: Draft suggestions from the study- Crossing the roads from places not designated for pedestrian crossing	109
Table 21: Draft suggestions from the study- Awareness of a pedestrian ticket for crossing roads at an inappropriate place.....	110
Table 22: Draft suggestions from the study- Using mobile phone while crossing the road	111
Table 23: Draft suggestions from the study - crossing the road as a pedestrian while drunk	112
Table 24: Draft suggestions from the study - the use of a welcome pack as an appropriate method to reduce RTAs	113

Publications and presentations

1. Hammoudi A, Karani G & Littlewood J (2014) Road Traffic Accidents Among Drivers in Abu Dhabi, United Arab Emirates. *Journal of Traffic and Logistics Engineering* Vol 2, No. 1, pp. 7-12, March 2014. doi: 10.12720/jtle.2.1.7-12
2. Hammoudi A, Karani G & Littlewood J (2013a) A study to evaluate causes of traffic accidents in Abu Dhabi, United Arab Emirates, Workshop at Abu Dhabi Police GHQ, March 31, 2013
3. Hammoudi, A. Karani, G. and Littlewood, J. (2013b). Causes of traffic accidents among pedestrians in Abu Dhabi, United Arab Emirates, *Proc. 2nd International Conference on Computational Techniques and Artificial Intelligence (ICCTAI'2013)*, Eds. March 17-18, 2013 Dubai (UAE), pp 207-211.
4. Hammoudi A, Karani G & Littlewood J (2013c) Causes of traffic accidents among pedestrians in Abu Dhabi, United Arab Emirates, *Proc. PSRC 2012 International Conference, UAE*, March 17-18, 2013. This paper was judged as the best session paper at the conference
5. Hammoudi A, Karani G & Littlewood J (2012a) A study to evaluate causes of traffic accidents in Abu Dhabi, United Arab Emirates, *Proc. 6th Traffic Safety Conference, Amman, Jordan* November 2012.
6. Karani, G., Hammoudi, A. and Littlewood, J. (2012b). Road traffic accidents- a pilot case study in Abu Dhabi, United Arab Emirates, *Proc. Environmental Public Health –Collaboration for Sustainable Development*, Eds. Karani, G. and Nganga, J.K., May 10-11, 2012, Nairobi, Kenya, pp 31-32.

7. Newspaper article: Survey reveals Abu Dhabi's 'worrying' accident stats, article in *7Daysnewspaper*, UAE, Mon, April 21, 2014.

Chapter One

Introduction

Chapter One Introduction

1.1 Introduction

Road traffic accidents (RTAs) cause major problems worldwide. More specifically, road accidents are ranked as the 11th leading cause of death globally (Ameratunga *et al.*, 2006; World Health Organization, 2013) and they are the main cause of physical disability for drivers, passengers and pedestrians in developing countries (Zimmerman *et al.*, 2012). The importance of traffic safety measures originates from the increasing number of vehicles and the consequent increasing RTAs. The continually developing economy also contributes to more RTAs since the use of vehicles for transportation has increased (Johansson *et al.*, 2014). Therefore, to reduce these RTAs, there needs to be greater traffic enforcement as well as traffic awareness programs.

The author chose Abu Dhabi as a case study area as there are huge challenges which presently face the United Arab Emirates (UAE) in terms of RTAs and their effects. For example, all Gulf Cooperation Council (GCC) countries have significantly higher traffic accident fatality rates compared with other high-income countries (Bener & Crundall, 2005; Abbas *et al.*, 2011). Moreover, in the researcher's experience as a police officer working with the Traffic Department, there is an increasing number of RTAs in the UAE with young drivers suffering injuries and the number of traffic violations increasing. According to the Ministry of Interior statistics (2010) a comparison between the UAE Emirates shows that while the size of the population and registered vehicles in Dubai is more than in Abu Dhabi, the number of RTAs and injuries is higher in Abu Dhabi (Ministry of Interior, 2011). Furthermore, in Abu Dhabi, 720 people were killed in RTAs in the UAE in 2011 compared with 826 in 2010 (*ibid*). Hence, although this reveals that slow progress is being made to reduce RTAs in Abu Dhabi, it also shows the extent of the problem that still needs to be addressed.

1.2 Research problem

There is little published research focusing on RTA reduction in Middle Eastern countries. The minimal research published thus far, focuses on engineering issues relating to road traffic and vehicle safety. There are also few studies concerning road user behaviour and traffic awareness issues. Therefore, the research problem of this thesis evaluates the causes of RTAs in Abu Dhabi and once the causes of RTAs have been identified, solutions can be more easily applied. Consequently, the author investigated the behaviour of drivers and pedestrians in the UAE and interviewed key traffic managers about particular issues concerning RTAs in Abu Dhabi as well as how to address them.

1.3 Aim & Objectives

1.3.1 Aim

The aim of the project is to benchmark the causes of RTAs in the UAE and to reduce the risk and occurrence of accidents by developing and testing a car accident reduction methodology for the UAE. This will provide the first review of current practices in the UAE's traffic departments, thereby providing all the relevant stakeholders with a comprehensive picture of the present status of the causes of RTA problems and potential solutions; in this way, the quality of life of people in the UAE will be increased.

1.3.2 Objectives

- To undertake a literature review which discusses and analyses current traffic accident causes that result in injuries and the current methods used to reduce RTAs.

- To critically review the major causes of road traffic accidents driver, vehicle and road and infrastructure issues that lead to road accidents in Abu Dhabi; this will be partly a literature review and also use interviews with traffic and police managers.
- To collect qualitative and quantitative data about RTAs in Abu Dhabi through interviews with traffic managers and questionnaires with drivers and pedestrians.
- To investigate and test traffic reduction methodologies for the UAE in order to provide practical safety programs and to reduce the risk of RTAs in Abu Dhabi.
- To inform traffic departments and other key stakeholders about the importance of traffic safety through a series of workshops and to propose solutions in order to reduce further road traffic deaths and serious injuries.
- To provide an update about the Abu Dhabi RTA benchmark following the workshops.

1.4 Original Contribution:

There has not been a comprehensive evaluation of RTA's investigation in the country

Holistic approaches have been used to investigate the causes of, and ways to reduce, RTA's using questionnaire for drivers and pedestrians and also key informant interviews for traffic managers and stakeholders. All traffic managers approached for the study agreed to take part.

Draft recommendations on RTAs in Abu Dhabi that were derived from drivers, pedestrians and key informant interviews were discussed with appropriate stakeholders, traffic managers and policy makers in the country that resulted in the development of RTAs benchmark in the country.

The results from this study will be used to update the Abu Dhabi Traffic Policy.

A number of Emirates in the UAE have contacted the author to discuss plans to undertake similar studies in their areas.

The study has identified the causes of RTA's in Abu Dhabi as

- Alcohol Consumption for drivers and pedestrians.
- Not wearing seat belt while driving.
- Using mobile phone while driving.
- Using mobile phone as a pedestrian while crossing roads
- Aggressive driving behaviour which was the most unsafe driving behaviours and included speeding, tailgating, not using indicators and jumping red traffic lights.
- Young people 18-25 years are the ones who are likely to cause RTAs in Abu Dhabi.
- Nationalities of the majority of drivers who contribute to high RTAs include drivers from Asia and UAE.
- Nationalities of the majority of pedestrians who contribute to most RTAs include pedestrians from Asia and UAE.
- Crossing roads at undesignated places.

The study has identified methods to reduce RTAs in Abu Dhabi

- Traffic law Enforcement.
- Traffic campaigns.
- Education on traffic safety programs as a tool to reduce RTAs in Abu Dhabi.
- Traffic calming measures.

- Welcome pack for new arrivals in the country.

The study discussed and recommended the use of welcome packs as a development of an appropriate method to reduce RTAs in Abu Dhabi. These packs were also designed to inform new arrivals to the UAE about the importance of traffic safety and to explain the traffic law in the country.

A large percentage of traffic managers reported that they had not been consulted regarding the start of any traffic campaigns. This shows that traffic departments in Abu Dhabi should be targeted to raise awareness about traffic safety. Traffic managers must also be involved in traffic safety planning programs since they play an important role in traffic safety and their views and opinions should be taken into consideration when planning traffic awareness programs. In addition, the problems with implementing traffic awareness campaigns in Abu Dhabi revolve around language barriers. It is therefore proposed that new traffic safety campaigns should be designed for people who speak a number of different languages, such as English and Urdu.

This study shows that there was a high percentage of female drivers and pedestrians who would prefer TV as their main source of traffic campaigns in Abu Dhabi. Therefore, future traffic campaigns should target females through TV programs and advertisements. In contrast, the study shows that there was a high percentage of male drivers in the Abu Dhabi area who preferred radio as their main source for traffic safety. This indicates that the radio should be used for future traffic awareness campaigns with the aim of reducing traffic accidents throughout Abu Dhabi.

Additionally, through findings of the study the traffic department in Abu Dhabi was able to develop and implement new strategies whereby traffic officers' opinions would be sought before commencing any traffic campaigns in Abu Dhabi.

1.5 Limitations

- Traffic accident investigators categorised most of the traffic accident causes under the title of 'carelessness' since the investigators lack the correct equipment and training to determine more specific causes.
- The author designed questionnaires in both Arabic and English language. Unfortunately, the participants who did not understand Arabic or English were unable to continue with the questionnaires. The questionnaires should also be produced in different languages such as Urdu.
- Gathering data and gaining permission from different sections and departments in Abu Dhabi police was a very lengthy process. These procedures must be reviewed and there should be an adequate system to gather data from the traffic departments in future.

1.6 Research layout

This thesis consists of six chapters. Chapter 1 includes an introduction and discusses the research problem, Original Contribution, aim, objectives, limitations and outline of the study. Chapter 2 includes a literature review of RTAs, discusses the reasons for using Abu Dhabi as the candidate's case study, road safety strategies, discusses the effects of road accidents and looks at the methods used to evaluate them. It also provides a classification

of RTAs, outlines their causes and considers the social and economic costs of road traffic injuries in addition to looking at case study areas; finally it shows how to reduce the severity of injuries and to prevent road accidents. Chapter 3 provides a methodology which shows a clear description of the specific steps used for the collection of data in this research project. The chapter then discusses the importance of quantitative and qualitative methods in addition to the pilot tested questionnaires and interview questions.

Chapter 4 is on the results of the study, this being followed by a discussion about the results and then considers the driver and pedestrian questionnaires as well as the manager interviews. The results of the study are divided into three different sections: section one discusses the results of the driver participants; section two discusses the results of the pedestrian participants; section three discusses and compares the results from the interviews of the stakeholders and managers from the traffic departments. In Chapter 5, there is a discussion about the results and findings of the stakeholder meetings conducted with the Abu Dhabi police managers, drivers and managers from other emirates. Chapter 6 concludes by summarizing the findings of this research project. It then includes the causes of RTAs in Abu Dhabi and indicates method to reduce RTAs in Abu Dhabi. Lastly, it includes the suggesting what further research is needed.

Chapter Two

Literature Review

Chapter Two Literature review

2.1 Introduction

This chapter aims to evaluate the literature available in relation to RTAs; it will also review the literature relevant to RTAs, this chapter describes the area used for this study (Abu Dhabi), road safety strategies, the effects of road accidents and methods used to evaluate RTAs, This will make the classification of RTAs and their causes more understandable and will provide examples of road safety strategies around the world.

2.2 Background

Road accidents are endemic, affecting every nation in terms of human suffering and cost to the community. Millions of people are injured or killed each year, and the financial impact is equally staggering, costing the world economy billions of pounds in medical treatment, healthcare and other forms of human suffering. The World Health Organization (WHO) has reported that 1.3 million people lose their lives every year worldwide, with considerably more people being severely injured from accidents (World Health Organization, 2009). According to WHO, it is expected that road accidents will be the fifth major cause of death in the year 2030 (World Health Organization, 2009). The cost of traffic accident injuries is estimated to amount to 2% of GNP (Gross national product) in high income countries, 1.5% in middle income countries, and is thought to be 1% in low income countries (Sabbour & Mibrahim, 2010; Alemany et al., 2013; World Health Organization, 2013). Consequently, countries need to take more action in order to reduce the problem and to make roads safer for all users.

According to road safety studies, it is very important to focus on ‘the four Es’: Engineering, Enforcement, Education and Emergency (Nedumaran et al., 2013; Sun et al., 2013). These elements must be addressed and combined in order to reach the goal of road safety. In addition, it is crucial to identify the nature of the RTAs.

There are numerous factors which contribute to RTAs and traffic injuries, and these factors can be classified into the following three categories: human error, unsafe vehicles and the infrastructure of roads (Chen, 2010; de Oña et al., 2011; Cornelissen et al., 2013). Every country must therefore focus on reducing accidents and developing good data recording systems. The causes of accidents must also be identified and analysed and it is vital to find appropriate counter measures.

2.3 Case study city: (Abu Dhabi)

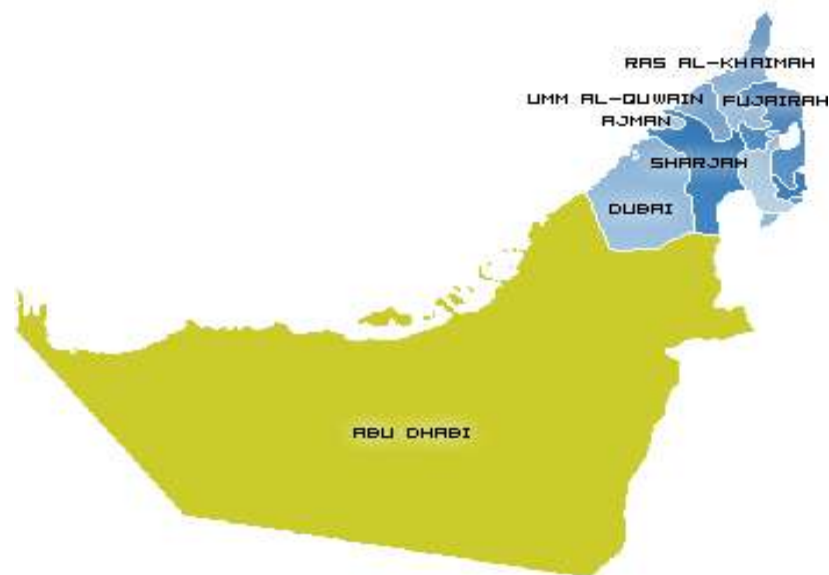


Figure 1: United Arab Emirates Map - adapted from (TopUAE movers.com, 2014)

All Gulf Cooperation Council (GCC) countries have significantly higher traffic accident fatality rates compared with other high-income countries. According to the Ministry of the Interior in the UAE, 826 people died and 9,187 were severely injured as a result of RTAs in 2010 (Ministry of Interior, 2011). The United Arab Emirates (UAE) is one of the Gulf Co-operation Council states (GCC), this being a constitutional federation of seven emirates - Abu Dhabi, Dubai, Sharjah, Ras Al Khaimah, Ajman, Umm Al Quwain and Fujairah – (Figure 1) which came together as one state on the 2nd December 1971. The total area of the UAE is 83,600 square kilometres (Al Murshidi, 2014).

According to the National Bureau of statistics (2013) in Abu Dhabi, the total population of the UAE was 8,264,070 in 2011, of which only 13% are Emirati citizens. There are 479,109 male and 468,888 female Emirati citizens and 5,682,711 male and 1,633,362 female non-Emirati citizens (ibid). The gross domestic product (GDP) was estimated in 2012 to be \$275.8 billion (Smithers, 2013).

Abu Dhabi is the capital of the United Arab Emirates and the largest city in the UAE (Sharif *et al.*, 2013). The latitude and longitude of Abu Dhabi, United Arab Emirates is: 24° 28' 0" N / 54° 22' 0" E. The area of Abu Dhabi is 67,340 sq km and it covers 86.7% of the total area of the UAE (Abu Dhabi Statistics Center, 2011). According to the Abu Dhabi Statistical Yearbook for 2010, the population of Abu Dhabi was estimated at about 1.6 million in mid 2009. This is 33% of the total UAE population (ibid). Abu Dhabi considers itself to be one of the most important economic cities in the Gulf region and it is one of the richest and most modern cities in the world (ibid).

In terms of transportation, according to the recent available data from the Ministry of Interior statistics, there were 785,076 vehicles and pieces of heavy equipment in the Abu Dhabi emirate in 2011, In 2009, There were also 662,683 driving licences issued in the

Abu Dhabi emirates. The length of the Abu Dhabi highways is 2,099.5 km (Abu Dhabi Statistics Center, 2011) According to recent available data from the Ministry of Interior in the UAE, the total number of road fatalities and casualties increased by 16% between 2007 and 2009. The author researched online and by telephone to obtain data about the number of RTAs, but found little completed work on them in the city. It was found that traffic incidents have an adverse impact in Abu Dhabi, badly affecting traffic flow, air pollution and fuel consumption, among other considerations. This research therefore shows the extent to which RTAs significantly impact on Abu Dhabi and the study will look at means to prevent these problems.

Figure 2 shows the number of road casualties in Abu Dhabi between 2002 and 2010. The number of fatalities and serious casualties are increasing, notwithstanding the fact that the total number of casualties, both moderate and minor, have been decreasing (which was particularly the case between 2009 and 2010). However, despite this decrease, a further reduction in RTAs is required to reduce the levels observed and to bring them into line with developed countries.

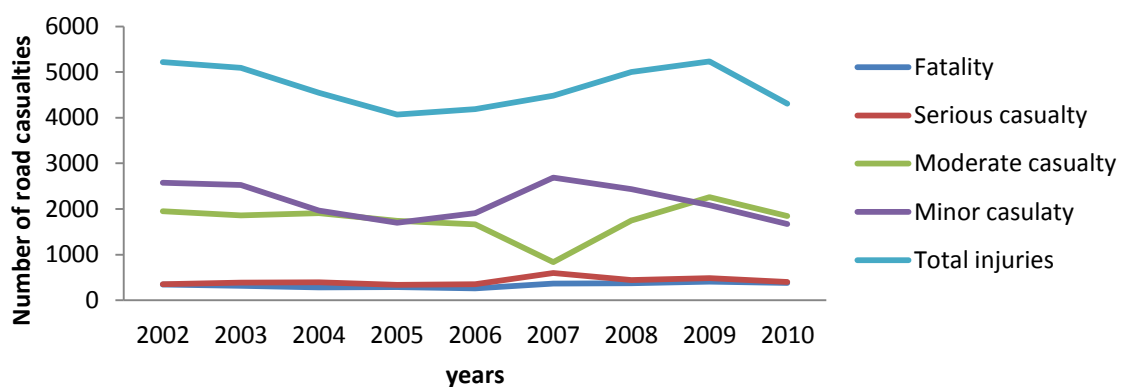


Figure 2: Number of road casualties in Abu Dhabi between 2002 and 2010 (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)

2.3.1 The causes of RTAs in the UAE in 2011:

RTAs are considered to be a major cause of fatalities in the UAE. Table 1 shows the main causes of RTAs in the UAE according to the Ministry of Interior Statistics (2011).

A study in the UAE (Hassan *et al.*, 2012) identified driving behaviour, awareness, education and training, infrastructure, vehicle and law enforcement as some of the main factors contributing to traffic safety in the country. The statistics found concerning RTAs and injuries were taken from the Ministry of Interior in Abu Dhabi between 2007 and 2010. The number of traffic injuries fluctuated over this period. The 18-35 age groups had the highest rate of traffic fatalities and injuries. The 'less than 15' age group were considered to be the next highest and the elderly had the lowest traffic injury rate. The traffic departments in Abu Dhabi play an important role in reducing the numbers of traffic fatalities and injuries. According to the manager of traffic departments in Abu Dhabi, the present traffic campaigns - which involve using speed cameras - are crucial for reducing traffic injuries and fatalities.

Table 1: Causes of RTA's in the UAE- (Ministry of Interior, 2011)

Causes of RTAs in the UAE	Number of accidents	Percentage
Tailgating	758	11%
Lack of consideration for other road users	624	9%
Lack of discipline with road lanes	540	8%
Entering the road before checking whether there are vehicles	532	8%
Jumping red lights	416	6%
Driving recklessly	129	2%
Exceeding the speed limit.	122	2%
Tyre explosion	96	1%
Other	3456	53%
		100%

The Emirate of Abu Dhabi is divided into three major regions – Abu Dhabi, Al-Ain and the Western Region.

2.3.2 Abu Dhabi city:

2.3.2.1 Traffic Fatalities:

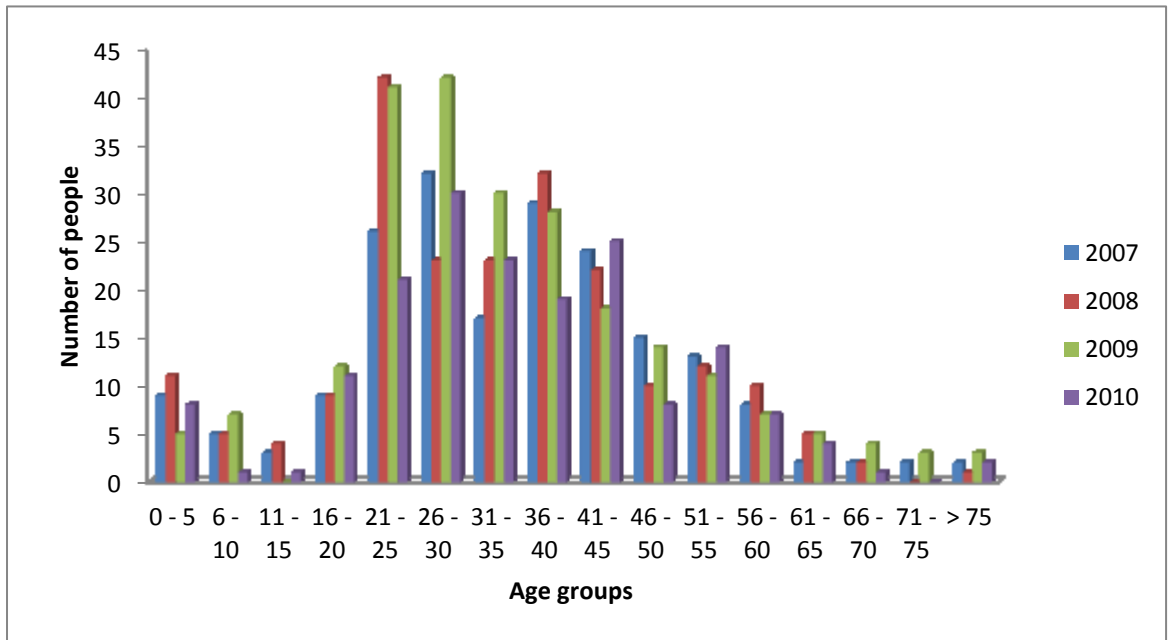


Figure 3: Distribution of the total number of road fatalities in Abu Dhabi city between 2007 and 2010 according to age groups (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)

When comparing 2009 with 2010, there was a decrease in the number of fatalities in general. However, in the previous period between 2009 and 2008 as well as in 2008 and 2007, there were increases in fatalities of 9% and 7% respectively. The largest number of fatalities in the city of Abu Dhabi was 230 in 2009. The main causes included the increasing numbers of registered vehicles and the lack of a role for the Traffic Department to reduce traffic fatalities. In 2010, the largest number of fatalities totalled 30 for the 26 to 30 age group. However, there were no fatalities for the 71 to 75 group. The results in Figure 3 show that young people are more likely to drive faster than older drivers and are also more likely to drive dangerously, without considering the risks (Ministry of Interior,

2013). Between 2009 and 2010, the number of fatalities decreased by 25% for the 0 to 10 age group. One of the main reasons behind this was that the Chornich Hospital in Abu Dhabi (Maternity Hospital) started to give away free child seats for new born children (Corniche Hospital, 2014). Nevertheless, the fatality rate for the >61 age group was very high between 2008 and 2009, although there was a significant decrease in the number of fatalities between 2009 and 2010 in this group as the traffic department in Abu Dhabi began to have more effective traffic campaigns. An example of this can be seen in the decrease in the number of pedestrians prosecuted for crossing roads in unallocated places. (Ministry of Interior, 2013).

2.3.2.2 Traffic Injuries:

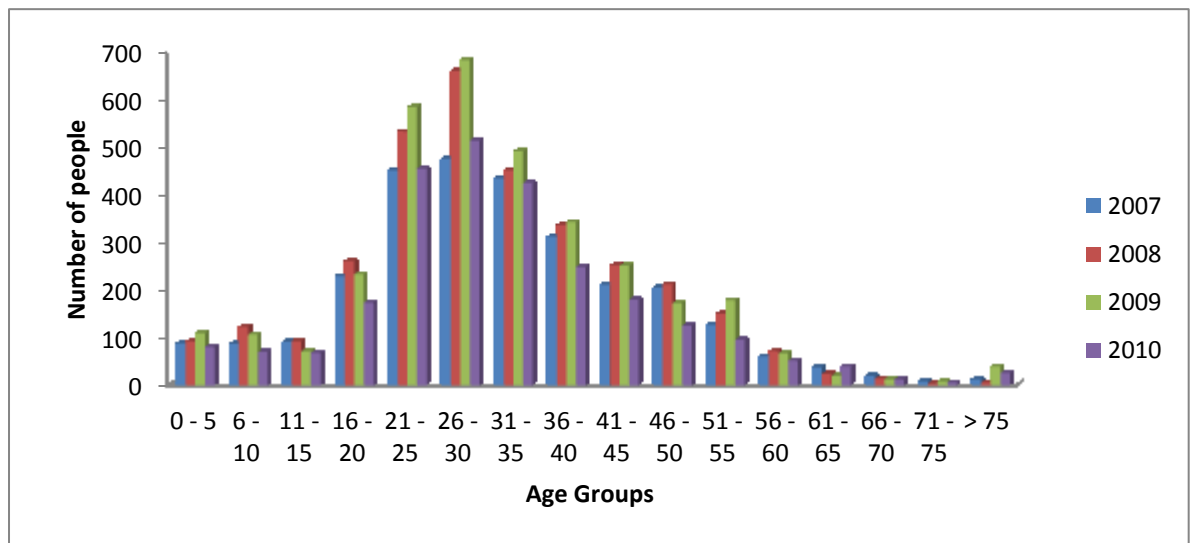


Figure 4: Distribution of the total number of road injuries in Abu Dhabi city between 2007 and 2010 according to age groups (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)

In general, there was a decline of 24% in traffic injuries between 2009 and 2010 (Figure 4). However, traffic injuries increased by 3% between 2008 and 2009, as well as there being an increase of 15% between 2007 and 2008. This was due increasing business activities in Abu Dhabi city as more workers from Asian countries who lacked traffic

awareness began using the roads. It was also noted that the injury rate among the >61 age group increased by 3% ; in fact, this was the only age group with increased injuries between 2009 and 2010 This was because there was a high number of elderly drivers who failed to wear a seatbelt (Ministry of Interior, 2013).

In general, the injury rate in the 21 - 45 age groups increased from 2007 to 2009 and then dropped to 22% between 2009 and 2010. This again was due to the traffic campaigns that were introduced, which involved using speed guns to manage the city's traffic (Ministry of Interior, 2013).

2.3.3 Al Ain City:

2.3.3.1 Traffic Fatalities:

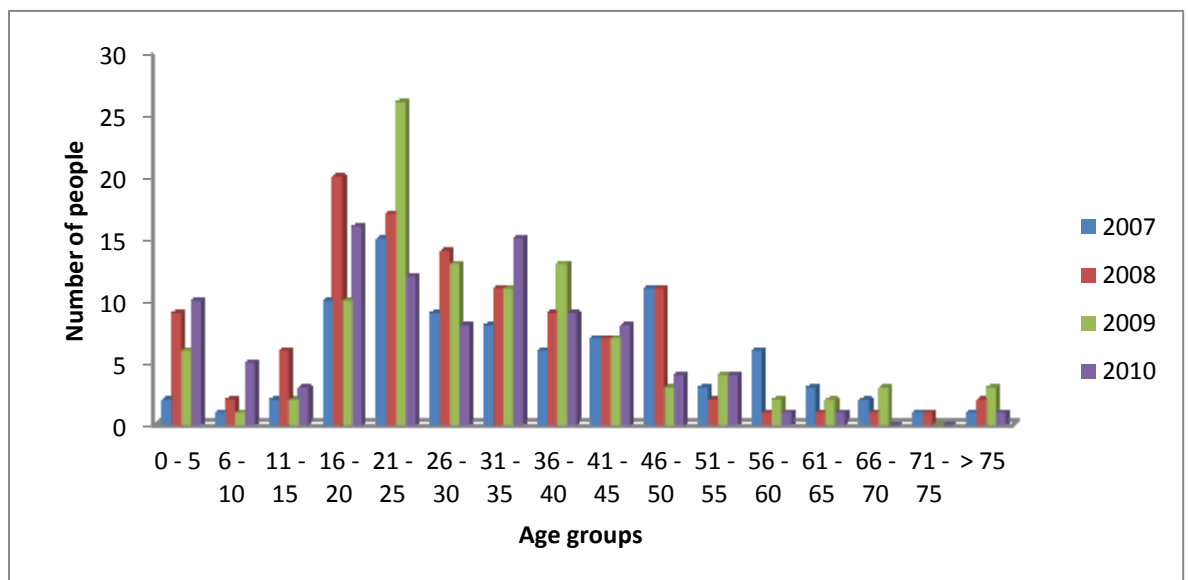


Figure 5: Distribution of the total number of road fatalities in Al Ain between 2007 and 2010 according to age group (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)

The number of traffic fatalities in the city of Al Ain declined from 106 in 2009 to 97 in 2010 (Figure 5). In 2010, the highest number of fatalities totalled 16 deaths for the 0 to16 age group and there were no fatalities for the >66 age group. This was because young people were driving too fast and not wearing seat belts, while the elderly tended to drive

more carefully. The number of fatalities for the 0 to 16 age group increased from 9 in 2009 to 18 in 2010. This was owing to an increase in the number of births and a lack of child seats being used. Between 2009 and 2010, there was a decrease (from 70 to 52) in the number of deaths for the 21 to 45 age group. It was Al Ain city's effective traffic campaigns which brought about this change. Moreover, in comparison with the previous years, the largest number of deaths (26) occurred in 2009 for the 21 to 25 age groups. Prior to this, there were 20 deaths in 2008 for the 16 to 20 age group (Ministry of Interior, 2013).

2.3.3.2 Traffic Injuries:

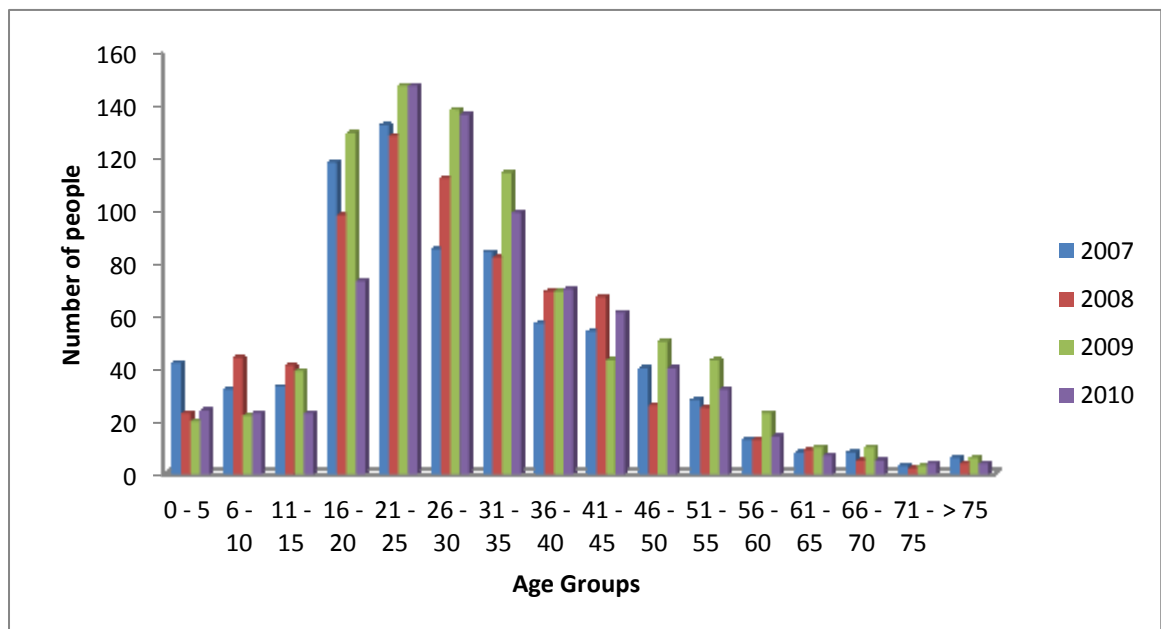


Figure 6: Distribution of the total number of road injuries in Al Ain between 2007 and 2010 according to age group (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)

Traffic injury data between 2009 and 2010 shows a decrease of 12% in the total number of injuries (Figure 6). There were 866 injuries in 2009 compared with 762 injuries in 2010, Al Ain's traffic enforcement being the main reason behind this reduction. The largest number of injuries in 2010 occurred among the 21 to 25 age group where the number of injuries totalled 147 (this being the same for 2009). The 26 to 30 age group had a reduction of only

two injuries between 2009 and 2010 (138 injuries occurred in 2009 while there were 136 injuries in 2010). Again, it was found that young people have the highest number of injuries due to their not wearing seat belts and speeding. The greater than 61years age group had the lowest number of injuries, with only 20 occurring in 2010, due to careful elderly drivers (Ministry of Interior, 2013).

2.3.4 The Western region:

2.3.4.1 Traffic Fatalities:

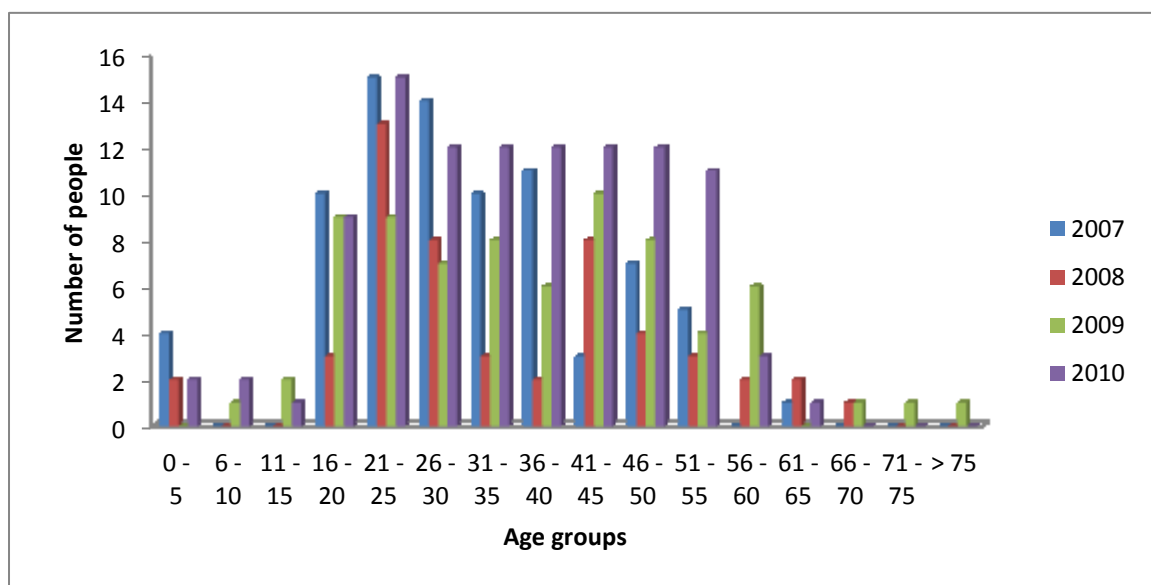


Figure 7: Distribution of the total number of road fatalities in the Western region between 2007 and 2010 according to age group (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)

The number of fatalities from RTAs increased overall in Abu Dhabi during 2010 (Figure 7). The total number of fatalities in the western region increased from 75 in 2009 to 104 in 2010 (a rise of 42%). The western region is the area connected to Saudi Arabia where there is a high volume of traffic using the highway. In addition, many different types of drivers use this road who may not be familiar with the road conditions in the area. There are also fewer traffic campaigns in the western region as opposed to the city of Abu Dhabi (Ministry of Interior, 2013).

The greatest number of fatalities in 2010 totalled 63 for the 21 - 45 age group, and in comparison with 2009, there were 40 fatalities. As can be seen, young people have the highest number of fatalities owing to newly licensed drivers exceeding the speed limit in this area since it is an open highway. The number of fatalities for the >60 age group decreased from 2009 (3) to 2010 (1). Older, nervous drivers may have avoided the highway which will then have caused this reduction (Ministry of Interior, 2013).

2.3.4.2 Traffic Injuries:

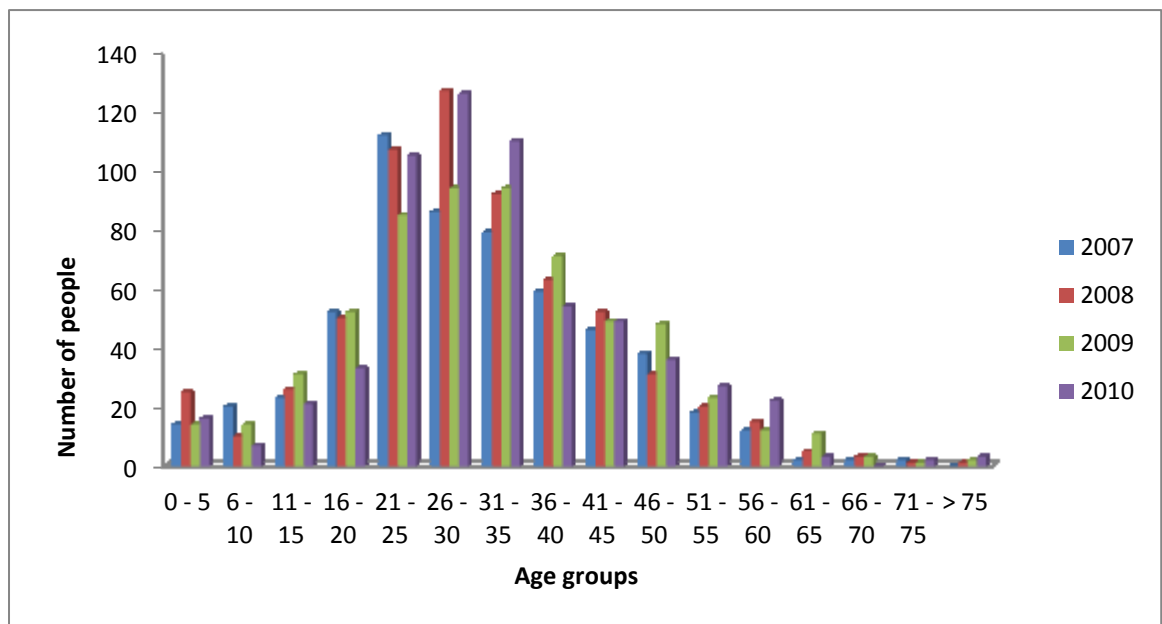


Figure 8: Distribution of the total number of road injuries in the Western region between 2007 and 2010 according to age groups (Ministry of Interior Abu Dhabi, personal communication, April 15, 2011)

The total number of traffic injuries increased from 604 in 2009 to 614 in 2010 (Figure 8). This rise of 2% was still high compared with other cities. It shows that there has been no improvement in road safety in this area. Even the hard work of the Traffic Department has not helped to reduce the number of injuries caused in road accidents, which means that greater effort is needed to reach the goal of road safety. The highest number of injuries (126) took place in 2010 for the 26 - 30 age groups. This was also an increase of 34% on

the 94 fatalities in 2009. It reveals that young people have the highest number of injuries, these being caused by speeding and the failure of young people to wear seat belts.

2.4 Road accident classification and definitions:

RTAs occur when one vehicle collides with another vehicle or a pedestrian, animal or other object; this may occur in a public or private location, and may be unintentional. The results of RTAs vary from minor damage to a vehicle to serious injury or death for the people involved (Jha *et al.*, 2004; Atamo, 2012).

RTAs are categorised into the following categories: head-on accidents, road departure accidents, rear-end accidents, side accidents and rollovers (Naja, 2013). When recording road traffic injuries or deaths, WHO refer to “*any person killed immediately or dying within 30 days as a result of an injury accident*” (Mohan, 2006, p.51). Some countries in the European Union, such as Greece, Portugal and Spain, use the period of 24 hours, France uses six days and Italy seven days to determine injury as a result of an accident, while all GCC countries and the UAE use a 30- day period.

According to Mackie (2003) the United Nations Cost Benefit Analysis of Transport Infrastructure Projects (2003) states:

“A damage-only accident is one in which there are no casualties. A fatal accident is one in which there is at least one fatality. A serious accident is one in which there is at least one serious casualty but no fatalities. A slight accident is one in which there is at least one slight casualty but no serious injuries and no fatalities” (Mackie, 2003,p.58).

Road accidents are also defined as follows:

“Casualty severities: Fatality - death within 30 days for causes arising out of the accident; Serious injury - casualties who require hospital treatment and have lasting injuries, but

who do not die within the recording period for a fatality; Slight injury - casualties whose injuries do not require hospital treatment or, if they do, the effects of the injuries quickly subside” (Mackie, 2003,p.58).

The National Institute for Statistics and Economic Studies (INSEE) in 2013 states: *“A road accident refers to any accident involving at least one road vehicle, occurring on a road open to public circulation, and in which at least one person is injured or killed.*

Intentional acts murder, suicide) and natural disasters are excluded”.

“Killed persons” are accident victims who die immediately or within thirty days following the accident, and *“injured persons”* are accident victims who have suffered trauma and require medical treatment (with or without hospitalization) (INSEE, 2013).

2.5 Causes of road accidents:

2.5.1 The effect of human behaviour on RTA’s

The causes of RTAs consist of three main components: the driver, the road and the vehicle. Ninety percent of RTAs result from human error, (Mearkle, 2009; World Health Organization, 2009; Sabbour & Mibrahim, 2010). According to The Ministry of Interior statistics report in the UAE, the highest cause of road accidents is carelessness. In Abu Dhabi in 2010, 506 RTAs occurred as a result of carelessness; 599 people were injured and 91 people died because of this type of negligence (Ministry of Interior, 2011). One of the most important aspects helping to improve traffic behaviour involves police enforcement. The traffic departments require more traffic rules and a traffic enforcement system, for example, to develop traffic behaviour for all road users. According to the WHO report in 2009, traffic enforcement increased the percentage rate of wearing seat belts from

52% to 92% for front seat passengers and from 9% to 80% for rear seat passengers in European Union countries (World Health Organization, 2009). Seat belts prevent around 50% of fatal injuries in a traffic accident (Ma *et al.*, 2012). Failing to wear a seat belt is particularly unsafe for drivers and contributes to more fatalities than any other unsafe driving behaviour (Fernando *et al.*, 2012).

Drivers should also have an understanding of the traffic rules and laws. Most people have experience of transportation risks, such as RTAs - these occurring with privately owned cars or with public transport (for example, a bus or train.). All the relevant stakeholders are concerned with how gender, age and education level affects RTAs (Moen & Rundmo, 2006; Harper *et al.*, 2012; Zhang *et al.*, 2013). Additionally, there is a distinct relationship between the number of accidents and driver acceleration behaviour, such as speeding, braking and steering actions (Wåhlberg, 2008; Af Wåhlberg, 2012). Hence, it is very important to improve driver behaviour in order to avoid RTAs. Moreover, speeding, drink-driving and the failure to wear seat belt can all be prevented and the lack of these measures heavily contributes to RTAs (Stanojević *et al.*, 2013).

2.5.2 The consequences of speeding

Exceeding the speed limit has a harmful effect on road safety issues. However, in the UAE it is difficult to record the number of RTAs occurring because of this. Specific training software is needed to investigate these types of accidents and to determine the speed of a vehicle before a collision, such as crash reconstruction computer programs. RTAs caused by excessive speed lead to increased damage and the injuries are more serious because of the nature of kinetic energy (Manner & Wunsch-Ziegler, 2013).

By way of example: the possibility of a driver or passengers being killed in a vehicle travelling 50 mph speed is 20 times higher than the possibility of being killed in a vehicle

travelling at a speed of 20 mph (SWOV, 2009). Using fixed speed cameras, radar and speed guns, or organising and delivering speed campaigns can be highly effective for raising road safety standards. The Netherlands is one of the countries using all of these technologies (Ribeiro, 2011); the Dutch government adopted a new law called Mulder law, which is appropriate for frequent risky behaviour concerning traffic regulations, such as when the vehicle speed exceeds the legal speed by less than 20 mph. If, however, the speed is higher than 20 mph, this is then regarded as a criminal offence in the Netherlands. Here the numbers of police managers were increased by more than a 50% to implement the law. It was then found that the number of fines increased five times between 1995 to 2006 (a total of 8.9 million speed fines) and the breakdown included a percentage of 41 for speed in urban areas, 40% for speed on motorways and 19% for speed on rural roads (SWOV, 2007; Ribeiro, 2011).

2.5.3 The impact of drink driving

According to the UK Department for Transport (2011) in the latest available statistics in 2010, 250 people were killed and 9,700 were injured from drink driving. It is known that drink-driving accidents can be caused by drivers of all ages, but especially young drivers in the 20 to 24 age groups. Drinking alcohol reduces the ability to observe long distance objects by 25%; it also lessens the response time for the driver by 10% to 30% (Institute of Alcohol Studies, 2010). In this regard, in France, after lowering the limit to 50mg from 80mg of alcohol in the blood, the number of fatalities was reduced by 4% (Charlton & Starkey, 2013). Therefore, it is vital to inform and educate people about the penalties of drink driving: for example, placing a story in the newspaper could reduce the number of people who drink and drive illegally (Sen, 2005; Jia et al., 2013; Smithers, 2013). According to the Department of traffic and patrols in Abu Dhabi between 2010 and 2012,

driving under the influence of alcohol resulted in a 219 RTAs ,with 23 deaths and 36 injuries (Ministry of Interior, 2013).

2.5.4 Road infrastructure:

Roads are planned according to specific criteria, such as the travel time, traffic congestion, environmental issues and travel costs. Moreover, in the period between a road being planned and a road being built, a number of circumstances can change, such as the volume of vehicles, the type of road users and the weather conditions. It is therefore crucial to focus on the black spot regions (the specific areas where most accidents take place) to reduce the number of road accidents or prevent accidents from happening in the first place. It is also vital to establish the circumstances of RTAs and to confirm where, how and why such accidents occur. Good quality data recording systems will therefore help safety engineers to understand the causes of accidents and to decide what suitable action to take for planning and designing future roads (Wang *et al.*, 2013a). For example, France's Pedestrian Only Zones are designed to give priority to pedestrians in public spaces (Martin, 2009).

2.5.5 The usefulness of traffic calming measures:

According to the Institute of Transportation Engineers (ITE) "Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour, and improve conditions for non-motorized street users" (SCRCOG., 2008). Traffic calming measures were also introduced into the Netherlands in the late 1960s. This was done to create spaces for pedestrians and vehicles to share in urban areas. There are different types of traffic calming measures, such as speed humps,

road narrowing, chicanes, traffic circles etc. Significantly, applying and operating traffic calming measures to lower vehicle speeds can reduce RTAs by up to 40%. This also helps to reduce pollution and noise levels (Harvey, 1992; Garrod *et al.*, 2002).

In Ciekot's view (2001), the use of speed humps has led to a reduction in the speed of vehicles: 85% of vehicles which used one particular road have lowered their speed from 35.5 mph to 30.96 mph. In another example in Denmark, in a 37.2 mph zone, traffic calming measures, such as prior warnings, gateways and lateral shifts were used. Lateral shifts were also employed in 31 mph zones, while narrowing and raised areas were used in 24.8mph areas. (Ewing & Brown, 2009). There are also further examples of traffic calming measures, namely speed humps, street narrowing and central islands.

2.5.5.1 Speed humps

Speed humps have been used all over the world as common traffic calming measures. A speed hump is designed to slow the vehicles and reduce the severity of pedestrian accidents. It also plays a very important role in changing driver behaviour over time and gives the driver time to react in sudden circumstances, such as when a child runs across the road (Tester *et al.*, 2004; Antić *et al.*, 2013). In contrast to other traffic calming measures, the selection of traffic calming measures depends on individual policy makers who consider the effects of traffic calming measures on their own particular communities: if they are concerned about public health and environment issues they may use traffic humps (Lee *et al.*, 2013). With the Department for Transportation in the USA, one example of using speed humps was in Bellevue, Washington; 16 speed humps have been used in five urban areas. Introduction of speed humps resulted in the reduction of speed of the vehicles at 12 mph (U.S. Department for Transportation, 1994).

2.5.5.2 Street Narrowing:

The use of street narrowing is very effective when encouraging drivers to reduce their speed, especially in urban and residential areas since narrower streets are safer for pedestrians (Gorrell, 2014). A Street narrowing location depends on the traffic flow and in some locations it may pose a problem for cyclists. It may also adversely affect emergency vehicles and large vehicles in addition to reducing the visibility of drivers to see children who are playing between cars near a street (Edquist et al., 2012). However, in Ontario in Canada, narrowing the road lanes reduced the percentage of the drivers who exceeded 30 km/h from 86% to 20% (Huang & Cynecki, 2011).

2.5.5.3 Central islands or Pedestrian Refuge Islands

Central islands help pedestrians to cross roads safely by allowing them to cross wide roads in two stages. They can also be used on two-lane roads where it is useful to reduce the speed of the vehicle by narrowing the roads. Central islands can be located near intersections and at places where there are a number of pedestrians crossing the roads (Li & Fernie, 2010; Bushell *et al.*, 2013). Central islands also serve as pedestrian protection. Additionally, there are some support calming measures that can be used with central islands, such as the planting of trees and constructing street waterfalls, but these measures will not in themselves reduce speed (Cambon de Lavalette *et al.*, 2009).

2.5.6 The role of high-risk vehicles in RTAs:

According to the European Commission, half the number of injuries and fatalities could be avoided if all cars were fitted with crash protection systems (European Road Safety Observatory, 2006). In high income countries, all vehicles are required to have standard

regulations for safety, such as seat belts, airbags etc. However, low income countries lack standard regulations for safety, which means that many pedestrians, motorcyclists and cyclists experience RTAs (World Health Organization, 2009). There are also faults on vehicles that could lead to serious injuries and fatalities, as described below.

2.5.6.1 Defective braking systems - anti skid braking system (ABS):

An effective (ABS) is very important for any vehicle as it helps the driver to control and steer the car while braking, and also prevents skidding (Zeng & Gao, 2013).

2.5.6.2 Defective head or rear lights:

If cars are driven less at night, then a third of motorcycle accidents could be avoided and 10% of car accidents would be prevented (World Health Organization, 2009).

2.5.6.3 Defective tyres:

Defective tyres lead to the driver losing control of the vehicle. There are many causes of defective tyres, such as low air pressure, the overloading of vehicles and tyre manufacturing defects (Shen *et al.*, 2013). The New Zealand Land Transport Safety Authority underlines this, indicating that 40% of fatal accidents in this country result from faulty tyres. Similarly, in Australia in 2000, 15 fatal accidents and 110 injury accidents were the result of defective tyres (Paine *et al.*, 2007).

According to the statistics of the General Directorate of Traffic Coordination at the Ministry of Interior (UAE), between 2010 and 2012 in the UAE, people driving with defective tyres resulted in a 278 RTAs with 88 deaths and 656 injuries (Ministry of

Interior, 2013). However, the statistics showed statistical improvements in indicators of traffic safety during the 2012 year, recording 25 deaths, as compared to 31 deaths in 2011 and 32 deaths in 2010; there was also a decrease in injuries resulting from these accidents, this being 197 injuries in the 2012 compared with 243 injuries in 2011, and 2,016 injuries in 2010. The numbers of violations for driving a vehicle with a defective tyre as recorded by the traffic departments in the UAE were 51,695 violations in 2012, in comparison to 59,729 and 49,224 in 2011 and 2010 respectively.

2.6 Road safety strategies around the world

As the Ministry of Interior statistics show, the UAE has a poor record for road safety compared to other countries. In 2009, the road death rate was 24.8 per population of 100,000 (Ministry of Interior, 2011). However, most of the other developed countries had lower rates. For example, in 2006, the UK had a road death rate of 5.4 per population of 100,000. The Office for National Statistics stated in 2008 that the United States had a road death rate of 14.3 per 100,000 population, Australia had 7.8 per 100,000 population and Japan had 5.7 per 100,000 population (Department of Transport, 2008). It can be seen that the UAE has one of the highest road death rates in the world.

The first assessment of road safety in 178 countries around the world was published by the World Health Organization in 2009 as the ‘Global Status Report on Road Safety’ (World Health Organization, 2009), and on a global level, the United Nations (UN) decade of Action for Road Safety aims to save five million lives on the world’s roads in the next 10 years. The main goal here is to ask governments to do their bit to reduce road traffic deaths and injuries. (Larson *et al.*, 2012). Table 2 shows examples of road safety strategies around the world.

Table 2: Road safety strategies around the world

Country	Road safety strategies
UK	<p>In the UK, according to the EU Road Safety Project, there are two traffic safety strategies. One is the Strategic Framework for Road Safety and is used in Great Britain. The other is the Road Safety Strategy used in Northern Ireland (Department of the Environment, 2013).</p> <ul style="list-style-type: none"> -The Strategic Framework for Road Safety in Great Britain aims to reduce traffic fatalities 37% to 1,770 by 2020, -The Road Safety Strategy in Northern Ireland has the objective of reducing traffic fatalities to 60% to 418 by 2020. <p>According to the Department for Transport in 2012, the UK had a lower RTA death rate in comparison with all the other European Union countries except Malta. In contrast, the USA had four times the number of deaths in RTAs compared to the UK (Department for Transport, 2013b).</p>
USA	<p>Road safety strategy was aimed at reducing the fatality rate to 1.05% per 100 million vehicles for each mile. This strategy also had the objective of reducing fatalities resulting from drink-driving to 32% and lessening fatalities from motorcycle accidents to 14% (Organization for Economic Co-operation and Development, 2012).</p>
Australia	<p>The Australian National Road Safety Strategy 2011–2020 aims at lowering the number of fatalities and serious injuries by 30% every year (Salmon <i>et al.</i>, 2012),</p>
Sweden	<p>The Swedish Vision Zero strategy is one of the most effective road safety strategies in the world. With the latter, no one has been killed or seriously injured on their roads (Belin <i>et al.</i>, 2012).</p>
Canada	<p>Canada’s road safety vision has the title of the “<i>safest roads in the world</i>”. Their vision was intended to result in Canada achieving a rate of five fatalities per 100,000 people. Since this vision was proposed, the roads have become much safer; in 2007 there were 2,767 fatalities and therefore the fatality rate was 8.4 per 100,000 people (CCMTA, 2011).</p>

Qatar	The National Strategy for Traffic Safety aims to reduce deaths through RTAs from the present number of 220 to 130 and it is hoped the rate of serious injuries will be reduced to 300 compared to a present rate of 550 injuries per year (Al-Mawlawi, 2013).
Saudi Arabia	The Strategic Traffic Safety Plan aims to reduce the number of road traffic fatalities and injuries in the city of Riyadh by 30% of the expected number of road accidents for the year 2014. After applying this strategy, the number of fatalities should be reduced to 266 deaths with an average of 22 deaths per month, compared to the average of 26 deaths per month during 2013 (Ar-Riyadh Development Authority, 2011).
The African Union	The Africa Decade Plan of Action of the African Union has the goal of reducing road traffic fatalities by 50% in 2020 and it is also aimed at preventing about one million severe injuries per year (Peden et al., 2013). To achieve this aim, there will need to be an increase in law enforcement on the roads and an improvement in the response times from emergency services after RTAs have occurred. Furthermore, people throughout Africa will have to be encouraged to use public transportation. Nigeria and South Africa have one of the highest road traffic death rates (33.7 and 31.9/100 000, respectively) (Peden <i>et al.</i> , 2013; World Health Organization, 2013).
Kenya	According to the Kenya Roads Board (KRB), the road safety vision is: <i>“An efficient road network for a prosperous Nation”</i> (Kenya Roads Board, 2013,p20). This can be achieved through increasing the funds available for road safety projects, developing the maintenance of the road network and improving the coordination between stakeholders for road safety within the KRB.

As regards the UAE, the Directorate of Traffic and Patrols in Abu Dhabi Police have stated that they plan to achieve Vision Zero by 2030 (Ministry of Interior, 2011). Abu Dhabi has one of the highest traffic accident rates in the world and speeding and reckless driving are the main causes of this (Abu Dhabi eGovernment Gateway, 2013).

Based on comprehensive research conducted by the Abu Dhabi Traffic and Patrol Police, (ADTP) more safety controls were introduced in 2011. These focus on speed regulations for different road types across the Abu Dhabi emirate. Briefly, the speeding regulations as per 2011 are as follows:

- Outside Abu Dhabi City, on the Abu Dhabi-Dubai and Abu Dhabi-Al Ain highways: 140km/h with an allowance of 20km/h.
- At the entrance to cities (Abu Dhabi, Al Ain and Madinat Zayed): 80 km/h.
- Residential areas: between 20 and 40 km/h

In 2011, speed-changing zones were introduced to alert drivers about the changes in speed limits. The speed-changing zones were marked by a red asphalt colour, this increasing the friction between tyres and roads.

Table 3: Speed limit zones introduced into Abu Dhabi in 2011-adapted from Abu Dhabi eGovernment Gateway (2013)

Area	Street	Speed Limit
Abu Dhabi	Airport Road	60 km/h
Abu Dhabi Island	Muroor Road	60 km/h
Abu Dhabi City	Corniche	60 km/h
Maqta	Rashed Bin Saeed Street (from Al Maqta Bridge to Al Saada Street)	60 - 80 km/h*
Mussaffah	Al Khaleej Al Arabi Street (from Mussaffah Bridge to Al Saada Street)	100 km/h
Abu Dhabi Island	Al Khaleej Al Arabi Street	60 km/h
Al Khubeirah - Al Bateen	Baynuna Street (from Al Antra roundabout to the Emirates Palace roundabout)	40 – 60 km/h*
Al Ain	Om Al Oush Street	80 km/h

*depending on the road section; note the signs and road zones.(Abu Dhabi eGovernment Gateway, 2013).

2.7 The social and economic costs of road traffic injuries:

The financial impacts of RTAs are equally staggering, costing the world economy billions of dollars in medical treatment, healthcare and other consequences of human suffering (Nguyen et al., 2013). Studies indicate that six different methods have been used to evaluate the cost of road accidents: net output, the implicit public sector valuation, life insurance, court awards, the gross output or human capital method and willingness to pay(WTP) (Hills & Jones-Lee, 1983; Ayuso et al., 2010; Widyastuti, 2012). The selection of an appropriate method depends upon two main objectives: the maximization of the national output and the pursuit of social welfare objectives (Dissanayake et al., 2008). The

valuation methods that concern these objectives include gross output and willingness to pay, particularly for the use in cost-benefit analyses and for social welfare maximization (Jacobs G et al., 2000; Yaya & Li, 2014) When using the gross output method, problems can occur since the result is sometimes affected by people who have a low income, revealing a very low value of life (Dionne & Lanoie, 2002).

The Willingness to Pay method (WTP) has been most significantly used as a valuation method since the late 1990s; it is useful for measuring non-market goods, such as pain, grief and suffering as a result of road accidents. It also allows people to take into account all the factors (for example, age, education, gender, occupation, income per month. (Jacobs G et al., 2000; David P et al., 2002; Widyastuti, 2007; Dissanayake et al., 2008; Hensher et al., 2009; Hejazi et al., 2013) The WTP approach evaluates costs based on people's preferences or how much they are willing to pay to reduce the risk of road accidents. However, the 'Gross Output' method is determined by only adding a fixed amount of money to the direct cost and loss of output (Dissanayake et al., 2008). No method has been used to evaluate road casualties in the UAE and the Willingness to Pay method cannot be applied to some developing countries because of the unavailability of data, incomplete data or inaccurate data (Asian Development Bank (ADB), 2005). The cost of road casualties is therefore affected by valuation techniques. There are two methods of collecting data to estimate how much people are willing to pay for a reduction in the risk of road accidents, namely Revealed Preference and Stated Preference. The Willingness to Pay method contains two parts: a material part (consumption loss) and an immaterial part (human losses), such as the value of pain (Wijnen et al., 2009). Firstly, the Willingness to Pay method makes estimations using the Revealed Preference approach, which studies how people decide whether they would like to pay more for a safe vehicle or less for a risky vehicle. This helps to estimate the actual money people spend on safety supplies. The respondent's answers are based on real behaviour and the estimate cost is designed to be

similar to market data. On the other hand, the Stated Preference approach estimates costs by asking people to value non-market goods (Beattie et al., 1998; Dionne & Lanoie, 2002; Banerjee & Shogren, 2014). The Stated Preference method depends upon what people say rather than what they do, and it can be applied in any road safety valuation. In theory, Revealed Preference methods are more useful than Stated Preference methods. In the latter, the expenditure of income depends upon what people state they will pay. However, their actual performance may be different from what they indicate, and their expenditure of income can be shown through revealed preference methods. Hence, it is difficult to determine whether a person has chosen a particular vehicle because of its safety devices (such as airbags and seat belts) since most modern vehicles now include these features (Wijnen *et al.*, 2009; Larice, 2013). According to David and Zdemiroglu (2002), Stated Preference methods are more flexible than revealed preference methods because hypothetical scenarios can be used to give a good estimation of the willingness to pay for things, these being related to people's preferences (David P *et al.*, 2002). Using hypothetical scenarios also means that real data does not need to be collected, so saving time and money (Wijnen *et al.*, 2009). In addition, stated preference studies present scenarios about risk changes and these scenarios are very easy for people to understand and answer correctly. Stated preference studies can be conducted by asking people about their willingness to pay for hypothetical safety developments for themselves as individuals or for others (Beattie *et al.*, 1998; Gyrd-Hansen, 2013; Navrud & Strand, 2013).

2.7.1 What does the value of a statistical life mean in general?

This is an estimate of the willingness to pay and how much people will pay for small reductions in mortality risks, such as the risk of RTAs.

As an example of this, where there are 100,000 people living in the city, on average there will be 5 deaths from road accidents every year. A road safety project will therefore reduce

this average from five to two road deaths per year. If everyone living in this city is willing to pay £150 every year to benefit from this road safety project, then the £15 million raised will save three statistical lives, reducing the average rate of road deaths from five to two. The value of a statistical life will be £5 million, which shows the population's preferences for a risk reduction (Henrik & Nicolas, 2009). The value of a statistical life depends upon many things, such as the level of risk of fatality and particular facts when making a decision about risk reduction. Thus, different situations and estimation groups (such as private or public ones) show different results (de Blaeij *et al.*, 2003).

2.7.2 The costs of road casualties:

The Willingness to Pay method is only available in developed countries and not developing countries. Most developing countries do not have the luxuries that developed countries do and because of this the Transport Research Laboratory (1995) suggested that these countries use the Gross Output method. The Willingness to Pay method requires accurate data to evaluate the wealth of the country so that the Gross Output method can be used to reach this objective (Downing, 1997) This method is used in many developed countries, such as the USA, the UK, Sweden and New Zealand (Jacobs, 1995; Downing, 1997; Le *et al.*, 2011). According to WHO, the global cost of RTAs is approximately US\$ 518 billion (World Health Organization, 2013).

The cost of RTAs in the United States is US\$99 billion every year which is equal to 2.3% of GNP (Naumann *et al.*, 2010). According to the Department of Transport in the United Kingdom in 2013, the cost of RTAs in Great Britain is £34 billion every year which is equal to .5% of GNP (Department for Transport, 2013b).

The Transport Research Laboratory started to use the Willingness to pay method in the UK in 1988 to calculate the cost of fatal accidents. In 1993 the method was used to calculate the

cost of all road injuries in the UK (Jones-Lee *et al.*, 1995; Campbell *et al.*, 2014). Meanwhile, in the UAE, according to Hawas (2011), one fatality in a road crash case costs around 2 million US\$. Severe injuries cost between 1 to 1.5 million US\$ and the medium injury cost is about 300,000 US\$, while minor injuries cost about 150,000 US\$ (Government Accountability Office, 2008).

Therefore, it is important to invest in road safety in the UAE. There is a new road network in the country with high specifications of safety but, notwithstanding this, the number of fatalities and road casualties is increasing (El-Sadig *et al.*, 2002).

2.8 How to reduce the severity of injuries and prevents road accidents?

Accidents have occurred for several reasons and it is difficult to decide the main causes of RTAs (Ministry of Interior, 2013). It is therefore important to work on all aspects relating to RTAs to ensure a reduction in the future.

2.8.1 The influence of efficient and effective emergency services

One of the key things to do concerns pre-hospital care and traffic injury services at the site of road accidents (Kumar *et al.*, 2008). After the event, a fast response is needed to provide the essential health services for accident injuries, thereby reducing the mortality rate caused by RTAs. The paramedics should also provide an appropriate level of care for traffic injuries at the scene of a crash. The distance between the scene of the accident and the hospital can be the difference between life and death (Elmqvist *et al.*, 2010; Andruszkow *et al.*, 2013). For example, a six mile distance from a traffic accident location to a hospital will cause a 1% increase in death (Nicholl *et al.*, 2007). However, some traffic injuries (such as excessive bleeding) need urgent care at the scene of the crash. A whole

variety of actions can affect response times, such as the time of the accident and whether or not it occurs in the evening or in the morning. Traffic congestion and weather conditions also play a role as regards the response time.

2.8.2 Enforcement:

Police enforcement plays a vital role in addressing the problem of road accidents. The police need greater powers to increase breath analyser tests and to increase penalties against drink driving. Moreover, enforcing speed limits is critical for reducing the severity of RTAs. According to the WHO report in 2009, police enforcement reduced the number of serious injuries and fatalities in the UK by 33% and in the EU, law enforcement could reduce this problem by 50% (World Health Organization, 2009).

The first safety belt campaign was introduced in the USA in 1985. This resulted in an increase from 49% to 77% of people using seat belts within a three-week period. Moreover, alcohol check point campaigns have reduced the number of accidents related to drink driving; in Charlottesville, Virginia, the number of accidents caused by drink-driving declined to 13% (The Government Accountability Office, 2008).

It is essential for police enforcement organizations to analyse public attitudes towards traffic safety in order to determine if any change has occurred. This requires the public to understand the aim of the campaign and to cooperate with the police in order to achieve road safety. During 2001 and 2004, a study into a large gas company in France was carried out to establish the main risks that drivers take. The objective was to investigate the behavioural changes of drivers in order to identify the risks. The researchers found that police enforcement and traffic campaigns are very effective in preventing drivers from speeding and using mobile phones while driving. The number of drivers both speeding and using mobile phones when driving decreased from 2001 to 2004 because of traffic

enforcements and strict traffic laws (Constant *et al.*, 2009). In addition, speed cameras have proved to be very effective in reducing the number of drivers speeding. In 2003 in Spain, eight speed cameras were installed in Barcelona at 22 sites. As a result, the average number of accidents declined from 638 to 486 and the average number of traffic injuries also went down from 946 to 696 (Pérez *et al.*, 2007). Finally, one of the most important proposals introduced into Abu Dhabi in the UAE involved using police vehicles (especially during public events and during times of celebration). A backup force was also used and proved effective in controlling the traffic, thereby preventing accidents (Ministry of Interior, 2013).

2.8.3 Providing valuable education on road safety issues:

Education can have a huge impact by raising awareness of road safety matters (Truong *et al.*, 2013). Governments should therefore provide traffic safety education programs in all schools so that road safety for children and teenagers can be achieved through these programs. In addition, drivers need to understand what acceptable driving behaviour is, and, in this way, education will help reduce traffic hazards, especially for people who break the law. In the Netherlands from 1998 to 2006, for example, the use of seat belts increased from 40% to 43% for all rear seat passengers in rural areas. This was because a campaign was organised which used a cartoon for children aged between 4 and 12 to encourage them to wear seat belts (Government Accountability Office, 2008).

In 1996 in the USA, the government began Graduated Driver Licensing (GDL) courses and the number of accidents for the 15 to 17 age group declined after applying these policies, especially at night and at weekends. According to the study, the accidents decreased because the number of teenagers driving dropped (Karaca & Ridgeway, 2010). GDL courses for 15 to 17 year-olds reduces RTAs by 10% for night time driving. The

GDL also reduced accidents caused by drink-driving by 13%. Additionally, passenger restrictions preventing passengers from travelling with teenage drivers also resulted in a 9% drop of RTAs. (Fell *et al.*, 2011). Education programs should therefore focus on traffic safety issues, such as speeding, drink driving, using mobile phones and other types of distractions. One of most successful traffic campaigns was used in the UK: the ‘THINK! Campaign’ was run by the Department of Transport in 1963 and focused on drink driving, speeding, motorcycle safety, the importance of seat belts for adults and young drivers. A useful website has since been set up to provide education and awareness for teachers, parents and pupils. This website presents road safety information for road users to reduce the number of fatalities and encourage road safety in the UK (Department for Transport, 2013a).

In the USA, RTAs are the leading cause of death for young people. In 2005, a total of 5,300 teenagers aged between 13 and 19 lost their lives as a result of RTAs. A range of studies have indicated that the reason for this was that young drivers do not have experience in driving at riskier times of day, such as when it is dark. Moreover, since teenagers tend to carry more teenage passengers while driving, this also contributed to the high death rate (Karaca & Ridgeway, 2010).

2.8.4 Engineering the key for safer standards

Road engineering is extremely important in the field of traffic safety (Wang *et al.*, 2013). By comparing accident locations (black spots), the engineers can determine the main faults on the road which lead to RTAs (Navin *et al.*, 2000; Yahya *et al.*, 2013). The role of traffic engineers is to examine the road conditions and to collect the statistics of the accident data, such as the locations of the accidents, the speed zones and traffic congestion. Roads should also meet road engineering standards to ensure that they are safe at all times. Some of the

characteristics include Sight distance, Visibility Splay, Design speed, Maximum Gradient and Bends.

2.8.4.1 Sight distance

Sight distance is the distance required for a driver to observe an unexpected event on the road. It gives the driver time to react, for example, when reducing the speed of the vehicle in sufficient time before emergency stopping or colliding with other objects on the road (Castro *et al.*, 2011). According to the National Cooperative Highway Research Programme (NCHRP) Report, a reduced stopping sight distance results in an increased road traffic accident rate. NCHRP conducted a number of studies from previous data of traffic accidents at specific location segments on the highway. Three main variables were used such as, *“traffic volume, number of intersecting roads influenced by limited sight distance and the percent of segment with stopping sight distance below a cretin length”* (Fambro *et al.*, 1997,p.46). Interestingly, the findings from this study suggested that limited stopping distance had no discernable effect on road traffic accidents rate (Fambro *et al.*, 1997). Therefore though the study initially suggested that reduced sight distance results in increased RTAs, their results showed stopping distance has no major effect on road traffic accidents rate. It is therefore unclear as to whether sight distance reduces RTAs.

2.8.4.2 Visibility Splay

Visibility splay is an important distance which allows drivers who are entering main roads from minor roads to see oncoming vehicles (Figure 9). It also helps other drivers on the

main road to see the vehicles entering (Plan *et al.*, 2010). The distance of visibility splay designed depends on the speed limit of the road. A faster speed limit on the road requires a longer distance to be used.

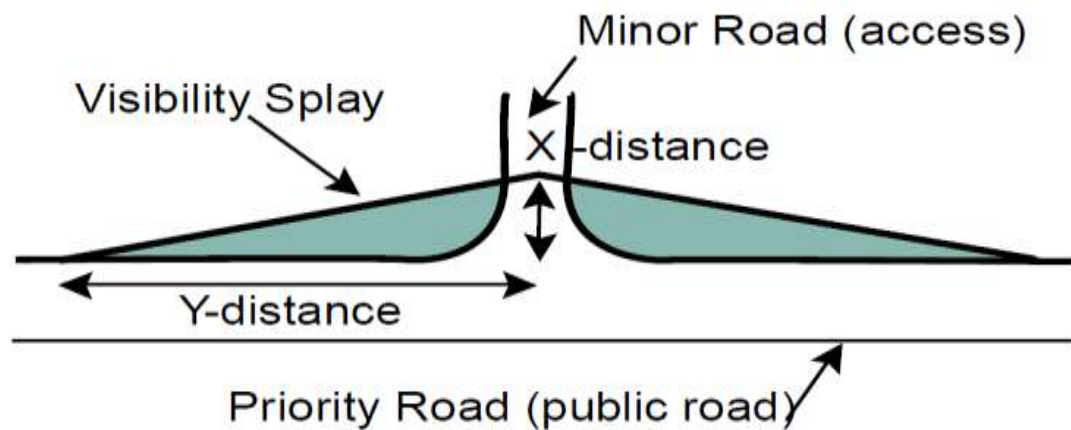


Figure 9: An example of visibility splay- adapted from The Department of the Environment's planning (1999).

As the Department of the Environment's planning report (1995) similarly explains, visibility splay enables emerging drivers to have sufficient visibility in each direction to see oncoming vehicles in sufficient time so that they can manoeuvre themselves safely without affecting the major road traffic speed. Visibility splays also enable drivers on the major road to have enough visibility to meet the desirable stopping sight distance (The Department of the Environment's planning, 1995). Though visibility splays are clearly designed to ensure roads are safe and to help reduce traffic accidents, no research seems to have been conducted in regards to their usefulness and practicality in relation to how they specifically affect RTAs.

2.8.4.3 Design speed

Design speeds are essential to indicate the maximum safe speed that a driver should operate at, under normal conditions. When roads are designed, the proposed design speed may be based on certain criteria such as the geometric design of road features, planned operating speed, legislated speed limits caps, anticipated traffic volume and the road's functional classification (Leisch & Leisch, 1977; Choi *et al.*, 2013). Highway engineers measure the existing speed on a road, round up to the next multiple of 5 mph and design the road for that safe speed. Recent research has concentrated on using the street design to influence drivers to choose an appropriate speed for the area. This speed has been referred to as the 'target speed and is preferably equal to the speed limit (Ivan *et al.*, 2009). Like sign distance and visibility splay processes, design speeds are also developed to help reduce road traffic accidents.

2.8.4.4 The Maximum Gradient

The Maximum Gradient refers to the inclined part of a road. The degree of gradient of the road is related to the ground nature of the slope of the road (Zhang *et al.*, 2014). In vehicular engineering, various land-based designs (for example, cars and trucks) are rated for their ability to mount land (Transport Department, 1993). The desirable maximum gradient for designing motorways is 3%, for dual carriageways the desirable maximum gradient is 4% and for single motorways the desirable maximum gradient is 6%. In hilly areas, steeper gradients will usually be needed, particularly where traffic volumes are lower (Transport Department, 1993). Furthermore, in hilly environments, the

implementation of gradient steeper than desirable maximum gradients could make considerable savings in construction or environmental costs, however also result in higher user costs, i.e. by delays, fuel and accidents(The Department of the Environment's planning, 1995).

2.8.4.5 Bends

Bends on the road help to reduce the speed of the vehicle so that the road should meet the standards of road safety. To create safer roads, sharp bends need to be avoided (Donnell, 2013) and in industrial areas, bends need to be widened. In regards to existing rural roads, engineers are often used to investigate and improve evident dangerous roads. Furthermore, direct vehicle access on the inside of a bend is not endorsed by road engineers (The Department of the Environment's planning, 1995).

In addition, traffic engineering can provide the right conditions and requirements on the roads to prevent deaths and severe injuries caused by RTAs. An example of this are measures to reduce speed and calm traffic, especially in urban and residential areas (Ariën *et al.*, 2013).

Chapter Three

Methodology

Chapter Three Methodology

3.1 Introduction:

The aim of this chapter is to present a clear description of the specific steps that have been used for the collection of data in this doctoral research project. To begin with, this chapter explains quantitative and qualitative methods in relation to this study, the pilot survey used, the sample size, planning and data collection process, the research assistants employed, the questionnaires for drivers and pedestrians, the interviews with the traffic managers and the planning and delivery of the focus group based research.

3.2 Data Collection

The triangulation method is one of the best methods that can be used to obtain the advantages of both qualitative and quantitative methods. Creswell & Miller defined triangulation as *“a validity procedure where researchers look for convergence among multiple and different sources of information to form themes or categories in a study”* (Nguyen *et al.*, 2013, p.126).

There are two main types of methods used for most research projects, namely ‘quantitative’ and ‘qualitative’ (Ayuso *et al.*, 2010). It was decided to combine these two types of methods to help obtain a large amount of data about RTAs in Abu Dhabi. Firstly, when it came to the drivers and pedestrians, quantitative methods were used to gather data. The author then used qualitative methods by interviewing managers to find out why RTAs occurred. This provided accurate information about the role of the traffic managers and their knowledge of RTAs.

3.2.1 Qualitative and Quantitative methods:

Qualitative research “*is used to explore substantive areas about which little is known or about which much is known to gain novel understanding*” (Corbin & Strauss, 2008, p.11).

In addition, it can be used to obtain the intricate details about phenomena such as feelings, thought processes and emotions which are difficult to extract or learn about through more conventional research methods (ibid).

Quantitative research is “*Explaining phenomena by collecting numerical data that are analyzed using mathematically based methods (in particular statistics) [and is] essentially about collecting numerical data to explain a particular phenomenon, particular questions seem immediately studied to being answered using quantitative methods*”(Muijs, 2010).

Table 4: Qualitative and Quantitative Comparisons (CCMTA, 2011; Ariën et al., 2013)

	Qualitative	Quantitative
Flexibility	Soft	Inflexible
Sample size	Small number	Large number
Selection of Respondents	Selected	Randomly
Collection data method	Interviews, focus groups and observations	Surveys and controlled experiments
Data types	Subjective	Objective

3.2.2 Advantages and disadvantages of Qualitative and Quantitative methods:

For each of these methods there are advantages and disadvantages to their approaches. The methods used in qualitative research are interviews, focus groups and observations, and for these methods only a small number of participants can be used as they are time consuming

processes. The researcher may also direct respondents according to his/her personal point of view which may lead to a lack of impartiality in the results. The advantages of qualitative methods include low cost and more detailed data from participants. In qualitative methods, the researchers aim to understand how and why specific human behaviour happens. The researcher is free to choose the way of asking questions and there is no need to follow rules for the interviews. According to the types of questions, it is easy to obtain more knowledge and have a greater understanding of the participants.

The methods used in quantitative research are surveys and controlled experiments (Creswell, 2013). The disadvantages of quantitative methods include the fact that they are more costly and there is no interaction between researchers and participants. The answers also provide numerical descriptions which do not necessarily reflect people's opinions accurately. However, among the advantages of quantitative methods, they aim to display the results of samples represented through the random selection of respondents and the data from large groups of people in order to answer specific questions and to establish causes. Quantitative methods help to answer when, where and how things happen; using these methods, the researcher can obtain a large amount of data which can easily be converted into charts or graphs since they deal with numbers and statistics (Creswell, 2013).

3.3 Quantitative data methods for the project

The quantitative data method has been used in this project through questionnaire surveys; drivers and pedestrians were asked to identify the relevant factors that contribute to RTAs in Abu Dhabi. To do this, they were requested to complete questionnaires and provide data, which could then be analysed and categorised.

3.3.1 Pilot survey:

The questionnaire was first randomly pilot-tested in January and February 2012 through participants in the UAE and Cardiff and the answers and comments from the respondents were used to inform the development of the final questionnaire survey.

The questionnaire was developed according to the researcher's knowledge of RTAs in Abu Dhabi. It is reported that 90% of RTAs are due to human error (Mearkle, 2009; World Health Organization, 2009; Sabbour & Mibrahim, 2010). Taking into account the pilot survey results, the final survey questions were modified to meet the purpose of the study and all the questions, which included yes/no, scale and open-ended questions, were modified.

3.3.2 Sample size:

The Power Calculation method (Liu *et al.*, 2013) was used to calculate the survey sample size for the drivers and pedestrians in Abu Dhabi. Calculating sample size is crucial before commencing a survey (Machin *et al.*, 2011; Halder & Naidu, 2012).

Therefore, 600 drivers questionnaires were distributed by hand and 291 (49%) were returned (185 male and 106 female) and (51%) refused to answer the questionnaire. 600 pedestrian questionnaires were also distributed by hand and 280 (47%) were returned (176 male and 104 female) and (53%) refused to answer the questionnaire. This high response rate made the research conducted more thorough and effective (Bryman, 2012). According to Bryman 2012, it was found that the response rate is different from one country to the next and it depends on the type of the study. It is also worthy of note that there has been no study conducted to date which has looked at response rates among drivers and pedestrians in the UAE.

3.3.3 Plan for data collection:

Good planning is very important in research work to minimise errors during the data gathering. Permission to carry out the research in the first place was also granted by the relevant authorities.

Firstly, the UAE embassy in London was contacted who then made contact with Abu Dhabi police GHQ in relation to this research project. Following this, the head of the education department at the Abu Dhabi police GHQ was approached and permission was requested and then given to carry out the surveys and interviews. The education department at the Abu Dhabi police GHQ contacted the Director of the Traffic and Patrol Directorate and the Director of the Traffic & Licensing Department to once again request permission for the research project to be carried out. According to the Abu Dhabi police GHQ regulations, this procedure had to be followed; it was also necessary to repeat this in order to obtain permission from the respective sections concerning the privacy and confidentiality of the data relating to these departments (See Appendix 1 for the formal letters used between the author and Abu Dhabi police).

3.3.4 Data Collection Process

The data was collected on three field trips to Abu Dhabi: in December 2011, March to April 2012 and April 2013. The surveys were distributed in person and the majority of respondents completed them. The decision was made to distribute the surveys this way rather than through email or telephone in order to avoid technological issues and barriers. The drivers who came to the traffic and registration departments were chosen so that the author could access the respondents easily on a daily basis and over a number of months.

3.3.5 Research assistants

The author recruited two research assistants (RAs) by speaking to the Abu Dhabi Traffic Department. The traffic managers recommended their best male and female assistants for this task. It was important to have an assistant from each gender so that many participants could be targeted for the research; potential female participants, for example, may feel more comfortable speaking to female research assistants. Both assistants had good interview techniques as well as experience about how to deal with respondents. These were qualified research assistants and they also took part in the workshops specifically organised for the research project.

The assistants distributed the questionnaires and then collected them after they had been completed, and sometimes, if necessary, answered questions raised by the respondents. The assistants were also informed that the answers in the questionnaires had to remain confidential.

3.3.6 Questionnaire:

The questionnaire was designed with the objective of obtaining information about driver and pedestrian behaviour and attitudes. The drivers and pedestrians used included individuals who were employed, unemployed or in higher education (and surrounding universities). This meant that a variety of individuals were used to represent the people of Abu Dhabi (see Appendix 2 & Appendix 3 for the questionnaires used for both drivers and pedestrians).

Two versions of the questionnaire surveys were distributed: one in Arabic and the other in English. This was necessary so that all those involved were able to answer the questionnaire surveys.

3.3.7 Drivers

Drivers are responsible for numerous RTAs. It has been shown that 90% of the causes of RTAs are a result of driver behaviour and human error. (Mearkle, 2009; World Health Organization, 2009; Sabbour & Mibrahim, 2010). Examples of this are: a lack of attention, falling asleep, excessive speed, overtaking at the wrong time or driving on the opposite side of the road to the direction of traffic. Drivers were selected to obtain the information relating to RTAs and their causes since it was important to identify their points of view concerning RTAs.

Questionnaires were also prepared for the drivers who visited the traffic and registration departments to pay for their traffic violations and to renew their vehicles. The questionnaire for the drivers contained two parts; the first section included the aim and purpose of the research project as well as a consent form; the second section included a 9-page questionnaire. Completing the questionnaire was voluntary, and this was made clear on the form.

3.3.8 Pedestrians

It is estimated that a third of all traffic fatalities involve pedestrians (Zhu *et al.*, 2013). It was therefore very important to understand the relevant factors relating to traffic safety and accidents among pedestrians in Abu Dhabi. The surveys for the pedestrians included questions based on crossing the roads near shopping centres and companies in Abu Dhabi.

These questionnaires for the pedestrian were divided into two parts: the first part included the aim and purpose of the research project as well as a consent form; the second part included a 6-page questionnaire. Again, completing the questionnaire was voluntary, which, as with the drivers, was made clear on the form.

The data was analyzed using a SPSS program and a chi-square test. According to Schumacker and Tomek, “The Chi-square test was developed by Karl Pearson to test whether two categorical variables were independent of each other” (Schumacker & Tomek, 2013,p.169). The Chi-square test determines whether an association (or relationship) between categorical variables in a sample is likely to reflect a real association between these variables in the population, such as if there is a statistically significant association between being involved in a traffic accident and gender.

The ‘p’ stands for probability and the p-value is the probability of seeing the observed difference; here the p-value provides a measure of the strength of an association. If the p-value is less than (0.05), it means that there is a statistically significant association; conversely, when the p-value is greater than (0.05), this indicates that there is no statistically significant association (Whitley & Ball, 2002; Petrie & Watson, 2013).

3.4 Qualitative data methods

3.4.1 Interviews

The definition of a qualitative interview is that in “*the art of hearing data we hope to transmit not only a set of techniques but also some of the exhilaration we have experienced in doing the research*” (Manner & Wunsch-Ziegler, 2013,p.vii) There are several types of interview, depending on the purpose of the study. Interviews are not like normal conversations between people in everyday life; the latter typically include shared knowledge and an understanding of everyday occurrences. Rather, the information from interviews makes it possible to detect particular aspects that can only be identified through a survey or questionnaire. The interview therefore allows the interviewer to ask open questions which he or she can explain to the participants (Elmqvist *et al.*, 2010).

In general, according to Pan and Li (2013), interviews are easier for the respondent, especially when asking about opinions. Another aspect of this is that people prefer to speak rather than write (Andruszkow *et al.*, 2013).

The interview was chosen in order to provide the largest possible number of facts about the causes of RTAs (Truong *et al.*, 2013) and these made it possible to identify the best ways to reduce them in the future. At the same time, it was useful to learn about the differences between the participants’ individual opinions according to their work in the various traffic departments. However, some difficulties occasionally arose when interviewing subjects, some people felt that they do not want to take part. The duration of each interview was about 30 minutes.

3.4.2 Pilot Interview Questions

According to Turner (2010), it is important to have a pilot test of an interview to determine if there are any weak points or limitations in the design of the interview (Department for Transport, 2013b). The interview questions had therefore been previously pilot-tested with three senior traffic managers in the UAE and the answers and comments from the respondents were used to complete the final interview questions.

3.4.3 Data Collection

Interviews are one way to collect data and obtain information about a study from respondents. It therefore helps if the researcher covers a list of questions or issues relating to the matter at hand, in this case - the RTAs in Abu Dhabi – in order to achieve his/her aim.

However, there are many types of interviews, such as structured and semi-structured interviews (Cambon de Lavalette *et al.*, 2009) and each of these has advantages and disadvantages. The author opted for a structured interview because of its particular advantages, such as the researcher being able to change the order of the questions in response to the conversation. In addition to this, during the interview the researcher can ask in-depth questions and explain unclear questions for the interviewee. However, one of the major flaws of the structured interviews method is that some participants may be afraid to answer questions. They might think the interviewer was trying to assess their work and to evaluate if they had been involved in an RTA during the course of their work or were being quizzed about traffic safety (Wang *et al.*, 2013b). Qualitative interviews were

conducted with a number of traffic managers from the Abu Dhabi Police Traffic and Patrols Directorate. All the managers contacted responded positively as regards taking part in this project and the interviews took place between March and April 2012 at particular traffic departments. In order to obtain information from reliable sources, the traffic managers included all the sections involved with RTAs in terms of investigations, engineering, enforcement, education, training and traffic awareness. The departments targeted constituted all the sections since these were concerned with dealing with minor and major RTAs. Forty interviews with managers were carried out in the Arabic language because interviewing people in their language is better for understanding and answering questions (Shen *et al.*, 2013). Only one interview was conducted in English (this concerned one of three traffic advisors in the UAE police who was the most appropriate advisor for the author to speak to). Table 5 shows the section, the number of managers and the responsibilities of each section targeted.

The author personally transcribed all the interviews, translating them from Arabic to English. This did not pose any problems since the first language of the author is Arabic, while his second language is English. The interviews were conducted face-to-face and involved open-ended questions.

Table 5: The Section, the number of managers and the responsibilities of each section targeted

Name of Section	Number of Managers	Responsibilities of Section
Traffic Investigation Section, Abu Dhabi	12	This section is responsible for all major RTAs scenes which result in loss of life or serious injuries in Abu Dhabi city.
Traffic Investigation Section, Al Ain	1	This section is responsible for all major RTAs scenes which result in loss of life or serious injuries in Al Ain.
Traffic Investigation Section, Al Mafrq	1	Responsible for all major RTAs crash scenes which result in loss of life or serious injuries in Al Mafrq and the highway unit.
Traffic Strategy Section	4	This section is responsible for the development of strategic plans for the Directorate of Traffic and Patrols as well as monitoring the implementation of the plan and the evaluation of the plan.
Traffic Enforcement And Control Section	5	This section is responsible for the implementation of the traffic law and traffic management and is also responsible for traffic enforcement on the roads.
Traffic Expert Section	1	This section is responsible for providing advice about traffic management and accident investigations.
Traffic Training Section	1	This section is responsible for providing all the training courses that the traffic departments need to help their employees develop.
Traffic Discipline Section	5	This section is responsible for discipline in the traffic departments and evaluates how policemen work.
Public Relations Section	5	This section is responsible for public relations in the traffic departments and all traffic awareness campaigns in terms of preparation and application
Traffic Engineering and Radar Section	5	This section is responsible for traffic engineering and deciding where to put radar and speed cameras on the roads.
SAAED	1	This private company is responsible for investigating all minor accidents in Abu Dhabi.

Although these types of questions can sometimes produce data that is difficult to categorise, in this case it allowed the managers to answer the questions and share their opinions freely without the author telling the participants what to talk about (Drever, 1995; Wang *et al.*, 2013b).

All the interviews were fairly informal to make the interviewees feel comfortable and able to discuss the issues with the interviewer as in a normal conversation. The interviews started by presenting the problem of RTAs in Abu Dhabi and making sure the interviewees understood the importance of the research in the field of traffic safety; it was hoped that the results of the study would contribute to reducing RTAs in the future. Written consent was obtained and signed from each interviewee before the beginning of the interview. (See Appendix 4 for the interview questions.)

3.4.4 Document interviews:

It is important to take notes so as to record answers; notes were therefore taken in all the interviews. Only 15 managers (who the author had known for long time) out of forty-one accepted tape recordings of the interviews. The iPhone was therefore used to record the interviews and to make notes about important points during the interviews.

3.5 Stakeholder meeting to discuss recommendations from the study

All the results and draft recommendations from the study were discussed with the relevant stakeholders, these including managers, senior policy makers, drivers and pedestrians at a

number of meetings in the UAE. The focus group approach was used for the stakeholder meeting. This is one of the techniques used in qualitative research. Focus group research facilitates the collection of multiple perspectives about the same subject from respondents and provides an understanding of how they are thinking. One way of achieving this is by inviting participants to sit with each other in a group and asking them to be prepared to interact (Kitzinger, 1995; Arnold et al., 2013; Silverman, 2013; Yahya et al., 2013).

In the author's research project, the purpose of the focus group discussions was to gather information and opinions to help the traffic managers learn how to use the current study findings. The stakeholder meeting discussions with numbers of Abu Dhabi traffic police managers, the drivers and the managers from the other emirates were also used to determine whether the traffic managers could take on board the recommendations that would arise from the study, and then make appropriate changes. The purpose of the focus group discussions was to gather feedback in an environment where the respondents were encouraged to discuss their opinions with each other (as opposed to participating in one-to-one interviews).

Managers within the traffic departments were chosen to take part in the stakeholder meeting discussions since their overriding goal is to reduce RTAs in Abu Dhabi. However, drivers from Zayed University were also selected to take part in the stakeholder meeting discussions since every driver is affected by RTAs.

3.5.1 The number and materials of focus groups

Sixteen participants were chosen for the stakeholder meeting discussions. These also included all the sections concerned with dealing with RTAs. This meant that every respondent could share his views and opinions freely. All the participants were male as there are no female managers. On the basis of current information, there is no senior female manager in the traffic department and therefore it was impossible to interview female managers working in the field of traffic enforcements and RTAs investigations. The female staff who do work in the traffic departments, stay within the office environment and therefore would not be very helpful for this research project.

Open-ended questions were designed to gain a variety of answers, ideas and opinions. Additionally, a list of participants, a signing sheet, a consent form and refreshments were all planned for the workshops. Before the first stakeholder meeting discussion, a meeting was held with Brigadier Engineer. Hussein Ahmed Al Harthi, Director of Traffic and Patrols Directorate. He indicated how important carrying out such research is in order to reduce RTAs in Abu Dhabi. The field work study was then presented to Abu Dhabi police managers. This resulted in a discussion on the results of the surveys and interviews.

A presentation was given for the managers indicated below: accordingly, an invitation was sent by email to all of the traffic sections throughout the organization. The managers of the sections below were invited and everyone showed a willingness to attend the stakeholder meeting workshop. The participants were:

- The Traffic Statistics Section manager
- The Traffic Studies Section manager
- The Traffic enforcement Section manager

- The Serious Accident Investigation Section - with two managers from Abu Dhabi
- The Serious Accident Investigation Section manager in Al Ain
- The Serious Accident Investigation Section manager for the Abu Dhabi Highway
- The Traffic CID Section manager.
- The Engineering Section manager
- The Traffic Section manager in Al Kznah
- The Traffic Section manager in Al Rhba

(See Appendix 5 for the questions of the stakeholder meetings).

For the next stage of the research project, the author had meetings with two drivers. These participants were selected through personal contacts and were chosen because they fell into the higher risk group of drivers. The research project was then discussed with them, in addition to considering the results of the study.

A meeting was then held with three traffic managers from the other emirates. Once again, the research project was introduced and the main objective of improving the quality of the awareness programs and traffic campaigns was explained. These managers concurred with the objectives of the project and suggested applying the research to all UAE emirates, not only Abu Dhabi on its own. The main topics covered by the stakeholder meetings discussions centred about the following areas:

- The use of study suggestions and accessibility
- Application / implementations of the study
- Future needs to bring about a reduction in RTAs

Finally, letters of thanks were sent to all the participants for their cooperation.

Chapter Four

Results and Discussions

Chapter four Results and Discussions

4.1 Introduction:

This chapter This chapter describes the results of the thesis and then discusses the study findings. The data is analyzed to identify, describe and explore the causes of RTAs in Abu Dhabi. In addition, the chapter discusses the driver and pedestrian questionnaires, the manager interviews and the focus groups. Data was obtained from two main survey questionnaires, which were completed by 291 drivers (63.5% male and 36.5% female) and 280 pedestrians (62.9% male and 37.1% female); 41 interviews were conducted with managers from different sections of the traffic department in Abu Dhabi. Following this, the results of the study were presented to Abu Dhabi police managers, the drivers and the managers from the other emirates. The results have been divided into four different sections: section one discusses the results of the driver participants; section two considers the results of the pedestrian participants; section three discusses and compares the results from the interviews of the stakeholders and managers from the traffic departments; section four looks at the results from the stakeholder meeting of Abu Dhabi police managers, the drivers and the managers from the other emirates.

4.2 Demographic characteristics of the drivers respondents

This section presents all the relevant demographic characteristics of the driver survey respondents. Of the 291 driver respondents, 63.5% were male and 36.5% female: the demographic features of the drivers are indicated in Tables 6 to 11 below. Table 6 shows the age profile of the respondents. The majority of the drivers were between 18 and 35 years old, while only 4.5% were aged 51-65. It is interesting to see that there was a significantly higher proportion of young driver respondents. This could indicate that young drivers are more willing to help solve the problem of RTAs.

Table 6: Age of drivers

Age	Percentage
Less than 18	1.7
18-25	29.3
26-35	43.8
36-50	20.7
51-65	4.5
Total	100.0

Table 7: Marital status of drivers

	Gender Percentage	
Marital status	Male	Female
Single	32.8	34.9
Married	63.9	56.6
Others	3.3	8.5
Total	100.0	100.0

Table 7 shows the marital status profiles of the respondents. Most of the drivers were married – the number here being 63.9% male and 56.6% female. In contrast, only a small percentage came under the ‘other’ category (3.3% male and 8.5% female).

Table 8 shows the nationality profile of the respondents. The majority of the respondents were Emirati citizens (48.3%), while 24.1% came under the ‘other Arab’ category and 15.1% were Asian drivers. There was a lower percentage of European and African drivers (1.4%).

Table 8: Nationality of drivers

Nationality	Percentage
Emirati citizen	48.3
Gulf Cooperation Council , (GCC) Countries	8
Other Arab nationality outside GCC	24.1
Asian	15.1
European	1.4
African	1.4
Other nationalities	1.7
Total	100.0

Table 9 shows the monthly income profile of the respondents; here 96.2 % of the respondents were employed or self-employed. Interestingly, the majority of the respondents (43.2%) earned more than 10,001 Emirati Dirham (AED) per month. Only 19.2% of the respondents stated that they received ‘Less than 2000 AED’ every month. These results indicate that the respondents who earn more than average (more than 10,001 AED) should be able to afford to pay their traffic violation fines and fees. However, the 19.2% of respondents who earn less than 2,000 AED would struggle to pay traffic violation fines and fees. According to the traffic laws in the UAE, the lowest speed fines start at 600 AED (United Federal Traffic Law, 2008). Similarly, the 3.8% of respondents who do not work but have a car would also struggle to pay any fines.

Table 10 shows the education profile of the respondents; here 88.9% of the respondents were educated. The majority of these (43.9%) were educated to undergraduate and post-graduate level; 10.4% were educated to a level less than that of high school; 34.6% were educated up to high school level and only 11.1% stated that they had no qualifications. It can therefore be seen that the majority of the participants have been educated to a high

level and they should therefore thoroughly understand and greatly benefit from traffic awareness programs.

Table 9: Monthly income of drivers

Monthly income	Percentage
Less than 2,000 AED	19.2
2,000 to 5,000 AED	13.9
5,001 to 10,000 AED	19.9
10,001 to 20,000 AED	29.3
More than 20,000 AED	13.9
Unemployed	3.8
Total	100.0

Table 10: Education of drivers

Education	Percentage
No qualification	11.1
Lower than high school	10.4
High school	34.6
Undergraduate	28.0
Post graduate	15.9
Total	100.0

4.2.1 Drivers involved in RTAs

From the results of this study, 49% male and 34% female respondents reported that they had been involved in RTAs over the last 12 months (April 2011 to March 2012); 21.7% and 15.4% female respondents reported being involved in non-injury RTAs, while the number involved in injury-related RTAs was 17.9% male and 12.5% female.

There was a statistically significant association between being involved in a traffic accident and gender ($p=0.014$), age ($p=0.023$) and monthly income ($p=0.025$). However,

there was no statistically significant association between being involved in accidents and education or nationality. (See Appendix 6 An example of Chi-Square testes tables).

Since nearly half the males and approximately a third of the females reported that they had been involved in RTAs, this demonstrates the extent of the issue of RTAs in Abu Dhabi. The fact that these participants had experienced a traffic accident within the last 12 months also reveals how regularly these accidents occur. Furthermore, nearly a third of the participants were involved in injury-related traffic accidents, which again shows how important it is to address this problem in Abu Dhabi.

4.2.2 Using a seat belt

According to the European Commission, half of injuries and fatalities might be avoided if all cars were fitted with crash protection systems (European Road Safety Observatory, 2006) . Every vehicle in high income countries has standards and regulations for safety, such as seat belts, airbags etc. Failing to wear a seat belt is very risky and contributes to more fatalities than any other unsafe driving behaviour (Fernando *et al.*, 2012). The chance of being fatally injured in a traffic accident increases by 50% if a seat belt is not used (Ma *et al.*, 2012). The seat belt law was only implemented in the UAE in 1999 (Munk *et al.*, 2008). Moreover, seat belts are required for front seat passengers, but not for backseat passengers or child restraints.

The results show that 45.1% of males and 47.6% of females wear seat belts at all times. However, 13.7% male and 13.3% female never wear a seat belt while driving. Similar

results on seat belt usage were observed when respondents were asked to indicate how frequently they had worn a seat belt in the previous seven days. Additionally, when respondents were asked how often they used a seatbelt when being driven by someone else, 20.8% male and 34.6% female stated that they never used a seatbelt, and only 33.9% of the males and 32.7% of the females always used a seat belt.

Of the sample investigated, 55% male and 53% female indicated they do not always wear a seat belt while driving when being driven by someone else, while 66% male and 67% female do not always wear a seat belt. This may be because the driver is the one who receives the traffic violation fine as opposed to anyone else travelling in a car. Furthermore, most respondents stated that wearing a seat belt would spoil their clothes and they did not feel comfortable wearing a seat belt. This suggests that if the participants were more aware of the importance of traffic safety, they would care more about wearing a seat belt and less about ruining their clothes.

There was a statistically significant association between wearing a seat belt and nationality ($p=0.018$) and monthly income ($p=0.024$) However, there was no statistically significant association between wearing a seat belt and gender, age or education.

4.2.3 Using Mobile phone while driving

According to the University Of Utah (2005), using mobile phone while driving will slow the ability to brake by up to 18%. Using mobile phone would also have the same harmful effect as having a 0.08% level of alcohol in the blood (Strayer *et al.*, 2006). Studies further show that young male drivers are most likely to use a mobile phone while driving (McEvoy *et al.*, 2006).

In the current study, 21.4% male and 22.1% female drivers admitted using mobile phone while driving, but 19.2% male and 21.2% female stated that they never use a mobile phone while driving. Similar results on using mobile phone while driving were observed when respondents were asked to indicate how frequently they had used a mobile phone while driving in the preceding two days. In total, 80% males and 79% females admitted using mobile phone while driving, even though the law does not allow this in the UAE (United Federal Traffic Law, 2008). The law currently states that if a person uses a mobile phone when engaged in the activity of driving then they will receive four penalty points on their licence and must pay 600 AED (ibid). In addition, since a famous football player in the UAE died in a traffic accident while using mobile phone and driving in September 2011 there has been more emphasis on the problem in the media here (Al Haddad, 2011). Despite this, there still needs to be more traffic safety awareness so that people will avoid using mobile phones when driving, thereby reducing accidents. People need to be aware that it is not only phone calls while driving which can cause accidents, it is also the use of phones and other technologies for electronic messaging (text messages/emails etc.) when driving.

There was a statistically significant association between using mobile phone while driving and nationalities ($p=0.045$) However, there was no statistically significant association between using mobile phone while driving and gender, age, monthly income or education.

4.2.4 Alcohol Consumption and Driving

According to the UK statistics in 2010, 250 people were killed and 9,700 injured from driving under the influence of driving (Department for Transport, 2011). Drink-driving accidents can be caused by all ages of drivers especially young drivers in the 20-24 age groups. Drinking alcohol reduces the ability for the driver to observe long distance objects by 25% and reduces the response time for the driver by 10 to 30%.

For example, in France the number of fatalities was reduced by 4% after lowering the limit to 50mg of alcohol in per 100 ml of blood (Institute of Alcohol Studies, 2010). In China the number of drink and driving cases decreased in the area of stricter law enforcement (Li *et al.*, 2012). It is very important to inform and educate people about the penalties of drink-driving. The inclusion of one story in the newspapers on the danger of drink-driving may reduce the number of people who drink alcohol and drive illegally (Sen, 2005).

From this study survey, 17% of male and 15% of female drivers admitted to drinking alcohol and driving in the UAE. 5.8% males and 4.2% females admitted driving a vehicle, once in the last one month, after drinking alcohol, while 1.2% of males and 1.1% of females had driven a vehicle after drinking alcohol on more than three occasions in the preceding month,.

There was a statistically significant association between drinking alcohol and nationality ($p=0.03$), education ($p<0.001$) and monthly income ($p=0.02$). However there was no

statistically significant association between drinking alcohol and gender or age. These results were unexpected and significant because RTA statistics in the UAE do not include drinking alcohol as one of the main causes of RTAs in the UAE. See Table 1 on the causes of RTAs in the UAE.

According to Act 49, Paragraph VII of the Federal Law No. 21 of 1995 Road Traffic Law in the UAE, a driver who drives his vehicle while under the influence of alcohol or drugs will be punished by imprisonment for not more than two years, a fine of not more than US\$ 1,860 or both and their driving licence will be cancelled.

4.2.5 Aggressive driving behaviour

The behaviour of the individual in any place of the world is sometimes affected by the culture and characteristics of the society in which he lives. In Abu Dhabi the population consists of around 85% of people who are not Emirati. 65% of male and 54% of female drivers confirmed that they had adopted aggressive driving behaviour and 70% of males and 71% of females admitted to being aggressive to other drivers on the roads.

4.2.6 Unsafe driving behaviour

Speed was ranked as the most common form of unsafe driving behaviour; 47% of males and 65% of females indicated that they had committed speeding violations more often than other types of unsafe driving behaviour. (Figure 10.a) shows the most common unsafe behaviour drivers commit on the roads while (Figure 10.b) indicates the most common

forms of unsafe driving behaviour drivers encounter on the roads. 33% of males and 40% of females indicated that speeding was the most unsafe form of driving behaviour encountered on the roads. According to the Institute for Safety Research in Netherlands, speed controls using radar cars can be effective in increasing road safety (SWOV, 2007).

4.2.7 Traffic law Enforcement

Police enforcement is very important for decreasing the problem of road accidents. The police need more powers to increase the number of alcohol breath test on the roads, increase penalties against drink-driving and to enforce speed limits so that the severity of RTAs can be reduced. According to the Global Status Report On Road Safety Time For Action, law enforcement reduced the number of serious injuries and fatalities in the UK by 33% and in the EU the law enforcement could reduce RTA problems by 50% (World Health Organization, 2009).

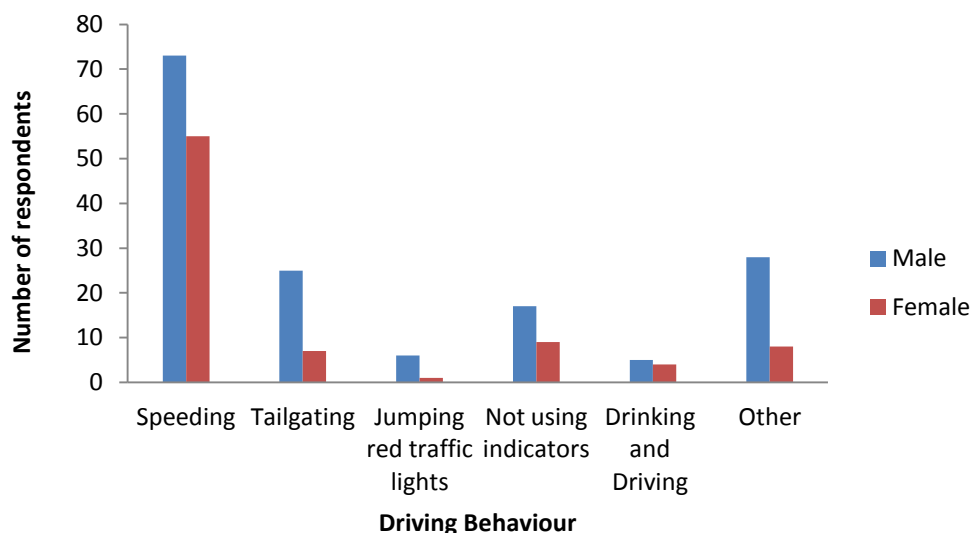


Figure 10.a: Commonly experienced aggressive driving behaviour that drivers commit on the road.

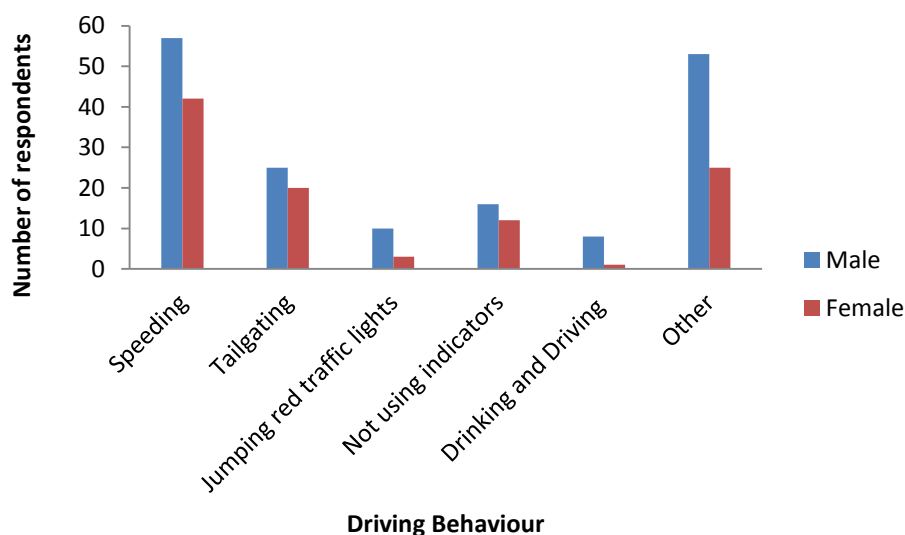


Figure 110.b: Commonly experienced aggressive driving behaviour that drivers encounter on the roads.

In this study, 68% of male and 55% of female drivers felt that the traffic enforcement was stringent enough on the Abu Dhabi roads.

4.2.8 Traffic campaigns

46.1% males and 38.8% females reported that they had never heard about traffic campaigns in Abu Dhabi. 23.9% of males and 35.6% of females preferred televisions (TV) as the main source of pedestrian traffic campaigns while 21.1% of males and 19.2% of females preferred the newspaper as the main source of these; 22.8% of males and 23.1% of females preferred the radio as the main source of pedestrian traffic campaigns, whereas 7.8% of males and 7.7% of females preferred using internet for such campaigns; 24.4% of males and 14.4% of females preferred ‘other’ sources, such as text messages, Twitter, blackberry and raising awareness of traffic safety in schools.

Since most drivers stated they preferred TV as the main source of traffic campaigns, this is something to consider when developing future campaigns and as there was a high percentage of drivers who preferred the radio as the main source for traffic safety then this is also something to include in future campaigns.

4.3 Demographic characteristics of the pedestrians respondents

This section presents all the relevant demographic characteristics of the pedestrian survey respondents, of the 280 pedestrian respondents, 62.9% were male and 37.1% female. (The demographic features of pedestrians are indicated in Tables 11-15.)

Table 11 shows the age profile of the respondents. It can be seen that the majority of the pedestrians were under 35 years old, while only 5.7% were aged 51-65. It is interesting to note there was a significantly higher proportion of young pedestrian respondents.

Table 11: Age of pedestrians

Age	Percentage
Less than 18	2.2
18-25	39.6
26-35	33.1
36-50	19.4
51-65	5.7
Total	100.0

Table 12: Marital status of pedestrians

Marital status	Gender Percentage	
	Male	Female
Single	23.9	54.8
Married	71.0	40.4
Others	5.1	4.8
Total	100.0	100.0

Table 12 shows the marital status profile of the respondents; most of the male pedestrians were married (71%) and most of the female pedestrians were single (54.8%). A small percentage represents the ‘other’ category (5.1% male and 4.8 % female).

Table 13 shows the nationality profile of the respondents. The majority of respondents were Emirati citizens (49.3%). 25.4% were ‘other Arab’ and 14.1% were Asian pedestrians. There was a lower percentage of European and Africans (2.5% and 1.1 respectively).

More than half the pedestrians were non-Emirati. This is an important factor to consider in traffic safety management as the majority of pedestrian deaths relating to RTAs in Abu Dhabi occur among the non-Emirati population. It is necessary to investigate whether there are differences in attitudes, perceptions and values as regards traffic safety between Emiratis and Non- Emiratis since some studies have reported differences in pedestrian injuries and ethnicity (Al-Shammari *et al.*, 2009; Steinbach *et al.*, 2010; Abdel-Rahman *et al.*, 2013).

Table 13: Nationalities of pedestrians

Nationality	Percentage
Emirati citizen	49.3
Gulf Cooperation Council , (GCC) Countries	5.8
Other Arab nationality outside GCC	25.4
Asian	14.1
European	2.5
African	1.1
Other nationalities	1.8
Total	100.0

Table 14 shows the monthly income profile of the respondents. 19.4% of the pedestrians did not work and the majority of those who worked earned less than AED 10,000 per month. Therefore, most people who cross the roads as pedestrians fall into low income groups.

Table 14: Monthly income of pedestrians

Monthly income	Percentage
Less than 2,000 AED	19.7
2,000 to 5,000 AED	15.8
5,001 to 10,000 AED	11.6
10,001 to 20,000 AED	19.5
More than 20,000 AED	14.0
Unemployed	19.4
Total	100.0

Table 15: Education of pedestrian

Education	Percentage
No qualification	8.6
Lower than high school	16.4
High school	35.8
Undergraduate	28.4
Post graduate	10.8
Total	100.0

Table 15 shows the education profile of the respondents. The data demonstrates that most of the pedestrians are at least educated to high school level, with 10% holding a postgraduate qualification. This means that when designing a traffic awareness campaign, the majority of pedestrians should have few problems in understanding and appreciating the information and laws.

4.3.1 Pedestrians involved in RTAs

Studies have shown that male pedestrians are killed or injured more often in road accidents than female pedestrians and females obey traffic rules on the crossing areas - such as zebra crossings - more than their male counterparts (Tom & Granié, 2011).

From the results of the study, 36% males and 31% females reported that they, or one of their relatives, had been involved in accidents as pedestrians. There was a statistically significant association between being involved in a traffic accident as a pedestrian and monthly income ($p=0.003$) and education ($p<0.001$). However, there was no statistically significant association between being involved in accidents and gender, age or nationality.

In relation to those responsible for RTAs involving pedestrians, 33% of the respondents blamed the drivers, 8% the pedestrians and 24% blamed both the drivers and pedestrians. More than a third of the respondents stated that no one was responsible for the RTAs involving pedestrians. Further studies are therefore needed to provide pedestrian injuries and mortality data in order to help improve road safety in the region.

There are very few published studies on RTAs 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. The provision of information packs to new arrivals in a number of countries have been shown to aid the integration of this group of people, and information on traffic rules and safety has been highlighted by pedestrians as necessary information to include.

4.3.2 Knowing the appropriate places designated for pedestrian crossing

Tom and Granié (2011) noted how studies have shown that in the places designated for pedestrian crossings men are more focused on the incoming cars and watch the cars more than women. Women are more aware than men when crossing the road at traffic lights and intersections (Tom & Granié, 2011). Matsui *et al.*, 2012 presented in their study that if the pedestrians did not use the pedestrian crossing to cross the roads, Average time to collision by vehicles will be shorter than when they use a pedestrian crossing (Matsui *et al.*, 2012) and a distance of two car lengths between a speed hump and the pedestrian crossing can improve the safety of pedestrians at a crossing (Johansson *et al.*, 2011).

From the results of the study, 84.6% male and 76.5% female reported that they knew places designated for pedestrian crossing. There was also a statistically significant association between knowing the places designated for pedestrian crossings and education ($p<0.001$) in addition to monthly income ($p<0.001$). However, there was no statistically significant association between knowing the places designated for pedestrian crossings and age, gender or nationality.

4.3.3 Crossing the road from places not designated for pedestrian crossings

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

There was also a statistically significant association between crossing the road from places not designated for pedestrian crossings and gender ($p=0.01$). It is therefore proposed that there should be more emphasis on targeting male pedestrians with traffic awareness campaigns. Males in particular need to be aware of the importance of crossing the road in places designated for pedestrians.

However, there was no statistically significant association between crossing the road from places not designated for pedestrian crossings and age, nationalities, education or monthly income.

4.3.4 Awareness of a pedestrian ticket for crossing roads at an inappropriate place

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

From this study, 16.7% of males and 11.8% of females reported that they had received a pedestrian ticket while in the UAE. This means that males in particular need to be aware of the regulations regarding pedestrian tickets and fines. The UAE traffic law currently states that if pedestrians cross the road in a place not specifically designed for pedestrians, they will incur a fine of 50 AED. There was a statistically significant association between receiving a pedestrian ticket while in the UAE and age ($p=0.02$), education ($p=0.002$) as well as monthly income ($p<0.001$). However, there was no statistically significant association between receiving a pedestrian ticket while in the UAE and gender or nationality. It is therefore suggested that pedestrians should continue to be encouraged to obey the laws of traffic safety and the police should increase patrols in urban areas to help address the problem of pedestrians crossing roads at inappropriate places.

4.3.5 Using mobile phone while crossing the road

Using mobile phone while crossing the road is one of the most reported hazardous habits among pedestrians; the latter take longer to cross the road when they are talking on a mobile phone. The results indicate that females are more likely to cross the road while using mobile phones (Hatfield & Murphy, 2007). It is important for pedestrians to be vigilant at all times (Wang et al., 2012) since using mobile phone when crossing makes it harder for pedestrians to recognise and act on crossing opportunities (Neider et al., 2010).

From this study, 65% of males and 51% of females admitted using mobile phone while crossing the roads. There was a statistically significant association 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 association between using mobile phone while crossing the road and nationality. 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. Traffic campaigns should therefore continue to address this unsafe pedestrian behaviour not only during targeted traffic campaigns but throughout the year.

4.3.6 Crossing the road as a pedestrian while under the influence of alcohol

A small number of studies have examined the effects of alcohol and RTAs among pedestrians. A study on the effect of alcohol impairment on road-crossing behaviour (Oxley *et al.*, 2006) reported that people who cross the road while under the influence of

alcohol are likely to take longer than people who are not. Pedestrian alcohol consumption has been identified as a contributory factor in pedestrian deaths (Bedford *et al.*, 2009; Vojtisek *et al.*, 2009).

From this study, 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 association between crossing the road after drinking alcohol and nationality ($p < 0.001$), education ($p < 0.001$), monthly income ($p < 0.001$) and gender ($p < 0.001$). However, there was no statistically significant association between crossing the road after drinking alcohol and age.

It is therefore proposed that all stakeholders involved in traffic safety should be made aware of this pedestrian behaviour so that they can educate both males and females on the dangers of crossing the roads after drinking alcohol.

4.3.7 Traffic campaigns

47% of males and 37% of females reported that they had never heard about traffic campaigns in Abu Dhabi. 27% of males and 36% of females preferred TV as the main source of pedestrian traffic campaigns, while 21% of males and 18.3% of females preferred the newspaper as the main source of pedestrian traffic campaigns. 21% of males and 13% of females however, preferred the radio as the main source of pedestrian traffic campaigns. A further 7.4% of males and 15.4% of females preferred using the internet as the main source of pedestrian traffic campaigns, with 23.3% of males and 21.2% of females preferring 'other' sources, such as text messaging, Twitter, blackberry in addition to raising awareness of traffic safety in schools. Since most pedestrians stated that they preferred TV as the main source of traffic campaigns, this is something to consider when developing future campaigns. Moreover, new technologies, such as Twitter and text messages should also be included. This is an interesting finding and one that can be used to target specific groups with traffic campaign messages.

4.4 Traffic Manager Interviews

Qualitative interviews were conducted with a number of traffic managers from the Abu Dhabi Police Traffic and Patrols Directorate

- Traffic Investigation Section Abu Dhabi - 12 Managers;
- Traffic Investigation Section Al Ain - 1 Manager;
- Traffic Investigation Section Al Mafraq - 1 Manager;
- Traffic Strategy Section - 4 Managers;

- Traffic Enforcement and Control Section - 5 Managers;
- Traffic Expert Section - 1 Manager;
- Traffic Training Section - 1 Manager;
- Traffic Discipline Section - 5 Managers;
- Public Relations Section - 5 Managers;
- Traffic Engineering and Radar Section - 5 Managers;
- SAAED, a private company for investigating minor accidents, -1 Manager;

Forty-one managers from different sections of the traffic department in Abu Dhabi were interviewed. The managers were selected based on the nature of their work and the relation of this to traffic accident reduction and investigation. The Managers were therefore asked questions related to the causes of accidents.

4.4.1 Causes of Accidents in Abu Dhabi:

Figure 11 shows the percentage of answers for the question ‘What are the causes of RTAs in Abu Dhabi?’ It can be seen from this figure that 34% of the answers attribute this to excessive speeding. However, excessive speeding is not mentioned as the main cause of RTAs in the Ministry of Interior Statistics for Abu Dhabi (Ministry of Interior, 2011). See Table 1 for the causes of RTAs in the UAE. Significantly, these statistics state that ‘carelessness’ is the main cause of RTAs in Abu Dhabi, because they do not have the equipment to measure the speed of vehicles during accidents (ibid). Therefore, Traffic investigators can only define the cause as ‘carelessness’. 16% of managers said that accidents are caused by driving without due care and attention, 13% blamed jumping red traffic lights and 13% stated that most accidents were caused by not keeping an adequate distance from the vehicles in front. The results for all other causes, were less than 6% and

included the use of a mobile phone while driving, drinking alcohol, flat tyres, weather (fog), pedestrian accidents and sudden deviations.

The managers were asked whether they had been involved in RTAs or not. 51% of the total number of managers indicated that they had been involved in one RTA. This means they have experienced these accidents and therefore are aware how they occurred. 25% of those involved in such accidents were investigators, and 24% stated they had not been involved in accidents.

4.4.2 Nationalities and ages of drivers

In the UK there is a Pass Plus scheme for new drivers which gives them a discount on car insurance (Elliott *et al.*, 2006). Pass Plus is a practical training course that takes at least 6 hours and helps drivers to improve their skills and drive more safely. *“It is designed to enable new drivers to gain experience and confidence, especially in conditions they may not have met during the pre-test training. It was designed by the Driving Standards Agency (DSA)”* (ibid).

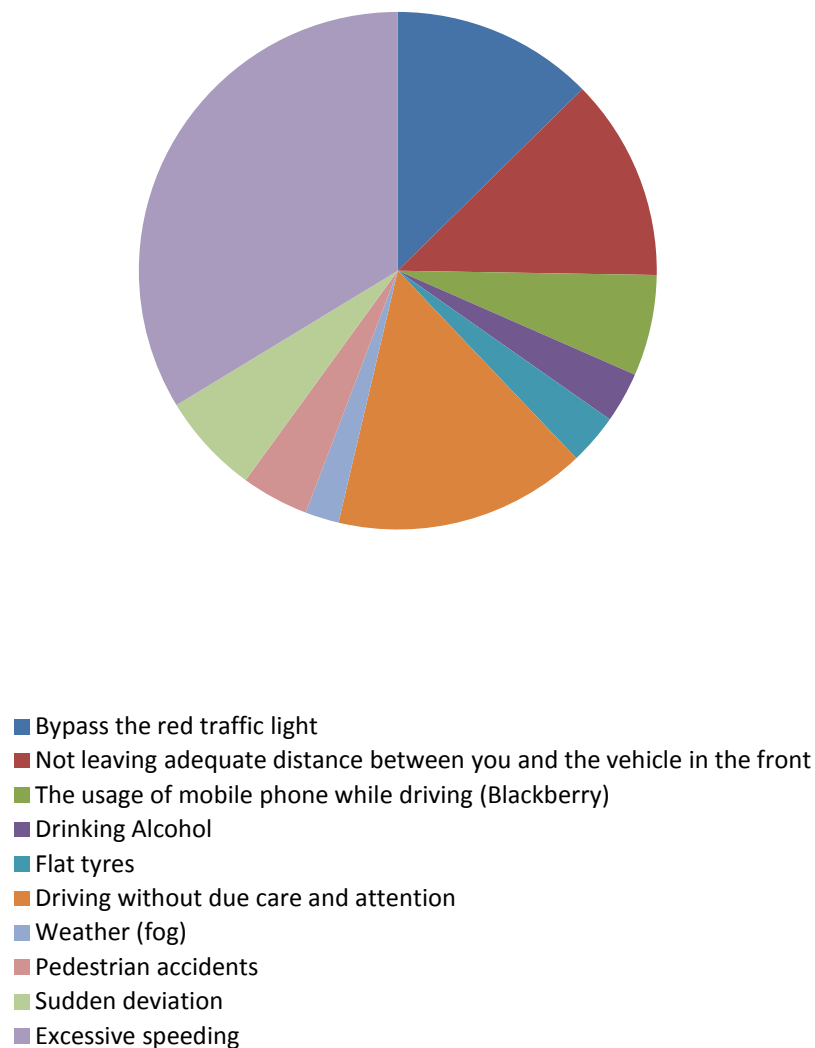


Figure 11: Pie-chart of traffic managers' responses to the causes of RTAs in Abu Dhabi.

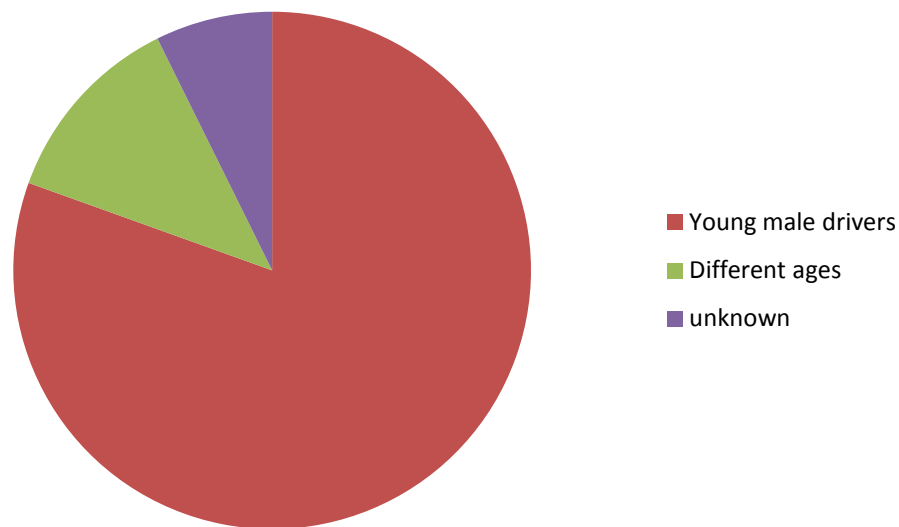


Figure 12: Pie-charts of traffic managers' response to the age of drivers who cause RTAs in Abu Dhabi.

According to the traffic managers, it was found that in terms of the ages of drivers who cause RTAs in Abu Dhabi (Figure 12). 81% are young male drivers (this being similar to the traffic department's statistics), 12% are of different ages and 7% indicated that they do not know the age of the drivers who cause accidents. As regards nationality, 41% of the managers stated that it was Asian drivers and pedestrians who cause RTAs, 39% stated it was Emirati drivers, and 20% stated that the drivers and pedestrians who cause RTAs have different nationalities. Based on these answers, the decision was made to focus on Asian and Emirati drivers and pedestrians when carrying out traffic campaigns and traffic awareness programs.

4.4.3 The number of Traffic Police Enforcement managers on the roads:

RTAs and injuries are preventable. According to the World Health Organisation, in high-income countries, the enforcement of legislation plays a very important role in reducing RTAs by controlling speed, alcohol consumption, making sure people wear seat belts and helmets, as well as promoting a safer design and use of roads and vehicles (Peden *et al.*, 2004).

49% of traffic managers indicated that the number of police managers who work on the road is a sufficient number, 32% indicated that the number is too small, and 19% stated that they do not know about the number of police managers who work on the roads. This shows that over half of police managers do not think there are enough police managers in Abu Dhabi and some do not know the size of the traffic police enforcement in the city. This is a concern since if there are insufficient traffic police managers working on the roads, this could increase the number of RTAs.

4.4.4 The experience of traffic police enforcers:

71% of traffic managers indicated that they do not know about the experience of police enforcers because the training program for each section depends on the needs and nature of the work. This is an interesting and also concerning finding because the police managers must know the experience of their colleagues and employees in order to help them develop and succeed in their work. 29% however did indicate that traffic enforcers do not have

enough experience and that they require more training courses. This is important as the traffic department needs to focus on training courses for police managers.

4.4.5 The age of police managers working in traffic department:

56% of traffic managers indicated that they do not know the ages of police managers, 39% stated that the police are aged between 20 and 45 years old, and 5% considered police managers to be elderly. It is important that the traffic departments mix more experienced police managers with newer ones to help the younger managers gain experience and knowledge about what the job involves.

4.4.6 The types of training courses - Continuing Professional Development Course (CPD)

22% of traffic managers indicated that they do not know what courses are taken by police enforcers, while 4% indicated that the traffic enforcers do not attend traffic accident investigation courses. It is very important for police managers to know about accidents and police managers must take courses addressing these areas. 37% of managers stated they attend courses on how to deal with the public, with 26% stating they attend foundation courses in traffic safety. Less than 5% indicated that they have taken a 'Traffic monitoring in external roads' training course, a riot control training course or a first aid training course. This shows that police managers need to attend more traffic safety courses and programs since these could significantly improve their awareness and impact on driver and pedestrian awareness.

4.4.7 Traffic campaigns carried out in Abu Dhabi in 2011

From the total of forty-one managers, four traffic managers indicated that they had not heard about any traffic campaigns over the last year (2011). This indicates that communication between the managers needs to be improved so that all managers are aware of current traffic campaigns. The majority of managers (24%) showed that they knew about the pedestrian campaigns because they reduced pedestrian accidents in commercial streets, 15% of managers stated they were aware of the traffic week campaigns, and 14% knew of the mobile phone campaigns. Only around 5% of managers were aware of the seat belts, tyre, child seat, and the traffic light campaigns in addition to the traffic campaigns on invalid or expired vehicles, speed, speed radar (Sniper/ Qunnass), risk campaign- extras and other campaigns.

66% of managers indicated that nobody had consulted them about starting any traffic campaigns, while 34% indicated that they had been informed of some traffic campaigns. Of those questioned, 24% indicated that the date of Gulf Traffic Week is important while 64% considered it unimportant and 12% of managers stated that they wanted to increase the number of Gulf Traffic Week campaigns. This suggests that Gulf Traffic Week should be changed from March to another time of year. For example, it may be more effective to hold Gulf Traffic Week during the summer school holidays when more people and children could be targeted. With only 12% of managers stating they wanted more Gulf Traffic Weeks, the other results from these interviews suggest that their traffic awareness needs to be improved and therefore they would benefit greatly from such campaigns.

4.4.8 The best way to create traffic awareness programs:

41% of traffic managers indicated that using TV to transmit traffic awareness programs is the best way to create traffic awareness, 12% cited education in schools, 9% supported sending text messages and 8% wanted to do this via newspapers and the distribution of booklets. Less than 6% of managers stated that traffic awareness programs should be used in companies and workplaces as well as by iPhone and Blackberry applications (apps), radio, internet, lectures and screens in public places.

4.4.9 Difficulties facing the traffic departments in implementing traffic safety programs:

Four percent of traffic managers indicated that they have no difficulty implementing traffic safety programs and 59% maintained that communicating with different nationalities (cultural transmission) is the most difficult aspect of their work, especially when dealing with people with different languages and behaviour. 13% maintained there was a lack of coordination with external agencies working with the traffic departments to reduce RTAs: examples of these are the transportation authority and the health authority. 12% indicated that traffic managers should behave politely and in a collaborative manner, as well as being flexible with the public with regard to minor mistakes or errors. 10% claimed that educating students at schools is also difficult because students need special courses to teach them about traffic safety. Finally, two percent pointed to the non-compliance of young drivers regarding traffic safety rules.

This shows that the biggest problem with implementing traffic awareness campaigns in Abu Dhabi revolves around language barriers and people with different kinds of behaviour. It is therefore proposed that new traffic safety campaigns should be designed for people who speak a number of different languages, such as English, Urdu.

4.4.10 Decreasing the risk of RTAs:

49% of traffic managers stated that using traffic awareness programs is the best way to reduce RTAs in Abu Dhabi. 17% considered the existence of visible traffic patrols in the streets to be very important and 13% thought that accidents could be reduced through engineering solutions such as the expansion of roads and pedestrian cross walk areas. 11% indicated using radars (speed cameras) as a deterrent, six percent wanted to enforce the wearing of seat belts, and four percent supported the use of road humps.

This shows that nearly half the managers agree that traffic awareness programs are the most effective way of reducing RTAs and therefore more campaigns should be organised and delivered to the public.

4.4.11 Precautions to be taken to ensure traffic safety on Abu Dhabi's roads.

The majority of answers here were split between traffic awareness and enforcement. In terms of awareness, the results showed that 27% of managers considered general road safety programs to be the best precaution for RTAs, 12% felt that the public should cooperate more with the police and traffic laws, while four percent stated that using electronic screens on the roads would be a good precaution for preventing RTAs. In terms of enforcement, the results showed that 21% of managers considered there should be more

police and civil traffic patrols and 20% wanted more speed cameras and radar. Only two percent of the managers considered warnings before fines would be helpful, two percent stated that the traffic law should be reviewed, four percent stated there should be an increase in police enforcement during bad weather (such as fog) and eight percent had no idea about which precautions should be taken to ensure traffic safety on Abu Dhabi's roads. This reveals the extent of the problem relating to RTAs in Abu Dhabi. Clearly, if traffic safety managers are not aware of the best precautions then the public and citizens will also not understand the importance of traffic safety and how to prevent accidents either.

4.4.12 Opinions about using traffic calming measures.

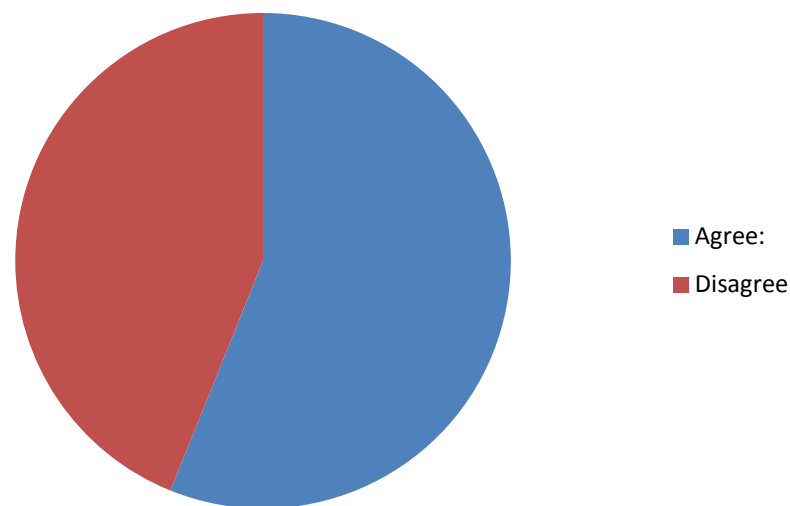


Figure 13: Pie-chart of traffic managers' response to applying traffic calming measures

56% of traffic managers agreed that using traffic calming measures would be useful in reducing RTAs in Abu Dhabi (figure 13). 44% disagreed and thought that the use of traffic calming measures in urban areas would increase traffic congestion in the city. Some of the reasons given against these methods are that they have insufficient scientific evidence. The author recommends providing the managers with evidence based on appropriate data to show the benefit of using traffic calming measures in the country.

4.4.13 Manager's recommendations about traffic accident risk reduction:

Recommendations include: holding traffic courses in schools, increasing traffic awareness programs, increasing traffic law enforcement against violations, having additional speed cameras, increasing pedestrian designated areas, greater cooperation with the public, better education on traffic safety within companies and workplaces, preventing the sale of used tires, the control of traffic signals and a review of driving license procedures. Managers also expressed the view that there should be more studies and research about traffic problems. All of these recommendations must be considered when applying traffic accident reduction strategies in the country.

4.5 Causes of RTAs in Abu Dhabi

The results of this study indicated that nearly half the male drivers and around a third of female drivers reported that they had been involved in RTAs. 36% of male and 31% of female pedestrians reported that they, or one of their relatives, had been involved in accidents as pedestrians, while 51% of the total number of managers showed that they had been involved in RTAs; this clearly demonstrates the extent of the problem of RTAs in Abu Dhabi.

4.5.1 Alcohol consumption for drivers and pedestrians

RTA statistics in the UAE do not include drinking alcohol as one of the main causes of RTAs in the UAE (see Table 1 on the causes of RTAs in the UAE). From this study, it

was apparent that a number of drivers and pedestrians admitted drinking alcohol and driving or crossing the road after drinking alcohol in the UAE. The results of the study also indicated a specific link between alcohol drinking for either drivers or pedestrians and RTAs in Abu Dhabi. There was a statistically significant association between drinking alcohol for drivers or pedestrians and their respective nationalities, education and monthly incomes.

4.5.2 Using a seat belt whilst driving

The results of this study demonstrated how failing to wear a seat belt is very risky and contributes to more fatalities than any other unsafe driving behaviour; the chance of being fatally injured in a traffic accident increases by 50% if a seat belt is not used. Nevertheless, more than half the drivers said they do not always wear a seat belt while driving. There was a statistically significant association between wearing a seat belt and nationalities and monthly income.

4.5.3 Using mobile phone while driving or crossing roads

The results of the study made it clear that using mobile phone while driving or crossing roads either as a driver or pedestrian is one of the most reported forms of risky behaviour in Abu Dhabi and a high percentage of respondents admitted to this practice.

4.5.4 Aggressive driving behaviour

There was a clear link between the answers that participants gave for the most unsafe driving behaviour and the most common unsafe driving behaviour encountered on the roads; speed was ranked as the most unsafe driving behaviour and 47% of males and 65% of females indicated that they had driven over the speed limit

4.5.5 Age of drivers who cause RTAs

Young people 18-25 years are the people most likely to cause RTAs. According to the Ministry of Interior statistics, young people have the highest number of injuries, these being caused by speeding and their failure to wear seat belts. From the results of the study, it was found that 81% of drivers who cause RTAs in Abu Dhabi are young male drivers. Young people are more likely to drive faster than older drivers and are also more likely to drive dangerously, without considering the risks. Additional to this, drink-driving accidents can be caused by all drivers of all ages, but especially by young drivers.

4.5.6 Nationalities of drivers and pedestrians who causes RTAs

From the results of the study, it was found that with regard to nationality, 41% of traffic managers considered Asian drivers and pedestrians to be likely to cause RTAs in Abu Dhabi, while 39% of traffic managers stated that Emirati drivers are most likely to cause RTAs here. This data is similar to that of the Ministry of Interior in Abu Dhabi.

4.5.7 Crossing roads at undesignated places

From the study it was discovered that most pedestrians reported they were aware of pedestrian tickets for crossing roads at undesignated places: half the male participants and 35% of the females reported that most of the time they crossed the road in places not designated for pedestrian crossings, while 16.7% of males and 11.8% of females reported that they received a pedestrian ticket while crossing the roads in the UAE.

4.6 Methods to reduce RTAs

Having evaluated the data from the drivers, pedestrians and traffic managers, the study proposes the following approaches to reducing RTAs in Abu Dhabi. It is also important that the people who are going to implement these approaches should be able to apply them. All the evidence here was obtained from the drivers, pedestrians and traffic managers

4.6.1 Traffic law Enforcement

In the study it was found that police enforcement is very important in decreasing the problem of road accidents. The police require greater powers to increase the number of alcohol breathalyzer tests on the roads, to increase penalties against drink-driving and people not wearing seat belts and to enforce speed limits in order to reduce the severity of RTAs . In this way, traffic law enforcements could reduce RTA problems by half every year. Over half the police managers stated that there are insufficient numbers of police officers in Abu Dhabi and some do not know the size of the traffic police enforcement in the city.

4.6.2 Traffic campaigns

From the results of the study it was found that most female drivers and pedestrians (nearly 36%) preferred TV as the main source of traffic campaigns and this is something to consider when developing future campaigns. Additionally, 41% of police managers indicated that using the TV to transmit traffic awareness programs is the best way to raise traffic awareness. This is an interesting finding and one that can be used to target specific groups with traffic campaign messages. There was also a high percentage of drivers who preferred the radio as the main source for traffic safety information, and this should be borne in mind for future campaigns. From the results of this study, it was found that 66% of traffic managers reported that nobody had consulted them about starting traffic campaigns, while 34% indicated that they had been informed of some traffic campaigns but not all.

4.6.3 Education traffic safety programs

The education profile shows that 88.9% of drivers and 91.4% of the pedestrians were educated to at least high school level. The traffic departments should therefore provide traffic safety education programs in all schools so that road safety for children and teenagers can be achieved through educational programs. The latter should also focus on traffic safety issues, such as speeding, drink driving, using mobile phones and any other types of distractions.

4.6.4 Traffic calming measures on roads

This study found that 44% of traffic managers thought the use of traffic calming measures in urban areas would increase traffic congestion in the city. Some of those questioned, argued that because of a lack of scientific evidence to support the idea that traffic calming measures would work, they did not think they would reduce RTAs. However, traffic calming measures play a very important role in changing driver behaviour over time and using them can be useful for pedestrian protection.

4.6.5 A welcome pack for new arrivals to the UAE

There have been a number of studies completed in a number of countries on the issues related to immigrants and how they can be helped to quickly integrate into their new communities. Most of those studies have been on diseases like HIV/AIDS, tuberculosis, malaria, diabetes and sexual health related issues so that appropriate resources would be allocated to address the issues identified.

In developed countries, the central governments have been delegating this responsibility to local authorities to look for ways to build relationships between new arrivals and local population. Most of the local authorities have developed welcome packs that contain information on details of support information available to the new arrivals. Some local authorities have developed resource centre staffed by experienced staff who provide guidance and information to new arrivals.

While welcome packs are only able to address some of the issues encountered by new arrivals, partly due to variable needs of the new arrivals, there is overwhelming evidence

that the welcome packs are a useful tool to aid in the integration of new arrivals to life in the countries they live. However, there is very limited information on packs specifically on traffic rules and regulations. In New Zealand, a campaign to dispel bad Asian drivers' myth was completed in Canterbury in 2003 targeting home stay providers for students. A survey on the needs of new settlers in Hamilton, New Zealand, identified information on traffic rules as one of the highly necessary information requested by new settlers (Ho et al. 2003).

The Environment Minister in Northern Ireland launched road safety packs for migrant groups in 2008, that included a DVD with five new instructional advertisements that would provide all drivers with a reminder of the need for attentive driving.

This study found that the use of welcome packs for new arrivals in Abu Dhabi would help them quickly learn the traffic rules and regulations of the country, and this would greatly decrease the risk of RTAs. From the recent population data in Abu Dhabi, it can be seen that 80% are non - Emirati and the population average annual growth of nearly 8% is mainly due to migration.

It is proposed to use information packs for new arrivals in Abu Dhabi to help them to quickly learn the traffic rules and regulations in the country, as this would definitely decrease the number of traffic accidents associated with this group.

The information pack will include information on the following:

- Traffic rules and regulations

- Rules of the road: the highway code
- Driving: age restrictions
- Driving licence
- Insurance
- Public transport
- Parking regulation
- Car registration
- Speed limits
- Seatbelts
- Drink driving
- Minor and major traffic accidents.
- Use of mobile phone while driving
- Pedestrian crossing the road
- Traffic awareness week

In addition, the problems with implementing traffic awareness campaigns in Abu Dhabi revolve around language barriers. It is therefore proposed that new traffic safety campaigns should be designed for people who speak a number of different languages, such as English, Urdu.

Chapter Five

Stakeholder meetings to discuss recommendations from the study

Chapter Five Stakeholder meetings to discuss recommendations from the study

5.1 Introduction

The results of the study were presented to Abu Dhabi police managers, drivers and managers from other emirates. The results of the study were discussed with the decision makers six stakeholder meetings were conducted to through a series of workshops. Discuss the participants' knowledge and attitudes concerning road traffic accidents reduction methods. The author then presented the results to the following managers and drivers:

- Traffic Statistics Section manager
- Traffic Studies Section manager
- Traffic Enforcement Section manager
- Serious Accident Investigation Section manager - Abu Dhabi
- Serious Accident Investigation Section manager - Al Ain
- Serious Accident Investigation Section manager - Abu Dhabi Highway
- Criminal Investigation for Traffic (CID) Section manager
- Traffic Investigation Section manager
- Engineering Section manager
- Traffic Section manager - Al Kznah
- Traffic Section manager- Al Rhba
- Two Drivers (Second Year Students from the University)
- Traffic Managers from other Emirates: three managers

The main goal of a stakeholder meeting is to discuss the results of the study in order to improve traffic safety in Abu Dhabi through quality of awareness programs and traffic campaigns. The first presentation was conducted with four groups in the traffic departments; the fifth group involved two young drivers; the sixth group had three traffic managers from different emirates in the UAE. The participants were asked the question: *“Are these suggestions workable?”*

Table 16: Draft suggestions from the study- Using a seat belt

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
<p>Percentage of respondents who do not always wear a seat belt while driving was 55% male and 53% female. When being driven by someone else, 66% of males and 67% of females do not always wear a seat belt.</p> <p>There was a statistically significant association between wearing a seat belt and nationality ($p = .018$) and monthly income ($p = .024$) However there was no statistically significant association between wearing a seat belt and gender, age or education.</p>	<p>All vehicles in high income countries have standards regulations for safety, such as seat belts, airbags etc. Failing to wear a seat belt is risky driving behaviour and contributes to more fatalities than any other unsafe driving behaviour (Fernando et al., 2012)</p> <p>Seat belts prevent around 50% of fatal injuries in a traffic accident (Ma <i>et al.</i>, 2012).</p>	<p>Failure to fasten a seat belt while driving 400AED fine and 4 traffic points.</p>	<p>Educating drivers and passengers with traffic safety programs and awareness campaigns. Drivers should be particularly targeted and informed of the importance of wearing a seat belt. Traffic managers must be stricter with enforcing the use of seat belts.</p>	<p>All the groups agreed with this suggestion</p>

Table 17 : Draft suggestions from the study- Using mobile phone while driving

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
<p>From the study, it was clear that 80% of males and 79% of females admitted using mobile phone while driving.</p> <p>There was a statistically significant association between using mobile phone while driving and nationality($p=.045$)</p> <p>However, there was no statistically significant association between using a mobile phone while driving and gender, age, monthly income or education.</p>	<p>According to the University of Utah 2005, using mobile phone while driving will slow the ability to brake by up to 18%.</p> <p>Using mobile phone may also cause a similar distraction as driving with 0.08% level of alcohol in the blood (Strayer et al., 2006).</p> <p>Young male drivers are most likely to use a mobile phone while driving (McEvoy <i>et al.</i>, 2006).</p>	<p>Using a hand-held mobile phone while driving 200AED fine and 4 traffic points.</p>	<p>Educating drivers with traffic safety programs and awareness campaigns. Traffic managers must be more strict about enforcing the law against the use of mobile phones while driving.</p>	<p>All groups agreed with this suggestion</p>

Table 18: Draft suggestions from the study- Drinking alcohol and driving

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
<p>From our survey, 17% of male and 15% of female drivers admitted to drinking alcohol and driving in the UAE. 5.8% of males and 4.2% of females admitted driving a vehicle one time in the previous month after drinking alcohol. 1.2% of males and 1.1% of females had, on more than three occasions in the previous month, driven a vehicle after drinking alcohol.</p> <p>There was a statistically significant association between drinking alcohol and nationality ($p = .03$), education ($p = .00$) and monthly income ($p = .02$). However there was no statistically significant association between drinking alcohol and gender or age.</p>	<p>Drink-driving accidents can be caused by drivers of all ages, especially young drivers in the 20-24 age group. Drinking alcohol reduces the ability of the driver to observe long distance objects by 25% and lessens the response time of the driver by 10 to 30%.</p> <p>For example, in France the number of fatalities were reduced by 4% after lowering the limit to 50mg of alcohol per 100 ml of blood (Institute of Alcohol Studies, 2010).</p>	<p>Driving under the influence of alcohol, drugs or similar substances: the fine is decided by the court - 24 traffic points and vehicle confiscated for 60 days</p>	<p>All drivers must carry a breathalyzer while driving cars in the UAE.</p> <p>Traffic managers must enforce the law against drinking alcohol and driving. In China, the number of drink and driving cases decreased in areas of stricter law enforcement (Li et al., 2012).</p>	<p>Most of the groups did not accept this suggestion.</p> <p>They did agreed, however, that all alcohol analysis must be carried out by the police.</p>

Table 19: Draft suggestions from the study- Knowing the designated places for pedestrian crossings

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
From the results of the study, 84.6% of males and 76.5% of females reported that they knew the designated places for pedestrian crossings. There was a statistically significant association between knowing the places designated for pedestrian crossings and education ($p<0.001$) as well as monthly income ($p<0.001$). However, there was no statistically significant association between knowing the places designated for pedestrian crossings and age, gender or nationality.	Studies have shown that in the places designated for pedestrian crossings, men are more focused on the incoming cars and watch the cars more than women. Women, however, are more aware than men when crossing the road at traffic light intersections (Tom & Granié, 2011). Average Time to collision by vehicles when pedestrians do not use the pedestrian crossings is shorter than when pedestrians use a pedestrian crossing (Matsui et al., 2012) and a distance of two car lengths between a speed hump and the pedestrian crossing can improve the safety of pedestrians at the crossing (Johansson et al., 2011).	The Directorate of Traffic and Patrols increased the value of the fine from AED 50 to AED 200 for pedestrians who cross roads from non-designated areas.	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. The traffic departments need to intensify awareness programs and conduct traffic campaigns to prevent pedestrians from crossing at places not designed for pedestrian crossing.	All the groups agreed with this suggestion

Table 20: Draft suggestions from the study- Crossing the roads from places not designated for pedestrian crossing

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
<p>From the results of the study, 50% of males and 35% of females reported that most of the time they crossed the road from places not designated for pedestrian crossings. This was surprising as most respondents had indicated that they knew the designated places for crossing the roads. It is therefore proposed that this should be a key theme during traffic awareness campaigns.</p> <p>There was a statistically significant association between crossing the road from places not designated for pedestrian crossings and gender ($p=0.01$). However, there was no statistically significant association between crossing the road from places not designated for pedestrian crossings and age, nationality, education or monthly income.</p>	<p>Studies have shown that on the places designated for pedestrian crossings, men are more focused on the incoming cars and watch the cars more than women. Women are more aware than men when crossing the road at traffic light intersections (Tom & Granié, 2011). Time to collision by vehicles when pedestrians do not use pedestrian crossings is shorter than when pedestrians use a pedestrian crossing (Matsui et al., 2012) and a distance of two car lengths between a speed hump and the pedestrian crossing can improve the safety of pedestrians at a crossing (Johansson et al., 2011).</p>	<p>The Directorate of Traffic and Patrols increased the value of the fine from AED 50 to AED 200 for pedestrians who cross roads from non-designated areas.</p>	<p>There is a need to increase traffic patrols in order to reduce the number of drivers who do not give priority to pedestrians at designated pedestrian crossing. The traffic departments need to intensify awareness programs as well as traffic campaigns to prevent pedestrians from crossing at places not designed for pedestrian crossings.</p>	<p>All the groups agreed with this suggestion</p>

Table 21: Draft suggestions from the study- Awareness of a pedestrian ticket for crossing roads at an inappropriate place

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
From the results of the study, 65% of males and 54% of females reported that they were aware of a pedestrian ticket for crossing roads at an inappropriate place. There was a statistically significant association between being aware of the penalty of 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 association between being aware of the penalty of a pedestrian ticket for crossing roads at an inappropriate place and age, gender or nationality.	Studies have shown that in the places designated for pedestrian crossings, men are more focused on the incoming cars and watch the cars more than women. Women are more aware than men when crossing the road at traffic lights intersections (Tom & Granié, 2011). Time to collision by vehicles when pedestrians do not use pedestrian crossings is shorter than when pedestrians use a pedestrian crossing (Matsui et al., 2012) and a distance of two car lengths between a speed hump and the pedestrian crossing can improve the safety of pedestrians at a crossing (Johansson et al., 2011).	The Directorate of Traffic and Patrols increased the value of the fine from AED 50 to AED 200 for pedestrians who cross roads from non-designated areas.	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 pedestrians crossing roads at inappropriate places.	All the groups agreed with this suggestion

Table 22: Draft suggestions from the study- Using mobile phone while crossing the road

Results from the data collections	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
From the study, 65% of males and 51% of females admitted using mobile phone while crossing the roads. There was a statistically significant association 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 association between using mobile phone while crossing the road and nationality.	Using mobile phone while crossing the road is one of the most reported forms of unsafe behaviour among pedestrians. Pedestrians who cross the road while talking on a mobile phone take longer to cross the road and results indicate that females are more likely than men to cross the road when using mobile phones (Hatfield & Murphy, 2007) It is important for pedestrians to be vigilant at all times when crossing the road (Wang et al., 2013a) as using mobile phone when crossing the road makes it harder for pedestrians to recognise and act on crossing opportunities (Neider et al., 2010)	The author is not aware of any legislation in the UAE	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	All the groups agreed with this suggestion

Table 23: Draft suggestions from the study - crossing the road as a pedestrian while drunk

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
From 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 association between crossing the road after drinking alcohol and nationality ($p < 0.001$), education ($p < 0.001$), monthly income ($p < 0.001$) and gender ($p = 0.001$). However, there was no statistically significant association between crossing the road after drinking alcohol and age.	A few studies have examined the effects of alcohol and RTAs among pedestrians. A study on the effects of alcohol impairment on road-crossing behaviour (Oxley et al., 2006) 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 (Bedford et al., 2009; Vojtisek et al., 2009)	The author is not aware of any legislation in the UAE	It is proposed that stakeholders are made aware of this pedestrian behaviour to encourage coordinated effort among all concerned to educate pedestrians on the dangers of crossing the roads after drinking alcohol.	All the groups agreed with this suggestion

Table 24: Draft suggestions from the study - the use of a welcome pack as an appropriate method to reduce RTAs

Results from the data collection	Results from the published literature	UAE Traffic Law	Recommendations from the author	Recommendations after the stakeholder meeting
Traffic police managers indicated that the distribution of a welcome pack should not be limited to the airport, but should also be handed out in departments of preventative medicine and by health authorities in Abu Dhabi. All newcomers must follow this process because it is a necessary requirement when applying for or renewing a resident visa.	There are very limited studies on welcome packs specifically dealing with traffic rules and regulations. In New Zealand, a campaign to dispel the negative Asian driver myth was completed in Canterbury in 2003, targeting home stay providers for students. A survey on the needs of new settlers in Hamilton, New Zealand, identified information on traffic rules as highly necessary information that was requested by new settlers (Ho et al., 2003).	The Author is not aware of any legislation in the UAE	The author discussed and recommended the use of a welcome pack as an appropriate method to reduce RTAs in Abu Dhabi. These packs were also designed to inform the new arrivals about the country and the importance of traffic safety as well as to explain the traffic law in the country.	All the groups agreed with this suggestion

Each table from (16 to 24) summarises a particular driver and/or pedestrian behaviour that impacts on RTAs throughout Abu Dhabi. Each table summarises the results from the researcher's data collection, information from previously published literature, the UAE traffic law, the researcher's recommendations on how to address this issue and the recommendations after the stakeholder meetings.

5.1.1 Not wearing a seat belt while driving.

The author recommends starting awareness programs for drivers to provide them with good examples of the importance of wearing seat belts while driving. All the respondents gave their opinions about using seat belts and every group agreed with the suggestion, some groups even adding further effective suggestions. The first group stated that: *“the awareness of using a seat belt must start at schools with all ages, and not only be limited to the drivers”*. The second group expressed the view that *“the awareness programs about using a seat belt must be taken to the shopping centres and sport clubs. There will be a huge number of people at these places so the awareness programs will reach all types of society”*. The third group indicated that *“the police departments must focus on working in areas such as offices and companies. The workers need an awareness program in their language, because most of the drivers come from poor countries and they need to learn about the law of the country, not only using seat belts, they also need more awareness programs”*.

5.1.2 Using mobile phone while driving

The author suggested that traffic safety programs and awareness campaigns should target drivers. All the respondents gave their opinions about using mobile phone while driving, and everyone was in agreement about the need for greater awareness concerning the importance of not using mobile phone while driving. Group number two added that *“the traffic departments should increase the penalty for drivers who drive their cars while using mobile phone”*.

5.1.3 Drinking alcohol and driving

The author suggested that stricter law enforcement was needed. For example, every driver should carry a breathalyzer while driving, this being similar to the laws in France, Sweden and Finland (Andersson et al., 2013; Radun et al., 2013). However, only groups two and five accepted these suggestions. The members of these groups considered that there should be more enforcement against drinking alcohol and driving because the UAE is an open country and it includes people from all over the world. The other groups- one, three four and six - did not accept this suggestion. The members stated that *“because we are in a Muslim society we reject this procedure, especially asking drivers to carry a breath analyser while driving”*. They agreed that all alcohol analysis should be carried out by the police. It is very important for police managers to carry a breathalyzer in their police cars, as is the case in Germany, Canada, USA and the UK (Harvey et al., 2013; Jones & Harding, 2013; Roiu et al., 2013; Solomon & Chamberlain, 2013).

5.1.4 Knowledge of places designated for pedestrian crossings

The author suggested that there was a need to increase traffic patrols in order 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 their vehicles on pedestrian crossings. Additionally, the traffic departments should intensify awareness programs and traffic campaigns to prevent people crossing at places not designed for this. All the groups agreed with these suggestions and group two added: *“we need to increase pedestrian crossing places in collaboration with the Department of Transport. We need more collaboration with them to built new crossing areas on the roads”*.

5.1.5 Crossing the road at places not designated for pedestrian crossings

The author suggested that there was 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 lessen the number of drivers who park vehicles on pedestrian crossings. In addition, the traffic departments need to intensify awareness programs and traffic campaigns to prevent pedestrians from crossing at places not designed for this purpose. Every group agreed with these suggestions and there were no additional comments or suggestions.

5.1.6 Awareness of penalty ticket for crossing roads at an inappropriate place

The author suggested that pedestrians should continue to be encouraged to obey the law on traffic safety and that the police should increase patrols in urban areas to help address this problem. All the respondents gave their opinions, and every group agreed with these suggestions. Group number two added that: *“The traffic engineering department should make barriers to prevent pedestrians crossing anywhere in the city, especially near shopping centres and parks”*. Additionally, group three stated that *“the awareness programs must be carried out in working places and companies”*.

5.1.7 Using mobile phone while crossing roads

The author put forward the suggestion that traffic campaigns should continue to address this unsafe pedestrian behaviour not only during targeted traffic campaigns, but throughout the year. It was disappointing that such a high percentage of respondents admitted to this practice. All the respondents gave their opinions about using mobile phones while crossing the road. Group numbers one, three, four and six agreed with these suggestions, while numbers two and five disagreed. They stated that *“we cannot prevent people from using their mobile phone while crossing roads. Also, there is no law in the country that prevents pedestrians from using mobile phone while crossing roads”*. The best suggestion is to inform the pedestrian about that traffic safety programs, and awareness campaigns should target pedestrians.

5.1.8 Crossing the road as a pedestrian while drunk

The author suggested that traffic stakeholders should be made aware of this pedestrian behaviour to encourage a coordinated effort among all concerned and to educate pedestrians about the dangers of crossing the road after drinking alcohol; all the groups agreed with these suggestions. There were some comments from group numbers two and three: group two stated that *“the traffic department should increase violations for those who cross roads after drinking alcohol”* while group three stated that the *“law in the UAE prevents nightclubs from letting drunk people go out after drinking alcohol”*.

5.1.9 The use of a welcome pack as an appropriate method to reduce RTAs among non-Emirati

One of the proposed methods for tackling RTAs is the use of information packs for new arrivals in Abu Dhabi to help them quickly learn the traffic rules and regulations in the country; this would clearly decrease the number of traffic accidents associated with this group. In recent population data in Abu Dhabi, it was established that 80% are non - Emirati and the population average annual growth of nearly 8% is mainly due to migration (Abu Dhabi Statistics Center, 2011). All the groups agreed with this proposal, and considered that all drivers and pedestrians would find it useful. Group number four stated: *“the proposal is very useful for residents and visitors in the country to reduce the risk of RTAs. Also the distribution of a welcome pack should not be limited to the airport, but also to departments of preventative medicine and health authorities in Abu Dhabi. All newcomers must follow this process because it is a necessary requirement in applying for or renewing a resident visa”*.

5.2 Recommendations to be incorporated in the Abu Dhabi road traffic strategy

At the end of the stakeholder meetings, the following recommendations were suggested for incorporation into the Abu Dhabi traffic strategy.

- **Using a seat belt**

The recommendation here is that traffic awareness programs for using a seat belt must start in schools with all ages, and not only be limited to drivers. It is very important to show good examples of the importance of wearing seat belts while driving.

- **Using mobile phone while driving**

This recommendation is that traffic safety programs and awareness campaigns should target all drivers. Additionally, the traffic departments should increase the penalty for drivers who drive their cars while using mobile phone

- **Drinking alcohol and driving**

It is recommended that all alcohol analysis should be carried out by the police.

- **Knowing the places designated for pedestrian crossings and crossing the road at places not designated for pedestrian crossing**

The recommendation here is for the traffic departments to intensify awareness programs and traffic campaigns to prevent pedestrians from crossing at places not designed for this purpose.

The traffic departments must 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.

- **Awareness of a penalty tickets for crossing roads at inappropriate places**

Here it is suggested that all pedestrians should continue to be encouraged to obey the law on traffic safety. Awareness programs must be carried out in work places and companies and the police should increase patrols in urban areas to help address the lack of awareness about penalty tickets for jay walking.

- **Using mobile phone while crossing roads**

This recommendation is to inform pedestrians about traffic safety programs and to conduct awareness campaigns which target pedestrians not only during targeted traffic campaigns, but throughout the year.

- **Crossing the road as a pedestrian while drunk**

It is important to educate all pedestrians about the dangers of crossing the road as a pedestrian while drunk. The number of traffic police should also be increased and the traffic department must punish offenders more who cross the road after drinking alcohol.

- **The use of a welcome pack as an appropriate method to reduce RTAs among non-Emirati people.**

As previously mentioned, there should be welcome packs for new arrivals in Abu Dhabi to help them to quickly learn the traffic rules and regulations in the country. This would thereby decrease the risk of RTAs. In addition, the problem with implementing traffic awareness campaigns in Abu Dhabi revolves around language barriers. It is therefore proposed that new traffic safety campaigns should be designed for people who speak a number of different languages, such as English and Urdu.

5.3 Discussions with stakeholders on other issues relating to RTAs.

Having discussed the recommendations from the study, the stakeholders were subsequently invited to discuss further issues relating to RTAs.

5.3.1 Why speeding is the major cause of accidents in Abu Dhabi

The participants were asked the question: *“Why do you think speeding is the major cause of accidents in Abu Dhabi?”*

Group numbers one and three stated: *“it is difficult to keep control of a vehicle while driving at high speeds. Also, the severity of the damage to the vehicle and the large number of injuries and deaths can lead to the safe assumption that speed is the main cause of accidents in the UAE”*. Group two pointed out that *“the normal driver reaction time is between 1.6 to 2 seconds, so he can not make a decision to slow down before this time, therefore at high speed he cannot control the vehicle and slow down”*. Group four stated the view that *“there are no awareness programs about the risk of speed at schools and universities; all young drivers have new and modern vehicles capable of high speeds and they are not aware of the risks of driving too fast on the road”*. Group five indicated how *“as young drivers we love to speed, and sometimes we need to speed to reach places on the time, especially on the highway. Also, the roads in the UAE help us to speed, as they are open roads with 6 lanes on the highways”*. Groups six stated that *“speed is the main cause of accidents in the UAE, not just Abu Dhabi, because the drivers cannot keep control of their vehicles”*.

This shows that future traffic campaigns need to focus specifically on reaction times, young drivers and the importance of traffic safety over rushing to reach particular destinations (work, home, shops/restaurants etc.) as quickly as possible.

5.3.2 What can we do to encourage our young people to be more careful on roads

The participants were asked the question: *“What can we do to encourage our young people to be more careful on our roads?”*

All the groups indicated that we need to increase traffic awareness programs for young drivers. Additionally, the number of enforcement measures, such as using speed cameras, must be increased. Group number one stated that *“the government must build places for young people to practice their hobbies, such as race tracks”* while group two stated that *“the traffic departments must show photos and video of severe accidents to create a strong impression”*. Group number four was keen that *“young people must get involved in seminars and lectures to show them the risks of RTAs”*.

5.3.3 How to be involved in planning for traffic campaigns

The participants were asked the question: *“How do you want to be involved in planning for traffic campaigns?”*

All the groups indicated the need to increase traffic awareness programs through TV programs and text messages. Group three stated that *“the section managers must hold workshops with police officers and discuss the things required to start traffic campaigns. Then they must take the suggestions to the directors and heads of the department to come up with traffic awareness*

programs”. Group four stated that “the traffic departments must work with cultural institutions in the community, such as sports clubs, and ask people about traffic problems they face and how we can solve them”.

5.3.4 What practical steps to encourage better cooperation among the teams involved in RTAs

The participants were asked the question: “What practical steps do you propose to encourage better cooperation among the teams involved in RTAs?”

All the groups indicated the need for greater cooperation among the teams involved in RTAs: there should be regular meetings between the separate parties throughout the year and a review of the results of the meetings every few months. Group two indicated that *“there is a need for the establishment of a strategic partnership between the departments working on reducing RTAs. Also, there is a need to use experts who can help and find solutions to this problem”.*

5.3.5 What are some practical ways to encourage collaboration between the police and stakeholders as regards traffic issues

The participants were asked the question: “What are some practical ways to encourage collaboration between the police and stakeholders as regards traffic issues?”

There are many suggestions regarding practical ways to encourage collaboration between the police and stakeholders concerning traffic issues. Moreover, such collaboration is vitally important, especially if it will unify efforts to reduce RTAs. In this regard, group one stated the following: *“Increasing training sessions for all police staff will help them to deal with the challenges facing the traffic departments”*. Group two were of the view that *“increased cooperation with the media and cooperation between the Department of Traffic Engineering and municipalities and transportation Authority will help to increase traffic safety awareness”*, while group three considered that *“the traffic departments should call stakeholders for regular meetings, and motivate and honour the participants”*.

5.3.6 Traffic Accident Investigation

A number of issues relating to RTAs were highlighted, such as using speed cameras, wearing seat belts, using mobile phones and Blackberry messenger when driving. In terms of speed as a cause of accidents, and although investigators can calculate the speeds in some severe RTAs, the public prosecutor in the United Arab Emirates does not accept these calculations. The consequence of this is that investigators estimate speeds by the severity of damage to the vehicles involved. Hence, speed was not established as a cause of accidents in Abu Dhabi.

5.3.7 Traffic Awareness Programs

The decision to start a traffic awareness program must be based on the participation of the managers and directors within the different traffic safety departments, and their views and

opinions should also be taken in to consideration. There must also be a strategic plan to organise traffic campaigns, while simultaneously assessing the results of these campaigns according to scientific standards. Subsequent to this, the students gave their own views and opinions about RTAs in Abu Dhabi, and consideration was given to ways of reducing RTAs. In particular, the students suggested the following measures:

- Increasing the number of speed cameras used
- Stressing the importance of wearing seat belts
- Using mobile phones and social network devices (e.g. Blackberry Messenger) to make people aware of safety measures.

Chapter Six

Conclusion

Chapter Six Conclusion

6.1 Introduction

This chapter begins by summarizing the findings of this research project. It then includes the causes of RTAs in Abu Dhabi and indicates method to reduce RTAs in Abu Dhabi. Lastly, it includes the suggesting what further research is needed.

1. The holistic approach has been used to investigate the causes of RTAs using questionnaire for drivers and pedestrians and also key informant interviews for traffic managers and stakeholders
2. There has not been a previous comprehensive evaluation of RTAs investigation in the country.
3. All traffic managers approached for the study agreed to take part and they indicated that they were looking forward to work and implement RTA recommendations from the study.
4. The recommendations that were derived from drivers, pedestrians and key informant interviews developed the recommendations which were discussed with appropriate stakeholders. The stakeholders meeting made some amendments to recommendations which formed the basis for a benchmark RTAs policy for Abu Dhabi.
5. The study has identified the causes of RTA's in Abu Dhabi as
 - Alcohol consumption for drivers and pedestrians.
 - Not wearing seat belt while driving.
 - Using Mobile phone while driving.

- Using Mobile phone while crossing roads as a pedestrian.
- Aggressive driving behaviour, The most unsafe driving behaviours are speeding, tailgating, not using indicators and jumping red traffic lights.
- Age of drivers, Young people 18-25 years are the one who are likely to causes RTAs in Abu Dhabi.
- Nationalities of drivers, drivers from Asia and the UAE are likely to causes RTAs in Abu Dhabi.
- Nationalities of pedestrians, pedestrian from Asia are likely to causes RTAs in Abu Dhabi.
- Crossing roads at undesignated places.

6. The study has identified methods to reduce RTAs in Abu Dhabi

- Traffic law Enforcement.
- Traffic campaigns.
- Education traffic safety programs as a tool to reduce RTAs in Abu Dhabi.
- Traffic calming measures.
- Welcome pack for new arrivals as a development of a appropriate method to reduce RTAs.

6.2 Further research

- As there are more than 200 nationalities in the UAE, It is recommended that future studies on RTAs should consider using different languages during data gathering and dissemination of the results.
- Further studies can be made on the area of road traffic accidents by undertaking similar projects into other regions of the UAE.
- From the results of this study it was felt to be useful to obtain feedback from taxi drivers in the country mainly due to their high usage of roads (over 12 hrs/day).

REFERENCES

- Abbas AK, Hefny AF & Abu-Zidan FM (2011) Seatbelt compliance and mortality in the Gulf Cooperation Council countries in comparison with other high-income countries. *Ann Saudi Med* **31**, 347-350.
- Abdel-Rahman N, Siman-Tov M, Group IT & Peleg K (2013) Ethnicity and road traffic injuries: differences between Jewish and Arab children in Israel. *Ethnicity & health* **18**, 391-401.
- Abu Dhabi eGovernment Gateway (2013). Abu Dhabi Systems and Information Centre (ADSIC). Abu Dhabi eGovernment, UAE.
- Abu Dhabi Statistics Center (2011) Statistical Yearbook of Abu Dhabi 2011: Abu Dhabi Statistics Center, Abu Dhabi, UAE.
- Af Wåhlberg A (2012) Changes in driver celeration behaviour over time: Do drivers learn from collisions? *Transportation Research Part F: Traffic Psychology and Behaviour* **15**, 471-479.
- Al-Mawlawi s (2013) Qatar National Traffic Safety Strategy: Qatar Ministry of interior, Qatar.
- Al-Shammari N, Bendak S & Al-Gadhi S (2009) In-depth analysis of pedestrian crashes in Riyadh. *Traffic injury prevention* **10**, 552-559.
- Al Haddad A (2011) Theyab Awana's relative hopes death will highlight danger. The National, UAE.

Al Murshidi G (2014) Participation challenges of Emirati and Saudi students at US universities. *International Journal of Research Studies in Language Learning* **3**, 33-52.

Alemaný R, Ayuso M & Guillén M (2013) Impact of road traffic injuries on disability rates and long-term care costs in Spain. *Accident Analysis & Prevention* **60**, 95-102.

Ameratunga S, Hajar M & Norton R (2006) Road-traffic injuries: confronting disparities to address a global-health problem. *The Lancet* **367**, 1533-1540.

Andersson AK, Karlsson A, Pettersson H & Hoek B (2013) Unobtrusive Breath Testing. In *International Conference on Alcohol, Drugs and Traffic Safety (T2013), 20th, 2013*: Brisbane, Queensland, Australia.

Andruszkow H, Lefering R, Frink M, Mommsen P, Zeckey C, Rahe K, Krettek C & Hildebrand F (2013) Survival benefit of helicopter emergency medical services compared to ground emergency medical services in traumatized patients. *Critical Care* **17**, R124.

Antić B, Pešić D, Vujanić M & Lipovac K (2013) The influence of speed bumps heights to the decrease of the vehicle speed–Belgrade experience. *Safety Science* **57**, 303-312.

Ar-Riyadh Development Authority (2011) Strategic traffic safety in the city of Riyadh. Riyadh, KSA.

Ariën C, Jongen EM, Brijs K, Brijs T, Daniels S & Wets G (2013) A simulator study on the impact of traffic calming measures in urban areas on driving behavior and workload. *Accident Analysis & Prevention* **61**, 43-53.

Arnold LS, Flannery A, Ledbetter L, Bills T, Jones MG, Ragland DR & Spautz L (2013) Identifying Factors that Determine Bicyclist and Pedestrian-Involved Collision Rates and

Bicyclist and Pedestrian Demand at Multi-Lane Roundabouts. California PATH Program.
Institute of Transportation Studies, University of California at Berkeley, California

Asian Development Bank (ADB) (2005) The Cost of Road Traffic Accident in Malaysia.
Asian Development Bank, Malaysia.

Atamo MA (2012) Safety assessment of freeway merging and diverging influence areas based
on conflict analysis of simulated traffic, University of Colorado, Colorado.

Ayuso M, Guillén M & Alcañiz M (2010) The impact of traffic violations on the estimated
cost of traffic accidents with victims. *Accident Analysis & Prevention* **42**, 709-717.

Banerjee P & Shogren JF (2014) Bidding behavior given point and interval values in a second-
price auction. *Journal of Economic Behavior & Organization* **97**, 126-137.

Beattie J, Covey J, Dolan P, Hopkins L, Jones-Lee M, Loomes G, Pidgeon N, Robinson A &
Spencer A (1998) On the contingent valuation of safety and the safety of contingent valuation:
part 1-caveat investigator. *Journal of Risk and Uncertainty* **17**, 5-26.

Bedford D, McKeown N, O'Farrell A & Howell F (2009) Alcohol levels in killed drivers and
pedestrians on Irish roads 2003-2005: a national study. *Irish medical journal* **102**, 310-312.

Belin M-Å, Tillgren P & Vedung E (2012) Vision Zero—a road safety policy innovationd.
International Journal of Injury Control and Safety Promotion **19**, 171-179.

Bener A & Crundall D (2005) Road traffic accidents in the United Arab Emirates compared to
Western countries. *Advances in Transportation Studies an international Journal Section A* **6**,
5-12.

Bryman A (2012) *Social research methods*: Oxford university press.

Bushell MA, Poole BW, Zegeer CV & Rodriguez DA (2013) Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public Chapel Hill, Highway Safety Research Center, University of North Carolina, US.

Cambon de Lavalette B, Tijus C, Poitrenaud S, Leproux C, Bergeron J & Thouez J-P (2009) Pedestrian crossing decision-making: A situational and behavioral approach. *Safety Science* **47**, 1248-1253.

Campbell M, Stone D, Kleinberg K & McLean R (2014) Down but not out: incidence and estimated costs to society of road casualties in Strathclyde, Scotland. *Public health* **128**, 350-353.

Castro M, Iglesias L, Sánchez JA & Ambrosio L (2011) Sight distance analysis of highways using GIS tools. *Transportation research part C: emerging technologies* **19**, 997-1005.

CCMTA (2011) Canada's Road Safety Strategy 2015. Canadian Council of Motor Transport Administrators, Canada.

Charlton SG & Starkey NJ (2013) Driver risk from blood alcohol levels between 50mg/100ml and 80mg/100ml December 2013. Traffic and Road Safety Research Group, University of Waikato, Hamilton.

Chen G (2010) Road traffic safety in African countries – status, trend, contributing factors, countermeasures and challenges. *International Journal of Injury Control and Safety Promotion* **17**, 247-255.

Choi J, Tay R & Kim S (2013) Effects of changing highway design speed. *Journal of Advanced Transportation* **47**, 239-246.

Constant A, Salmi LR, Lafont S, Chiron M & Lagarde E (2009) Road Casualties and Changes in Risky Driving Behavior in France Between 2001 and 2004 Among Participants in the GAZEL Cohort. *American Journal of Public Health* **99**, 1247-1253.

Corbin J & Strauss A (2008) *Basics of qualitative research: Techniques and procedures for developing grounded theory*: Sage, Los Angeles, CA.

Cornelissen M, Salmon PM, McClure R & Stanton NA (2013) Using cognitive work analysis and the strategies analysis diagram to understand variability in road user behaviour at intersections. *Ergonomics* **56**, 764-780.

Corniche Hospital (2014) Corniche Hospital at a glance. Abu Dhabi, UAE.

Creswell JW (2013) *Research design: Qualitative, quantitative, and mixed methods approaches*: Sage, Los Angeles, CA.

David P, Ece O, Özdemiroglu & al. e (2002) Economic Valuation with Stated Preference Techniques Summary Guide. Department for Transport, Local Government and the Regions, London.

de Blaeij A, Florax RJ, Rietveld P & Verhoef E (2003) The value of statistical life in road safety: a meta-analysis. *Accident Analysis & Prevention* **35**, 973-986.

de Oña J, Mujalli RO & Calvo FJ (2011) Analysis of traffic accident injury severity on Spanish rural highways using Bayesian networks. *Accident Analysis & Prevention* **43**, 402-411.

Department for Transport (2008) Road Casualties in Great Britain: Main Results: 2007. Department for Transport, London.

Department for Transport (2011) Reported Road Casualties in Great Britain: 2010 Annual Report. Department for Transport, London.

Department for Transport (2013a) National road safety communications activity calendar: Department for Transport, London.

Department for Transport (2013b) Reported Road Casualties Great Britain.2012. Department for Transport, London.

Department of the Environment (2013) Northern Ireland Road Safety Strategy to 2020. Department of the Environment, Belfast.

Dionne G, Lanoie P & Transportation CfRo (2002) *How to make a public choice about the value of a statistical life: The case of road safety*: École des hautes études commerciales, Montreal, Canada.

Dissanayake D, Radin Umar S, Faudzi M, Widyastuti H, Bentotage S & Herijanto W (2008) Inter Regional Valuation of Road Casualties and Exploration of Social Attitudes to Road Casualty Reduction in Southeast Asian Countries, Thailand, Malaysia and Indonesia, ICRA-EASTS, ICRA Final Report.

Donnell ET (2013) Review of Fundamentals of Road Design by Wolfgang Kühn. *Journal of Transportation Engineering* **139**, 1146-1147.

Downing A (1997) Accident Costs in Indonesia: A Review. In *International Conference on Road Safety*. Andhra University, Visakhapatnam, India.

Drever E (1995) *Using Semi-Structured Interviews in Small-Scale Research. A Teacher's Guide*: Scottish Council for Research in Education, Glasgow.

Edquist J, Rudin-Brown CM & Lenné MG (2012) The effects of on-street parking and road environment visual complexity on travel speed and reaction time. *Accident Analysis & Prevention* **45**, 759-765.

El-Sadig M, Nelson Norman J, Lloyd OL, Romilly P & Bener A (2002) Road traffic accidents in the United Arab Emirates: trends of morbidity and mortality during 1977–1998. *Accident Analysis & Prevention* **34**, 465-476.

Elliott M, House C & Ride NM (2006) Can we use the Cohort II data to explore the effects of taking Pass Plus? *Behavioural Research in Road Safety 2006 Sixteenth Seminar*, 225.

Elmqvist C, Brunt D, Fridlund B & Ekebergh M (2010) Being first on the scene of an accident—experiences of ‘doing’prehospital emergency care. *Scandinavian journal of caring sciences* **24**, 266-273.

European Road Safety Observatory (2006) Vehicle Safety – web text of the European Road Safety Observatory.[online] Available at: <[http:// www.europa.eu/](http://www.europa.eu/)>: [Accessed 25 March 2011].

Ewing R & Brown SJ (2009) Traffic Calming Progress Report. *Planning* **75**, 32-35.

Fambro D, Fitzpatrick K & Koppa R (1997) NCHRP Report 400: Determination of Stopping Sight Distances. *Transportation Research Board, National Research Council, Washington, DC*.

Fell JC, Todd M & Voas RB (2011) A national evaluation of the nighttime and passenger restriction components of graduated driver licensing. *Journal of Safety Research* **42**, 283-290.

Fernando DMG, Vadysinghe AN, Sudasinghe N & Premasinghe K (2012) Use of seat belts: prior to the legal requirement. *Sri Lanka Journal of Forensic Medicine, Science & Law* **2**, 23-25.

Garrod GD, Scarpa R & Willis KG (2002) Estimating the Benefits of Traffic Calming on through Routes: A Choice Experiment Approach. *Journal of Transport Economics and Policy* **36**, 211-231.

Gorrell C (2014) Narrowing The Gap: Correlating Street Width And Pedestrian Safety To Justify Narrowing Urban Streets. Department Of Landscape Architecture and Regional Community Planning College Of Architecture Planning Design, Kansas State University, Manhattan.

Gyrd-Hansen D (2013) Using the Stated Preference Technique for Eliciting Valuations: The Role of the Payment Vehicle. *PharmacoEconomics* **31**, 853-861.

Halder S & Naidu JG (2012) A Study on Employee Burnout in IT Sector.

Harper S, Strumpf E, Burris S, Davey Smith G & Lynch J (2012) Do Mandatory Seat Belt Laws Affect Socioeconomic Inequalities in Seat Belt Use? ,Working paper.

Harvey AJ, Kneller W & Campbell AC (2013) The elusive effects of alcohol intoxication on visual attention and eyewitness memory. *Applied cognitive psychology* **27**, 617-624.

Harvey T (1992) Review of current traffic claiming techniques Institute for Transport Studies (ITS), University of Leeds, Leeds.

Hassan MN, Hawas YE & Maraqa MA (2012) A holistic approach for assessing traffic safety in the United Arab Emirates. *Accident Analysis & Prevention* **45**, 554-564.

Hatfield J & Murphy S (2007) The effects of mobile phone use on pedestrian crossing behaviour at signalised and unsignalised intersections. *Accident Analysis & Prevention* **39**, 197-205.

Hejazi R, Shamsudin MN, Radam A, Rahim KA, Ibrahim ZZ & Yazdani S (2013) Estimation of traffic accident costs: a prompted model. *International Journal of Injury Control and Safety Promotion* **20**, 152-157.

Henrik A & Nicolas T (2009) The Value of a Statistical Life: LERNA, University of Toulouse.

Hensher DA, Rose JM, Ortúzar JdD & Rizzi LI (2009) Estimating the willingness to pay and value of risk reduction for car occupants in the road environment. *Transportation Research Part A: Policy and Practice* **43**, 692-707.

Hills PJ & Jones-Lee MW (1983) The role of safety in highway investment appraisal for developing countries. *Accident Analysis & Prevention* **15**, 355-369.

Ho ES, Lidgard JM, Cowling WE & Bedford RD (2003) Knowledge for new settlers: a survey of needs in Hamilton. Migration Research Group and Anthropology Department, University of Waikato, New Zealand.

Huang HF & Cynecki MJ (2011) The Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior. McLean. Federal Highway Administration, Turner Fairbank Highway Research Center, US Department of Transportation, US.

INSEE (2013) Definitions and methods-Definitions Road accidents. National Institute for Statistics and Economic Studies, France.

Institute of Alcohol Studies (2010) IAS Fact Sheet – Drinking and Driving. IAS Secretariat, Cambridgeshire.

Ivan JN, Garrick NW & Hanson G (2009) Designing roads that guide drivers to choose safer speeds.

Jacobs G (1995) Costing road accidents in developing countries. In *OVERSEAS ROAD NOTE 10*. Transport Research Laboratory, Crowthorne.

Jacobs G, Aeron-Thomas A, Astrop A & Britain G (2000) Estimating global road fatalities. Transport Research Laboratory, Crowthorne.

Jha N, Srinivasa D, Roy G, Jagdish S & Minocha R (2004) Epidemiological study of road traffic accident cases: A study from South India. *Indian J Community Med* **29**, 20-24.

Jia K, Fleiter JJ, King MJ, Sheehan MC, Dunne MP & Ma W (2013) Reducing alcohol-related driving on China's roads: Traffic police officers' perceptions and practice. In *In Road Safety on Four Continents 16th International Conference*. Beijing, China.

Johansson C, Rosander P & Leden L (2011) Distance between speed humps and pedestrian crossings: Does it matter? *Accident Analysis & Prevention* **43**, 1846-1851.

Johansson O, Pearce D & Maddison D (2014) *Blueprint 5: True Costs of Road Transport*. Routledge.

Jones-Lee MW, Loomes G & Philips P (1995) Valuing the prevention of non-fatal road injuries: Contingent valuation vs. standard gambles. *Oxford Economic Papers*, 676-695.

Jones AW & Harding P (2013) Driving under the influence with blood alcohol concentrations over 0.4 g%. *Forensic science international* **231**, 349-353.

- Karaca P & Ridgeway G (2010) Behavioral impact of graduated driver licensing on teenage driving risk and exposure. *Journal of Health Economics* **29**, 48-61.
- Kenya Roads Board (2013) Strategic plan 2013-2017-Kenya. Kenya Roads Board, Nairobi, Kenya.
- Kitzinger J (1995) Qualitative research. Introducing focus groups. *BMJ: British medical journal* **311**, 299.
- Kumar A, Lalwani S, Agrawal D, Rautji R & Dogra T (2008) Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years. *Indian Journal of Neurotrauma* 2008, Vol. 5, No. 2, pp. 63-67.
- Larice M (2013) Motor vehicle with several active or passive safety devices: U.S. Patent Application 13/757,229.
- Larson K, Henning K & Peden M (2012) The importance of data for global road safety. *Traffic injury prevention* **13**, 3-4.
- Le H, van Geldermalsen T, Lim WL & Murphy P (2011) Deriving Accident Costs using Willingness-to-Pay Approaches-A Case Study for Singapore. *Australasian Transport Research Forum 2011 Proceedings*, 1-16.
- Lee G, Joo S, Oh C & Choi K (2013) An evaluation framework for traffic calming measures in residential areas. *Transportation Research Part D: Transport and Environment* **25**, 68-76.
- Leisch J & Leisch J (1977) New concepts in design-speed application. *Transportation Research Record*.

- Li Y & Fernie G (2010) Pedestrian behavior and safety on a two-stage crossing with a center refuge island and the effect of winter weather on pedestrian compliance rate. *Accident Analysis & Prevention* **42**, 1156-1163.
- Li Y, Xie D, Nie G & Zhang J (2012) The drink-driving situation in China. *Traffic injury prevention* **13**, 101-108.
- Liu S, Han J, Nacif M, Jones J, Kawel N, Kellman P, Sibley CT & Bluemke DA (2013) Sample size calculation for clinical trials using cardiac magnetic resonance partition coefficient and extracellular volume fraction for the assessment of diffuse myocardial fibrosis. *Journal of Cardiovascular Magnetic Resonance* **15**, P39.
- Ma S, Tran N, Klyavin VE, Zambon F, Hatcher KW & Hyder AA (2012) Seat belt and child seat use in Lipetskaya Oblast, Russia: frequencies, attitudes, and perceptions. *Traffic injury prevention* **13**, 76-81.
- Machin D, Campbell MJ, Tan S-B & Tan S-H (2011) *Sample size tables for clinical studies*: John Wiley & Sons.
- Mackie PJ (2003) *Cost Benefit Analysis of Transport Infrastructure Projects*: United Nations Publications.
- Manner H & Wunsch-Ziegler L (2013) Analyzing the severity of accidents on the German Autobahn. *Accident Analysis & Prevention* **57**, 40-48.
- Martin S (2009) The new regulation of traffic calming areas in France. In *European Transport Conference*. Association for European Transport, Netherlands.
- Matsui Y, Hitosugi M, Takahashi K & Doi T (2012) Situations of Car-to-Pedestrian Contact. *Traffic injury prevention* **14**, 73-77.

- McEvoy SP, Stevenson MR & Woodward M (2006) Phone use and crashes while driving: a representative survey of drivers in two Australian states. *Medical journal of Australia* **185**, 630-634.
- Mearkle JPE (2009) Road Safety Fundamentals. Cornell Local Roads Program, Ithaca, New York.
- Ministry of Interior (2011) Traffic Accidents Reports. Abu Dhabi, UAE.
- Ministry of Interior (2013) Traffic Accidents Reports. Abu Dhabi, UAE.
- Moen B-E & Rundmo T (2006) Perception of Transport Risk in the Norwegian Public. *Risk Management* **8**, 43-60.
- Mohan D (2006) *Road traffic injury prevention: training manual*: World Health Organization, Geneva.
- Muijs D (2010) *Doing quantitative research in education with SPSS*: Sage.
- Munk MD, Carboneau DM, Hardan M & Ali FM (2008) Seatbelt use in Qatar in association with severe injuries and death in the prehospital setting. *Prehosp Disaster Med* **23**, 547-552.
- Naja R (2013) A Survey of Communications for Intelligent Transportation Systems. In *Wireless Vehicular Networks for Car Collision Avoidance*, pp. 3-35: Springer.
- Naumann RB, Dellinger AM, Zaloshnja E, Lawrence BA & Miller TR (2010) Incidence and total lifetime costs of motor vehicle-related fatal and nonfatal injury by road user type, United States, 2005. *Traffic injury prevention* **11**, 353-360.
- Navin F, Zein S & Felipe E (2000) Road safety engineering: an effective tool in the fight against whiplash injuries. *Accident Analysis & Prevention* **32**, 271-275.

Navrud S & Strand J (2013) Valuing global public goods: a European Delphi stated preference survey of population willingness to pay for Amazon rainforest preservation. Policy Research Working Paper Series, The World Bank, New York.

Nedumaran C, Ramachandran T & Kaliyaperumal K (2013) 4 Es: Environment, Education, Engineering and Enforcement on Road Safety in Indian context. *International Conference on Technology and Business Management March* **18**, 20.

Neider MB, McCarley JS, Crowell JA, Kaczmariski H & Kramer AF (2010) Pedestrians, vehicles, and cell phones. *Accident Analysis & Prevention* **42**, 589-594.

Nguyen H, Ivers RQ, Jan S, Martiniuk AL, Li Q & Pham C (2013) The economic burden of road traffic injuries: evidence from a provincial general hospital in Vietnam. *Injury prevention* **19**, 79-84.

Nicholl J, West J, Goodacre S & Turner J (2007) The relationship between distance to hospital and patient mortality in emergencies: an observational study. *Emergency Medicine Journal* **24**, 665-668.

Organization for Economic Co-operation and Development (2012) Road safety annual report 2011. In *InternationalTransport Forum*. : International Traffic Safety Data and Analysis Group, Organization for Economic Co-operation and Development(OECD), Paris.

Oxley J, Lenné M & Corben B (2006) The effect of alcohol impairment on road-crossing behaviour. *Transportation Research Part F: Traffic Psychology and Behaviour* **9**, 258-268.

Paine M, Griffiths M & Magedara N (2007) The Role of Tyre Pressure in Vehicle Safety, Injury and Environment. Caringbah, New South Wales state, Australia

- Peden M, Kobusingye O & Monono M (2013) Africa's roads-the deadliest in the world. *SAMJ: South African Medical Journal* **103**, 228-229.
- Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E & Mathers CD (2004) World report on road traffic injury prevention: World Health Organization, Geneva.
- Pérez K, Marí-Dell'Olmo M, Tobias A & Borrell C (2007) Reducing Road Traffic Injuries: Effectiveness of Speed Cameras in an Urban Setting. *American Journal of Public Health* **97**, 1632-1637.
- Perkins A (2010) Abu Dhabi urban street design manual: Abu Dhabi Urban Planning Council, Abu Dhabi, UAE.
- Petrie A & Watson P (2013) *Statistics for veterinary and animal science*: John Wiley & Sons.
- Plan L, Recommendation M & Grant D (2010) Garioch Area Committee Report–21 February 2012. *WAY* **2**, 1.
- Radun I, Ohisalo J, Rajalin S, Radun JE, Wahde M & Lajunen T (2013) Alcohol Ignition Interlocks in All New Vehicles: A Broader Perspective. *Traffic injury prevention* **15**, 335-342.
- Ribeiro LML (2011) How Does the Criminal Justice System Operate from an Empirical Point of View? An Analysis of the Netherlands Case. *European Journal on Criminal Policy and Research* **17**, 267-284.
- Richard A, Retting SA, Ferguson AT & McCartt (2003) A Review of Evidence-Based Traffic Engineering Measures Designed to Reduce Pedestrian–Motor Vehicle Crashes. *American Journal of Public Health* **93**, 1456-1463.

- Roiu I, Birngruber CG, Spencer VC, Wollersen H, Dettmeyer R & Verhoff MA (2013) A comparison of breath-and blood-alcohol test results from real-life policing situations: A one-year study of data from the Central Hessian Police District in Germany. *Forensic science international* **232**, 125-130.
- Sabbour S & Mibrahim JM (2010) Driving Behaviour, Driver Style and Road Traffic Accidents among Young Medical Group. In *Safety 2010. 10th World Conference* ,London
- Salmon PM, McClure R & Stanton NA (2012) Road transport in drift? Applying contemporary systems thinking to road safety. *Safety Science* **50**, 1829-1838.
- Schumacker R & Tomek S (2013) Chi-Square Test. In *Understanding Statistics Using R*, pp. 169-175: Springer.
- SCRCOG. (2008) Traffic Calming Resource Guide. South Central Regional Council of Governments, Fitzgerald & Halliday Inc, Hartford
- Sen A (2005) Do Stricter Penalties or Media Publicity Reduce Alcohol Consumption by Drivers? *Canadian Public Policy / Analyse de Politiques* **31**, 359-379.
- Sharif AA, Blair I, Taha NF & Loney T (2013) Health systems in the United Arab Emirates: progression, challenges and future directions. *International Journal of Behavioural and Healthcare Research* **4**, 270-282.
- Shen X, Yan Y, Li X, Xie C & Wang L (2013) Analysis on tank truck accidents involved in road hazardous materials transportation in China. *Traffic injury prevention* **15**, 762-768.
- Silverman D (2013) *Doing qualitative research: A practical handbook*: SAGE Publications Limited.

- Smithers M (2013) To gauge the attitude, behaviour and knowledge of students in the age group 18 to 30 in relation to drinking and driving. Dublin Institute of Technology, Dublin.
- Solomon R & Chamberlain E (2013) Canada's New Drug-Impaired Driving Law: The Need to Consider Other Approaches. *Traffic injury prevention* **15**, 685-693.
- Stanojević P, Jovanović D & Lajunen T (2013) Influence of traffic enforcement on the attitudes and behavior of drivers. *Accident Analysis & Prevention* **52**, 29-38.
- Steinbach R, Green J, Edwards P & Grundy C (2010) 'Race' or place? Explaining ethnic variations in childhood pedestrian injury rates in London. *Health & place* **16**, 34-42.
- Strayer DL, Drews FA & Crouch DJ (2006) A comparison of the cell phone driver and the drunk driver. *Human factors: The journal of the human factors and ergonomics society* **48**, 381-391.
- Sun H, Yang D & Chen C (2013) Research and Application on Traffic Safety Education to Migrant Workers. *Procedia-Social and Behavioral Sciences* **96**, 418-424.
- SWOV (2007) Police enforcement and driving speed. SWOV Fact sheet. SWOV Institute for Road Safety Research, Leidschendam.
- SWOV (2009) The relation between speed and crashes. SWOV Fact sheet. SWOV Institute for Road Safety Research, Leidschendam.
- Tester JM, Rutherford GW, Wald Z & Rutherford MW (2004) A matched case-control study evaluating the effectiveness of speed humps in reducing child pedestrian injuries. *American Journal of Public Health* **94**, 646.

The Department of the Environment's planning (1995) Vehicular Access to All-Purpose Trunk Roads. The Department of the Environment's planning, Northern Ireland.

The Department of the Environment's planning (1999) Development Control Advice Note 15 Vehicular Access Standards. The Department of the Environment's planning, Northern Ireland.

The Government Accountability Office (2008) Traffic Safety: GAO-08-477. In *GAO Reports*, pp. 1: U.S. Government Accountability Office.

Tom A & Granié M-A (2011) Gender differences in pedestrian rule compliance and visual search at signalized and unsignalized crossroads. *Accident Analysis & Prevention* **43**, 1794-1801.

TopUAEmovers.com (2014) United Arab Emirates Map.[online] Available at: <<http://topuaemovers.com/>>. [Accessed 10 October 2009].

Transport Department (1993) Design Manual for Roads and Bridges - Highway Link Design. London.

Truong WH, Hill BW & Cole PA (2013) Automobile safety in children: a review of North American evidence and recommendations. *Journal of the American Academy of Orthopaedic Surgeons* **21**, 323-331.

U.S. Department of Transportation (1994) Traffic Calming, Auto-Restricted Zones and Other Traffic Management Techniques-Their Effects on Bicycling and Pedestrians: ,Federal Highway Administration, US.

United Federal Traffic Law (2008) United Federal Traffic Law. Ministry of Interior, Abu Dhabi, UAE.

Vojtisek T, Lekarstvi S & Lekarske CSSLC (2009) Death of pedestrians after traffic accidents with motor cars. *Soudní lékařství/casopis Sekce soudního lékařství Cs. lékařské společnosti J. Ev. Purkyne* **54**, 28.

Wåhlberg AE (2008) Driver celeration behaviour and accidents – an analysis. *Theoretical Issues in Ergonomics Science* **9**, 383-403.

Wang C, Quddus M & Ison S (2013a) A spatio-temporal analysis of the impact of congestion on traffic safety on major roads in the UK. *Transportmetrica A: Transport Science* **9**, 124-148.

Wang C, Quddus MA & Ison SG (2013b) The effect of traffic and road characteristics on road safety: A review and future research direction. *Safety Science* **57**, 264-275.

Wang T, Cardone G, Corradi A, Torresani L & Campbell AT (2012) WalkSafe: a pedestrian safety app for mobile phone users who walk and talk while crossing roads. In *Proceedings of the Twelfth Workshop on Mobile Computing Systems & Applications*. ACM, New York.

Whitley E & Ball J (2002) Statistics review 3: Hypothesis testing and P values. *Critical Care* **6**, 222.

Widyastuti H (2012) Valuing motorcycle casualties in developing countries using willingness-to pay method: stated-preference discrete choice modelling approach. School of Civil Engineering and Geosciences, Newcastle University, UK.

Widyastuti H, Mulley, C. and Dissanayake, D. (2007) Binary Choice Model to Value Motorcyclist's Slight Injury Cost In Surabaya. *Journal of the Eastern Asia Society for Transportation Studies* **7**, 2674-2685.

Wijnen W, Wesemann P & de Blaeij A (2009) Valuation of road safety effects in cost-benefit analysis. *Evaluation and Program Planning* **32**, 326-331.

World Health Organization (2009) Global Status Report on Road Safety Time For Action. World Health Organization, Geneva.

World Health Organization (2013) *WHO global status report on road safety 2013: supporting a decade of action*: World Health Organization, Geneva.

Yahya MN, Faulks IJ, Hambleton P & Wass C (2013) Development of an integrated road safety management system in Indonesia: Traffic police as lead agents in a Safe System approach. *the Australasian College of Road Safety* **24**, 28.

Yaya S & Li X (2014) Guide to cost benefit analysis of community-based interventions. *Journal of Hospital Administration* **3**, p47.

Zeng XH & Gao Y (2013) An Optimized Algorithm for Advanced Vehicle Anti-Lock Braking System. *Advanced Materials Research* **791**, 1489-1492.

Zhang G, Yau KK & Chen G (2013) Risk factors associated with traffic violations and accident severity in China. *Accident Analysis & Prevention* **59**, 18-25.

Zhang R, Lv N, Wu C & Yan X (2014) Speed Control for Automated Highway Vehicles under Road Gradient Conditions. *Bridges* **10**, 9780784412442.9780784412135.

Zhu M, Zhao S, Coben JH & Smith GS (2013) Why more male pedestrians die in vehicle-pedestrian collisions than female pedestrians: a decompositional analysis. *Injury prevention* **19**, 227-231.

Zimmerman K, Mzige AA, Kibatala PL, Museru LM & Guerrero A (2012) Road traffic injury incidence and crash characteristics in Dar es Salaam: A population based study. *Accident Analysis & Prevention* **45**, 204-210.

APPENDIXES

7.1 Appendix 1 the translation of the correspondence between the author and Abu Dhabi Police GHQ.

Letter 1

Number:.....

Date: 18/3/2012

To:

Director of Traffic and Patrol Directorate

Director of Traffic & Licensing Department

Title: Scholarships

We would like to inform you that the student number (.....) Abdulla Hammoudi would like to carry out some interviews and questionnaire surveys with your employees and customers to collect scientific data regarding his PhD project.

Please note: he is doing a PhD project in the field of traffic strategies in the United Kingdom. This is for your information and according to the Procedures followed at your departments.

Regards

Copy to:

- Deputy Director of Education Department
- Head of Scholarships section.

Letter 2

Number:.....

Date: 19/3/2012

To: Deputy Director of Traffic and Patrol Directorate

Title: Scholarships

- 1- Copy of the letter from the General Manager of Human Resources/education department. Number(.....) which includes the information that the researcher number (.....)Abdulla Hammoudi would like to carry out some interviews and questionnaire surveys with your employees and customers to collect scientific data regarding his PhD project.
- 2- Please find attached a copy letter for your consideration

This is for your information and according to the procedures followed in your departments.

Regards

Copy to:

- Head of Traffic Engineering department
- Head of Traffic Departments Abu Dhabi
- Head of Traffic Department Western Region
- Head of Traffic Department Alain
- Head of Traffic Institute Alain
- Head of Traffic Department CID
- Head of Traffic Strategy Department
- Head of Traffic Department IT Section
- Head of Traffic Quality Department
- Head of Traffic Department – Manager’s Office
- Head Traffic Support Service
- Head of Committee dealing with suggestions and complaints

7.2 Appendix 2 Drivers questionnaires

Consent Form

Title of Research: Traffic Accidents risk reduction in Abu Dhabi.

Researcher: Abdulla Hammoudi

I am a student studying for a PhD. As part of my studies in Cardiff Metropolitan University, I am inviting you participate in a research project to study the traffic accidents in Abu Dhabi.

I would like you to answer the enclosed questions.

The survey contains a variety of questions about Traffic accidents in Abu Dhabi. The following questionnaire will require approximately ten minutes to complete.

I am asking you to look over the questionnaire and, if you choose to do so, complete it and return it to me. I hope you will take the time to complete this questionnaire and return it.

Your answers will be used in the study and will be used for academic purposes only.

Participant consent:

- 1) I have understood the aim of this study and I can refuse to answer any particular question.**
- 2) I have been provided with a copy of this form.**
- 3) I have had an opportunity to ask questions and to receive answers.**
- 4) I understand that I am free to withdraw from the research at any time, for any reason.**

Name of participant

(print).....Signed.....Date.....

Name of researcher (print)

.....Signed.....Date.....

Researcher's contact details:

Abdulla Hammoudi

Cardiff Metropolitan University, Llandaff Campus,
Western Avenue, Cardiff, CF5 2YB

DRIVER QUESTIONNAIRE

Please tick all appropriate boxes

Part 1: Personal Information

1. Gender

☐ Male

☐ Female

2. Age

☐ Less than 18

☐ 18-25

☐ 26-35

☐ 36-50

☐ 51-65

☐ More than 65

3. Nationality

.....

4. What is your current marital status?

☐ Single

☐ Married

☐ Other

5. What is your highest level of education?

☐ No qualification

☐ Less than high school

☐ High school

☐ Undergraduate degree

☐ Post- graduate degree

6. What is your monthly income?

- | | |
|---|---|
| <input type="checkbox"/> Less than 2000 AED | <input type="checkbox"/> 2,000 to 5,000 AED |
| <input type="checkbox"/> 5,001 to 10,000 AED | <input type="checkbox"/> 10,001 to 20,000 AED |
| <input type="checkbox"/> More than 20,000 AED | <input type="checkbox"/> Unemployed |

7. Does your employer provide you with accommodation?

- ☐ Yes ☐ No

8. To the best of your knowledge, are you in a good health?

- ☐ Yes ☐ No

Part 2 : Traffic Accidents

9. How important is the traffic accidents problem to you?

- ☐ Not Important ☐ Some Importance ☐ Very Important

10. I am worried about traffic accidents in the UAE

- ☐ Strongly disagree ☐ Disagree ☐ Neither agree nor disagree ☐ Agree ☐ Strongly agree

11. Over the last 12 months, have you been in a traffic accidents?

- ☐ YES ☐ No

If the answer is 'yes', go to question number 12; if the answer is 'no', go to question number 14.

12. Over the past 12 months, how many traffic accidents, without injuries, have you been involved in?

☐ None

☐ Two

☐ One

☐ More than Three

13. Over the last 12 months, how many traffic accidents, with injuries, have you been involved in?

☐ None

☐ Two

☐ One

☐ More than Three

14. Do you think that weather is an important factors in traffic accidents?

☐ Yes

☐ No

15. When do you think most traffic accidents take place?

☐ Morning

☐ Afternoon

☐ Evening

☐ Night

16. What day of the week do you think most traffic accidents take place?

☐

☐

☐

☐

☐

☐

☐

Saturday

Sunday

Monday

Tuesday

Wednesday

Thursday

Friday

17. How many years have you been driving?

- | | |
|--------------------------------------|---|
| <input type="checkbox"/> 1-3 years | <input type="checkbox"/> 4-6 years |
| <input type="checkbox"/> 6-10 years | <input type="checkbox"/> 11-15 years |
| <input type="checkbox"/> 16-20 years | <input type="checkbox"/> More than 20 years |

18. How many years have you been driving in the UAE?

- | | |
|--------------------------------------|---|
| <input type="checkbox"/> 1-3 years | <input type="checkbox"/> 4-6 years |
| <input type="checkbox"/> 6-10 years | <input type="checkbox"/> 11-15 years |
| <input type="checkbox"/> 16-20 years | <input type="checkbox"/> More than 20 years |

19. Have you received a traffic ticket while you have been driving in the UAE?

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|------------------------------|-----------------------------|

20. How many years have you been living in the UAE?

- | | |
|---|---|
| <input type="checkbox"/> Less than 1 year | <input type="checkbox"/> Three to five years |
| <input type="checkbox"/> 1 to three years | <input type="checkbox"/> More Than five years |

21. Are you the owner of the vehicle you drive?

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|------------------------------|-----------------------------|

22. How many vehicles do you own?

- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| One | Two | Three | Four | More than 4 |

23. How old is the vehicle you mostly use?

- | | | | |
|--------------------------|------------------|--------------------------|-----------------------|
| <input type="checkbox"/> | Up to 1 year old | <input type="checkbox"/> | 4to 7 years old |
| <input type="checkbox"/> | 1 to 3 years old | <input type="checkbox"/> | More than 8 years old |

24. What is the main purpose of the vehicle?

- | | | | |
|--------------------------|-----------------|--------------------------|---------------------------|
| <input type="checkbox"/> | Commute to work | <input type="checkbox"/> | commercial purposes |
| <input type="checkbox"/> | Social purposes | <input type="checkbox"/> | private business purposes |

25. How many kilometers do you drive per day?

- | | | | |
|--------------------------|-----------------|--------------------------|------------------|
| <input type="checkbox"/> | Less than 30 Km | <input type="checkbox"/> | 61-80 Km |
| <input type="checkbox"/> | 31-40 Km | <input type="checkbox"/> | 81-100 Km |
| <input type="checkbox"/> | 41-60 Km | <input type="checkbox"/> | More than 101 Km |

26. Do you wear a seat belt?

- | | | | | | |
|--------------------------|--------|--------------------------|-----------|--------------------------|-------|
| <input type="checkbox"/> | Always | <input type="checkbox"/> | Sometimes | <input type="checkbox"/> | Never |
|--------------------------|--------|--------------------------|-----------|--------------------------|-------|

27. During the last 7 days, how often did you wear a seat belt when driving the vehicle?

- | | | | | | |
|--------------------------|--------|--------------------------|-----------|--------------------------|-------|
| <input type="checkbox"/> | Always | <input type="checkbox"/> | Sometimes | <input type="checkbox"/> | Never |
|--------------------------|--------|--------------------------|-----------|--------------------------|-------|

28. During the last 7 days, how often did you wear a seat belt in a vehicle driven by someone else?

☐ Always ☐ Sometimes ☐ Never

29. Do you use mobile phone while driving?

☐ Always ☐ Sometimes ☐ Never

30. During the last 2 days, how many times did you drive and use mobile phone while driving?

☐ Always ☐ Sometimes ☐ Never

31. Do you have child's car seat in your vehicle?

☐ Yes ☐ No

32. During the last 7 days, how many times did you drive with your children while seated on child's seat?

☐ ☐ ☐ ☐ ☐ ☐ ☐
None One Two Three Four Five More than five

33. Do you drink alcohol?

☐ YES ☐ NO

If the answer is 'yes', go to question number 34; if the answer is 'no', go to question number 35.

34. During the last month, how many times did you drive a vehicle after you had been drinking alcohol?

- | | | | |
|--------------------------|------|--------------------------|-------------|
| <input type="checkbox"/> | None | <input type="checkbox"/> | Two |
| <input type="checkbox"/> | One | <input type="checkbox"/> | More than 3 |

35. Over the last month, which of these unsafe forms of driving behaviour do you commit most often on the roads? Please tick all appropriate boxes

- | | | | |
|--------------------------|----------------------------|--------------------------|------------------------|
| <input type="checkbox"/> | Speeding | <input type="checkbox"/> | Not using indicators |
| <input type="checkbox"/> | Tailgating | <input type="checkbox"/> | Drinking and driving |
| <input type="checkbox"/> | Jumping red traffic lights | <input type="checkbox"/> | Other (indicate) |

36. Which these unsafe forms of driving behaviour do you encounter most often on the roads? Please tick all the appropriate boxes

- | | | | |
|--------------------------|----------------------------|--------------------------|-----------------------|
| <input type="checkbox"/> | Speeding | <input type="checkbox"/> | Not using indicators |
| <input type="checkbox"/> | Tailgating | <input type="checkbox"/> | Drinking and driving |
| <input type="checkbox"/> | Jumping red traffic lights | <input type="checkbox"/> | Other (indicate)..... |

37. As a driver, I am sometimes very angry with other drivers?

- | | | | |
|--------------------------|-------|--------------------------|----------|
| <input type="checkbox"/> | Agree | <input type="checkbox"/> | Disagree |
|--------------------------|-------|--------------------------|----------|

38. Over the last 12 months, have you been subjected to aggressive behaviour from other drivers?

- | | | | |
|--------------------------|-----|--------------------------|----|
| <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |
|--------------------------|-----|--------------------------|----|

39. What role do you think the traffic departments should play to reduce traffic accidents?

.....

.....

.....

.....

.....

40. When was the last traffic campaign you heard about?

- | | |
|---|---|
| <input type="checkbox"/> Never | <input type="checkbox"/> 2 to 6 months ago |
| <input type="checkbox"/> Less than 2 months ago | <input type="checkbox"/> More than 6 months ago |

41. What is the main source of traffic campaigns you are interested in?

- | | |
|--|-----------------------------------|
| <input type="checkbox"/> Newspaper | <input type="checkbox"/> Radio |
| <input type="checkbox"/> Television | <input type="checkbox"/> Internet |
| <input type="checkbox"/> Other (indicate)..... | |

42. What do you think about the amount of police enforcements of traffic laws on the roads?

- | | |
|--|--|
| <input type="checkbox"/> There is enough | <input type="checkbox"/> There is not enough |
|--|--|

43. Over the last 12 months, how many times have you been stopped by traffic police while driving?

- | | | | |
|--------------------------|--------|--------------------------|-------------|
| <input type="checkbox"/> | None | <input type="checkbox"/> | Less than 2 |
| <input type="checkbox"/> | 2 to 6 | <input type="checkbox"/> | More than 6 |

If the answer is 'none' go to question number 45.

44. Over the last 12 months, what were you stopped for by traffic police? Please tick all appropriate boxes

- | | |
|---|--|
| <input type="checkbox"/> Speeding | <input type="checkbox"/> Not using indicators |
| <input type="checkbox"/> Tailgating | <input type="checkbox"/> Drinking and driving |
| <input type="checkbox"/> Jumping red traffic lights | <input type="checkbox"/> Other (indicate)..... |

45. Did you change your driving behaviour as a result of receiving a traffic ticket?

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|------------------------------|-----------------------------|

46. What do you think about the cost of fines for traffic violations?

- | | | |
|------------------------------------|--|-------------------------------------|
| <input type="checkbox"/> Expensive | <input type="checkbox"/> Not expensive | <input type="checkbox"/> Don't know |
|------------------------------------|--|-------------------------------------|

47. Over the last 12 months, how much in Emirati Dirham have you paid for traffic violations when renewing your vehicle license?

- | | |
|--|---|
| <input type="checkbox"/> Nothing | <input type="checkbox"/> 3,001 to 5,000AED |
| <input type="checkbox"/> Less than 1,000 AED | <input type="checkbox"/> 5,001 to 10,000AED |
| <input type="checkbox"/> 1,001 to 3,000AED | <input type="checkbox"/> More than 10,001 AED |

48. Do you think that it is better if you are asked to pay the fines immediately after receiving the ticket violation?

☐ Yes ☐ No

49. Over the last 12 months, have you paid traffic violation fees on behalf of your children under 25 years old?

☐ Yes ☐ No ☐ Not applicable

If the answer is yes, how much have you paid in traffic violation fees?

50. If you saw a vehicle breaking the traffic law, would you take action?

☐ Yes ☐ No ☐ Don't care

51. How likely are you to report the offence to the traffic police?

☐ Always ☐ Sometimes ☐ Never

52. Do you have any suggestions?

.....

.....

.....

.....

.....

.....

.....

.....

Thank you for your help with this study

Arabic version of drivers questionnaire

استمارة استبيان

يرجى وضع اشارة على كل المربعات المناسبة:

الجزء 1: المعلومات الشخصية

1. الجنس ☐ ذكر ☐ انثى
2. العمر ☐ أقل من 18 سنة ☐ 18-25 سنة ☐ 26-35 سنة ☐ 36-50 سنة ☐ 51-65 سنة ☐ أكثر من 65 سنة
3. الجنسية:
4. ما هو الوضع الاجتماعي الحالي؟ ☐ اعزب ☐ متزوج ☐ أخرى
5. ما هو المؤهل التعليمي؟ ☐ بلا مؤهل ☐ أقل من شهادة الثانوية ☐ شهادة الثانوية ☐ دراسات عليا ☐ دراسات جامعية
6. ما هو دخلك الشهري؟ ☐ أقل من 2000 درهم ☐ من 2000 الى 5000 درهم ☐ 5001 الى 10000 درهم ☐ من 10001 إلى 20000 درهم ☐ أكثر من 20000 درهم ☐ لا تعمل
7. هل يتم توفير السكن من جهة العمل؟ ☐ نعم ☐ لا

8. من وجهة نظرك، هل انت في صحة جيدة؟

☐ نعم ☐ لا

الجزء 2: الحوادث المرورية

9. ما هو مدى أهمية مشكلة حوادث المرور بالنسبة لك؟

☐ ليست مهمة ☐ لها بعض الأهمية ☐ هامة جدا

10. أنا قلق حول مشكلة الحوادث المرور في دولة الإمارات العربية المتحدة

☐ لا أوافق بشدة ☐ لا اوافق ☐ محايد ☐ أوافق ☐ أوافق بشدة

11. هل سبق ان تعرضت لحادث مروري على مدى الأشهر ال 12 الماضية؟

☐ نعم ☐ لا

إذا كان الجواب نعم انتقل إلى السؤال رقم 12، إذا كان الجواب لا انتقل إلى السؤال رقم 14.

12. كم عدد الحوادث المرورية التي تعرضت لها دون وقوع إصابات على مدى الأشهر ال 12 الماضية ؟

☐ لا يوجد ☐ مرة واحدة

☐ مرتين ☐ أكثر من 3 مرات

13. كم عدد الحوادث المرورية التي تعرضت لها مع وقوع إصابات على مدى الأشهر ال 12 الماضية ؟

☐ لا يوجد ☐ مرة واحدة

☐ مرتين ☐ أكثر من 3 مرات

14. هل تعتقد أن الطقس هو واحد من العوامل المهمة لوقوع حوادث المرور؟

☐ نعم ☐ لا

15. من وجهة نظرك في اي الاوقات تحدث الحوادث المرورية ضع علامة على كل الاجابات المناسبة

☐ صباحا ☐ ظهرا ☐ مساء ☐ ليلا

16. من وجهة نظرك في اي الايام تحدث الحوادث المرورية ضع علامة على كل الاجابات المناسبة؟

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
السبت	الاحد	الاثنين	الثلاثاء	الاربعاء	الخميس	الجمعة

الجزء 3: سلوك السائق

17. منذ متى وأنت تقود السيارة؟

<input type="checkbox"/>	3-1 سنوات	<input type="checkbox"/>	4-6 سنوات
<input type="checkbox"/>	6-10 سنوات	<input type="checkbox"/>	11-15 سنة
<input type="checkbox"/>	16-20 سنة	<input type="checkbox"/>	أكثر من 20 عاما

18. منذ متى وأنت تقود السيارة في دولة الإمارات العربية المتحدة؟

<input type="checkbox"/>	3-1 سنوات	<input type="checkbox"/>	4-6 سنوات
<input type="checkbox"/>	6-10 سنوات	<input type="checkbox"/>	11-15 سنة
<input type="checkbox"/>	16-20 سنة	<input type="checkbox"/>	أكثر من 20 عاما

19. هل سبق ان حصلت على مخالفة مرورية اثناء قيادتك السيارة في دولة الامارات؟

<input type="checkbox"/>	نعم	<input type="checkbox"/>	لا
--------------------------	-----	--------------------------	----

20. . منذ متى و انت تعيش في الامارات؟

<input type="checkbox"/>	اقل من سنة	<input type="checkbox"/>	سنة الى ثلاث سنوات
<input type="checkbox"/>	ثلاث الى خمس سنوات	<input type="checkbox"/>	اكثر من خمس سنوات

21. هل أنت مالك المركبة التي تقودها؟

<input type="checkbox"/>	نعم	<input type="checkbox"/>	لا
--------------------------	-----	--------------------------	----

22. كم عدد المركبات التي تمتلكها؟

- ☐ واحدة ☐ اثنان ☐ ثلاث ☐ اربع ☐ اكثر من اربع

23. كم عمر المركبة التي تستخدمها في الغالب؟

- ☐ يصل إلى 1 سنة ☐ سنة إلى ثلاث سنوات
☐ 4 إلى 7 سنوات ☐ اكثر من 8 سنوات

24. ما هو الغرض الرئيسي من استخدام المركبة؟

- ☐ الذهاب للعمل ☐ الذهاب للتسوق
☐ الاغراض الاجتماعية ☐ اغراض تجارية خاصة

25. كم عدد الكيلومترات التي تقطعها في اليوم الواحد؟

- ☐ 30 كلم أو أقل ☐ 40-31 كلم
☐ 60-41 كلم ☐ 80-61 كلم
☐ 100-81 كلم ☐ 101 كلم أو أكثر

26. هل تستخدم حزام الامان؟

- ☐ دائما ☐ أحيانا ☐ أبدا

27. ، كيف كان استخدامك لحزام الامان اثناء قيادتك المركبة خلال الأيام ال 7 الأخيرة ؟

- ☐ دائما ☐ أحيانا ☐ أبدا

28. كيف كان استخدامك لحزام الامان عند ركوب مركبة يقودها شخص آخر خلال الأيام ال 7 الأخيرة؟

- ☐ دائما ☐ أحيانا ☐ أبدا

29. هل تستخدم الهاتف النقال أثناء القيادة؟

☐ دائما ☐ أحيانا ☐ أبدا

30. خلال اليومين السابقين، كم مرة استخدمت الهاتف النقال أثناء قيادتك المركبة؟

☐ دائما ☐ أحيانا ☐ أبدا

31. هل لديك مقعد خاص للأطفال في سيارتك؟

☐ نعم ☐ لا

32. كم مرة قمت بقيادة المركبة برفقة أولادك خلال الأيام ال 7 الأخيرة ؟

☐ لا يوجد ☐ واحدة ☐ اثنان ☐ ثلاث ☐ اربع ☐ خمس ☐ اكثر من خمس

33. هل تشرب الكحول؟

☐ نعم ☐ لا

إذا كان الجواب نعم انتقل إلى السؤال رقم 34، وإذا كان الجواب لا انتقل إلى السؤال رقم 35.

34. خلال الشهر الماضي، كم مرة كنت تقود المركبة بعد شرب الكحول؟

☐ لا يوجد ☐ مرة ☐ اكثر من ثلاث مرات ☐ مرتين

35. أي من هذه السلوكيات غير الآمنة التي ارتكبتها خلال الشهر الماضي أثناء القيادة ؟ يرجى وضع علامة على كل المربعات المناسبة

- | | |
|---|---|
| <input type="checkbox"/> السرعة الزائدة | <input type="checkbox"/> عدم استخدام الاشارات |
| <input type="checkbox"/> عدم ترك مسافة | <input type="checkbox"/> القيادة تحت تأثير الكحول |
| <input type="checkbox"/> تجاوز الاشارات الضوئية الحمراء | <input type="checkbox"/> أخرى (اذكر) |

36. اي من هذه السلوكيات غير الآمنة التي تجدها في معظم الأحيان على الطرق؟ يرجى وضع علامة على كل المربعات المناسبة

- | | |
|---|---|
| <input type="checkbox"/> السرعة الزائدة | <input type="checkbox"/> عدم استخدام الاشارات |
| <input type="checkbox"/> عدم ترك مسافة | <input type="checkbox"/> القيادة تحت تأثير الكحول |
| <input type="checkbox"/> تجاوز الاشارات الضوئية الحمراء | <input type="checkbox"/> أخرى (اذكر) |

37. انا اغضب جدا كسائق في بعض الأحيان من السائقين الآخرين؟

- | | |
|--------------------------------|-----------------------------------|
| <input type="checkbox"/> موافق | <input type="checkbox"/> لا اوافق |
|--------------------------------|-----------------------------------|

38. هل واجهت سلوك عدواني من السائقين الآخرين على مدى الأشهر ال 12 الماضية؟

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> نعم | <input type="checkbox"/> لا |
|------------------------------|-----------------------------|

الجزء 4: السلامة المرورية

39. ما هو الدور الذي تعتقد أن إدارات المرور ينبغي أن تقوم به للحد من الحوادث المرورية؟ يرجى توضيح إجابتك

.....

.....

.....

.....

.....

40. متى كانت اخر حملة مرورية علمت بها؟

- | | | | |
|--|-------------------|--------------------------|----------------|
| <input type="checkbox"/> | لم اسمع | <input type="checkbox"/> | 2 الى 6 اشهر |
| <input type="checkbox"/> | أقل من شهرين | <input type="checkbox"/> | أكثر من 6 أشهر |
| 41. ماهي الطريقة التي تفضلها في الاعلام عن الحملات المرورية؟ | | | |
| <input type="checkbox"/> | الصحف | <input type="checkbox"/> | الراديو |
| <input type="checkbox"/> | التلفزيون | <input type="checkbox"/> | الإنترنت |
| <input type="checkbox"/> | أخرى (اذكر) | | |

42. ما رأيك في عدد دوريات الشرطة التي تضبط قوانين السير على الطرق؟

- | | | | |
|--------------------------|------|--------------------------|----------|
| <input type="checkbox"/> | كافي | <input type="checkbox"/> | غير كافي |
|--------------------------|------|--------------------------|----------|
43. على مدى الأشهر ال 12 الماضية، كم عدد المرات التي تم إيقافك من قبل شرطة المرور بينما كنت تقود المركبة؟

- | | | | |
|--------------------------|--------------|--------------------------|----------------|
| <input type="checkbox"/> | لا يوجد | <input type="checkbox"/> | اقل من مرتين |
| <input type="checkbox"/> | 2 الى 6 مرات | <input type="checkbox"/> | اكثر من 6 مرات |

اذا كان الجواب لا يوجد انتقل إلى السؤال رقم 45.

44. 44. على مدى الأشهر ال 12 الماضية، ما نوع المخالفة التي ارتكبتها ؟ يرجى وضع علامة على كل المربعات المناسبة

- | | | | |
|--------------------------|--------------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | السرعة الزائدة | <input type="checkbox"/> | عدم استخدام الاشارات |
| <input type="checkbox"/> | عدم ترك مسافة | <input type="checkbox"/> | القيادة تحت تأثير الكحول |
| <input type="checkbox"/> | تجاوز الاشارات الضوئية الحمراء | <input type="checkbox"/> | أخرى (اذكر) |

45. هل قمت بتغيير سلوك القيادة بعد استلام المخالفه المرورية؟

- | | | | |
|--------------------------|-----|--------------------------|----|
| <input type="checkbox"/> | نعم | <input type="checkbox"/> | لا |
|--------------------------|-----|--------------------------|----|

46. ما رأيك في قيمة المخالفات المرورية؟

☐ مبالغ فيه ☐ غير مبالغ فيه ☐ لا اعرف

47. كم المبلغ الذي دفعته بالدرهم الاماراتي عند تجديد رخصة سيارتك خلال العام ؟

☐ لا يوجد ☐ اقل من 1000 درهم
☐ 1001 الى 3000 درهم ☐ 3001 الى 5000 درهم
☐ 5001 الى 10000 درهم ☐ اكثر من 10001 درهم

48. هل تعتقد أنه من الأفضل انه إذا طلب منك أن تدفع في الوقت نفسه من تلقي المخالفة؟

☐ نعم ☐ لا

49. هل سبق ان دفعت قيمة مخالفات مرورية نيابة عن اطفالك في عمر اقل من 25 سنة خلال الأشهر ال 12 الماضية ؟

☐ لا ☐ نعم ☐ لا يوجد

إذا كان الجواب نعم، كم المبلغ الذي قمت بدفعه ؟

50. إذا رأيت سيارة مخالفة قانون السير، هل تتخذ أي إجراء؟

☐ نعم ☐ لا ☐ غير مهتم

51. ما مدى امكانية قيامك بابلاغ ادارة شرطة المرور؟

☐ دائما ☐ أحيانا ☐ أبدا

52. هل لديك اي اقتراحات؟

.....
.....
.....
.....
.....
.....

شكرا لكم على مساعدتكم في اجراء هذه الدراسة

7.3 Appendix 3 Pedestrians questionnaires

Consent Form

Title of Research: Traffic Accidents risk reduction in Abu Dhabi.

Researcher: Abdulla Hammoudi

I am a student doing PhD. As part of my studies in Cardiff Metropolitan University, I am inviting you to participate in a research project to study the traffic accidents in Abu Dhabi.

I would like you to answer the enclosed questions..

The survey contains a variety of questions about Traffic accidents in Abu Dhabi and the following questionnaire will require approximately ten minutes to complete.

I am asking you to look over the questionnaire and, if you choose to do so, complete it and return it to me. I hope you will take the time to complete this questionnaire and return it. Your answers will be used in this study and will be used for academic purposes only.

Participant consent:

- 1) I have understood the aim of this study and I can refuse to answer any particular question.**
- 2) I have been provided with a copy of this form.**
- 3) I have had an opportunity to ask questions and have them answered.**
- 4) I understand that I am free to withdraw from the research at any time, for any reason I want.**

Name of participant

(print).....Signed.....Date.....

Name of researcher (print)

.....Signed.....Date.....

Researcher's contact details:

Abdulla Hammoudi

Cardiff Metropolitan University, Llandaff Campus,
Western Avenue, Cardiff, CF5 2YB

PEDESTRIAN QUESTIONNAIRE

Please tick all appropriate boxes

Part 1: Personal Information

1. Gender

☐ Male

☐ Female

2. Age

☐ Less than 18

☐ 18-25

☐ 26-35

☐ 36-50

☐ 51-65

☐ More than 65

3. Nationality

.....

4. What is your current marital status?

☐ Single

☐ Married

☐ Other

5. What is your highest level of education?

☐ No qualification

☐ Less than high school

☐ High school

☐ Undergraduate degree

☐ Post-graduate degree

6. What is your monthly income?

- | | |
|---|---|
| <input type="checkbox"/> Less than 2,000 AED | <input type="checkbox"/> 2,000 to 5,000 AED |
| <input type="checkbox"/> 5001 to 10,000 AED | <input type="checkbox"/> 10,001 to 20,000 AED |
| <input type="checkbox"/> More than 20,000 AED | <input type="checkbox"/> Unemployed |

7. Does your employer provide you with accommodation?

- ☐ Yes ☐ No

8. To the best of your knowledge, are you in a good health?

- ☐ Yes ☐ No

Part 2 : Pedestrian Accidents

9. How important is the traffic accidents problem to you?

- ☐ Not Important ☐ Some Importance ☐ Very Important

10. I am worried about traffic accidents in the UAE

- ☐ Strongly disagree ☐ Disagree ☐ Neither agree nor disagree ☐ Agree ☐ Strongly agree

11. Have you, or one of your relatives, ever been in an accident as a pedestrian?

- ☐ Yes ☐ No

If the answer is 'yes', go to question number 12; if the answer is 'no' go to question number 13.

12. From your point of view, who was responsible for that accident?

- ☐ Driver ☐ Pedestrian ☐ Driver and Pedestrian ☐ No one

13. Do you think that weather is an important factor in traffic accidents?

- ☐ Yes ☐ No

14. When do you think most traffic accidents take place?

☐ Morning ☐ Afternoon ☐ Evening ☐ Night

15. What day of the week do you think most traffic accidents take place?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Saturday Sunday Monday Tuesday Wednesday Thursday Friday

Part 3 : Pedestrian Behaviour

16. How many years have you been living in the UAE?

☐ Less than 1 year ☐ Three to five years
☐ 1 to three years ☐ More than five years

17. How often do you cross roads as a pedestrian?

☐ Always ☐ Sometimes ☐ Never

18. Do you know the places designated for pedestrian crossings?

☐ Yes ☐ No

19. Do you mostly cross from the places not designated for pedestrian crossing?

☐ Yes ☐ No

20. Are you aware that you can receive a pedestrian ticket for crossing roads at an inappropriate place?

☐ Yes ☐ No

21. Have you received a pedestrian ticket while in the UAE?

☐ Yes ☐ No

22. What is the main purpose of crossing the road?

☐ Going to work ☐ Shopping
☐ Social purposes ☐ Other.....

23. During the last 7 days, how often did you cross the roads?

☐ Always ☐ Sometimes ☐ Never

24. During the last 7 days, how often did you cross the roads from the places not designated for pedestrian crossing?

☐ Always ☐ Sometimes ☐ Never

25. Do you use a mobile phone while crossing the roads?

☐ Always ☐ Sometimes ☐ Never

26. Do you drink alcohol?

☐ Yes ☐ No

If the answer is 'yes', go to question number 27; if the answer is 'no', go to question number 28.

27. During the last month, how many times did you cross the roads after you had been drinking alcohol?

☐ None ☐ Two
☐ One ☐ More than 3 times

28. What role do you think the traffic departments should play in reducing pedestrian accidents?

.....

.....

.....

.....

.....

.....

29. When did you last hear about a pedestrian traffic campaign?

- | | |
|---|---|
| <input type="checkbox"/> Never | <input type="checkbox"/> 2 to 6 months |
| <input type="checkbox"/> Less than 2 months | <input type="checkbox"/> More than 6 months |

30. Which main source of traffic campaigns are you interested in?

- | | |
|-------------------------------------|-----------------------------------|
| <input type="checkbox"/> Newspaper | <input type="checkbox"/> Radio |
| <input type="checkbox"/> Television | <input type="checkbox"/> Internet |
| <input type="checkbox"/> Other | |

31. Do you think there is a sufficient amount of police enforcement of traffic laws on the roads?

- | | |
|---------------------------------|-------------------------------------|
| <input type="checkbox"/> Enough | <input type="checkbox"/> Not enough |
|---------------------------------|-------------------------------------|

32. Over the last 12 months, how many times have you been stopped by traffic police while crossing on the places not designated for pedestrian crossing?

- | | | | |
|--------------------------|--------------|--------------------------|-------------------|
| <input type="checkbox"/> | Never | <input type="checkbox"/> | Less than 2 times |
| <input type="checkbox"/> | 2 to 6 times | <input type="checkbox"/> | More than 6 times |

If the answer is ‘never’, go to question number 34.

33. Did you change your way of crossing the road as a result of receiving the ticket?

- | | | | |
|--------------------------|-----|--------------------------|----|
| <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |
|--------------------------|-----|--------------------------|----|

34. What do you think about the cost of the ticket for crossing the road from a places not designated for pedestrian crossing?

- | | | | | | |
|--------------------------|-----------|--------------------------|---------------|--------------------------|------------|
| <input type="checkbox"/> | Expensive | <input type="checkbox"/> | Not expensive | <input type="checkbox"/> | Don’t know |
|--------------------------|-----------|--------------------------|---------------|--------------------------|------------|

35. Do you think that it is better if you are asked to pay the fine immediately when receive a ticket?

- | | | | |
|--------------------------|-----|--------------------------|----|
| <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |
|--------------------------|-----|--------------------------|----|

36. Do you have any suggestions?

.....

.....

.....

.....

.....

Thank you for your help with this study.

Arabic version of pedestrians questionnaire

استمارة استبيان

يرجى وضع اشارة على كل المربعات المناسبة:

الجزء 1: المعلومات الشخصية

1. الجنس ☐ ذكر ☐ انثى

2. العمر

☐ أقل من 18 سنة ☐ 18-25 سنة ☐ 26-35 سنة

☐ 35-26 سنة ☐ 36-50 سنة ☐ 51-65 سنة

☐ أكثر من 65 سنة

3. الجنسية:

.....

4. ما هو الوضع الاجتماعي الحالي؟

☐ اعزب ☐ متزوج ☐ أخرى

5. ما هو المؤهل التعليمي؟

☐ بلا مؤهل ☐ أقل من شهادة الثانوية

☐ شهادة الثانوية ☐ دراسات جامعية

☐ دراسات عليا

6. ما هو دخلك الشهري؟

☐ أقل من 2000 درهم ☐ من 2000 الى 5000 درهم

☐ 5001 الى 10000 درهم ☐ من 10001 إلى 20000 درهم

☐ أكثر من 20000 درهم ☐ لا تعمل

7. هل يتم توفير السكن من جهة العمل؟

☐ نعم ☐ لا

8. من وجهة نظرك، هل انت في صحة جيدة؟

☐ نعم ☐ لا

الجزء 2: حوادث المشاة

9. ما هو مدى أهمية مشكلة حوادث المرور بالنسبة لك؟

☐ ليست مهمة ☐ لها بعض الأهمية ☐ هامة جدا

10. أنا قلق حول مشكلة الحوادث المرور في دولة الإمارات العربية المتحدة

☐ لا أوافق بشدة ☐ لا اوافق ☐ محايد ☐ أوافق ☐ أوافق بشدة

11. هل سبق ان تعرضتوا احد اقاربك لحادث دهس على مدى الأشهر ال 12 الماضية؟

☐ نعم ☐ لا

إذا كان الجواب نعم انتقل إلى السؤال رقم 12، إذا كان الجواب لا انتقل إلى السؤال رقم 13.

12. من وجهة نظرك من هو المخطئ؟

☐ لا يوجد ☐ السائق
☐ المشاة ☐ السائق والمشاة

13. هل تعتقد أن الطقس هو واحد من العوامل المهمة لوقوع حوادث المرور؟

☐ نعم ☐ لا

14. من وجهة نظرك في اي الاوقات تحدث الحوادث المرورية ضع علامة على كل الاجابات المناسبة

☐ صباحا ☐ ظهرا ☐ مساء ☐ ليلا

15. من وجهة نظرك في اي الايام تحدث الحوادث المرورية ضع علامة على كل الاجابات المناسبة؟

☐ السبت ☐ الاحد ☐ الاثنين ☐ الثلاثاء ☐ الاربعاء ☐ الخميس ☐ الجمعة

الجزء 3: سلوك المشاة

16. منذ متى وانت تعيش في الامارات؟

☐ اقل من سنة ☐ سنة الى ثلاث سنوات
☐ ثلاث الى خمس سنوات ☐ اكثر من خمس سنوات

17. ما مدى عبورك للطريق؟

☐ دائما ☐ أحيانا ☐ أبدا

18. هل تعرف الاماكن المخصصة لعبور المشاة؟

☐ نعم ☐ لا

19. هل غالبا ما تعبر من اماكن غير مخصصة لعبور المشاة؟

☐ نعم ☐ لا

20. هل تعلم انه قد تحصل على مخالفة اثناء عبورك للطريق من مكان غير مخصص لعبور المشاة؟

☐ نعم ☐ لا

21. هل سبق ان حصلت على مخالفة مشاة اثناء وجودك في الامارات؟

☐ نعم ☐ لا

22. ماهو الغرض الرئيسي من عبورك الطريق؟

- ☐ الذهاب للعمل ☐ التسوق
☐ اغراض اجتماعية ☐ اخرى

23. كم مرة قمت بعبور الطريق خلال الأيام ال 7 الأخيرة ؟

- ☐ دائما ☐ أحيانا ☐ أبدا

24. كم مرة قمت بعبور الطريق من اماكن غير مخصصة لعبور المشاة خلال الأيام ال 7 الأخيرة ؟

- ☐ دائما ☐ أحيانا ☐ أبدا

25. هل تستخدم الهاتف النقال أثناء عبورك للطريق؟

- ☐ دائما ☐ أحيانا ☐ أبدا

26. هل تشرب الكحول؟

- ☐ نعم ☐ لا

إذا كان الجواب نعم انتقل إلى السؤال رقم 27، وإذا كان الجواب لا انتقل إلى السؤال رقم 28.

27. خلال الشهر الماضي، كم قمت بعبور الطريق بعد شرب الكحول؟

- ☐ لا يوجد ☐ مرة
☐ مرتين ☐ أكثر من ثلاث مرات

28. ما هو الدور الذي تعتقد أن إدارات المرور ينبغي أن تقوم به للحد من حوادث الدهس؟ يرجى توضيح إجابتك

.....

.....

.....

.....

29. متى كانت اخر حملة مرورية علمت بها؟

<input type="checkbox"/>	لم اسمع	<input type="checkbox"/>	2 الى 6 اشهر
<input type="checkbox"/>	أقل من شهرين	<input type="checkbox"/>	أكثر من 6 أشهر

30. ماهي الطريقة التي تفضلها في الاعلام عن الحملات المرورية؟

<input type="checkbox"/>	الصحف	<input type="checkbox"/>	الراديو
<input type="checkbox"/>	التلفزيون	<input type="checkbox"/>	الإنترنت
<input type="checkbox"/>	أخرى (اذكر)		

31. ما رأيك في عدد دوريات الشرطة التي تضبط قوانين السير على الطرق؟

<input type="checkbox"/>	كافي	<input type="checkbox"/>	غير كافي
--------------------------	------	--------------------------	----------

32. على مدى الأشهر ال 12 الماضية، كم عدد المرات التي تم إيقافك من قبل شرطة المرور بينما كنت تعبر الطريق؟

<input type="checkbox"/>	لا يوجد	<input type="checkbox"/>	أقل من مرتين
<input type="checkbox"/>	2 الى 6 مرات	<input type="checkbox"/>	أكثر من 6 مرات

إذا كان الجواب لا يوجد انتقل إلى السؤال رقم 34.

33. هل قمت بتغيير سلوك القيادة بعد استلام المخالفه المرورية؟

<input type="checkbox"/>	نعم	<input type="checkbox"/>	لا
--------------------------	-----	--------------------------	----

34. ما رأيك في قيمة المخالفات المرورية؟

☐ مبالغ فيه ☐ غير مبالغ فيه ☐ لا اعرف

35. هل تعتقد أنه من الأفضل أنه إذا طلب منك أن تدفع في الوقت نفسه من تلقي المخالفة؟

☐ نعم ☐ لا

36. هل لديك اي اقتراحات؟

.....

.....

.....

.....

.....

.....

.....

.....

شكرا لكم على مساعدتكم في اجراء هذه الدراسة

7.4 Appendix 4 Interview Questions

Consent Form

Title of Research: Traffic Accidents risk reduction in Abu Dhabi.

Researcher: Abdulla Hammoudi

I am a student doing PhD. As part of my studies in Cardiff Metropolitan University, I would like to meet with you and ask you some questions about traffic accident risk reduction in Abdu Dhabi.

I have chosen you because you are the best people to provide the information I need since this is a part of your work as a traffic police manager.

The conversation will take about 30 minutes. You are free to refuse answering any questions you do not feel comfortable with. You are also free to withdraw from this conversation at any time. Your answers will be used in this study and will be used for academic purposes only.

Participant consent:

- 1) I have understood the aim of this study and I can refuse to answer any particular question.**
- 2) I have been provided with a copy of this form.**
- 3) I have had an opportunity to ask questions and to receive an answer.**
- 4) I understand that I am free to withdraw from the research at any time, for any reason I want.**
- 5) The conversation will be taped and will be kept until the completion of the study.**

Name of participant

(print).....Signed.....Date.....

Name of researcher (print)

.....Signed.....Date.....

Researcher's contact details:

Abdulla Hammoudi

Cardiff Metropolitan University, Llandaff Campus,
Western Avenue, Cardiff, CF5 2YB

Manager's questions:

1. What are the causes of traffic accidents in Abu Dhabi?

- Have you been involved in any of them?
- How old are the drivers?
- What are their nationalities?

2. How many traffic officers are working in the field of traffic law enforcement?

- How much experience do they have?
- How old are the policemen?
- What type of training courses do they have? CPD

3. Describe the traffic campaigns carried out by Abu Dhabi traffic departments over the last 12 months.

- Have you been informed of any of the campaigns? What is your opinion about these?
- Do you think changing the times of the traffic week is important?
- How can we create traffic awareness programs?

4. What are the difficulties facing the traffic departments when implementing traffic safety programs?

- How can we decrease the risk of traffic accidents?

5. What precaution should be taken to ensure the traffic safety in Abu Dhabi's roads?

- What do you think of using traffic calming measures?

6. Do you have any recommendations about traffic accidents risk reduction?

- Which of these recommendations is the most important?

Arabic translation of the questions:

1. ما هي أسباب الحوادث المرورية في أبوظبي؟
2. كم عدد ضباط المرور الذين يعملون في مجال تطبيق قانون المرور؟
3. ناقش الحملات المرورية التي قامت بها إدارات المرور أبو ظبي على مدى الأشهر ال 12 الماضية ؟
4. ما هي الصعوبات التي تواجه إدارات المرور في تطبيق برامج السلامة المرورية ؟
5. ما هي الخطوات التي اتخذت لضمان سلامة حركة المرور في أبو ظبي؟
6. هل لديك أي توصيات بشأن الحد من مخاطر الحوادث المرورية؟

7.5 Appendix 5 Stakeholder meetings questions:

Are these suggestions workable?

هل من الممكن تطبيق هذه المقترحات؟

What advice would you suggest considering?

ماهي النصائح المقترحة التي يجب وضعها في عين الاعتبار ؟

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

Why do you think speeding is the major cause of accidents in Abu Dhabi ?

لماذا تعتقد ان السرعة هي السبب الرئيسي للحوادث في ابوظبي ؟

Young people are causing accidents and young people are also the majority who are killed in accidents, What can we do to encourage our young people to be more careful on our roads?

فئة الشباب هي الفئة العمرية التي تتسبب في الحوادث وكذلك اكثر الوفيات من هذه الفئة
ما الذي نستطيع عمله لتشجيع هذه الفئة ليكونو اكثر حرصا في القيادة على الطرقات؟

We propose having a welcome pack on traffic regulations for new arrivals to Abu Dhabi,

Do you think this approach is a good one to address traffic issues among the non-Emirati people?

نقترح عمل نشرة ترحيبية (بروشور) للقادمين الجدد الى الدولة متعلقة بقواعد المرور
هل تتوقع ان هذا الاسلوب جيد في الحد من مشاكل المرور بالنسبة الى غير الاماراتيين؟

How do you want to be involved in planning traffic campaigns?

كيف ترغب ان تكون في وضع مخططات لبرامج التوعية المرورية؟

What practical steps do you propose to encourage better cooperation among the teams involved in traffic accidents?

ماهي الخطوات العملية التي تقترحها لتشجيع التعاون بين المجموعات المتعلقة بالحد من الحوادث المرورية؟

What are practical ways to encourage collaboration between the police and stakeholders on traffic issues?

ماهي بعض الخطوات العملية التي تقترحها لتشجيع التعاون بين الشرطة والشركاء في المسائل المرورية؟

7.6 Appendix 6 An example of Chi-Square test tables:

Gender * involved in traffic accident

Crosstab

			involved in traffic accident		Total
			yes	no	
Gender	Male	Count	92	93	185
		% within Gender	49.7%	50.3%	100.0%
	Female	Count	37	69	106
		% within Gender	34.9%	65.1%	100.0%
Total	Count	129	162	291	
	% within Gender	44.3%	55.7%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.001 ^a	1	.014	.015	.010
Continuity Correction ^b	5.415	1	.020		
Likelihood Ratio	6.068	1	.014		
Fisher's Exact Test					
Linear-by-Linear Association	5.980	1	.014		
N of Valid Cases	291				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 46.99.

b. Computed only for a 2x2 table

Age * involved in traffic accident

Crosstab

			involved in traffic accident		Total
			yes	no	
Age	less than 18	Count	0	5	5
		% within Age	.0%	100.0%	100.0%
	18-25	Count	47	38	85
		% within Age	55.3%	44.7%	100.0%
	26-35	Count	56	71	127
		% within Age	44.1%	55.9%	100.0%
	36-50	Count	23	37	60
		% within Age	38.3%	61.7%	100.0%
	51-65	Count	3	10	13
		% within Age	23.1%	76.9%	100.0%
	Total	Count	129	161	290
		% within Age	44.5%	55.5%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.368 ^a	4	.023
Likelihood Ratio	13.397	4	.009
Linear-by-Linear Association	3.648	1	.056
N of Valid Cases	290		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 2.22.

Nationality * involved in traffic accident

Crosstab

			involved in traffic accident		Total
			yes	no	
Nationality	Emirati citizen	Count	59	79	138
		% within Nationality	42.8%	57.2%	100.0%
	Gulf Cooperation Council (GCC) citizen	Count	9	14	23
		% within Nationality	39.1%	60.9%	100.0%
	Other Arab	Count	34	35	69
		% within Nationality	49.3%	50.7%	100.0%
	Asian	Count	19	24	43
		% within Nationality	44.2%	55.8%	100.0%
	European	Count	2	2	4
		% within Nationality	50.0%	50.0%	100.0%
	African	Count	2	2	4
		% within Nationality	50.0%	50.0%	100.0%

		% within Nationality	50.0%	50.0%	100.0%
Other Nationality	Count		1	4	5
	% within Nationality		20.0%	80.0%	100.0%
Total	Count		126	160	286
	% within Nationality		44.1%	55.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.373 ^a	6	.882
Likelihood Ratio	2.478	6	.871
Linear-by-Linear Association	.009	1	.923
N of Valid Cases	286		

a. 6 cells (42.9%) have expected count less than 5. The minimum expected count is 1.76.

Education * involved in traffic accident

Crosstab

			involved in traffic accident		Total
			yes	no	
Education	No qualification	Count	20	12	32
		% within Education	62.5%	37.5%	100.0%
	Less than High school	Count	11	19	30
		% within Education	36.7%	63.3%	100.0%

High school	Count	44	56	100
	% within Education	44.0%	56.0%	100.0%
Undergraduate degree	Count	34	47	81
	% within Education	42.0%	58.0%	100.0%
Post graduate degree	Count	18	28	46
	% within Education	39.1%	60.9%	100.0%
Total	Count	127	162	289
	% within Education	43.9%	56.1%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.678 ^a	4	.225
Likelihood Ratio	5.662	4	.226
Linear-by-Linear Association	2.489	1	.115
N of Valid Cases	289		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.18.

Monthly income * involved in traffic accident

Crosstab

			involved in traffic accident	
			yes	no
Monthly income	Less than 2000 AED	Count	34	21
		% within Monthly income	61.8%	38.2%
	2000 to 5000 AED	Count	20	20
		% within Monthly income	50.0%	50.0%
	5001 to 10000 AED	Count	26	31
		% within Monthly income	45.6%	54.4%
	10001 to 20000 AED	Count	28	56
		% within Monthly income	33.3%	66.7%
	More than 20000 AED	Count	17	23
		% within Monthly income	42.5%	57.5%
	Don't work	Count	3	8
		% within Monthly income	27.3%	72.7%
Total	Count		128	159
	% within Monthly income		44.6%	55.4%

Crosstab

			Total
Monthly income	Less than 2000 AED	Count	55
		% within Monthly income	100.0%
	2000 to 5000 AED	Count	40

	% within Monthly income	100.0%
5001 to 10000 AED	Count	57
	% within Monthly income	100.0%
10001 to 20000 AED	Count	84
	% within Monthly income	100.0%
More than 20000 AED	Count	40
	% within Monthly income	100.0%
Don't work	Count	11
	% within Monthly income	100.0%
Total	Count	287
	% within Monthly income	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.819 ^a	5	.025
Likelihood Ratio	12.962	5	.024
Linear-by-Linear Association	9.763	1	.002
N of Valid Cases	287		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 4.91.