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Epidemiology of Road Traffic Accidents in Lusaka, Zambia: Trends, Risk Factors and Countermeasures.

Master's Thesis in Development Studies, Specialising in Geography.

Trondheim, May 2014

NTNU – Trondheim
Norwegian University of Science and Technology

Epidemiology of Road Traffic Accidents in Lusaka, Zambia: Trends, Risk Factors and Countermeasures.

By

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Master's Thesis for partial fulfillment of the award of Master of Philosophy (M.Phil.) in Development Studies, (Specialising in Geography).

NTNU – Trondheim
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Trondheim, Norway
May, 2014

DECLARATION

I, Trusty Mudenda, do declare that, apart from referencing to other people' work, which have been duly acknowledged, this thesis is a product of my own work and efforts under the supervision of Professor Stig H. Jørgensen at Geography Department, NTNU. This work has neither in part nor in whole been presented elsewhere for other degrees.

……..	……..
Trusty Mudenda	Prof. Stig H. Jørgensen
Author/Researcher	Supervisor

.....

DATE

DEDICATION

I dedicate this thesis to my dear wife, Mukandeke Siabalima Mudenda, for her love, care and support for the period I was away from home

and

To my three children Rufaro, Farai and Farisai Mudenda who missed the fatherly love and care during my absence.

ACKNOWLEDGMENTS

First and foremost I thank and give glory to the Almighty God for bringing me this far which could not have been possible without His will. I can surely say "***I can do all things through Christ who strengths me***" Philippians 4 verse 6.

Secondly I am grateful to several people and organizations for their diverse contributions in the process of both field work and report writing.

I would like to express my deepest and heart-felt gratitude to my supervisor Professor Stig H. Jørgensen for his patience with me, continuous guidance, constructive criticisms, valuable suggestions, encouragements and inspirations even as my lecturer in *Geography of Health*, the 'root' of my thesis. I salute you professor!

I am also grateful to MPhil Development Studies Programme and in particular the Geography Department Staff members. Specific sincere thanks go to the administrative staff for well-coordinated program activities, Bodil Wold, Anette Sofie Knutsen, Rita Hokseggen, and Per Ivar Chiutko and also to my lectures in various courses especially Prof. Ragnhild Lund, Prof. Cathrine Brun and Prof. Haakon Lein. I say am so thankful to you all.

I am indebted to Kyrre Svarva a staff at NTNU IT Department for his enormous contributions in the design and modifications of the 'machine readable' questionnaire before field work and scanning of all completed questionnaires after field work. I say thank you Sir.

I am very appreciative to the Norwegian State Loan Fund for granting me scholarship under Quota Scheme and in particular, by then, the coordinator Anette Moen and her fellow staff members for her effective communication during the application process and orientation activities.

I also thank all respondents especially key informants for their willingness and for being available to provide information and official statistics data which have made this study a success. Special thanks go to Mr. Gladwell Banda (RTSA Deputy Director), Mr. Mulenga (U.T.H Public Relations Officer) and institutions like Zambia Police Service, Professional Insurance, and ZISC.

I am very grateful to Conroy Davy the author of the You Tube video which has been used as secondary source of data for granting me permission to use his video. I thank you sir.

I also extend my gratitude to my research assistants and other people who helped in various ways during data collection period. These include Messrs. Mtonga Thomas, Musonda

Emison, Phiri Stanely, Muvwanga Robert, Mrs. Haachiboya and Ms. Nsimbinini Siabalima and. I say thank you all.

I also appreciate my employers, the Ministry of Education especially DEBS-Luangwa District and PEO- Lusaka Province for processing and granting me a paid study leave.

I further express my thanks to my spiritual family, the Overcomers' Chapel International especially Pastor Uduak for his spiritual support and guidance during my stay in Norway.

Lastly but not the least special thanks go to my fellow MPhil. Development Studies, Specialising in Geography Programme 2012-2014, for their contributions and willingness to share knowledge during our studies in various courses we took together.

Abstract

Road traffic accidents are major causes of morbidity and mortality. It is projected that by 2020 they will be 3rd leading cause of global disease burden. Less developed countries like Zambia account for about 85% of the world's road traffic fatalities and have had increasing trends. The situation is worse in urbanized cities, like Lusaka, characterized by high densities of both vehicle and human population.

This is an epidemiological approach to road traffic accidents in Lusaka, Zambia focusing on trends, risk factors and counter-measures. The main objectives of this study were to examine the trends between 2008 and 2012; to identify factors contributing to risk-taking behavior which is associated with causes of road crashes; to investigate how socio-demographic characteristics influence risk taking behavior and to explore counter-measures that can be adopted by relevant authorities in reducing road traffic accidents.

Identification of risk factors, data interpretation and discussion are based on knowledge drawn from the System Theory in road traffic accident causation, model for traffic accident causation, Risk Theory of accident causation and Geographical approach to road traffic accidents.

The triangulation (quantitative and qualitative) approach which encompassed multiple methods of data collection included self-reporting questionnaire with 155 stratified and quota sampled respondents, semi-structured interviews with five key informants, register based statistics, video and media text analyses and simple personal observation.

This study found that road traffic accident trends increased by about 4% between 2008 and 2012. Pedestrians and passengers, as vulnerable road users, accounted for 82% of total casualties and females had the most involvement in casualties as pedestrian and passengers while males were involved as drivers. This study has also found that road traffic accidents have multiple causation (risk) factors categorized as vehicle element factors: poor brake system, worn out tires, lack of protective devices (air bags and seat belts); human behavior factors: rule violation such as speeding , driving and drinking, non-use of seat belts(drivers and passenger), pedestrians crossing roads at undesignated point, bus drivers picking passengers at places other than bus stops; environmental factors: poor road design which has no pedestrians and cyclist lanes in most places, few or no road signs, lack of traffic calming system (speed limits, humps, narrow roads), general traffic mix of road users and traffic regulation and enforcement factors: weak or inadequate enforcement especially in training of drivers and issuance of driving license, checking vehicle fitness. Specific socio-demographic risk factors identified include being male, young(less than 29 years), being single (never married). Attitude towards rule violation, age and gender were found to be good predictors of drivers' behavior (watchful and cautious driving, inattentive driving and drinking and driving and non-use of seat belts).

Field work limitations include bureaucratic procedures in public institutions which led to delayed access to required data, manually kept OPD records at University Teaching Hospital took more time to sort required data. RTSA and Zambia police service data was based on reported accidents giving possibility of under reporting and non-reporting of some accidents. Self-reporting questionnaire had possibilities of respondents reporting good behavior and yet in reality they could violate traffic rules. To overcome these limitations, this study used multiple methods to explore information and to have a comprehensive picture of risk factors and road traffic accident situation in Lusaka.

Key words: Epidemiology, risk factor, risk exposure, fatality, road crash, casualty, public transport, behavior, risk compensation, less developed country, enforcement and road user (pedestrian, passenger, driver, and cyclist).

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List of Acronyms and Abbreviations

ABS	Anti-lock Braking System
AIDS	Acquired Human Immune Deficiency syndrome
ANOVA	Analysis of Variance
BID	Brought in Dead
CBD	Central Business District
CSO	Central Statistical Office
DBQ	Driver Behaviour Questionnaire
HDI	Human Development Index
HIV	Human Immune Virus
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
NTNU	Norwegian University of Science and Technology
OPD	Out Patient Department
PSV	Public Service Vehicle
RTSA	Road Traffic and Safety Agency
SAPs	Structural Adjustment Programmes
SPSS	Statistical Package for the Social Sciences
TB	Tuberculosis
UNDP	United Nations Development Programme
U.T.H	University Teaching Hospital
WHO	World Health Organisation
ZISC	Zambia State Insurance Corporation

1 INTRODUCTION.

1.1 Background of the Study

Road traffic accidents and injury-related deaths are increasing worldwide with less developed countries like Zambia having more cases of fatalities. Globally, it is projected that by 2030 road traffic injuries will be 5th leading causes of death (M. Peden, 2004). Table 1 also shows that by 2020, road traffic injuries are projected to become the 3rd cause global burden of disease measured in Disability-Adjusted Life Year (DALYS) (Peden et al, 2004).This implies that in Zambia, road traffic accidents and injury-related deaths will be higher than deaths caused by malaria and HIV/AIDS, which are current highest causes of death and suffering. This problem is of great concern for less developed countries which have limited resources for research and development of road traffic accidents counter-measures.

Change in rank order of DALYs for the 10 leading causes of the global burden of disease

	1990		2020
Rank	Disease or injury	Rank	Disease or injury
1	Lower respiratory infections	1	Ischaemic heart disease
2	Diarrhoeal diseases	2	Unipolar major depression
3	Perinatal conditions	3	Road traffic injuries
4	Unipolar major depression	4	Cerebrovascular disease
5	Ischaemic heart disease	5	Chronic obstructive pulmonary disease
6	Cerebrovascular disease	6	Lower respiratory infections
7	Tuberculosis	7	Tuberculosis
8	Measles	8	War
9	Road traffic injuries	9	Diarrhoeal diseases
10	Congenital abnormalities	10	HIV

DALY: Disability-adjusted life year. A health-gap measure that combines information on the number of years lost from premature death with the loss of health from disability.

Figure 1-1 Ten (10) Leading causes of global burden of disease

Source: Peden et al 2004 p5

Broader over view of the Trends

Road traffic accidents have continued to become a threat to public health as it causes about 1.2 million deaths and 20 to 50 million injuries per year worldwide. Deaths from road traffic crashes

account for about 25% of all deaths from injuries (Peden et al, 2004). Occurrenceof these road crashes show spatial variation where less developed countries account for about 85% of total casualties. Whereas in low and middle-income countries road traffic deaths will increase by over 80%, in high-income countries road traffic deaths will fall by 30% despite increasing motorization levels in high income-countries. This could be attributed to heavy investments in research, safety campaigns, strict traffic rule enforcement systems and physical traffic separation and traffic calming systems in urban areas which have been implemented.

Road users and risk factors in less developed countries

In less developed countries the impact of road traffic crashes is more among the vulnerable road users such as pedestrians, passengers (on public buses and minibuses) and cyclists who belong to low socio-economic status and have limited access to post crash emergency health care. Peden et al (2004, p 41) argue that "*a review of 38 studies found that pedestrian fatalities were highest in 75% of studies, accounting for between 41% and 75% of all fatalities while passengers were second largest group accounting between 38% and 51 % of fatalities*." One example is a study in Kenya which found that pedestrians and passengers accounted for about 80% of all fatalities between 1971 and 1990 (Odero et al, 2003).

According to Peden et al (2004) studies on age and gender show significant differences in road traffic crash involvement where over 50% of global mortality occurs among young males (15-44 years) who in 2002 accounted for 73% of all road deaths. These age and gender differences are attributed to exposure to traffic system, risk-taking behavior, cultural and socio-economic reasons among others.

Most of the studies have found that few but more severe crashes occur in rural areas (due to higher speed limits) while more but less severe injuries are reported in urban areas which could be due to posted speed limits and traffic congestions which slows traffic flow. In most of less developed countries other risk factors are attributed to few road signs, poor road design which have no traffic separation system leading to traffic mix of road users.

While theories and research have shown that road traffic crashes are caused by interaction of multiple factor (vehicle factors, human behavior factors, environmental factors and enforcement factors), human error has been identified as accounting for about 95% of all road fatalities. These human error factors include general rule violation and risk-taking behavior such

as speeding, drinking and driving, non-use of seat belts, overloading, crossing road in undesignated places (Peden et al 2004).

Unlike other major causes of deaths like malaria and HIV/AIDS which have been well researched, there is little evidence of epidemiological studies on risk factors on road traffic crashes in Zambia. The main purpose of this study was to investigate factors contributing to risk-taking behavior associated with accident causation in Lusaka, Zambia and examine counter-measures that can be adopted by relevant authorities.

1.2 Statement of Problem

Road traffic accidents in Zambia have been on the increase for the past decades. For example in 1998 there were 800 road traffic deaths which rose to 1,300 by 2007. There has been concurrent rapid increase in population and number of registered motor vehicles in Zambia. For instance, there were 183,701 total registered vehicles in 2006 which increased to 328,732 by 2010.

In trying to address this problem, the Zambian Government established Road Traffic and Safety Agency (RTSA) in 2002 with the main aim of promoting road safety through education, regulation and law enforcement (RTSA, 2012). RTSA embarked on different measures of safety campaigns such as Television and radio programs, school safety campaigns, and highway patrols by both RTSA and traffic police officers. Despite these measures, road traffic accidents have continued to increase. According to RTSA (2012), road traffic crashes rose by 49% from 15,186 in 2010 to 22,570 in 2011 in the whole Zambia. Lusaka and Copper belt provinces had the highest reported road traffic crashes probably due to higher density of people and vehicles. According to RTSA (2012) the number of road traffic accidents in Lusaka increased by almost 40% from 8,217 in 2010 to 11,498 in 2011. These figures are three times higher than the second highest province (Copper belt) which had 4,742 crashes in 2011 and it is about half Zambia's total fatalities in 2011. Although mortality and morbidity from road traffic injuries is preventable, it appears to have received little attention from research and donor community in comparison with other health issues such as TB, malaria and HIV/AIDS especially in Zambia (Jones et al., 2008).

While in developed countries and some neighboring African countries like Tanzania, Uganda and South Africa more research has been done in various aspects of risk factors, there seems to be little evidence of such epidemiological studies in Zambia. It is against this

background that this research will be undertaken to fill this knowledge gap and was undertaken to finding out road traffic accident trends from 2008 to 2012; to investigate the factors contributing to risk-taking behavior which is associated with increasing road traffic accidents (deaths and severe injuries) and to explore counter-measures that can be adopted by relevant authorities.

1.3 Main Objective (aim)

The overall aim of this research is to investigate the road traffic accidents in Lusaka, Zambia focusing on five years trend, risk factors and counter-measures that can be adopted by relevant authorities.

1.3.1 Specific objective.

This research will undertake to explore the following objectives;

1. *To describe how the trends of road traffic accidents have been in Lusaka over a period of five (5) years (2008-2012).*
2. *To identify risk factors associated with road traffic accident deaths and severe injuries.*
3. *To explore the countermeasures that can be taken by relevant authorities to prevent and reduce accidents and injury-related deaths.*

1.3.2 Research Questions.

In order to collect data for the above objectives, the following research questions will be asked;

1. *How has been the trend in road traffic accidents in Lusaka in the past five years, from 2008 to 2012?*
2. *What factors contribute to risk-taking behavior which is associated with the causes of road traffic accidents in Lusaka?*
3. *How do socio-demographic characteristics influence attitude and risk-taking behavior in traffic?*
4. *What kinds of measures can relevant authorities adopt to control and prevent road traffic* accidents?

1.4 Rationale (justification) and Motivation of the Study.

Personal curiosity

One of the reasons for the choice of this topic was that when perusing a *master of philosophy in*

development studies, Specialising in geography, the researcher developed interest in the course *geography of health* especially the topic which was comparing variations of road traffic accidents between developed and less developed countries. The revelations that road traffic accidents would become 3rd major causes of global burden of disease by 2020 and that 85 % of these deaths occur in low and medium-income countries aroused curiosity to investigate reasons for these spatial variations and associated risk factors.

Curiosity was further deepened when the researcher realized how frequently road crashes are reported in public media on daily basis in his home country (Zambia). The researcher also became more interested in this topic because he grew up in Lusaka and has since seen the growth of the city in terms of population and traffic volumes against static road infrastructural development leading to congestions during 'peak hours'. The researcher was yet again exposed to European traffic systems (i.e. Norway and Sweden) where less or no accidents occur on daily basis yet they have almost similar congestions during 'peak hours'.

Geographical curiosity

Geography as a subject of scientific observations seeks to understand the spatial variation and distribution of a phenomenon which may be done through analyzing social, physical and environmental factors behind these variations. Human geography in general and population studies (demography) in particular are concerned with the causes of mortality and morbidity which could either be disease or injury related causes. Geography as an inquiry discipline is concerned with the causes of mortality and morbidity and seeks to find measures to prevent or lower these causes. This research topic is therefore geographical in nature especially with the fact that geography studies epidemics and pandemics which cause mortality, it was deemed necessary to look at road traffic accidents as 'hidden epidemic' causing injury related deaths.

Study area curiosity (choice)

Road traffic accidents are associated with areas with high population densities of people and large numbers of vehicles. Lusaka as a political and commercial center represents the most complex motor and pedestrian traffic system in Zambia. The growth of Lusaka city may have had no adequate plans and control which could have led to existing mix-up of land uses. The study area was chosen because as a capital city, Lusaka has the highest population density and

biggest number of registered vehicles and it is more likely that there can be more road traffic accidents in Lusaka than other provinces.

Research and knowledge production

This study will add to the knowledge bank on the risk factors contributing to causes of road traffic accidents in Zambia. The generated information and recommendations can be used by relevant authorities and other stake holders in planning, implementation and evaluation of traffic safety measures. The findings data and information can also be used as a baseline for further related studies.

1.5 Structure of the Thesis

This thesis has been organized in seven main chapters which are all linked to the study problem. The current chapter *one* gives the background of the study problem, statement of the problem, main aim, specific objectives and research questions of the study and rationale of the study.

Chapter *two* presents a review of relevant literature to theme of the current study and provides conceptual, theoretical and analytical framework for the study.

Chapter t*hree* presents methodology in terms of sample size, sampling framework, data collection methods and instruments. Further the chapter gives an over view of data analysis and formats of presentation of results and it outlines challenges and limitations of the study.

Chapter *four* gives the detailed description of the study area in terms of geographical information and traffic situation and road network in Lusaka District.

Chapter *Five* presents register based statistics in relation to the research question on 2008-2012 trends and chapter *six* presents SPSS analyzed results from questionnaires, interviews, video and text analysis and simple observation, in response to research questions on risk factors and countermeasures.

Chapter *seven* is the main discussion, conclusions, study limitations and recommendations to relevant authorities and for further research.

2 CONCEPTUAL, THEORETICAL FRAMEWORK AND LITERATURE REVIEW.

Introduction

This chapter presents definitions of key concepts, the theories and approaches that have been used in this study and an analytical framework which shows the areas where this study will focus from each theory or approach. Road traffic accidents and injuries have multiple causal factors and are quite a multifarious issue and accepting them requires a combination of theories and approaches. This research has used two main theories and two approaches which have addressed both risk factors and counter- measures. The chapter also provides a review of relevant literature to this study. Literature from both developed and less developed countries have been used but more focus was on studies from less developed countries with special attention on Africa which provides similar context to the study area (Lusaka, Zambia).

2.1 Definition of key Concepts

The study will focus on the following key concepts: risk factors, road traffic accidents, crashes, injuries, casualties and traffic attitude. These major and other concepts are defined below;

Epidemiology: *"the study of the distribution and determinants of health-related states or events (including disease), and the application of this study to the control of diseases and other health problems"* (WHO http://www.who.int/topics/epidemiology/en/).

Road traffic crash, "*an event occurring on a street, road or highway, in which at least one motor vehicle in motion is involved by collision or losing control, and which causes physical injury or damage to property*" (Odero et al, 1997, p. 445).

Road traffic fatalities refer to "*deaths that occur within 30 days as a result of a motor vehicle crash"* (Odero et al., 1997, p. 445).

Road Traffic Injuries (RTIs) refers to number of persons who sustain tissue damage, which may be slight or serious, in a road traffic crash. A serious injury "*is an injury for which a person is detained in hospital as an in-patient* (Odero et al., 1997, p. 445). Such injuries include fractures, internal injuries or severe cuts (Jones et al., 2008).

Road traffic casualties refer to "*the total number of fatalities and injuries resulting from a motor vehicle crash*" (Odero et al., 1997, p. 445).

Road user: a person using any part of the road system as a non-motorized or motorized transport road user (Peden et al., 2004, p. 201). These include drivers, pedestrians, passengers, cyclists/riders.

Risk: "*the likelihood that an individual will experience the effect of danger*" (Moen & Rundmo, 2005, p. 363). Risk is the probability judged (estimated) by consequences.

Risk factor: the probability that an event will occur following a particular exposure (Burt, 2001).

Attitude is defined as "*tendencies to evaluate an entity with some degree of favor or disfavor, ordinary expressed cognitive, affective and behavioral responses*" (Iversen & Rundmo, 2004, p. 556). This means behavior in traffic can be predicted on the basis of a person's attitude in traffic.

Risk compensation: *"behavioral adaptation to perceived lower risk situation especially when the lower risk is brought about by an accident countermeasure*" Assum et al (1999, p. 545)

Public transport: in this study it refers to buses, minibuses and taxis owned by private individual and or companies but regulated and licensed by the local authorities. They are usually painted same colour and are driven by public service vehicle (PSV) drivers.

2.2 Theories

A theory can be defined as, "*a set of explanatory concepts that are useful for explaining a particular phenomenon, situation or activity and are essential in defining a research problem*." (Kitchin & Tate, 2000, p. 33). According to Mikkelsen (2005, p. 187) theory is, "*a system of interconnected abstracts or ideas that condenses or organizes knowledge about the social world*." There is nothing to research without theory (Kitchin & Tate, 2000). This shows that theory is very important in undertaking a research. Most research in human geography especially those associated with human-environment relationships are multi-faceted and complex and may require a combination of paradigms, approaches and concepts. This study has employed two theories and two approaches. These are system theory, risk theory, model of traffic accidents causation and geographical approach to road traffic causation.

2.2.1 The System Theory of road traffic accident causation.

The System Theory of road traffic accident causation explains the man-environment adjustments and maladjustments. The basic assumption of the systems theory is that road traffic crashes result from the interfacial malfunctioning of the components of the traffic systems. The main emphasis is on man-environment adjustments and maladjustments (Muhlrad & Lassarre, 2005). Hence,

human factors and vehicle factors combine with physical and social environmental factors to bring about road traffic accidents. The interdependence of these factors in relation to accident causation suggests that in trying to investigate the causes of road crashes all the relevant factors within the system ought to be given (equal) attention. According to Peden et al. (2004, p. 12) " *the system approach seeks to identify and rectify the major sources of error or design weakness that contribute to fatal and severe injury crashes , as well as to mitigate the severity and consequences of injury*". The system based models assumes that accidents which occur in a complex socio-technical system are caused by a range of interacting human and system failures (Aderamo, 2012).

The System Theory focusses on three main components: vehicle, behavior and environment. The vehicle component of the theory describes motor vehicle composition, age, its technical aspect (condition of tires and brake system) and safety equipment like air bags and seat belts. The behavior of man component comprises of demographic characteristics which include age, sex, attitude, general traffic behavior, driving experience and driving styles including rule violation such as over speeding and others. The environment component comprises of the natural, social-cultural, built-up environments and road environment (transport networks). Time of the day, settlement pattern and land use are all part of the environment in the system. The system traffic laws, controls and regulations were superimposed to the system theory in the model for traffic accidents.

2.2.1.1 The Jørgensen-Abane model of traffic accident causation.

This model is a sub of system theory and it will be used with its key components of system of traffic laws, control regulation and as well as looking at aspects of behavior, vehicle and the environment. Traffic laws and regulations will help to highlight on the countermeasures.

This model was developed by Jørgensen-Abane (1999) and it draws spur from both the system theory and the social ecological model. The model tries to propose that dealing with risk factors and prevention measures, four aspects should all be considered. These are the vehicle, behavior, physical environment and traffic regulations and control.The strength of this model is in its holistic approach to road traffic accident causation. All categories of road users are covered and it adds the policy making and implementation aspect. The path line arrows in the figure2-1 show direction of influence and nature of relationship among the different elements of the model.

a) *Vehicle*

This model presumes that the condition of the vehicle being used on the road is a risk factor responsible for the number of accidents. These conditions include old vehicle, brake failure, poor state of tires (which can lead to tire burst) and poor maintenance of the vehicle by using cheap and old spare parts. Other aspects of the vehicle include inside protective mechanism such as seat-belts and airbags.

Some studies have shown that there is a positive relationship between increasing road traffic crashes in developing countries and poverty. Chen (2010) argues that the majority of Africans use public buses and matatus for daily routine as passengers which expose them to risk of collision and injury. These vehicles usually have no seat belts since they are imported as second hand vehicles (Chen, 2010). Hazen and Ehiri (2006) observed that socio-economic factors indirectly contribute to and worsen road casualties. Most of the poor are among the vulnerable pedestrians or passengers on unsafe public transport. Odero et al. (1997, p.446) argue that, "*a high prevalence of old vehicles that often carry many people than they are designed to carry, lack safety belts and helmet use, poor road design and maintenance and traffic mix on roads are other factors that contribute to the high rates of crashes in less developed countries*". It was also observed from other studies (Aderamo, 2012; Chen, 2010; GD Jacobs & Sayer, 1983) that most of the vehicles in developing countries are defective, lack maintenance and use low quality spare parts which contribute to road traffic crashes.

b) *Physical, social-cultural, built up and road environment*

The model considers the physical environment to be one of the key risk factors in vehicle crashes as it influences both the road user and vehicle. For instance potholes can influence the driving behavior. Other aspects are quality of road, road segments, lane width, roundabout, junctions and appropriate road signs. The physical environment also looks at spatial conditions (structures), settlements pattern and topography like uphill or downhill and road bends which expose road users to higher risk of road traffic crashes.

One characteristic of physical or built environment which is common in less developed countries (due to poor economic situations) is lack of traffic separation for motorized and non-motorized road users. This makes pedestrians to walk close to or on the main road especially in

rainy season when the sides of the road are covered by pools of water.

The socio-cultural environment looks at people's attitude in traffic safety. In most of less developed countries a lot of people are not in formal employment hence they live stressful lives as they struggle to earn a living. When in the city, they are very busy with ways of making money and usually neglect traffic safety. Some of the people are involved in businesses which are conducted in illegal locations such along the street (see Appendix XIII).

The other aspect of traffic culture neglected in less developed countries is none use of retro-reflective attires when it gets dark. These attires could indicate to motorized road users about pedestrians crossing the roads. This is worsened by poor street lights yet most of the people walk along these roads as they knock off from work and their business in the city.

Although it is not a culture of using bicycles and motor cycles as means of transport in some less developed countries like Zambia (especially in Lusaka), the few that ride rarely use helmets and reflectors. They sometimes ride on the main road due to lack of cyclist lanes in some places. Those who use personal cars are usually in hurry to get to work because of traffic congestion hence do not exercise patience when driving which result in collisions with other cars or pedestrians and cyclists.

c) *Human behavior*

The behavior of the population includes demographic characteristic like age and sex. The model considers the attitude and behavior of road users (drivers, cyclists, pedestrians and passengers) as being key risk factor in road traffic crashes. For instance a pedestrian who crosses outside crosswalks or a driver who does not obey traffic rights or speed limits can pose danger to other road users. Other aspects of the behavior are training attained by the driver or driving experience, driving under influence of alcohol or drugs. Some minibus drivers do not go to formal driving schools instead they learn driving while working as conductors leading to acquisition of driving licenses by corrupt means. All these pose great danger (risk) to other road users.

Attitude in traffic (rule violation) and risky driving behavior

Attitude towards rule violation in traffic is associated with risky driving behavior such as reckless driving, drink and driving and seat belt user (Iversen, 2004). According to Iversen and Rundmo (2004, p.569), "*attitude towards traffic safety were associated with involvement in risk*

behavior, especially attitude concerning rule violations and speeding and reckless driving". Drinking and driving has been found to significantly contribute to driver risky behaviour and is associated with high rate of road traffic crashes (Iversen, 2004). Horwood and Fergusson (2000) also found that drinking and driving to be one of a constellation of risky driving behaviors that may include speeding, unsafe and careless driving and also found that the high rates of accidents reflect a general tendency to risky driving. In a study of road accidents in Kenya, Muchene (2013) found that Public Service Vehicle (PSV) drivers have been blamed for careless driving, drunken driving, incompetence, over speeding and other myriad of attitude and behavior that render them prone to causing accidents which could have been avoided. In the same study pedestrians were also known for flouting traffic rules by crossing the roads at non-designated points even failing use fly-over and underpasses foot bridges.

Kobelo et al (2013, p. 62) also argued that "*the contributing human error in causing crashes is not only confined to drivers but also to passengers, cyclists and pedestrians*." There are cases where pedestrians cross the roads in undesignated places or penetrate in between cars in congestion. Passengers may also stop and board a bus or lorry on any part of the road where there is no bus stop and can even get on an overloaded vehicle just to rush for their urgent issues disregarding the risk.

Socio-demographic characteristic factors:

a) *Age and gender*

Studies examining dangerous driving have shown that gender is significant in predicting involvement in accident (Iversen & Rundmo, 2004; Nordfjærn et al., 2012; Yagil, 1998). Growing number of studies have shown that demographic characteristics have an important relations to driver attitude and behavior (Nordfjærn et al, 2012). A global fatality study found that females rarely account more than 25-30% of road casualties in developing countries but females instead tend to have higher pedestrian involvement (G Jacobs & Aeron-Thomas, 2000). Females are more involved as pedestrians in Africa probably due to cultural attitude where more males take driving jobs than females and males are economically able to buy cars than females hence males are more exposed as drivers. The few females that drive only do it for shorter distance (few kilometers) such as when going for work or shopping hence less exposure.

A study done by Turner and McClure (2003) in Australia showed that male drivers, aged 17-25 years, were involved in 75 % of fatal road crashes both in 1999 and 2000. Ackaah and Adonteng (2011) also found that in Ghana about 74.3% of fatalities involving males. Young males aged 15-44 years are more affected and 50% of global mortality occurs in this age group (Hazen & Ehiri, 2006; Odero et al., 1997; Sharma, 2008). Males engage in unsafe driving behaviors such as driving after drinking and speeding more than females (Nordfjærn et al., 2012; Yagil, 1998). In a study of gender and age related attitudes toward traffic laws and violation, Yagil (1998) attributed the gender difference in traffic behavior to socialization process and gender roles where girls are encouraged to be obedient and dependent while boys are allowed to be independent. Women's role is passive and non-competitive as a result they are not expected to take risks. Males are encouraged to express anger, take risk and compete hence they may commit more driving violations than females.

b) Marital status

In a study on age and gender differences in risk-taking behavior, Tuner & McClure (2003) found that those never married showed higher driver aggression scores. The married and divorced/separated were not different in driver aggression scores. The single people are usually young people who are more likely to take risk because they have no families to take care of.

c) Education

Education is an important variable for driver attitude and behavior. Studies found that seat belt-use differed significantly among young drivers with different levels of educational achievement (Hoseth & Rundmo, 2005; G Jacobs & Aeron-Thomas, 2000). Another study (Hoseth & Rundmo, 2005) found that individual with higher education demanded less transport risk mitigation which could mean they are more liable to take risks. While gender and age predicted driver attitude and behavior, education was a weaker predictor (G Jacobs & Aeron-Thomas, 2000). Lourens et al (1999) found no significant relation between educational level and accident involvement. Tuner and McClure (2003) found higher mean scores on driver aggression for those who had completed university education. Increased frequency of driving drowsy was associated with demographic characteristics like younger driver, high education and men(McCart et al, 1999) while Dobson et al (1999) also found that higher socio-economic status

(education & occupation) was associated with driving lapses and errors.

d) Vulnerable road users

Most of road traffic studies, in Africa and Asia, show that pedestrians and passengers are most vulnerable road users accounting about 80% of road fatalities (Aderamo, 2012; Chen, 2010; Nantulya & Reich, 2002; Odero et al, 2003; Sharma, 2008). Pedestrians alone accounted between 41 & 75%, passengers between 38-51 % (Ackaah & Adonteng, 2011; Lagarde, 2007; Odero et al., 1997).

d) *Traffic laws, regulations and controls*

The element of traffic laws, regulations and controls was superimposed by the model as a fourth element. It included policy making and implementation process which plays a fundamental role in road crash prevention. The vehicle, behavior and environment elements can, to a large extent, are influenced by traffic laws and enforcement. The level of regulation and control will determine vehicle conditions, behavior of road users and condition of the road. There is a two way influence between each pair of factors. For instance the vehicle will determine how a driver behaves such as a new vehicle makes the driver over speed. People‘s behavior or attitude will also determine the type of vehicle they buy i.e. a vehicle with no airbags. The environment (nature of road) will influence the driving behavior and vice versa. The vehicle condition, nature of environment and behavior to some extent may also influence the traffic regulations to be adopted hence small dotted arrows indicating little influence in that direction (see figure 2-1).

Corruption and traffic law enforcement

There is poor enforcement of safety regulations in less developed countries (Sharma, 2008). Corruption has been seen as an indirect (distant) contributing factor to road traffic crashes especially in the area of law enforcement by police and on issuance of drivers' license. Nordfjærn et al. (2012,p.1863) argue that, "*countries in Sub-Saharan Africa usually have fewer explicitly defined road traffic regulations and less enforcement of these regulations due to lack of resource and high levels of corruption*". Kobelo (2013, p.62) also argued that, "*corruption is one of the major impediments to success of road safety efforts. For example, learner's driver license and driver's licenses are issued regardless of whether the person has the required knowledge and skills to operate a vehicle on the road*". There are some cases where traffic police were seen, on

camera, receiving bribes from traffic law breakers and allow such drivers to go free (Muchene, 2013). "*Corruption is a huge problem in some countries often creating a circle of blame-police blame driver, public blame drivers and police and drives blame police. Corruption also extends to vehicle and driver licensing agencies*" (Nantulya & Reich, 2002, p. 1140).

In summary it can be argued that all factors contribute to accident causation. Odero et.al (2010) studying road traffic injuries in Kenya, identified major causes of road crashes as being human factors (85%), vehicle factors (5.1 %), road environment (2.9%) and other factors (6.4 %). On the other hand, Kobelo, et al (2013) found road design deficiencies, human factors and lack of proper enforcement as contributing factors to unsafe road ways in Tanzania.

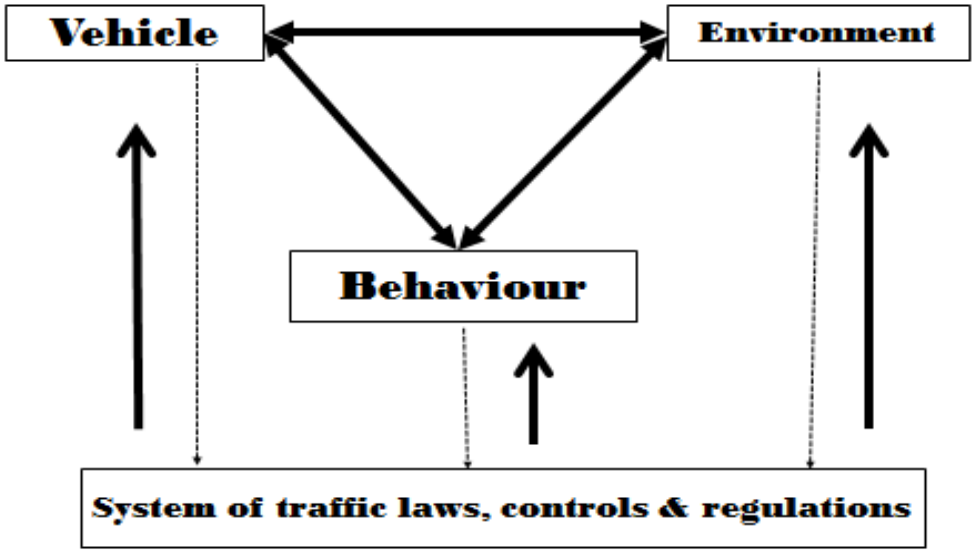

Figure 2-1 Model of Traffic Accident Causation (modified)

Source: Adapted from Jørgensen-Abane (1999)

2.2.2 The Risk Theory in road traffic accident causation.

Risk theory in road traffic accident studies has also been used to describe accident causation and identification and implementation of countermeasures. According to Moen & Rundmo (2005, p. 363) risk can be defined as "*the likelihood that an individual will experience the effect of danger*". The word risk therefore, carries both probability of a negative event and the

consequences of such an event. Risk increases as the probability increases and as the expected consequence increases (Moen & Rundmo, 2005). According to (Peden et al., 2004), road traffic accident risk is a function of four elements: amount of exposure-that is the amount of movement or travel within the system by different road users; probability of crash given a particular exposure; probability of injury, given the crash and the outcome of injury. In Table Peden et al. (2004) also outline three main areas of risk factors based on risk theory.

Table 2.1 Main risk factors of road traffic injuries based on risk theory

Factors influencing exposure to risk	*Factors influencing crash involvement*	*Factors influencing crash severity*
Economic factors(poverty), demographic factors(age & gender), land use pattern, speed limits and road design & traffic mix	Excessive speed, presence of alcohol, being young male, poor vehicles maintenance & brakes, inadequate visibility	Human tolerance, excessive speed, non-use of seat belts &child restraints, presence of alcohol, no air bags.

Source: Adapted from Peden et al (2004, p.71).

The risk theory in road traffic accident causation may be more applicable to less developed countries where large part of the population is exposed to public transport system for their daily activities. They are exposed as passenger, pedestrian or cyclists. Peden et al. (2004, p. 73) argue that, "*in terms of exposure to risk, the main modes of travel in these countries in the foreseeable future are likely to remain walking, cycling and public transport"*. This large amount of exposure may lead to high probability of injury and severe injury outcome. In these modes of travel, there are major variations in risk of injuries existing among pedestrians, cyclists and bus passengers (Peden et al., 2004). Nordfjærn et al (2011) observed that poor countries exhibit a higher risk tolerance because of being exposed to various risks every day. It is very likely that people in poor countries can neglect traffic risk due to the influence of other existing risks such as HIV/AIDS, malaria and hunger.

2.2.2.1 Risk compensation (homeostasis).

Risk compensation as a sub of risk theory is also referred to as behavioral adaptation. The theory stresses on the resilience, adaptability and flexibility of road users to the changing environmental conditions and contingencies (Wilde, 1989). Assum et al (1999, p. 545) define risk compensation as, *"behavioral adaptation to perceived lower risk situation especially when the lower risk is*

brought about by an accident countermeasure." This means that drivers may perceive a higher risk on a narrow or rough road and reduce speed or increase attention but once the road is widened as a risk reduction measure, drivers tend to compensate by speeding. Wilde (1989,p.276) argues that risk compensation may occur where " *drivers who wear seat belts as a consequence of the law that compels them to do so, perceive reduced accident likelihood of their own, change their behavior in traffic (for instance becoming less attentive or increase speed) and thus pose a greater risk to other road users*". Sagberg et al (1997) also argue that people who drive cars with airbags and antilock braking system (ABS) tend to compensate by increasing speed and close following the vehicle in front. They also have reduced attention in traffic. Risk compensation can also be seen among pedestrians who become less caution when using painted crosswalks since they perceive less risk (Sagberg et al., 1997). Some studies have shown that risk compensation is seen in traffic enforcement measures. Wilde (1989) gives an example of Japan where driving licensing tests were very expensive coupled with very high penalty on drivers who broke traffic regulations which resulted in drivers' reducing their accident involvements. This means that drivers were more cautious due to high perceived risk in terms of strict enforcements (as consequences).

Risk compensation may also be applied to less developed countries especially Africa where traffic enforcement is weak and driving licenses is easily obtained by corrupt means. According to Grimm & Treibich (2010, p. 16) , "*in countries where corruption is widespread, the incentive to respect rules and regulations may be very low, since major legal steps may be avoided by bribing police officers and public bureaucrats*." Drivers are more likely to disobey traffic rules because they know they cannot face a heavy penalty by paying little amount to a traffic police or responsible public officer hence they perceive less risk due to less consequences compared to the penalty. It is also more likely that drivers may observe traffic rules when they approach the traffic police check point but compensate with speeding once they pass the check points. Risk compensation also applies to other traffic rules such as wearing of seat belts by drivers who only do so when they see traffic police but drive without seat belts if there are no traffic police on the road. This is supported by Assum et al. (1999) who argue that road users compensate adjusting to a risk factor but increase speed or become less attentive again once the factor is removed. The other area where risk compensation may be applied is where drivers reduce speed in traffic congestion or where there are speed humps but later on compensate by

speeding once the roads are clear or less congested. Risk perception and risk-taking behavior fluctuates according to the risk environment that road users are exposed to.

2.2.3 Geographical approach to road traffic accidents causation.

The geographical approach to the study of traffic accidents relates to the concepts of place, time and environment of accident occurrence. The key elements are land use and road elements such as width, bends and topography (i.e. hilly, slopes) and regional distribution in occurrence of road traffic accidents. Jones et al. (2008) argue that the study of road traffic accidents should focus on wider areas rather than just sites with highest crash frequencies. The geographical approach examines the context of the environment within which road crashes occur. This approach also looks at population densities, economic activities and land use effects on road crashes. The other multifaceted elements of the geographical approach are residency population, demographic characteristics such as age, gender and socio-economic of a population, traffic volumes and road length. Jones et al. (2008, p.525) state that, "*the physical structure of the road network, expressed in terms of the curvature or sinuosity of road and frequency of junctions, may influence road traffic accident risk*". This means that the road density, road bends and junctions are usually associated with risk of crashes. The geographical approach also looks at spatial distributions of population such as urban and rural and high and low residential areas may influence their vulnerability to traffic risk.

Although the geographical approach looks at road traffic accidents from a broader perspective, this study will only focus on demographic characteristics like age, gender and high or low residential areas. Other aspects will be road density, junctions, traffic volumes, time and day of occurrence.

Physical and socio-cultural urban traffic environment in less developed countries

In relation to geographical approach, urban areas in less developed countries are characterized by high volume of traffic causing traffic congestions and higher risk of vehicle collision especially at cross roads or junctions. The other characteristic of urban traffic environment is high number of pedestrians both in city center and residential areas. In most less developed countries, as argued by Sharma (2008), there is poor road and land use planning characterized by mix of high speed traffic, heavy commercial vehicles, pedestrians and cyclists with no pavements and cyclists lanes. This is argued further by Chen (2010) and Nantulya & Reich, (2002) who cited

poor road design, overcrowding and hazardous road environment in developing countries. This complex road user environment creates more potential conflict between vehicles and vulnerable pedestrians (Jørgensen, *in press*). Businesses conducted in undesignated areas especially along the shop corridors and on road pavements create a higher risk exposure to the street vendors.

Urban-rural disparities

Road traffic studies have shown that there are variations in pattern of road traffic accidents between urban and rural areas. Jorgensen (*in press*, p.167) argues that, "*risk exposure will vary geographically, influenced by motorization, transport mode use and travel distances on the one hand and transport context, time and place and speed conditions on the other hand*." This implies that densely populated areas in terms of vehicle densities and road users are more likely to have more but less severe crashes while sparsely populated (rural) areas are more likely to have fewer but more severe crashes. High traffic volumes, speed limit, roundabout, traffic lights and junctions may lead to reduced speed in urban areas while speed increases in rural (high ways) areas with higher speed limits, less traffic volumes and fewer pedestrians crossing the roads.

In the study of pattern of road traffic injuries in Ghana, Afukaar et al (2003) found that pedestrian fatalities accounted for about 66.8% in urban areas and 33.5% in rural area. But the car occupant fatalities were 8% in urban and 11.1 % in rural areas. Bus and minibus occupants fatalities were 8.9% in urban areas and 28.5% in rural areas. Odero et al. (2003) found that 60% of all injury-producing crashes occurred on road in rural areas while 40% occurred in urban areas in Kenya and these were attributed to greater number of buses and matatus (minibuses) that are involved in crashes. The same study also found that road user involvement varied between urban and rural areas. 68% of fatalities of pedestrians were in Nairobi (urban) whereas in other (rural) provinces, the majorities killed were passengers (Odero et al., 2003). This shows spatial variation in road user fatalities between urban and rural areas by mode of transport. This could be explained by less population density (fewer pedestrians) and posted high speed limits in rural areas leading to severe fatalities compared to urban areas. Other factors could be less presence of police leading to more rule violation such as reckless driving.

2.3 Global Overview of Trends

The 1999 Road Traffic data shows that Sub-Saharan Africa had about 10 % of global road crash deaths but with only 4 % of registered vehicles yet the entire developed world with about 60 % of global registered vehicle had only 14 % of road crash deaths (G Jacobs & Aeron-Thomas, 2000). Sharma (2008) also observed that road traffic crashes caused over one million deaths and 50 million injuries and that about 90 % occur in low to middle- income countries. There is a positive correlation between increasing levels of motorization and road deaths especially in developing countries. While developed countries like Sweden has about 1.3 deaths per 10,000 vehicles, the rate is more than 100 deaths per 10,000 vehicles in some African countries (Sharma, 2008). Aderamo (2012) observed that road traffic injury mortality rate was highest in Africa (28.3 per 100,000 population) compared with Europe with 11 deaths per 100,000 population.

2.3.1 Spatial trends of road traffic crashes in less developed countries.

Most of road traffic studies for less developed countries show an upward trend. Afukaar et al. (2003) observed that in Ghana between 1994 and 1998 road traffic serious injuries increased by 52.8% and deaths by 65.3%. Odero et al. (2003) also found that between 1965 and 1998 road traffic crashes and persons killed in Kenya increased by 300% and 430% respectively. Museru et al. (2002) conducted a ten year epidemiological appraisal of road traffic accidents in Tanzania and results showed that road traffic accidents increased by 44%, injuries by 42% and deaths also increased by 64% between 1990 and 2000. Museru et al. (2002) also cited Nigeria with an increase of 43% road traffic accidents and deaths by 110% between 1977 and 1983. In a ten year analysis of road traffic accidents in Zambia, Emenalo et al (1977) found that the post-independence period (1964-74) the number of accidents increased by 66 %; persons killed increased by 63 % and seriously injured increased by 60 %.

2.3.2 Road crash incidences

Time and day of the week of occurrence of accidents

Studying road traffic accidents in developing countries, Odero et al. (1997), observed that between 60 and 80 % of casualties were injured during the day and only one-third of traffic injuries occurred during the night between 18:00 and 24:00 hours. During the day there is usually

traffic congestion during 'rush hours' and more risk exposure to pedestrians hence higher probability of collisions. Drivers force their way to cover up open spaces in the congestion disregarding breaking distance. But day accidents on the other hand are less severe due to low speed of vehicles move to those that occur at night when drivers over speed. The night create scope for risk taking behavior than day time because there is less presence of traffic police hence rule violation is common especially drink and drive and speed limit violation. More than 50 % of weekly traffic injuries occurred on Friday, Saturday and Sunday. Weekend crashes are associated with drink-driving and over speeding due to less traffic volume on the roads.

2.4 Analytical Framework

The system theory of road traffic accident causation and model of traffic accidents causation is used as the main framework to analyze and understand multiple causes of road traffic crashes. The model of traffic accidents causation also helps to identify prevention and countermeasures from its system of traffic laws, controls and regulations. This study will look at all the four aspects of the system theory and Model of traffic Accidents causation (see fig 2-2). The assumption is that attitude and behavior are influenced by traffic laws enforcement levels and in turn this attitude and behavior determine the type and condition of vehicle driven and how the vehicle will be used or driven will depend on the environmental characteristics. This study assumes that risk factors are as a result of the interaction among the four aspects of the model of traffic accident causation.

The risk theory in road traffic accident causation will be used to identify factors which influence risk exposure, crash involvement, crash severity and post-crash severity. The focus will be on vehicle protective mechanisms and road design, traffic mix and how they influence road users' behavior adaptations or risk compensation based on countermeasure. This means the risk theory will also look at the vehicle factors, behavior factors (rule violation and demographic characteristics), environmental and traffic law enforcement factors.

The second model-geographical approach will help to compliment the system theory and model for traffic accidents by looking population and vehicle densities and road design. The geographical approach will further help identify risk factors related to socio-economic factors of the population (poverty and corruption), urban environmental factors such as: pedestrians, road junctions, traffic volume, time and day of accident occurrence.

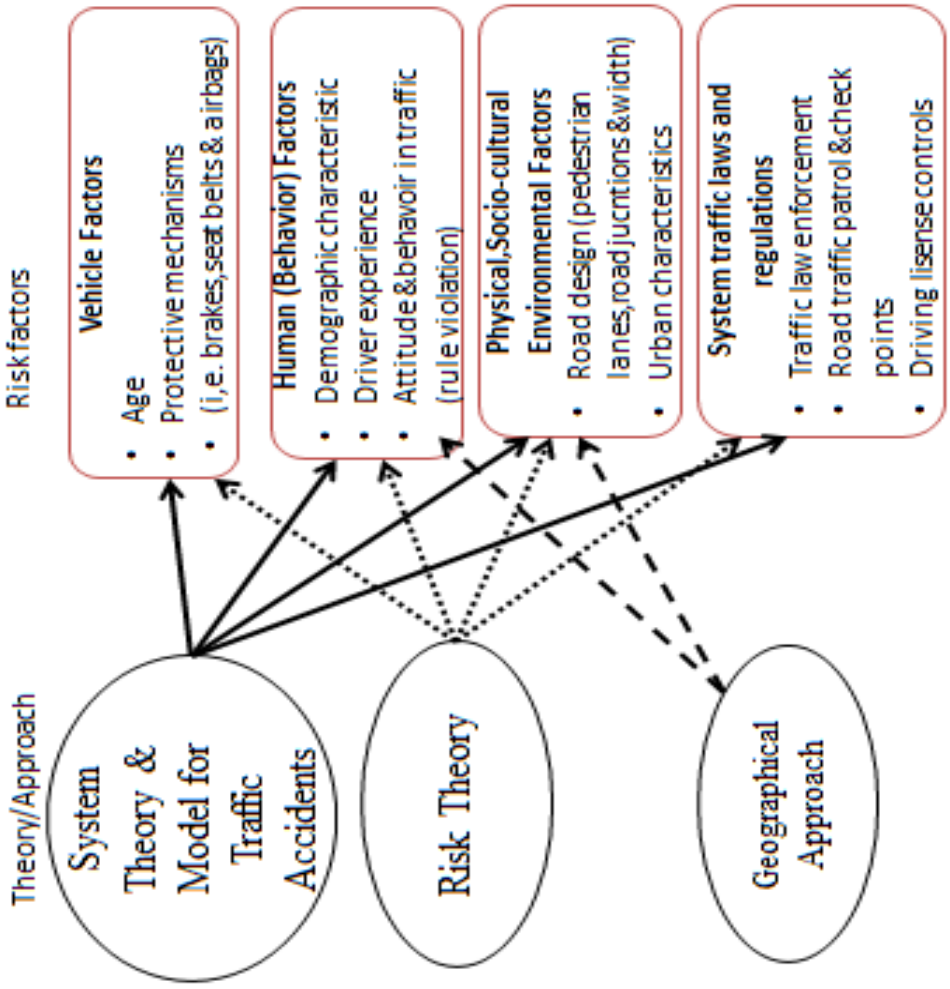

Figure 2-2 Conceptual /Analytical Framework (Model)

Source: Author's own construct, 2014.

3 METHODOLOGY

Introduction

This chapter presents methods that were used in the field in data collection for this study on epidemiology of road traffic accidents in Lusaka, Zambia. The chapter gives an explanation of how the study was conducted, methods applied and data collection instruments and reasons for choice of such methods. The chapter also looks at study site(s), sampling techniques and justifications. Reliability, validity and data analysis are also discussed in this chapter. This research applied mixed methods where both quantitative and qualitative approaches were used, with a framework of a case study of Lusaka District. The quantitative approach addressed the research questions of five year trends and risk factors in road traffic accidents while the qualitative approach addressed the research questions of risk factors and countermeasures.

3.1 Research Problem

Road traffic accidents and injury related deaths have become a major public health concern in Zambia as they are becoming a major cause of mortality and morbidity. While the trends in developed countries have decreasing trends, in Zambia they have been increasing. By 2011, road traffic crashes rose by 49% for the whole Zambia (RTSA, 2012). This increase could probably be associated with the increase in population and number of registered vehicles per year especially in Lusaka province which has been recording highest numbers of fatalities (RTSA, 2012). Although mortality and morbidity from road traffic injuries is preventable, it appears to have received little attention from research and donor community in comparison with other health issues such as TB, malaria and HIV/AIDS especially in Zambia (Jones et al., 2008).

It is against this background that this research was undertaken to find out the trends for five years from 2008 to 2012 and the risk factors associated with the increasing road traffic fatalities and severe injuries and to explore the countermeasures that can be adopted.

3.2 Research Questions

The following research questions were addressed in this study;

1. *How has been the trend in road traffic accident in Lusaka for the past five years, from 2008 to 2012?*

2. *What factors contribute to risk-taking behavior associated with the causes of road traffic accidents in Lusaka?*
3. *How do socio-demographic characteristics influence attitude and risk-taking behavior in traffic?*
4. *What kinds of measures can relevant authorities adopt to control and prevent road traffic accidents?*

3.3 Methods and Justification

The actual methods that were applied in particular are survey (questionnaires), interviews, video and media text analysis and simple observation methods. This mixed method approach was adopted in order to adequately address the four research questions as it would generate the required data. While interviews gathered data on views of the key informants on causes of accidents and countermeasures, the survey and official based accident data gathered data on trends, risk factors in terms of demographic characteristics, behavior and attitude in road traffic among drivers and other road users. Video analysis, text analysis and simple observation acted as confirmatory to data from interviews and questionnaires.

3.4 Quantitative Approach

This approach was used to collect both primary and secondary data. Primary quantitative data was gathered by a self-reporting questionnaire while secondary quantitative data was from register based accident data. Quantitative approach generated a bigger amount of data.

3.4.1 The survey (questionnaire).

Confidentiality and participation

Participants were informed and assured of confidentiality and anonymity since no names were required except age and occupation which were asked for. Participation was on voluntary basis and questions required personal opinion about road safety. This survey targeted 170 respondents but only 155 completed the survey questions with the response rate of 77.6%.

Measures and structure of the questionnaire

All questions in the survey were only about opinions or point of view concerning traffic safety hence both persons with or without driving license could participate. This questionnaire has been

applied as measurement instruments and knowledge in other projects carried out internationally (including Norway, Tanzania and Ghana) in several studies on attitudes, risk perception, risk and safety culture, and risk behavior in traffic and transport safety research. However, the content and form was cut down and slightly revised (modified) in order to adjust from more general to specific cultural contexts and local Zambian conditions. Questions which were not relevant for this study were left out in the final version. The final designed questionnaire had seven sections and 99 questions in total as shown(number of items in brackets): *A*. '*Your opinion about traffic safety'* (26); *B.* '*Your risk judgment in traffic' (19); C. 'Your risk willingness' (5); D. 'Your behavior as a pedestrian' (19); E. Demographic information (11); F 'Your traffic behavior' (27); G. 'your accident history' (14).* For easy data analysis, these items (questions) were divided into sub-scales (dimensions). For instance, item *F*, *your traffic behavior*, was subdivided into three dimensions*:* watchful and cautious driving, drinking and driving and non-use of seat belts and inattentive driving. The majority of items applied a Likert 5 point scales (From 'strongly agree' to 'strongly disagree') statements where respondents should make up their mind about traffic safety. Other variables were probability (from 'very likely' to 'very unlikely'); Risk willingness (from 'most willing' to 'very unwilling'). It was estimated to take 20 to 30 minutes to complete the form. The last two sections (F&G) were for persons with driving license only (See appendix II). All these items have been validated from other studies where the survey has been used (see Nordfjærn et.al.2011).

Data collection

The field work (collecting questionnaire data) was carried out for the entire two months of research period. Respondents were approached at market places (shopping area), work places and bus stations (drivers and passengers). Three research assistants, two students and one lecturer, from the University of Zambia were used in distributing the questionnaires. They were trained and given NTNU introductory letters (see Appendix I) to enable them administer the survey easily. This was done to reach the desired sample size (170 respondents) though only 155 responded were attained.

Most of respondents filled in the questionnaires on their own while for others the it was administered in form of interview (reading questions and writing for respondents). Since the research was on voluntary participation basis, respondents who were approached and showed un-

willingness (hesitance) were replaced by other respondents who were willing. About 10 public service vehicle (PSV) drivers, 3 female drivers, 6 female and 4 male other road users were replaced. This means that 23 refrained and 15 did not return giving the total of 38 who did not participate but had been selected. The response rate was 77.6%. No incentives in form of gifts or money were used during data collection to respondents to participate as this would have led to response bias.

Advantages of the questionnaire

A questionnaire is usually a list of questions, which are carefully structured to provide valid and reliable data. An important aspect of the validity and reliability of questionnaire method is that same questions are posed in the same manner to all participants. Questionnaires are versatile, allowing the collection of both subjective and objective data through the use of open or closed format questions. The questions it contains makes the questionnaire good. Risk factors in traffic are related to attitudes and behavior of road users and this questionnaire was appropriate to measure attitudes in traffic safety (see Nordfjærn, et.al.2011). Since everybody has an opinion on traffic safety and the issue concerns the whole population, this questionnaire was distributed in low, medium and high economic status areas of Lusaka.

Reverse answer categories to some items were included to make respondent read the questions critically to see if the question had different wording without just ticking same boxes. This was done to reduce response set bias.

Weakness of the questionnaire

As a researcher, I did not participate in the first design of the questionnaire, however, I had the opportunity to revise the questionnaire in advance, which led to a reduction in its length. Despite the reduction, the questionnaire was still too long for many of the participants who struggled with the language and the design of the questionnaire. There were also some confusion on how the questions were asked and what motive lied behind them. For instance some questions were specifically targeting drivers, passengers or pedestrians yet some participants were found in either two or all categories. The questions in the questionnaire are based upon a standard American/European survey (Driver Behavior Questionnaire -DBQ) on traffic safety, which was originally designed for people who speak English very well. Many of my Zambian participants

did not have good knowledge of written and more advanced English. This however did not affect the sample results as the questions were read to some respondents hence all classes were well represented as indicated in participant description (see 3.4.1.1).

The other methodological limitation of this questionnaire was that data was based on self-reports of behavior which means that it was possible for drivers (or other road users) to report low traffic violations. Some drivers for instance could behave in a formal way when reporting and yet they violated traffic regulations. However, since respondents completed the questionnaire anonymously, they could not gain anything by giving biased responses. They were initially assured that after data were analyzed it would not be possible to identify which respondent answered which particular questions. Nevertheless, they could give desirable, expected answers to social norms, high way codes and general traffic safety. This methodological limitation was overcome by using qualitative methods such as interviews, simple observation, video and media text analysis which provided richer data in addition to the questionnaire data.

Biasness of the questionnaire

The sample was biased in favor of higher socio-economic classes due to their better knowledge of English, their accessibility and willingness to participate in the survey and their general higher possession of driving license. The lower classes were, nevertheless, captured as pedestrians or passengers meaning that their opinions were also considered since the survey allowed people without driving license to participate (see 3.4.1.1.). The PSV bus drivers were also from different socio-economical classes.

3.4.1.1 Sample size and sample procedure.

Description of participants

Respondents

The participants in this survey had diverse background. Participants comprised of 90 (58.1%) male and 41.9% (65) female. Of the 90 males, 44.5 %(40) were public service vehicle (PSV) bus drivers, 22.2% (20) were private drivers and 33.3% (30)were other road users who included pedestrians, passengers, bikers and cyclists. Of 65 females, 53.8% (35) participated as drivers while 46.2% (30) as other road users. In Table 3.1, there were more female drivers sampled (40) compared to male drivers (20) which was deliberately done to increase the female drivers'

participation since all the 50 PSV drivers were males giving the total of 70 male drivers compared to 40 female drivers This also helped raise the female respondent percentage to 41.9% closer to 58.1% for males. The age of participants for both sexes ranged from 19 to 54 year (*M*=34.4; *SD*=7.144). In terms of civil status, 30.5% were single, 66.2% married and 3.3% divorced/widowed. Of 106 valid participants, 68.4% had children while 31.6% had no children. The variables, number of children, civil and educational status were included to see risk taking behavior among demographic characteristics. The levels of education were basic education 9.7%; high school 22.6%, vocational/training 12.3% and college/university 55.4%. This college/university percentage looks high because there was a possibility of some drivers who did some mechanic courses at some college selected this option as well instead of selecting vocational/training because the two were similar. The other reason could be that Lusaka has a lot of public institutions of learning such as the University of Zambia, National Institute for Public Administration, Evelyn Hone College, University Teaching Hospital, Chainama College of Health Sciences and other private colleges and universities and it could be that most students from these institutions participated since they are often found on either public or private transport. In terms of areas of residence 22.5% lived in high cost residential area, 42.4% in medium and 35.1% in low cost residential areas. The longest experienced driver was 25 year while the lowest had few months experience (*M*=5.57; *SD*=5.035).

Non respondents:

Some of the selected respondents refrained from participating but were replaced. These were 10 PSV drivers, 3 female drivers, 6 female other road users and 4 male other road users giving the total of 23. Of 170 respondents who were given the questionnaire forms, 15 did not return them giving 77.6% response rate.

3.4.1.2 Sampling Techniques.

Since participants were divided into three categories, PSV bus drivers, private drivers and other road users, different sampling methods were applied (see Table 3.1).

Table 3.1 Number and types of participants

Target respondents	*Males*	*Females*	*Totals*
PSV bus drivers	50	0	50
Private car drivers	20	40	60
Other road users*	30	30	60
Totals	100	70	170

*Note '*other road users'* include pedestrians, passengers and cyclists

Source: Field data in Lusaka, Zambia; June-August, 2013.

A stratified sampling was used for PSV drivers where 50 drivers were selected from five bus stations within the city center (see figure 4.3). From each bus station 10 drivers were sampled from bus route registers and finally 2 drivers randomly selected from each bus route (see table 3.2).The PSV drivers were selected from five different bus routes to have a representation of different residential areas since some buses go specifically to high, medium and low residential areas and there were different types of buses such 12 and 29 seat buses in different bus routes and different residual areas. For private car drivers, quota sampling was used, where 40 females and 20 males were sampled and finally judgmental sampling was use.

Table 3.2 Sampling of bus drivers

Bus station	*Number of sampled routes*	*Number of sampled drivers per route*	*Totals*
City Market Bus Station	5	2	10
Kulima Tower Bust Station	5	2	10
Millennium Bus Station	5	2	10
Lumumba Road Bus Station	5	2	10
Kamwala Bus Station	5	2	10
Totals	**25**	**2**	**50**

Source: Field data in Lusaka, Zambia; June-August, 2013.

For other road users (pedestrians, passengers and cyclists) a quota sampling technique was applied where 30 females and 30 males were selected and this was followed by convenient or judgmental method due to lack of sampling frame which is a common problem in low-income countries (see Nordfjærn et.al, 2011). Of the 50 PSV bus drivers that were given questionnaire, only 40 (80%) filled in and returned and of 40 female drivers given questionnaires, only 35 (87.5%) returned the filled questionnaires. The sampling procedure was based on sampling by

replacement. Some respondents, who were approached, refrained from participating and gave excuses that they were 'busy' while others said the questionnaire was too long and had no time to answer all the questions. These were replaced by other respondents in order to attain sufficient numbers for each group to perform some statistical analysis. Table 3.3 shows age range among respondents.

Table 3.3 Age and types of respondents.

	PSV drivers	*Female drivers*	*Male drivers*	*Female others*	*Male others*	*Total Number*
Age groups	*No (%)*	*No (%)*	*No (%)*	*No (%)*	*No (%)*	
20-29	6 (15)	6 (17)	4 (20)	11 (37)	3 (10)	30
30-39	22 (55)	18 (51)	10 (50)	11 (37)	20 (67)	81
40-49	10 (25)	10 (29)	6 (30)	6 (20)	7 (23)	29
50+	2 (05)	1 (03)	0 (0)	2 (6.6)	0 (0)	5
Totals	40 (100)	35 (100)	20 (100)	30 (100)	30 (100)	155

Source: Field data in Lusaka, Zambia; June-August, 2013.

Note: 'others' refers to pedestrians, passengers and cyclists.

Weaknesses of sampling procedure

Sampling by replacement did not give actual response rate since those who were sampled but refrained from participating were replaced with new respondents hence raising the response rate to 77.6%. A non-random sampling technique which was used for non PSV drivers had allowed for selection bias. However, other techniques such as quota sampling, which was representative, allowed males, female and other socio-economic groups to have a chance of being selected. The sample size of 155 is small in relation to the population of Lusaka and it's not ideal to perform some statistical analysis. This was due to limited funds and time of the study (Bryman, 2012).

3.4.2 Register based accident data.

This was secondary data obtained from three institutions; Road Traffic and Safety Agency (RTSA), Zambia Police Service and The University Teaching Hospital (U.T.H). RTSA and Zambia Police Service have the responsibilities of collecting road traffic accident data for the whole country while U.T.H records all referral road traffic accident cases for the whole country also. Nevertheless, the data for this study were for Lusaka District (urban) only.

3.4.2.1 Procedure.

Written letters (Appendix I) were delivered to the three key institutions seeking permission to conduct research and access data from their records. These were addressed to senior management such as directors (RTSA and U.T.H) and Inspector General (Zambia Police Service). When permission was granted and consent forms (appendixes III) were signed, appointments were made with respective (delegated) departments dealing with road traffic accident data.

3.4.2.2 Data from Road Traffic and Safety Agency (RTSA).

Type of data:

The RTSA data collected were on number of road traffic accidents, deaths and severe injuries for Lusaka District over a period of five year (2008 -2012). The severely injured road users imply injuries which demanded hospital treatment/admission, such as fractures, internal injuries or severe/deep cuts (Jones et al., 2008) .The RTSA data were split into categories of road users such as drivers, pedestrians and passengers. The data were also gathered in terms of days of the week and time of accident occurrence. The data were obtained from RTSA quarterly and annual accident reports. The year 2012 had the highest number of reported accidents (13,687) compared to previous years. The mean accidents reported for five year period was 9,645.4 with the mean of 411 persons killed and 1,131 seriously injured for three years only since there was missing data for 2008 and 2011 for serious and slightly injured. The reason for missing data could be that RTSA gets secondary data gathered by Zambia Police Service from accidents sites.

Quality of data:

Although data from RTSA appears to be up to date, it did not meet the research criteria of diving data into age groups and gender. For instance RTSA data only recorded number of people killed and injured without diving it by gender. There was also missing data for 2008 and 2011 on persons killed and severely injured. There was a possibility of reporting errors due to observed high variations in reported accidents in year before 2012. For instance in 2008 only 627 accidents were reported while in 2012 the figure rose to 13, 687. The data was only based on reported accidents which means that there was a possibility of some accidents not being report such as minor accidents, bicycle accidents, heavily drunk road users involved, if the car was not road worthy or if the driver(s) involved didn't have driving license, theft and other illegal road

traffic activities. RTSA data on the other hand were easy to access with less bureaucratic procedures. Data were computerization, consistent and had a systematic format of reporting.

3.4.2.3 Data from Zambia Police Service.

Type of data:

The data from Zambia Police were also collected on road traffic accidents, deaths and severe injuries for Lusaka District over a five year period (2008 -2012). The data were split into categories of different road users such as drivers, pedestrians, passengers and cyclists. The data were obtained from annual accident reports. The year 2012 had the highest number of reported accidents (13,687) compared to 2008 (11,180) indicating an increase. The mean accidents reported for five year period was 11,770 with the mean of 348 persons killed and 2,262.4 for seriously injured for three years only. Most road users affected in five years were pedestrians with the total of 1,234 while the least affected were cyclists with the total of 122.

Quality of Zambia Police data:

The data from Zambia police service, on the one hand, appears to be complete since they recorded direct figures from accident sites. There was less variation over the reported years. Just like the case for RTSA, this data, on the other hand, was only based on reported accidents, which means there was possibility of some accidents not being report as stated earlier. The recording system does not split into gender and age groups above 16 years but only total numbers of male and females are recorded.

3.4.2.4 Data from University Teaching Hospital (U.T.H).

Type of Data:

This data were based on number of road traffic accident (severely injured) victims who were admitted to the surgical wards of the hospital via emergency department. The data did not include those brought in dead (BID) although they were also taken to U.T.H mortuary from various accident sites. Data were separated into road traffic accident victims who died and those who were discharged. Although it was split into gender, age groups were only divided into 4 year cohorts up to 14 years. Those above 15 years were put in one cohort (age group). The data were collected by manually reviewing monthly, quarterly and annual road traffic accident reports from Out-patient department (OPD) for the period 2008-2012.

Quality of data:

Since the data was retrieved from manual (un-computerized) registers, there was a high probability of registration errors. It was also not systematic as in some cases only monthly returns were available while in other cases annual returns. The fact that the U.T.H is a national referral hospital, it was difficult to find records that split accident victims by province (place of residency). Therefore the data collected were not accidents for Lusaka District only but could be for the whole Zambia as long as cases were referred to U.T.H. This data therefore would include casualties from places of accidents in and out of Lusaka even if they are not Lusaka residents. Annual returns for 2008 and one month for 2009 were missing due to the manual way of keeping data.

Difference between RTSA, Zambia Police Service and U.T.H data

U.T.H data did not capture the road traffic accident BID cases which could reduce the number of road traffic deaths compared to figures captured by RTSA and Zambia Police Service. The other difference between RTSA and U.T.H data was that those captured as severely injured by RTSA might have died in U.T.H hence U.T.H recorded them under road traffic accident deaths.

3.4.3 Quality of data in general.

This section will discuss validity and reliability of quantitative data in general.

Validity

Validity deals with the extent to which the instrument measures what was intended to measure (Bui, 2009). To increase the validity of the survey (questionnaire), a standard cross cultural survey designed by Psychology and Geography departments at NTNU was used which has also been used in Europe, Asia and Africa. It was, however, reviewed and modified to suit Zambian culture and standards, hence some questions that were not relevant for this study were eliminated and few aspects were included.

Reliability

According to Bui (2009), reliability refers to the extent to which an instrument consistently measures what it was intended to measure. Bryman (2012), on the other hand, argues that

internal reliability deals with whether the indicator that makes up the scale or index are consistent. To test the internal consistency (reliability) on multiple responses with Likert scale response and to determine if the scale was reliable, cronbach's alpha was used in this study. Factor analysis was also used as a variable reduction technique to reduce variable into smaller sets. Table 3.4 gives the summary of cronbach's alpha on Likert sub scales which ranges from .706 to .883. There were reverse items within the questions which helped to reduce response bias. This means respondents had to read the items before ticking to see if they were phrased the other way round.

Table 3.4 Summary of Factor analysis showing internal consistency of items

Factors	*Dimension*	*No.of Items*	*Cronbach's alpha*
Factors for Traffic Safety			
Factor 1: Attitude towards rule violation	Dim 1	8	α=.778
Factors for risk consequences (two dimension)			
Factor 1: Risk consequences on overturn and head on collision	Dim 1	3	α=.734
Factors 2: risk consequences on parking and collision	Dim 2	4	α=.794
Factors for Risk Judgment in traffic (two dimensions)			
Factors 1: Risk judgment on overturn and collision	Dim 1	7	α=.794
Factor 2 : Risk Judgment as driver, pedestrian or passengers	Dim 2	3	α=.771
Factors for Risk willingness			
Factor 1: risk willingness	Dim 1	5	α=.734
Factors for Driver behavior (Three dimensions)			
Factor 1: Watchful &cautious driving	Dim 1	12	α=.883
Factor 2: Drinking &driving and non-use of seat belts	Dim 2	5	α=.801
Factor 3 : Inattentive driving	Dim 3	4	α=.706

Source: Field (SPSS) data in Lusaka, Zambia; June-August, 2013.

3.5 Qualitative Approach

This approach used interviews, observation, and video and text analyses as data collection instrument.

3.5.1 Interviews.

procedure

Written letters were delivered to the five key institutions seeking permission to conduct interviews (see Appendix I). These were addressed to five senior management, such as public relations officers (U.T.H and ZSI), Deputy Director (RTSA), Claims Manager (Professional Insurance) and Division Traffic Officer (Zambia Police Service).When permission was granted and consent forms were signed (see appendixes III) and key informant informed about the purpose of the study, interviews were conducted.

The sampling techniques were purposive or convenience for RTSA, U.T.H and Zambia Police and snowball for insurance companies where the first insurance company proposed other reputable insurance companies that could participate. Most of the key informants were the only officers allowed to serve as spokespersons to the general public. Their opinions represented the views of other officers in the institutions they worked. Hence only one key informant was selected from each institution (see Appendix IV). It was unethical for junior officers at Zambia Police Service, U.T.H and ZSIC to give their personal opinions to the public apart from the public relations officers or an officer responsible for that department. Initially it was planned that at least two officers from each institution would be interviewed but considering ethical issues stated above only one officer was interviewed.

There were five interviews in total with the key informants (RTSA, Zambia Police Service, U.T.H, Professional Insurance and ZISC. The third insurance company,Guardian Insurance Company that was selected did not honor the several appointments that were booked and hence did not participate. All the five interview guides had similar structures with only minor differences on questions that did not concern that particular institution. The introductory part of the interview guide outlined the aim of the study, participation, confidentiality and personal particulars. The rest of the interview guide was divided into four main parts. Part *A* was about occurrence of accidents (trends), part *B* was about obtaining information and registration, part *C* was on assessment and causes of accidents (risk factors) and the last part *D* was about

counter-measures. The interview guide was designed in such a way that it could be self-administered since there were spaces for writing responses and questions were simplified. Follow up questions were asked on face to face interviews as well as on self-administered where provisions for 'any other comments' were left for respondents to add other views related the previous questions after each section (see appendix IV).

Of the five interviews, only two were conducted as face to face interviews with key respondents and they lasted between 30 and 40 minutes and the other three interview guides were filled in by the key informants on the scheduled dates. None of the interviews was recorded as key informants did not feel comfortable with the idea of recording but opted for the researcher to take notes. Of the five key informants four were males and one female. They had the mean age of 36 years and mean experience of 10.5 years in their positions.

Worthiness of interview gathered data.

Interviews with key informants provided intensive understanding of road traffic and safety issue because all the key informants had vast knowledge and many years of experience (M=10.5) in their positions related to road traffic and safety. The interviews also adequately covered the two research questions on risk factors and countermeasures and few comments on trends (first research question).

Despite these strengths of interviews as a data collection instrument in this study, there were some limitations. Interviews had status bias since only senior managers had chance to be selected, junior officers in these institution could not have their opinions heard. If time and finances allowed, it could have been ideal to interview road users as well.

None of the interviews was tape recorded since most informants opted to fill in the interview guides or have note taking during the interview. This could lead to some important information being left out. But this helped to remove the barrier that tape recording brings. Gatrell & Elliot (2009) argue that apart from the risk of technical failure, interview taping can be a barrier to interaction and can be seen as a means of surveillance.

Most of the interviews were held in public offices (informant's work places) as a result, there were some interruptions of phone calls and visitors entering during the interview. This, however did not compromise the quality of the data collected.

3.5.2 Video analysis.

After obtaining permission from the author, Conroy Dave , a you tube video "*riding into Lusaka*" was analyzed as a secondary source of data where key risk factors were identified. Gatrell & Elliot (2009, p. 51) argue that, "*visualization provides visual evidence of an association with social or environmental factors"* The video therefore provided visual evidence of major traffic rule violations by drivers, pedestrians and cyclists and some aspects of road design in Lusaka. These key aspects have been presented as pictures extracted from some parts of the video. The full video clip has also been inserted on CD and as a link and it lasts 37:39 minutes. (http://www.youtube.com/watch?v=VX0_zqbtjwY)

3.5.3 Simple (personal) observation.

Observation

A simple observation of accident risk and road safety issues was carried out simply by the researcher being part of the traffic system as pedestrians or automobile occupants in minibus, in taxis and private cars. Gatrell and Elliott (2009) state that rich data can be collected by participating or observing daily human activity. This observation was an additional or confirmatory observation to the researcher's knowledge of cultural practices since he grew up in the same area (Lusaka). Matthews and Ross (2010, p.187) state that "*an observation can be carried out covertly, by for example, observing via a concealed video camera or by a researcher participating or a member of the group being observed*" .The simple or passive observation did not need concert of the participants since it was just the natural traffic system and traffic culture being observed and not a particular institution or group of individuals. Bryman (2012, p.273) argues that "*a simple observation is one in which the observer is unobtrusive and is not observed by those being observed*". If those being observed know that they are being observed they can change their behavior. The observations included quality and roadworthiness of the vehicles, the road environment with the system risk related to different road elements (road width, surface, lack of traffic separation, posted speed limits etc.) and the driving behavior such as reckless, cautious driving, and practicing of high way codes. Furthermore area variation in traffic volume between densely populated and sparsely populated areas of Lusaka were observed.

3.5.4 Text analysis.

This involved the analysis of secondary data which included online newspaper articles and photographs based on the study issue. Gatrell & Elliot (2009) argue that, documentary and photo analysis have contributed to understanding of health geography. This method was used to capture major accidents which drew public media attention during the field work period. The analysis included sites, road users involved, types of motor vehicle involved and the causes of the accidents.

3.6 Data Analysis

The collected interview data were categorized into four themes related to research questions. These themes included occurrence of accidents, obtaining of accident information, assessment of causes of accidents and road safety measures. Qualitative data analysis involved thematic analysis core themes extracted from the data through coding of key themes. Video and media text analyses focused on general rule violations by road users.

For quantitative data, descriptive statistics were applied in order to determine general characteristics of the samples and to investigate the means and standard deviations of attitude towards rule violation and risk behavior in traffic in the samples. Factor analysis with varimax rotation was applied to identify the dimensions of opinion about traffic safety and traffic behavior. Cronbach's alpha coefficient and the average corrected item-total correlations were calculated, for the purpose of measuring the internal consistency of the scales (see table 3.4). Independent samples t-tests were carried out to investigate gender differences in attitude towards rule violation and inattentive driving and watchful and cautious driving and inattentive driving by marital status. One-way analyses of variance (ANOVA) were performed to investigate whether sub-samples with age groups differed in watchful and cautious driving, drinking and driving and non-use of seat belts. One-way analyses of variance were also conducted to investigate whether sub-samples with levels of education differed in inattentive driving and watchful and cautious driving. Regression models were performed on watchful and cautious driving, inattentive driving and on sum scores of three drivers' behavior variable (inattentive driving, watchful and cautious driving and drinking and driving and non-use of seat belts.)

3.7 Data Presentation Techniques.

Text presentation of data

Most of the qualitative data from interviews was presented in text format where views from different key informants were summarized under four main themes as stated in 3.6 above. Video and text analyses were also presented in text format. Text presentation was also done on quantitative data in form of descriptions and explanations on tabular and graphical presentations.

Statistical presentation of data

Quantitative data collected from Zambia Police and RTSA were presented in form of tables and figures which covered number of accidents, fatalities and severely injured for five year (2008-2012). Data from U.T.H were also presented in form of table divided into out- patients who were admitted, discharged and those who died. The survey (questionnaire) data which was analyzed by statistical package for the social sciences (SPSS) version 20 was presented in tables and figures

Pictorial presentation

Data from personal observation, video and media text were presented in form of pictures. These were photos from online newspaper articles and major fatalities captured during field work. Other pictures were highlights extracted from the video clip.

3.8 Challenges and Limitations

There were challenges and limitations that were faced during data collection for this study.
Some respondents thought that the researcher was working with RTSA and that they would be reported about their behavior, they were hesitant to participate until the purpose of the study was explained to them and after producing NTNU introductory letters.

Some appointments were rescheduled several times due to key informants being occupied with other official duties. For instance the Division Traffic Officer (DTO) could not be found in the office despite several appointments made because usually he went for traffic patrols and presidential escorts. Data from Zambia Police was only received by email after research period.

Insurance companies were not in a position to provide statistics as earlier planned because they claimed the data for three sampled insurance companies would not represent the

other insurance companies that were more than ten (10). Their point was genuine and the interview guide was modified in the field to remove the questions on statistics.

There were bureaucratic procedures in public institutions such as Zambia Police and U.T.H which led to several trips made. For example after making appointments with Zambia Police Service, Lusaka Division for about a month, there was a directive to seek authority from higher office of the Inspector General of Police, who represents the whole police service in Zambia. But after permission was granted, the release of required data was again delegated to Lusaka Division since the study was about Lusaka district and not the whole Zambia. This led to data being available and sent by email after the data collection period.

Some respondents such as PSV drivers were always busy and had little time to complete the questionnaires. Those who were given to complete the forms at their own time were difficult to trace since they were not found at one place but used different bus stations. The sample size of 155 is small according to ideal requirements to perform some statistical analyses.

Data from U.T.H was found in manual records which was difficult to compile the required data. Some years like 2008 had missing data. Age groups which was a planned requirement for this study was not possible because the institutions had a different format of recording which only captured age groups for those below 14 years and the rest were considered as adults for either males or females.

Despite these challenges, the use of mixed methods helped to cover the gaps which were left out by other institutions. This enabled the collection of adequate data. While quantitative approach develops generalization of the study to a large population, qualitative approach develops an intensive understanding of the issue under study. Insight from in-depth interviews, for instance, added colour and explanatory power to quantitative study (Gatrell & Elliott, 2009). Video and media text analyses confirmed the survey and interview data.

4 STUDY AREA

Introduction

This chapter presents background information about the study area. It begins by giving a broad overview of Zambia's country profile with emphasis on socio-economic aspects relevant to the study. The chapter presents a detailed description of Lusaka District as the specific study area.

4.1 Brief Country Description

Geographical and Demographic Data

Zambia is a landlocked country located in Central Africa. According to 2010 census, Zambia with the total area of 752,614 km^2 had the total population of 13,092,666 giving the population density of 17.4 persons per square kilometer (CSO, 2012).

There are ten provinces in Zambia and Lusaka Province is geographically the smallest but most populous. According to 2010 census, Lusaka Province had the population of 2,191,225 and population density of 100.1 persons per square kilometer. Lusaka District, which covers the whole city, is the smallest of the five districts in Lusaka Province but it accounts for 79.7% of the provincial population (CSO, 2012).

Socio-economic Characteristics

Since its independence in 1964, Zambia's economy has been heavily dependent on copper mining with copper exports accounting 95% of export earnings and 45% of government revenue. Copper mining industry has been a major employer till privatization (Bigsten & Kayizzi-Mugerwa, 2000). The situation changed after 1975 as Zambia's revenue fell drastically due to a decline in world copper prices (CSO, 2000). To recover from these economic problems, Zambia embarked on Structural Adjustment Programme (SAPs) proposed by IMF and World Bank in the 1980s. SAPs however, did not achieve expected results since many people lost their jobs as a result of privatization and retrenchment. The majority of the people were found in informal employment just doing small businesses to earn a living (Bigsten & Kayizzi-Mugerwa, 2000). Combined with the impact of HIV/AIDS and other diseases, Zambia's poverty levels increased.

According to the UNDP 2013 Report, Zambia was ranked 163 of the 187 countries with HDI value of 0.448.This value is below the average of 0.466 for countries in Low Human

Development Group and below the average for countries in Sub-Sahara Africa. This implies that Zambia is one of the poorest countries with poverty level of 64.2% (Malik, 2013).

This position has implications on risk perception, risk willingness, risk exposure and risk-behavior of the population in road safety. Poverty level may lead to too many risks such HIV/AIDS, malaria, robbery and people may not avoid traffic risk rather it seems odd to minimize traffic risk in relation to other risks. The other implication of poverty is that it hinders road infrastructure development hence exposing people to greater risk (traffic mix). It can also be argued that due to poverty people cannot even wear retro-reflective attire to reduce traffic risk when it gets dark. Poverty may also lead to high corruption in term of training and issuance of driving license and even when a driver is caught with a traffic offense, he can easily bribe a responsible officer without going to court of law. Most of the people in Zambia drive vehicles that are barely road worthy and which may have no safety devices (airbags, seat belts and ABS) due to poverty. This is coupled with customs rules that if one imported a latest model of a vehicle, he pays more import duty during clearing so poor people opt to buy very old vehicles. Poverty is therefore, regarded as a cause of the causes (distant cause) to traffic accidents.

4.2 Lusaka District

Lusaka District is located in Lusaka Province, central part of Zambia. The district has an area of 360 km^2 and it shares boundaries with Chongwe, Kafue, Mumbwa and Chibombo districts (see fig 4.1). Lusaka has a generally flat topography with an elevation ranging from 1200 to 1300 m above sea level (JICA, 2009).

There are mainly three seasons in Lusaka and Zambia as a whole: cool and dry; hot and dry and hot and wet (rainy) season. The hottest temperatures are around 30.6^oC in October while lowest is 10.1^oC in July (JICA, 2009). The rainy season is the one with greater influence on the road traffic and safety due to slippery road surfaces and sidewalks which are flooded with rain water forcing people to walk in main roads together with heavy traffic.

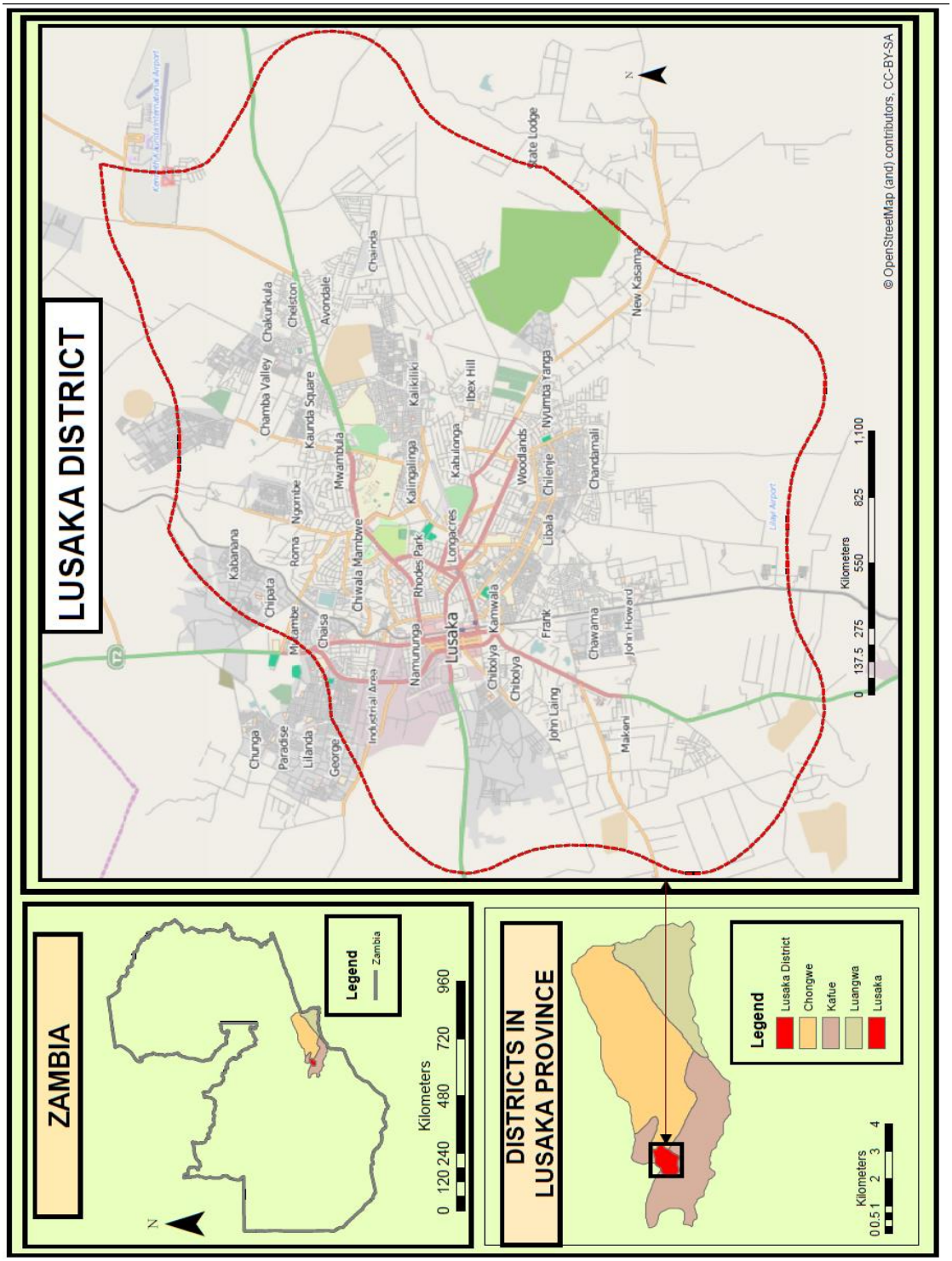

Figure 4-1 Location Map of Lusaka District (Study Area) in Zambia

Source: Author's own modification using GIS.

Lusaka is the most urbanized district in Zambia with the population of 1,747,152 which is about 13% of Zambia's total population and the density of 4, 8522.2 persons per km^2 (CSO, 2012).This population density has implications on road safety. One of the implications of higher population density is that it leads to higher per capita expenditure especially on public safety whereby the local government may not provide road infrastructures (sidewalks, pedestrian crossing, speed humps and appropriate road signs) at the fast rate of population growth. The other implication is that there is an increase in the number of pedestrians crossing roads which results in higher risk exposure. Others social services such as markets may not be adequate forcing vendors to be selling from parking slots, pavements and main roads (see video 20:20 minutes & Appendix XIII). Lusaka being urbanized also implies it's a car-oriented city and that people use public transport for most of their daily activities hence exposed more to the traffic system.

4.2.1 Road traffic situation in Lusaka District.

Road network in Lusaka

The official (main) road network in Lusaka City has a total length of 867 km. The road types include surface (tarred), gravel and earth. The total length of all roads and streets in Lusaka is about 1,600 km (JICA, 2009).

The major roads in Lusaka city are Great East Road, Great North Road, Kafue Road, and Lumumba Road, Independence Avenue, Church Road (see figures 4.3 & Appendix VIII). Since Lusaka is situated at the cross point of the north-south and east-west corridors, all the four major trunk roads converge into the city. Kafue Road is a trunk road that stretches to the south, connecting Lusaka to Kafue and Livingstone. Great North Road connects Lusaka to the northern area such as Chibombo and Copperbelt. Cairo Road connects Kafue Road and Great North Road at both ends with roundabouts, running through the town center. Great East Road is the trunk road between Lusaka and Eastern Province. Mumbwa-Mongu links Lusaka to Western Province. Kafue road has six lanes, while both Great East & Great North Roads have four lanes each and Mumbwa-Mongu Road has only two lanes. There are no ring roads in Lusaka City but only few by-pass roads to avoid congestion within the City Centre. One is Katimamulilo Road branching from Great North Road to join Great East Road and the other by-pass road branches off from Kafue Road before Kafue roundabout to join Chilimbulu Road and Independence Avenue. Heavy

duty trucks from north or south are only allowed to use Lumumba Road which also passes through the city center while those east bound trucks use Katimamulilo Road to join Great East Road (JICA, 2009).

Road facilities

The road network in Lusaka adopts roundabout system at major junctions. The two major roundabouts are found at the junction of Independence Avenue, Haile Selassie Avenue and Chikwa Road. The other two large roundabouts are found at both ends of Cairo Road (Figure 4.3 and Appendix VIII), which are heavily congested during 'peak hours' (JICA, 2009). Although traffic signals are installed at major junctions on congested roads, most of them currently are given limited phasing functions causing more congestion. To improve efficiency of traffic flows, traffic police officers control the flows at both roundabouts and other major road junctions during peak hours within the city center.

There are few pedestrian facilities such as sidewalks and pedestrian crossings. However, the connectivity of the pedestrian network is not fully developed, and this is causing dangerous situations and inconveniences to pedestrians. Most motorists scarcely stop for pedestrians at pedestrian crossings and most of the pavements and sidewalks are occupied by street vendor forcing pedestrians to walk on main roads or cross at any point.

Road traffic situation

Lusaka City accounts for a bigger percentage of all registered vehicles in Zambia. According to JICA (2009) out of 181,000 registered vehicles in Zambia, 151,411 (84%) were registered in Lusaka City alone and car owning households accounted 15% of the total households in Lusaka. The screen Line Traffic Survey conducted in 2007 indicated that more than 20,000 number of vehicles per day were observed on the four major trunk roads with about 90% dominated by passenger traffic using cars, taxis and buses (JICA, 2009).

Traffic jam

My personal observation showed heavy traffic jam was during 'peak hours' that are from 06:00 to 09:00hrs; 12:00 to 14:00 and 16:00 to 18:00 hours, especially at Cairo Road roundabouts and the three bridges that cross the railway line. According to JICA (2009), Independence Avenue

had the highest traffic volume per day about 47,000 passing cars followed by Great East Road with 31,000 and Church Road with 28,000. These are major roads leading to the high cost residential areas. Figure 4-2 shows that in some cases waiting queues at major junctions are so long that they even obstruct the next junction (JICA, 2009). Due to these traffic jams during peak hours, the average travel speed is between 15 and 33kph especially along Cairo Road. The speed, however, increases during off peak hours (see video). Reduced speed may lead to reduced accidents for motorized road users (including car occupants). There was a major observation that most of the fatal accidents occurred in the out skirt of the city, in high ways, where there is less congestions on the roads and drivers over sped as drivers try to compensate the delays they had in congestions in the city center.

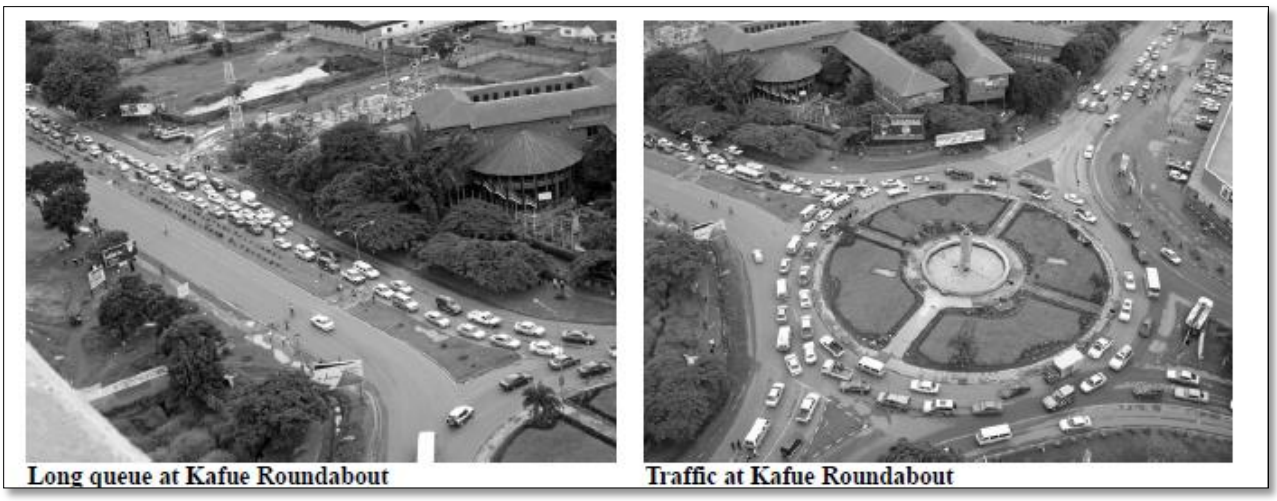

Figure 4-2 Traffic situation in Cairo Road in Lusaka during 'pick hours'

Source: JICA, 2009

4.2.2 Public service transport system in Lusaka.

Public service transport here refers to buses and taxis that operate under the jurisdiction and control of both RTSA and the municipality although they are owned by private individuals and companies. Since the government's privatization of the transport sector privately owned buses became the major modes of public passenger transport. All public transport services in Lusaka are provided by the private sector but the bus stations and intra-city bus routes are designated and operated by Lusaka City Council. Every route originates either in the township or suburbs into the main bus station in the Central Business District (CBD). All the public transport vehicles need certification as Public Service Vehicle (PSV) from RTSA. There is no railway system for

public transport within the city (Luanga, 2005).

The most popular type of bus is the Toyota hiace minibus with 12 seats although medium-size buses with 29-33 seats are also operated. Large-size buses (coaches), on the other hand, are operated as intercity transport. Bus population has increased rapidly in the last decade especially after the government's reduction in import duty on minibuses and that most of the people use buses as mode of transport instead of walking and biking.

There are five bus terminals in the center of the city: Lusaka City Market, Kulima Tower Bus Station, Lumumba Bus Station, Millennium Bus Station, and Intercity (Kamwala) Bus Terminus (see figure 4-3). Most of the bus terminals, especially Kulima Tower Bus Station and Lusaka City Market are congested mainly because a bus does not leave until it is fully loaded with passengers (JICA, 2009).

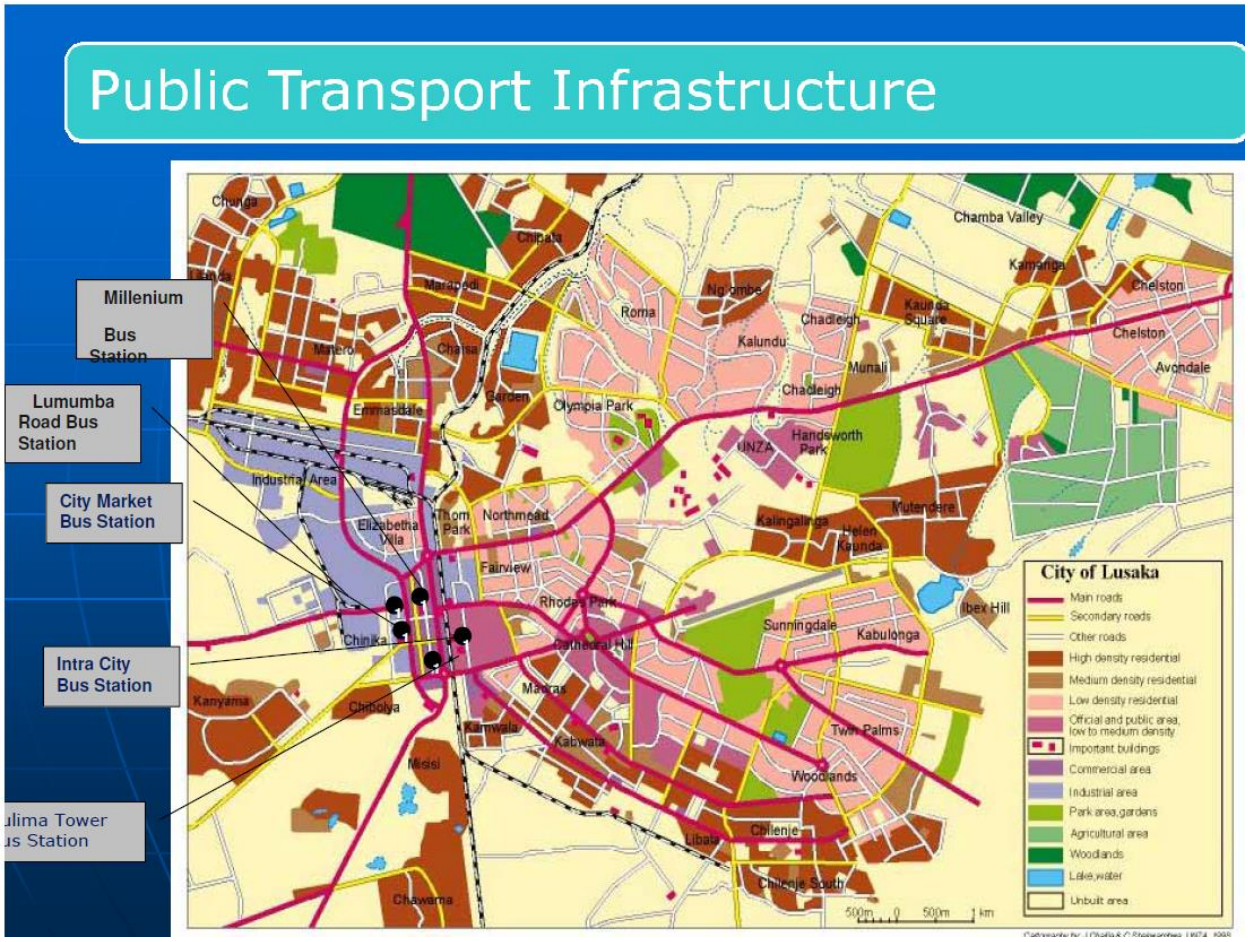

Figure 4-3 Sketch map of main bus stations in Lusaka

Source: (Luanga, 2005).

Each bus owner lends his vehicle to a bus driver by collecting daily/weekly rental fee from the driver. Operational bus routes by each minibus are not fixed because each minibus driver can change the bus route according to passengers' demand at that time. Normally drivers select high demand bus routes to meet daily/weekly cashing. Due to this individual daily/weekly cashing system, minibuses are one of the main causes of traffic congestion and accidents because of the dangerous manner in which the drivers maneuver the vehicles. Pedestrians and passengers are at a higher risk of these road traffic accidents from these public service minibuses and private cars.

4.2.3 Traffic safety and accidents in Lusaka.

Traffic safety

Traffic accident rates, in Lusaka, have been increasing in proportion to motorization and road development. Most of vehicle collisions occur at road intersects as drivers become impatient in long queues which influence the driving and risk taking behaviors. Other dangerous accident locations are pedestrian crossings (since most drivers hardly stop for pedestrians), railway crossings, highways and blind spots. This is usually common with public service buses and taxi where drivers rush to make more money (JICA, 2009).

Road traffic accidents in Lusaka

There was an increase in number of reported road traffic accidents in Lusaka Province from 8,217 in 2010 to 11,498 in 2011 while the total reported accidents for the whole Zambia was 22,570 (RTSA, 2012). This shows an increase of 40% and it also shows that Lusaka accounted for about 51% of the total fatalities in Zambia in 2012. The frequencies of road crashes in Lusaka were high on weekend and public holidays, 'peak hour' periods, and rain season (Simoonga, 2009). High frequencies during weekends and public holidays could be attributed to less traffic volumes leading to over speeding and driving under the influence of alcohol while during the rainy season it is probably due to slippery road surfaces. According to Simoonga (2009), the major risk factors are as a result of driver behavior such as disobeying traffic rules/sign, un licensed driving, driving under influence of alcohol and disregard of pedestrians.

5 RESULTS: TRENDS OF ROAD TRAFFIC ACCIDENTS IN LUSAKA (2008-2012).

Introduction

This chapter presents the results addressed by the first research question which is about trends of road traffic accidents in Lusaka from 2008 to 2012. Analyses of register based accident data from the three institutions (Zambia Police Service, RTSA and U.T.H) revealed the findings within the area of the first research question which was trying to describe the number of road traffic accidents and severe injuries which occurred in Lusaka for the past five years (2008 -2012).

This data have been categorized into number of crashes, number of persons killed and number of severely injured persons. The road traffic casualties have also been categorized into road user categories such as drivers, pedestrians, passengers and riders/cyclists. While data from RTSA and Zambia Police combined the number of casualties for both gender, U.T.H data were separated according to gender and age groups. The chapter presents results of traffic crashes reported by RTSA, Zambia Police Service and U.T.H separately.

5.1 Road Traffic Accidents Trends Reported by Road Traffic and Safety Agency.

Distribution of road crashes in Lusaka from 2008 to 2012

The data revealed the total of 48,227 reported accidents between 2008 and 2012. Table 5.1 shows that the total 2,055 persons were killed and 3,395 persons were severely injured. The data have revealed almost 5% increase in the road crashes from 23.7% in 2009 to 28.4 %in 2012. The data for 2008 cannot be used for comparison as it appears to have reporting error (underreporting). One cannot rule out minor under reporting cases even from the other years.

Table 5.1 Distribution of serious crashes in Lusaka by year

2008-2012 SERIOUS ROAD TRAFFIC ACCIDENTS						
Year	*Reported Road Traffic Accidents*		*Persons Killed*		*Person Seriously Injured*	
	No.	(%)	No.	(%)	No.	(%)
2008	627	(1.3)*	89	(4.3)*	-**	
2009	11,430	(23.7)	417	(20.3)	1,001	(29.5)
2010	11,055	(22.9)	349	(17.0)	716	(21.1)
2011	11,428	(23.7)	395	(19.2)	-**	
2012	13,687	(28.4)	805	(39.2)	1,678	(49.4)
TOTALS	**48, 227**	**(100)**	**2,055**	**(100)**	**3,395 *****	**(100%)**

Note :*there is a very high under reporting here

Note: **missing data (recording error)

Note:*** slight injuries not included

Source: Field Data from RTSA; June-August, 2013.

Distribution of crashes by days and time

The RTSA data for 2010, in figure 5.1, have revealed that most accidents occurred in time intervals of 9:00-12:00 hours (14.2%); 16:00-18:00 hours (14.5%); 18:00-20:00 hours (14.9%). The least reported accidents occurred in time interval of 23:59-07:00 hours with 8.6% reported of accidents. The highest 14.9% for time interval of 16:00 to 20:00 hours might be attributed to congestions that characterizes city roads and reduced visibility after 18:00 hours due to darkness.

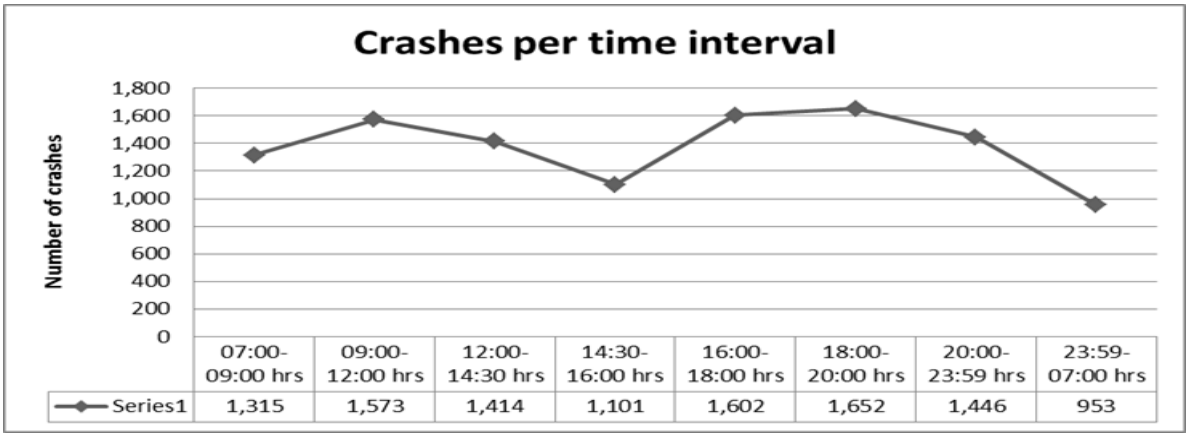

Figure 5-1 Distribution of dailly crashes per time interval

Source: Field Data from RTSA;June-August, 2013.

Generally, Lusaka experiences low traffic volumes from 23:00 hours to early hours of the morning because many people may avoid driving at night due to high rates of robbery and car theft hence only 8.6% of accidents occurred. There is also less business in the city after 20:00 hours hence few people are likely to drive around that time.

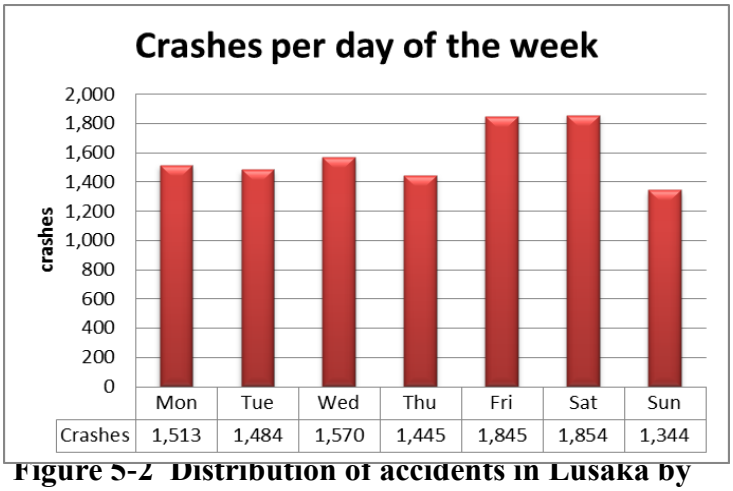

Figure 5-2 Distribution of accidents in Lusaka by day of the week

Source: Field Data from RTSA, June-Aug, 2013

In consideration of days of the week, most of the road crashes were observed towards the weekend on Friday (16.7%) and Saturday (16.8%) as shown in figure 5.2. Together the three days of weekends (Friday, Saturday and Sunday), on the one hand, accounted for almost half of crashes (45.7%). This might be attributed to less traffic volumes on city roads hence drivers over speed. Another reason could be driving under the influence of alcohol as most people drink on weekend coupled with reduced presence of traffic police officers on the roads. Sunday alone, on the other hand, had the lowest accidents (12.2 %) which can be attributed to less business in the city center as most of offices and business centers are closed.

5.2 Accidents Reported by Zambia Police Service

Yearly distribution of accidents in Lusaka

Figure 5.3 shows the total of 58,850 reported accidents from 2008 to 2012 giving a mean of 11,772 accidents per year but 2008 had the lowest (19%) while 2012 had the highest number of accidents (23.3%). This indicates about 4% increase over the five year period. The pattern has revealed a steady increase for other years but a dramatic sharp rise in 2012. A possible reason for this increase could be that there was more complete registration system of road traffic accidents. Another reason could be an increasing population and level of motorization.

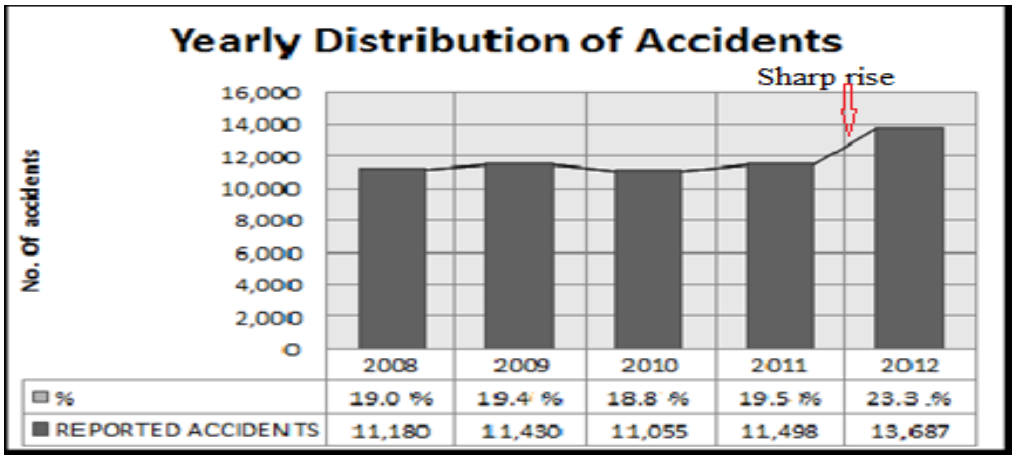

Figure 5-3 Distribution of accidents in Lusaka by year (2008-2012).

Source: Field Data from RTSA, June-Aug, 2013

Distribution of crashes by casualties

The total of 13,052 accidents were reported in Lusaka during the five year period (2008-2012) resulting in 13% being killed and 87% severely injured (see Table 5.3.). It should be noted that the number of casualties could have been more than this figure but those who were slightly injured were excluded from the study partly due to underreporting and poor data quality for the slightly injured (see methodology chapter).This shows about 4% yearly increase of total casualties from 19.4% in 2008 to 23.1% in 2012.

Table 5.2 Distribution of crashes by casualties

2008-2012 Reported serious road traffic accidents by casualties

YEAR	*2008*		*2009*		*2010*		*2011*		*2012*		*TOTALS*	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	%
Severely injured	2,180	(86)	2,166	(86)	2,115	(87)	2,209	(86)	2,642	(88)	11,312	(87)
Killed	354	(14)	337	(14)	316	(13)	364	(14)	369	(12)	1,740	(13)
Totals	2,534	(100)	2,503	(100)	2,431	(100)	2,573	(100)	3,011	(100)	13,052	(100)

Source: Field data from Zambia Police Service, June-August, 2013.

5.2.1 Distribution of casualties by categories of road users.

Categories reported by RTSA

One out standing feature of road traffic crashes in Lusaka was that there was high involvement of the most vulnerable road users who are either pedestrians or passengers in public minibuses. Data in Table 5.3 below indicate the mean and total casualties per road user for the five years (2008-2012) and have revealed that pedestrians accounted for 62.8% of the total crashes while the least affected road users were the rider/cyclists with 6%. But the pedestrians and passengers together accounted for 82%. This could be attributed to the fact that the majority of Lusaka residents from low to medium socio-economic status use public minibuses for their daily routines. As passengers they are exposed to risk of collision and injury involving public buses which are usually overcrowded and lack protective equipment such as seat belts and airbags (see also Study Area Chapter 4.1). As pedestrians they are exposed to risk of collision as they cross roads within residential areas or in the city center. Their vulnerability is worsened by lack of traffic separation (sidewalks), zebra crossing, pedestrians bridges, tunnel in road design (see also video at 17:55 and 19:25 minutes and study Area chapter 4.2.1)

Table 5.3 Distribution of casualties by road users

Reported casualties by types road users, 2008-2012

YEAR	2008		2009		2010		2011		2012		TOTALS	MEAN
ROAD USERS	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
DRIVERS	43	(11)	57	(14)	35	(10)	57	(14)	47	(11)	**233**	**(12.0)**
PEDESTRIANS	257	(65)	249	(60)	230	(66)	246	(62)	255	(61)	**1,234**	**(62.8)**
PASSENGERS	82	(20)	93	(22)	57	(17)	72	(18)	77	(19)	**381**	**(19.2)**
RIDER/CYCLISTS	17	(4)	18	(4)	25	(7)	24	(6)	38	(9)	**122**	**(6.0)**
TOTALS	**393**	(100)	**417**	(100)	**347**	(100)	**393**	(100)	**420**	(100)	**1,970**	**(100)**

Source: Field Data from, RTSA, June-August, 2013.

5.3 Road Traffic Accidents Reported by University Teaching Hospital (U.T.H).

The data from U.T.H was gathered from the casualty ward registers of road traffic victims who were admitted but were either discharged or died for the period 2009 to 2012. It should be noted that the year 2008 has not included because it had missing data (see methodology chapter 3.3.4).

Table 5.4 Male casualties in U.T.H (2009-2012)

Male Casualties in U.T.H 2009-2012																		
Year	*2009*				*2010*				*2011*				*2012*					
	Admitted		*Number*		*Admitted*		*Number*		*Admitted*		*Number*		*Admitted*		*Number*		*Admitted*	
Age	*No.*	*%*	*Disch**	*Died*	*No.*	*%*	*Disch**	*Died*	*No.*	*%*	*Disch**	*Died*	*No.*	*%*	*Disch**	*Died*	*No.*	*%*
<1 Yrs.	5	2.3	4	1	3	1.7	3	0	0	0	0	0	0	0	0	0	8	1.2
1-4 Yrs.	11	5.1	10	1	7	3.9	6	1	9	5.5	9	0	8	6.3	8	0	35	5.1
5-14Yrs	29	13.1	28	1	29	16.1	28	1	14	8.6	12	2	15	12	15	0	87	12.7
15+ Yrs.	171	79.5	154	17	141	78.3	133	8	140	85.9	133	7	104	82	96	8	556	81
Totals	**215**	100	**196**	**20**	**180**	100	**170**	**10**	**163**	100	**154**	**9**	**127**	100	**119**	**8**	**686**	100

Note: Disch*- refers to number discharged

Source: Field data from U.T.H, June-August, 2013.

Data in Table 5.4 and 5.5 have revealed that males above the age of 15 years accounted for 81% of the total admission between 2009 and 2012 while female of above 15 years of age had accounted for 74.9%. Male children with age less than 1 year and those between 1 and 4 years had 1.2 % and 5.1% respectively while female children of the same age groups accounted for 0.8% and 8.6% respectively.

Table 5.5 Female casualties in U.T.H (2009-2012)

Female Casualties in U.T.H 2009-2012																		
Year	*2009*				*2010*				*2011*				*2012*					
	Admitted		*Number*		*Admitted*		*Number*		*Admitted*		*Number*		*Admitted*		*Number*		*Admitted*	
Age	*No.*	*%*	*Disch**	*Died*	*No.*	*%*	*Disch**	*Died*	*No.*	*%*	*Disch**	*Died*	*No.*	*%*	*Disch**	*Died*	*No.*	*%*
<1 Yrs.	1	0.7	1	0	1	1.3	1	0	0	0	0	0	1	1.3	1	0	3	0.8
1-4 Yrs.	12	8.2	11	1	2	2.6	2	0	7	9.9	7	0	11	15	11	0	32	8.6
5-14Yrs	25	17	23	2	12	15.8	12	0	12	16.9	11	1	9	12	9	0	58	15.7
15+ Yrs.	109	74.1	106	3	61	80.3	58	3	52	73.2	51	1	55	72	53	2	277	74.9
Totals	**147**	100	**141**	**6**	**76**	100	**73**	**3**	**71**	100	**69**	**2**	**76**	100	**74**	**2**	**370**	100

Note: Disch*- refers to number discharged

Source: Field data from U.T.H, June-August, 2013.

Child casualty in Lusaka in 2010

Those aged 0-4 years accounted for 7.4% and these could be children killed or injured as car occupants or as pedestrians playing on the roads. The 13.7% of age 5-14 years were children of school going age usually injured or killed as passengers or as pedestrians. Table 5.6 shows categories of child casualty and also confirms that the total of 268 child road crashes in 2010 and 74.2% children were involved in road crashes as pedestrians while 21.6%) were involved as passengers. This means that pedestrians and passengers accounted for 95.8% of the total child crashes.

Table 5.6 Categories of child casualty in Lusaka in 2010

Road user	*Pedestrian*			*M/V passenger*			*Cyclists*			*Cycle passenger*			*playing on the road*			
	K	*S*	*SL*	*K*	*S*	*SL*	*K*	*S*	*SL*	*K*	*S*	*SL*	*K*	*S*	*SL*	*Total*
Number	34	32	133	9	17	32	0	2	5	0	1	1	1	1	0	
Totals	199 (74.2%)			58 (21.6%)			7 (2.6%)			2 (0.8 %)			2 (0.8 %)			268 (100%

Note: K-Killed S-serious Injured SL- slightly injured

Source: Field Data from RTSA, June-August, 2013.

Road crashes and the poor

Although there was no data available on income levels and occupation of the road casualties in Lusaka, a reasonable assumption is that the poor on the one hand, are more likely to be crashed as pedestrians because they usually walk and cross roads in the city. This is more so for those who were selling and buying along the roads as street vendors (see video at 20:20 minutes and Appendix XIII.). The poor on the other hand are more likely to use public minibuses since they cannot afford personal cars. These public buses are not equipped with safety devices (seat belts and air bags) and they are usually overcrowded posing a greater risk of fatalities. If the poor afford to drive, they are less likely to drive vehicles which are road worthy, with high standard safety devices (see also study Area Chapter 2.1.2.).These assumptions may, to a large extent, explain the 82% casualties of pedestrians and passenger.

6 RESULTS: FROM SURVEY, INTERVIEWS AND OTHER ANALYSES.

This chapter presents results from the survey, interviews with key informants, video and media text analyses and results from simple observation.

6.1 Results from the Survey (Questionnaire)

Introduction

This section presents the results from the questionnaire data analyzed by Statistical Package for Social Sciences (SPSS) version 20. The main objective of this section is to investigate the differences in risk-taking behavior among groups (demographic characteristics). The other objective is to find out the best predictors of risk-taking behavior. Most of the Likert scale items were arranged from strongly agree; very likely; very severe; most willing and very often (1) to strongly disagree; very unlikely; very minimal; very unlikely; very unwilling and never (5) (see Methodology Chapter 3.4.1 and Appendix II). 'Five' represented positive attitude (low risk behavior) while 'one' represented negative attitude (high risk behavior). In the analyses presented in this chapter *low* mean score indicates high risk behavior and attitude while *high* mean score indicates low risk behavior and attitude and all interpretation will be based on this rating. The section presents measure of variability , reliability and measure of central tendency (mean and standard deviation) and results from four (4) independent sample t tests, four (4) ANOVA tests and three (3) main multiple regression models are presented. Only significant results have been presented but non-significant results are shown in Appendix VII and VIII.

6.2 Descriptive Statistics

Measure of variability (Factor Analysis) and reliability test

The questionnaire had four main Likert scale type of variables (opinion about traffic, risk judgment, risk willingness and drivers' traffic behavior), demographic and accident history variables (see Appendix II). A factor analysis was run to describe variability among a number of observed variables in terms of potential sub-sets (factors) and these factors will give the best overall summary of the selected variables and maximize the amount of variance accounted for by small groups of factors. Based on these factors, Cronbach's alpha was calculated to investigate

the internal consistency of these items which have been used in statistical analyses. Since these dimensions had satisfactory α-value, preferably >0.7, they were considered adequate for further analysis. Table 6.1 shows the number of items, dimensions and the cronbach's alpha.

Table 6.1 Summary of factor analysis and Cronbach's alpha

Summary of Factor Analysis			
Factors	*Dimension*	*No. of Items*	*Cronbach's alpha*
Factors for Traffic Safety			
Factor 1: Attitude towards rule violation	Dim 1	8	α=.778
Factors for risk consequences (two dimension)			
Factor 1: Risk consequences on overturn and head on collision	Dim 1	3	α=.734
Factors 2: risk consequences on parking and collision	Dim 2	4	α=.794
Factors for Risk Judgment in traffic (two dimensions)			
Factors 1: Risk judgment on overturn and collision	Dim 1	7	α=.794
Factor 2 : Risk Judgment as driver, pedestrian or passengers	Dim 2	3	α=.771
Factors for Risk willingness			
Factor 1: risk willingness	Dim 1	5	α=.734
Factors for Driver behavior (Three dimensions)			
Factor 1: Watchful &cautious driving	Dim 1	12	α=.883
Factor 2: Drinking &driving and non-use of seat belts	Dim 2	5	α=.801
Factor 3 : Inattentive driving	Dim 3	4	α=.706

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

These factors, as computed sums of mean scores of relevant variables within a factor, were then put in a correlation matrix (see Appendix XI) and only variables which were significant have been used in the following analyses. Socio-demographic variables (age, gender, education level, civil status) ,attitude towards rule violation and driving experience were used as independent variables, while watchful and cautious driving, inattentive driving and drinking and driving and on-use of seat belts and have been used as dependent variables in various analyses presented in this section.

Means and standard deviation for selected factors on risk attitude and behavior

Table 6.2 presents the means and standard deviations of six selected factors on risk attitude and behavior between female and male respondents. The results show that generally, female respondents reported slightly higher mean scores indicating low risk behaviors than male respondents on risk judgment, risk consequences, risk willingness, and inattentive driving factors. The most notable difference was on attitude towards rule violation where female respondents had significant positive behavior than male respondents (the scale used *low* mean score=*high* risk). This may imply that females generally are low risk takers in traffic. Male respondents on the other hand reported higher mean score indicating lower risk on watchful and cautious driving and drinking and driving and none use of seat belts (see Table 6.2.). Based on these observed mean score differences between female and male respondents, several independent sample t tests were performed (conducted) to see if the observed differences were statically significant. The significant results are presented in section 6.1.3(see also Appendix VI).

Table 6.2 Means and standard deviations for nine factors by gender

	*Mean(SD) Females(n=65;=35)**	*Mean (SD) Males (n=90;59)**
Attitude towards rule violation*****	36.34 (3.57)	34.2 (4.92)
Risk Judgment on overturns & collisions****	28.74 (4.61)	28.06 (4.75)
Risk Judgment as driver, pedestrian or passenger****	11.08 (3.23)	11.01 (2.46)
Risk Consequences on overturn & head on collision***	13.35 (1.88)	13.30 (2.05)
Risk Consequences on parking & collision accidents***	13.26 (3.71)	13.43 (3.11)
Risk willingness as driver, pedestrian & at work**	18.82 (5.05)	18.39 (4.60)
Watchful & cautious driving*	47.94 (8.60)	49.95 (6.41)
Drinking &driving and none use of seat belt*	20.79 (5.16)	21.81 (3.36)
Inattentive driving*	17.43 (1.90)	16.25 (3.14)

Note: Ratings given on a 5-point scale from (1) *****strongly agree; ****very likely; ***very severe**most willing; *very often to (5) strongly disagree; very un-likely; very minimal; most unwilling; never.

Note: n=65;35 & n=90;59 the first number is the total sample for all road users while the second number is the sample for drivers only for both females and males since section F &G were only answered by holders of driving license.

Note: *low* mean score= high risk

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Table 6.3 presents descriptive statistics on means and standard deviations among age groups. The results show that respondents of younger age groups 20-29 and 30-39 reported higher risk in various traffic behavioral variables compared to older age group 40-49. This may imply that younger people are more likely to take risky behavior in traffic than older people. The most notable differences were observed in risk judgment, risk consequences, watchful and cautious driving, drinking and driving and none use of seat belts and inattentive driving.

To investigate if these observed differences were statistically significant, ANOVA tests were performed and significant results are presented in section 6.4.

Table 6.3 Means and standard deviations for nine factors by age groups

Age Groups	*20-29* Mean (SD)	*30-39* Mean (SD)	*40-49* Mean (SD)	*50+* Mean (SD)
Attitude towards rule violation*****	34.59 (4.78)	34.70 (4.63)	36.38 (4.06)	35.00 (3.67)
Risk Judgment on overturns & collisions****	27.97 (4.26)	28.28 (5.07)	28.38 (4.40)	31.2 (2.39)
Risk Judgment as driver, pedestrian or passenger****	11.07 (2.85)	11.05 (2.67)	10.92 (3.15)	11.6 (2.30)
Risk Consequences on overturn & head on collision***	13.37 (1.40)	13.16 (2.34)	13.61 (1.53)	13.4 (1.67)
Risk Consequences on parking & collision accidents***	12.3 (3.72)	13.42 (3.23)	13.84 (3.28)	15.00 (3.39)
Risk willingness as driver, pedestrian & at work**	18.17 (5.28)	18.50 (4.79)	19.21 (4.35)	17.2 (5.45)
Watchful & cautious driving*	44.13 (8.25)	49.87 (6.90)	50.58 (6.31)	54.67 (4.73)
Drinking &driving and none use of seat belt*	19.07 (4.94)	21.00 (4.28)	23.19 (2.30)	25.00 (0.00)
Inattentive driving*	15.44 (3.21)	16.86 (2.76)	16.96 (2.57)	18.33 (1.53)

Note: Ratings given on a 5-point scale from (1) *****strongly agree; ****very likely; ***very severe**most willing; *very often to (5) strongly disagree; very un-likely; very minimal; most unwilling; never.

Note: low mean score= high risk

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.3 Comparing Means: Independent Sample T Tests

This section presents independent sample t test results with the objective of investigating the risk-taking behavior differences between gender and marital status. Independent sample t tests were carried out, in order to examine if the estimated traffic risk differences observed between gender in descriptive statistics (see 6.2) were statistically significant. The only independent sample t test results presented are those whose results were statistically significant but non-

significant results have also been presented in appendix VI. It should again be noted that (as already stated in 6.2.) the scale used to interpret the mean scores is *low* mean score= high risk.

6.3.1 Mean score differences in attitude towards rule violation by gender.

Research Question: Do females and males exhibit different attitude towards rule violation?

Hypothesis:

H_0: There is no difference in attitude towards rule violation between females and males.

H_1: There is a significant difference in attitude towards rule violation between females and males.

Using an alpha of 0.05, an independent sample t test was performed comparing the mean scores of female and male respondents in attitude towards rule violation. As predicted, the test has revealed that female respondents (M=36.34, SD=3.57, N=64) reported higher mean scores indicating low risk behavior in attitude towards rule violation than male respondents (M=34.24, SD=4.91, N=90) t (152) =2.912, p=.003, two tailed (see Table 6.4).

Since the significance level is less than 0.05, the Null hypothesis was rejected in favor of the alternative hypothesis. There were statistically significant differences in attitude towards rule violation between females and males. Females are less likely to violate traffic rules than males.

Table 6.4 Mean score differences for attitude towards rule violation by gender

Independent Samples Test

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
									Lower	*Upper*
Attitude towards rule violation	*Equal variances assumed*	9.213	.003	2.912	152	.004	2.099	.721	.675	3.524
	Equal variances not assumed			3.069	151.912	.003	2.099	.684	.748	3.451

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.3.2 Mean score differences in inattentive driving by gender.

Research Question: Do females and males exhibit different behavior in inattentive driving?

Hypothesis:

H_0: There is no difference in behavior towards inattentive driving between females and males.

H_1: There is a significant difference in behavior towards inattentive driving between females and males.

Using an alpha of 0.05, an independent sample t test was performed comparing the mean scores of females and males in behavior towards inattentive driving. The test has revealed that male respondents (*M*=16.25, *SD*=3.14, *N*=59) reported significantly lower mean scores indicating higher risk behavior in behavior towards inattentive driving than female respondents (M=17.43, *SD*=1.90, *N*=35) t (92) =2.001, *p*=.026, two tailed (see Table 6.5).

Since the significance level is less than 0.05, the Null hypothesis was rejected in favor of the alternative hypothesis. There were statistically significant differences in behavior towards inattentive driving between males and females

Table 6.5 Mean score differences in inattentive driving by gender

Independent Samples Test

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
									Lower	*Upper*
Inattentive driving	*Equal variances assumed*	16.364	.000	2.001	92	.048	1.174	.587	.009	2.340
	Equal variances not assumed			2.258	91.950	.026	1.174	.520	.141	2.207

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.3.3 Mean scores in watchful and cautious driving by singe and married.

Research Question: Do the single and the married people exhibit differences in watchful and cautiousness driving?

Hypothesis:

H_0: There is no difference in risk taking behavior of watchful and cautious in driving between the single and the married.

H_1: There is a significant difference in risk taking behavior in cautious and watchfulness in driving between the single and the married.

Using an alpha of 0.05, an independent sample t test was performed comparing the mean scores of the single and the married in watchful and cautious driving. As predicted, the test has revealed that married respondents (M=50.37, SD=6.46, N=62) reported high mean indicating low risk behavior watchful and cautious driving than the single respondents (M=46.43, SD=8.28, N=28) t (88) =-2.45, p=.031, two tailed (see Table 6.6.).

Since the significance level is lower than 0.05, the *Null* hypothesis was rejected in favor of the alternative hypothesis. There was statistically significant differences risk taking behavior in watchful and cautious driving between the single and married respondents.

Table 6.6 Mean score differences in watchful and cautious driving by single and married

Independent Samples Test

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
									Lower	*Upper*
Watchful & cautious driving	*Equal variances assumed*	6.067	.016	-2.449	88	.016	-3.942	1.610	-7.142	-.743
	Equal variances not assumed			-2.231	42.484	.031	-3.942	1.767	-7.507	-.378

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.3.4 Mean score differences in inattentive driving between the single and the married.

Research Question: Do the single and the married people exhibit different risky behavior in inattentive driving?

Hypothesis:

H_0: There is no difference in risk taking behavior in inattentive driving between the single and the married.

H_1: There is a significant difference in risk taking behavior in inattentive driving between the single and the married.

Using an alpha of 0.05, an independent sample t test was performed comparing the mean scores of the single and the married in inattentive driving. As predicted, the test result in Table 6.7 has revealed that married respondents (M=17.19, SD=2.59, N=64) reported higher mean scores indicating low risk behavior inattentive driving than the single respondents (M=15.46, SD=2.95, N=28) t (90) =-2.815, p=.006, two tailed.

The significant level is lower than the threshold value 0.05, therefore, the Null hypothesis was rejected in favor of the alternative hypothesis. There were statistically significant differences risk taking behavior in inattentive driving between the single and the married respondents.

Table 6.7 Mean scores differences in inattentive driving between single and married

Independent Samples Test

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
									Lower	*Upper*
Inattentive driving	*Equal variances assumed*	2.102	.151	-2.815	90	.006	-1.723	.612	-2.939	-.507
	Equal variances not assumed			-2.674	45.999	.010	-1.723	.645	-3.021	-.426

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.4 Comparing Means: Analysis of Variance (ANOVA)

One-way analyses of variance (ANOVA) were carried out, in order to examine if the estimated mean differences on dependent variables (watchful and cautious driving, inattentive driving and drinking and driving and none use of seat belts) among groups observed in descriptive statistics (see 6.2) were statistically significant. As stated earlier the objective of this subsection is to investigate the risk-taking behavior among groups.

6.4.1 ANOVA for age groups.

a) Watchful and cautious driving

A One-Way ANOVA was conducted to assess if there were statistically significant differences among age groups. The independent variable was age groups with four levels (age groups 20-29, 30-39, 40-49 & 50+), while watchful and cautious driving was used as a dependent variable. Table 6.8 shows that the ANOVA was statistically significant [(F (3, 88) =3.946, p=011. Since this p-value is less than the threshold 0.05, there were, therefore, significant differences on watchful and cautious driving among age groups.

Table 6.8 ANOVA for watchful and cautious driving among age groups

ANOVA

Watchful & cautious driving

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	572.210	3	190.737	3.946	.011
Within Groups	4253.997	88	48.341		
Total	4826.207	91			

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

The Post Hoc comparisons using Bonferroni test was conducted to show where these differences were and the test indicated that the age group 20-29 (M=44.13, SD=8.25, gave significantly lower mean scores on watchful and cautious driving than age group 30-39 (M=49.87, SD=6.91 ,95% CI [-11.18,-.32]), p=.023.The age group 20-29 (M=44.13, SD=8.25) also gave significantly lower mean scores on watchful and cautious driving than age group 40-49 (M=50.58, SD=6.31, 95% CI [-12.42,-.49]), p=.011. Table 6.9 shows that pair wise comparison among other groups were non-significant at p>.05.

These observations have revealed that younger people (age 20-29) who had low mean scores (*low* mean score=high risk behavior) exhibited higher risk behavior in watchful and cautious driving than older people (age 30-39 & 40-49).

Table 6.9 Post Hoc Test on watchful and cautious driving among age groups

Multiple Comparisons
Dependent Variable: Watchful & cautious driving
Bonferroni

(I) Age Groups (Binned)	*(J) Age Groups (Binned)*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
20 - 29	30 - 39	-5.747*	2.012	.032	-11.18	-.32
	40 - 49	-6.452*	2.209	.027	-12.42	-.49
	50+	-10.542	4.374	.108	-22.35	1.27
30 - 39	20 - 29	5.747*	2.012	.032	.32	11.18
	40 - 49	-.705	1.699	1.000	-5.29	3.88
	50+	-4.794	4.140	1.000	-15.97	6.38
40 - 49	20 - 29	6.452*	2.209	.027	.49	12.42
	30 - 39	.705	1.699	1.000	-3.88	5.29
	50+	-4.090	4.239	1.000	-15.53	7.35
50+	20 - 29	10.542	4.374	.108	-1.27	22.35
	30 - 39	4.794	4.140	1.000	-6.38	15.97
	40 - 49	4.090	4.239	1.000	-7.35	15.53

*. The mean difference is significant at the 0.05 level.

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

b) *Drinking* and *driving and none use of seat belts*

A One-way ANOVA was conducted to assess if there were significant differences among age groups. The independent variable was age groups with four levels (age groups 20-29, 30-39, 40-49 & 50+) while drinking and driving and none use of seat belts was used as a dependent variable. As shown in Table 6.10 the ANOVA was statistically significant [(F (3, 88) =4.657, p=005. Since this p-value was less than the threshold 0.05, there were, therefore, significant differences on drinking and driving and none use of seat belts among age groups.

Table 6.10 ANOVA for drinking and driving and none use of seat belts among age groups

ANOVA

Drinking &driving and none use of seat belt

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	211.637	3	70.546	4.657	.005
Within Groups	1332.972	88	15.147		
Total	1544.609	91			

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

The Post Hoc comparisons using Bonferroni test was conducted to show where these differences were and it indicated that the age group 20-29 (*M*=19.07,*SD*=4.94) gave significantly lower mean scores on drinking and driving and none use of seat belts than age group 40-49 (*M*=23.19, *SD*=2.30 ,95% CI [-7.53,-.72]), *p*=.009. Pairwise Comparison among other age groups were non-significant at *p*>.05 (See Table 6.11).

These observations have revealed that younger people of age 20-29 reported low mean score indicating higher risk behavior on drinking and driving and none use of seat belt behavior (as *low* mean score=high risk) than older people of age group 40-49.

Table 6.11 Post Hoc Test on drinking and driving and none use of seat belts by age groups

Multiple Comparisons

Dependent Variable: Drinking &driving and none use of seat belt

Bonferroni

(I) Age Groups (Binned)	(J) Age Groups (Binned)	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
20 - 29	*30 - 39*	-1.933	1.151	.580	-5.04	1.17
	40 - 49	-4.126*	1.262	.009	-7.53	-.72
	50+	-5.933	2.461	.108	-12.58	.71
30 - 39	*20 - 29*	1.933	1.151	.580	-1.17	5.04
	40 - 49	-2.192	.948	.138	-4.75	.37
	50+	-4.000	2.316	.526	-10.25	2.25
40 - 49	*20 - 29*	4.126*	1.262	.009	.72	7.53
	30 - 39	2.192	.948	.138	-.37	4.75
	50+	-1.808	2.373	1.000	-8.21	4.60
50+	*20 - 29*	5.933	2.461	.108	-.71	12.58
	30 - 39	4.000	2.316	.526	-2.25	10.25
	40 - 49	1.808	2.373	1.000	-4.60	8.21

*. The mean difference is significant at the 0.05 level.

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.4.2 ANOVA for education level.

a) Watchful and *cautious driving*

A One-Way ANOVA was conducted to assess if there were significant differences among educational levels. The independent variable was education with four levels (college/university; vocational education/training; high school/equivalent and primary/basic education), while watchful and cautious driving was used as a dependent variable. The ANOVA, as shown in Table 6.12, was statistically significant [(F (3, 88) =3.336 , p=.023]. Since this p-value was less than the threshold 0.05, there were statistical significant differences on watchful and cautious driving among different levels of education.

Table 6.12 ANOVA for watchful and cautious driving among education levels

ANOVA

Watchful & cautious driving

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	492.885	3	164.295	3.336	.023
Within Groups	4333.322	88	49.242		
Total	4826.207	91			

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

The Post Hoc comparisons using Bonferroni test was conducted to show where these differences were and it indicated that the Vocational Education /Training (M=54.62,SD=4.8) gave significantly higher mean scores on watchful and cautious driving than High school / equivalent (M=47.13, SD=6.3 ,95% CI [.91,14.06]), p=.017. Table 6.13 shows that pair wise comparison among other groups were non-significant at p>.05. But college/university and vocational education had a marginal significant results (p=.077).

These observations have revealed that people with high school education tend to take lower risk in watchful and cautious driving than those with vocational education / training (as *low* mean score=high risk).

Table 6.13 Post Hoc Test on watchful and cautious driving among education levels

Multiple Comparisons

Dependent Variable: Watchful & cautious driving

Bonferroni

(I) Education Level recoded	(J) Education Level recoded	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
College/University	Vocational Education/Training	-5.615	2.210	.077	-11.58	.35
	High School or Equivalent	1.870	1.799	1.000	-2.99	6.72
	Primary/Basic education	.818	2.360	1.000	-5.55	7.19
Vocational Education/Training	College/University	5.615	2.210	.077	-.35	11.58
	High School or Equivalent	7.485*	2.435	.017	.91	14.06
	Primary/Basic education	6.434	2.875	.167	-1.33	14.19
High School or Equivalent	College/University	-1.870	1.799	1.000	-6.72	2.99
	Vocational Education/Training	-7.485*	2.435	.017	-14.06	-.91
	Primary/Basic education	-1.051	2.572	1.000	-7.99	5.89
Primary/Basic education	College/University	-.818	2.360	1.000	-7.19	5.55
	Vocational Education/Training	-6.434	2.875	.167	-14.19	1.33
	High School or Equivalent	1.051	2.572	1.000	-5.89	7.99

*. The mean difference is significant at the 0.05 level.

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

b) Inattentive driving

A One-way ANOVA was conducted to assess if there were significant differences among different educational levels. The independent variable was education with four levels (college/University, vocational, high school/equivalent and primary/basic education), while inattentive driving was used as a dependent variable. Table 6.14 shows that the ANOVA was statistically significant [(F (3, 90) =4.610 , p=.005].

Table 6.14 ANOVA for inattentive driving among education levels

ANOVA

Inattentive driving

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	96.716	3	32.239	4.610	.005
Within Groups	629.337	90	6.993		
Total	726.053	93			

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

The Post Hoc comparisons using Bonferroni Test was conducted to show where these differences were and it indicated that respondent with college/university education (*M*=17.37,*SD*=2.15) reported significantly higher mean scores on inattentive driving than high school/equivalent (*M*=15.35, *SD*=3.51 ,95% CI [.20,3.84]), *p*=.005. The result imply that people with high school/equivalent education are more likely to be more attentive in driving (since low mean scorer=high risk) than people with college/ university education.

The comparison between vocation education/training with high school education showed marginal significant result (*p*=.059). Pairwise Comparison among other education levels were non-significant at *p*>.05 as show in Table 6.15.

Table 6.15 Post Hoc Test on inattentive driving among education levels

Multiple Comparisons

Dependent Variable: Inattentive driving

Bonferroni

(I) Eduacation Level recoded	(J) Eduacation Level recoded	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
College/University	*Vocational Education/Training*	-.345	.807	1.000	-2.52	1.83
	High School or Equivalent	2.022*	.675	.021	.20	3.84
	Primary/Basic education	2.006	.888	.157	-.39	4.40
Vocational Education/Training	*College/University*	.345	.807	1.000	-1.83	2.52
	High School or Equivalent	2.366	.896	.059	-.05	4.78
	Primary/Basic education	2.351	1.065	.179	-.52	5.23
High School or Equivalent	*College/University*	-2.022*	.675	.021	-3.84	-.20
	Vocational Education/Training	-2.366	.896	.059	-4.78	.05
	Primary/Basic education	-.016	.969	1.000	-2.63	2.60
Primary/Basic education	*College/University*	-2.006	.888	.157	-4.40	.39
	Vocational Education/Training	-2.351	1.065	.179	-5.23	.52
	High School or Equivalent	.016	.969	1.000	-2.60	2.63

*. The mean difference is significant at the 0.05 level.

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.5 Inferential Statistics: Multiple Regression Models

The objective of this section is to find out the best predictors of risk-taking behavior in traffic safety. Multiple regression models were conducted to assess the variance explained by different independent variables on drivers' behavior variables. A correlation matrix was run to see which

variables would be used in the models (see Appendix XI). Attitude towards rule violation, age, gender, civil status, education and experience have been used as predictors while watchful and cautious driving and inattentive driving have been used as predicted variables in the two models respectively. Gender and education, though did not turn out significant, have been included in the secondary models since they are key demographic characteristic variables.

6.5.1 Multiple Regression Model 1: watchful and cautious driving.

Model 1 (a) Main regression model for watchful and *cautious driving.*

Using enter method, standard multiple regression analysis was conducted to predict the outcome watchful and cautious driving from predictors: gender, age and attitude towards rule violation.

It was found that the predictors significantly explained the amount of variance in watchful and cautious driving F (3, 88) = 10.714, $p < .001$, $R^2 = 0.268$ and R^2 adjusted=0.243 (see Table 6.16). The adjusted R^2 indicates that approximately 24% of variance of watchful and cautious driving in the sample can be accounted for by linear combination of attitude towards rule violation, gender and age.

Table 6.16 Regression Model on watchful and cautious driving

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.517[a]	.268	.243	6.338

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F
1	Regression	1291.173	3	430.391	10.714
	Residual	3535.034	88	40.171	
	Total	4826.207	91		

a. Dependent Variable: Watchful & cautious driving

b. Predictors: (Constant), Age in years only, Gender Dummy, Attitude towar violation

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Table 6.17 shows that all five variables added statistically significantly to the prediction, $p < .05$. (i.e., the regression model shows good fit of the data).

Table 6.17 Predictors of watchful and cautious driving

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.829	5.968		2.652	.009
	Attitude towards rule violation	.649	.141	.438	4.588	.000
	Gender Dummy	3.876	1.434	.257	2.703	.008
	Age in years only	.242	.097	.230	2.506	.014

a. Dependent Variable: Watchful & cautious driving

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Model 1 (b): Secondary regression model for watchful and cautious driving

Using enter method, another standard multiple regression analysis was conducted to predict the outcome watchful and cautious driving. Education as one of the key demographic variables was added to the first model as a predictor.

Table 6.18 shows that the predictors significantly explained the amount of variance in watchful and cautious driving F (4, 87) = 7.945, $p < .001$, $R^2 = 0.268$ and R^2 adjusted= 0.234. The adjusted R^2 indicates that approximately 23 % of variance of watchful and cautious driving in the sample can be accounted for by linear combination of these four predictors. Table 6.11 shows that all four variables added to an overall statistically significantly to the prediction, $p < .05$. (i.e., the regression model shows a good fit of the data).

Table6.18 Secondary Regression Model on watchful and cautious driving

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.517[a]	.268	.234	6.374

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1291.250	4	322.813	7.945	.000[b]
	Residual	3534.956	87	40.632		
	Total	4826.207	91			

a. Dependent Variable: Watchful & cautious driving

b. Predictors: (Constant), Education Level recoded, Age in years only, Attitude towards rule violation, Gender Dummy

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

The analysis shown in Table 6.19 has revealed that attitude in towards rule violation, gender and age significantly predicted watchful and cautious driving. However education level was non-significant and when added to the model it decreased the value of adjusted R^2 from 0.243 to 0.234 indicating less linear combination of explanatory power of the model. The result has also shown that education had a negative relationship.

Table 6.19 Predictors of watchful and cautious driving

Coefficients[a]

Model		*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
		B	*Std. Error*	*Beta*		
1	*(Constant)*	15.970	6.820		2.342	.021
	Attitude towards rule violation	.646	.158	.436	4.091	.000
	Gender Dummy	3.910	1.639	.259	2.385	.019
	Age in years only	.242	.097	.230	2.489	.015
	Eduacation Level recoded	-.034	.791	-.005	-.044	.965

a. Dependent Variable: Watchful & cautious driving

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Model (2 a): Main regression model for Inattentive driving

Using enter method, a standard multiple regression analysis was conducted to predict the outcome inattentive driving from predictors: attitude towards rule violation, experience and civil status. Table 6.20 shows that the predictors significantly explained the amount of variance in inattentive driving F (3, 89) = 17.667, $p < .001$, $R^2 = 0$ .373 and R^2 adjusted= 0.352. The adjusted R^2 indicates that approximately 35% of variance of inattentive driving in the sample can be accounted for by linear combination of attitude towards rule violation, civil status and experience.

Table 6.20 Regression Model for Inattentive driving

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.611[a]	.373	.352	2.260

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	270.813	3	90.271	17.667	.000[b]
	Residual	454.757	89	5.110		
	Total	725.570	92			

a. Dependent Variable: Inattentive driving

b. Predictors: (Constant), Civil status, Attitude towards rule violation, Experience

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Table 6.21 shows that all three variables added statistical significantly to the prediction, $p < .05$. (i.e., the regression model shows good fit of the data). Attitude towards rule violation was a better predictor ($\beta = 0.52$ ($p<.001$) while experience and civil status had almost same beta value and marginal significance values ($\beta=.172$; $p=.067$).

Table 6.21 Predictors of Inattentive driving

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.050	1.801		2.249	.027
	Attitude towards rule violation	.300	.049	.525	6.182	.000
	Experience	.095	.051	.172	1.855	.067
	Civil status	1.014	.547	.173	1.854	.067

a. Dependent Variable: Inattentive driving

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Model 2(b): Secondary regression model for Inattentive driving

Using enter method, another standard multiple regression analysis was conducted to predict the outcome inattentive driving. Education and gender as key demographic variables were added to

the first model as predictors. Table 6.22 shows that the predictors significantly explained the amount of variance in inattentive driving F (5, 87) = 10.7555, $p < .001$, $R^2 = 0.382$ and R^2 adjusted= 0.346. The adjusted R^2 indicates that approximately 35 % of variance of inattentive driving in the sample can be accounted for by linear combination of these five predictors.

Table 6.22 Secondary regression Model of Inattentive driving

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.618[a]	.382	.346	2.270

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	277.163	5	55.433	10.755	.000[b]
	Residual	448.407	87	5.154		
	Total	725.570	92			

a. Dependent Variable: Inattentive driving

b. Predictors: (Constant), Eduacation Level recoded, Experience, Civil status, Attitude towards rule violation, Gender Dummy

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Table 6.22 shows that all five variables added to an overall statistically significantly to the prediction, $p < .05$. (i.e., the regression model shows a good fit of the data). The results in Table 6.23 has revealed that attitude towards rule violation, experience and civil status significantly predicted inattentive driving however gender and education were non-significant and when added to the model, they decreased the adjusted R^2 from 0.352 to 0.346 indicating less linear combination of explanatory power to the model. The result has also shown that gender and education had a negative relationship.

Table 6.23 Predictors secondary model of inattentive driving

Coefficients[a]

Model		*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
		B	*Std. Error*	*Beta*		
1	*(Constant)*	5.132	2.326		2.207	.030
	Attitude towards rule violation	.280	.056	.489	5.004	.000
	Experience	.099	.052	.178	1.901	.061
	Civil status	1.041	.551	.178	1.889	.062
	Gender Dummy	-.503	.582	-.087	-.865	.389
	Eduacation Level recoded	-.057	.280	-.022	-.204	.838

a. Dependent Variable: Inattentive driving

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.5.2 Regression Model 3: Drivers' behavior.

When a correlation matrix was run (see Appendix XI) it was found that the three driver behavior dependent variables (watchful and cautious in driving, drinking and and driving and none use of seat belts and inattentive driving) were highly correlating and the next step was to combine the three dependent variable and use one sum scores of driver behavior as predicted variable in the last model.

Using enter method, another standard multiple regression analysis was conducted to predict the outcome sum scores of three driver behavior in driving. Age, gender and attitude towards rule violation were used as independent variables. Table 6.24 shows that the predictors significantly explained the amount of variance in sum scores of drivers behavior F (3, 85) = 12.682, $p < .001$, R^2 = 0.309 and R^2 adjusted= 0.285. The adjusted R^2 indicates that approximately 28 % of variance of sum score of driver's behavior in the sample can be accounted for by linear combination of these three predictors.

Table 6.24 Regression Model of sum scores of drivers' behaviour

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.556[a]	.309	.285	10.055

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3846.512	3	1282.171	12.682	.000[b]
	Residual	8593.960	85	101.105		
	Total	12440.472	88			

a. Dependent Variable: Sum Scores of driver behavior

b. Predictors: (Constant), Age in years only, Gender Dummy, Attitude towards rule violation

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

Table 6.25 shows that all three variables added to an overall statistically significantly to the prediction, $p < .05$. (i.e., the regression model shows a good fit of the data).

Table 6.25 Predictors of sum scores of drivers' behaviour

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	28.856	9.530		3.028	.003
	Attitude towards rule violation	1.074	.226	.446	4.755	.000
	Gender Dummy	5.198	2.301	.211	2.259	.026
	Age in years only	.507	.154	.297	3.280	.002

a. Dependent Variable: Sum Scores of driver behavior

Source: Field work (SPSS) data in Lusaka, Zambia; June-August, 2013.

6.6 Summary for Survey Results

The two independent sample t tests between female and male respondents have revealed that females tend to take lower risk in both attitude towards rule violation and inattentive driving. The other two tests also revealed that married respondents reported lower risk than single respondents both on watchful and cautious driving and inattentive driving.

The two ANOVA tests on watchful and cautious driving and drinking and driving and none use of seat belts have shown that younger age groups (20-29) exhibited high risk behavior than older age groups (30-39 &40-49) in both dependent variables.

The ANOVA test results on education levels have shown that respondents with high school education reported lower risk than respondents with vocational/training and college/university education on watchful and cautious driving and inattentive driving respectively.

The multiple regression models have shown that attitude towards rule violation, age and gender predicted watchful and cautious driving by about 24 % in model 1 (a). In model 2 (a) attitude towards rule violation, civil status and experience predicted inattentive driving by about 35% and in model 3 attitude towards rule violation, age and gender predicted sum score of driver behavior by 28%. It has been observed that when education and or gender were added to the two main models as key demographic predictors, the adjusted R^2 was reduced in secondary models (1 *b* and 2 *b*) and the two variables had a negative correlation.

6.7 Results from Interviews with Key Informants

Introduction

This section presents risk factors and control measures based on the interviews with key informants (Zambia Police service, RTSA, U.T.H and three insurance companies). The objective of this section is to investigate risk factors that contribute to risk- taking behavior associated with road traffic accident causation and assess counter-measures that relevant authorities can adopt. Responses are based on semi structured interviews where key informants were answering by filling in the form during the interview sessions although others filled in at their own time. Although the interview guides varied from one institution to another, they had a lot of common items which enabled interviews to be analyzed into key themes (see appendix V).

6.7.1 Trends and factors contributing to road traffic crashes.

The risk factors identified from interviews by key informants are presented based on the five key themes corresponding with risk factor areas (vehicle, behavior, environmental and traffic regulation and enforcement).

Trends

Interviews with Zambia Police Service, RTSA and ZISC revealed that road traffic crashes in Lusaka have been on the increase. This was supported by Professional Insurance Company which argued that there is an increase in the number of people buying motor insurance policy which was attributed to an increase in number of accidents.

a) Vehicle factors

An interview with Zambia Police Service identified defective tires, brakes and headlamps as vehicle risk factors contributing to road traffic crashes. RTSA had this to say "*Some vehicles are not road worthy and they avoid traffic police check points*" This may imply that some vehicles have other defects apart from those identified by Zambia police and such vehicles never pass through check point.

b) Human behavior factors

According to interview with Zambia police, U.T.H and ZISC, most of the behavior risk factors related to drivers were drinking and driving, over speeding, cutting in lanes (improper over-taking) and miss-judge of distance especially at junctions. RTSA said drivers work under pressure of making money hence neglect traffic rules. RTSA also added that even where there are speed humps, some drivers pass with high speed on humps. Professional Insurance cited incompetent drivers who obtain licenses through corrupt means and U.T.H identified both incompetent drivers and under-age driving as a risk factor contributing to road traffic crashes in Lusaka. The major rule violation that was mentioned by most of the key informants were speeding, unlicensed driving and drunken driving.

c) Environmental factors

Most of the key informants mention poor road infrastructure which is not in proportion to number of vehicles as an environmental risk factor contributing to road traffic crashes in Lusaka. Zambia Police Service also added that these poor roads have pot-holes, they are unmarked and have poor signage. RTSA also said that there is road conflict between vehicles and vulnerable (non-motorized) road users which contributes to road traffic crashes in Lusaka.

d) Traffic regulations, controls and enforcement factors

Asked whether the current traffic rules are adequate to address road traffic crashes, RTSA on the one hand said, "*Legislation is just okay. Road Traffic Act No.11 is sufficient to handle the accidents only behavior needs to be checked*." But Professional Insurance Company on the other hand, said that traffic rules and regulations are not enforced but only done at the occurrence of an accident.

6.7.2 Countermeasures

The objective here was to explore countermeasures that can be adopted by relevant authorities.

The key informants identified existing measures and also proposed some measures to be implemented to re-enforce the current ones. The outstanding measures proposed by most of the key informants only fall in two themes: environmental factors and traffic regulation and control factor related measures. But vehicle and behavior seem to be concealed within traffic regulation and countermeasures.

a) Existing counter-measures: Traffic regulations, controls and enforcement factors related measures

RTSA said that, "*Our (RTSA) officers are on patrol from 05:00 hours to 22:00hrs in the field and recently RTSA recruited about 60 officers to be on major high ways in different regional (provincial) centers to boost the number of officers on patrol*." Zambia Police Service also said they are currently involved in road traffic patrols and impounding vehicles that are not road worthy.

b) Proposed countermeasures:

Environmental factors related measures

The Zambia Police Service and ZISC proposed building more roads with more lanes or dual carriage ways as control measure. In addition to improvements on roads, Professional Insurance Company said that, "*there should be development areas outside the city center to reduce on congestion on city roads."* RTSA added that roads should be well labeled with more humps in residential areas.

Traffic regulations, controls and enforcement factors related measures:

ZISC proposed that, "*There should be a mandatory law on insurance policy for all motorists since it is generally observed that motorists with insurance policies are usually careful on the road because insurance companies want to know who was at fault before paying compensation to a client and a faulty client is not usually compensated*." Professional Insurance added that policy coverage should be strict to make road users pay more attention to avoid accidents. Professional Insurance also said that, "*The government should introduce or re-enforce liquor sale control and bar patronage and RTSA should have strict control on driver license issuance.*" ZISC added that, "*There should be enhanced police check points, restricted movements of public vehicles and continuous monitoring drunk driving*." ZISC added that police check points should have breathalyzers to check on alcohol content on drivers.

RTSA proposed the use of an electronic device to test vehicle for fitness and added that the equipment was already procured from Europe. RTSA mentioned plans of having a fast track courts for traffic offense so that traffic offenses are dealt with immediately, which is not there in Zambia. Zambia Police Service proposed the need for more enforcement, road patrols and mounting of speed trap machines to reduce over speeding. Both Professional Insurance Company and U.T.H echoed that RTSA need to do more checks on motorists and be strict on issuance of driving licenses. Professional Insurance Company also added that there is need for education on the public on traffic rules and ZSIC added that rules and regulations should be made available to all road users.

6.8 Video Clip Analysis: Rule Violations Highlights

As stated in methodology chapter (3.5.2) that a YouTube video clip was used as a secondary source of data. The video helped to identify and highlight some aspects of traffic rule violation by all road users especially pedestrians, drivers and cyclists. This part presents images extracted from some parts of the video clip (see inserted CD). The video lasts 37:39 minutes.

The video has revealed that minibus drivers on the one hand stop at any part of the road besides designated bus stops to pick passengers and passengers on the other hand also stop minibuses at places other than bus stops (see figure 6-1)

Figure 6-1 Pictures of minibus picking passengers along the road

Source: YouTube video clip (http://www.youtube.com/watch?v=VX0_zqbtjwY)

The video has also revealed most parts of the road design in Lusaka have no pedestrians or cyclist lanes or sidewalks hence pedestrians and cyclists squeeze themselves close to the main road. It has also shown that in rainy season pools of water by road side reduce the available sidewalks even further forcing people to walk in the main road (figure 6-2).

Figure 6-2 Picture of road side with no sidewalks in Lusaka

Source: YouTube video clip (http://www.youtube.com/watch?v=VX0_zqbtjwY)

The video has also revealed that street vending is done both close to and on the main roads even when vehicles are passing (see figure 6-3)

Figure 6-3 Picture of pedestrians and street vendors on the main road in Lusaka

Source: YouTube video clip (http://www.youtube.com/watch?v=VX0_zqbtjwY)

The video has also shown that in Lusaka there is traffic mix of motorized, pedestrians, cyclists and vendors on the same road (figure 6-4)

Figure 6-4 Pictures of street vending and traffic mix in Lusaka

Source: YouTube video clip (http://www.youtube.com/watch?v=VX0_zqbtjwY)

Figure 6-5 shows that drivers do not stop for pedestrians at zebra crossing but instead hoot.

Figure 6-5 Picture of drivers not stopping for pedestrians at zebra crossing in Lusaka

Source: YouTube video clip (http://www.youtube.com/watch?v=VX0_zqbtjwY)

Figure 6-6 shows some extracts from the video that pedestrians violate traffic rules by crossing the roads at undesignated points.

Figure 6-6 Pictures of pedestrians crossing roads at undesignated places in Lusaka

Source: YouTube video clip (http://www.youtube.com/watch?v=VX0_zqbtjwY)

6.9 Simple Observation: Rule Violation

This section presents results from observation conducted by the researcher during field work (as a passenger on both public and private vehicle and as a pedestrian crossing road in the city).

Simple (Personal) observation

It was generally observed that almost all passengers and drivers (both in private and public

vehicles) don't use seat belts. When explored further in traffic Act No 11 of 2002, it was found that the emphasis on seat belt use is on drivers (see Appendix XII).

It was also observed that children do not use child restraints on both private and public vehicles. In public buses children did not have their own seats instead sat on laps of parents (especially mothers) just to avoid paying extra money for a seat occupied by a child.

Another observation was that it was a common behavior for both drivers and passengers to stop the minibus at any part of the road to either pick a passenger or to board the bus hence blocking other in-coming vehicles resulting in unnecessary loud hooting (Figure 6-7).

Figure 6-7 Bus drivers loading buses on main road blocking other vehicles

Source: Filed work Data in Lusaka, Zambia, June-August, 2013.

It was also observed that drivers on the one hand drivers don't wait for pedestrians even at zebra crossing instead would even hoot and shout loudly at pedestrians and pedestrians on the other hand were seen crossing the roads even at undesignated places and some were even avoiding using footbridges.

Another observation was that most of the buses were overloaded in the morning and evening when people were rushing for work or knocking off from work.

The other observation was that traffic lights could not adequately control traffic flows during pick hours in major junctions resulting in impatient drivers blocking other vehicles. Traffic police usually help out to control traffic flow every pick hour period at major junctions and roundabouts.

Traffic police and RTSA check points were mounted just for short period of time and bus

drivers would warn friends approaching such points by flashing head lamps so that they either remove excess passengers or use an illegal bus route. Figure 6.8 shows traffic police following up some erring bus drivers into the station in city center.

Figure 6-8 Pictures of traffic police following up minibus erring drivers

Source: Filed work Data in Lusaka, Zambia, June-August, 2013.

6.10 Media Text Analysis: Risk Factors and Incidences

The other observation especially from online news media clip analysis was that major road traffic accidents with many deaths and injuries which attracted media attention happened in highways outside the city especially along Great North Road and Great East Road. Most of these accidents involved buses and minibuses (see appendix XIV). RTSA cited billboard along high ways, use of second hand tires and negligence by drunken drivers as major cause of road traffic accidents

Highway accidents

Most of the reported road traffic accidents occurred along highways to or from Lusaka. The following were extracted from media reports;

- 50 people died along Great East Road on post Bus to Lusaka
- Chibombo accident claims 16 lives on Kabwe-Lusaka bound minibus with 20 passengers after tire burst
- Four (4) people died near Chibombo when a Marco polo bus collided with a truck
- Ten (10) people died on a Lusaka bound minibus along Choma-Monze high way.

7 DISCUSSION, LIMITATIONS, CONCLUSION AND RECOMMENDATIONS

Introduction

This chapter discusses results based on the research questions, theories (and approaches) used and in relation to the literature review. The chapter begins with general discussion and ends with limitations, conclusions and recommendations to relevant authorities and for further research.

7.1 Discussion

Trends

One of the main objectives of this study was to find out how the trend of road traffic accidents in Lusaka has been for past five years, 2008 to 2012.

Distribution of road crashes in Lusaka, 2008-2012

This study has found about 4% increase in road traffic crashes between 2009 (19%) and 2012 (23.3%). This general increase in trend is congruent to previous study in Zambia (Emenalo et al, 1977) and studies from other less developed countries (Afukaar et al., 2003; Museru et al., 2002; Odero, 2004). The pattern showed steady increase from 2008 to 2010 but a sharp increase in 2012 which may be attributed to an increase in number of registered motor vehicles and an improved reporting system which captured more accidents incidences. The increasing trends of road traffic crashes in less developed countries such as Zambia may also be explained by high motorization (exposure) but with inadequate resources for road infrastructure development and other intervention measures. Other factors are poor road design (traffic mix) and risk-taking behavior such as rule violation (speeding, drinking and driving). Poverty is also an indirect (distant) cause as it leads to use of second hand vehicles, use of cheap and sub-standard spares, corruption and poor enforcement of traffic rules and regulations.

Distribution of road crashes by casualties

This study has found that there were more severe injuries than deaths between 2008 and 2012 with about 4% increase in all fatalities. The possible explanation for more severe injuries than deaths is because of the urban environment of Lusaka where speed is reduce by high volume of traffic and posted speed limits compared to rural environments with more deaths due to higher speed limits. The lower speed within the urban areas (especially in CBD) reduces the impact of vehicle occupants hence few deaths. High densities of pedestrians in the urban environment could also lead to more and severe injuries un-like rural areas. This is explained by risk theory (risk compensation) and geographical approach and congruent with previous study on rural and urban environments (Afukaar et al., 2003).

Distribution of road crashes by road users

Another interesting finding was that pedestrians were the most vulnerable road users and the least were cyclists/riders. The pedestrians and passengers together accounted for 82% which is in support with findings from previous studies (Afukaar et al., 2003; Chen, 2010; Lagarde, 2007; Mabunda et al, 2008; Nantulya & Reich, 2002; Odero et al., 1997). One possible explanation for high pedestrians involvement in Lusaka could be that majority of the people do not drive but walk along and cross roads in the city and residential areas which could lead to higher exposure to traffic risks. The other possible explanation could be attributed to behaviors of both drivers and pedestrians who violate traffic regulations with regard to crossing roads and speeding in densely populated areas. Another reason is that road infrastructure in Lusaka (urban) has low level of traffic separation (motorized vs non-motorized). The reason for passengers' involvement could be due to the fact that the majority of the people use public buses which are usually overloaded and have no safety devices such as seat belts and airbags.

The smaller number of cyclists and riders is due to that biking is not a common culture in Lusaka as means of transport for the public. The few casualty cases of cyclists/riders could be due to non-use of helmets and reflective attires which is common among cyclist in Lusaka. Another reason could be that there are few cyclists and bikers in Lusaka and accidents for single cyclists are less likely to be reported to police.

Results showed that most of children casualties were involved as pedestrians. The reason for children casualty (and adults) as pedestrians may be attributed to the mixed traffic situation in

urban environment where roads are shared between motorized and non-motorized road users with no pedestrian lanes and few zebra crossings. Where zebra crossings exist, drivers are not cautious of non-motorized road users. Generally all road users do not use reflective attires during dark hours as a result children are more likely to be hit by vehicle as they play near the main roads. The reason for children involvement as passengers could be due lack of and non-use of child restraints facilities on most vehicle and generally children less than five years do not occupy their own seats which expose them to high risk. These are risk factors which influence crash involvement and crash severity (elements of risk theory).

Distribution of crashes by time of the day and day of the week

The results have showed that more crashes in 2010 happened between 16:00 hours and 20:00 hours time interval while the least was from 23:59 hours to 07:00 hour's interval. This is similar to findings by Valent et al. (2002) and could be attributed to the high traffic volumes and congestions which characterize most of the urban roads in Lusaka at the period most of the people knock off from formal and informal employment in the city center and cross busy roads. These poor road designs with no traffic separations (i.e. sidewalks and cyclist lanes) may also contribute to higher incidences during the peak hour period as people may squeeze themselves in between slowly moving vehicles. Another explanation could be that of reduced visibility due to darkness after sun set coupled with poor street lighting and non-use of reflective attires by the pedestrians. The issue of alcohol taking and impaired driving cannot be ruled out since most of the people (both pedestrians and drivers) may take some beer after knocking off as leisure and drive and/or walk along roads while drunk.

Another interesting finding which could be explained by risk theory and congruent to previous studies (Ackaah & Adonteng, 2011; Odero et al., 1997; Valent et al., 2002) was that most incidences happened towards weekend especially on Friday and Saturday. This could be attributed to less traffic volume on the main roads on weekends making drivers over speed an element of risk compensation since during the week days there are usually congestions which reduce speed. Another reason could be that driving under the influence of alcohol is common on weekends coupled with less presence of traffic police leading to drivers violating several other traffic rules.

Road traffic casualties admitted to University Teaching Hospital (U.T.H)

The results provide evidence that more male casualties above 15 years were admitted to U.T.H than females. This high involvement of males is again similar to previous studies (Afukaar et al., 2003; G Jacobs & Aeron-Thomas, 2000; Valent et al., 2002) and could be attributed to higher risk-taking behavior in traffic among young males as confirmed by survey analyses. Another reason is that all bus and taxi drivers are males as a result males are more exposed to traffic system especially as drivers than females and due to high exposure to traffic and they may perceive less risk.

7.1.1 Factors contributing to risk-taking behavior.

The main objective of this study here was to investigate risk factors contributing to accident causation. The study had two main research questions;

i. *What factors contribute to risk-taking behavior which is associated with the causes of road traffic accidents in Lusaka?*
ii. *How do demographic characteristics influence attitude and risk-taking behavior in traffic?*

a) *Vehicle element factors.*

Interview results of this study established that most of the vehicles were barely road worthy since they were cited as having defective tires, poor brake systems and headlamps contributing to road crashes as a result they avoided police check points. This is consistent with previous study (Odero, 2004). The main reason for this could be that most of the vehicles are bought as used vehicles from developed countries especially the UK and Japan. Due to high poverty levels, the majority buy very old (used) vehicles which, according to Zambian customs and revenue system, attract lower import duty. The minibuses are usually bought as goods caravans but are converted into passenger vehicles by installing passenger seats locally without provisions for seat belts. In some cases more seats are squeezed so as to increase the number of passengers which exceeds the vehicle's carrying capacity. Due to high poverty levels, most people in rarely maintain their vehicles and if they do so they use cheap and substandard spares making these vehicles risk factors of road traffic crashes.

b) Human behavior factors

Age

Univariate analyses results showed that the younger people exhibited higher risk behavior both in watchful and cautious driving and drinking and driving and none use of seat belts than older age groups. Interview results also confirmed that under-age, unlicensed and incompetence driving, rule violations such as speeding, cutting in lanes, and driving under influence of alcohol as major risk factors mostly violated by young drivers but even some older drivers do violate. This confirms a previous study (Shibata & Fukuda, 1994) which found unlicensed driving, speeding and driving under influence of alcohol as high risk of fatalities in motor vehicle traffic accidents. A plausible explanation, and in support with previous study (Jonah, 1986) is that especially young males, despite less experience, are more likely to drive with excitement and are more exposed in traffic by taking higher risk. Results from other findings showed that young drivers are usually more optimistic hence they may perceive less risk (DeJoy, 1992; Jonah, 1986). Another explanation could be that most of the young people do not go to formally established driving schools but instead do 'peer driving lessons' and obtain driving licenses by corrupt means. Drivers with less experience coupled with excitement and higher exposure are more likely to be inattentive in driving.

Gender

This study has found statistical significant differences both in attitude towards rule violation and inattentive driving between males and females. This supported one of the research hypothesis that females are less likely to violate traffic rules and also in support with previous studies (Hazen & Ehiri, 2006; Iversen & Rundmo, 2004; Nantulya & Reich, 2002; Özkan et al., 2006; Valent et al., 2002; Yagil, 1998) that females generally have positive attitude towards traffic rule violation and that gender has been a consisted predictor of attitude in traffic. Lower risk-taking behavior among females could be attributed to gender roles where females are more of caretakers, submissive, less aggressive and obedient hence they are less likely to violate traffic rules while younger males who are usually aggressive and independent are more likely to violate traffic rules.

Multiple regression results (Table 6.24 and 6.25) showed that attitude towards rule violation, age and gender were good predictors and they explained 28.5% of variance in sum scores of driver behavior (watchful and cautious driving, drinking and driving and non-use of seat belts and inattentive driving). This is congruent to previous studies (Iversen & Rundmo, 2004; Oltedal, Moen, Klempe, & Rundmo, 2004; Yagil, 1998) that demographic characteristic and driver attitude may predict and influence behavior in traffic. This supports the explanations of young male involvement in traffic rule violation and risk taking behavior.

Marital status

It was interesting that this study found a significant difference both in watchful and cautious driving and inattentive driving between single and married respondents. This is similar to a study (Turner & McClure, 2003) which found that the never married (single) had higher risk acceptance. The multivariate analyses also clearly showed that civil status, experience and attitude towards rule violation were good predictors and explained about 35% of variance in inattentive driving. Lower risk-taking behavior among the married could be attributed to care, family responsibility and maturity while the singles, who are usually young have no worries about family care, are more likely to be higher risk-takers.

Education

This study found interesting results that people with higher education levels were associated with high risk-taking driver behavior (positive association) which is in line with some previous studies (Dobson et al, 1999; Mann et al., 2010; McCartt et al, 1996; Turner & McClure, 2003). This may appear contrary to a general assumption that people with higher education exhibit lower risk in traffic than those with lower education since they are more informed. Another surprising result was that education level was found to have a negative relationship with other independent variables in predicting watchful and cautious driving. This finding added support to previous studies (Nordfjærn et al., 2011) which found education as a weaker predictor. A plausible explanation why there is a positive correlation between education and drivers' behavior in traffic is that most often people in less developed countries who have lower education make driving a career. For instance all minibus and taxi drivers in Lusaka are males who have low to medium education. Those with higher education and own official cars (who are part of this

survey as private drivers) are also driven by less educated drivers which is contrary to developed countries where driving and car ownership is associated with high education levels. Another reason is that people with high education are more likely to take high risk in driving because they may feel stigmatized (humiliated) if they were to go to formal driving schools after buying a personal car. They would rather ask a colleague to offer few private lessons and thereafter become over confident (optimistic) in driving. Another reason could be that in a Zambia (African) culture people with high positions are likely to be reckless in driving when rushing for urgent appointments and they also compensate because of type of vehicles they drive which have protective devices like airbags, seat belts and ABS.

Road users

Adding support to the previous study (Muchene, 2013), this study has found that human error (include drivers, pedestrians and passengers) were leading risk factors in causing accidents. Highlights from video and text analysis revealed that drivers and passengers load and board minibuses at any point other than designated bus stops, pedestrians in most cases cross roads at undesignated places. One possible reason is that generally people in less developed countries are more willing to take risk in traffic due to being exposured to many other risks such as malaria, HIV/AIDS and unemployment. Another reason is that the pressures of trying to earn a living in 'hush' economic situations make people get so busy and become more mindful of other urgent issues such as sticking to time schedules and earning more money hence neglecting traffic safety. For instance street vendors along main roads in Lusaka are just mindful of their business disregarding traffic safety.

c) Environment factors

Road networks characterized by poor road signs and lack of traffic separation for vulnerable road users have been found to be major risk factor. One identified risk factor associated with accident causation in Lusaka is road design which has no separations for different road users in most of the areas. This leads to increasing risk of road crashes especially the pedestrians and cyclists who are most vulnerable road users.

Another factor is the number of substandard road infrastructure compared to the ever increasing volume of traffic lead to higher risk of collision at roundabouts and junctions

especially during ‘rush hours’ but due to reduced speed in the urban environment, as argued earlier, the crashes only result in severe injuries and vehicle damage but few deaths.

Another identified risk factor is poor and few road signs leading to motorists driving at their own limits. These could be attributed to the poor economic situation in Zambia coupled with high population density where the municipality cannot afford to provide all necessary road design (pedestrian and cyclists lanes) because of many other social services which are considered more urgent.

d) Traffic regulation & enforcement factors

Traffic enforcement levels may lead to reduction in risk-taking behaviors especially among drivers. This study identified weak and inadequate traffic rule enforcement as a risk factor leading to road users, especially drivers, violating traffic rules. Specific areas of weak enforcement is issuance of drivers’ license where some drivers acquire their licenses without formal driving lessons and others could easily replace their license if it is withheld by the traffic police for rule violation. Still others drive illegally as unlicensed drivers. The other area is that penalties for traffic offenses are usually negotiated for between the driver and traffic police on duty without following standard fine which is supposed to be paid to the state. The weak enforcement may be attributed to poor economic situation where traffic police officers accept bribes due to low wages they get. Another possible explanation could be that poor people cannot afford to service and maintain their vehicles hence violate traffic rules by driving vehicle which are barely road worthy (with defective brakes and worn out tires) and avoid police check points.

7.1.2 Countermeasures

The main objective of the study here was to explore the countermeasures that relevant authorities can adopted to reduce road traffic accidents. This study on the one hand found that RTSA and Zambia police are involved in road patrols and impounding of motor vehicles that are not road worthy but interviews on the other hand revealed that traffic rules and regulations are not enforced strictly as this was seen from the increasing trends of accidents and general rule violation by drivers especially PSV drivers of minibuses. This supports findings from previous study which found poor enforcement in traffic regulations as a result of inadequate resources and corruption (Kobelo et al., 2013; Nantulya & Reich, 2002; Nordfjærn et al., 2012).

Proposed measures

One of the interventions proposed through interviews was an improvement in road design through road signs, more lanes (as long term measures) and mounting of speed trap machines. Others include strict control of issuance of drivers' license and monitoring drivers who drive under the influence of alcohol by use of breathalyzers at police check points (short term measures). It was also proposed to have mandatory law on insurance motor vehicle policies as it was observed that vehicle owners with insurance policies were more careful when driving because when an accident occurs insurance companies do not compensate erring drivers.

7.2 Summary and Conclusions

This section makes a summary of the results in this study in relation with research problem. The literature review and the theories (system theory, model for road traffic accident causation, risk theory and geographical approach) were used to explore and interpret the findings of this study.

This study illuminated some important findings about trends and risk factors contributing to risk-taking behavior associated with accident causation. Four major conclusions can be drawn based on initial research questions.

This first conclusion is that there was an increasing trend (4%) of road traffic crashes between 2008 and 2012 with more severe injuries than deaths probably due to an increase in number of vehicles and subsequent exposure however an improved reporting system could not be ruled out as a contributing factor to the increase in trend. Pedestrians and passengers were identified as the most vulnerable road users accounting for 82 % of total casualties. Males had the most involvement than females. Without interventions road traffic accident trends are likely to continue increasing because of the identified risk factors.

The second conclusion is that road traffic crashes are caused by different multiple factors which include technical factors such as level of development of road infrastructure, general vehicle conditions and availability of public transport which is an attribute of the traffic system. In addition there are also institutional and behavioral factors like traffic rule enforcement and driver training and licensing system and road users' attitude and behavior. This study has

identified risk factors contributing to risk-taking behavior associated with accident causation. These are presented under the following categories;

a) *Vehicle element factors*

This study found that most vehicles are barely road worthy especially that they are bought as used vehicles coupled with less maintenance. Specific risk vehicle element factors are poor brake system, poor lighting systems (headlamps), worn out tires, no protective mechanisms like seat belts, air bags. The minibuses used as public transport have their seats fitted locally most often more seats are squeezed than vehicle carrying capacity.

b) *Human behavior factors*

This study has found that the behavior of pedestrians, passengers and drivers is one of high risk factor contributing to causes road crashes in Lusaka. The specific risk factors include rule violation such over speeding, drinking and driving, unlicensed driving, crossing road at undesignated places (pedestrians), loading buses (drivers) and stopping buses (passengers) along the road other than bus stops and non-use of seat belts and child restraints.

c) *Environmental factors*

One of the risk factors associated with accident causation in Lusaka is road design which has no traffic separation for different road users in most areas of Lusaka. This leads to increasing system risk of road traffic crashes especially the pedestrians and cyclists who are most vulnerable road users. Another factor is the number and quality of roads compared to the ever increasing traffic volume leads to higher risk of collision at roundabouts and junctions especially during 'peak hours'.

In addition poor and few road signs which can lead to motorists driving at their own speed limits and few consequences for over speeding.

d) *Traffic enforcement factors*

Traffic enforcement levels determine reduction in risk-taking behaviors especially among drivers. This study identified weakness and inadequacy in traffic rule enforcement as a risk factor leading to road users especially drivers violating traffic rules. Specific areas of weak

enforcement are issuance of drivers' license where some drivers acquire their licenses without formal driving lessons and easy replacement of their licenses. The other area is that penalties for traffic offenses are usually negotiated between the driver and traffic police on duty.

The third conclusion is that the consisted demographic variables associated with high risk-taking behavior were identified as being male, aged 20-29 years and being single. Multiple regression results showed that attitude towards rule violation, age and gender were good predictors of sum scores of driver behavior (watchful and cautious driving, drinking and driving and non-use of seat belts and inattentive driving) while education was found to be weak predictor. Socio-cultural factors could be attributed to gender differences in risk-taking behavior. For instance young males are allowed to be more independent (less control) and aggressive than females hence males are more likely to violate traffic rule. All bus and taxi drivers are males (higher exposure).

The fourth conclusion is that there should be improvements on road designs by adding more lanes, sidewalks and road sign (long term measures). RTSA and Zambia Police Service should be stricter in enforcement of traffic regulations especially on driving license and drinking and driving through check points. Seat belts use should be mandatory to all vehicle occupants. These could be implemented in the short run.

Over all the findings of this study confirm the system, risk theory and geographical approach that road traffic accidents are caused by multiple factors and that in trying to address them, a multifaceted approach should be taken.

7.3 Theoretical Implications

The theories and approaches employed by this (deductive) study have been supported and proved effective in identifying risk factors contributing to risk-taking behavior which is associated with accident causation.

The system theory and model of traffic accident causation helped identify vehicle, human behavior, environment and enforcement factors which became the pillar of the analysis and discussion of this study. It is important to note that the level of enforcement of traffic rules and regulation on the one hand has a bigger influence on the type of vehicle, risk-taking behavior and environmental factors in terms of road engineering and design. The level of enforcement on the

other hand is influenced by economic development and good governance as enforcement in less developed countries is weak and it is spoiled by high poverty level and corrupt systems.

The risk theory also helped identify factors that influence exposure to risk (poverty, age, gender and mixed traffic system), factors that influence crash involvement (speeding, being young male, brake system and maintenance, road design and factors that influence severity (excessive speed, seat belt use and child restraints and presence of alcohol). Others were time and day of accident occurrence due to possible risk compensation by drivers.

The geographical approach helped identify risk factors associated with socio-demographic characteristics such as age, gender and educational level as well as spatial variations of accident occurrence in terms of area, time and days of the week. The urban environmental factors (posted speed limits and high pedestrian density in CBD and residential areas), to a large extent, are explained by the geographical approach.

This study has confirmed literature review and the research assumptions that demographic characteristics have important relationship to driver's behavior and that vehicle, behavior, environment factors and traffic regulations together contribute to accident causation.

7.4 Limitation of the study

One of the limitation was that register based data in most cases did not indicate place of residency of the victims and gender and gender which became difficult to use the geographical approach in data interpretation and analysis in spatial distribution between residential areas and the CBD and demographic characteristics. Data from U.T.H did not separate victims according to place of residency giving a possibility of victims from other provinces who were referred to U.T.H to be included under casualties in Lusaka District. This could limit the spatial distribution analysis. As stated in methodology chapter, U.T.H and RTSA data had missing cases and variable like age and gender.

Another limitation was that regression models focused on dependent variables which were only dealing with drivers which means the variance explained could only applied to drivers leaving out other road users. The questionnaire should have been reduced further to focus only on one type of road users (either pedestrians and passengers or drivers only).

Another limitation was that most of the reported accidents did not separate males and

females above 15 yours which made it difficult to analysis data on demographic characteristics especially gender.

Another limitation was that leaving out the slight injured persons, due to poor registration system did not give a more comprehensive or complete picture of actual trends.

With more time and resources, a survey sample size could have been enlarged for better statistical analyses and trends could have covered more than five years.

This study focused on Lusaka, a big city whose results could be different from smaller cities and even rural areas.

The municipality should have been included as an institution that deals with infrastructural planning and development including road design.

7.5 Recommendations to Relevant Road Safety Authorities

Table 7.1 gives recommendations based on three (3) approaches. It is proposed that less developed countries with less resource could invest more on change of behavior which does not require huge budgets especially that behavior has been found to be highest risk factor in road traffic. Behaviour change approach could be implemented in the short run since it does not require huge capital investment like road design which are long term capital projects.

Table 7.1 Recommendations to relevant authorities

Enforcement programs	***Education programs***	***Engineering programs***
Stricter enforcement on: Speeding, seat belt use, drinking and driving, regards to pedestrians, vehicle road worthiness and discourage importation of very old vehicles by imposing higher import duty	Include awareness campaigns on; Traffic behavior, use of retro-reflective clothes i.e. reflective bands & reflective vests.	Involving road network and design i.e. traffic separation system, calming system in high risk areas i.e. speed humps, traffic lights, roundabouts and narrow road system.

Source: Author's construct, 2014

7.6 Proposed Further Research Area

This study proposes the following research areas which could not be covered;

- There is need to conduct a research on how to improve pre-hospital and in-hospital

trauma care as a measures to prevent deaths caused by road traffic injuries which has not been covered by this study.

- Risk factors affecting pedestrians and passengers as vulnerable road users could be examined further.
- Since media reports showed more accidents in highways, there is need to conduct a research in areas other than urban environments which has not been covered by this study. For instance a comparative study of urban and rural environments.
- Investigation of social characteristics of traffic accidents by looking at the role played by education, gender, age and culture in risk taking behavior.

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9 APPENDICES

Appendix I Introductory letter

NTNU
Norwegian University of
Science and Technology

Faculty of Social Science
and Technology Management
Department of Geography

To whom it may concern

Our consultant: Rita Hokseggen
Telephone no.: + 47 7359 19 10
E-mail: rita.hokseggen@svt.ntnu.no

Dated: 2013-05-14 Our ref.: Your letter dated: Your ref.:

Letter of introduction

We hereby confirm that Trusty Mudenda is a student on the programme *Master of Philosophy in Development Studies, specialising in Geography* at the Department of Geography, Norwegian University of Science and Technology.

He will undertake his fieldwork and data collection during June – August 2013 in Zambia, on the topic:

"Road Traffic Accidents in Lusaka, Zambia: Trends, Risk factors and Control measures"

We would be grateful for any assistance given to him during this process. This includes granting interviews, assisting him in making appointments, handing out materials and making information accessible to him.

Yours sincerely,

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Appendix II Questionnaire

SURVEY ON CAUSES OF ROAD TRAFFIC ACCIDENTS & INJURIES IN LUSAKA, ZAMBIA

INTRODUCTION: Road traffic crashes have been observed to be among the commonest causes of fatal deaths and injuries in Zambia, and available data shows that increasing numbers of vehicles bring about increased numbers of accidents. The aim of this survey project is to identify human risk factors, such as attitudes and behaviours related to traffic and traffic safety. By answering this questionnaire you are providing valuable information about traffic safety, and you are contributing towards adoption of measures that can help reduce road traffic accidents in our country. Results from the survey will be used in a master's degree thesis at the Norwegian University of Science and Technology (NTNU).

CONFIDENTIALITY: Participation is voluntary, and all participants are anonymous – when data are analysed, it will not be possible to identify who answered any particular questionnaire. Your name is not asked, only your age and occupation. Any information you will provide will be held in strictest confidence and will be used for research purposes only.

SURVEY ANSWERS: We want everyone to answer this questionnaire, even if you do not have a driving license. There are no correct or incorrect answers to the questions - we are interested in your points of view and honest opinions concerning traffic safety. It is important that all questions are answered, but if there are any questions you cannot or will not answer, please proceed to the next question.

Thank you for participating,

Trusty Mudenda, Master's Degree Student

Stig H. Jørgensen, Associate Professor, Academic Supervisor

NTNU
Innovation and Creativity
Department of Geography

PLEASE READ THIS FIRST.	This form will be machine read. Please follow these rules. • *Use a black or blue ball point pen or a good pencil. Do not write outside the boxes.* • ***Mark boxes like this:*** ☒. *Errors may be cancelled by filling the entire box.* • *Mark one box only per question unless otherwise instructed.*

A. YOUR OPINIONS ABOUT TRAFFIC SAFETY

On a scale from 1 to 5, to what extent do you agree or disagree with these statements about traffic and driving in general?
One mark only per statement.

		Strongly agree 1	*Agree* 2	*Neither /nor* 3	*Dis-agree* 4	*Strongly disagree* 5
1.	To maintain flow in traffic, one must ignore several traffic regulations	☐	☐	☐	☐	☐
2.	It makes sense to increase speed to drive past cars which are driving too slowly	☐	☐	☐	☐	☐
3.	One should respect traffic regulations, independently of driving conditions	☐	☐	☐	☐	☐
4.	It is reasonable to ignore red lights when there are no other cars or people in sight	☐	☐	☐	☐	☐
5.	Drivers who violate traffic regulations don't represent a larger threat for safety than those respecting these regulations	☐	☐	☐	☐	☐
6.	Traffic regulations are overcomplicated, and therefore difficult to comply with when driving	☐	☐	☐	☐	☐
7.	If a pedestrian is run down by a car, the pedestrian is to blame	☐	☐	☐	☐	☐
8.	If you are a decent driver it's acceptable to drive a bit faster	☐	☐	☐	☐	☐
9.	There should be severe sanctions for driving too fast	☐	☐	☐	☐	☐

Mark one box only per question.

	Strongly agree 1	Agree 2	Neither /nor 3	Dis-agree 4	Strongly disagree 5
10. In the absence of other good alternatives, I would let an unsafe driver drive me home	☐	☐	☐	☐	☐
11. If my friends were passengers of an unsafe driver, I would join them	☐	☐	☐	☐	☐
12. I feel it's my responsibility to tell a driver if he/she is driving too fast	☐	☐	☐	☐	☐
13. I would never drive after alcohol consumption	☐	☐	☐	☐	☐
14. I would never let a drunk driver take me home, if I knew they had consumed alcohol	☐	☐	☐	☐	☐
15. There should be severe sanctions for hitting pedestrians with a car	☐	☐	☐	☐	☐
16. Driving after dark should be avoided in respect of traffic safety	☐	☐	☐	☐	☐
17. I have good knowledge of traffic rules	☐	☐	☐	☐	☐
18. Pedestrians have a large responsibility making sure they are not hit by cars	☐	☐	☐	☐	☐
19. Drivers are often powerless faced with unpredictable pedestrians	☐	☐	☐	☐	☐
20. People violate speed limits because these limits are too low	☐	☐	☐	☐	☐
21. If I drive in a familiar area, it is reasonable to drive about 20 km faster than usual	☐	☐	☐	☐	☐
22. If am the only one at risk, it is reasonable to take chances in traffic	☐	☐	☐	☐	☐
23. Seat belts are less important when driving home in a taxi	☐	☐	☐	☐	☐
24. Experienced drivers should not need to use seat belts	☐	☐	☐	☐	☐
25. Seat belts are mandatory in public transport (buses, taxis)	☐	☐	☐	☐	☐
26. Speed humps decrease chances ofr traffic incidents	☐	☐	☐	☐	☐

B. YOUR RISK JUDGEMENT IN TRAFFIC

1. How likely is it that you would be injured due to the following? ⇨

	Very likely 1	Likely 2	Neither /nor 3	Un-likely 4	Very unlikely 5
1. A car running off road	☐	☐	☐	☐	☐
2. Head-on collision	☐	☐	☐	☐	☐
3. Collision with another vehicle from behind	☐	☐	☐	☐	☐
4. Collision caused by changing driving lane	☐	☐	☐	☐	☐
5. Collision with a pedestrian	☐	☐	☐	☐	☐
6. The vehicle overturns in the roadway	☐	☐	☐	☐	☐
7. Collision with an animal	☐	☐	☐	☐	☐
8. A parking accident	☐	☐	☐	☐	☐
9. As a driver of a motor vehicle	☐	☐	☐	☐	☐
10. As a pedestrian	☐	☐	☐	☐	☐
11. As a passenger of a motor vehicle	☐	☐	☐	☐	☐

Please check that you have not accidentally omitted anything on this page.

Mark one box only per question.

2. If any of these accidents should happen to you, how severe would the consequences be? ⇨

	Very severe or fatal 1	Severe 2	Neither /nor 3	Small 4	Very minimal 5
1. A car running off road	☐	☐	☐	☐	☐
2. Head on collision	☐	☐	☐	☐	☐
3. Collision with another vehicle from behind	☐	☐	☐	☐	☐
4. Collision caused by changing driving lane	☐	☐	☐	☐	☐
5. Collision with a pedestrian	☐	☐	☐	☐	☐
6. The vehicle overturns in the roadway	☐	☐	☐	☐	☐
7. Collision with an animal	☐	☐	☐	☐	☐
8. A parking accident	☐	☐	☐	☐	☐

C. YOUR RISK WILLINGNESS

In general, how willing are you to take risks in the following situations? ⇨

	Most willing 1	Willing 2	Neither /nor 3	Un-willing 4	very un-willing 5
1. At work	☐	☐	☐	☐	☐
2. In my spare time	☐	☐	☐	☐	☐
3. As a driver of a motor vehicle	☐	☐	☐	☐	☐
4. As a passenger of a motor vehicle	☐	☐	☐	☐	☐
5. As a pedestrian	☐	☐	☐	☐	☐

D. YOUR BEHAVIOUR AS A PEDESTRIAN OR PASSENGER

Approximately how often do you act as described in these statements? ⇨

	Very often 1	Often 2	Some-times 3	Seldom 4	Never 5
1. Avoid walking on roads with traffic after dark	☐	☐	☐	☐	☐
2. Take risks in traffic	☐	☐	☐	☐	☐

E. DEMOGRAPHIC INFORMATION

1. Sex:
   Female ☐ 1
   Male ☐ 2

2. Year of birth: 19 ☐☐

3. Civil status:
   Single ☐ 1
   Married ☐ 2
   Separated/divorced ☐ 3
   Widow/widower ☐ 4

4. Do you have any children? ⇨ Yes ☐ 1 ⇨ / No ☐ 2

5. *If yes*: How many? ⇨ ☐☐

6. What is your highest level of *completed* education? ⇨
   Primary/basic education ☐ 1
   High-school or equivalent ☐ 2
   Vocational education/training ☐ 3
   College/University ☐ 4

KS-13
30-6

The survey is conducted with assistance from SVT-IT, NTNU

Please check that you have not accidentally omitted anything on this page.

Mark one box only per question.

7. What is your occupation? *Note: Mark all that apply.* ⇨
   1. Full time employed ☐
   2. Part-time employed ☐
   3. Business person ☐
   4. Student ☐
   5. Unemployed ☐
   6. Retired ☐

8. In what kind of area do you live? ⇨
   - High cost residential area (e.g. kabulonga, Woodlands) ☐ 1
   - Medium cost residential area (e.g. Matero, Emmasidale) ☐ 2
   - Low cost residential area (e.g. Kanyama, Chiwama) ☐ 3

9. Do you have a driving licence? ⇨
   - Yes ☐ 1 ⇨
   - No ☐ 2

10. *If yes*: Which year did you get your *first* driving licence? ⇨ ☐☐☐☐

11. *If yes*: What type (class) of licence do you have? ⇨
   - Motor cycle (A/A1) ☐ 1
   - Car (B/BE) ☐ 2
   - Larger vehicles (C/C1/CE/C1E) ☐ 3
   - Taxi / public bus (PSV) ☐ 4

If you have a driving license, please proceed with the rest of the survey.
If you do not have a driving license, please stop here. Thank you for your answers.

F. YOUR TRAFFIC BEHAVIOUR

Research shows that most of us violate some traffic regulations at one time or another. Approximately how often do you act as described in these statements?

		Very often 1	*Often* 2	*Some-times* 3	*Seldom* 4	*Never* 5
1.	Slow down when there are pedestrians on the road	☐	☐	☐	☐	☐
2.	Slow down if I see a pedestrian approaching	☐	☐	☐	☐	☐
3.	In consideration of pedestrians, I often avoid driving at night	☐	☐	☐	☐	☐
4.	Slow down considerably in densely populated areas	☐	☐	☐	☐	☐
5.	Slow down when it is dark	☐	☐	☐	☐	☐
6.	Increase speed in densely populated areas	☐	☐	☐	☐	☐
7.	Try to pass the car in front of you, even if that car is driving quite fast	☐	☐	☐	☐	☐
8.	Ignore traffic regulations to reach your destination in time	☐	☐	☐	☐	☐
9.	Drive above the speed limit to reach a very important appointment	☐	☐	☐	☐	☐
10.	Keep such a short distance from the car in front of you, that you wouldn't be able to stop if that car braked suddenly	☐	☐	☐	☐	☐
11.	Get distracted by events in the environment while driving	☐	☐	☐	☐	☐
12.	Create dangerous traffic situations as a result of being inattentive	☐	☐	☐	☐	☐
13.	Keep on driving, even if you feel tired	☐	☐	☐	☐	☐
14.	Drive over shorter distances without wearing a seatbelt	☐	☐	☐	☐	☐
15.	Drive longer trips without wearing a seatbelt	☐	☐	☐	☐	☐
16.	Slow down because a car behind you is trying to pass	☐	☐	☐	☐	☐

Mark one box only per question.

		Very often 1	Often 2	Some-times 3	Seldom 4	Never 5
17.	Slow down due to a road sign which signals caution	☐	☐	☐	☐	☐
18.	Slow down due to difficult driving conditions	☐	☐	☐	☐	☐
19.	Slow down due to slippery driving conditions	☐	☐	☐	☐	☐
20.	Drive after you have had a beer	☐	☐	☐	☐	☐
21.	Drive when you have had several beers	☐	☐	☐	☐	☐
22.	Drive the morning after heavy alcohol consumption, without knowing if you are completely sober	☐	☐	☐	☐	☐
23.	Go as a passenger with a driver you know has been drinking alcohol	☐	☐	☐	☐	☐
24.	Reduce my speed considerably where a road sign states that children are playing	☐	☐	☐	☐	☐
25.	Slow down in areas where children are playing, even when none are visible	☐	☐	☐	☐	☐
26.	Tell a person to slow down, if he/she is driving too fast	☐	☐	☐	☐	☐
27.	Discuss traffic safety with others	☐	☐	☐	☐	☐

G. YOUR ACCIDENT HISTORY

1. Approximately how many hours do you drive per day? ⇨

0 – 2 hours	☐ 1	6 – 8 hours	☐ 3
3 – 5 hours	☐ 2	9 – 11 hours	☐ 4
		12 hours or more	☐ 5

2. Approximately how many days do you drive per week? ⇨

None	☐ 1	4 days per week	☐ 5
1 day per week	☐ 2	5 days per week	☐ 6
2 days per week	☐ 3	6 days per week	☐ 7
3 days per week	☐ 4	7 days per week	☐ 8

3. Have you, during the last 5 years, been involved in a traffic accident where you were injured (person injury)? ⇨

	Never 1	Once 2	Several times 3
1. As a driver	☐	☐	☐
2. As a passenger	☐	☐	☐
3. As a pedestrian	☐	☐	☐

4. Have you, during the last 5 years, been involved in a traffic accident where others were injured (person injury)? ⇨

	No accidents 1	One accident 2	2 - 3 accidents 3	Several accidents 4
1. As a driver	☐	☐	☐	☐
2. As a passenger	☐	☐	☐	☐
3. As a pedestrian	☐	☐	☐	☐

Please check that you have not accidentally omitted anything on this page.

Mark one box only per question.

5. *If you, during the last 5 years, have been involved in accident(s) where someone was injured*: How long ago was the last time? ⇨

☐ years and ☐ months

6. *If you, during the last 5 years, have been involved in accident(s) where some one was injured*: To what extent do you consider yourself to be responsible for the accident(s)? *One mark only.* ⇨

- It was my fault only ☐ 1
- I was partly responsible ☐ 2
- It was someone else's fault entirely ☐ 3
- No one in particular could be blamed ☐ 4

7. Have you (during the 5 last years) been involved in a collision with vehicle damages (no person injuries)? ⇨

	No accidents 1	*One accident* 2	*2 - 3 accidents* 3	*Several accidents* 4
1. As a driver	☐	☐	☐	☐
2. As a passenger	☐	☐	☐	☐

8. *If you, during the last 5 years, have been involved in accident(s) with vehicle damage (no person injuries)*: How long ago was the last time? ⇨

☐ years and ☐ months

9. *If you, during the last 5 years, have been involved in accident(s) with vehicle damages (no person injury)*: To what extent do you consider yourself to be responsible for the accident(s)? *One mark only.* ⇨

- It was my fault only ☐ 1
- I was partly responsible ☐ 2
- It was someone else's fault entirely ☐ 3
- No one in particular could be blamed ☐ 4

Thank you very much for your answers.

Appendix III Consent form

Informed consent

Informed consent form

The researcher
I am Mudenda Trusty. I am a student at the Norwegian University of Science and Technology (NTNU, Norway). I am conducting a study on risk factors in terms of attitudes and behavior among road users (drivers, passengers and pedestrians). Your opinion on this issue will be crucial for this research project as it will help plan safety interventions.
I would be glad if you could take part in this study.

Information for the participant

Your participation in this research project is voluntary. Your participation or non-participation will NOT bring punishments or rewards to you. Even if you decide to partake and somewhere along the line, you feel uncomfortable to continue you can withdraw from it. Your withdrawal will not be penalized or communicated to anyone.
The information you provide will be strictly anonymous and confidential and will be used for Academic (research purpose) purposes only.

My decision
I agree to take part in this project. The aim of the project has been explained to me. I understand that my decision to participate or not to participate is a voluntary one and that I can withdraw from the study any time I like. I am convinced the information I provide will be subjected to Strict anonymity and confidence. I am okay with the planned data storage procedures and I agree that the information I provide could be audio-recoded.

participant :
Signature:..... Date:.....

Many thanks!

Appendix IV List of key informants

Title	*Institution*
Deputy Director	Road Transport and Safety Agency (RTSA)
Public Relations Officer	University Teaching Hospital (U.T.H)
Public Relations Officer	Zambia State Insurance Corporation (ZSIC)
Claims Manager	Professional Insurance Company
Division Traffic Officer	Zambia Police Service

Appendix V Interview guide for key informants

a) Interview guide for RTSA

INTERVIEW GUIDE QUESTIONS FOR ROAD TRAFFIC & SAFETY AGENCY (RTSA) OFFCERS.

AIM OF STUDY

Dear respondent, this study aims to investigate risk factors in road traffic accidents and injuries among drivers, passengers and pedestrians. Road traffic crashes have been observed to be among the commonest causes of fatal deaths and injuries in Lusaka, Zambia. Available data shows that increasing number of vehicles bring about increased accidents.

The human factors' contribution to traffic accidents in Zambia should be considered as well. This study hope to gather relevant data that will provide useful information concerning road traffic safety which will contribute towards adoption of measures that can help reduce road traffic accidents in Lusaka.

CONFIDENTAIALITY

In this study, we will only need your position (occupation) and age but **not** your name and address. Any information you will provide will be held in strictness confidence and will be used for academic (research) purpose only.

PERSONAL PARTICULARS

Date---------- Age---------- Sex----------

Rank---------- Woking experience----------

A. THE OCCURRENCE OF ACCIDENTS

1. Why do you think motor traffic accidents are important problem in Lusaka? ----------
   ----
2. What are the main characteristics of motor traffic accidents in Lusaka?

- Types of accidents (road users involved)----------
- Rule violations----------
- vehicle road worthiness----------
- Traffic separation ----------

1

3. How do you describe the traffic accident pattern in Lusaka?(increase/decrease) ----------
---

4. What is your comment on the trends of road traffic accident and deaths from 2008 to 2013 on the tables your office filled in?

   Table 1.----------

   Table 2----------

   Table 3.----------

   Table 4----------

B. OBTAINING INFORMATION AND REGISTRATION

5. How do you normally get information after the motor accident has occurred? ----------
---

6. If any, what types of problems do you face in getting information about the site and severity of an accident? ----------
---

7. What type of information do you normally register? [i.e. No. of injured, sex, age, condition of vehicle]----------
---

8. What type of problems do you face in both receiving and keeping accurate accident reports in police traffic register?----------
---
---

9. To what extent does RTSA collaborate with the hospital, Zambia Police and the insurance companies on causes of accidents, injury level and describing circumstance surrounding the accident? ----------
---

C. ASSESSMENT OF CAUSES OF ACCIDENTS

10. What factors, do you think, facilitate the occurrences of road traffic accidents in Lusaka in terms of?

a) Vehicle condition----------

---

b) Road network----------

---

c) People' behavior----------

---

d) Number of motor vehicles----------

---

e) Legislation and regulations----------

---

11. Do you think the current traffic rules and regulation are effective enough to reduce road traffic accidents? ----------

---

12. What could be done to improve? ----------

13. Any other comments:----------

D. ROAD SAFETY MEASURES

14. In your opinion, what measures has RTSA taken to reduce road traffic accidents? ------

---

---

15. What else could RTSA do to reduce road traffic accidents? ----------

---

16. What are your recommendations and opinions on strategies of reducing road traffic accidents in Lusaka?----------

---

---

17. Do you have any other views or comments:----------

Thank you for participation.

b) Interview guide for U.T.H

INTERVIEW GUIDE QUESTIONS FOR THE HOSPITAL (UTH).

AIM OF STUDY

Dear respondent, this study aims to investigate risk factors in road traffic accidents and injuries among drivers, passengers and pedestrians. Road traffic crashes have been observed to be among the commonest causes of fatal deaths and injuries in Lusaka, Zambia. Available data shows that increasing number of vehicles bring about increased accidents.

The human factors' contribution to traffic accidents in Zambia should be considered as well. This study hope to gather relevant data that will provide useful information concerning road traffic safety which will contribute towards adoption of measures that can help reduce road traffic accidents in Lusaka.

CONFIDENTAIALITY

In this study, we will only need your position (occupation) and age but **not** your name and address. Any information you will provide will be held in strictness confidence and will be used for academic (research) purpose only.

PERSONAL PARTICULARS

Date---------- Age---------- Sex----------

Rank---------- Woking experience----------

A. THE OCCURRENCE OF ACCIDENTS

1. How do you think motor traffic accidents are an important problem at UTH? ----------
   ---
   ---
2. What are the main types of injuries you receive at UTH? ----------
   ---

1

3. Do you have specific registration system for road traffic casualties in the hospital? -----

---

---

4. What do you register and to what extent doe it differs from police road traffic accident record? ----------

---

5. To what extent does hospital collaborate with the insurance companies, RTSA and the traffic police on causes of accidents, injury level and describing circumstance surrounding the accident?----------

---

B. TREATMENT AND REGISTRATION

6. What are different modes of treating accident casualties with regard to severity? -------

---

C. ASSESSMENT FO CAUSES OF ACCIDENTS

7. What factors, do you think, facilitate the occurrences of road traffic accidents in Lusaka in terms of?

a) Vehicle condition----------

---

b) Road network----------

---

c) People' behavior----------

---

d) Legislation and regulations----------

---

8. What is your comment on the trends of road traffic accident and deaths from 2008 to 2013 on the tables your office filled in?

Table 1. ----------

Table 2----------

Table 3----------
---

8. Do you think the current traffic rules and regulation are effective enough to reduce road traffic accidents? ----------

9. What could be done to improve on these rules? ----------
---

10. Do you have any other comment? ----------

D. ROAD SAFETY MEASURES

11. In your view, what measures do police traffic officers and RTSA take to reduce road traffic accidents? ----------
---

12. In your opinion, what other measure do you think should be included in reduction of road traffic accidents?----------
---
---

13. What are your recommendations and opinions on strategies of reducing road traffic accidents in Lusaka?----------
---

---

14. Any other comments or views: ----------

Thank you for participation.

c) Interview guide for insurance companies

INTERVIEW GUIDE QUESTIONS FOR INSURANCE COMPANIES.

AIM OF STUDY

Dear respondent, this study is about risk factors in road traffic accidents and injuries among drivers, passengers and pedestrians. Road traffic crashes have been observed to be among the commonest causes of fatal deaths and injuries in Lusaka, Zambia. Available data shows that increasing number of vehicles bring about increased accidents.

The human contribution to traffic accidents in Zambia should be considered as well. This study hope to gather relevant data that will provide useful information concerning road traffic safety which will contribute towards adoption of measures that can help reduce road traffic accidents in our country.

CONFIENTAIALITY

In this study, we will only need your position (occupation) and age but not your name. Any information you will provide will be held in strictness confidence and will be used for academic (research) purpose only.

PERSONAL PARTICULARS

Date---------- Age---------- Sex----------

Rank---------- Woking experience----------

A. THE OCCURANCE OF ACCIDENTS

1. Why do you think motor traffic accidents are important problem in Lusaka? ----------
---

2. How do you compare the magnitude of motor traffic accidents in Lusaka to those of other Districts in the country? ----------
---

1

Appendix VI Significant and non-significant independent sample t test

Independent Samples Test

		Levene's Test		*t-test for Equality of Means*						
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Differen*	*Std. Error*	*95% Confidence Lower*	*Upper*
Attitude towards rule violation	*Equal variances assumed*	1.703	.194	-.645	146	.520	-.520	.807	-2.114	1.074
	Equal variances not assumed			-.605	75.308	.547	-.520	.859	-2.231	1.191
Watchful & cautious driving	*Equal variances assumed*	6.067	.016	-2.449	88	.016	-3.942	1.610	-7.142	-.743
	Equal variances not assumed			-2.231	42.484	.031	-3.942	1.767	-7.507	-.378
Risk Consequences on overturn & head on collision	*Equal variances assumed*	3.094	.081	.878	145	.381	.303	.345	-.379	.985
	Equal variances not assumed			.989	121.903	.325	.303	.307	-.304	.910
Risk Consequences on parking & collision accidents	*Equal variances assumed*	.549	.460	-.622	144	.535	-.368	.592	-1.538	.801
	Equal variances not assumed			-.594	80.556	.554	-.368	.621	-1.603	.866
Risk willingness as driver,pedestrian & at work	*Equal variances assumed*	.075	.785	-.635	146	.527	-.541	.852	-2.226	1.144
	Equal variances not assumed			-.624	86.073	.534	-.541	.867	-2.266	1.183
Drinking &driving and none use of seat belt	*Equal variances assumed*	5.571	.020	-1.989	88	.050	-1.862	.937	-3.724	-.001
	Equal variances not assumed			-1.753	38.267	.088	-1.862	1.062	-4.012	.288
Inattentive driving	*Equal variances assumed*	2.102	.151	-2.815	90	.006	-1.723	.612	-2.939	-.507
	Equal variances not assumed			-2.674	45.999	.010	-1.723	.645	-3.021	-.426
Risk Judgment on overturns & collisions	*Equal variances assumed*	.829	.364	.017	147	.987	.014	.833	-1.632	1.659
	Equal variances not assumed			.018	106.217	.986	.014	.778	-1.529	1.556
Risk Judgment as driver,pedestrian or passanger	*Equal variances assumed*	.230	.633	-.307	146	.759	-.156	.506	-1.156	.845
	Equal variances not assumed			-.300	82.190	.765	-.156	.518	-1.187	.875

Source: Field work (SPSS) data in Zambia; Jun-Aug 2013.

Appendix VII Significant and non-significant ANOVA tests

ANOVA for Age groups

		Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Watchful & cautious driving	Between Groups	572.210	3	190.737	3.946	.011
	Within Groups	4253.997	88	48.341		
	Total	4826.207	91			
Drinking &driving and none use of seat belt	Between Groups	211.637	3	70.546	4.657	.005
	Within Groups	1332.972	88	15.147		
	Total	1544.609	91			
Inattentive driving	Between Groups	36.487	3	12.162	1.587	.198
	Within Groups	689.566	90	7.662		
	Total	726.053	93			

ANOVA for Education

		Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Watchful & cautious driving	Between Groups	492.885	3	164.295	3.336	.023
	Within Groups	4333.322	88	49.242		
	Total	4826.207	91			
Drinking &driving and none use of seat belt	Between Groups	24.423	3	8.141	.471	.703
	Within Groups	1520.186	88	17.275		
	Total	1544.609	91			
Inattentive driving	Between Groups	96.716	3	32.239	4.610	.005
	Within Groups	629.337	90	6.993		
	Total	726.053	93			

ANOVA for Residential Area

		Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Watchful & cautious driving	Between Groups	174.416	2	87.208	1.697	.189
	Within Groups	4471.140	87	51.392		
	Total	4645.556	89			
Drinking &driving and none use of seat belt	Between Groups	45.791	2	22.896	1.426	.246
	Within Groups	1396.709	87	16.054		
	Total	1442.500	89			
Inattentive driving	Between Groups	39.512	2	19.756	2.569	.082
	Within Groups	684.346	89	7.689		
	Total	723.859	91			

Source: Field work (SPSS) data in Zambia; Jun-Aug 2013.

Appendix VIII Map of road network in Lusaka urban

Source: JICA, 2009

Appendix IX Summary of factor analysis for independent variables

Factors for Traffic safety

	Dim 1	*Dim 2*	*Dim 3*
Factor 1 Attitude towards rule violation *(Cronbach's alpha .778, mean corrected item total correction .49)*			
It is reasonable to ignore red lights when there are no other cars or people in sight	.742		
To maintain flow in traffic, one must ignore several traffic regulations	.731		
In the absence of other good alternatives, I would let an unsafe driver drive me home	.645		
If my friends were passengers of an unsafe driver, I would join them	.619		
I feel it's my responsibility to tell a driver if he/she is driving too fast	.602		
Seat belts are less important when driving home in a taxi	.509		
Experienced drivers should not need to use seat belts	.481		
Traffic regulations are overcomplicated, and therefore difficult to comply with when driving	.464		
Factor 2 Attitude towards general safety and drinking *(Cronbach's alpha .590, mean corrected item total correction .27)*			
Speed humps decrease chances of traffic incidents		.648	
Seat belts are mandatory in public transport (buses, taxis)		.639	
I would never drive after alcohol consumption		.584	
I would never let a drunk driver take me home, if I knew they had consumed alcohol	.310	.476	
Driving after dark should be avoided in respect of traffic safety		.435	-.321
Pedestrians have a large responsibility making sure they are not hit by cars		.409	
I have good knowledge of traffic rules		.388	
There should be severe sanctions for driving too fast		.317	
Drivers who violate traffic regulations don't represent a larger threat for safety than those respecting these regulations			
There should be severe sanctions for hitting pedestrians with a car			

Factor 3 Attitude towards reckless driving	
(Cronbach's alpha .530, mean corrected item total correction .29)	
People violate speed limits because these limits are too low	.698
If am the only one at risk, it is reasonable to take chances in traffic	.596
If I drive in a familiar area, it is reasonable to drive about 20 km faster than usual	.552
If you are a decent driver it's acceptable to drive a bit faster	.366
If a pedestrian is run down by a car, the pedestrian is to blame	.327

Source: Field work (SPSS) data in Zambia; Jun-Aug 2013.

Appendix X Summary of factor analysis for dependent variables

Factors for Driver behavior dimensions

	Dim 1	Dim 2	Dim 3
Factor 1 watchful & cautious driving			
(Cronbach's alpha .883, mean corrected item total correction .60)			
Slow down due to slippery driving conditions	.764	.179	.217
Slow down considerably in densely populated areas	.706	.200	.102
Slow down due to difficult driving conditions	.683	.261	.074
Slow down due to a road sign which signals caution	.663	.273	.111
Go as a passenger with a driver you know has been drinking alcohol	.656	.456	.059
Slow down when there are pedestrians on the road	.628	.268	.032
Slow down if I see a pedestrian approaching	.581	.088	.012
Increase speed in densely populated areas	.576	.139	.052
Drive above the speed limit to reach a very important appointment	.572	.121	.528

Slowdown in areas where children are playing, even when none are visible	.523	.008	.147
Discuss traffic safety with others	.511	.494	.299
Slow down because a car behind you is trying to pass	.420	.278	.204
Factor 2 drinking & driving and none use of seat belts			
(Cronbach's alpha .801, mean corrected item total correction .59)			
Drive when you have had several beers	.039	.829	.156
Drive after you have had a beer	.247	.787	.122
Drive longer trips without wearing a seatbelt	.207	.655	.198
Drive the morning after heavy alcohol consumption, without knowing if you are completely sober	.477	.604	.086
Drive over shorter distances without wearing a seatbelt	.302	.523	.288
Factor 3 Inattentive driving			
(Cronbach's alpha .706, mean corrected item total correction .50)			
Create dangerous traffic situations as a result of being inattentive	.219	.144	.735
Get distracted by events in the environment while driving	.056	.205	.653
Ignore traffic regulations to reach your destination in time	.477	.210	.589
Keep on driving, even if you feel tired	.428	.145	.434

Source: Field work (SPSS) data in Lusaka, Zambia, June-August, 2013.

Appendix XI Correlation matrix for key variables

		Watchful & cautious driving	*Drinking &driving and none use of seat belt*	*Inattentive driving*	*Eduacation Level recoded*	*Experience*	*Attitude towards rule violation*	*Risk Consequences on overturn & head on collision*	*Risk Consequences on parking & collision accidents*	*willingness as driver,pedestrian & at work*	*Risk Judgment on overturns & collisions*	*Risk Judgment as driver,pedestrian or passanger*	*Age in years only*
Watchful & cautious driving	*Pearson Correlation*	1	.593**	.482**	-.083	.191	.390**	.150	.201	.138	.150	.226*	.272**
	Sig. (2-tailed)		.000	.000	.432	.069	.000	.156	.057	.193	.154	.030	.009
	N	92	89	92	92	92	92	91	90	91	92	92	92
Drinking &driving and none use of seat belt	*Pearson Correlation*	.593**	1	.315**	.027	-.013	.128	-.051	.050	.150	.120	.109	.334**
	Sig. (2-tailed)	.000		.002	.802	.900	.225	.634	.638	.155	.253	.301	.001
	N	89	92	91	92	92	92	91	90	91	92	92	92
Inattentive driving	*Pearson Correlation*	.482**	.315**	1	-.319**	.219*	.536**	.160	.205	-.061	.118	.273**	.199
	Sig. (2-tailed)	.000	.002		.002	.034	.000	.125	.050	.561	.258	.008	.054
	N	92	91	94	94	94	94	93	92	93	94	94	94
Eduacation Level recoded	*Pearson Correlation*	-.083	.027	-.319**	1	.016	-.466**	-.139	-.088	-.115	-.198*	-.152	.059
	Sig. (2-tailed)	.432	.802	.002		.878	.000	.086	.284	.155	.014	.059	.469
	N	92	92	94	155	95	154	153	152	154	155	154	155
Experience	*Pearson Correlation*	.191	-.013	.219*	.016	1	-.044	-.021	.027	-.038	-.107	.150	.316**
	Sig. (2-tailed)	.069	.900	.034	.878		.673	.838	.794	.717	.303	.147	.002
	N	92	92	94	95	95	95	94	93	94	95	95	95
Attitude towards rule violation	*Pearson Correlation*	.390**	.128	.536**	-.466**	-.044	1	.222**	.169*	.075	.245**	.226**	.062
	Sig. (2-tailed)	.000	.225	.000	.000	.673		.006	.038	.354	.002	.005	.445
	N	92	92	94	154	95	154	152	151	153	154	153	154
Risk Consequences on overturn & head on collision	*Pearson Correlation*	.150	-.051	.160	-.139	-.021	.222**	1	.454**	-.103	.371**	.243**	-.029
	Sig. (2-tailed)	.156	.634	.125	.086	.838	.006		.000	.206	.000	.003	.725
	N	91	91	93	153	94	152	153	151	152	153	152	153
Risk Consequences on parking & collision accidents	*Pearson Correlation*	.201	.050	.205	-.088	.027	.169*	.454**	1	-.049	.431**	.214**	.152
	Sig. (2-tailed)	.057	.638	.050	.284	.794	.038	.000		.553	.000	.008	.062
	N	90	90	92	152	93	151	151	152	151	152	151	152
Risk willingness as driver,pedestrian & at work	*Pearson Correlation*	.138	.150	-.061	-.115	-.038	.075	-.103	-.049	1	-.005	-.103	.069
	Sig. (2-tailed)	.193	.155	.561	.155	.717	.354	.206	.553		.955	.204	.392
	N	91	91	93	154	94	153	152	151	154	154	153	154
Risk Judgment on overturns & collisions	*Pearson Correlation*	.150	.120	.118	-.198*	-.107	.245**	.371**	.431**	-.005	1	.346**	.048
	Sig. (2-tailed)	.154	.253	.258	.014	.303	.002	.000	.000	.955		.000	.555
	N	92	92	94	155	95	154	153	152	154	155	154	155
Risk Judgment as driver,pedestrian or passanger	*Pearson Correlation*	.226*	.109	.273**	-.152	.150	.226**	.243**	.214**	-.103	.346**	1	-.025
	Sig. (2-tailed)	.030	.301	.008	.059	.147	.005	.003	.008	.204	.000		.762
	N	92	92	94	154	95	153	152	151	153	154	154	154
Age in years only	*Pearson Correlation*	.272**	.334**	.199	.059	.316**	.062	-.029	.152	.069	.048	-.025	1
	Sig. (2-tailed)	.009	.001	.054	.469	.002	.445	.725	.062	.392	.555	.762	
	N	92	92	94	155	95	154	153	152	154	155	154	155
**. Correlation is significant at the 0.01 level (2-tailed).													
*. Correlation is significant at the 0.05 level (2-tailed).													

Source: Field work (SPSS) data in Lusaka, Zambia, June-August 2013.

Appendix XII Road Traffic Act 11 on seat belt usage

counted and two children of or over the apparent age of four years but under the apparent age of eight years shall be counted as one occupant.

(3) Any person who contravenes the provisions the subsection (1) commits an offence.

Obligation to wear seat belts

167. (1) Subject to subsection (2), a person shall not drive or ride in, a motor vehicle on a road without fastening the seat belt.

(2) Notwithstanding subsection (1)—

Source: Field work data in Lusaka, Zambia, June-August, 2013.

Appendix XIII Street vendors along Lumumba Road in Lusaka

(Source: Field data.
http://www.lusakatimes.com/wp-content/uploads/2009/08/vendors-Lumumba-road-.jpg)

Appendix XIV News articles on road traffic accidents during data collection period

Zambia: Road Accidents Rock Lusaka and Copperbelt

BY NSE UDOH, 17 MAY 2013

RELATED TOPICS

The worrisome trend of road traffic accidents in Zambia has continued with two recorded on Thursday on the Copperbelt and Lusaka provinces.

In Lusaka 33 people escaped with injuries when a Ticklays Bus registration number ABM 9416 overturned after bouncing off a speed hump whilst overspeeding in Chisamba area.

The victims were rushed to the University Teaching Hospital where 25 of the 33 admitted had been discharged by evening Thursday with the rest still at the hospital in serious condition.

2 die in the Mongu-Lusaka road accident

21/10/2013

TWO people died on the sport in a road traffic accident after the vehicle there were travelling in careered off the road and rammed into a tree after the driver lost control due to excessive speeding. The accident happened around 18 hours along the Mongu-Lusaka road at the weekend. The vehicle was coming from Lusaka to Mongu at Longo area 45kilometres away from Mongu.

Truck Runs over Woman on Kabwe Road

By Nse Udoh | Published July 11, 2013

Zambia Long weekend – 216 road traffic accidents with 20 deaths

Published on August 7, 2013.

Saved under POLICE & COURTS

Truck Drivers Cheat death in July 19th accident between Kapiri Mposhi and Copperbelt

Latest Lusaka Accidents In The News

RTSA identifies major causes of accidents

LUSAKA | ZAMBIA |

The Road Transport and Safety Agency (RTSA) has cited billboards mounted on the Islands of the highways, use of second-hand tyres and negligence by drunken drivers as some of the major causes of road traffic accidents in Zambia.[...]

AUG 28, 2013 05:16AM | 5 VIEWS | SOURCE: YAHOO

Lusaka Accidents News Archives

Another accident claims four on great north road

Lusaka, zambia

Four people died on the spot while several others sustained serious injuries when a Marcopolo bus they were travelling in collided head-on with a tanker near 15 Miles in Chibombo district in Central Province.

Read Article
Jun 29, 2013
26 views

Source: http://www.accidentin.com/world/zambia/lusaka/archives/201306.htm

Road traffic accidents worrying - Times of Zambia

Lusaka, zambia

Times of Zambia - I AM particularly concerned with the numerous road traffic accidents that have been recorded in the last five months between Kabwe and Lusaka. Something should be done urgently to stop the accidents.

Read Article
May 23, 2013
20 views

10 seriously injured in Mini bus head on collision with truck - Lusaka Times

Lusaka, zambia

Lusaka Times - Ten people have been seriously injured when a Lusaka bound mini bus collided head on early today with an oncoming truck at Demu area on the Choma-Monze highway. Pemba District Commissioner Reginald Mugoba who confirmed the accident to

Read Article
May 23, 2013
24 views

Source: http://www.accidentin.com/world/zambia/lusaka/archives/201305.htm

Easter Holiday road accidents claim 17 lives-Police - Lusaka Times

Lusaka, zambia

Lusaka Times - Police Spokesperson Elizabeth Kanjela said a total number of 203 road traffic accidents were recorded over the Easter holiday. Lusaka was the hardest hit with 111 Road Traffic Accidents recorded where four people died. Northern Provinc

Read Article
Apr 19, 2013
4 views

At least over 50 people have died in a road traffic accident that occurred this morning on the Great North Road.The accident happened around 07 hours in Chibombo district after a 70 sitter Post bus heading to Lusaka from Ndola collided with a truck.

Police to continue impounding mini buses

Published on June 15, 2013.

Saved under POLICE & COURTS

Police have said they will continue to impound buses whose drivers are contravening the road service license.

In a statement to ZANIS today, Zambia Police Deputy Public Relations Officer CharityChanda says the operation to impound buses was being done to bring sanity on roads to avoid unnecessary accidents that lead to injuries, damage to property, and loss of lives.

Ms Chanda said for this reason police traffic officers countrywide have been directed to intensify operations with the view of impounding mini buses whose drivers are picking and dropping off passengers at undesignated areas.

http://lusakavoice.com/2013/06/15/police-to-continue-impounding-mini-buses/

Another Chibombo bus accident:16 people are feared dead

minibus was travelling from Kabwe in Central Province to Lusaka with 20 passengers on board but after a tyre-burst the driver lost control of the vehicle which overturned and killed the sixteen on board while the status of the four others has been described as critical and they have all been evacuated to Lusaka's University Teaching Hospital (UTH).

Source: Field work data in Lusaka, Zambia, June-August, 2013.