ROAD TRAFFIC ACCIDENTS IN ZIMBABWE, INFLUENCING FACTORS IMPACT AND STRATEGIES.

Mervis Patience Muvuringi

Zimbabwe

48th International Course in Health Development

September 19, 2011- September 7, 2012

KIT (ROYAL TROPICAL INSTITUTE)

Development Policy and Practice/

Vrije Universiteit Amsterdam

ROAD TRAFFIC ACCIDENTS IN ZIMBABWE, INFLUENCING FACTORS, IMPACT AND STRATEGIES.

A thesis submitted in partial fulfilment of the requirement for the degree

of Masters of Public Health

by

Mervis Patience Muvuringi

Zimbabwe

Declaration:

Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.
ROAD TRAFFIC ACCIDENTS IN ZIMBABWE INFLUENCING FACTORS, IMPACT AND STRATEGIES…is my own work

Signature: 

48th Masters of Public Health (MPH)/International Course in Health Development (ICHD)
September 19, 2011 – September 07, 2012
KIT (Royal Tropical Institute)/Vrije Universiteit Amsterdam
Amsterdam, The Netherland

September 2012

Organised by:

KIT (Royal Tropical Institute), Development Policy & Practice
Amsterdam, The Netherlands

In co-operation with:

Vrije Universiteit Amsterdam/ Free University of Amsterdam(VU)
Amsterdam, The Netherlands

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENT

Firstly I give great thanks to the Nuffic and the Netherlands government for giving me the fellowship to study for the MPH/ICHD. Had it not been them studying for this international recognized course would have remained a dream for me.

Secondly I would like to thank the almighty God who gave me strength throughout the course. Many thanks go to the ICHD coordinator and her team of the Royal Tropical Institute for their dedicated team spirit and giving me opportunity to study the course of MPH/ICHD 2011-2012.

Thirdly I would like to thank my thesis advisor for her guidance she offered me advice, suggestions and critics where necessary and encouraged me to progress with my thesis. Many thanks also go to my back-stopper who ensured a smooth progress on my thesis.

Fourthly I am also grateful to all the course participants for their dynamic experiences and abilities. I gained a lot of experience and drew inspiration from the comments and advice I took from them I will always remember them.

Lastly I would like to thank my mother who took care of my only daughter during my absence.

ABBREVIATIONS

AfDB	African Development Bank
AFTTR	Africa Transport Sector
AIDS	Acquired immune deficiency syndrome
AUC	African Union Commission
BAC	Blood alcohol concentration
BTS	Bureau of Transportation Statistics
CDC	Centre For Disease Control and prevention
DALYs	Disability adjusted life years
DDF	District Development Fund
e.g.	For example
ETSC	European Traffic Safety Council
GDLS	Graduated drivers' licensing system
GDP	Gross Domestic Product
GRSF	Global Road Safety Facility
GRSP	Global road safety partnership
HIV	Human Immune Deficiency Virus
ICS	International Citizen Service
i.e.	That is
IOM	International Organisation for Migration
IRF	International road Federation
MARS	Medical Air Rescue
MDG	Millennium Development Goals
MOH&CW	Ministry of Health and Child-Welfare
NGO	Non-Governmental Organisation
PDMT	Potential mechanical defect test
PHC	Primary Health Care
RITA	Research and Innovative Technology Administration
RTIs	Road traffic injuries
SADC	Southern African Development Community
SDH	Social determinants of Health
SSATP	Sub-Saharan Africa Transport Policy Program
TEST	Transport and Environment Science Technology network
THET	Tropical Health and Education Trust
TSCZ	Traffic Safety Council of Zimbabwe
UNECA	Economic Commission for Africa
WB	World Bank
WHO	World Health Organization
WMA	World Medical Association
ZINARA	Zimbabwe National Roads Administration
ZUPCO	Zimbabwe United Passenger Company

GLOSSARY

Road traffic injury (RTI) – Injuries incurred as a result of road traffic crashes. These can be fatal or non-fatal.

Speed cameras- devices used at fixed sites or by mobile police patrols to take photographs of vehicles exceeding the speed limit. They are used as means of enforcing speed limit.

Traffic crash - incident or collision occurring in public road, involving one or more vehicles moving that may or may not lead to injury.

Traffic death – death due to traffic crash immediately or within 30 days after the crash

Occupant – a person operating or intending to operate (driver), or a person being carried (passenger) in any mechanically or electrically powered device designed primarily for or being used at the time primarily for conveying persons or goods from one place to another.

Motorcyclist – a person operating or being carried in a two wheeled mechanically or electrically powered device having one or two riding saddles and sometimes having a third wheel for the support of a side car.
Bicyclist – a person riding or being carried on any transport vehicle operated solely by pedals.

Pedestrian – a person involved in an accident who was not at the time of the accident riding in or on any mechanically or electrically powered device.

Child restraint - a device used for restraining a child travelling inside a motor vehicle, e.g., baby capsule, baby seat or a booster seat.

Passenger – A person other than the driver travelling in or on a car, truck or bus

Black spot - is an engineering tem to denote the section of a road network where traffic accidents frequently occur.

Accident - is unfortunate incident that happens unexpectedly and unintentionally (Oxford university press, 2001).

Definitions were taken from the PIARC technical dictionary of road terms 8th edition (Freire, *et al* 2007) as well as Austroads glossary of terms 4th edition (Milne *et al*, 2010).

ABSTRACT

Zimbabwe has comprehensive road network linking the different parts of the country and providing access to neighbouring countries for imports and exports. The country is experiencing an increase in motorisation while roads have deteriorated resulting in increased road accidents. This study seeks to improve understanding of road traffic injuries (RTIs) and their impact as an agenda for public health. It highlights that RTIs are a safety problem and an equity public health issue. The perceived risk of fatal RTIs exceeds all other risks in the country (Andrews, 2011). The productive age group is mostly affected with more males dying than females.

This study is based on peer reviewed and grey literature. An active search for informal and formal information about RTIs was done. The Safe Systems Approach framework was adapted with some components from the Commission of Social Determinants of Health.

Zimbabwe's key risk factors that contribute to RTIs include reckless driving, violation of traffic laws, damaged vehicles, and bad roads. The country has basic legislation for road safety that needs to be reviewed, e.g., speed limits are faster than the global recommendations. There is inadequate enforcement of existing road safety laws, corruption and poor data collection and recording. Those injured face challenges to access health care.

Accurate RTI data collection and recording is needed for designing strategies and understanding RTIs risks. Research should be done to establish knowledge gaps on RTIs. Public transport should be improved to achieve road safety for passengers. Country should establish universal national health insurance to improve access to health care.

Keywords: Zimbabwe, road, traffic, injury, accident. Combinations of these words were also used.

Word count: 12800

INTRODUCTION

About 3000 people die from RTIs daily in the world. Eighty five percent of the deaths and 90% of health years of life lost due to RTIs are from the low income and middle income countries (Peden *et al*, 2004). Mostly **passengers and pedestrians** are affected (ibid). One of the top three causes of deaths for 5-44 years age group in many countries is RTIs (World Bank, 2011). This has enormous implications for development.

RTIs strongly contribute to mortality, morbidity and increased inequality among the productive age group and their dependants in Zimbabwe. Fatal road traffic accidents top all the risks and threats of life in the country (Andrews, 2011). The estimated road traffic death rate in the country is 27.5 per 100 000 population per year and the [1]modelled number of road traffic deaths is 3,669 per year (WHO, 2011). However this number does not include those that die after 24 hours which implies under estimation (ibid). An estimation of 30% of patients at St Giles Rehabilitation Centre[2] and 60% of people who need artificial limbs are a result of RTIs (TSCZ, undated). RTIs contribute to loss of productive life due to death or due to disability. In Zimbabwe the 26-45 years age group is the most affected (TSCZ, undated). RTIs cost about 2% of gross domestic product (GDP) in the country (ibid).

Public holidays have been heavily associated with loss of life due to road traffic accidents in Zimbabwe (Towindo and Bulla, 2011). Mutore and Nyambuya (2011) in their article "Don't be a stat this holiday' cites Easter, heroes and festive season holidays as holidays that RTIs are particularly encountered. This is the time when most people have ample time to travel for social gatherings such as church gatherings and visiting friends and relatives thereby increasing traffic volume on roads. Occurrence of accidents is also related to time, most accidents occur from 0600-1800 hours (TSCZ, undated) though fatal accident occurs at night with greater frequency than during the day due to reduced visibility (Parirenyatwa, 2004).

My rationale for this research is due to my experience of the burden of RTI. My uncle who brought me up was involved in a road traffic accident and died on the spot leaving seven children with the first born doing form two. At that time I had just qualified as a Registered General Nurse (RGN) so had to take over the responsibilities for bringing up these children in terms of school fees, food and clothing.

[1]Modelled number of road traffic deaths is the estimated number of road traffic accidents based on method used in the Global Status Report on Road Safety. The method of estimation is number of traffic deaths predicted using negative binomial regression (WHO, 2011b).

[2] St Giles Rehabilitation Centre is a medical rehabilitation centre and the only one in Harare, Zimbabwe. It gives post stroke, major accident and brain injury patients the ability to regain their motor skills and use limbs that were rendered inactive.

[2] St Giles Rehabilitation Centre is a medical rehabilitation centre and the only one in Harare, Zimbabwe. It gives post stroke, major accident and brain injury patients the ability to regain their motor skills and use limbs that were rendered inactive.

After my RGN qualification I worked in an outpatient department where I was attending to RTI casualties on almost every public holiday and Fridays of month-end. In 2007 I joined a humanitarian organization where three of my colleagues were involved in RTIs in different occasions with all of them dying on the spot within a year. One had recently married, with his wife in her first trimester and the other was a father of three with children at college and the other was a bachelor. This implies that the health impact due to RTI does not only affect an individual but it extends to dependents, family, children, community and country.

This paper seeks to improve understanding and awareness of RTIs and determinants for improved decision making. It calls for more attention to the health impacts of RTIs in Zimbabwe as an agenda for public health in order to reduce the burden of RTI. It calls for decision makers, researchers, practitioners and people to be concerned and contribute to the reduction of RTIs in Zimbabwe. The next chapter will discuss the background information of Zimbabwe.

CHAPTER ONE: BACKGROUND INFORMATION OF ZIMBABWE

1.1 Population and population dynamics

Zimbabwe's population is around 12,523 million, with 38% in urban areas and 62% in rural areas (WHO, 2011). Life expectancy at birth is 47years for males and 50years for females and literacy rate is 90.5% (ibid). There is a lot of migration to neighbouring countries due to lack of employment in the country (Ngwato, 2009) (IOM, 2012). Cross boarder trading and employment in neighbouring countries has created a lot of travelling by road.

1.2 Geographic location and administrative system

Zimbabwe is a landlocked, low income country in southern Africa with an area of 390,757 square kilometres. It is divided into eight provinces and two cities with provincial status. Zimbabwe's government is centralized. The climate is mostly subtropical and its terrain is desert and savannah. (see Annex 2).

1.3 Socio economic situation

Zimbabwe is a lower middle-income country. Economic performance depends on agriculture, mining, and manufacturing. Economic growth is strongly influenced by the annual performance of the agriculture sector which provides most raw materials for the manufacturing sector. The government's land reform program which was characterised by violence and chaos affected the commercial farming sector, which has been the traditional source of exports and provider of employment (World Bank, 2010). After loss of employment by so many people who were employed by the white commercial farmers and deterioration of the economy most of Zimbabweans migrated to neighbouring countries in search of green pastures resulting in a net migration of 4-5 migrants per 1000 population (IOM, 2012). The size of the formal sector has decreased and most Zimbabweans survive on self-employment and cross boarder trading.

1.4 Health system

The National Health Service in Zimbabwe is at four levels, primary, secondary, tertiary and quaternary. The health services are provided by the public sector Ministry of Health and Child-Welfare (MOH&CW) and Local Government, both in the rural and urban areas. The services are complemented by Mission (Church related) and private facilities. Health care programmes are implemented based upon the Primary Health Care strategy (PHC) (MOH&CW 2012). However health care services have been severely affected with the status of economy of the country as summarised by the Minister of Finance in his statement:

"*The economic decline has contributed to the deterioration of health delivery, including the shortage of health professionals, inadequate supply of essential drugs, equipment, and other medical supplies, inadequate provision and maintenance of equipment, infrastructure, ambulances, and service vehicles. The provision of health facilities is critical in order to meet increased demand for services…The above have contributed to an increase in the incidence of preventable diseases" (Biti, 2009).*

Due to limited emergency trauma management, injuries encountered during a road traffic crashes are often permanent (TSCZ, undated).

1.5. Road Network

Zimbabwe's road network is comprised of around 88,300 kilometres of road network including 15,000km paved. The road network is divided into primary, secondary, tertiary feeder access road and urban roads. Primary roads comprised of 5% of the network. Primary roads link the country to its neighbouring countries and are important for imports and export of goods. Secondary roads enable movement of people and goods; they link main economic centres and comprise 14% of the network. The Department of Roads manages the secondary and primary road networks. Seventy percent of the road network is made up of the tertiary or feeder access roads which link the rural network to secondary roads and also to social amenities such as schools, health centres and markets. They are managed by the District Development Fund (DDF).Town councils manage the remaining 7% urban road network. The need to travel by precarious means (public transport), exposes people to a risk of RTIs and some people are at more risk than the others. However for social, political and economic reasons it is essential for people to move. WHO (2006a) mentioned the desired outcome of road transport system as the essential mobility for people in order to go for work, school, health care services, leisure, shopping as some of the reasons which can make people travel. Figure 1, shows the changes in road conditions in fair and good condition estimated to have declined from 73% to around 60% of all roads between 1995 and 2009. However this is based on estimation. Most roads in the country are not properly paved, and conditions of these roads worsen during the rainy season.

Figure 1: Zimbabwe changes in road infrastructure condition

Source (AfDB, 2011)

In the next chapter I will focus on the analysis of RTI and point out why it is a problem in Zimbabwe. Objectives of the study will be given as well as the framework that I am going to use for my study.

CHAPTER TWO: UNDERSTANDING ROAD TRAFFIC INJURIES IN ZIMBABWE

2.1. Problem analysis and justification

Severe injuries and mortality in road traffic accidents are a public health problem with consequences such as long term disabilities which are similar to any other public health problem such as tuberculosis, HIV/AIDS and cancer, but they are not mentioned in the Millennium Development Goals (MDGs). Road injuries continue to increase in many countries, around 1.2 million die in road accidents annually, 65% being pedestrians and 35% of pedestrian deaths are children (UNECA *et al*, 2011). Low and middle-income nations account for 85% for all road traffic deaths (Arumugam, 2007). *The top cause of death by injury* is road traffic injuries (UNECA *et al,* 2011). Disability due to road traffic injuries account for about 30-50million people (ibid). The traumas involved account for lot of costs, about 1 to 3 % of GDP in most countries which implies that road injuries result in a lot of expenditure (UNECA *et al*, 2011).

THET ICS did a risk assessment in Zimbabwe based on information from other NGOs, the University of Zimbabwe College Of Health Sciences, the Zimbabwe Health Training Support, and the Foreign Commonwealth Office travel advice and reported that fatal road traffic accidents are the greatest existing threat among all risks. Table 1 show the existing threats that were found during the assessment.

Table 1: Existing risks in Zimbabwe

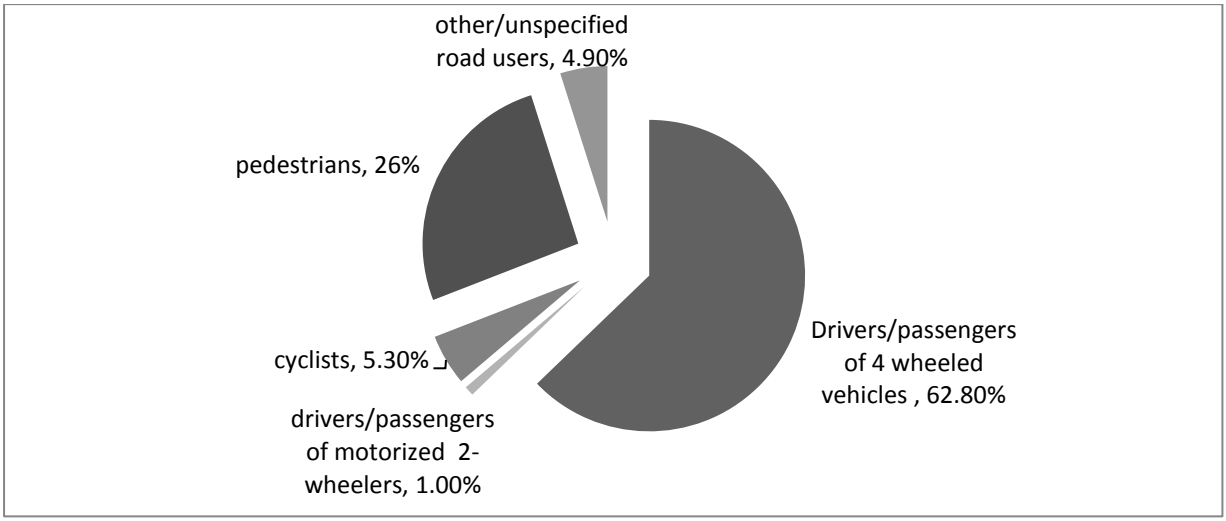
1. Fatal road traffic accidents	9. Major household accident (e.g. gas explosion)
2. Robbery/ muggings and crime	10. Natural disasters (e.g. violent storms, floods, fire)
3. Political unrest-violent rallies or demonstrations	11. **Non-fatal road traffic accidents**
4. Health risks – HIV/AIDS	12. Terrorist attacks
5. Health risks – Water (cholera)	13. Entanglement with the authorities
6. Health risks - Malaria	14. Physical assault
7. Sexual assault	15. Sexual harassment
8. Kidnapping	

(Andrews, 2011)

This implies that road traffic accidents are really a problem in the country besides being the number one threat, it also appear on number 11 as a risk for injury. The estimated annual road traffic deaths rate in the country is 27.5 per 100,000 populations (WHO, 2011).

Figure 2 shows the distribution of traffic deaths by type of road user for Zimbabwe in 2006.

Figure 2: Distribution of traffic deaths by type of road user in 2006



Source: WHO, 2011a

A high percentage of passengers' fatalities are associated with the utilisation of public transport (Odero *et al* 1997). The use of public transport is the daily routine for most of poor Africans (Chen, 2010). Socio economic status usually determines or influences individuals' choice of mode of transport (Sharma, 2008).However use of public transport is not safe due to lack of seat belts, overloading, speeding and poor road conditions especially in Zimbabwe where family owned commuters are used as public transport. Zimbabwe's national transport policy does not favour walking; there are no pedestrian paths in the design of the roads. This could be also one of the risk exposures of pedestrians who contribute the second highest percentage of traffic deaths.

The Zimbabwe country profile on road traffic injuries showed that in reported road traffic fatalities for 2006 of the 1,037 deaths 71% were males and 29% females and there were 13,819 non-fatal RTIs (WHO, 2012). Households are affected either by the deaths of a bread winner (mostly men) or by the deaths of a caretaker and mother.

Table 2: Road traffic accidents fatality and injuries from 1997-2005

Year	Total reported	Persons killed	Persons injured
1997	43,086	1,307	17,906
1998	56,433	2,152	25,984
1999	51,219	1,858	23,722
2000	40,316	1,433	18,105
2001	39,841	1,399	18,153
2002	41,753	1,871	20,419
2003	78,481	3,549	37,144
2004	37,596	1,771	17,577
2005	36,390	1,291	18,531

Source: Jokonya, 2006

In 2003 there was a marked increase in the total number of accidents with more deaths and injuries. This seems to be an outlier though with no explanation given for increase. Therefore it could also be a human error in data collection or recording.
Access to comprehensive primary health care is one of the prime objectives of all health systems including Zimbabwe's. The methods of financing household health care in Zimbabwe are mostly out-of-pocket payments at the point of delivery of service. Maximum barriers to effective utilisation of health care especially by the lower income groups are created. RTI is one of uncertain events that can occur, usually associated with financial burden. Households are subjected to impoverishment due to the out-of-pocket way of financing injury care. Zimbabwe is a poor country with economic constraints which makes it harder for the RTI victims and affected families to recover (World Bank, 2003).

The burden of RTIs affects dependents of victims as well, causing suffering, school drop outs and poverty especially when the breadwinner is dead or disabled. Odero *et al* (1997) reviewed RTIs in developing countries including Zimbabwe and noted that RTIs represent between 30-86% of all trauma admissions, and the victims tend to be hospitalised longer than for other conditions.
If no mitigation is done projections shows that the situation will get worse with road accidents forecasted to rise because of increase in motorization, from ninth to second leading cause of disability-adjusted life years (DALYs) lost in developing countries and third in the industrialized world (Krug, 1999) (WHO, 2001)

Table 3: Globally Disease of burden (DALYs lost) for 10 leading causes

1998 Disease or Injury	**2020 Disease or Injury**
1. Lower respiratory infections	1. Ischaemic heart disease
2. HIV/AIDS	2. Unipolar major depression
3. Perinatal conditions	3. **Road traffic injuries**
4. Diarrhoeal diseases	4. Cerebrovascular disease
5. Unipolar major depression	5. Chronic obstructive pulmonary disease
6. Ischaemic heart disease	6. Lower respiratory infections
7. Cerebrovascular disease	7. Tuberculosis
8. Malaria	8. War
9. **Road traffic injuries**	9. Diarrhoeal diseases
10. Chronic obstructive pulmonary disease	10. HIV/AIDS

Source: WHO, 2001

Having gone through these worrying problems of RTIs one can conclude that RTIs are a huge public health and development problem in Zimbabwe. The majority of RTIs affects young males who are bread winners. Reducing RTIs and fatalities will reduce suffering and free

resources for development and more productive uses. This leads me to the research questions that I intend to answer in my study.

2.2. Research questions

1. What are the burden, contributing factors and trends of RTIs in Zimbabwe?
2. What are the circumstances that lead to road traffic accidents?
3. What are the strategies that can be used to reduce road traffic injuries?
4. What can be done to strengthen the road transport sector legislation and policies in Zimbabwe?

2.3. Main Objective

To analyse the situation on road traffic injuries in Zimbabwe in order to make recommendations towards reduction of the burden of road traffic injuries.

2.3.1. Specific objectives

1. To describe and analyse road traffic injuries and their trends in Zimbabwe.
2. To critically analyse causes and contributing factors related to road users, road and road sides, vehicles factors and road safety decision making.
3. To describe and discuss consequences of road traffic accidents in Zimbabwe.
4. To review current strategies in Zimbabwe.
5. To identify and discuss good practices from other countries.
6. To formulate recommendations based on findings.

2.4. Methodology

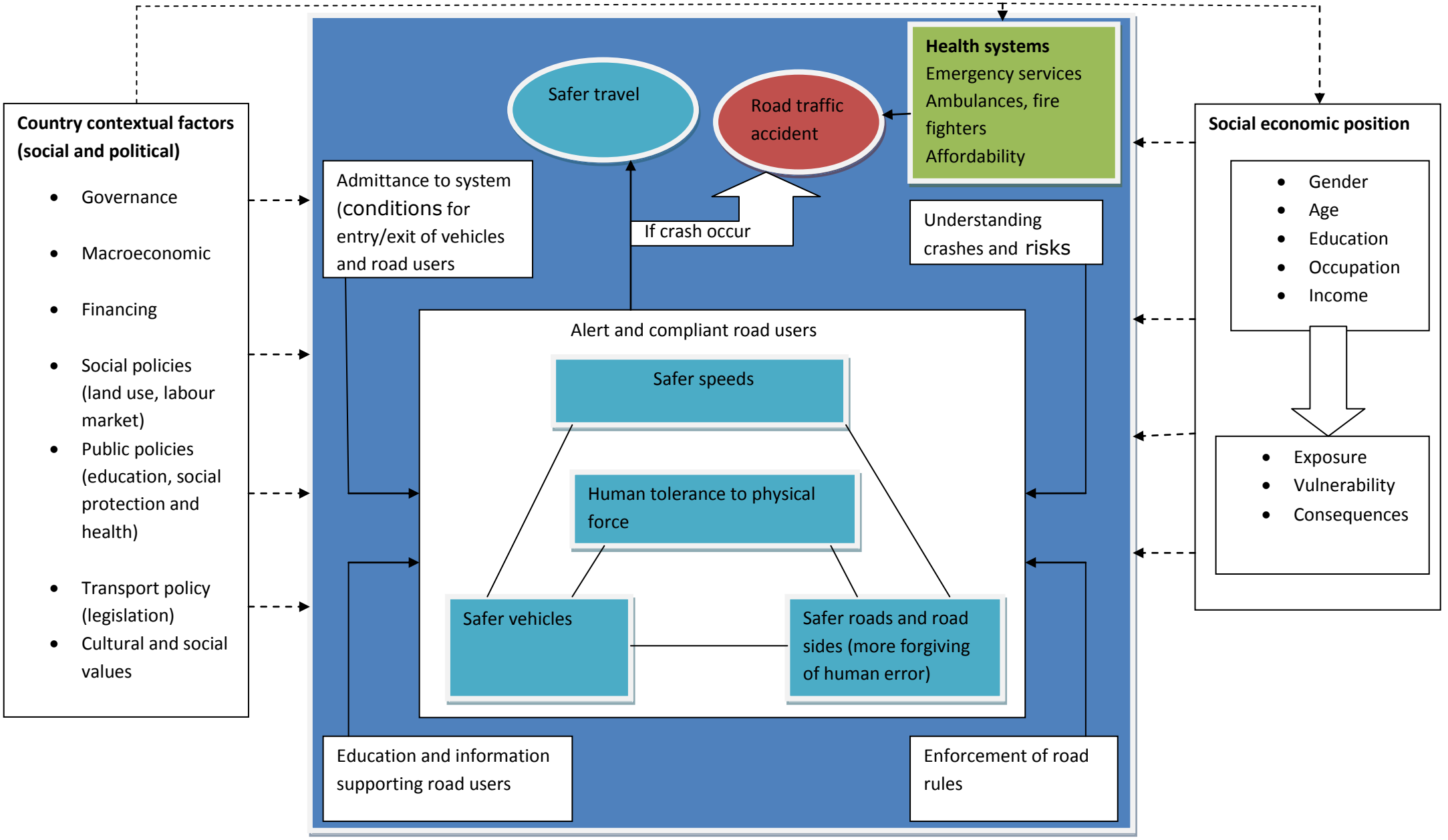
This study is based on both peer reviewed and grey literature. An active search for informal and formal information about RTIs in the country was done to analyse the RTI problem. An internet search was done to search for information on RTIs through Google scholar, Google search, Science direct, Cochrane library and Pub med. African development Bank, World Bank, World Health Organisation and Traffic Safety Council of Zimbabwe (TSCZ) websites were also used to identify papers related to the topic as well as other international organisations.

Analysis of available RTI statistics was done. Efforts to get updates of the situation in Zimbabwe were made by listening to news, reading online newspapers and emails from colleagues and the Ministry of Transport.

Current strategies which are being implemented were looked into and analysis of the gap between discourse and practice as well as gap in reducing health inequities has been made.

Below is the adopted conceptual framework from a systems approach and some components from commission of social determinants of health framework (Australian Transport Council, 2008) (WHO, 2007).

The safe system Conceptual Framework



Adopted from: (Australian Transport Council, 2008) and (WHO, 2007)

2.5 Conceptual framework

To analyse contributing factors for RTI in Zimbabwe the social political country contextual factors has been considered as basic contributing factors to RTIs. The systems approach model has been adopted (Australian Transport Council, 2008), to consider the system as whole, interaction between elements (vehicles, roads, road users and their physical, social and economic environments). Some components from the social determinants of health framework have been used in the block with country contextual factors and the block with socio economic position (WHO, 2007). The systems approach model for prevention did not include what happens when the road traffic injury occurs so this block has also been added.

RTIs affect the poor more than the wealthy in developing countries especially pedestrians (Nantulya and Reich, 2003). This framework does not separate behaviour from its context for example the intermediary determinants are linked to transport policy, land use policy and values of the society. From the left column the first box shows contextual factors that bring influence on social stratification leading to socioeconomic position. For example transport policy influences the transport infrastructure, land use influence distance to be travelled.

Socioeconomic positions influences susceptibility to RTI; for instance the means of transport most frequently used by poor people in Zimbabwe is walking (pedestrian), bus, minibuses and cycling and these are more vulnerable to RTIs. Poor people can only afford second hand vehicles. Poor people cannot afford trauma care hence this may lead to inequalities increasing severity of the problem.

Zimbabwean‘s cultural and social values put men at more risk of RTI; men are expected to provide for the family hence end up working more hours causing drivers exhaustion. Anxiety, stress, use of sedative drugs and sleeping problems also contributes to loss of concentration.

Education, occupation and income are linked together. Incorporating road safety education at schools reduces number of RTIs and improves crossing behaviour (Duperex *et al*, 2002). Awareness of risks and ability to deal with information about risks shapes the behaviour and attitudes of an individual. Some occupations such as truck driving also place individuals at more risk. Income has been seen to influence a lot of accidents in roads for example commercial drivers are given a target that determines their salary, hence competing for passengers, leads to speeding. Demands for income at home forces people to work overtime.

Socioeconomic position influences exposure to RTIs by acting through intermediary determinants. These include material factors such as

vehicles conditions, roads conditions and working conditions, psychological factors and behavioural factors. These factors are interlinked for example lack of material affects living and working conditions and this may lead to psychological problems resulting in bad behavioural acts such as speeding, drinking and driving. The health system is also influenced by the country's economy. Road environment factors, human factors and vehicle factors are interrelated factors that result in road traffic injuries or safe journeys travelled. They are also influenced by material circumstances, behavioural factors and psychological factors. Health systems determine the trauma care of the victims of RTI.

One can conclude that the determinants of RTI are multifactorial. Structural determinants of health form the basis of the RTI outcome. The framework explains how social inequities determine risk for RTI morbidity, mortality and differentials in socioeconomic groups.

2.6. Limitations of the thesis

The researcher faced a lot of problems trying to get updated RTI information from Zimbabwe. It is very difficult. Statistics from the TSCZ website were used and the World Health Organisation (WHO) Zimbabwe profile has 2007 statistics for injury surveillance. Data reported and quoted by different entities were often conflicting, which may be related to differences in reporting (quality and completeness).The researcher used personnel experiences and newspapers articles in some situation which at times may not be valid.

The next chapter looks at the burden of RTI and trends and factors that contribute to RTI with critical analysis of the causes and contributing factors related to road users, road and road sides as well as vehicle factors. A discussion on trends is also presented and how RTIs impact on human beings socially and economically.

CHAPTER THREE: DETERMINANTS, TRENDS AND CONSEQUENCES OF ROAD TRAFFIC INJURIES IN ZIMBABWE

Interaction among road users, vehicle factors, road and roadsides may result in road traffic accidents (ICSU, 2011), (WHO, 2006a). The burden of RTIs in Zimbabwe is influenced by factors that worsen the effects of RTIs and factors that influence the severity of trauma. This analysis is essential to come up with recommendations for interventions.

This chapter looks at the trends of RTIs in Zimbabwe and analyses the contributing factors to road traffic injuries. Using the conceptual framework 3.1 the country contextual factors are found in the left and right box of the framework. 3.2 gives the trends of road traffic injuries in the country.3.3 Road users, vehicle factors, road and road-sides factors are found in blue coloured blocks in the middle box of the framework. 3.4 looks at the consequences of RTIs and what happens when the road traffic injury occurs using the box in green labelled health systems.

3.1. Country contextual factors contributing to road traffic injuries

The conditions in which people live and work determine their health status (ICSU, 2011). These conditions have an influence on the severity of RTIs and cause disparities among peoples' chances of leading healthy lives. Cultural and social values also influence the road users' perception on the impact of RTIs. Gordon Chavhunduka, a traditionalist, argues that cleansing ceremonies could help in treating the black spots through consultation with the spirit medium of the respective places where RTIs are common (Mukarati, 2011). Some also argues that African countries have faced many disasters such as war, famine and fatal diseases so they perceive RTIs as killing a relatively few people because they have witnessed many people dying in a massacre (Assum, 1998).

A summary of data on global disparities in RTIs and the underlying issues found that populations in low and middle income countries bear the highest burden of injuries and fatalities due to RTIs (Nantulya and Reich, 2003). This could be attributed to increases in urbanization, increases in motorization without matching road engineering and functional RTI prevention programmes.

African countries have agreed on integration to achieve industrialisation by freeing trade. To overcome constraints in development and improve the lives of the majority population, reduction in trade barriers between states has been effected and harmonisation of economic and trade policies (Kargbo, 2008). Although economic growth and trade generally have beneficial effects on health, trade contributes to injury because it generates huge volumes of road traffic. In Zimbabwe people are surviving on cross-border trading and use of heavy goods vehicles for trading, trucks and cross-border bus are involved in the majority of traffic crashes.

Zimbabwe's geographical location links other countries with cross border roads to Zambia, Malawi, South Africa and Botswana to Mozambique hence it also makes these roads busier due to increased traffic and long distance transport (Pushak and Briceno-Garmendia, 2011).

The status of the roads has been deteriorating since the late 1990s due to inability to maintain and rehabilitate the existing infrastructure. Zimbabwe experienced economic disturbance due to political instability (Pushak and Briceno-Garmendia, 2011).

3.2. Road traffic injuries and mortality in Zimbabwe

The estimated road traffic death rate is 27. 5/ 100,000 populations per year (WHO, 2011b) and the number of traffic deaths predicted using negative binomial regression) is 3,669 (ibid). However the police define road traffic deaths as anyone who dies within 24 hours of a road traffic accident and this leaves out those who die later. Also the data does not show the severity of the injury, but only that the victim is alive and there is also possibility of unreported RTIs. RTIs cause around 20% of disability in the country (MOH&CW, 2009, p.76).

Table 4 compares national accidents in January 2010 and January 2011

Table 4: 2010-2011 National accident

	Jan 10	Jan 11	+/-	Trends
Accidents	1964	2449	485	25%
Deaths from RTI	121	236	115	95%
Injuries	1192	1176	-16	-2
Fatal road accidents	112	86	-26	-23%

Source: TSCZ, undated

There were 25% more accidents in January 2011. Deaths increased by 95%.

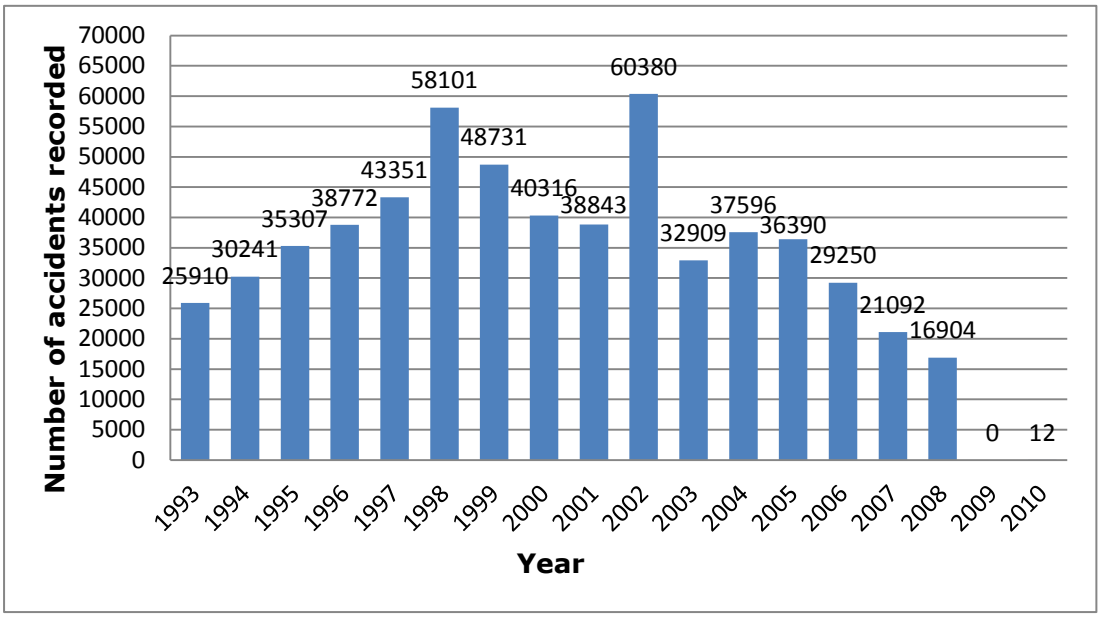
Table 5: Accident Concentration by Age in Zimbabwe

	18-25 years	26-34 years	35-42 years	43-50 years	50+ years
Harare Metro	264	438	272	117	67
Northern Region	70	175	142	55	42
Southern Region	46	167	153	51	29
Bulawayo Metro	23	70	65	33	09
Total	403	850	632	256	147

Source: TSCZ, undated

The 26-42 age group expected to be more productive is most affected with RTIs. In 2006 71% of the fatalities were males and 29% females (WHO, 2011). This implies unequal distribution among age and sex.

Figure 3: Number of accidents recorded in Zimbabwe from 1993-2010



Source: TSCZ, undated

Accidents increased from 1993 to 1998 and then, except for 2002 (which may be an outlier) decreased to 2008. The decline could be due to road safety activities being implemented. This could also be associated with a trend of neglect in recording and reporting accidents because in 2009 not even a single accident was recorded and in 2010 only 12 accidents were recorded which is unlikely. Police also do not always have means to get to the site of accidents due to economic constraints such as shortages of fuel or vehicles. Some accidents also go unreported, for instance, those that occur in rural remote areas, and some victims negotiate on personnel grounds if that accident is not fatal. The graph also does not show the number killed and number injured. Data from the same source seems to be conflicting; for instance if we look at Table 4 it gives information for RTIs in 2010 which is different from the 12 recorded in figure 3.

Other sources show that from 2009 there was an increase in the RTI trend and an increase in the number killed (see Table 6). There is clearly a need to improve on RTI data collection and recording. The importance of RTI statistics should be made clear to the people responsible for data collection.

Table 6: Road traffic injuries reported 2006-2011

Year	Total Reported	Total Killed	Total Injured
2006	29,250	1,037	13,819
2007	21,092	1,127	10,378
2008	16,904	1,149	10,427
2009	20,553	1,576	12,354
2010	26,841	1,796	14,336
2011	33,955	1,992	16,944

Source: TSCZ, 2006-2011 accident record in (Nyoni, 2012)

3.3. Determinants of road traffic injuries

Road user factors, vehicle factors, road and road-sides factors determine the RTIs occurrence.

3.3.1. Road user factors

Jokonya's presentation in 2006 showed that in 85% of RTIs in Zimbabwe human factors are involved. Reckless driving and violation of traffic laws are the human behaviours that influence RTIs occurrence. Among these human factors speeding and drinking and driving are the two key leading contributing factors (Odero *et al*, 2003).

Speeding

A speed limit law exists in Zimbabwe. Awareness campaigns on dangers of speeding are carried out, but speeding remains the key cause of vehicle accidents (Dube and Mawere, 2011) (WHO, 2011). One of the long distance bus operators in the country said that speed is used as a marketing tool and a criterion for employment for long distance drivers while in urban areas it is used to maximize earnings (Peace and Maunder, 2000). This implies the public has a positive perception on benefits of speed. The chances of crash occurrence and the severity of crash consequences are directly related to increase in average speed (Nilsson, 2004). Speed contributes to the number of RTI as well as the severity of injuries, the higher the speed the greater the stopping distance and the higher the risk of RTIs. The WHO training manual on prevention of RTIs sites age, sex, alcohol level and number of people in the vehicle as some of the factors that influence the drivers speed choice (WHO, 2004),(WHO, 2006a).

Alcohol drinking and driving

Around <1% of road traffic deaths are attributed to alcohol in Zimbabwe (WHO, 2011)[3]. The percentage seems low because people are not always

[3] Road traffic deaths involving alcohol 2006 Zimbabwe Republic Police in (WHO, 2011)

tested for BAC. Although drinking and driving law exist in the country, its enforcement score is 3/10 which is very low (ibid)[4]. Those suspected of drinking and driving are supposed to be taken to hospital for blood alcohol content test by a medical doctor however sometimes doctors are unavailable. Use of breathalyzers by police on road block is not yet being practiced due to lack of equipment. Police officers are therefore not motivated to enforce drinking and driving laws (Assum,1998). This implies that people continue to drink and drive under the influence of alcohol.

Alcohol drinking impairs judgment (CDC, 2011), leading to taking more risks and behaving more aggressively to other road users. The chance of death and serious injuries is increased by drinking and driving (Peden *et al,* 2004). The risk of crash involvement increases with blood alcohol concentration (BAC) above 0.04g/dl (Compton *et al* as cited in WHO, 2009) and yet Zimbabwe's legal BAC limit is 0.08g/dl. The harmful issue of driving under the influence of alcohol is the effects of alcohol on reflexes (Peden *et al*, 1996) (UK essays, 2003). Perception, balance, coordination and concentration of drivers are compromised by alcohol (Parirenyatwa, 2004). Impairment by alcohol does not influence accident frequency alone but also the severity of the injuries that result from crashes (WHO, 2006a). Alcohol also affects pedestrians' judgment when crossing the roads when a vehicle is coming. Drunken pedestrians have more chances of fatality and sustain more severe RTIs than sober pedestrians (Peden *et al*, 1996).

Drugs

Driving under influence of drugs also contributes to accidents; for example drugs such as antiepileptic, antipsychotic drugs and those drugs that make a person drowsy such as drugs for treatment of cold. Hence precaution should be taken to avoid accidents for example staying out of the road when feeling drowsy or while taking medicine that decreases concentration. Illness also causes changes in the body that can lead to inability to perform driving tasks optimally (Parirenyatwa, 2004)

Driver fatigue

Driver fatigue in Zimbabwe is common in commercial and public transport drivers due to long hours of work and long distance travelling especially for the cross-border vehicles. A study done in South Africa showed that about 24% of heavy vehicle road accidents were associated with sleeping while driving. (Peltzer, 2008). Such situations are likely to be similar in Zimbabwe. The Research and Innovative Technology Administration (RITA) Bureau of the Transportation Statistics (BTS) conducted a review of road safety in Africa and found that drivers cited economic pressure

[4] Enforcement score represents consensus based on professional opinion on a scale of 0-10 where 0 is not effective and 10 is highly effective

and high rental rates as factors pushing them to drive long hours resulting in exhaustion (RITA/BTS, undated).

Driver distraction

Driver distraction can result in an accident at any time. Drivers can be distracted by changing the CD for music, using a mobile phone (even hands free) and interaction with passengers or eating and applying makeup while driving.

Violation of regulations

Recklessness by the drivers is one of the causes of RTI in Zimbabwe, for example, overtaking when there is oncoming vehicle, changing lanes without signalling, or stopping where there is no stop sign. Drivers also have a tendency of not stopping at red traffic light and following other vehicles too close resulting in a lot of accidents. Peer pressure was also found to be among young drivers in terms of trying to show off[5] through speeding, high volume of radio resulting in impairment of sense of hearing and inexperience plus overconfidence (Parirenyatwa, 2004).

Drivers' attitude

Risky attitudes according to Dr D Parirenyatwa are one of the causes of RTI; these are attitudes related to misguided feelings, opinions and perceptions, for example, not being sensitive to specific hazards and overexcited. Overloading vehicles and over speeding are all human behaviour related to attitudes that are linked to the vehicle factor (Peltzer, 2008). In Zimbabwe commuter minibuses (Kombi) which serve as public transport usually carry more than the vehicle's capacity resulting in issues like tyre bursts probably due to pressure exerted by overloading.

Corruption

Nyoni (2012) in his article "Bribery adds to road carnage" said corruption has been a hot issue in the country and seem to be a norm as it has been a common practice for drivers to be seen giving bribes to police officers at road blocks. The following crimes are cited as the most common for road bribes: unworthy road vehicles, unlicensed drivers, overloading, speeding and drink driving (Nyoni, 2012) (Dube and Mawere, 2011). Corruption in issuing of driver's license has been informally discussed. Some have mentioned that private companies actually want to employ those without licenses because they are cheaper to pay as there are no negotiations in terms of driver payment. Hence driving without proper training is one of the factors that also contribute to RTIs in Zimbabwe.

[5] Show off means informal boastfully display one's abilities or accomplishments

3.3.2. Vehicle factors that contribute to road traffic injuries

Increase in motorization

The vehicle population has grown considerably while the road infrastructure remains the same or has become worse with little rehabilitation or improvement in terms of new road designs. Studies have indicated that when traffic increases by 100% the number of traffic injuries will increase by around 80% and number of fatal accident will increase by 25% (Elvik and Vaa, 2004).

Vehicle maintenance and state

Vehicle road-worthiness is a cause of concern in Zimbabwe as about 10% of RTI are attributed to vehicle factors (TSCZ, undated). Most of the vehicles are imported from Japan with ages ranging from three years to twenty years with instructions stating that the vehicles should be fully serviced before use.

Most Zimbabweans cannot afford to buy new cars hence they tend to buy cars which are no longer road worthy in some other countries. For example South Africa banned the ex-Japanese vehicles. The operational cost of these vehicles is always high and besides that the Zimbabwean vehicle mechanics are not trained to maintain these types of automatic vehicles. The quality of imported tyres is not known since tyre bursts is one of the causes of RTIs in the country. Mukoyi the acting director of the Standards Association of Zimbabwe agreed that some reputable garages in the country were importing spare parts which are not genuine (Dube and Mawere, 2011).

Vehicle safety equipment (Seat belt and child restraint use)

Use of seat belt in Zimbabwe applies to driver and front seat passenger, although seat belt law exists and is being enforced, it does not apply to all vehicle occupants because some vehicles do not have seat belts especially the public transport vehicles. According to the WHO, (2006a) use of seat belts reduces the severity of injuries especially in rollover crashes and frontal collisions. A child restraint law does not exist in Zimbabwe hence no enforcement is being done.

3.3.3. Road and road sides' factors

There are various factors affecting the road safety in Zimbabwe; for example the lack of segregated lanes for different road users, lack of pedestrian facilities for crossing busy roads, insufficient road lighting, absence of road signs which may for example lead the drivers into exceeding speed limits.

The advice on the travel guide to Zimbabwe has a warning to visitors of this country; notify travellers that RTIs are a common cause of death and

injury in Zimbabwe. Roads are characterised by deep and large potholes which are very dangerous. Road traffic lights are not always functioning and cause many accidents. Stray animals and cyclists with no lights are some of the hazards (Foreign Commonwealth Office, 2012). Heavy goods vehicles are left in roads with no signal to show that it is a stationed vehicle (ibid). Roads are surrounded with unclear bushes and tall grass making it more difficult for the road users to see the road well.

Weather is something that people do not have much control over. The state of the atmosphere increases the chance of accidents, for example, mist, rain, sun and too much heat, through reducing driver's sight and making it harder to stop in time. Peace and Maunder (2000) noted weather as one of the external factors that influence RTIs especially during rainy season in Zimbabwe.

Secondary to heavy rains during rainy season the roads are damaged and narrowed due to erosion (McSweeney *et al*, 2011) making it difficult to see the road demarcations. Land reform programs have resulted in a lot of vandalism resulting in also vandalism of security fence which were restricting animals from the roads hence a lot of animals are found on highway road sides causing RTIs (personal observation), (Peace and Maunder, 2000). The roads do not promote alternative transport such as cycling and walking as there are no lanes for cyclist and pedestrians (WHO, 2011).

Peden *et al* in WHO 2004 mentioned that RTIs could be reduced with appropriate road networks, road design, and better maintenance.

3.4 Consequences of road traffic injuries

It is of great importance to note that road traffic accidents happen in a fraction of a second but their consequences take a long time (ETSC, 2007). Besides loss of life or reduced quality of life due to road traffic accident, consequences attributed to RTI include costs such as:

- Replacement and repair of property damaged
- Medical treatment
- Home renovations, for example, toilet or bathroom to accommodate wheelchairs as well as vehicle adaptation
- physical pain, grief and suffering
- Permanent disability and disfigurement as well as travel anxiety (ETSC, 2007).
- Furthermore RTIs affect household income and national economy through cost of prolonged medical care, together with funeral costs and loss of income due to disability. Involvement of a breadwinner pushes the household affected into poverty (Odero *et al* 1997).

3.4.1 Socio-economic impact of road traffic injuries in Zimbabwe

Globally the estimated cost of RTI is 518 billion USD in low income countries the cost of RTI is around 65-100 billion USD which exceeds the total amount of assistance that the countries received for development (WHO, 2006b). Although no cost study was done in Zimbabwe it is estimated that around 1-2% of GDP is spent on road traffic injuries (AfDB, undated).

RTIs affect males in their active period of life, when they are socially important economic as heads of household. In 2006, 71% of deaths due to RTIs were males (WHO, 2012). While women are less victims of RTIs they suffer as secondary victims; loss of their husband exposes them to socially, financially insecurity and likewise children also are impacted by the social and economic of the loss of their parent (Odero *et al,* 1997) (WHO, 2004).

WHO noted that the impact of RTI on poor people is greater than the rich and they represent the higher risk group such as pedestrians, passengers and motorcyclists. Although not all pedestrians are poor, it is assumed that the poor cannot afford buying a vehicle hence will be pedestrians or passengers. Low socio economic group of people have less access to medical services and this results in disparities of recovery and survival (Sharma, 2008).

3.5. Health systems response to RTIs

The health systems response to RTIs influences the degree of recovery as well as survival chances (Chen, 2010). Zimbabwe's health care system has been characterised with delays in attending to the victims. Shortages of resources and delays in detecting the scene of crash have been the hiccup of the health system. Presence of fire resulting from collision has also been a contributing factor to worsen the situation (ZBC, 2012). Hospital care has also been affected by lack of appropriate emergency care mainly due to lack of necessary resources (Biti, 2009); for example, lack of suture materials. Health care systems have also been affected with brain drain; many experienced human resources have moved out of country for greener pastures hence the poor economy has also lead to poor hospital care (IOM, 2012)(Zimbabwe Health Workforce Observatory, 2009). Accessibility to services is also influenced by the economic status of the individuals so that those who afford to pay for the services are better cared for.

Having gone through RTI situation in the country, the next chapter looks at what has been done in the country to curb road carnage and decision making on road safety.

CHAPTER FOUR: ZIMBABWE'S STRATEGIES TO ACHIEVE ROAD TRANSPORT SAFETY SYSTEM

This chapter gives an overview of what has been done to prevent RTIs Decision making process on road safety and stakeholders involved in road safety activities. The following headings are used: 4.1 Institutional organization, 4.2 Admittance to system, conditions for entry/exit of vehicles and road users, 4.3 education and information supporting the road users, 4.4 legislation and enforcement of road rules, 4.5 understanding crashes and risks and 4.6 Health systems responsiveness when a road traffic accident occur. Headings 4.2 to4.6 are corresponding to intervention blocks in the conceptual framework.

4.1 Institutional organization

The Traffic Safety Council of Zimbabwe (TSCZ) Act (Chap13:17) forms the basis of council to coordinate the three pillars of road safety work (education, enforcement and engineering). TSCZ is the lead agency promoting road and traffic safety (WHO, 2011). TSCZ is overseen by a board appointed by the Minister of Transport, Communication and Infrastructural Development (TSCZ, undated).

However the TSCZ does not have powers to influence road engineering design or to enforce safe driving practices (AfDB, undated). The Ministry of Home Affairs enforces road traffic laws and the Ministry of Health provides care to the injured victims.

Zimbabwe joined in the World Health Day commemoration of 2004 whose theme was "Road safety is no accident".
The country also adopted the declarations of the first and second African Conference on Road Traffic injury prevention held in Windhoek Namibia in 2004 and in Addis Ababa Ethiopia in 2011.
There are multiple national road safety strategies but with no funds allocated for the program and no targets specified it is very difficult to achieve road safety (WHO, 2011).

In 2005 a road safety review workshop was held in response to increasing road traffic accidents. The Sub-Saharan Africa Transport Policy Program (SSATP) provided technical advice. As major influences of high accident rates, the workshop identified lack of finance and inadequate enforcement for road safety activities (World Bank, 2008).

The TSCZ, Zimbabwe Republic Police (ZRP) and the Zimbabwe Hospital Doctor's Association co-organised traffic safety campaign to remind drivers and passengers on the importance of traffic safety measures in 2010 (TEST, 2010).

Zimbabwe launched its first pedestrian campaign in February 2012. The campaign calls for opinion leaders, politicians and NGOs to be fully concerned since a lot of unfruitful road safety campaigns have been done with no concrete national and local actions taken (TSCZ, 2012a).

4.2. Admittance to system (conditions for entry/exit of vehicles in the country and road users

According to TSCZ requirements for vehicles for public service purposes are guided by The Road Motor Transport Act, The Road Traffic Act and S.I. 168 of 2006. These legal instruments state that a public service operator should have an operator's license, schedule of licensed vehicles and drivers employed a valid certificate of fitness and route authority with time table and fare scrutiny. Public service vehicles can be goods or passenger carrying such as buses, commuter omnibuses, taxis and haulage trucks.

4.2.1. Driver licensing

Driver requirements for public vehicles are age limit (25 to 71 years), five years prior driving experience, defensive drivers certificate, medical certificate and a five year interval for a retest (TSCZ, 2012b). However, enforcement of these laws and issues of bribery are of concern(Assum,1998). For the rest of the drivers a new driver undergoes a written and a practical test and the legal age of driving is 16 years for class 4 (WHO, 2011).

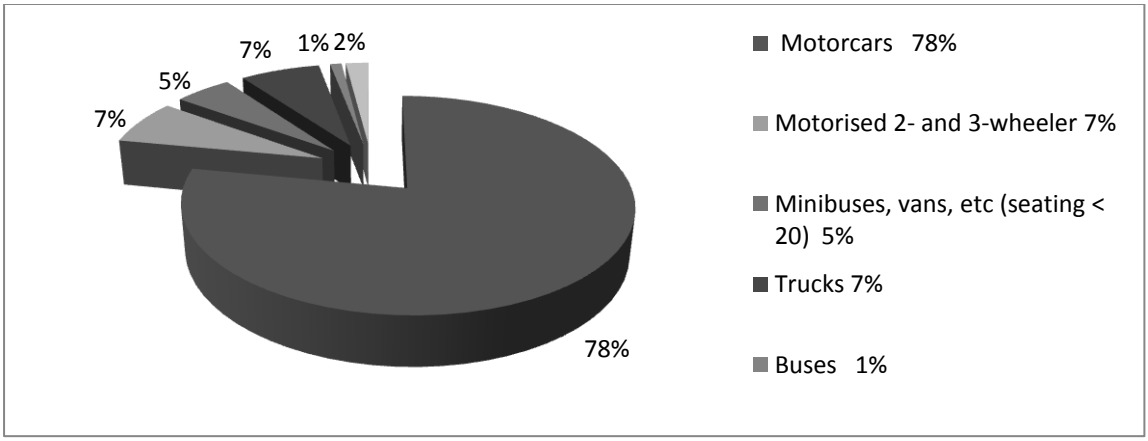
4.2.2. Vehicle inspection

Periodic motor vehicle services are done after a mileage of 5,000 kilometres for minor service and 10,000 kilometres for major service. Statutory instrument 154 of 2010 provide guidance on safety equipment to be in the vehicle and safety precautions to be taken, it also require that safety standards specified by the Standard Association of Zimbabwe be met. The regulation sets minimum requirements for vehicle safety equipment and specific requirement to the use of vehicles. These include mandatory rear view mirrors, standards of tyres, vehicle lights, reflectors, reflective breakdown triangles, fire extinguishers, a functional indicators, suspension and axles, well secured seats, doors and panels, functional speedometer, well maintained engine and number of passengers permitted. (See annex 3).

Currently there is an on-going vehicle registration process. It is estimated that around 20,000 vehicles are unregistered (zim.gov.zw, 2012).The Zimbabwe National Road Administration (ZINARA) "says at least US$25 million in potential revenue per term was lost due to counterfeit license

discs" (ibid). In 2007, 1,556,586 vehicles were registered and Figure 4 shows the registered vehicles by type:

Figure 4 : Registered vehicles by type in 2007



Source: WHO, 2012

4.3. Education and information supporting road users

The Ministry of Transport through TSCZ takes the lead in the dissemination of information on road safety through an awareness campaigns. Its function is the promotion of safety on roads, publication of the high way code, dissemination of information on road safety, advising the Minister on matters relating to road safety and establishing standards for learners licenses and certificates of competence through controlling and regulating of driving schools (AfDB undated)(TSCZ undated). Traffic education of school children is done by the Ministry of Education.

4.4. Legislation and enforcement of road rules

The road transport policy

Currently the transport sector is supported by a number of legislations for delivery of its services. These include the Road Act that specifies management of road network under the Department of Roads (DoR), Urban Councils, the District Development Fund (DDF) and the Rural District Council (RDC). The Urban Act and the Municipal Traffic laws enforcement Act support the Traffic Safety Council Act that defines how safety issues are to be handled in the road transport sector under TSCZ as well as the Police Act. The Vehicle Registration and Licensing Act set the requirements for vehicle standards, e.g., inspection for road worthiness of vehicle carrying passengers (Kodero, 2005) (AfDB undated). However the country does not have a comprehensive legal instrument to cover all aspects of road safety policy implementation (WHO 2011).

The country is operating with a Draft National Transport Policy that has the objective of protecting life and property through improving traffic/transport safety and security, but it does not expand much on further reference to road safety (Kodero,2005) (AfDB, undated). The Ministries of Transport and Home Affairs are responsible for enforcement of road safety in Zimbabwe. The Ministry of health is responsible for care of the road traffic injured victims.

Speed limit

Speed limits are set nationally. The urban road speed limit is 60km/hour and maximum limit for highway is comparatively fast 120km/hour. Enforcement leaves a lot to be desired because speed is among the biggest causes of vehicle accidents (WHO, 2011).

Ninety percent of people ticketed for road offenses do not pay their fines and the Zimbabwean Police Department does not have enough mechanisms to trace the road traffic offenders so that they can pay their fines (Murwira, 2012).

Drink driving law

The national drink-driving law exists. Blood alcohol concentration (BAC) and random breath testing at check points is supposed to be done. However the enforcement score was 3/10 although around <1%[6] of traffic deaths are attributed to alcohol (WHO, 2011)[7]. The BAC limit in Zimbabwe is 0.08g/dl which is above 0,05g/dl the WHO recommended BAC limit (WHO, 2009). It is great to note that civil society has also started to realize the dangers of alcohol on the roads as seen in formation of social groups on face book such as Zimbabweans Against Drink Driving (ZADD).

Motorcycle helmet law

The motorcycle helmet law exists and it applies to all riders. However the helmet wearing rate has never been measured but the law enforcement scored 9/10 in terms of enforcement (WHO, 2011).

Seat belt law

Seat belt laws exist, but do not apply to all vehicle occupants. Seat belt wearing rate was not measured although the enforcement score was 8/10 (WHO, 2011). *No child restraints law exists* (ibid).

[6] <1% traffic deaths attributed to alcohol, seems very low but BAC test is not always done due to lack of resources and this could be the reason why it is low.

[7] Enforcement score represents consensus based on professional opinion on a scale of 0-10 where 0 is not effective and 10 is highly effective.

Vehicle standards

There is no law that requires car manufacturers to adhere to standards on fuel consumption, installation of seat belts for all seats (WHO, 2011). Most of the commuter minibuses used as public transport in Zimbabwe have no seat belts on all seats, because it is not taken as a mandatory thing. Seat belts are on the driver seat and front passengers usually and the rest of the passengers have nothing to secure them.

Road safety audits

A road safety audit is a formal analysis of roads which give guarantee of optimal safety criteria to the new road construction or existing road infrastructure. Usually this is done by people independent from the road projects. This strategy has worked to reduce road accidents and their consequences in other countries like Mexico. Although regular safety audits of infrastructure and formal audits for required major new roads is said to be done (WHO, 2011) the problem of road safety continues to exist such that one may suggest there is lack of concern and response to audit results.

Promoting alternative transport

There are no walking or cycling paths. This may imply that those who are driving are the owners of the road the pedestrian and the cyclist has no space hence become vulnerable to road traffic injuries. The national policy to promote public transportation does not exist.

4.5. Understanding crashes and risks

WHO (2004) recognizes road traffic data system as necessary to develop effective prevention strategies such as having records on who is at risk, where crashes frequently occur and understanding the kind of risks within the nation to help in planning interventions such as selection of a speed limit per given road segment. TSCZ admits that not all traffic accidents are recorded in the country (AfDB, undated). There are also places where by road traffic accident repeatedly occur and if these were recorded and data utilized interventions to mitigate would be applied accordingly. Keeping a record of registered vehicles would help in planning the road infrastructure; however as noted (www.zim.gov) around 20,000 vehicles are not registered. Understanding crashes also helps in reduction of issues such as overloading, speeding and drink driving if one understands their consequences. Refer to page 14 on inconsistent and poor quality of statistics.

4.6. Health systems responsiveness

On paper hospitals and emergency responses ambulance companies exist (WHO, 2011), but patients fail to be attended in time still exists because of economic reasons such as fuel shortage and victims failing to pay for services. For example Medical Air Rescue (MARS) only assist those with cash or private insurance which impacts on health inequalities and increase the severity of road traffic injuries. There is neither universal health coverage nor national health insurance in Zimbabwe.

These initiatives show that the government has realized the burden of road traffic injuries and the need for growth of concern, commitment and formulation of targets in order to achieve the goals of road traffic safety. This can be achieved through learning and adopting what other countries has done to reduce the burden of road traffic injuries. This leads to the next chapter where good practices from other countries are discussed.

CHAPTER FIVE: GOOD PRACTICES.

This chapter discusses how people can achieve safer travel, how practices and technology can protect people from RTIs. Safer travel involves safer vehicles with safer speeds, alert, compliant road users and safer roads. All components of the framework are going to be used to discuss the categories of good proven practices done in other countries. RTI prevention strategies used in other countries are analysed and how they can be applicable to Zimbabwe under the following headings 5.1.road transport safety management, 5.2 alert and compliant road users (safer people), 5.3 safer vehicles, 5.4 safer roads and emergency responsiveness if RTI occur. WHO has literature on reviews of proven categories of good practices done in other countries.

5.1. Road transport safety management

Road transport safety management relates to governance, coordination, design and overview of all traffic safety interventions. Safer travel involves everyone, hence responsibilities needs to be shared by all stakeholders. A systems approach to road safety has been identified having impact than separate approaches. WHO, (2004) emphasized that the existence of a functional lead agency in road safety issues is important for reducing the burden of RTIs. The agency is mandated to take a leading role in managing road safety measures comprehensively as well as providing opportunities for the cooperation and harmonizing of other stakeholder.

Organisation of road safety is essential for implementing accident counter-measures and this involves attention design of road network and transport policies addressing issues of safer transport use, improvement of public transport system, promotion of alternative transport and control of access to roads for certain vehicles and also certain age road users as well as restrictions on engine performance.

Development requires a transport system that can transport people to their places in time and comfort. Goods essential for economic development needs a good transport system to distribute them in time.

5.1.1. Safer mode of transport

WHO, (2004) showed that in other countries buses and trains are safer modes of transport in terms of deaths per distance travelled than other mode of transport. However in Zimbabwe the Zimbabwe United Passenger Company (ZUPCO) which is the public transport company provided by the government of Zimbabwe has since deteriorated and has no capacity to cater for all who need public transport. This has resulted in deregulation of the transport system (AfDB, undated). This provided an opportunity for

the family owned commuter buses which are less safe. The increase of family owned commuters created a sudden rise in violation of traffic regulations as well as corruption in the police force (The Herald, 2012a).

5.1.2 Providing shorter and safer routes

WHO (2004) noted that every 1% reduction in travelling distance may result in 1.4-1.8% of crash reduction. Provision of shorter and safer routes can reduce the exposure of road users to crash. Zimbabwe has strong road connections with the SADC. It provides linkages to the Durban port, Beira in Mozambique. People from other countries pass through these corridors to the ports there by creating pressure on the road and as a result buses make double trips of very long distances such as from Harare to South Africa and back. Measures to reduce trips can having people living closer to their work place, better management of vehicles, use of timetables, parking and road use, use of internet to reduce travelling. In some countries spreading traffic in time has helped e.g. different holiday time for different provinces to reduce number of people travelling at a time.

5.1.3. Restrictions on engine performance

In UK restrictions on motorcycle engine performance for beginners reduced motorcycle crashes among young cyclists (Broughton 1987 as cited in WHO, 2004). In Zimbabwe no such study has been done but however personal experience as a field officer under CARE International in Zimbabwe I have noted that all my colleagues who were involved in fatal crash were using 200cc motorcycles and no one among those using 125cc motorcycles were involved in fatal accidents.

5.1.4. Graduated driver licensing system

Beginner drivers lack experience and skills in recognizing the possibility of dangers and this could be worse for male teenage drivers with brain immaturity leading to high rates of crashes. Graduated drivers licensing systems (GDLS) gives the opportunity to gain experience following a series of steps with some restrictions until becoming fully licensed. It reduces exposure to driving situations that carry an increased risk of crashes. Commonly imposed restrictions are limits on night time driving, limits on the number of passengers to carry and prohibition on driving after alcohol consumption (WHO, 2004). GDLS was summarized as an effective way of gaining experience in driving while reducing risks of crashes and injuries for the teenagers (Hedlund *et al,* 2003). The legal age of driving in Zimbabwe is 16 years hence considering graduated driver licensing will be essential in reducing teenage road traffic injuries.

5.2. Alert and compliant road users (safer people)

In Zimbabwe road user behaviour is one of the challenges to be met in reaching road safety goals and targets considering the fact that in 85% of RTI human factors may be involved (TSCZ, undated) (Jokonya, 2006). The safe systems approach requires road users that are alert and compliant, physically able and adequately trained drivers using appropriate speeds. Activities to encourage alert and compliant behaviour of road users include education, regulation, enforcement and penalties (WHO, 2004)

5.2.1. Safety education.

Promoting the use of safety equipment

Safety equipment protects people from injuries when crashes occur. Evidence shows that the use of safety equipment such as helmets for motorcyclist (Lui *et al* 2008), seat belts and child restraints for vehicle drivers and passengers reduce the risk of injury and fatalities (Halman, *et al* 2002), (Rice *et al*, 2009) (Evans,1986). Education and promotion of the use of safety equipment can be done in many ways such as media campaigns highlighting importance of their use, lessons targeting communities and including parents and children. These programmes have been proved to be successful in the use of safety equipment (Royal *et al,* 2005), although there is less research on impacts on injury some evaluations have produced beneficial results such as a UK hospital-led helmet promotion among 5-15 year old children showing decreased rates of accident and emergency attendances for cyclist head injuries (Lee *et al*, 2000). A community based program to increase the use of car seat restraints had a significant reduction in the risk of vehicle occupant injury (Turner *et al*, 2005).

Safety education for pedestrians

Developing countries lack studies on pedestrian behaviour however even in the developed countries most studies on pedestrian behaviour are conducted on children. Peden *et al* (1996) conducted a study in South Africa on injured pedestrians and recommended that attention should be given to safe and convenient crossing points and education with regard to wearing of reflective clothing after dark. Education programmes have been used to influence individuals' ability to cope with the traffic environment to reduce pedestrian injuries. Children's knowledge about road safety was observed to improve after pedestrian safety education but it is not clear on reduction of crash occurrence (Duperrex *et al* 2002), (Whelan *et al*, 2008).

Driver training/education programmes

Driver education programmes are done to improve safety behaviours and reduce driver errors. Programmes can be given to individuals or group or can be targeted to a higher risk group (older people or novice drivers). Although there is no impact on road traffic accidents, there is some evidence that driver education programmes can improve driving performance and knowledge (Kormer-Bitensky *et al,* 2009) as well as awareness of driving hazards (Fisher *et al,* 2006).

In Zimbabwe a study done by Guruva in 2002 revealed that defensive driving course[8] graduates had a fewer traffic violations and crashes proving that education for the driver improves performance. However Ker *et al*, 2005's systemic review of a randomised control trial showed that post driver license education has no significant effect on reducing crashes. O'Neil and Mohan*,* 2002 emphasised that enforcement of traffic safety has an impact on reduction of road traffic injuries as compared to driver education which may give good knowledge without leading to any behaviour change. It is believed that law enforcement is more effective when it is highly visible, publicised, enforced selectively and sustained for a long period (WHO, 2004). Zimbabwe might need both education and enforcement since a defensive drivers course was seen to be effective in reducing of driving law violation.

5.2.2. Enforcement to reduce alcohol impaired driving

Alcohol drinking and driving does not only cause road traffic injuries but it also makes it difficult to assess the severity of injuries when a person is drunk (as it affects the diagnosis, management and treatment of injuries).

Reduction in behaviour of drinking and driving has been seen to decrease road traffic injuries through interventions such as strong and well publicised campaigns, public education to change attitudes on drinking and driving, legislation that clearly spell out illegal for driving levels of BAC and penalties for drinking and driving offences (GRSP,2007).

In Australia such interventions influenced strong community views that drinking and driving behaviour was socially irresponsible and a change in attitudes was noticed through about 50% reduction in crash related to alcohol (GRSP, 2007).
Random breath testing and enforcing soberness check points was seen to be cost effective in developed countries and leads to reduction of alcohol related road traffic crashes by around 20% (Elder *et al*, 2002), however this may need to be tested in Zimbabwean context.

[8] Defensive driving is utilizing safe driving strategies to enable motorists to address identified hazards in a predictable manner. These strategies are more than instruction on basic traffic laws and procedures. It involves knowing how to avoid traffic crashes and recognize potential hazards before it's too late.

5.2.3. Safer speed (speed limit enforcement)

The burden of road traffic injuries can be reduced by setting speed limits in different roads and enforcing them. Five percent increase in average speed leads to ten percent increase in crashes that cause injuries and twenty percent increase in fatal crashes (WHO, 2010). According to Odero *et al* 2003 human factors contribute to 85% of all traffic crashes and among them speeding is one of the key factors. The world report on road traffic prevention recommend that interventions for speed could be setting and enforcing speed limits, engineering measures designed to reduce speed and public education and awareness campaigns (WHO, 2004).

After enforcement of speed law in Johannesburg, South Africa a significant decrease in the number of patients admitted with road traffic injuries was noted (Wilkson, 1974).

A survey done in Namibia showed that, most drivers exceed the speed limit. The same also was found in Accra Ghana where a speed study showed that nearly all the drivers were disregarding the speed limits leaving the vulnerable road users at extreme risk of severe injuries from the high speed (GRSP, 2009).Therefore there is need to enforce the law.

Zimbabwe has a legislation to address speeding, however the researcher thinks there is lack of enforcement of the law in the country because most of the road traffic accidents are attributed to speeding as noted by Chiwanga in Sunday news of 31 December 2011.While the research on speed limit indicates that urban speed limit should not exceed 50km/h (WHO,2009), Zimbabwe's urban limit is at 60km/hour which is a little bit higher than the recommended also the 120km/hour highway limit is much faster than in countries like Canada where roads are better.

In most European countries speed humps and roundabout have helped to reduce traffic speeds (Elvik and Vaa, 2004). In Ghana speed humps reduced crashes by around 35%, fatalities by 55% and serious injuries by 76% between January 2000 and April 2001 (Afukaar, 2003). However possible obstacle in Zimbabwe could be poor road signalling, speed humps needs to be linked with road signs because otherwise can cause more harm than good.

5.2.4. Red light camera (Traffic lights and speed cameras)

Installation of cameras at intersection can limit speeding cars from violating red traffic light at intersections. Retting and Kyrychenko (2002) concluded that red light camera installation can be a sustainable measure because the camera can be a permanent component of transportation

infrastructure. This intervention could be expensive in Zimbabwe but considering prioritizing the busiest intersections with record of crashes could help to reduce RTIs.

5.2.5. Enforcement to use functioning seat belt and appropriate child restraint

Correct use of seat belts and appropriate child restraint has been identified as the most important way of reducing the severity of injuries (Evans, 1996), (Koushki *et al*, 2003), (Cunill et al 2004) and Elvik and Vaa, 2004). The effectiveness of the seat belts use was found to reduce the death of the drivers and passengers on the front seat by 40-50% and by 25% for those seating on the rear seat (Elvik and Vaa, 2004)(WHO, 2004) and (WHO, 2009).

The level of seat belt use is said to be influenced by the legislation mandating their use, the degree to which the law is enforced, complimented by publicity campaigns and incentives offered to encourage the use (Elvik and Vaa, 2004), (WHO, 2004) and (Stevenson et al 2008).

Cunill et al (2004) found that the social influence also determine the use of seat belts as well as information on the effectiveness of the seat belt in preventing or reducing injuries or deaths in roads.

Most cars in the country do not have functional seat belts it would be advisable to equip cars with functional belts and the government to ban importing and manufacturing cars without seat belts. The intervention seems to be sustainable effective and feasible if the vehicle are bought with safety belt fitted.

5.2.6. Enforcement to use helmet

Evaluation of mandatory motorcycle helmet laws in low income and high income countries showed that implementation of these laws increases the rate of motorcycle helmet use among motorcyclists (Law, 2009). Head injury is the common cause of deaths among the motorcyclist. The use of helmets protects from head injury. Norvell and Cummings (2002) found that the relative death risk for helmet users was lower than the non-helmet users. Hundley *et al*, 2004) also concur that use of helmet reduce injury severity, mortality and resource utilization in his report on a study of non-helmeted motorcyclist as a burden to the society. Zimbabwe has legislation on motorcycle helmet use and its enforcement was rated at 9/10 but no study was done to measure wearing rate. Helmet use enforcement is an effective intervention in Zimbabwe considering the fact that most of the people who use motorcycle in the country are those who serve the community such as Environmental Health Officers, Agricultural Extension Officers and humanitarian aid workers saving their lives would

mean a lot to the communities they serve, it will save a lot of lives directly and indirectly.

5.3. Safer vehicles

It is known that vehicle safety contributes to reduction in road traffic injuries (Australian Transport Council, 2011). Provision of safer vehicles can help the driver to avoid a crash or in the event that the crash has occurred can protect vehicle occupants and those outside against injury. To improve the vehicle design to make it more forgiving safer car fronts, seat belts, child restraints and air bags can be included in the design or vehicle manufacturing. Standards can also be set for imported vehicles for example considering the age of a vehicle. Above all functioning brakes lights and handling makes a vehicle safer (ibid).

5.3.1. Daytime running lights for motor vehicles

The researcher's own experience involving motorcycle crashes at her work place found that all the vehicle drivers involved said the motorcycle was not visible, they didn't see it. In several countries the use of daytime running lights by motorized two wheelers has been proven to reduce visibility related crashes by 10-15% (WHO, 2004). A study done in the United States found 13% reduction in fatal daytime crashes in 14 states which had motorcycle headlight-use laws (Zador, 1985). A study done 14 months after introduction of daytime running lights for motorcycles in Singapore found reduction in fatal daytime crashes by 15% (Yuan, 2000). At two month information campaign preceded legislation requiring daytime running lights in Malaysia and the number of visibility related crashes were seen to be reduced by 29% (Radin Umar, 1996) and in Europe the crash rate for motorcyclists who use daytime running lights was found to be 10% lower (Roelof Wittink,2001). In Zimbabwe although motorcyclists are supposed to have their head lights on during the day there is need for enforcement of the law since most of the motorcycles' lights do not work.

5.3.2. Periodic motor vehicle inspection

In contributing to reduction of road traffic injuries periodic motor vehicle inspection can ensure that only road worthy vehicles share the road. However studies done have differing findings; Schoor *et al* (2001) in their study in South Africa identified the conditions of the inspected vehicle in the potential mechanical defect test (PDMT) as area of concern with tyres, brakes and overloading especially of commuter omnibus being the main problem. Their findings showed that 40% of the vehicles had mechanical defects that contravened the road and traffic regulations in South Africa and risked causing accidents due to mechanical failure. Blows *et al* (2003) also found that periodic vehicle inspection and frequent tyre checks

reduced the risk of crashes. Christensen and Elvik (2007) in Norway found that there is no significant reduction in car crash following the periodic vehicle inspection, but there are no old cars like in Zimbabwe. However according to the researcher considering the fact that Zimbabwe is a developing country with economic hardships where sometimes the population is forced to make use of the older and less reliable vehicles, the risk of accidents caused by mechanical failure increases. Currently the country is depending mainly on used Japanese vehicles. Therefore the need to have periodic motor vehicle inspection maintained and probably with other safety requirements such as seat belts and child restraints installed.

5.4. Safer roads

WHO recommended that awareness of safety in the planning of new road networks, incorporation of safety features in the design of new roads, safety improvements to existing roads, and remedial action at sites with high risk of traffic crash are essential for improving road safety (WHO, 2006a).

Currently the Government making separate lanes for different types of traffic along the most busy highway roads such as Harare – Masvingo to Beitbridge and the Harare to Gweru road in order to reduce congestion. Rehabilitation of bridges in several locations is also in progress. (Parliament of Zimbabwe, 2012). However the process is moving slowly. Zimbabwe's road network was designed from the motor vehicle users' perspective considering the fact that there are no pedestrian paths, no cyclist paths and no plans for them have been made (WHO, 2012). Evidence in some developed countries suggests that cyclist involvement in crash can be reduced by 35% through provision of lanes for cyclist (Ameratunga *et al*, 2006).

An unrecognized commented in Newsday newspaper reported that an accident that claimed 18 peoples' lives on the 25th of March 2012 occurred at the same place as an unforgettable bus disaster 1991 which claimed 89 students and teachers from Regina Coeli Secondary school and another 19 people have also perished at the same spot. It is said there is a sharp curve and road seems to "disappear" in front of the driver and there are no road signs. This could be an example that needs instant remedial action. (Newsday, 2012). The same applies to the Ngundu area along the Beitbridge road where a lot of road accidents have been encountered at the same place and declared national disasters but no remedy has been done (The Herald 2012b).

5.4.1. Traffic calming measures

Traffic calming measures such as creating speed humps, roundabouts, road narrowing, road closures and speed restrictions changes at junctions are measures to reduce speed of vehicles. Bunn *et al*, (2003) noted that the road user death was reduced by 37% in eight studies and road traffic injuries lowered by 11% in sixteen studies where traffic calming measures were implemented. Between January 2000 and April 2001 rumple strips and speed humps installed in Ghana highway roads at the crash hot spot of Suhum junction reduced number of crashes by about 35% and fatalities by around 55% (WHO, 2004).

Intersection crashes contribute around 32% of serious road casualties traffic injuries, roundabouts and traffic lights are the most effective intervention to reduce such crashes because they lower vehicles speed when approaching and travelling through the intersection (Australian Transport Council, 2011). Some of the Zimbabwe's roads have the speed humps as well as roundabouts however the signage is poor to alarm motorist the presence of a roundabout ahead. WHO, (2004) recommends that these calming measures need to be backed up by speed limit of around 30km/hour. However there is need for evaluation of the effectiveness of these measures in the country.

5.4.2 Safer road sides

Bushes and tall grass on road sides have been noted to cause road traffic accidents (Foreign commonwealth office, 2012). Stray animals have also been noted as problems that result in road accidents (Peace and Maunder, 2000). Having planned regular road maintenance activities can help to reduce such problems. Lay-byes to promote rest have been seen to reduce driver fatigue (Australian Transport Council, 2011).

5.5 Emergency responsiveness if road traffic injuries occur

Immediate delivery of good quality pre-hospital care through to rehabilitation can save the lives of many injured people (WHO, 2009). Incidents have been reported where by accidents occur and victims are retrieved after more than 12 hours for example an accident that resulted in 12 people perishing where remains of the deceased were retrieved the following afternoon (RadioVop, 2012), and the Ngundu disaster which claimed 21 lives (ZBC, 2012) to mention a few recent incidents only.

Emergency responsiveness involves efficient rescue of casualty with no further harm. This involves medical rescue as well as physical rescue. Everyone is involved. First people to witness should inform police, medical staff, fire brigade and the informed are supposed to act within

the first hour simultaneously. Public toll free numbers should be known by everyone.

An overall plan for road traffic accident could ensure scene safety with police directing and controlling other motorists, early casualty contact, severely injured to be attended first, stabilizing the vehicle, rapid entry and casualty care and creating space as well as rescuing packaging and transportation of victims (National directorate for fire and emergency management, 2009).This can be achieved if an adequately trained emergence team is present.

The next chapter looks at conclusions drawn from the analysis and recommendations are given considering feasibility.

CHAPTER SIX: DISCUSSION CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The objective of this thesis was to analyse the situation on road traffic injuries in Zimbabwe in order to make recommendations towards reduction of the burden. A conclusion was drawn based on a review of the RTI information in Zimbabwe and on experiences from other countries. The analysis shows that the country has basic legislation in place for road safety, but the laws are not comprehensive in their relevance. Speed limits are above the global recommendation, seat belt laws do not apply to all vehicle occupants, and the BAC limits level is higher than the WHO recommendation. Above all the country does not have a well-publicised road safety strategic plan or national road safety policy which is a huge gap in all road safety activities. Absence of the policy documents compromise coordination of activities. Road safety activities are said to be implemented but with no target and funding to support the activities are limited. RTIs data lack accuracy. There is negligence of road safety regulations by road users, poor law enforcement, and corruption.

RTIs are a safety problem as well as an equity public health issue in Zimbabwe. Fatal road traffic accidents are the greatest existing threat among all risks in the country. The country has a road traffic deaths rate of 27.5 deaths per 100,000 populations per year. The most affected age group is 26-42 year and majority of the affected are passengers and pedestrians. Males have more risk than females.

Reckless driving and violation of traffic laws are the human behaviours that influence RTIs occurrence. However alcohol impaired and over speeding have been identified as the worst human behaviour resulting in accidents in Zimbabwe. Road users include motorists, passengers, pedestrians and cyclists.

Inadequate and corrupted law enforcement coupled with public acceptance has resulted in the increase of unworthy overloaded damaged vehicles and unregistered vehicles on the road. Vehicle fleets have increased considerably in the country. However the majority of these vehicles are not roadworthy.

Zimbabwean roads have been found lacking in terms of safety measures, which are associated with a lot of road traffic injury risks such as poor technical design of the highway construction, narrow roads that cannot accommodate high traffic volumes, potholes, poor signage, bushes surrounding the roads and stray animals found in the road environment. There is no traffic separation such as cyclist lanes, pedestrian lanes and

all these factors contribute significantly to risk of road traffic injury occurrence in the country.

Those injured face challenges in order to access health care, due to lack of adequate post trauma care. RTIs cause suffering within families such as school drop outs and poverty due to involvement of the breadwinner. Universal national health insurance is needed to improve accessibility to health care services. Majority of the RTI victims are passengers and pedestrians. This implies public transport system needs improvement, proper pedestrian paths needs to be established and improvement in road traffic law enforcement. A sense of responsibility is required to share the road with others

A main challenge to road safety in Zimbabwe is the lack of accurate data. Comprehensive data is essential for drawing attention from law makers, setting targets, designing and evaluating strategies and prioritizing activities.

In order to improve understanding and awareness of road traffic injuries determinants and consequences among decision makers, researchers, practitioners and people, I will give the following recommendations based on analysis of the study and proven good practices from other countries as well as feasibility.

6.2. Recommendations

Government's capacity, commitment and support to the established lead agency (TSCZ) are needed in order to reduce RTI in Zimbabwe. A number of interventions were analyzed as to their applicability for Zimbabwe. (see Annex 4.).

Road safety management

- The Ministry of Transport and Infrastructure Development should finalize the national road transport safety policy in order to have an authenticated guiding document in all road safety activities.
- Public transport should be improved to address the road transport safety needs of vulnerable population (passengers), e.g., setting standards on minibuses and to enforce their compliance.
- RTIs data collection and recording by Zimbabwe Republic Police, TSCZ and MOH&CW should be done accurately. RTIs data is essential for explaining the burden, prioritizing activities, setting targets and designing strategies.

Safer road users

- Drinking and driving law, speed limit law should be reviewed and changed to meet the WHO recommendation.
- Seat belt use should be mandatory to all vehicle occupants. This can be done gradually to allow those cars with no seat belts to be fitted.
- Improve on regular, consistent and comprehensive enforcement of road rules to improve road user behaviours especially on drinking and driving, speeding, use of seat belts and helmet use.
- Place speed cameras on busy intersections and black spots to enforce speed limit.
- Defensive driving should be incorporated in driver licensing training. This involves training on knowing how to avoid traffic crashes and recognize potential hazards before it's too late.
- Establish graduated drivers licensing system for novice drivers. This gives novice drivers time to gain experience, with some restrictions, e.g., on night driving or carrying passengers.
- Education and encouragement to improve alertness and obedience to road rules as well as regular and consistent anti-corruption campaigns.
- NGOs and TSCZ should advocate for policies such as public transport policy, policy to promote walking and cycling this helps in drawing policy makers' attention to road safety.

Safer vehicles

- All new cars should have seat belts. A period of time can be given for the old cars to have seat belts fitted.
- Enforcement of regular vehicle services and proper inspection periodically.
- Collaborate with Environmental Management Agency in tracking unworthy vehicles on road
- Mandatory daytime running lights usage and headlight usage for motorcyclists.

Safer roads and road sides

- Establish policy on routine road maintenance
- Involve engineers in road accident investigation to detect road engineering problems
- Instant remedial action on black spots with traffic calming measures such as roundabout, speed humps with good signaling. This may

help to reduce traffic accidents especially at intersections and at areas with repeated accidents.
- Establish pedestrian and cyclist paths in busy roads where mostly pedestrians are involved in accidents.
- Revive public private partnership relationship to raise funds for road maintenance.
- NGOs implementing food for work programs should target road maintenance, e.g., (clearing tall grass and bushes along road-sides) in their activities.

Post-crash management

- Refresher course for trauma care management to health workers
- Establish universal national health insurance
- Revive CPU committees

Interventions that can be prioritized for further enhancement of road safety are:

- Research on road safety to establish cost of interventions, follow up of RTIs victims to establish how they are coping and surviving. Comprehensive information on road traffic injuries gives clear picture of the problem, e.g., seat belt wearing rate
- Advocacy to win political attention for public transport policy, road safety policy, legislation change on BAC limit and urban maximum speed limit to meet WHO recommendations.
- Regular improved enforcement of new and old traffic regulations through police and media coverage; this needs some additional cost for media coverage however media have benefit in reaching a lot of people and drivers are able to access and understand television and radio news.
- Anti-corruption campaigns.
- Establish universal national health insurance.

REFERENCES

AfDB (undated) *Road transport services and infrastructure. Zimbabwe report.* [Online]. Available from: http://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/11.%20Zimbabwe%20Report_Chapter%209.pdf. [Accessed 06 February 2012].

AfDB (2011). *Infrastructure and growth in Zimbabwe. An action plan for sustained strong economic growth*. [Online]. Available from: http://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/1.%20Standalone%20Summary%20Report.pdf. [Accessed 28 July 2012].

Afukaar, F.K., Antwi, P. and Ofosu- Amah, S (2003). Pattern of road traffic injuries in Ghana: implications for control. *Injury control and safety promotion*, 10 pp 69-76

Ameratunga, S., Hijar, M and Norton, R. (2006). Road-traffic injuries: confronting disparities to address a global- health problem. *Lancet*. 367 (9521), pp. 1533-1540.

Andrews, L. (2011) *THET ICS. Zimbabwe country risk assessment*. Harare, Zimbabwe.

Arumugam, N. (2007). Presidential address at the 57th WMA general assembly (summary). *International Medical Community JMAJ* 50 (3) PP. 269-271.

Assum, T. (1998). *Road safety in Africa – Appraisal of road safety initiatives in five selected countries in Africa*. Sub-Saharan Africa Transport Policy Program. The World Bank and Economic Commission for Africa. World Bank SSATP Working paper no. 33.

Australian Transport Council (2008). *National road safety action plan2009 and 2010*. [Online] Available from: http://www.atcouncil.gov.au/documents/files/ATC_actionplan0910.pdf. [Accessed 16 June 2012]

Australian Transport Council. (2011). *National road safety strategy* 2011-2020 [Online] Available from: http://www.atcouncil.gov.au/documents/files/NRSS_2011_2020_15Aug11.pdf. [Accessed 17 July 2012].

Biti H (2009) "Statement on the 2009 budget" Presented to Zimbabwe Parliament, 17 March 2009. [Online].Accessed from: http://www.abaz.co.zw/pdf/Government%20of%20Zimbabwe/Fiscal%20Policy/Zimbabwe%20Budget%20Statement%202010.pdf. [Accessed 13 July 2012].

Blows, S., Ivers, R.Q., Woodward, M., Connor, J., Ameratunga, S and Norton, R. (2003). Vehicle year and the risk of car crash injury. *Injury prevention*. 9, pp. 353-356

Bunn F, Collier T, Frost C, Ker K, Roberts I and Wentz R (2003). Traffic calming for the prevention of road traffic injuries: systemic review and meta-analysis. *Injury prevention*, 9, pp. 200-204

CDC. (2011). *Injury prevention control: Motor vehicle safety*. [Online]. Available from: http://www.cdc.gov/MotorVehicleSafety/Impaired_Driving/impaired-drv_factsheet.html. [Accessed on 14June 2012].

Chatora, R. and Tumusiime, P. (2004). *Module 1.District Health Team Training*. Health Sector Reform and District Health System WHO Regional Office for Africa: Brazzaville.

Chen, G. (2010). Road traffic Safety in African Countries- status, trend, contributing factors, countermeasures and challenges. *International Journal of Injury and Safety Promotion,* 17(4), pp.247-255.

Chiwanga, S. (2011). Is there a solution in sight? *Sunday News* 31 December 2011. [Online]. Available from: http://www.sundaynews.co.zw/index.php?option=com_content&view=article&id=25837:is-there-a-solution-in-sight&catid=39:opinion-a-analysis&Itemid=132. [Accessed 31 March 2012].

Christensen, P. and Elvik, R.(2007). Effects on accidents of periodic motor vehicle inspection in Norway. *Accident analysis & prevention*.39 (1), pp. 47-52

Cunill, M., Gras, M.E., Planes, M., Oliveras, C. and Sullman, M.J. (2004). An investigation of factors reducing seat belt use amongst Spanish drivers and passengers on urban roads. *Accident analysis and prevention*. 36(3) pp. 439-445.

Dube, J. and Mawere, R. (2011) Police blamed for road carnage in accidents. *The Standard* Sunday 04 September 2011. [Online]. Available from: http://www.thestandard.co.zw/local/31394-police-graft-blamed-for-road-carnage-inaccidents.html. [Accessed 14 July 2012].

Duperrex, O., Roberts, I., Bunn, F. (2002). Safety education of pedestrians for injury prevention. *Conchrane Database Systemic Review*

ETSC. (2007). *Social and economic consequences of road traffic injury in Europe*. Brussels: ETSC.

Elder, R.W., Shults, R.A., Sleet, D.A, Nichols, J.L., Zaza, S and Thompson R.(2002) Effectiveness of sobriety checkpoints for reducing alcohol-involved crashes. *Traffic Injury Prevention*. 3, pp. 266-274.

Elvik, R and Vaa, T. (2004). *The handbook of road safety measures*. Amsterdam, Elsevier Science.

Evans L. (1986). The effectiveness of safety belts in preventing fatalities. *Accident Analysis and Prevention*, 18(3), pp. 229-241.

Evans, L. (1996). Safety belt effectiveness: the influence of crash severity and selective recruitment. *Accident analysis and prevention* 28, pp. 423-433.

Fisher, D.L., Pollatsek, A.P., Pradhan, A. (2006). Can novice drivers be trained to scan for information that will reduce their likelihood of a crash? *Injury prevention,* 12, pp. 125-129

Foreign Commonwealth Office (2012). Travel and living abroad. [Online]. Available from: http://www.fco.gov.uk/en/travel-and-living-abroad/travel-advice-by-country/sub-saharan-africa/zimbabwe. [Accessed 16 February 2012].

Freire, P., Gemme, R., Glander, A., Hermann, F., Higuera, C., Horz, H., Powell, D., Retour, P and Verfaillie D. (2007).*PIARC technical dictionary of road terms*. 8th edition. [Online]. Available from: www.piarc.org. [Accessed 06 August 2012].

Government of Zimbabwe/United Nations Country team (2010). Country analysis report for Zimbabwe: Harare.

Guruva, D. (2002). *Defensive driving as a preventive strategy for road traffic violation and collisions in Zimbabwe*. Masters of Arts, thesis in the subject Criminology. University of South Africa.

GRSP. (2007). *Drinking and driving: A road safety manual for decision makers and practitioners.* GRSP, Geneva.

GRSP. (2009a).*Speed study Accra, Ghana*. [Online]. Available from: (http://grsp.drupalgardens.com/sites/grsp.drupalgardens.com/files/Speed%20Ghana.pdf. [Accessed 31 March 2012].

GRSP. (2009b). *Speed survey, Namibia*. [Online]. Available from: http://grsp.drupalgardens.com/sites/grsp.drupalgardens.com/files/Speed%20Namibia.pdf. [Accessed 31 March 2012].

Halman, SI., Chipman, M., Parkin, P.C., and Wright, J. (2002).Are seat belt restraints as effective in school-age children as in adults? A prospective crash study. *British Medical Journal*, 324(7346), pp.1123.

Hedlund, J., Shults, R.A. and Compton, R. (2003). What we know, what we don't know and what we need to know about Graduated Driving License. *Journal of safety research*. 34, pp. 107-115

Holder, Y., Peden, M., Krug, E., Lund, J. Gururaj, J and Kobusingye, O eds. (2001). *Injury Surveillance Guidelines*. Geneva: WHO.

Hundley, J.C., Kilgo, P.D., Miller, P.R., Chang, M.C., Hensberry, R.A., Meredith, J.W., and Hoth, J.J. (2004) Non-helmeted motorcyclist: A burden to society? A study using the national trauma data bank. *Journal of trauma*. 57, pp.944-949

ICSU. (2011). Report of the ICSU planning group on health and wellbeing in the changing urban environment: A system analysis approach. International council for science, Paris.

IOM. (2012).*Facts and figures*. Updated April 2012. [Online] Available from: http://www.iom.int/jahia/Jahia/activities/africa-and-middle-east/southern-africa/zimbabwe. [Accessed 06 July 2012].

Jokonya, M. (2006) PIARC Technical committee 3.1 Road safety 6th meeting, presentation on Traffic safety of Zimbabwe at Lome 9. [Online]. Available from: http://www.piarc.org/ressources/documents/actes-seminaires06/c31-togo06/8720,2-PRESENTATION_ONE_M_JOKONYA.pdf [Accessed on 14 February 2012].

Kargbo, J. (2008). *Progress and prospects in the implementation of protocols in South Africa*. UNECA, South Africa.

Ker, K., Roberts, I., Collier, T., Beyer, F., Bunn, F., Frost, C (2005). Post-licence driver education for the prevention of road traffic crashes: a systemic review of randomised controlled trials. *Accid Anal Prev*.37 (2), pp.305-313.

Kodero, K. (2005). *Transpolicy: Pro-poor transport policy meeting the challenge in Zimbabwe*. [Online]. Available from: http://www.ifrtd.org/new/proj/Transpolicy_Vol11.pdf. [Accessed 11 July 2012].

Kormer-Bitensky , N, Kua, A., von Zweck, C and van Benthem, K (2009). Older driver training: an updated systemic review of evidence of effectiveness. *Journal of safety research*, 29 pp. 105-111

Koushki,P.A., Bustan, M.A. and Kartam, N. (2003). Impact of safety belt use on road accident injury and type in Kuwait. *Accident analysis and prevention*. 35, pp. 237-241.

Krug E (Ed) (1999) *Injury: a leading cause of global burden of disease*. World Health Organisation, Geneva

Labonte, R. and Schrecker, T. (2007) Globalization and social determinants of health: Introduction and methodological background (part 1 of 3).*Biomedical central.* [Online]. Available from: http://www.globalizationandhealth.com/content/3/1/5.[Accessed 22February 2012].

Law, T.H. (2009).*The effects of political governance, policy measures and economic growth on the Kuznets relationship in motor vehicle crash deaths*. Ph.D thesis, UK: Imperial College London. [Online] Available from: http://www.cts.cv.ic.ac.uk/documents/theses/LawPhD.pdf. [Accessed 10 July 2012].

Lee AJ, Mann NP, Takriti R. (2000). A hospital led promotion campaign aimed to increase bicycle helmet wearing among children aged 11-15 living in West Berkshire 1992-98. *Injury Prevention*, 6, pp.151-153.

Lui B.C., Ivers, R., Norton, R., Boufous, S and Blows,S. (2008). Helmets for preventing injury in motorcycle riders. *Cochrane Database of*

Systematic Reviews, 2008, 23. Issue 1. Art. No.: CD004333.DOI: 10.1002/14651858.CD004333.pub3

Mbara, T. C. (2002) *Transport: How have African cities managed the sector? What are the possible options?* Paper presented at the urban & city management course for Africa, UMI, Kampala Uganda. [Online]. Available from: http://info.worldbank.org/etools/docs/library/110868/kampala/docs/TRANSPORT-%20T%20MBARA.pdf. [Accessed 04 March 2012].

McSweeney, R., Wiggins, M and Liu, L. (2011). *Zimbabwe climate change profile.* [Online]. Available from: http://tilz.tearfund.org/webdocs/Tilz/Topics/Environmental%20Sustainability/Zimbabwe_Final.pdf. [Accessed 16 February 2012].

Milne, P., Sharp, K., ARRB Group and Ungers, B consultant (2010). *Austroads glossary of terms*. 4th edition. Austroads ltd: Australia.

MOH&CW. (2009). *The national health strategy for Zimbabwe 2009-2013*. Harare: Zimbabwe

Mugauri, G. (2012) Left vs right: Is Zimbabwe ready? *Zimpapers* Saturday 18 June 2011. Available from: http://bit.ly/MhL7pe. [Accessed 07 July 2012].

Mukarati, L. (2011) Zim gambling with road traffic safety. *The Financial Gazette* Friday 12 August 2011 [Online]. Available from: http://www.financialgazette.co.zw/national-report/9413-zim-gambling-with-road-traffic-safety.html. [Accessed 31 July 2012].

Murwira, Z. (2012). 'Cops have no right to impound vehicles' *The Herald* Sunday 22 July 2012. [Online] Available from: http://www.herald.co.zw/index.php?option=com_content&view=article&id=47825:cops-have-no-right-to-impound-vehicles&catid=37:top-stories&Itemid=130. [Accessed 22 July 2012].

Mutore, R. and Nyambuya, P. (2011) "Don't be a stat this holiday" *The Sunday mail* 19th November 2011. [Online]. Available from: http://www.sundaymail.co.zw/index.php?option=com_content&view=article&id=25595:dont-be-a-stat-this-holiday&catid=37:top-stories&Itemid=130. [Accessed 9 February 2012].

Nantulya,V.M. and Reich, M.R.(2003) Equity dimensions of road traffic injuries inlow and middle income countries. *Injury control and safety promotion* 10 (1-2), pp. 13-20

National directorate for fire and emergency management (2009) *Road traffic accident handbook*. Available from: http://www.environ.ie/en/Publications/LocalGovernment/FireandEmergencyServices/FileDownLoad,23411,en.pdf. (Accessed on 23 April 2012).

Newsday. (2012). Someone is to blame for the blood on our roads, *Newsday*, 28 March 2012. [Online]. Available from: http://www.newsday.co.zw/article/2012-03-28-someone-is-to-blame-for-the-blood-on-our-roads/. [Accessed 01 April 2012].

Ngwato, T.P. (2009) *Migration issue brief 1: Regularising Zimbabwe migration to South Africa.* [Online]. Available from: http://independent.academia.edu/TaraPolzerNgwato/Papers/247599/Migration_Issue_Brief_1_Regularising_Zimbabwean_Migration_to_South_Africa. [Accessed 09 July 2012].

Nilsson, G. (2004). *Traffic safety dimension and the power model to describe the effect on speed safety*. Lund; Lund Institute of Technology.

Norvell, D.C. and Cummings, P. (2002).Association of helmet use with death in motorcycle crashes. A matched-pair cohort study. *American Journal of Epidemiology.* 156, pp 483-487

Nyoni, J. (2012). Bribery adds to road carnage. *Chronicle* Wednesday 09 May 2012. [Online]. Available from: http://www.chronicle.co.zw/index.php?option=com_content&view=article&id=34697:bribery-adds-to-road-carnage&catid=39:opinion-a-analysis&Itemid=132. [Accessed 30 June 2012].

Odero, W., Garner, P. and Zwi, A. (1997) Road traffic injuries in developing countries: a comprehensive review of epidemiological studies. *Tropical Medicine and International Health* 2(5) pp. 445-460.

Odero, W., Khayesi M., Heda, P.M. (2003). Road traffic injuries in Kenya: Magnitude, causes and status of intervention. *Inj Control Saf Promot* 10, pp. 53-61.

O'Neil, B. and Mohan, D. (2002). Reducing motor vehicle crash deaths and injuries in newly motorised countries. BMJ, 324, PP. 1142-1145

Oxford University press (2001) *Concise oxford english dictionary* 10th ed Oxford OX22DP: UK.

Parirenyatwa, D. (2004). World health day commemoration speech by the Honorable Minister of Health and Child welfare*. Theme Road safety is no accident*. Harare, Zimbabwe. [Online]. Available from: www.bjdonline.org/ViewDocument.aspx?ContId=373. [Accessed 03 March 2012].

Parliament of Zimbabwe. (2012). *Ministry of Transport and Infrastructure Development: Highlights of the achievement of 2011 government work programme*. [Online]. Accessed from: (http://www.parlzim.gov.zw/attachments/article/30/13_March_2012_38-25.pdf). [Accessed 01 April 2012].

Pearce, T. and Maunder, D.A.C. (2000). The causes of bus accidents in five emerging nations. Technical field of this paper: Road safety for daily lives. *Transport Research Laboratory*, 2000. [Online]. Available from: http://www.transportlinks.org/transport_links/filearea/publications/1_549_PA3574%20.pdf. [Accessed 02 July 2012].

Peden, M.M., Knottenbelt, J.D, van der Spuy. J., Oodit, R, Scholtz HJ, Stokol JM. (1996). Injured pedestrians in Cape Town: the role of alcohol. *South Africa Medical Journal*. 86(9), pp. 1103-1105.

Peden, M., Scurfield, R., Sleet D. (2004).*The World Report on road traffic injury prevention*. WHO, Geneva.

Peltzer, K. (2008). The road "kill" factor*. Human Science Research Council review* 6 (4).

Pushak, N. and Briceno-Garmendia, C.M. (2011) Zimbabwe's infrastructure: A continental perspective. Policy research working paper, 5816. World Bank Africa Region sustainable development unit.

Radi Umar,R.S., Mackay, M.G. and Hills B.L (1996) Modeling of conspicuity-related motorcycle accidents in Seremban and Shah Alam Malaysia. *Accident analysis and prevention.* 28, pp 325-332

RadioVop (2012).*Twelve perish in car accident* .11 April 2012 [Online]. Available from:http://www.radiovop.com/index.php/national-news/8681-twelve-perish-in-car-accident.html. [Accessed 23 April 2012].

Retting R.A, Kyrychenko S.Y. (2002). Reduction in injury crashes associated with red light camera enforcement in Oxnard, California. *Am J Public Health*. 92 (11), pp.1822-1825.

Rice, T.M., Anderson, CL. and Lee, A.S. (2009). The association between booster seat use and risk of death among motor vehicle occupants aged 4-8: a matched cohort study. *Injury Prevention*, 15(6), pp.379-383.

RITA/BTS (undated). *Literature review on road safety*. [Online]. Available From:http://www.bts.gov/publications/africa_road_safety_review/html/appendixC.html. [Accessed 09 July 2012].

Roelof Wittink (2001) Promotion of mobility and safety of vulnerable road users: *Final report of the European research project PROMISING*. SWOV Institute for road safety research. The, Netherlands.

Royal, S.T., Kendrick, D. and Coleman T.(2008). Non-legislative interventions for the promotion of cycle helmet wearing by children. *Cochrane Database Systematic Reviews*, 2005, 18:CD003985. DOI: 10.1002/14651858.
CD003985.pub2

Schoor, O., Niekerk, J.L and Grobbelaar, B. (2001) Mechanical failures as a contributing cause to motor vehicle accidents- South Africa. *Accident analysis & prevention*. 33 (6), pp. 713-721.

Sharma, B.R. (2008). Road traffic injuries: A major global public health crisis. *Journal of public health.* 122, pp. 1399-1406.doi: 10. 1016/j.puhe.

Soderlund, N and Zwi, A.B (1995) WHO bulletin 73

Stevenson, M., Yu, J., Hendrie, D.,Li, L-P., Ivers, R., Zhou, Y., Su, S and Norton, R. (2008). Reducing the burden of road traffic injury: Translating high-income country interventions to middle income and low-income countries. *Injury prevention*, 14, pp. 284-289.

TEST network (2010).*TEST in road safety campaign: The importance of taking up safety measures*. [Online]. Available from: http://bit.ly/OAeF0R. [Accessed 10 February 2012].

The Herald. (2012a). Zimbabwe: Answer lies in efficient of public transport system. *The Herald* 07 March 2012 Available from: http://bit.ly/QbtoiB. [accessed 16 March 2012].

The Herald (2012b).Ngundu crash site a black spot, say drivers. *The Herald.* Saturday 21 April 2012. [Online]. Available from: http://www.herald.co.zw/index.php?option=com_content&view=article&id=39609:ngundu-crash-site-a-blackspot-say-drivers&catid=37:top-stories&Itemid=130. [Accessed 17 July 2012].

Towindo, L. and Bulla, F. (2011) Curse Of holidays--- as accidents claim lives every year. *Zimpapers* Saturday 06 August 2011. [Online]. Available from: http://bit.ly/Mxe38g. [Accessed 17 February 2012].

TSCZ. (undated). *Accident statistics*. [Online]. Available from: http://www.trafficsafety.co.zw/index.php?option=com_content&view=article&id=70&Itemid=78 [Accessed 06 April 2012].

TSCZ. (2012a). *Speech pedestrian safety week 2012*. [Online]. Available from: www.trafficsafety.co.zw/index.php?option=com_docman. [Accessed 04 July 2012].

TSCZ, (2012b). *National safe public service vehicles day*. Available from: http://www.trafficsafety.co.zw/index.php?option=com_docman&task=cat_view&gid=36&Itemid=65&limitstart=10. [Accessed 09 July 2012].

Turner C., McClure, R., Nixon, J. and Spink, A. (2005). Community-based programs to promote car seat restraints in children 0-16 years – a systematic review. *Accident Analysis and Prevention*, 2005, 37(1):77-83.

UK Essays (2003). *Transportation.* [Online]. Available from: http://www.ukessays.com/essays/industry/transportation.php. [Accessed 17 February 2012].

UNECA, IRF, AUC, AfDB, SSATP, GRSF and WB (2011). *The second African Road safety conference.* Addis Ababa, Ethiopia

Whelan K., Towner, E., Errington G and Powell, J. (2008). Road safety research report no. 82. *Evaluation of the national child pedestrian training pilot projects*. London: Department for Transport

WHO (2001) *A 5-year WHO strategy for road traffic injury prevention*. World Health Organisation: Geneva.

WHO (2004). *The world report on road traffic injury prevention*. World Health Organisation: Geneva.

WHO (2006a). *Road traffic injury prevention. Training manual*. World Health Organisation: Geneva

WHO (2006b). *First United Nations Global Road Safety week. A toolkit for organizers of events.* World Health Organisation: Geneva.

WHO. (2007). Commission on social determinants of health: A conceptual framework for action on the social determinants of health. *Discussion paper for the commission on social determinants of health draft*. World Health Organisation: Geneva.

WHO. (2009). *Global status report on road safety. Time for action*. World Health Organisation, Geneva.

WHO. (2010). *Road safety in 10 countries*. [Online].Available from: http://www.who.int/violence_injury_prevention/road_traffic/countrywork/rs_overview.pdf. [Accessed 31 March 2012].

WHO (2011a). *Distribution of traffic deaths by type of road user in 2006*. [Online]. Available from: http://apps.who.int/ghodata/?vid=51210# [Accessed 11 July 2012].

WHO. (2011b). *Mortality road traffic deaths*. [Online]. Available from: http://apps.who.int/ghodata/?vid=51210. [Accessed 03 August 2012].

WHO (2012) *Zimbabwe country profile*. [Online]. Available from: http://www.who.int/violence_injury_prevention/road_safety_status/country_profiles/zimbabwe.pdf. [Accessed 16 February 2012].

Wilkson, A.E. (1974). Speed limits and accidents. *South African Medical Journal*, 48, pp.1323

World Bank (2003). *Road safety at a glance*. [Online]. Available from: http://siteresources.worldbank.org/INTPHAAG/Resources/AAGRoadSafety3-04.pdf. [Accessed 06 February 2012].

World Bank. (2006). *Zimbabwe Infrastructure Assessment Note for Roads, Railways, and Water Sectors*: Africa Transport Sector (AFTTR) Report No. 36978-ZW.

World Bank. (2008). *Zimbabwe infrastructure dialogue in roads, railways, water, energy and telecommunication sub-sectors*. Report no. 43855-zw. Harare. AFTTR.

World Bank. (2011). *World Bank group steps up support for road safety* Available from: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSDNET/0,,contentMDK:23084571~pagePK:64885161~piPK:64884432~theSitePK:592982,00.html. [Accessed 9 February 2012].

Yuan, W (2000). The effectiveness of the "ride bright" legislation for motorcycles in Singapore. *Accident analysis and prevention.* 32, pp.559-563.

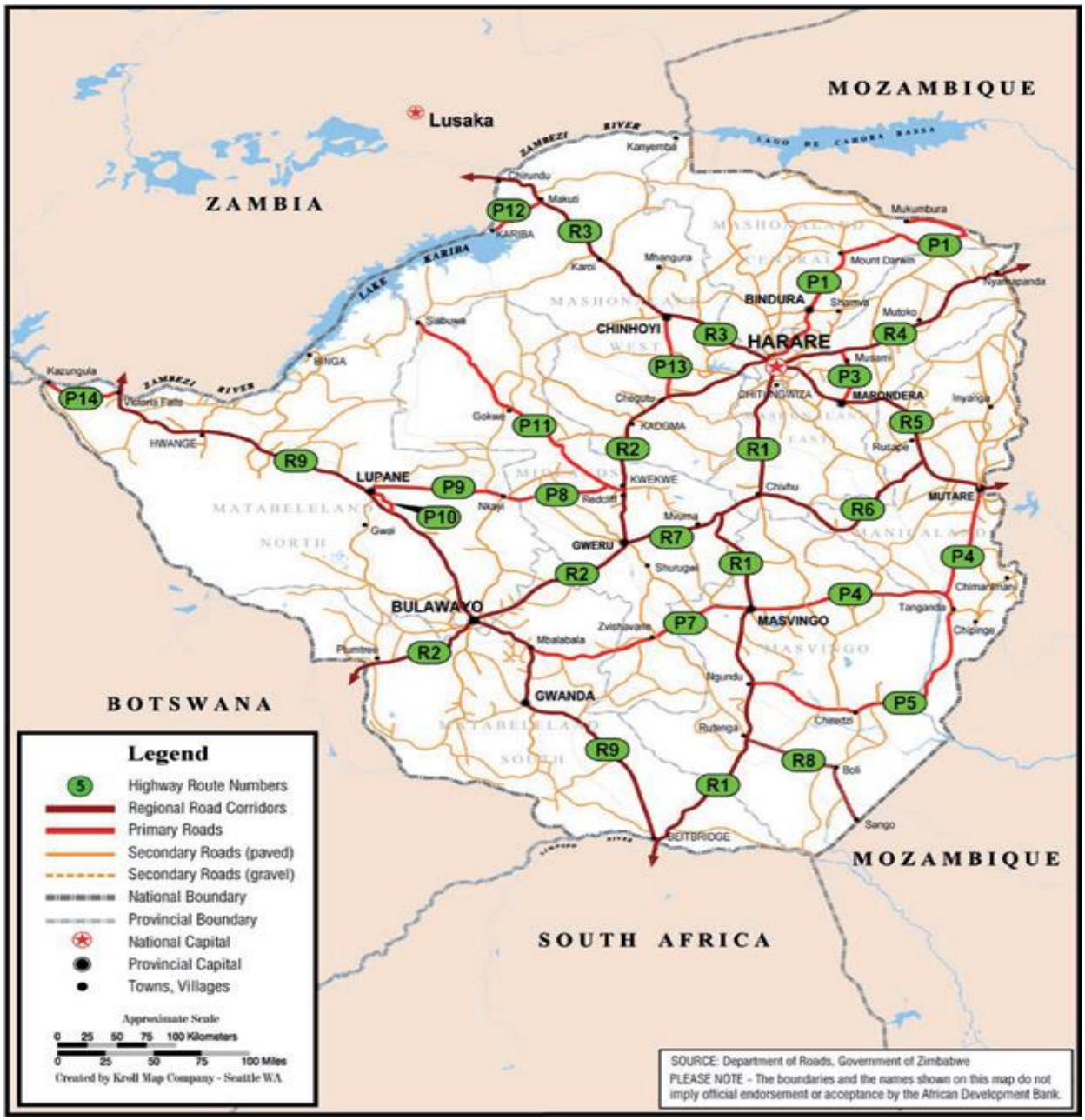
Zador, P.L. (1985) Motorcycle headlight-use laws and fatal motorcycle crashes in the US. *American journal of public health*. 75, pp. 543-546.

ZBC, (2012). Ngundu Disaster exposes fire brigade. 17 April 2012 [Online]. Available from: http://www.zbc.co.zw/news-categories/top-stories/18607-countrys-disaster-plan-raises-concern.html. [Accessed 23 April 2012].

Zim.gov.zw (2012).*Hopes high on new licence disc*. [Online]. Available from: http://www.zim.gov.zw/index.php/component/content/article/133-june-2012/5493-hopes-high-on-new-licence-disc-. [Accessed 11 June 2012].

Zimbabwe Health Workforce Observatory (2009). *Human resources for health country profile Zimbabwe.* Harare: Zimbabwe Health Workforce Observatory.

Annex 1: Road Transport network of Zimbabwe



Source: AfDB ,undated

Annex 2: Country Fact sheet

Location	Southern Africa
Area	390.757 km2
Natural resources	Platinum, diamonds, coal, iron ore, copper, zinc, chrome, gold, silver, magnesium limestone, arable land
Bordering Countries	Botswana, Mozambique, South Africa, Zambia
Provinces	Bulawayo Metropolitan, Harare Metropolitan, Manicaland, Mashonaland Central, Mashonaland East, Mashonaland West, Masvingo, Matebeleland North, Matebeleland South, Midlands
Capital City	Harare: Population - 1 896 134 (2002 national census
Local Authorities	31 urban authorities comprising cities, municipalities, town councils, and town boards; 60 rural authorities
Population	11 631 657, of which Male = 5 634 180 and Female = 5 997 477 (2002 national census), growing to 12.3 million (2009 estimate)
Constitution	The current Constitution was agreed at Lancaster House, London in 1979. Up to December 2009, 19 amendments had been made to the 1979 Constitution. Work is underway to come up with a new Constitution for the country.
Political System	Republic
Official Languages	English, SiNdebele, ChiShona
Economically Active Population	5 664 924, of which 9.3% classified as unemployed, 30.3% as communal and resettlement area workers, and 60.36% as employed (2004 Labour Force Survey. (Unemployed 95% 2009est)
GDP	$5.1 billion (IMF)
	GDP growth rate: 8.1% (2010 estimate from the Ministry of Finance
Total Foreign Debt	$7.1 billion as of 31 December 2009 (139.2% of GDP)(IMF)

Source: Government of Zimbabwe/United Nations Country team, 2010.

Annex 3: Statutory Instrument 154 of 2010: Road Traffic Regulation

STATUTORY INSTRUMENT 154 of 2010: ROAD TRAFFIC (CONSTRUCTION, EQUIPMENT & USE) REGULATIONS 2010.

The above regulations, gazetted on 17th September 2010, come into operation on 1st December 2010 and replace the regulations of 1972 (Chapter 13:11) as last amended in 1988. The motivations of these regulations included the consolidation and updating of road traffic regulations pertaining to vehicle construction and equipment as well as the granting of legal force to some provisions of the Highway Code and those of the VID Handbook. The regulations also make a major shift towards conformance with Standards Association of Zimbabwe standards and gives a greater role to SAZ in the approval of road traffic equipment. National Tyre Services Ltd had informal input through the Zimbabwe Traffic Safety Council and the Ministry of Transport.

The regulations lay minimum compliance requirements for motor vehicles construction and equipment and fixtures required to be carried on or fixed to the vehicle. It also sets out specific requirements with respect to the use of vehicles, equipment and fixtures. Provisions of general interest to motorists are as follows:

1. **Left hand Drive Vehicles:** No LHD vehicles will be registered for the first time after 31st March 2011. LHD Heavy vehicles will not be allowed on the road after 31 December 2015.
2. **Rear View Mirror:** Mandatory
3. **Tyres:**
    a. Minimum tread depth on any part of the tyre stated as 1mm.
    b. Regrooving of non-regroovable tyres prohibited
    c. Tyres with exposed cords, lumps / bulges consistent with ply separation, tread lift prohibited.
    d. Adherence to tyre load and speed indices a must.
    e. Tyres must be of the right size and correctly inflated as per manufacturer's specifications.
    f. Tyres on the same axle must be of the same size, type and construction.
    g. Retreaded tyres outlawed on front axles of passenger public service vehicles and heavy vehicles and passenger service vehicles without dual tyres.
    h. Serviceable Spare Wheel, working jack and appropriate wheel spanner mandatory.

4. **Tail Lights:** White lights prohibited hence tail lights with broken lenses will not be allowed.
5. **Headlamps, Tail Lights and "park" lights:** Defective lamps prohibited.
6. **Height lamps:** Heavy vehicles to be fitted with Height lamps front and rear.

7. **Reflectors:** White reflectors in front, red reflectors at the rear. Heavy vehicles to have reflectors on the side as well. Detailed specifications available in the regulations.
8. **'Breakdown' Triangle:** Two reflective breakdown triangles per vehicle and with serial numbers, name of manufacturer and year of manufacture and conforming to SAZ standards will be mandatory. A pair is also required for each trailer. These must be placed one in front and one at the rear of a vehicle (30 to 50m) when it is stationery on any road at a place not designated for stopping.
9. **Fire Extinguishers:** All vehicles to carry an appropriate and SAZ approved fire extinguisher in the CAB of the vehicle - Light vehicles (750g) and heavy vehicles (1,5kg).
10. **Direction Indicators:** Functional requirements specified and mandatory.
11. **Suspension and Axles:** Must be properly maintained.
12. **Seats:** Must be secured
13. **Doors and Panels:** Driving of a car with defective locking mechanisms, hinges or catches, malfunctioning window winding mechanism prohibited. Doors must be operable from both the inside and outside.
14. **Speedometre:** Working speedometer mandatory for vehicles capable of at least 40km/h.
15. **Speed Monitoring and Speed limiting Devices:** All heavy vehicles and passenger public service vehicles must have a speed monitoring device e.g. tachograph, data recorder.
16. **Motor Vehicle Imports:** Imports of Vehicles that are over 5years old prohibited.
17. **Gross mass:** Pick-ups and other commercial vehicles must display the gross and net mass in kilograms.
18. **Maintenance of Engines:** Vehicles with defective exhausts, silencers, emissions outside SAZ specifications; oil, grease and fuel leaks prohibited.
19. **Carriage of passengers:** Goods Vehicles: Maximum permissible number is seven except where the vehicle is carrying employees of the vehicle owner or the employees' family members in which case the floor area available to each person shall not be less than 0.5m².

Failure to observe any of the regulations will constitute an offence punishable by a fine not exceeding level five or to a period of imprisonment not exceeding 6 months or both.

Annex 4: Interventions and its applicability in Zimbabwe

Intervention	Stakeholders	Expected results	Obstacles	What can be done to overcome obstacles
Road safety system				
Finalisation of the National Transport Policy	Ministry of Transport, Communication and infrastructural Development, Ministry of Home Affairs, Local Government, Urban Councils and Rural District Councils.	Road safety activities will be guided by an authenticated document Increases traffic law enforcement	Lack of capacity	Engage expertise from other countries which have functional transport policy and strategic road plans
Accurate data collection and recording	TSCZ, Ministry of Home Affairs (traffic police) and MOH&CW	RTIs data with clear trends. proper prioritization of interventions	Knowledge gaps	Engaging expertise from countries with good practices on data collection.
Setting targets to improve road safety	Ministry of Transport, Communication and infrastructural Development, TSCZ Ministry of Local Government, Public Works & Urban Development, MOH&CW, Ministry of Home Affairs, Ministry of Education, Fire Brigade, Zimbabwe passengers transport operators and interested NGOs.	Targets indicate commitment of the government to reduce RTI therefore we expect support on proposed policy and legislative changes as well as allocation of sufficient resources for safety programmes. Targets communicate the importance of road safety, hence motivate stakeholders. Managers of road safety become accountable for achieving defined results.	Interventions to achieve targets may be expensive	Allocation of a percentage of resources specifically for road safety activities. Public-Private Partnership
Improving the public transportation system and setting safety standards on the existing kombi (minibuses)	Ministry of Transport, Communication and infrastructural Development, Ministry of Home Affairs, Ministry of Local Government, Urban and Councils	RTI will be reduced through better and safer public transportation. Vulnerable population's needs(passengers) will be cared for	Need for capital to increase the number of public buses	Prioritising road safety for vulnerable people and allocation of budget for provision of public transport gradually
Reviewing speed limits	Ministry of Transport,	Low speed in urban will reduce	Drivers who	Encouragement and

and BAC level in the country to meet the global recommendation	Communication and infrastructural Development, Ministry of Home Affairs, CPU members	number of crashes at intersections	drink may oppose this idea	education as well as advocacy for perception change towards drinking and driving
Safer people and safer behaviours				
Education and encouragement of road users Anti-corruption campaigns	TSCZ, MOH&CW, Ministry of Home Affairs, CPU, Fire brigade and Media	Growth in concern and commitment on road safety is expected among road users. Perception of road users will be changed. Increase in understanding crash risks Reduction of pedestrian casualty	Budget	Mainstreaming road safety issues in all Ministries and companies, churches gatherings as well as media coverage
Enforcement of traffic regulation on road users (installing speed cameras at intersections), (Provision of breathalysers to police officers on patrol)	Ministry of Home Affairs, Ministry of Transport, Communication and infrastructural Development	Road users deterring from speeding and drink driving. Reduction in number of RTI. Perception on drinking and driving will be changed	Budget constraints	The intervention can be sustained. Cameras can be permanent road infrastructure. Public-Private Partnership.
Mandatory defensive driving for every driver	TSCZ, Ministry of Home Affairs, Ministry of Transport, Communication and infrastructural Development	Alert drivers able to anticipate and handle emergency situations. Reduction in RTI	Driver may be against this idea	Education, enforcement, encouragement and advocacy
Safe vehicle				
Ensuring standards for imported motor vehicles	Ministry of Home Affairs, Ministry of Transport, Communication and infrastructural Development, vehicle inspection department (VID)	Reduced number of RTI Reduced severity of injuries in the event that crash occur	Corruption	Ant corruption campaigns through education and encouragement
Periodic motor vehicle inspection	Ministry of Transport, Communication and infrastructural Development, VID	Vehicles in good condition sharing the road	Corruption	Ant corruption campaigns through education and encouragement. increase salaries and

				incentives for law enforcers
Mandatory day time running lights for motorcycle and other vehicles	Ministry of Home Affairs, Ministry of Transport, Communication and infrastructural Development, VID	Increased visibility especially for motorcyclist Reduced RTI will be achieved with increased visibility of vehicles sharing the road	none	
Increase safety of vehicles	Vehicle manufacturing companies	Increase in electronic stability vehicles. Reduction in RTI e.g. with collision avoidance and lane departure warning system	Opposition from manufacturing companies	Education and encouragement together with advocacy.
Safer roads and road sides				
Scheduled routine road maintenance. Targeted road improvements e.g. black spots treatment	Ministry of Transport, Communication and infrastructural Development, NGOs	Increase in percentage of roads in good conditions Reduction in RTI will be achieved.	Budget	NGOs implementing food for work programmes can target road maintenance
Promoting alternative transport such as cycling and walking (provision of cyclist lanes and pedestrian tracks)	Ministry of Transport, Communication and infrastructural Development, TSCZ, MOH&CW	Safety of cyclists and pedestrians will be ensured. There will be an increase in the use of healthier mode of transport	Financial constraints to construct these lanes	Use of levy for financing road safety activities. Prioritizing budget allocation for road safety activities.
Post crash management				
Establishment of universal national health insurance	MOH&CW, Private companies and the Government of Zimbabwe	Increase in access to health care	Capacity to initiate the	Engaging experts in establishment of insurance can help
Reviving CPU committees/ emergency response teams	TSCZ, Ministry of Transport, Communication and infrastructural Development, Ministry of Local Government, Public Works & Urban Development, MOH&CW, Ministry of Home Affairs, Ministry of Education, Fire Brigade, Zimbabwe	Civil Protection unit and committees will be revived Emergency preparedness will be achieved RTI victims will be attended earlier. Increase in chances of survival secondary to first aide and early rescue. Better collaboration of	Lack of trained personnel to coach the team members in districts	Districts with experts to assist other districts

	passengers transport operators and interested NGOs.	stakeholders on road safety will be achieved.		