EFFECTS OF TRAFFIC ACT ENFORCEMENT ON INJURY SEVERITY AMONG MOTOR VEHICLE CRASH VICTIMS AT RIFT VALLEY PROVINCIAL GENERAL HOSPITAL, NAKURU.

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Muguku, Enos Ngungu
Effects of Traffic Act enforcement on
DECLARATION

This thesis report is my original work and has not been presented for any award in any university.

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DEDICATION

To my wife, Grace Wangui and sons, Dishon and Ezekiel for their support and encouragement.
ACKNOWLEDGEMENT

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<td>Acquired Immunodeficiency Syndrome</td>
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<td>AAAM</td>
<td>Association for the Advancement of Automotive Medicine</td>
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<td>AIS</td>
<td>Abbreviated Injury Scale</td>
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<td>CBS</td>
<td>Central Bureau of Statistics</td>
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<td>FGD</td>
<td>Focus Group Discussions</td>
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<td>GoK</td>
<td>Government of Kenya</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>IA</td>
<td>Impact Assessment</td>
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<tr>
<td>ICD</td>
<td>International Classification of Diseases</td>
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<tr>
<td>kph</td>
<td>Kilometers per hour</td>
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<td>MOTC</td>
<td>Ministry of Transport and Communication</td>
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<td>MPH</td>
<td>Miles per Hour</td>
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<td>NRSCK</td>
<td>National Road Safety Council of Kenya</td>
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<td>RVPGH</td>
<td>Rift Valley Provincial General Hospital</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
</tr>
<tr>
<td>UAE</td>
<td>United Arab Emirates</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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DEFINITION OF KEY TERMS

Injury Severity

This is the impact of injury in terms of the extent of tissue damage, (pathological evidence of trauma) and/or the physiological response of the body to that damage.

Traffic Act

This refers to the rules and regulations as stipulated in the Traffic Act (Cap 403) of the laws of Kenya that govern the conduct of road users in the country.

Enforcement

The use of instruments such as surveillance, policing, rewards and punishment to encourage the public comply with the traffic law.
ABSTRACT

From 1st February 2004, the Traffic Act was rigorously enforced in Kenya. The effects of this enforcement on injury severity are unknown. This study examined the effects of the enforcement of the Traffic Act on the severity of injuries among motor vehicle crash victims admitted at the Rift Valley Provincial General Hospital (RVPGH), Nakuru. This is an *ex post facto* study that used secondary data from patient's records at RVPGH between 1st February 2003 and 31st January, 2005, that is one year before and one year after the enforcement of the Traffic Act. Using simple random sampling, 276 patients were selected. Data was collected using a coding schedule which measured among others, the patients' bio-data, injury severity and length of stay in hospital. Injury severity was measured using the Abbreviated Injury Scale (AIS). The difference between severities of injuries in the two periods was analyzed using Kolmogorov Smirnov Test. Two Focus Group Discussions (FGDs) with RVPGH health professionals who attend to motor vehicle injury victims were also conducted in order to obtain in-depth data on the effects of the enforcement of the traffic act on injury severity. These qualitative data was content analyzed. Results indicate that three quarters of the sampled patients were males. The mean age of the sampled patients was 31.49 years (Standard Deviation 14.58). The sex profile of patients admitted at RVPGH did not change with the enforcement of the traffic act ($\chi^2 = 1.914$, $df = 1$; $p = 0.167$). There was a drop of 29 percent in admissions due to motor vehicle crashes, after the enforcement of the traffic act. Further, most of the sampled patients sustained injuries with AIS values of 1, 3 and 6 in both policy periods. The frequencies of patients with different injury severity levels remained the same in both policy periods (Most Absolute difference = 0.087, Kolmogorov-Smirnov Z = 0.722, $p = 0.674$). Therefore, the severity of injuries never changed despite the enforcement of the Traffic Act. The hypothesis that there was no difference in the level of injury severity among patients admitted at the RVPGH before and after the enforcement of the Traffic Act in Kenya was supported. Medical personnel suggested that seatbelt related injuries were emerging after the enforcement of the traffic act. This study has extended our understanding of the patterns of injury severity among motor vehicle crash victims. The study recommends that measures to reduce injury severity should be given priority. Policy makers can prioritize the minimization of minor, serious and fatal injury severity levels and focus on males aged around thirty years in their campaigns. Likewise, medical personnel should be prepared to handle similar profiles of injuries when motor vehicle crashes occur. The study also recommends that more studies should be conducted particularly using different injury severity scales, methods and with different samples.
1 INTRODUCTION

1.1 Background

The World Health Organization (WHO) ranks road crashes as the 9th leading cause of mortality and disease. An estimated 1.17 million deaths occur each year worldwide due to road crashes (WHO, 2004). About 70 percent of these deaths occur in developing countries, with 65 percent of these deaths involving pedestrians of which 35 percent are children. The economic burden on developing countries due to road accidents is estimated at US $ 65 billion per year (Jacobs and Aeron-Thomas, 2000).

By the turn of the millennium, 3000 people were killed on Kenyan roads annually (Odero et al., 2003; Assum, 1998). This translated to approximately 68 deaths per 10,000 registered vehicles, which is 30-40 times greater than highly motorized countries. This translates to an average of 7 deaths from 35 road crashes that occur each day. This is one of the highest road fatality rates in relation to vehicle ownership in the world. The economic burden of road traffic crashes in Kenya is estimated to be 5 percent of the Gross National Product (Odero et al., 2003). Casualties from road traffic injuries account for between 45 percent and 60 percent of all admissions in surgical wards in Kenya, and up to 75% of inpatients at the National Spinal Injury Hospital (Ating’a, 1990). On average 10.3 percent of road crashes victims die, 32.5 percent are seriously injured and 57.2 percent are slightly injured. Road traffic crashes are the third leading cause of death after malaria and HIV/AIDS and present a major public health problem in terms of morbidity, disability and healthcare costs (Government of Kenya (GoK), 1998). Hence, the need for radical road safety interventions.
There are spatial differences in the distribution of road traffic crashes in Kenya; 30 percent of all crashes reported between 1986 and 1994 occurred in Nairobi. Central, Coast and the Rift Valley provinces reported between 10 percent and 20 percent of the crashes (Odero et al., 2003). Children accounted for 10 percent of all road traffic casualties.

Seventy six percent of all road traffic crash related admissions at the Rift Valley General Hospital were aged between 19 and 49 years (Odero, 1998). Patients admitted due to road traffic crashes in Nairobi were aged between 15 and 44 years. The mean age in Eldoret is estimated to be 30.3 years. Males are overrepresented with hospital surveys in Nairobi, Nakuru and Eldoret showing males involvement at 98, 77.8 and 59.6 percent respectively (Ating’a, 1990 and Odero et al., 2003). The most vulnerable road users in Kenya are pedestrians (Odero, 1998). Such demographic profiles indicate that the young are at most risk of road traffic crashes in Kenya.

Road safety work was given a low profile in the first decade of Kenya’s independence. Odero et al. (2003) observe that there was no programmed, coordinated and country wide road traffic injury prevention system in this period. A national road safety improvement project was initiated in 1974 with the help of the Finnish government. The programme initially focused on development of organizational structure, law enforcement, crash investigation, driver training, vehicle inspection, first aid training, information, education and road safety research (GoK, 1983). Later on it focused on engineering improvement at
hazardous road locations, developing new road safety demonstration projects, traffic law enforcement and public education (Odero et al., 2003).

A major turning point in road safety in the country was heralded by the establishment of the National Road Safety Council of Kenya (NRSCK) in 1982. Its mandate was to set national policy on road safety, develop relevant implementation strategies, co-ordinate the work of all organizations involved in the promotion of road safety, acquire and monitor the use of resources and personnel for road safety work and formulate a long-term programme for effective road safety work in Kenya. Its membership was multisectoral and composed of relevant government ministries, organizations and institutions involved in road safety work in the country. At inception the NRSCK’s major goal was to reduce traffic fatalities to less than 1000 deaths per annum by 1993 (Mwasi, 1984). Over the years the NRSCK primarily focused on preventive measures like public information and identification of hazardous road sections (Odero et al., 2003).

The existence of an organizational framework (NRSCK), basic road safety legislation and policy and the formulation of specific targets, objectives and implementation plans have several advantages. However, reservations exist on the implementation and design of effective road safety measures in Kenya (GoK, 2005).

In the year 2003, the Government of Kenya focused on road safety in the public transport sector. This sector is dominated by small-scale public transport vehicles popularly known as Matatus (Muyia, 1995; Khayesi, 2004). The Matatu industry pays Kshs 1.09 billion
per year to the government in taxes, provides 80,000 direct jobs and another 80,000 indirect jobs (Chitere and Kibua, 2004). In addition, the industry plays leading role in the transportation of both people and goods in the country.

The origins of Matatu industry can be traced from the type of transport system that operated in Kenyan towns in the early 1960s. Initially, the Kenya Bus Service which was established in 1934 was the sole legal provider of public transport services in Nairobi, Mombasa, Kisumu, Nakuru and Eldoret (Aduwo and Obudho, 1992). However, this company could not cope with the increase in demand for transport services. Consequently, some enterprising individuals started charging fixed fares to passengers to take them to specific destinations. In 1973, the first President of Kenya, Mzee Jomo Kenyatta, while responding to lobbying from Matatu operators declared that Matatus were a legal mode of transport and could carry fare paying passengers without obtaining special licenses to do so but had to comply with existing insurance and traffic regulations (Chitere and Kibua, 2004; Aduwo and Obudho, 1992).

In the early 1960s, the total number of Matatus operating in Kenya was less than 400 (Chitere and Kibua, 2004). However, by the year 2003 the number of Matatus operating in Kenya was estimated at 40,000 (Aisingo, 2004). The Matatus largely comprised of vans, mini-buses and pick-ups. The increase in the number of Matatus over the years was also met with an increase in the number of road traffic crashes. For instance, road traffic crashes tripled from 3,578 in 1963, to 10,106 in 1989 and 11,785 in 1994 (Muyia, 1995). In these accidents, 2,014 people were killed, 6,650 were seriously injured and 11,094 had
minor injuries. *Matatus* account for approximately 19 percent of all traffic crashes in Kenya (Gachuhi, 2004). However, public transport vehicles were associated with disobeying traffic rules, overspeeding, playing loud music, reckless driving, overloading, harassing passengers, insecurity, chaos and death (Khayesi, 2004; Muyia, 1995). By the year 2003 there were over 10,000 traffic crashes in Kenya that resulted in 3,004 fatalities and 25,971 injured persons (Chitere and Kibua, 2004). Passengers commuting in *Matatus*, buses and trucks are the second largest vulnerable group to traffic crashes in Kenya after pedestrians (Nantulya and Reich, 2002). This discussion underscores the importance of initiating road safety interventions that target public transport in Kenya.

In October 2003, the Minister for Transport and Communications issued Legal Notice No. 161 that sought to regulate the Public Service Vehicle sub-sector (GoK, 2003). This legal notice was meant to make amendments of the Traffic Act (Cap. 40). The objectives of this legal notice were to: reduce crashes caused by overspeeding; enhance safety of commuters; ensure responsibility, accountability and competence of drivers and conductors; eliminate illegal drivers, conductors and criminals that had infiltrated the industry; and facilitate identification of vehicles and restrict their operation to authorized routes (GoK, 2004; Khayesi, 2004). The requirements of this legal notice included:

- Fitting of seatbelts in all public service and commercial vehicles.
- Fitting of speed governors in all public service and commercial vehicles whose tare weight exceeds 3048 kg in order to limit speed to 80 kph.
- Security vetting of drivers and conductors of a public service vehicles and compulsory wearing of badges and uniforms when on duty.
• Employment of drivers and conductors of public service vehicles on permanent basis.

• Compulsory re-testing of public service vehicle drivers after every two years to ascertain his or her level of competence.

• Every driver of a public service vehicle prominently displaying his or her photograph in the vehicle.

• Indication of route details and painting of a continuous yellow band on both sides and on the rear of matatus for ease of identification.

The Legal notice required that vehicles meeting these conditions be inspected and certified by the government motor vehicle inspection centres in different parts of the country. It also indicated that any person who owns, drives or has charge of a taxicab or matatu and contravenes or fails to comply with these provisions could pay a fine or face imprisonment. There was also the possibility of withdrawal of certification in case of continuous contravention of these regulations. A passenger found not wearing a seatbelt would also be subjected to a fine.

The effective date for the enforcement of the traffic act was 1st February, 2004. Throughout the year 2004 the above reforms were vigorously enforced by the Ministry of Transport, traffic police and the Transport Licensing Board. There were arrests by police, crackdowns and hotlines that were used by the public to report non-compliers to the Ministry of Transport (Khayesi, 2004). The enforcement of these road safety measures led to a decline in the number of road traffic crashes in Kenya by 73 percent in the first
six months of the enforcement of the legal notice (GoK, 2004). Table 1 offers details of the decline in traffic crashes. However, the supplied figures may actually be biased due to the observation that during that time many public service vehicles were withdrawn from the roads.

Table 1: Number of Traffic Crashes before and After Enforcement of the Traffic Act

<table>
<thead>
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<th>Feb-July, 2003</th>
<th>Feb-July, 2004</th>
<th>Percentage Drop</th>
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<tr>
<td>Fatal Accidents</td>
<td>1,047</td>
<td>616</td>
<td>41%</td>
</tr>
<tr>
<td>Serious Accidents</td>
<td>2,110</td>
<td>1,199</td>
<td>43%</td>
</tr>
<tr>
<td>Slight Accidents</td>
<td>3,445</td>
<td>2,092</td>
<td>39%</td>
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</table>

Source: MOTC Report (GoK, 2004)

Nonetheless, there are concerns that the gains made are slowly being eroded. Many factors are to blame for this concern such as failure to involve stakeholders and lack of accurate information, thus studies to inform road safety measures should be encouraged.

1.2 Research Problem

Basic road safety legislation and policy has existed in Kenya since independence (GoK, 2005) but have not been properly enforced (Chitere and Kibua, 2004; Khayesi, 2004; Odero et al., 2003; Mwasi, 1984). This poor enforcement is largely to blame for the increase in road traffic crashes in the country. Thus attempts to curb road traffic crashes in the country have been recommended. The Traffic Act was enforced in Kenya from 1st February 2004. This enforcement led to a marked decline in road traffic crashes (GoK, 2004). However, the effects of this enforcement on the severity of injuries are largely
unknown. This is despite the fact that severity of injuries determines the morbidity and mortality outcomes of victims of road traffic crashes. It is therefore important to determine whether there is a change in the nature, type and severity of these injuries. Without this knowledge, it will be difficult to audit and design effective road safety measures in Kenya.

This study is designed to examine the effects of the enforcement of Traffic Act on the severity of injuries using a sample of road traffic crash victims, admitted at the Rift Valley Provincial General Hospital (RVPGH), Nakuru, between 1st February 2003 and 31st January, 2005. This is the period corresponding to one year before the enforcement of the traffic act (1st February, 2003 to 31st January, 2004) and one year thereafter (1st February, 2004 to 31st January, 2005). RVPGH has a very high number of trauma admissions, probably related to its proximity to the busy Trans-African highway as well as its position as one of the main referral hospitals for the vast Rift Valley province. Masiira- Mukasa and Ombito (2002) observe that trauma, particularly due to road traffic crashes is a growing public health concern in this region that urgently calls for specific intervention measures.

1.3 Research Questions

1) What is the magnitude and pattern of injuries in patients admitted at RVPGH from motor vehicle crashes one year before the enforcement of the amended traffic Act?

2) What is the magnitude and pattern of injuries in patients admitted at RVPGH from motor vehicle crashes one year after the enforcement of the amended traffic Act?
3) To what extent has the enforcement of Legal Notice Number 161 of 2003 changed the injury severity levels of road traffic crash victims admitted at the RVPGH?

4) To what extent has the enforcement of the amended Traffic Act changed the demographic profile of road traffic crash victims admitted at the RVPGH?

5) What are the perceptions of health workers at RVPGH on changes in injury severity levels of road traffic crash victims admitted at the RVPGH following the enforcement of the amended Traffic Act?

1.4 Null Hypothesis

There is no difference in the level of injury severity among motor vehicle crash victims visiting RVPGH before and after the enforcement of the Traffic Act.

1.5 Study Objectives

1.5.1 General Objective

The general objective of this study was to examine the effects of the enforcement of the Traffic Act on injury severity using a sample of motor vehicle crash victims, who were admitted at the RVPGH, Nakuru between 1st February 2003 and 31st January, 2005.

1.5.2 Specific Objectives

1) To establish levels of injury severity among motor vehicle crash victims who were admitted at the RVPGH during the one-year period before the enforcement of the Traffic Act.

2) To determine injury severity levels among patients admitted at the RVPGH following motor vehicle crashes one year after the enforcement of the traffic Act.
3) To establish whether the enforcement of the amended traffic act had any impact on injury severity levels among motor vehicle crash victims who were admitted at the RVPGH.

4) To establish whether the enforcement of the traffic act caused any shifts in the demographic profile of patients admitted at the RVPGH.

5) To assess the perceptions of health workers on the effects of the enforcement of the amended Traffic Act on injury severity levels.

1.6 Study Significance

This study enhances our understanding on the effects of the enforcement of the Traffic Act on injury severity in Kenya. It also offers systematic profiles of injury severity levels among motor vehicle crash victims who are treated at the RVPGH. This information is vital for both healthcare management and road safety policy development. Odero et al. (2003) argue for the need to raise the awareness of policy makers on the effectiveness of the existing counter measures to road traffic crashes.

1.7 Study Limitation

Several limitations should be considered when interpreting the results of this study. First, the study is restricted to patients who were admitted in the RVPGH. Therefore, data on motor vehicle crash victims who died prior to arriving at RVPGH, who were treated at RVPGH as outpatients or who did not require any medical care could bias the results. Second, the data were collected retrospectively from medical records. Medical records may not contain all the data that a particular study requires. In this study, information on
the use of seatbelts, the use of intoxicants and the sitting position of a victim in a vehicle during the crash would have been very informative. However, such information was missing from patient records at RVPGH. Consequently the study could not control for the effects of these variables and this limits the interpretation of the results.

In addition, some information relating to injury severity for some sampled patients was not available from medical records, leading to the possibility of underestimating the magnitude of injury severity from motor vehicle crashes at the RVPGH. In such cases, attempts were made to replace the sampled patient with another one who was randomly selected.
2 LITERATURE REVIEW

2.1 Introduction

The effects of road safety measures on injury severity continue to attract a lot of scholarly interest. This chapter reviews this literature. It begins by examining the concept of injury severity. It then reviews literature on the effects of road safety measures on road traffic injuries. Finally it discusses the results, approaches and methods used in previous studies to examine this topic. From this review of literature, a conceptual framework that links road safety measures and injury severity is then offered.

2.2 The Concept of Injury Severity

Defining the term injury is not easy. Injury severity describes the impact of injury by the extent of tissue damage, (the pathological evidence of trauma) and/or the physiological response of the body to that damage (Expert Group on Injury Severity Measurement, 2004). Stoner (2006) notes that injuries are caused by acute exposure to physical agents such as mechanical energy, heat, electricity, chemicals and iodizing radiation interacting with body in amounts or rates that exceed the threshold for human tolerance. In other cases (for example, drowning and frostbite) injuries may results from the sudden lack of essential agents such as oxygen and heat. Injuries have also been defined as sudden series of occurrences in the interplay between the individual, object and environment that result in tissue damage to a personal (Tercero, 2007).

Currently, there is need to obtain information to monitor trends in injury events, plan interventions, identify emerging health and safety issues and to determine the costs of injury to society. These efforts require valid measures of injuries. Two types of
 classifications of injury severity have been used in previous studies namely the Abbreviated Injury Scale (AIS) (Gennarelli and Wodzin, 2005) and the clinical modification of the International Classification of Diseases (ICD) (World Health Organization, 1992). Both types of indicators of injury severity have been widely utilized in the developed countries (Expert Group on Injury Severity Measurement, 2004). The AIS does not require expensive proprietary software to analyze data and thus is widely used in the developing countries for instance in Saudi Arabia (El Sadique et al., 2004), Nicaragua (Tercero, 2007) and Kenya (Saidi, 2004). Following this observation, the AIS was used in this study.

The AIS involves converting injury diagnosis and text descriptions of injuries into AIS90 codes (AAAM, 1990). Then each injury is categorized by body region (head or neck, chest, abdominal or pelvic contents, extremities or pelvic girdle and general) and by severity (0: no injury; 1: minor; 2: moderate; 3: serious, not life-threatening; 4: severe, life-threatening-survivable; 5: critical, survivable-uncertain; 6: fatal-unsurvivable) (Gennarelli and Wodzin, 2005). For multiple injuries affecting more than one body region, codes are assigned on the basis of the injury with the highest severity. The AIS scores are shown in Figure 1 below.
A higher severity score indicates a progressively more severe injury (O'Keefe and Jurkovich, 2001). An AIS score of 1 translates to a minor injury, while an AIS score of 6 is deemed an unsurvivable injury. It is important to note that the scores from 1 to 6 do not reflect an interval scale, and similar AIS scores may not be comparable across body regions (MacKenzie, 2000). For example, an AIS 3 score for head trauma may reflect an injury of different severity than an AIS 3 score for another body region, such as the extremities.

Severity scores are subjective assessments assigned by experts. They are implicitly based on four criteria: threat to life, permanency of injury, impairment, treatment period and energy dissipation (Stoner, 2006). Injuries with greater magnitude of these criteria are weighted to reflect greater severity. AIS values are considered to be well ordered within the body regions (Expert Group on Injury Severity Measurement, 2004). Care was taken to ensure that severity scores were assigned accurately in this study.
2.3 Road Safety Measures and Road Traffic Injury Severity

A road traffic crash is an event involving a motor vehicle that results in harm. Road traffic safety deals exclusively with how to reduce the number and consequences of road traffic crashes. It aims at reducing the harm that results from usage of roads by vehicles. This harm occurs either as damage to property, death or injury.

Contributing factors to road traffic crashes include the driver, the vehicle or the road itself (Assum, 1998). Incompetent drivers, illness, fatigue and driver error usually cause road traffic crashes (Chitere and Kabua, 2004; Muyia, 1995). Assum (1998) lists brake failure, steering problems, control of maximum speed and throttle as vehicle specific factors that lead to crashes. Sight distance and poor roadside clear zones are road specific features that have also been blamed for motor vehicle crashes (European Road Safety Observatory, 2006a; Khayesi, 2004). Road safety interventions seek to reduce or compensate for these factors, or reduce the severity of crashes that do occur. A comprehensive outline of interventions areas for traffic crashes are described in Management systems for road safety (European Road Safety Observatory, 2006b). Some of these interventions were emphasized by Legal Notice No. 161 that sought to regulate the Public Service Vehicle sub-sector in Kenya (GoK, 2003). This included fixing of speed governors, use of seatbelts, sticking to given routes and driver behaviour particularly discipline and competence. Underlying these interventions is the enforcement status of road safety measures.
2.3.1 Safety Belts as a Measure for Road Safety

A seat belt, which is sometimes called a safety belt, is a safety harness that is designed to secure the occupant of a motor vehicle against harmful movement that may result from a collision, rollover or sudden stop. Seatbelts function as an overall occupant restraint system. They are intended to reduce injuries by stopping the wearer from hitting hard interior elements of the vehicle or other passengers and by preventing the passenger from being thrown out of a motor vehicle.

Two of the most common types of seatbelts in motor vehicles are the lap seatbelt and the three-point seatbelt (Ferrini, 1997). The lap is an adjustable strap that goes over the waist. There is evidence that lap seatbelts have the potential to cause separation of the lumbar vertebrae and the sometimes associated paralysis or seat belt syndrome (Burriel et al., 2007). This has led to a revision of passenger safety regulations in the developed world requiring that all seats in motor vehicles be equipped with three-point seatbelts (European Road Safety Observatory, 2006b; Ferrini, 1997).

The three-point seatbelt is made up of a lap and shoulder harness, but in one single continuous length of webbing. This helps to spread out the energy of the moving body in a collision over the chest, pelvis, and shoulders. The seatbelt is considered an effective restraint in case of motor vehicle crashes particularly in the developed countries (European Road Safety Observatory, 2006b).
Seatbelts are effective in reducing the risk of injury in motor vehicle crashes (Bener et al., 2007; Bendak, 2005; El Sadiq et al., 2004). Allen et al. (2006) have demonstrated that unbelted occupants of motor vehicles that crash are more likely to require inpatient admission and to have sustained a severe injury to numerous body regions than are belted occupants. Similar results are reported by Kaplan and Cowley (1991) in a study in the USA which showed that seatbelts reduced the total number of injuries by 34 percent, major injuries by 57 percent, minor injuries by 20 percent and deaths in the belted group to zero. However, Rivara et al. (2000) while showing similar rates in reducing fatalities found an associated increased risk of serious injury to chest and abdomen. In another study in Surrey, Thomas (1990) found out that the number of those who escaped injury increased by 40 percent and those with mild and moderate injuries decreased by 35 percent after seatbelt legislation. There was also a significant reduction in soft tissue injuries to the head. Only whiplash injuries to the neck showed a significant increase in this study. Such divergence of opinion may be attributed to failure of specifying the type of seatbelt used in these studies.

Studies on usage of seatbelts and their effects on injury severity in Kenya are scarce. However, the usage of seatbelts in Kenya has been shown to be 3 percent of patients admitted in Kenyatta National Hospital (Saidi, 2004). It is not clear whether the enforcement of the amended traffic Act, which made the usage of seatbelts as compulsory in public service vehicles, had any effects on the injury severity levels in the country.
2.3.2 Speed Governors as a Measure for Road Safety

A governor is a device that is used to measure and regulate the speed of a machine. Speed governors work using various principles in physics. For example, the centrifugal governor, also known as the Watt or fly-ball governor uses weights mounted on spring-loaded arms to determine how fast a shaft is spinning, and then use proportional control to regulate the speed of a shaft. Motor vehicles are a common application for speed governors.

There are two types of motor vehicle governors. The first type limits the rotational speed of the motor vehicle engine, while the second limits the speed of the vehicle. Speed governors play two important roles. First, they are useful in the protection of the engine from damage that may occur from excessive rotational speed or pushing the engine beyond its peak abilities. Second, in larger, higher performance engines, governors are used to limit the speed of the vehicle. This helps to reduce undesirable incidences such as tyre failure that occur in high speeds. Both roles of the speed governors are important in mitigating the chances of motor vehicle crashes. Many countries have legislation that stipulates the maximum speed for heavy commercial vehicles and public transport vehicles; however the issue of tampering with them is rampant (Chitere and Kibua, 2004; Khayesi, 2004; Assum, 1998).

Speed governors have been shown to be effective measures for lessening severity of injury in cases of motor vehicle crashes (European Road Safety Observatory, 2006c). There is some evidence that lower speeds result in fewer collisions and therefore in
reduced injury severity (European Road Safety Observatory, 2006c; 2006d). On average it is documented that a one percent change in speed leads to a two percent change in crashes causing injuries, a three percent change in crashes causing severe injuries and a four percent change in fatal crashes (European Road Safety Observatory, 2006d). On the other hand, Brooks (2006) suggests that the increase of speed limit from 55 mph to 65 mph actually lowers the number of crashes and therefore fatalities in the USA. This difference in opinion can be explained partly by the observation that drivers tend to drive at 15mph more than the stipulated speed limit (European Road Safety Observatory, 2006d; Ritcher et al., 2006). This may therefore be a reflection of the behaviour of drivers and not necessarily the effects of speed governors. Studies examining the effectiveness of speed governors in Kenya are not readily available but there is evidence that drivers tend to tamper with the gadget (Khayesi, 2004; Chitere and Kabua, 2004). It is unclear whether the enforcement of the amended traffic Act, which requires speed governors to be fitted in all public service vehicles, has any effect on the injury severity levels in the Kenya.

2.3.3 Changing the Behaviour of Motor Vehicle Users as a Road Safety Intervention Measure

Behaviour refers to the ways in which individuals respond to given conditions when using motor vehicles. Several studies have shown that the behaviour of motor vehicle users affects severity of injuries in cases of traffic crashes. For example, Cradon et al. (2006) found that drivers of new vehicles were more likely to use seat belts than drivers of old vehicles. Further, the study established that females were significantly more likely to wear seat belts than males, both when driving and as front seat passengers. Allen et al.
(2006) also indicated that unbelted occupants of motor vehicles involved in crashes are most likely to be young males who had used alcohol. These unbelted occupants were also more likely to require inpatient admission and to have sustained a severe injury to numerous body regions than the belted occupants.

In Kenya, Saidi (2004) found that only 2 out of 61 victims of traffic crashes admitted at Kenyatta National hospital had used a safety belt. Moreover, 26 percent of these patients had used alcohol. In this study, drivers and males were more likely to have used alcohol. Another study in Eldoret found that 97 percent of the interviewed drivers had been involved in one or several motor vehicle crashes (Muyia, 1995). This high incidence of motor vehicle crashes can be traced to poor working conditions and lack of adequate training for public service vehicle drivers in Kenya (Chitere and Kibua, 2004). It is unclear whether the disciplinary measures particularly for drivers, which were incorporated in the amended traffic act, had any effects on the injury severity levels in the Kenya.

2.3.4 Enforcement of Traffic Laws

Enforcement of the traffic act can be defined as any instruments such as surveillance, policing and reward systems that encourage the public to comply with road safety measures. The enforcement of Traffic law influences driving behaviour through two processes: general deterrence and specific deterrence (European Road Safety Observatory, 2006c). General deterrence refers to the impact of the threat of legal punishment on the public at large while specific deterrence can be seen as the impact of actual legal punishment on those who have been apprehended. Thus, general deterrence
results from the perception of the public that traffic laws are enforced and that there is a risk of detection and punishment when traffic laws are violated. On the other hand, specific deterrence results from actual experiences with detection, prosecution, and punishment of offenders.

The enforcement of traffic laws is among the most important instruments that are used to secure or improve compliance with traffic law. In the literature the concepts of ‘traffic law enforcement’ and ‘police enforcement’ are often used interchangeably. However, the concepts differ in width. Traffic law enforcement is wider and covers the entire enforcement chain, from detection of a violation through to the penalty while police enforcement refers to the actual work of detecting a traffic law violation, apprehending the offender, and securing the evidence needed for his prosecution. Police enforcement can only be effective if it operates in a supportive environment of laws, regulations, and a sensitive penal system. Consequently, the effectiveness of police enforcement cannot be seen in isolation from how police collaborate with the stakeholders.

Yannis et al. (2007) describe the hierarchy of road safety enforcement (Figure 2). The legal and organizational framework enabling police enforcement provides the foundation for the actual policing operations. Such a framework will result in well-planned, intensified police controls on selected locations of the road network, resulting in an increase in the perceived risk of apprehension. As a result, violation rates will decrease. Changes in road user behaviour will result in less traffic crashes and less traffic victims and injuries, and in reduced costs for society (social benefits).
The European Road Safety Observatory (2006c) argues that enforcement targeted at a limited number of high risk violations is more effective in reducing road crashes than non-targeted general enforcement primarily due to heavy organizational, road safety and communication requirements that are involved. Further, police enforcement is more effective if it is accompanied by publicity, is unpredictable and difficult to avoid, uses a mix of highly visible and less visible activities, is primarily focused on times and locations with high violation (maximum feedback to potential offenders) and is continued over a longer period (Goldenbeld, 1995). The enforcement of the traffic act in Kenya should use such guidelines.

Enforcement of traffic laws in many developing countries has been poor. This poor enforcement is usually caused by inadequate resources, administrative problems and corruption (Chitere and Kibua, 2004; Nantuliya and Reich, 2002). Specifically, corruption is a big problem in developing countries which creates a cycle of blame – the police blame drivers and the public, the public blames the police and the drivers blame the police. Corruption also extends to the registration of motor vehicles. Chitere and
Kibua (2004) point out that the enhanced regulatory requirements for public service vehicles in Kenya, increases the possibility of extortion for bribery by principal agents of government. Similar sentiments are offered by Gachuhi (2004) who point outs that the main weakness for traffic rules in Kenya has been lack of their enforcement by the government. Stakeholder involvement has been cited as a major limitation of the enforcement of traffic act in Kenya (Khayesi, 2004).

The enforcement status of road safety measures is considered to influence levels of traffic crashes (Williams et al., 1995). Natulya and Reich (2002) argue that poor enforcement of traffic safety regulations contributes to the high burden of road traffic injuries in developing countries. It is therefore expected that the strict enforcement of road safety measures should lessen the injury severity burden caused by motor vehicle crashes. However, it is not known whether the enforcement traffic act led to a decline in the pattern and magnitude of injuries sustained after motor vehicle crashes.

2.4 Methodological Appraisal of Previous Studies

This section offers a brief review of previous studies that examine the link between road safety measures and injury severity. It begins by offering a discussion of the approaches used in previous studies to address this topic. The section ends with an analysis of the methods used in previous studies to examine the link between road safety measures and injury severity.
2.4.1 Approaches to Measuring Road Safety Policy Effects

The effects of road safety policies have continued to attract a lot of scholarly interest. Road safety policy effects can be measured in two ways (Runhaar et al., 2006). One is to assess the situation after an intervention with the situation that would have occurred if the policy had not been implemented (the base case). This approach is most informative about actual policy effects but, it has practical difficulties, as it is hard to know for certain how things would have been if the policy had not been implemented.

The other is to measure the difference in a situation before and after a policy intervention. El Sadiq et al. (2004) have utilized this approach to investigate the effects of introduction of seat belts in the United Arab Emirates (UAE) on the level of injury severity. Figure 3 shows both approaches.

Figure 3: Two Approaches for Measuring Effects

![Diagram showing two approaches for measuring effects](source: Runhaar et al. (2006))
There are two types of Impact Assessment (IA): randomized experiments and quasi-experimented research designs. Randomized experiments use groups of participants that are sorted into at least two groups. Few studies on the effectiveness of road safety measures have attempted to adopt such designs. Despite the reliability of the results in this design, questions about its practicability always arise (Runhaar et al., 2006).

The second type of IA consists of non-randomized quasi-experiments in which the intervention group and the control group are only presumed to be similar (Rossi et al., 2004). This is the case in El Sadiq et al. (2004) study who examined the effects of seatbelt usage on severity of injuries in the United Arab Emirates. Designs using non-randomized controls universally yield less convincing results. This stems from the observation that such studies ignore the intrinsic value of developing road safety measures in collaboration (Runhaar et al., 2006).

To address this concern stakeholder participation is a promising avenue. More important stakeholders may also be a source of information when it comes to operationalisation (or estimation) of effects. Focus Group Discussions (FGDs) and Delphi surveys are useful means in this direction (Runhaar et al., 2006). Few studies on the effects of road safety measures on injury severity have taken advantage of such advice.

2.4.2 Methods for Measuring Road Safety Policy Effects

A majority of studies have examined the effects of a single road safety intervention. For instance, Bener et al. (2007), Bendak (2005) and El Sadiq et al. (2004) have each examined the effects of seatbelt legislation on severity of injuries. On the other hand
(European Road Safety Observatory, 2006d) showed that speed governors lessen the severity of injury in cases of motor vehicle crashes. Moreover, the behaviour of drivers has also been shown to affect the severity of injuries (Muyia, 1995). Crandon et al. (2006) found significant relationships between the personal characteristics and behaviour of drivers' in the usage of seatbelts. This study is particularly interesting as it suggest that the behaviour of drivers affects injury severity indirectly through compliance (or lack of it) with road safety measures. This study examined this observation.

Studies indicate that age, gender, time, usage of restraints and the presence of intoxicants affect injury outcomes (Crandon et al., 2006; Saidi, 2004). It is therefore important to control for these variables in future studies. However some of these control variables are controversial. For instance, Allen et al. (2006) found that male drivers exhibit a higher probability of involvement in serious/fatal crashes. In contrast, Kockelman and Kweon (2001) found that males are associated with decreased injury severity levels. Contextual factors such as differences in cultures among the samples in these two studies may explain the divergence in findings. Studies examining the effects of introduction of road safety measures should therefore demonstrate definitional rigour. This not only facilitates useful comparisons between studies but is a first step towards developing a clear and unifying theoretical and methodological direction in this topic. Consequently, this study applied rigorous definition of key variables.

To capture the effects between road safety measures and injury severity, studies have generally employed quantitative methods (for example, El Sadiq et al., 2004). Few
studies have used either qualitative methods or a combination of both. Thus the rich perspective that can be provided by the use of mixed methods is generally lacking. There is need to explore this concern.

The quantitative approaches utilized in previous studies employ a wide range of methods with a high level of sophisticated analytical approaches. For example, Kockelman and Kweon (2001) applied an ordered probit model to estimate the effects of driver, vehicle and crash on injury severity. Shankar et al. (1996) applied nested logic formulation for estimating crash severity likelihood conditioned on the use of a restraint system. Similarly, Chong et al. (2005) summarize the performance of four machine learning paradigms applied to modeling the severity that occurred during traffic crashes. The use of such a wide variety of methods maybe explained by the observation that most of these studies are either meant to test hypothesis or validate models. However, there are concerns on the use of parametric models with volatile data or events that tend to have many outliers. Thus data on injury severity requires more flexible statistical models such as the logit analysis and Chi-Square. Another stream of research has explored this direction.

Kockelman and Wang (2005) used a heteroscedastic ordered logit model to examine among others the effects of occupant characteristics on injury severity. Similarly, Allen et al. (2006) used logistic regression to compare the odds of having sustained an injury to specific body parts and of being admitted to an inpatient unit in unbelted individuals compared with those who were belted. It should be observed that the utilization of logit
models in previous studies involves usage of data that is not readily available from hospital records but from police records as well.

Elsewhere, El Sadiq et al. (2004) used chi-square tests to compare injury severity before and after the introduction of seatbelts. Similarly, Allen et al. (2006) used chi-square to test differences between belted and unbelted occupants of vehicles involved in road crashes.

A majority of previous studies use secondary data and especially hospital based data, (El Sadiq et al., 2004), police records (Odero et al., 2003) or road crash data bases (Kockelman and Kweon, 2001). A few have however used primary data using observation methods particularly when investigating seatbelt usage (Wells et al., 2001). Accident based databases are largely non-existent in Kenya, whereas police records may not be reliable (Odero, 2004). Thus hospital-based records remain the only meaningful source of motor vehicle crash data in Kenya. Therefore this study utilized hospital-based records.

The sampling procedures adopted by previous studies are also a matter of concern. A number of previous studies do not bother to indicate the sampling procedures they utilize. However, a few such as El Sadiq et al. (2004) have used probabilistic sampling procedures. Such weak utilization of robust sampling procedures places the generalizability of finding of such studies into wider contexts into question.
A majority of studies on the effect of adoption of road safety measures on injury severity have been done outside Kenya. The few studies that exist in Kenya such as Odero (2004) and Odero et al. (2003) tend to be descriptive. Need therefore exists to supplement such studies with studies that link road safety policy measures with injury severity. This study attempted to fill this knowledge gap.

2.5 Conceptual Framework
Chapter 1 indicated that the effectiveness of Legal Notice No. 161 that sought to regulate the Public Service Vehicle sub-sector in reducing the patterns and magnitude of injury severity among motor vehicle crash victims has not been documented. Effectiveness can be defined as the percentage reduction in injury severity in people applying a road safety measure compared to those that do not when a crash occurs.

Figure 4 present the major issues identified in the review of literature described in this chapter. For analytical purposes, the provisions of Legal Notice Number 161 of 2003 are grouped into three in this study, the first group focuses on the usage of safety belt, the second addresses issues of regulating speed through the use of speed governors and the final one is concerned with the discipline of public service vehicles crew. The reviewed literature suggested that the usage of appropriate seatbelts leads to decline in severity of injuries in case of a motor vehicle crash (Bener et al., 2007; El Sadiq et al., 2004). This review of literature also showed that the use of speed governors lessen the injury burden in case of a motor vehicle crash (European Road Safety Observatory, 2006d; Ritcher et al., 2006). Another stream of literature demonstrated that appropriate behaviour of motor vehicle users leads to decline in injury severity (Allen et al., 2006; Muyia, 1995). Finally,
it was established from literature that the enforcement of safety measures is very effective in reducing morbidity and mortality from motor vehicle crashes in addition to medical treatment costs of victims (European Road Safety Observatory, 2006d; Yannis et al., 2007; Khayesi, 2004).

Figure 4: The Relationship between Traffic Act, Enforcement and Injury Severity

The arrows show the direction of influence. Measures of road safety influence the level of severity. However, enforcement of these measures has an added influence on the level of injury severity in case of motor vehicle crashes. In other words, measures of road safety influence the severity of injuries from motor vehicle crashes if appropriate enforcement is present.
3 RESEARCH METHODOLOGY

3.1 Research Design

This was an *ex post facto* study that examined the effects of the enforcement of Traffic Act on the severity of injuries among motor vehicle crash victims attending the Rift Valley Provincial General Hospital (RVPGH), Nakuru. Mugenda and Mugenda (2003) describe an *ex post facto* study as one that is used to determine whether one or more variables causes or affects one or more outcome variables and where the researcher is not able to manipulate the independent variable(s). Essentially, *ex post facto* studies are designed to discover possible causes of outcomes in given subjects by comparing them with others whom the independent variable is not present. The distinguishing mark of *ex post facto* studies is that the researcher is not in a position to manipulate the independent variable since it has already occurred.

This study involved both quantitative and qualitative techniques. The quantitative component involved the analysis of secondary data that was obtained from hospital records. The qualitative component involved two Focus Group Discussions (FGDs) with the medical personnel of the RVPGH which assessed their perceptions on the effects of the enforcement of the traffic act on injury severity. FGDs played an important role of offering in-depth information that could not be obtained through analysis of secondary data.

3.2 The Study Area

This study was conducted at the Rift Valley Provincial General Hospital (RVPGH), Nakuru, a 650 bed public hospital located in Nakuru town approximately 160 km west of
Nairobi along the Trans-African highway. It is the third largest public hospital in Kenya and one of the main referral hospitals for the Rift Valley Province. The department of surgery with approximately 200 beds is the largest department of this public hospital. This hospital has a very high number of trauma admissions, probably related to its proximity to the busy Trans-African highway as well as its position as one of the main referral hospitals for the vast Rift Valley Province. This province is estimated to have a population of more than 7 million people (CBS, 2001).

Managing data is an important function of the medical records department in the RVPGH. There are two departments in the medical records, outpatient and inpatient. Usually the first contact with a patient is at casualty department. Here all patients are issued with a patient number before any services are offered. It's also in the casualty department that filtering of patients is done. Outpatients are treated and sent home. Patients requiring admission are screened and referred to the inpatient department. This inpatient department has one admission center where an inpatient number is issued. Each patient is offered a medical file where his or her details are recorded. Coding and indexing in these files is currently done using the ICD 10 codes. Inpatient’s files are stored using the straight numerical system of filing. Outpatient records are not filed because of shortage of space.

An examination of hospital records indicate that in the year 2007, the RVPGH attended to 59,612 new patients and 39,340 inpatients. There were 2,341 deaths recorded in the
same period. Patients visiting the hospital due road traffic crashes totaled 6,247. Thus 10 percent of new patient cases in the RVPGH are due to road traffic crashes.

3.3 The Study Population and Sampling Procedures

Hospital-based injury surveillance is an effective and potential means available for the prevention and control of injuries. However, its lack of representativeness is a concern due to people’s limited access to hospital services. There are also the possibilities of underreporting, ill defined catchment areas, lack of trained personnel for coding injury severity and missing entries that hospital-based studies face. Despite these challenges, it is possible and informative to conduct hospital based studies, if caution is however taken. Tercero (2007) calls for the inclusion of only inpatients on a regular basis to cater for feasibility and sustainability issues. Following this advice, the population of this study included all patients who were admitted at the Rift Valley Provincial General Hospital due to injuries sustained from public service motor vehicle crashes in the period ranging from 1st February, 2003 to 31st January, 2005. Injuries sustained from public service vehicles such as matatus and buses are assigned unique ICD codes. These codes were used to identify the study population. Consequently, a sampling list of all patients admitted at the RVPGH with injuries sustained in such vehicles was constructed from hospital records. From this exercise 854 patients were identified.

This sampling list was then divided into two strata. The first stratum was made up of all patients admitted at the Rift Valley General Hospital due to motor vehicle crash related injuries between 1.02.2003 and 31.01.2004 while the second consisted of similar patients
who attended the RVPGH between 1.02.2004 and 31.01.2005, the pre and post traffic enforcement periods respectively. In the first period, 499 patients were identified while in the second period 355 patients were identified. From the two sampling lists, simple random sampling procedures were used to select the study sample.

Following Bartelett et al. (2001) and Mugenda and Mugenda (2003), the minimum sample size for this study was obtained using the formula:

\[ n = pq (z^2) D / d^2 \]

where:
- \( n \) is the desired sample size
- \( p \) is the prevalence of road traffic injuries in Kenya which is estimated to be 0.1
- \( D \) is the design effect, taken as 2 in this study
- \( q = 1 - p \)
- \( z \) is the standard normal deviate
- \( d \) is the margin of error allowed (5% in this case).

Here \( p \) was calculated as follows:-

Approximately 30,000 people are injured annually from road traffic crashes (Odero et al., 2003). From this, the prevalence rate of road traffic injuries in Kenya is:

\[ \frac{(\text{Total number of road traffic crash victims per year})}{\text{Total Kenyan population}} \times 1000 \]

\[ = \frac{30,000}{30,000,000} \times 1000 \]

\[ = 1/1000. \] This translates into a proportion of 1/1000×100 = 0.1
Consequently the minimum sample size for this study was obtained as \( n = (0.1) (0.9) (1.96)^2 (2)/(0.05)^2 = 276 \) patients.

3.3.1 Inclusion Criteria

All motor vehicle crash related patients who were admitted at the RVPGH between 1.02.2003 and 31.01.2005 were considered. Further, these patients should have crashes involving public service vehicles as the cause of their injury as shown from the ICD based codes in their files. In cases where the retrieved medical files did not contain all the necessary data, the missing data was searched for from wards admission registers, nurses' reports books, theatre operation registers and radiology record books. Any sampled patient whose medical data was incomplete or missing after this search was replaced with another randomly selected patient from the study population until the minimum sample size was attained. Consequently, only data for patients whose medical records were available and complete was used in this study.

3.3.2 Exclusion Criteria

All the patients that were involved in all other traffic crashes and patients with incomplete medical records were excluded from this study. Further, those treated and discharged as outpatients and the dead were not included in this study. Patients involved in crashes involving private vehicles were also excluded.
3.4 Data Collection

Both primary and secondary data were collected in this study. Primary data consisted of the perceptions of the medical personnel of the RVPGH’s on the severity of injuries and road safety measures. Two Focus Group Discussions (FGDs) with surgeons, clinical officers and nurses working in the RVPGH were conducted. The first FGD involved seven surgeons. The second FGD included two nurses and six clinical officers. The researcher moderated these FGDs using a topical guide (Appendix 3). Personal notepads and camcorder were used to record the data for the two FGDs.

Secondary data involved retrieving medical files of all motor vehicle crash related patients falling within the period of interest and meeting the inclusion criteria. A coding scheme was developed to gather this secondary data. This coding scheme was made up of a coding schedule and a coding manual. The coding schedule captured the biodata, date of index attendance, injury severity and duration of hospital stay. This coding schedule is given as Appendix 1. On the other hand, the coding manual contained instruction to coders. It also included all the possible categories for each dimension being coded. This coding manual is offered in Appendix 2.

The research instruments for this study were pre-tested in order to improve their validity and reliability. Initially, the validity of the coding scheme was ensured through extracting variables from previous studies and testing them for relevance. Then a draft coding scheme was developed using inputs from experts in health information and surgery to improve its validity and reliability. This draft coding scheme was pre-tested using 15
patient files at the RVPGH. Data collected from this exercise was not reported but was used to refine the coding scheme.

To enhance the validity of the topical guide, a list of possible questions were submitted to critical analysis by experts in health sciences who assessed its construct and language clarity. Then, the revised topical guide was pre-tested using a FGD with six medical personnel at Naivasha Sub-District Hospital in order to test its consistency. Responses from this exercise were only used to improve the quality and administration of the topical guide.

These pre-tested research tools were used to gather data by the researcher with the help of two research assistants who were trained for this purpose. A team of seven surgeons helped in the scoring of severity in one session. Each scored every case alone and differences in scoring were resolved by discussion. During data collection, the research assistants were closely supervised by the researcher. In total data collection took 14 days.

3.5 Data Analysis

Variables for this study were summarized using percentages, frequencies, means, and standard deviations (SD). The data was also presented using graphs, tables and pie-charts. Patient age and the numbers of days spent in hospital by patients in the two periods of interest were compared using t-tests. Chi-square tests were used to examine differences in gender in the two periods of interest. Finally, to determine whether the distribution of injury severity differs significantly between the two periods of interest, a Kolmogorov-
Smirnov test for two unrelated samples (Cramer, 2000) was conducted. A p-value of less than 0.05 was considered significant. In addition the interpretations of medical staff on changes in injury severity during the study period were taken into account when analyzing the result of this study. Data variables for this study were coded and analyzed using the statistical software package Statistical Package for Social Sciences (SPSS) Version 12.

Data from the FGDs was initially recorded using a camcorder and later transferred into audio CDs. These audio CDs were then transcribed manually. The transcribed notes and moderator notes were summarized across the two FGDs sessions using content analysis. This exercise involved classifying data into meaningful categories based on the thematic issues addressed in this study. Units of data were then attached to appropriate categories manually. This involved indexing categories by recording where they occur in the moderator notes and transcripts. A search for key themes, patterns and relationships in the re-arranged data then followed. Here the categories were either subdivided or integrated as a way of refining and focusing the analysis. Finally, propositions and conclusion were made based on the apparent patterns or relationship within the data.

3.6 Ethical Consideration

Ethical clearance to conduct this study was sought from both the Graduate School of Kenyatta University and the medical superintendent of the RVPGH. Further, ethical clearance was obtained from the Ministry of Science and Technology under Research Permit Number MOST 13/001/37C 544/2 (Appendix 4). Confidentiality and privacy of
patient information was maintained throughout the data collection period. Extraction of patient information from files was done by personnel in the RVPGH records office in order to guarantee maximum privacy. Ethical standards in the handling of patient data were followed.
4 RESULTS AND DISCUSSION

4.1 Introduction
The aim of this study was to establish the effects of the enforcement of the Traffic Act on injury severity using a sample of motor vehicle crash victims admitted at the RVPGH. The findings of this study are presented in this chapter. This chapter is made up of two sections. The first section presents the results of the study while the second offers a discussion of these results.

4.2 Presentation of Results
This section begins by offering a description of the study sample. It then compares the characteristics of the sampled patients before and after the enforcement of the traffic act. Then a comparison of injury severity levels of patients admitted at the RVPGH before and after the enforcement of the Traffic Act is done. The section ends by reporting on the perceptions of surgeons and other medical professionals who attend to motor vehicle injury patients at the RVPGH.

4.2.1 Sample Characteristics
The study focused on two policy periods. The first period was between 1st February 2003 and 31st January 2004 while the second period was between 1st February 2004 and 31st January, 2005. In this section, data on sex distribution, age and length of stay in hospital of the sampled patients is presented.
A total of 854 patients were admitted at the RVPGH during the study period from injuries sustained in crashes involving public service and commercial vehicles. A sample of 276 of these patients was randomly selected from this population. Three quarters of these patients were men (Figure 5).

![Pie chart showing sample distribution by gender: 75% Male, 25% Female.]

Figure 5: Sample Distribution of Patients by Gender

The mean age of this sample was 31.49 years (SD = 14.58). Seven percent of the study sample were classified as children, of which eleven (58 percent) were males (Table 2).

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>11(58%)</td>
<td>8 (42%)</td>
<td>19 (7%)</td>
</tr>
<tr>
<td>Adult</td>
<td>195(76%)</td>
<td>62(24%)</td>
<td>257(93%)</td>
</tr>
<tr>
<td>Total</td>
<td>206(75%)</td>
<td>70(25%)</td>
<td>276(100%)</td>
</tr>
</tbody>
</table>

Table 2: Sample Distribution by Sex and Child/Adult Status

Each patient had a mean hospital stay of 10.35 days (SD = 20.65), while the mode was one day. The large SD relative to mean indicates that the data on the length of stay in
hospital is skewed. The mode of one day confirms that the distribution of length of stay is skewed to the right (positively skewed).

4.2.2 Comparison of Sample Characteristics in the Two Policy Periods

In the period before the enforcement of the traffic Act 499 victims of motor vehicle crashes were admitted in this hospital as compared to 355 patients thereafter. This was a 29 percent drop in admissions at the RVPGH due to injuries sustained from crashes involving public service and commercial vehicles.

For each policy period, 138 patients were randomly selected from hospital records. In each policy period, a quarter of the patients were females (Figure 6). Sex differences in both periods were not statistically significant ($\chi^2 = 1.914$, df = 1; $p = 0.167$). This gives us confidence to presume that the populations of patients visiting the RVPGH due to motor vehicle crash related injuries were similar in both policy enforcement periods.

![Figure 6: Gender Distribution of Patients Before and After Policy Shift](chart.png)
Patients admitted at the RVPGH before the enforcement of the traffic act had a mean age of 31.71 years (SD = 14.19) while those who were admitted thereafter had a mean age of 31.28 years (SD = 15.03). There were no statistically significant differences in mean ages of both policy periods (t = 0.206, p = 0.837).

On average patients stayed in hospital for 9.94 days (SD = 15.85) before the enforcement of the Traffic Act and 10.75 days (SD = 24.58) thereafter (Table 3). The difference between the mean lengths of stay in both policy periods was not statistically significant (t = -0.326, df = 274, p = 0.745). This indicated that the enforcement of the Traffic Act did not alter the length of stay in hospital by patients after a motor vehicle crash.

Table 3: The Length of Stay in Hospital in Both Policy Periods

<table>
<thead>
<tr>
<th></th>
<th>Before Policy Change</th>
<th>After Policy Change</th>
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<tbody>
<tr>
<td>Mean</td>
<td>9.94</td>
<td>10.75</td>
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<tr>
<td>Median</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Mode</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>15.85</td>
<td>24.58</td>
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<tr>
<td>Minimum</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>93</td>
<td>150</td>
</tr>
<tr>
<td>t = -0.326, df = 274, p = 0.745</td>
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<td></td>
</tr>
</tbody>
</table>

4.2.3 Differences in Injury Severity in Both Policy Periods

In both policy periods the frequency of patients with the AIS value of 3 was highest followed by AIS values of 6 and 1 in that order (Table 4). In other words, the sampled patients had serious, fatal and minor injuries in that order in both policy periods. There were no statistically significant differences in the frequencies of patients with various
levels of injuries before and after the enforcement of the Traffic Act (Most Absolute difference = 0.087, Kolmogorov-Smirnov Z = 0.722, p = 0.674).

Table 4: Frequency of Patients with Different AIS Scores

<table>
<thead>
<tr>
<th>Policy Period</th>
<th>AIS Scores</th>
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<tr>
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<td>1 2 3 4 5 6</td>
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<tr>
<td>Before</td>
<td>33 6 59 2 8 30</td>
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<tr>
<td>After</td>
<td>32 3 51 5 8 39</td>
</tr>
<tr>
<td></td>
<td>65 9 110 7 16 69</td>
</tr>
</tbody>
</table>

This finding indicates that the enforcement of the Traffic Act did not shift the profile of the severity of injuries among patients visiting the RVPGH. Thus the hypothesis that there is no difference in the level of injury severity among patients visiting RVPGH before and after the enforcement of the Traffic Act in Kenya is supported.

4.2.4 Perception of Medical Personnel on the effects of the enforcement of the Traffic Act

Two Focus Group Discussions (FGDs) were conducted in this study, one with surgeons and another with other medical professionals who handle motor vehicle crash victims. Both FGDs were content analyzed and two broad themes emerged. The first was on the effects of the enforcement of the Traffic Act on motor vehicle crashes and the second was on the inadequacies of road safety policies in Kenya.

Theme 1: The effects of enforcement of Traffic Act on Injury Severity

Two sub-themes emerged in this area namely, a decline in number of motor vehicle crashes and a shift in the types of injuries after the enforcement of the Traffic Act. These two sub-themes are described next.
Sub-theme 1

The enforcement of the Traffic Act led to a decline in the number of crashes

Participants in the FGDs suggested that the enforcement of the Traffic Act led to a decline in the number of motor vehicle crashes. "The volumes of motor vehicle crashes reduced tremendously. We used to be called at night to help with managing road traffic crash victims, but now we are seldom called," said one participant. Another one noted that before the enforcement of the Traffic Act almost all the occupants of a bus or matatu were injured. These statements suggested that the participants of the FGDs associated the enforcement of the Traffic Act with a decrease in road traffic crashes.

The participants agreed unanimously that the enforcement of the Traffic Act made some drastic and immediate changes to the impact of motor vehicle crashes but were concerned with lack of sustenance of these impacts. "Drastic changes were obtained but we are losing the battle," a participant commented.

Sub-theme 2

The enforcement of the Traffic Act led to a shift in types of injuries

The participants noted that there was an increase in soft tissue injuries (STIs). Another noted that "multiple fractures had decreased due to speed reduction." A participant also observed that there are now fewer severe injuries especially on drivers. This suggested that the participants associated the enforcement of the Traffic Act with changes in the types of injuries from motor vehicle crashes.
The participants also argued that the enforcement of the Traffic Act shifted the type of vulnerable road user from public service motor vehicle occupants to private vehicle passengers, cyclists and pedestrians. “There was a whole two weeks when all the patients in the ICU were from bicycle related crashes,” a participant observed.

The participants also noted that the enforcement of the Traffic Act led to a shift in the body regions injured after a motor vehicle crash. “Head injury patients used to sleep on the floor, they are now very few. We now work like in any other ward in the hospital,” a participant noted. Another participant reported that they are now witnessing an upsurge of safety belt related injuries.

Theme 2: The inadequacies of road safety policies in Kenya

Three sub-themes emerged in this area. The first focused on omissions in Kenya’s road safety measures, the second on inconsistencies in policy implementation while the third raised concerns on the quality of data that is used to inform policy development in the country.

Sub-theme 3

The road safety measures in Kenya are inadequate

The participants complained that the focus of enforcement of the Traffic Act was narrow and limited. Notable omissions mentioned included the interior safety design of public transport vehicles, the quality of seatbelts, health status of driving license applicants, children and airbags. One respondent noted that the seats of matatus are not firmly fixed on the chassis of vehicles, thus in the case of a crash, all the seats come off and this
causes injuries to passengers. Another noted that the metal bar that separates the driver’s cabin from the passenger area is the main cause of fractures to travelers. “This metal bar should be cushioned appropriately or replaced with plastic,” the participant advised. The design of seats in matatus should also be addressed to incorporate safety measures. “Most of these seats are made of blunt and sharp metals that need to be discouraged. The seats do not have head rests,” a participant said. Hence there is need to address the interior safety designs of vehicles.

The respondents saw the Traffic Act as being rigid. “This law does not address emerging issues such as airbags, the carrying of children and health status of drivers adequately,” one participant said. Thus road safety policies should have inbuilt systems to inform on their improvement.

Respondents also observed that the enforcement of the Traffic Act targeted only Public Service Vehicles (PSVs) but excluded other road users such as private vehicles, pedestrians and cyclists. “Some of the serious motor vehicle crashes in Kenya are attributed to drunk driving particularly by private vehicle drivers”, a participant commented. Thus the respondents viewed the enforcement of the Traffic Act as selective.

Sub-theme 4
Data in RVPGH is inadequate

The participants raised concerns on the quality of data that is used to inform roads safety measures in the country. A participant noted that “....data on the time of the traffic crash
and the type of vehicle involved is not always collected during history taking of the patient.” A tendency to code all road traffic crash victims into one default code raised spirited criticisms. One participant noted that most road traffic crash victims were recorded in one default code (V89). This code is meant for cases where the type of the crash vehicle can not be identified with reasonable confidence. When such data is used it leads to biased information, hence, inappropriate road safety policy.

Sub-theme 5

The enforcement of road safety measures was inconsistent

The participants raised concerns about the inconsistencies in the enforcement of road safety measures in Kenya. These concerns included changing policy enforcers, lack of policy ownership by the public and erratic enforcement. The participants complained that changing the minister in charge of transport was inappropriate. “Michuki (Minister for transport then) should not have been removed”, a participant said. The participants viewed the change of the minister as a case of policy instability that probably explains the erosion of the initial gains made by the enforcement of the Traffic Act.

The participants decried the haphazard manner in which some good intentioned road safety measures are enforced. Giving an example, a participant noted that the introduction of the alcohol blow was done at the exits of popular entertainment clubs. Another noted that in developed countries alcohol blow is only administered when one is suspected to be driving when drunk. Furthermore it was a screening test that should lead to a diagnostic test before charging the driver.
The participants were also concerned about the lack of ownership of the policy change. "The public did not own the policy enforcement process; they thought that it was a government project. It is better if the government started by educating the people on the need to adhere strictly to the Traffic Act", a participant said. The public lost enthusiasm and eventually failed to fully support the enforcement of the Traffic Act. The lack of public involvement led to the instability of the enforcement of the Traffic Act.

4.3 Discussion

This study found that the number of motor vehicle crash victims admitted in the RVPGH reduced with the enforcement of the Traffic Act. In the period before the enforcement 499 motor vehicle crash victims were admitted to this hospital while 355 patients were admitted thereafter. Therefore the enforcement of the traffic act led to a decline in the number of admissions to the RVPGH due to injuries sustained from crashes by public service vehicles by 29 percent. This is evidence that the enforcement of the Traffic Act reduced the number of motor vehicle crash victims. This finding collaborate official government records that indicate that the enforcement of the Traffic Act reduced the number of road crashes in the country (GoK, 2004). It is expected that the reduction in the number of road traffic crashes leads to a reduction in the number of motor vehicle crash victims.

This study established the profile of motor vehicle crash victims. Three quarters of these patients were men. This is a confirmation of previous studies in Kenya which show that men are over represented in motor vehicle crashes (Ating’a, 1990; Odero et al., 2003).
The gender distribution in this study is similar to that reported in Odero (2004) who showed that 77.8 percent of all motor vehicle crash victims in Nakuru are males. The over representation of males in motor vehicle crashes is consistent with traveling nature of men in Kenya, mainly in attempts to make a living.

The mean age of the sampled motor vehicle crash victims was found to be 31.49 years. This mean age falls within the range reported in Odero et al. (2003) and Akama et al. (2007) which show that males aged between 19 and 49 years are over represented in motor vehicle crashes. This mean age is indicative of the observation that people in the middle of their lives tend to travel often mainly to eke out a living. Thus they are more exposed to motor vehicle crashes.

Children made approximately 7 percent of the study sample. This finding agrees with the results reported by Odero (2004) that children involved in motor vehicle crashes make around 10 percent of all road traffic cases in Kenya. This finding is not surprising as children are not regular travelers in the country.

The gender distribution of motor vehicle crash victims in the period before and after the enforcement of the Traffic Act in Kenya was similar. Males constitute approximately three quarters of these patients in both periods. This suggests that the populations of patients treated at the RVPGH with injuries due to motor vehicle crashes were similar in both periods. It is also a further indicator of the profile of the typical motor vehicle crash victim. The profile of the typical motor vehicle crash victim constructed in this study is
that of a productive young male. The enforcement of the Traffic Act appears to have no impact on this profile. This means that motor vehicle crashes continue to have negative impacts on the most productive age group of the Kenyan male population.

This study also contrasted the length of stay in hospital in the two periods. On average patients stayed in hospital for 9.94 days before the enforcement of the Traffic Act and 10.75 days thereafter. The difference in the length of stay in hospital during the two policy periods is not statistically significant. This finding differs from a previous study in the United Arab Emirates that show a reduction in the length of hospital stay after implementation of road safety measures (El Sadiq et al., 2004). The result is also at variance with the finding in Allen et al. (2006) who demonstrated that unbelted occupants of motor vehicles that crash are more likely to require inpatient admission and to have sustained a severe injury to numerous body regions than are belted occupants.

Establishing the differences in length of stay in hospital in the two periods may be taken as a crude indicator that the patients had similar levels of injuries in both periods. It may also allow us to estimate the individual gains (or losses) one incurs after the enforcement of the Traffic Act. In this study it emerges that the enforcement of the Traffic Act did not alter the average length of stay in hospital for patients after a motor vehicle crash. This suggests that the implementation of the Traffic Act may not have had any impact on injury severity or individual gains, especially in terms of length of stay in hospital.

The frequencies of patients with minor, serious and fatal injuries in both policy periods were high. These are AIS scores of 1, 3, and 6 respectively. In contrast the frequencies of
motor vehicle injury patients with moderate, severe or critical injuries were low in both periods. These are AIS scores of 2, 4 and 5 respectively. This study did not establish any significant changes in the levels of injury severity as measured using AIS in both policy periods. Therefore, the hypothesis that there is no difference in the level of injury severity among patients visiting RVPGH before and after the enforcement of the Traffic Act in Kenya is supported. This means that the enforcement of the Traffic Act did not shift the profile of injury severity among patients visiting the RVPGH. These findings contrast with results reported by El Sadiq et al. (2004) who found a shift in AIS levels after introduction of safety belt measures in the UAE. The finding also differs with previous studies which show that seatbelts as road safety measures are effective in reducing the risk of injury in motor vehicle crashes (Bener et al., 2007; Bendak, 2005; Rivara et al., 2000; Kaplan and Cowley, 1991; Thomas, 1990). The differences with this study can be explained from the observation that the enforcement of the Traffic Act in Kenya targeted only public service vehicles. Consequently, the narrow and limited focus of the enforcement of the Traffic Act was not able to shift injury severity among motor vehicle crash victims.

Two broad themes emerged from the FGDs. In the first theme it emerged that the enforcement of the Traffic Act led to a decline in number of motor vehicle crashes. The FGDs participants associated the enforcement of the Traffic Act with changes in the types of injuries from motor vehicle crashes. They cited increases in soft tissue injuries and safety belt related injuries. They also argued that cases of multiple fractures and head injuries had decreased. These perceptions of RVPGH medical staff on shifts in injury
severity appear to differ with the findings of secondary analysis of hospital records. However, these perceptions are in agreement with the literature that shows that lap seatbelts have the potential to cause separation of the lumbar vertebrae and the sometimes associated paralysis or seat belt syndrome (Burriel et al., 2007). The perceptions also agree with the findings by Rivara et al. (2000) which demonstrated that the use of seatbelts increased the risk of serious injury to the chest and abdomen. Together, this evidence suggests that it is important from a policy point of view to address the issue of usage of appropriate seatbelts.

The second theme focused on inconsistencies in policy enforcement and the omissions in Kenya’s road safety measures. The participants gave examples such as the transfer of policy enforcers, lack of policy ownership by the public and erratic road safety policy enforcement. The participants identified omissions from the current motor vehicle safety measures as the lack of elaborate mention of the interior safety design of public transport vehicles, health status of driving license applicants, children, airbags and the quality of seatbelts and passenger seats. Omissions in policy can be eliminated if all stakeholders are involved in policy development (Runhaar et al., 2006). Policy ownership and stability are preconditions for obtaining sustainable effects particularly in road safety (Khayesi, 2004; Chitere and Kabua, 2004).

The FGDs participants raised concerns on the quality of data that is used to inform roads safety measures in the country. When poor quality data is used it leads to biased road safety policy. The default code V89 which is reserved for cases where the type of the
crash vehicle cannot be identified with reasonable confidence can best illustrate this point. This observation is in agreement with the findings reported in Tercero (2007) that hospital-based data may suffer from the possibilities of underreporting, ill defined catchment areas, lack of trained personnel for coding injury severity and missing entries. This is an indication that poor quality data may lead to inappropriate policy choice. However, they are various ways to minimize bias for instance the use of multiple data sources, involvement of stakeholders (Runhaar et al., 2006) or even the inclusion of only inpatients on a regular basis to cater for feasibility and sustainability issues (Tercero, 2007).
5 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The effects of the enforcement of the Traffic Act in Kenya in the year 2004 on the severity of injuries among motor vehicle injury patients have not been documented. This study addressed this knowledge gap using a sample of motor vehicle injury patients admitted to the Rift Valley General Hospital, Nakuru. The hospital was selected due to its very high number of trauma admissions, probably related to its proximity to the busy Trans-African highway and its position as one of the main referral hospitals for the vast Rift Valley province.

A retrospective research design was adopted. This study focused on two periods. The first period was between 1st February 2003 and 31st January 2004 while the second period was between 1st February 2004 and 31st January, 2005. These are the periods covering one year before and one year after the enforcement of the Traffic Act in Kenya. All victims of crashes involving public service and commercial vehicles admitted in these two periods at the RVPGH formed the population of this study. For each period 138 patients were selected from hospital records using simple random sampling procedures.

Secondary data from patient records at the RVPGH was used. Data was collected using a coding manual which captured among others, the patients bio-data, injury severity and medical history. The severity of the injuries was measured using the Abbreviated Injury Scale (AIS). Two Focus Group Discussions (FGDs) with Rift Valley General Hospital staff (surgeons, nurses and clinical officers), who handle motor vehicle injury patients
were also conducted to supplement the secondary data. Data was collected using pre-
tested research tools with the help of two trained research assistants.

Descriptive statistics were used to summarize and present data. In addition, the difference
between severities of injuries in the two periods was analyzed using Kolmogorov-
Smirnov test. Qualitative data was analyzed using pattern matching of key themes and
relationships.

The study found out that the number of admissions in the RVPGH occurring from
injuries sustained in crashes involving public service and commercial vehicles reduced by
29 percent in the two policy periods. The age and gender profiles of the sampled patients
also remained the same in both policy periods. A key finding of this study is that the
frequencies of patients with different levels of injuries remained the same in both periods.
In both periods most patients had severe, fatal or minor injuries in that order. These are
AIS Scores of 3, 6 and 1 respectively. Thus the severity of injuries never changed despite
the enforcement of the Traffic Act. Thus the hypothesis that there is no difference in the
level of injury severity among patients visiting RVPGH before and after the enforcement
of the Traffic Act in Kenya is supported.

Medical staff had different opinions on the type of injuries. Surgeons said that abdominal
and chest related injuries had increased due to the use of seatbelts while other medical
staff suggested that there was a decline in head injuries. These FGDs also noted that the
road safety policies in Kenya were inadequate. Specifically these policies failed to capture emergent issues such as airbags and their enforcement was haphazard.

5.2 Conclusion

Six conclusions can be made from the results of this study:

1) In both policy periods, the most common AIS values among patients admitted at the RVPGH due to injuries sustained from crashes involving public service and commercial vehicles are 3, 6 and 1 in that order.

2) The profile of injury severity among patients admitted at the RVPGH due to injuries sustained from crashes involving public service and commercial vehicles does not change with the enforcement of the Traffic Act.

3) Males aged on average 31.49 years are most exposed to crashes involving public service and commercial vehicles within the RVPGH catchment’s area.

4) The age and sex profile of patients admitted at the RVPGH due to injuries sustained from crashes involving public service and commercial vehicles does not change with the enforcement of the Traffic Act.

5) Seatbelt related injuries emerged after the enforcement of the traffic act in the RVPGH.

6) Road safety measures enforced in the year 2003 in Kenya were inadequate and discriminatory.
5.3 Recommendations

Based on above conclusions five broad categories of recommendations on the way forward are offered. These include factoring injury severity in policy development, involving the public in road safety policy development, educating the public and medical personnel on actual trends in motor vehicle crashes and areas for future research.

The study recommends that injury severity should be incorporated into the country’s road safety policy. Policy makers can prioritize the minimization of minor, serious and fatal injury severity levels and focus on males aged around thirty years in their campaigns. Likewise medical personnel should prepare to handle similar profiles of injuries and people in the event of motor vehicle crashes.

There is need to fully involve the public on road safety policy development. A starting point will be to identify all the stakeholders and to define their specific roles in road safety policy development and enforcement. This will be a sure way to enhance the ownership of road safety measures in the country.

The study also recommends that more studies should be conducted particularly using different injury severity scales, methods and with different samples. A databank on injury severity should be set up. This data bank should include basic data on traffic crashes. It should also include data on the severity of injuries in the country. Such data is currently lacking in Kenya. Training of officers in data management should also be prioritized. Further studies profiling injury severity from motor vehicle crash victims who are treated
in other hospitals should conducted. There is also room to use other injury severity scales in such studies. In addition future research should examine injury severity among cyclist and pedestrians.

The need for educating the public on road safety measures deserves emphasis. Such education can focus on awareness of the key components of road safety measures, injury severity and the handling of motor vehicle crash victims. The mass media, brochures and outreach programmes to communities are some suggested methods to accomplish public education. Media campaigns to highlight injury severity in the country can target the profile of injury severity that is documented in this study. Such a media campaign can also be targeted to the males of around thirty years in age.
REFERENCES


## Appendix 1 Coding Schedule

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age</th>
<th>Gender</th>
<th>Attendance/ admission date</th>
<th>Body region injured</th>
<th>Injury severity (AIS score)</th>
<th>Date of Discharge/ abscond/ death</th>
<th>Length of stay in hospital</th>
</tr>
</thead>
<tbody>
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</table>

### Body Region Injured

1 = Head/ Neck
2 = Chest
3 = Abdominal and pelvic regions
4 = Extremities or pelvic girdle
5 = General

### Injury Severity

AIS score ranges from 1 (minor injury) to 6 (injury that leads to death). Higher scores indicate greater injury severity.

### Length of stay

The duration of the patient's stay in the hospital.

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**Criteria for Stay**

1. **Threat to Life**
2. **Permanency of Injuries**
3. **Severity of Injuries**
4. **Comorbidities**

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Appendix 2 Coding Manual

Age - Age of patient in years

Gender
Male = 1
Female = 2

Admission / attendance date - Day ______ Month

Date of discharge - Day ______ Month ______ Year ______

Number of days spent in hospital - Subtract day of admission from date of discharge and add one.

Body Region Injured
1 = Head / neck
2 = Chest
3 = Abdominal and pelvic contents
4 = Extremities or pelvic girdle
5 = General

Injury Severity
Coders should convert injury diagnosis and text descriptions of injuries into AIS90 codes (AAAM, 1990). Then they should categorize each injury by body region (head or neck, chest, abdominal or pelvic contents, extremities or pelvic girdle and general) and by severity (0: no injury; 1: minor; 2: moderate; 3: serious, not life-threatening; 4: severe, life-threatening-survivable; 5: critical, survivable-uncertain; 6: fatal-unsurvivable) (Gennerelli and Wodzin, 2005). For multiple injuries, affecting more than one body region, codes should be assigned on the basis of the injury with the highest severity.

Criteria for Scoring
1. Threat to Life
2. Permanency of Injury
3. Impairment
4. Treatment Period and Energy Dissipation
Appendix 3 Topical Guide

1. Road safety measures were enforced on 1st February, 2004 in this country. Did these measures reduce the number of motor vehicle crashes? Did they shift types of injuries? Were these measures adequate?

2. One year before the enforcement of the Traffic Act, what types of injuries were most common?

3. One year after the enforcement of the Traffic Act, what types of injuries were most common?

4. What are your suggestions on how to improve the road safety measures in Kenya?

5. Do you have any comment you wish to add?
RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on, *The Effects of Implementation of Road Safety Measures on Injury Severity among Road Traffic Injury Patients in Nakuru Kenya*

I am pleased to inform you that you have been authorized to carry out research in Nakuru District for a period ending 30th August 2008.

You are advised to report to the District Commissioner, the District Education Officer and Medical Officer of Health Nakuru District and before embarking on your research project.

On completion of your research, you are expected to submit two copies of your research report to this office.

M. O. ONDIEKI
FOR: PERMANENT SECRETARY

Copy to:

The District Commissioner
Nakuru District

The District Education Officer
Nakuru District

The Medical Officer of Health
Nakuru District