PREVALENCE AND FACTORS ASSOCIATED WITH COMMERCIAL MOTORCYCLE ACCIDENTS IN EMBU COUNTY, KENYA

PAUL MURIITHI NGARI

MASTERS OF SCIENCE

(Public Health)

JOMO KENYATTA UNIVERSITY OF

AGRICULTURE AND TECHNOLOGY

2020

Prevalence and Factors Associated with Commercial Motorcycle Accidents in Embu County, Kenya

Paul Muriithi Ngari

A Thesis Submitted in Partial Fulfillment for the Degree Master of Science in Public Health in the Jomo Kenyatta University of Agriculture and Technology

2020

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

Signature …… Date ……..

Paul Muriithi Ngari

This thesis has been submitted for examination with our approval as University Supervisors.

Signature …… Date ……..

Dr. John Gachohi, PhD

JKUAT, Kenya

Signature …… Date ……..

Prof. Kenneth Ngure, PhD

JKUAT, Kenya

DEDICATION

I dedicate this thesis to my supporting wife Elizabeth Njeri and our beloved children; Loreen B. Nyakio, Edgar Muthomi and Valeen G. Ngatha.

ACKNOWLEDGEMENT

To God be the Glory for His unmerited favour and provision to bring this work to success. My sincere gratitude and heartfelt thanks to my supervisors; Prof. Kenneth Ngure and Dr. John Gachohi for their guidance, advice and continuous support. May God richly bless and keep you well.

I appreciate all the Commercial motorcycles riders in Embu Town and their able leadership for taking part in this study up to the end.

I acknowledge the immeasurable moral support received from the Department of Health, Embu Level 5 Hospital in Embu County

Special thanks to my family for believing in me and for moral support during my study period.

TABLE OF CONTENTS

LIS T OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

DEFINITION OF OPERATION TERMS

Boda boda: Local name for commercial motorcycles

Piki-piki: Swahili name for motorcycle

ABBREVIATIONS AND ACRONYMS

DALY	Disability Adjusted Life Years
DETRI	Department of Environment, Transport the Regions
KNBS	Kenya National Bureau of Statistics
KNH	Kenyatta National Hospital
KSI	Killed and Serious Injury
LMIC	Low and Middle Income Countries
MCA	Motor Cycle Accidents
NTSA	National Transport and Safety Association
QALY	Quality Adjusted Life Years
RTA	Road traffic accidents
RTC	Road Traffic Crash
RTIs	Road Traffic Injuries
SPSS	Statistical Package for Social Sciences
STA	Structural Adjustment Programme
TB	Tuberculosis
UoN	University of Nairobi
WHO	World Health Organization

ABSTRACT

Road traffic injuries (RTIs) stand as one of the leading causes of death and disability around the globe. The accidents have increased over the recent past as the number of motorcycles grows around the world, making motorcycle-related accidents to become an important public health issue. There were 1.2 million deaths and around 50 million injuries globally related to both motor vehicle and motorcycle accidents annually. The burden is even higher in low and middle-income countries where the motorcycles are used as an income earner but data on commercial motor cycle accidents is lacking. The main objective of the study was to determine the causal factors associated with commercial motorcycle accidents in Embu Town, Embu County. A prospective cohort study design was employed to assess commercial motorcycle riders in Embu town. Baseline data were collected among 200 commercial motorcycle riders who were then followed up for three months. A semi-structured questionnaire was administered weekly to capture risk factors for motorcycle accidents. Participants were censored when they got involved in an accident. Data were entered into excel and imported to SPSS software version 24 for analysis. Descriptive statistics including mean, standard deviation and percentage of sociodemographic characteristics and motorcycle accidents were calculated. Bivariate analysis was conducted to determine factors that influence commercial motorcycle accidents. All variables significant at bivariate level were included in logistic regression model. All tests were significant at $P< 0.05$. A total of 48 (24%) commercial motorcyclists were involved in road accident during the three months of the study. Factors independently associated with accidents among motorcyclists were use of alcohol ($\chi2=4.9889$, df=1, $P=0.026$), use of *khat* ($\chi2=8.1015$, df=1, $P=0.004$), driven the motorcycle under alcohol influence ($\chi2=14.1186$, df=1, $P<0.001$) and riding while chewing *khat* ($\chi2=4.5132$, df=1, $P=0.034$). The findings show motorcycle accidents were prevalent and use of alcohol and *khat* have a significant association with motorcycle accidents. Therefore, there is need to have interventions programs addressing dangers of using alcohol and *khat* among the riders. They should target the younger commercial riders. The findings from the study will assist in developing feasible interventions to reduce the increasing road accidents related to motorcycle accidents both in the study area and in other areas.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Globally, road traffic injuries are the eighth leading cause of death for all ages and account for 1.35 million deaths annually (WHO, 2015). Nearly 3700 people dying on the worlds' roads every day (WHO, 2015). A majority of this burden is experienced in low- and middle-income countries (LMICs) and vulnerable road users such as pedestrians, cyclists, and riders of motorcycle (Nantulya & Reich 2002). The road traffic injuries costs between 1-2% of LMICs gross national product estimated at over US$ 100 billion a year (Jacob, Aeron-Thomas & Astrop, 2000). Countries in Africa and South-East Asia are still have higher rates of road traffic deaths than global rate with 26.6 and 20.7 deaths per 100,000 populations respectively (WHO, 2015). Motorcyclists are among the most vulnerable road users accounting for 23% of the world's road traffic deaths and have a 34 higher risk of death per mile traveled in a crash than other types of motor vehicles (Lin & Kraus, 2009).

Injuries to the lower-extremity and head are most common among motorcyclists (Lin & Krauss). Other motorcycle injuries range from minor abrasions to fractures and spinal deformations (Schwellnus & Derman, 2005; Michon, 2013). Motorcyclist face higher dangers from several road hazards such as potholes, dead animals, slick pavement conditions, uneven heights between lanes, and other irregularities or unexpected objects in the road posing a serious safety threat due to the smaller size and less stable nature of the motorcycles than other motor vehicles; as the motorcyclist is not surrounded by a metal case and is likely to be thrown far and hard, such crashes are more deadly than those involving other vehicle types. (Berecki-Gisolf *et al.*, 2015; Koornstra *et al*., 2003).

Factors that influence motorcycle crashes include age, ethnicity, income, education, motorcycle license, insurance status, self-reported alcohol consumption in the 12 hours

preceding the crash, years of on-road riding experience, kilometers travelled on the specific motorcycle at interview, posted speed limit, and weather conditions (Slesak *et al*., 2015; Woratanarat *et al*., 2013; Mullin *et al*., 2000; Langley *et al*., 2000; Wells *et al*., 2004; Cheng, Wang & Lu, 2014). Other factors are engine size, time of day, ownership, speed and risk-taking behaviour (Lin & Kraus, 2009).

In Kenya, fatalities that are attributed to road traffic accidents in Kenya have been seen to increase steadily over the years and is one of the highest road fatality rates with about 68 deaths per 10,000 registered vehicles with about 45-60% of admissions to surgical wards being due to road traffic injuries (WHO, 2008). This is accompanied by several implications to health, with increasing mortalities and disabilities; and increasing associated economic costs as well as diminished productivity (Odero, Khayesi, & Heda, 2003).

Motorcycle use in Kenya has also significantly increased over the last decade filling the transport system gap due to their relatively low cost, ease of use, availability and flexibility (Nesoba, 2010; WHO, 2011). According to NTSA statistics, the number of registered motorcycles by the year 2014 rose to about 111,124 (NTSA, 2015). Over the years, motorcycles have also been a major contributor to Road Traffic Injuries (RTI's) (Nesoba, 2010). A total of 3055 road traffic deaths were reported by the Kenya traffic police and of these, approximately 7% were motorcyclists (WHO, 2011). A study at Naivasha hospital revealed that 36% of patients who presented to the emergency department because of road traffic crash (Road Traffic Crash) were motorcyclists and 75% of these patients were not wearing a helmet at the time of the crash (WHO, 2011).

Motorcycles are a special area of interest because their usage has vastly increased throughout the country and the safety culture in Kenya is poor. It is in this regard that this study sought to examine factors associated with commercial motorcycle accidents, as in Embu town. In this process it also establishes whether factors associated with motorcycle accidents in studies elsewhere are mirrored in Embu County.

1.2 Statement of the Problem

Motorcycle injuries constitute a major but neglected public health concern in rapidly motorizing Kenya. As a result of rapid motorization without sufficient improvement of road safety strategies and poor implementation of preventive measures has increased the number of RTIs in Kenya (Chandran, Hyder & Peek-Asa, 2010; Peden *et al*., 2004; Odero, 2009). A majority of this burden are vulnerable road users such as pedestrians, cyclists, and riders of motorcycle (Nantulya & Reich 2002). In 2019 there have been 724 fatalities, 1337 serious injuries and 341 minor injuries related to motorcyclist (NTSA 2019). Road traffic crashes, injuries and deaths involving motorcycles have increased noticeably and is putting a heavy burden on families, communities and health system in general (WHO, 2011). Motorcycle injuries contribute to a substantial number of deaths and hospital admission in Kenya especially among productive age. This translates to approximately 68 deaths per 10,000 registered vehicles and motorcycles, which is 30 – 40 times greater than in highly motorised countries (Odero, 2009). This has a significant social and economic implications to the country as it costs approximately 5% of country's Gross Domestic Product. Embu Town is estimated to have over 1,200 registered commercial motorcycles and the number is expected to grow since the *Boda Boda* are the cheapest means of transport in the region and especially for short distances. A growing number of motorcycle accidents as reported by police and other local source is expected to change the pattern of injuries and hence influence the treatment in future. So far this information has not been documented in Embu County and constitutes a gap in the epidemiological understanding of commercial motorcycle accidents in the study area.

1.3 Justification of the Study

The utilization of motorcycles as a mode of transport has gained increased prominence in Kenya. The KNBS, (2009) recorded a substantial increase in the number of registered motorcycles from 4136 to 16,293 from 2004 to 2007. According to NTSA statistics, the number of registered motorcycles by the year 2014 rose to about 111,124 (NTSA, 2015).

With the majority of rural road infrastructure not being paved and many roads being impassable by vehicles, the use of motorcycles stands as the quickest and most reliable form of transportation for both people and goods.

It is estimated that Motorcycles generate a revenue of about 400 million daily (KNBS, 2009). Despite the fact that there are not yet adequate measures in place for the taxation of such, the exponential growth of motorcycle usage as a means of transport is evident. About 500,000 people are estimated to be gaining meaningful employment through the motorcycle industry (KNBS, 2009).

However, evidence suggests that there has been an increased number of accidents over the years. The exponential growth of the motorcycle industry has been in direct proportion to the exponential increase in road transport accidents (RTA's) in Kenya (NTSA, 2015). This is mostly linked to regions that are described as 'boda-boda hubs'. These are urban, peri-urban and rural areas, especially in Western and Nyanza regions. Its impact has been so serious that speciality wards have been set aside in anticipation of motorcycle-associated victims (NTSA, 2015). In Kenya, RTAs are responsible for death and causation of disability of between 3000-13,000 Kenyans annually. A majority of the victims are composed of pedestrians, passengers and cyclists.

1.4 Objectives

1.4.1 General Objective

To determine prevalence and factors associated with commercial motorcycle accidents in Embu Town, Embu County.

1.4.2 Specific Objectives

1. To establish socio-demographic characteristics related to commercial motorcycle riders in Embu Town, Embu County.

2. To determine the road safety practices among the commercial motorcycle riders in Embu Town, Embu County.
3. To determine prevalence of commercial motorcycle-related road traffic accidents in Embu Town, Embu County.
4. To determine factors associated with commercial motorcycle accidents in Embu Town, Embu County.

1.5 Research Questions

1. What socio-demographic characteristics are related to commercial motorcycle riders in Embu town, Embu County?
2. What is the road safety practices among the commercial motorcycle riders in Embu Town, Embu County?
3. What is the prevalence of commercial motorcycles related road traffic accidents in Embu Town, Embu County?
4. What are the factors associated with commercial motorcycle accidents in Embu Town, Embu County?

1.6 Significance of the Study

There has been need to improve the collection and availability of accurate data to help in recognizing traffic injury as a priority public health problem, raising awareness of policymakers on existing effective countermeasures and mobilizing resources for implementation. The study will provide evidence-based information to the Kenyan government that will aid in developing road safety regulations and management strategies. The findings will assist the County Government of Embu, Ministry of Health and National Transport Safety Authority (NTSA) to develop interventions specifically targeted at mitigating factors associated with commercial motorcycle accidents in Embu town and the wider Embu County. This study is important to those in academia as it will provide relevant baseline data to inform other research studies and also adds evidence to

existing literature that can aide interventions to effectively deal with commercial motorcycle accidents.

1.7 Limitations and Delimitations of the Study

This study was mainly conducted among motorcyclists in Embu County as such the results cannot be generalized to other areas in the country. Time was major limitation for the study given that the data collection was conducted during working hours.

1.8 Conceptual Framework

There were a number of factors which could be interconnected to the occurrence of commercial motorcycle accidents. These factors were either associated with the rider, the motorcycle or the road underuse. These factors were the independent variables and included the socio-demographic and behavioural characteristics of the rider, commercial motorcycle roadworthiness and road safety practices which could result in the occurrence of a commercial motorcycle accident; the dependent variable.

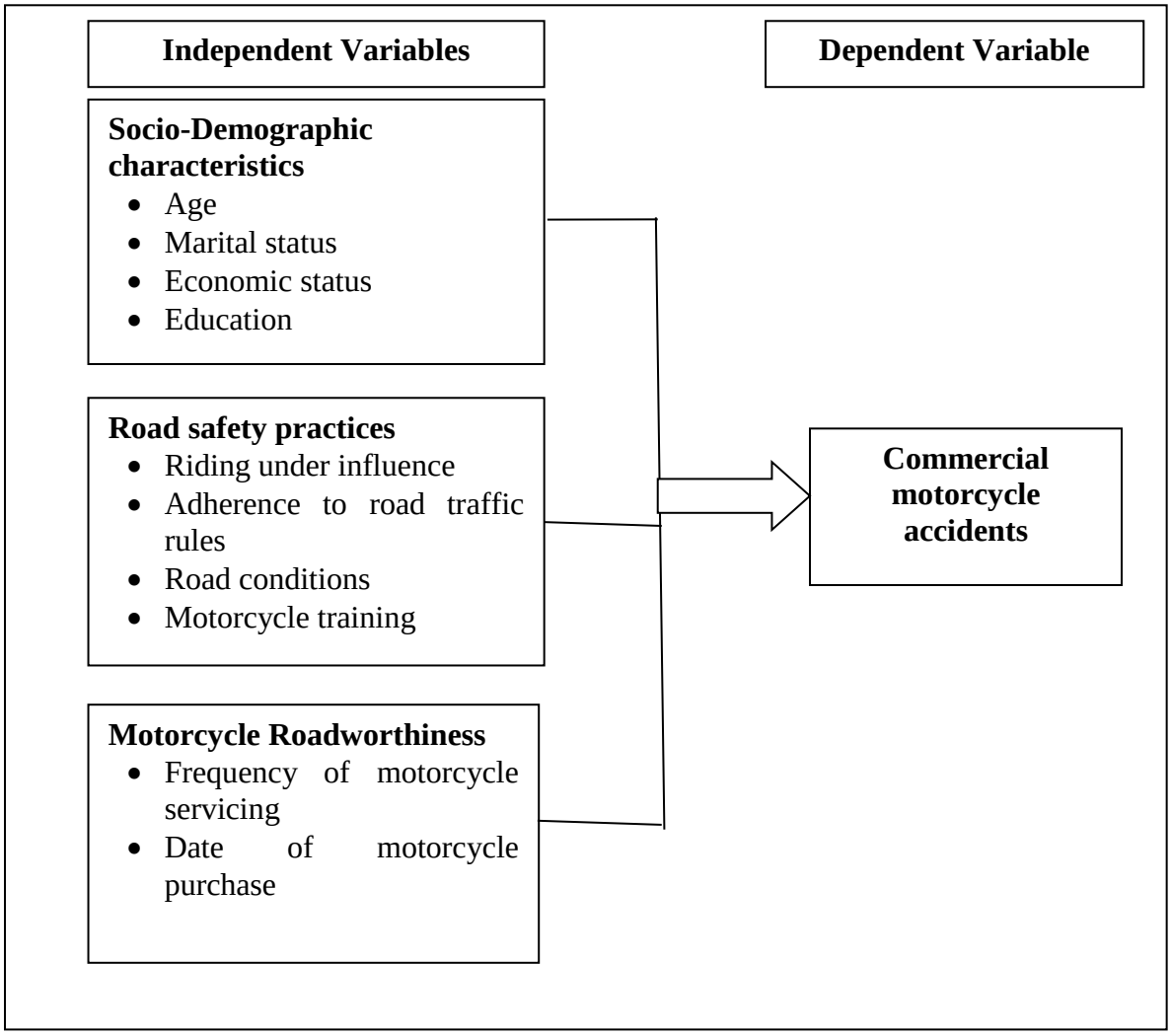


Figure 1.1: Conceptual Framework

Source: Synthesized from literature review

CHAPTER TWO

LITERATURE REVIEW

2.1 Motorcycle Transport

Motorcycle usage as a form of public transportation globally is an ancient thing. In fact, the application of motorbikes as a method of public transportation dates back to the 1930s in Kaolack Senegal and the 1960s in Kenya, Uganda and Benin where bicycles, the predecessor to today's motorcycle, would carry both people and goods. Motorbike taxis were launched in Nigeria in the 1970s however a steep growth in their usage was recorded in the mid-1980s in Niger, Cameroon, Togo, Benin, Uganda and Kenya as a development from the bicycle taxi (Mutiso & Behrens, 2011). Its increased usage led popular names for these motorbike taxis e.g. Boda boda in Uganda and Kenya and other different names like zemidjan, bendksin, kabu-kabu and Okada in Benin, Cameroon, Niger and Nigeria respectively (Mahlstein, 2009). Piki-piki is a Swahili term being used also to describe motorcycles (Howe & Maunder, 2004). The usage of commercial motorcycles is mostly linked to three factors which include the increased level of production, shortage of transport and loose regulatory frameworks (Olvera *et al.,* 2012).

Additionally, commercial motorcycles are convenient solutions for transport issues that affect private vehicles and public transport e.g. poor road infrastructure and traffic jams. The purchase of personal vehicles is also expensive and due to the low-income levels of the general population as such the household ownership rates are still low. A majority of the population rely on public transport to commute (Olubomehin, 2012). Some regions also lack roads while others are in a poor state which makes it hectic and costly for motor vehicles to operate through. Urban transport is also insufficient and public transport is inadequate in major cities and there are usually limited public transport in smaller towns (Goodfellow & Titeca, 2012).

Proliferation of motorcycles as a means of commercialized transport is triggered by socioeconomic policies that are unfriendly that have manifested themselves in the rate of

high unemployment rates, decayed social infrastructure, and poverty (Michael, Usman, & Eke, 2013). Also, inadequate transport systems in developing nations have sparked interest in motorcycles (Goodfellow & Titeca, 2012). Moreover, the Structural Adjustment Programme (SAP) and other unfriendly economic policies have caused many to lose their jobs and move into looking for alternative sources of transportation (Peden *et al.*, 2004). Ownership and use of motorcycles as means of transport is common in South and East Asia (Tung *et al*., 2008; Zhang *et al*., 2004). In Kenya, bicycles were replaced by motorcycles taxis (*boda bodas*). The government of Kenya move to zero rate duty on the imports saw an increase in the number of persons adopting motorcycle use as a replacement of the bicycles (WHO, 2004). The number of motorcycles in Kenya leaped from 3,759 in 2005 to 140,215 in 2011 (KNBS, 2012). This shift naturally saw an increase in the indices attributed to motorcycle related accidents that impacted cost of the economy in excess of US$ 50 million exclusive of the actual loss of life (Bachani *et al.*, 2012).

2.2 Classes of Injuries Experienced

There are seven main injuries which can result in the causation of injuries for motorcycles.

Table 2.1: Classes of Injuries

S/No.	Injuries
1	Brain and head injuries
2	Neck injuries
3	Spinal cord injuries
4	Back injuries
5	Facial injuries
6	Internal injuries
7	Psychological injuries

2.3 Determinants of motorcycle accidents

Motorcycle accidents are largely associated with gender in that males are highly likely to be engaged in accidents contrary to females. This is largely due to the fact that males are highly likely to use alcohol and other drugs while driving contrary to their counterparts (Singoro, Wakhungu, & Obiri, 2016). Most male motorcycle riders are exposed to multi-occupant motorcycle accidents (Oluwadiya *et al*., 2016; Sanusi & Emmelin 2015). Also male commercial motorcycle riders engage in more risk-taking activities related to dangerous riding which eventually result into the causation of accidents (Sanusi & Emmelin, 2015). Commercial motorcycle riders use acquired revenue for their daily expenses contrary to the repair and maintenance of the motorcycles (Tumwesigye, Atuyambe & Kobusingye, 2016). Similarly, the young riders her mostly utilized the revenue to purchase khat and alcohol while riding as they had minimal expenses as a majority of them spent most of their revenue on inhalants and other psychoactive substances largely due to the fact that a majority of the respondents had fathers who used these substances (Gudaji & Habib 2015). Marital status has significant correlation between RTAs and the marital status of the commercial motorcycle riders (Ogunmodede & Emeahara, 2016). Single commercial motorcycle riders are highly likely to be engaged in motorcycle accidents (Gudaji & Habib, 2015)

Age is also considered to be a major risk factor of motorcycle accidents in the world. Younger riders are usually engaged in risky riding behaviours and speeding which usually result in the causation of accidents (Gudaji & Habib, 2015). Tumwesigye *et al*., (2016), points out that RTAs were most common among riders of younger age groups and that these accidents were mostly attributed to that lack of knowledge on the traffic. Young commercial motorcycle riders lack resources which hinders them from purchasing protective equipment (Kamulegeya *et al*., 2015). Those who possess helmets rarely use as they believe upon immunity to injury and accidents (Olusayo *et al*., 2015).

2.4 Motorcycle safety measures

According to da Silva et al., (2012) ignorance of the road traffic rules also signifcanlty contributes to the increased level of RTAs. Additionally, efforts to educate the public on proper road traffic rules are deemed to be ineffective. In relation to the Accident Cause Code Classification, the Kenya police reports that at least 85.5% of the crashes are attributed to poor driver behaviours thus leading to the death of pedestrians (44.4%), passenger (33.9%) and pedal cyclists (7.2%) (Odero et al., 2003). Other factors include vehicle defects (5.1%), and poor road infrastructure (2.9%) (Macharia *et al*., 2009). Riding at high speeds could result in the causation of accidents especially due to slippery roads (Matheka *et al*., 2015). Maneuverability of the motorcycle is limited when carrying heavy luggage or more than one passenger, especially where the road conditions are poor (Bagenda *et al*., 2017). A study conducted in Nigeria revealed that most of the road traffic accidents were mainly associated with poor road safety rules adherence and young age (Olumide & Owoaje, 2015). Another study conducted in Thailand among teenage commercial motorcycle riders revealed a significant association between the RTAs and failure to wear helmets, riding at speeds higher than 60km/hr and alcohol consumption (Tongklao, Jaruratanasirikul & Sriplung, 2016).

The state of the motorcycle can also result in the causation of accidents due to the frequency of motorcycles servicing and the date of the motorcycle accidents Motorcycle accidents can also be attributed to poor road conditions like sharp bends, potholes and poor lighting which can limit the riders' capacity to carefully pass through the roads. Reduction in the number of RTAs is associated with the geographical scale of a particular area (Mohtasham-Amiri *et al*., 2016),. The extent to which land is used, road networks, local business and system risks are associated with the causation of accidents in a particular area (Komba, 2007).

2.5 Inadequacies of Public Transport Policy

In a few decades, urban centres all over the world, in both developing and developed nations, have become highly automobile-dependent and less sustainable. In developing nations in specific, towns have experienced tremendous growth in transport-related issues, including accidents, pollution, the decline in public transport, climate change, depletion of energy, and lack of accessibility particularly for the poor living in towns. In developed nations, especially Northern Europe, some metropolis have seen a trend of reclaiming town space from vehicles and restricting cars from major sectors of downtown regions and limiting them in other ways (Pojani & Stead, 2015). Today, these areas are usually considered as key examples of sustainable development in urban areas as towns from all around the world seek more sustainable means of transport within major towns.

In essence, the inadequacies in public transport, in urban and rural areas in both developed and developing nations, there has been a witnessed upsurge in the use of motorcycles for public transport. Frequent gridlocks and jams, especially in cities like Nairobi have made motorcycle transport lucrative as it is faster and convenient. Motorcycles taxis are also easily accessible and can transport people to the remote area thus serving a larger population whose travel needs are not met by other modes of transport (Olvera *et al*., 2012). The *Boda Boda* motorcycle taxi system has become a fairly reliable, rapid and relatively cheap service which can pass on dirt roads that are too difficult for cars, and go longer distances and into steeper and rugged terrain that would be possible with a bicycle.

Functionally, *Boda Bodas* are used for children and teachers to go to school, workers and employees to go to work and, in the villages, it facilitates travel to markets and health facilities. Motorcycle taxi driving, however, is not an easy job and it is currently only the work of young men (Rizzo, 2011). Every day they travel around 50 kilometres, and this factor, together with accidents and the dust they inhale, leading to illnesses and general body weaknesses. A further indication that the *Boda Boda* job is dangerous

comes from citing police reports, which reveal that between 2008 and 2012, the injuries among drivers increased from 1795 to 3043 (DETR, 2011). From the foregoing, the increased number of motorcycle accidents can be attributed to inadequacies in the provision of transport as well as weak enforcement legal framework. The government enforcement machinery appears overwhelmed by the robust upsurge in motorcycles on the roads today.

2.6 Vulnerability of Motorcyclists to Accidents

Motorcyclists have an especially poor safety record compared to other road user groups. They are killed and serious injury (KSI) rate per million vehicle kilometres, is approximately twice that of pedal cyclists and over 16 times that of car drivers and passengers. Motorcyclists constitute less than 1% of vehicle traffic, but their riders suffer 14% of total death and serious injuries on United Kingdom roads. (DETR, 2011). The global economy can also be affected by RTAs which is estimated to be US$500 billion annually from which developing countries lose at least $100 billion (WHO, 2010). These annual loses exceed the countries development revenue, aid and received loans and causes a significant reduction in the growth of economy by1-2%. According to WHO, (2009) RTA injuries attributes to the causation of 23% of deaths in the world. Road traffic accidents are also forecasted to be the third leading cause of death by the year 2020 above heart disease, clinical depression and other infection like TB and HIV/AIDs (Macharia, *et al.*, 2009).

Road traffic accidents (RTAs) are a serious public health problem for both developed and developing nations. This is largely due to their association with the causation of injury and its association with the death of individuals who are mostly of the age of 15-29 years. Additionally, RTAs are linked to the death of 1.2 million individuals and a potential 50million who are left injured (WHO, 2009). RTAs have claimed the largest toll on human life and it is the highest cause of death among individuals in the society (Kual *et al*., 2005). Death which is associated with RTAs is predicted to rise from 5.1-8.4 million individuals in the world (Buchani *et al*., 2012b).

In low and middle-income countries RTAs are responsible for the causation of 205,000 fatalities and 7, 151,000 DALYS. This converts to a total of 969 DALYS per 100,000 populations in Africa which is higher compared to the global rate of 640 DAYs per 100,000 (WHO, 2008). According to Chandran et al., (2010) the increased level of development in Africa especially in form of road infrastructure, a number of vehicles is associated with an increase in the number of RTIs and fatalities.

Additionally, Road traffic accidents (RTAs) are associated with the causation of annual losses which are approximately $65-100 billion annually. RTAs are also associated with the causation of burdens to the victims of the injured. Americans bear 11% of burden which is caused by road traffic injury mortalities ina n average year. The accidents can also result in the causation of 13 million deaths and a total of 20-50 million disabilities annually (WHO, 2012).

RTAs are also rapidly becoming the principal cause of death and disability in developing countries (Mohtasham-Amiri et al., 2016). The annual RTA fatality rate is estimated at 20.1per 100,000 people contrary to 8.7 people per 100,000 in developed countries (WHO, 2010). In essence, the risk of death attributed to RTA is higher in Africa (24.1 per 100,000) compared to the rate in Europe (10.3 per 100,000). Kenya has the highest rate in the world which is estimated at 34 per 100,000 which are attributed to alcohol, poor driving capabilities and an increased risk of crashes. their has also been evidence of usage of minor tranquillizers like benzodiazepines as a significant cause of RTAs (Gururaj, 2008; Mohan, 2002). Another study also revealed that drivers with diabetes, cardiovascular diseases, epilepsy are also highly likely to involve road accidents (Peden et al., 2004) additionally, a lower risk of RTA has been recorded among individuals with chronic medical conditions and disabilities (Mohan, 2002).

According to a study conducted by Odero *et al*., (2003) there has been a 35% increase in the rate of fatalities in Kenya. The study also revealed that these accidents are caused by rapidly expanding transport and industrial expansion and poor safety precautions. They are also associated with an annual loss of US $3.8 billion which translates to a 5%

annual gross national product. This is however not inclusive of the loss in productivity and the number of the year lost (Peden *et al*., 2004; Odero *et al*., 2003). It is critical to note that there are limited findings on the current estimates and therefore a need to estimate the magnitude of these burden in order to curb the road carnage. Little attention has been given to RTAs despite the increased rise in their occurrence in Kenya. Interventions were only initiated through the actions of the World Health Organization and World Bank were critical in the advocating for safety on the roads which contributed to the enforcement of traffic rules in order to reduce the RTIs. (World Bank, 2015; Peden *et al*., 2004).

RTAs in Kenya cause the country at least $50 million annually which is exclusive of the loss of life (Buchani *et al*., 2012). Kenya lost an estimated 4 billion due to the number of fatalities which translated to an 11% decline in the growth of the GDP. The impact of these issues is also deemed to be inconsequential to the society and to the government thus making it public health concern. Additionally, it is increasingly difficult for policymakers to develop and implement road traffic laws that are associated with the causation of injuries and death.

2.7 Theoretical Framework

This theory was developed by Ludwig Benner jr. in order to act as guides in the investigation of accidents that occurred in the society. These are inclusive of the single event, chain of events and determinant variable approaches which are discussed in the following sections. In relation to this approach, assumptions can be made in relation to the causation of accidents as they consist a single event with a cause. In order to capture the phenomenon, the cause of the accidents must be properly defined in order to correct them and prevent future occurrences. This approach stipulates that there is a chain of events which occur before a particular accident occurs. This theory is instrumental in capturing the factors associated with accidents and to easily develop measures to correct them. This approach mainly stipulates that there are precursors which can be deemed as

being the main cause of the accident. This can then be used to in the development of hypothesis of the main cause of the accidents (Benner, 1978).s

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Site

The study was carried out in Embu Town, Embu County among sampled commercial motorcycle riders. The County covers a total of 2,818sqkm and borders six Counties namely; Kirinyaga, Kitui, Machakos, Muranga, Tharaka Nithi and Meru. The County has an estimated population of about 569,300 with an annual growth rate of 1.4% (KNBS, n.d.). Embu Town is located approximately 120 kilometres North East of Nairobi towards Mount Kenya. Embu Town serves as the headquarters of Embu County. The County has an expansive road network with coverage of 914.3km earth surface, 402km of ground surface and 120 km of tarmac including the Meru- Embu Highway and Embu – Kiritiri road. Most of the earth surface roads in Embu are impassable during rainy seasons.

Figure 3.1: Map of Embu County

3.2 Study Population

The study population comprised commercial motorcycle riders within Embu Town, Embu County.

3.2.1 Inclusion Criteria for riders

a. Those respondents who gave informed consent.
b. Those motorcycle riders based in Embu Town.

3.2.2 Exclusion Criteria for riders

a. Those eligible respondents who declined to consent.
b. Those who refused to complete the interview.
c. Those motorcycle riders who operate outside Embu town.

3.3 Study design

This study employed a prospective cohort study of commercial motorcycle riders that were followed for three months. At the beginning of the period, 200 motorcycle riders had not experienced prior accidents were recruited into the prospective study and the rate of motorcycle accidents during the three months' period was measured. The motorcyclists were further censored when involved in an accident.

3.4 Research Variables

3.4.1 Dependent Variable

The dependent variable was commercial motorcycle related accidents.

3.4.2 Independent Variables

The independent variables were socio-demographic characteristics (Age, sex, marital status, religion, education level, employment, monthly income and daily income) and

road safety measures (Valid riding license, formal motorcycle training, use of personal protective equipment, Alcohol consumption, *Khat* chewing, riding speed and carrying passengers with their heavy luggages).

3.5 Sampling and Sampling Procedure

The study utilized a two-stage cluster sampling technique. The first step involved the researcher to undertake a reconnaissance a week prior to starting data collection. The aim was to get familiar with the study area and to identify areas where commercial motorcycle operators operated. It was observed that the commercial motorcycle riders congregate at designated points to wait for passengers. The designated passengers waiting points were treated as clusters for the purpose of sampling. The clusters were identified within the central business district. The second step was listing of riders in the identified clusters. Simple random sampling was used in selection of the commercial motorcycle riders in the identified clusters.

3.6 Sample size calculation

The sample size for the study was calculated based on the Yamane 1967 formula. The formula has two main components; the population and level of precision.

Sample size

$$n = N \div [1 + N (e)^2]$$

Where;

n= sample size required

N= the population size of motorcycle riders

e= the level of precision

To determine the sample size, the study used 95% confidence level (level of precision of 5%) and a population of 450 motorcycle riders in Embu town. Therefore

$n = 450 \div [1 + 450(0.05)^2] = 212$. The sample size calculated was 212 motorcycle riders in Embu town.

3.7 Data collection instrument

A semi-structured questionnaire was used to record data. It captured sociodemographic characteristics (Age, sex, marital status, religion, education level, employment, monthly income and daily income) and road safety measures (Valid riding license, formal motorcycle training, use of personal protective equipment, Alcohol consumption, Khat chewing, riding speed and carrying passengers with their heavy luggages) (**Appendix III**). The questionnaire was pretest on 10 commercial motorcycle riders in Meru County which has similar conditions to the study site. After the pre-test, the sections were modified by rewording and revised to ensure clarity to respondents. This also ensured validity and reliability. Expert advice was sought to ensure the validity of the questionnaire and the Lee Cronbach alpha test was used in the determination of the reliability of the questionnaire.

3.8 Data collection procedure

The questionnaire was administered to the sampled commercial motorcycle riders to capture baseline information and were followed for a period of three months. The questionnaires were administered by trained research assistants and collect information sociodemographic characteristics and road safety measures. The data was collect using paper-based questionnaires. All the interviews were conducted in a quiet and private places convinient to the respondent. Tracking of the participants was done through two field visits per week in identifying whether any of them had been involved in an accident and hence censoring the subject from the study.

3.9 Data Analysis and Management

Questionnaires were checked for completeness during collection, to minimize cases of missing data. Data were entered into MS-Access software and cleaned before being exported to SPSS statistical software version 24.0. Data were encrypted to prevent unauthorized access and to protect the confidentiality of respondents. Descriptive statistics, frequencies, and proportions were provided, as necessary for the continuous and categorical variables respectively. Pearson's Chi-square test was done to ascertain the association between the various possible risk factors of commercial motorcycle accidents and rate of the commercial motorcycle accidents. Significant relationships were flagged at the alpha level of 0.05. A multivariate logistic regression using backward conditional method was used to explore determinants of commercial motorcycle accidents and P-values <0.05 were considered statistically significant.

3.10 Ethical Considerations

Ethical clearance was sought from relevant authorities. The study protocol was submitted to KNH-UoN Ethics and Research Committee for approval (**Appendix I**). Prior to data collection, informed consent was sought from all potential study respondents. Consent was voluntary and whether one participated in the study or not, did not affect them. The interviews were done in private to uphold confidentiality. The database was anonymized and individual information stored separately from anonymized data. Access to data was only by all authorized persons. The participants were informed that the study does not have direct benefits and there are no foreseeable risks.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic characteristics of the participants

A total of 200 commercial motorcycle riders aged 18-55 years were enrolled in the study and consisted 195 (97.5%) males and 5 (2.5%) females with a mean age of 30± (10SD). A high proportion (n= 100, 50%) was aged between 25-34. A majority of the respondents were married (n=131, 65.5%) with a majority being Christian (n=190, 95%). Nearly half of the respondents had acquired at least a secondary education (n=96, 48%) and 94 (47%) did not have any other form of employment. A majority of the respondents had monthly incomes ranging from KES 15,000- 24,000 (n=69, 34.5%) and a daily income of KES 500-1000 (n=90, 45%) as shown in **Table 4.1.**

Table 4.1: Socio-demographic characteristics of Commercial Motorcycle riders

Characteristic	n	%
Age		
<24	65	32.5
25-34	100	50.0
35-44	23	11.5
>45	12	6.0
Sex		
Male	195	97.5
Female	5	2.5
Marital status		
Single	69	34.5
Married	131	65.5
Religion		
Christian	190	95.0
Muslim	10	5.0
Education level		
No formal education	6	3.0
Primary education	52	26.0
Secondary education	96	48.0
Tertiary education	46	23.0
Employment		
Yes	106	53.0
No	94	47.0
Monthly income (KES)		
<10000	29	14.5
10000-15000	34	17.0
15000-24000	69	34.5
>24000	68	34.0
Daily income (KES)		
<500	44	22
500-1000	90	45
1000-1500	52	26
>1500	14	7
Total	**200**	**100**

4.2 Road safety practices of study participants

Majority of the study participants had valid license (n=147) and had undergone motorcycle riding training (n= 133, 66.5%). A high proportion own a reflector jacket and a helmet at 138 (66.5%) and 127(63.5%) respectively. A small proportion of the participants use alcohol (n=47, 63.5%) and *khat* (n=59, 29.5%). The same was witnessed in driving under influence of alcohol (n=32, 16%) and riding while chewing *khat* (n=48, 24%). Majority of the study participants ride their motorcycle at a speed between 50-80 Km/h as shown in Table 4.2.

Table 4.2: Road safety practices of study participants

Variables	n	%
Valid license		
Yes	147	73.5
No	53	26.5
Formal motorcycle riding training		
Yes	133	66.5
No	67	33.5
Own a reflector		
Yes	138	69.0
No	62	31.0
Own a helmet		
Yes	127	63.5
No	73	36.5
Use of alcohol		
Yes	47	23.5
No	153	76.5
Use of Khat		
Yes	59	29.5
No	141	70.5
Driven under influence		
Yes	32	16.0
No	168	84.0
Ride while chewing khat		
Yes	48	24.0
No	152	76.0
Average riding speed		
<50	52	26.0
50-80	123	61.5
>80	25	12.5
Transport passengers with their heavy luggages		
Always	55	27.5
Often	34	17.0
Sometimes	48	24.0
Rarely	32	16.0
Never	31	15.5
Total	**200**	**100**

4.3 Prevalence of commercial motorcycle-related road traffic accidents among the study participants.

A total of 48 (24%) commercial motorcycle accidents occurred in Embu during the study period among the study participants as shown in **Figure 4.1.**

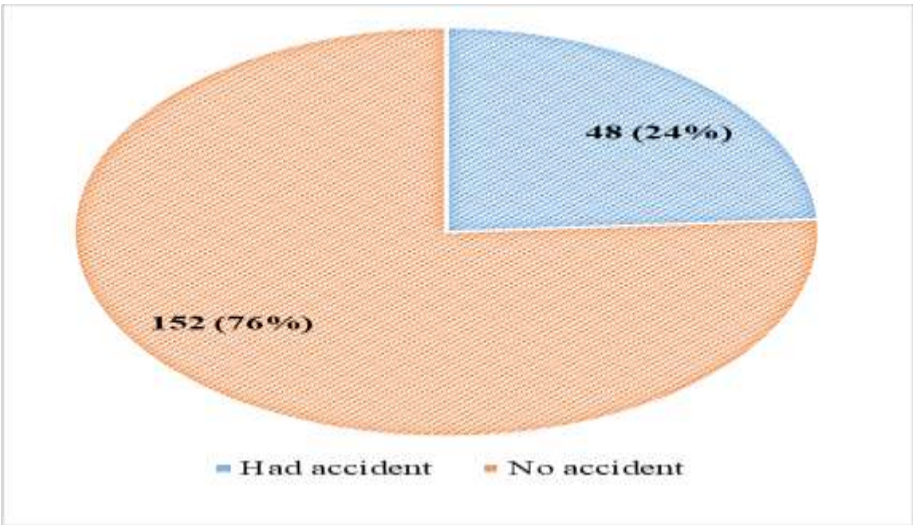


Figure 4.1: Prevalence of commercial motorcycle related accidents

4.4 Socio-demographic characteristics and commercial motorcycle accidents.

The relationship between dependent variable and socio-demographic of study participants were compared. The sociodemographic characteristics i.e. age in years, sex, marital status, religion, educational level, employment, monthly income and daily income were not significantly associated with motorcycle related accidents as shown in Table 4.3.

Table 4.3: Association of sociodemographic characteristics with motorcycle related accident

Variables	Accident occurred n (%)	No Accident n (%)	$\chi 2$	df	p-value
Age					
<24	17(35.4)	48(31.6)	4.4292	3	0.219
(25-34)	19(39.6)	81(53.3)			
(35-44)	9(18.8)	14(9.2)			
>45	3(6.25)	9(5.9)			
Sex					
Male	47(97.9)	148(97.4)	0.045	1	0.832
Female	1(2.1)	4(2.6)			
Marital status					
Single	21(43.8)	48(31.6)	2.3914	1	0.122
Married	27(56.3)	104(68.4)			
Religion					
Christian	44(91.7)	146(96.0)	1.4774	1	0.224
Muslim	4(8.3)	6(4.0)			
Education level					
No formal education	1(2.1)	5(3.3)	2.131	3	0.546
Primary education	9(18.8)	43(28.3)			
Secondary education	25(52.1)	71(46.7)			
Tertiary education	13(27.1)	33(21.7)			
Employment					
Yes	29(60.4)	77(50.7)	1.3947	1	0.238
No	19(39.6)	75(49.3)			
Monthly income (KES)					
<10000	11(22.9)	18(11.8)	4.0395	3	0.257
10000-15000	6(12.5)	28(18.4)			
15000-24000	15(31.3)	54(35.6)			
>24000	16(33.3)	52(34.2)			
Daily income (KES)					
<500	13(27.1)	31(20.4)	2.188	3	0.534
500-1000	22(45.8)	68(44.7)			
1000-1500	9(18.8)	43(28.3)			
>1500	4(8.3)	10(6.6)			

The influence of sociodemographic characteristics was tested among motorcyclist. From the findings all the items were not significant as shown in Table 4.4.

Table 4.4: Influence of sociodemographic characteristics on motorcycle related accident

Variable	B	S.E	Wald	df	P-value	Exp (B)	95% CI for Exp (B)	
							Lower	Upper
Age	0.042	0.043	0.99	3	0.321	0.082	-0.042	0.127
Sex	-0.197	0.205	-0.96	1	0.339	-0.072	-0.601	0.208
Marital status	-0.121	0.073	-1.67	1	0.097	-0.135	-0.264	0.022
Religion	0.116	0.073	1.59	1	0.114	0.118	-0.028	0.260
Education level	0.050	0.041	1.24	3	0.215	0.092	-0.030	0.130
Employment	-0.068	0.064	-1.05	1	0.295	-0.079	-0.194	0.059
Monthly income (KES)	-0.026	0.032	-0.81	3	0.422	-0.062	-0.088	0.037
Daily income (KES)	-0.017	0.039	-0.42	3	0.672	-0.033	-0.094	0.060

B=Beta Coefficient, SE=Standard Error of Beta value, Exp (B)- Exponential Value of B (Beta)

4.5 Road safety practices and commercial motorcycle accidents.

The relationship between dependent variable and road safety practices were compared. Four factors were significantly associated with commercial motorcycle accidents. Factors associated with accidents among motorcyclists were use of alcohol ($\chi2$=4.9889, df=1, *P*=0.026), use of khat ($\chi2$=8.1015, df=1, *P*=0.004), driven the motorcycle under alcohol influence ($\chi2$=14.1186, df=1, *P*<0.001) and riding while chewing khat ($\chi2$=4.5132, df=1, *P*=0.034). Factors that were not associated with motorcycle related accidents include having a valid license ($\chi2$=0.073, df=1, *P*=0.787) formal motorcycle riding training ($\chi2$=0.1047, df=1, *P*=0.746), owning a reflector jacket ($\chi2$=0.0018, df=1,

P=0.966), owning a helmet ($\chi 2$=0.2591, df=1, *P*=0.611), riding speed ($\chi 2$=0.2581, df=2, *P*=0.879) and carrying passengers together with their heavy luggages ($\chi 2$=7.2551, df=4, *P*=0.123) as shown in Table 4.5.

Table 4.5: Association of road safety practices with motorcycle related accident

Variables	Accident occurred n (%)	No Accident n (%)	$\chi 2$	df	p-value
Valid license					
Yes	36(73.0)	111(73.0)	0.073	1	0.787
No	12(25.0)	41(27.0)			
Formal motorcycle riding training					
Yes	33(68.8)	100(66.2)	0.1047	1	0.746
No	15(31.2)	51(33.8)			
Own a reflector					
Yes	33(68.8)	105(69.1)	0.0018	1	0.966
No	15(31.2)	47(30.9)			
Own a helmet					
Yes	29(60.4)	98(64.5)	0.2591	1	0.611
No	19(39.6)	54(35.5)			
Use of alcohol					
Yes	17(35.4)	30(19.7)	4.9889	1	**0.026**
No	31(64.6)	122(80.3)			
Use of Miraa					
Yes	22(45.8)	37(24.3)	8.1015	1	**0.004**
No	26(54.2)	115(75.7)			
Driven under influence					
Yes	16(33.3)	16(10.5)	14.1186	1	**<0.0001**
No	32(66.7)	136(89.5)			
Ride while chewing miraa					
Yes	17(35.4)	31(20.4)	4.5132	1	**0.034**
No	31(64.6)	121(79.6)			
Average riding speed					
<50	13(27.1)	39(25.7)	0.2581	2	0.879
50-80	30(62.5)	93(62.2)			
>80	5(10.4)	20(13.1)			
Transport passengers with their heavy luggages					
Always	12(25.0)	43(28.3)	7.2551	4	0.123
Often	6(12.5)	28(18.4)			
Sometimes	10(20.8)	38(25.0)			
Rarely	9(18.8)	23(15.1)			
Never	11(22.9)	20(13.2)			

The influence of road safety practices and motorcycle related accidents was tested among the motorcyclist. From the findings a few items were significant. There was 0.256 times likely motorcyclist driving motorcycle under alcohol influence will be involved in an accident (P=0.039, 95% CI; Exp (B) -0.471- -0.012. There was 0.27 times likely motorcyclist riding while chewing miraa will be involved in an accident as shown in Table 4.6.

Table 4.6: Influence of road safety practice on motorcycle related accident

							95% CI for Exp (B)	
Variable	**B**	**S.E**	**Wald**	**df**	**P-value**	**Exp (B)**	**Lower**	**Upper**
Valid license	-0.057	0.078	-0.72	1	0.469	-0.058	-0.211	0.098
Formal motorcycle riding training	0.001	0.076	0.02	1	0.988	0.001	0.149	0.151
Own a reflector	-0.038	0.076	-0.49	1	0.622	-0.041	-0.189	0.113
Own a helmet	-0.017	0.076	-0.23	1	0.822	-0.019	-0.168	0.133
Use of alcohol	0.036	0.092	0.39	1	0.694	0.036	-0.145	0.218
Use of Miraa	-0.241	0.116	-2.07	1	**0.039**	-0.256	-0.471	-0.012
Driven under influence	-0.315	0.102	-3.07	1	**0.002**	-0.270	-0.517	-0.113
Ride while chewing miraa	0.104	0.126	0.82	1	0.413	0.103	-0.146	0.353
Average riding speed	-0.029	0.050	-0.58	2	0.565	-0.041	-0.128	0.070
Transport passengers with their heavy luggages	0.039	0.022	1.77	4	0.078	0.128	-0.004	0.082

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

5.1.1 Socio-demographic characteristics of study participants

Majority of the commercial motorcycle riders were male. Studies elsewhere show the commercial motorcycle transport is a male dominated business (Konings, 2006; Mahlstein, 2009). This is due to the physical demands of riding and may not be an occupational option that females will like to venture into. Furthermore, society perceives commercial motorcycle riding as realm of men (Mahlstein, 2009). Globally, being male is associated with risk factors for RTA compared to females due to use alcohol and other drugs while driving (Singoro, Wakhungu & Obiri, 2016). According to a study conducted by Sanusi and Emmelin (2015), a majority of the motorcycle riders who were involved in RTAs were mostly male. Similarly, another study found that most male commercial riders were highly likely to be exposed to multi-occupant motorcycle accidents (Oluwadiya *et al*., 2016). In another study, it was also noted that a majority of the affected were men who were the most commercial motorcycle riders and lacked resources hiders to purchase protective equipment (Kamulegeya *et al.*, 2015). It has long been observed that males engage in more risk-taking activities related to dangerous driving (Sanusi & Emmelin, 2015).

Young riders aged 25-34 years were the highest age cohort likely to cause accidents in Embu County likely due to failure to observe traffic rules. The findings agree with a study that was conducted in Kitengela where majority of *boda boda* operators were young people aged 20-29 years (Nyachieo, 2013). This also concurs with a study conducted in Nigeria revealed that majority of commercial motorcycle riders were aged 20-39 years and there were at least 2 cases which occurred every hour in Kano metropolis (Badaru, Lawal & Muhammad, 2017). According to a study conducted in

Uganda, RTAs were most common among riders of younger age groups (Tumwesigye, Atuyambe & Kobusingye, 2016). Younger riders ride under influence of drug, over-speeds and exercise risky riding behaviours. This combination of risk factors and behaviours likely placed them at an increased likelihood of being involved in accidents, which in certain cases, were serious. (Badaru, Lawal & Muhammad, 2017). Another study noted that a majority of the young commercial motorcycle riders had helmets in their possession however, they rarely used as they believed upon immunity to injury and accidents (Olusayo *et al*., 2015). In addition, young riders spent most of their revenue on inhalants and other psychoactive substances largely (Gudaji & Habib, 2015).

Regarding level of education almost a half of the motorcyclist had at least secondary education. This finding agrees with other studies that found motorcycle riders were not illiterate (Mahlstein, 2009; Ngim & Udosen, 2007). This also concurs with a study that found that commercial motorcycle riders were reasonably educated (Kumar, 2011). This implies that most educated people have slim chances in the formal employment market hence most of them have settled for commercial motorcycle business as a source of income.

5.1.2 Road safety measures among study participants

In this study, prevalence of helmet use was high among motorcyclists. The findings differ with those of studies done in Cambodia and two towns in Kenya where helmet usage remains low (Bachani *et al*., 2012; Bachani *et al.*, 2017). This increase in helmet can attributed to the enforcement of National motorcycle helmet-wearing laws by the traffic police. The law requires mandatory helmet wearing by both drivers and passengers. Motorcycle helmets have been consistently found to be effective in reducing the risk of death and head injury among motorcyclists in crashes (Liu et al., 2008). Most of deaths among motorcyclists involved in road traffic crashes is as a result of head injuries which accounts for over 80% of the fatalities in low- and middle-income countries (Hyder, 2013). Study conducted in Taiwan concluded that non-helmeted motorcyclists were more than 4 times likely to have head injuries and 10 times as likely

to have brain injuries compared to helmeted motorcyclists (Yu *et al*., 2011). Correct use of standard helmets when riding a motorcycle is highly important (Passmore *et al*., 2010; Ackaah *et al*., 2013).

The study findings indicated majority of the motorcyclists used reflector jackets which made them conspicuous to other road users. This differs from studies done in Kenya and New Zealand that found 27.9% and 10.6% motorcyclist wore reflector jackets respectively (Karau *et al*., 2015; Wells *et al*., 2004). Low motorcycle conspicuity, or the inability of the motorcyclist to be seen by other road users is associated with risk of motorcycle crashes (Williams & Hoffmann 1979). This is attributed to several factors, including size of motorcycle, irregular outline, low luminance or contrast with the background environment, and the ability to travel in unexpected places in the traffic stream. Adoption of inexpensive measures for example adding a light source and the use of light, bright, reflective, or fluorescent colours can potentially enhance conspicuity of motorcyclists (Wells *et al*., 2004). Wearing a high visibility upper torso garment reduces in involvement in crashes (Hurt, 1981).

The study findings of those motorcyclists who reported having used alcohol concurs with studies conducted in Kangundo where 17.4% had intoxicated alcohol (Karau *et al*., 2015). Alcohol consumption impairs motorcyclist judgement and this explains the correlation with road injury. A majority of the motorcyclists were male who were more likely to report alcohol use. This is in agreement with a study that reported that males were more likely to be involved in alcohol-related crashes (Romano et al., 2012). Stiffer penalties and enactment of new traffic codes of conduct can reduce incidence of alcohol-related crashes. This has worked in Brazil where there was reduction in alcohol use following enactment of a new traffic code of conduct was observed (Liberatti, Andrade & Soares, 2001).

Khat chewing offers euphoria and excitement because of its amphetamine-like properties. The riders pursue the alertness effect to remain active and “high” for long working hours. However, this long-period alertness is counterproductive as it

subsequently increases the level of exhaustion that affects their ability to work effectively (Karema *et al*., 2017). The proximity of khat production around Embu region in Kenya increases its use given that the community around has embraced its wider production and use. Focusing efforts on the reduction of the use of Khat is key in minimizing RTAs. For example, local community-level interventions which attempt to counter negative personal and social factors, including emotional stress, financial stress and peer pressure that are putative predictors of youths' use of substances (Singoro, Wakhungu & Obiri, 2016).

5.1.3 Prevalence of motorcycle-related road traffic accidents in Embu town

Traffic accidents involving motorcyclist are quite prevalent (Oliveira & Sousa, 2012). Motorcycle accidents are inherently more dangerous than motor vehicle accidents for drivers and occupants because riders are not protected by steel and are typically thrown from the motorcycle during a collision (Berecki-Gisolf *et al*., 2015). This study confirms the high burden of motorcycle road accidents in the country as has been documented by other studies and this is linked to the liberation in the acquisition of motorcycle by the government (Odero & Garner, 1997). The proportion of motorcycle related accidents reported in the study is higher than 15% reported in STEPs survey conducted in Kenya (Gathecha *et al*., 2018). This is also higher than what has been reported in developed countries such as Germany with 10.7% (Sass & Stang, 2013) and developing countries such as Sierra Leone with 12.4% (Stewart *et al*., 2013) and Uganda with 14% (Lett Kobusingye & Ekwaru, 2006). The proportion is almost closer to 28.3% accidents of commercials motorcyclists with either pedestrian or motor vehicle in Niavasha town (Odiwuor, Nyamusi & Odero, 2015). The rate is lower than 63.6% of motorcycle taxi drivers were involved in at least one motorcycle accident in Brazil (de Almeida *et al*., 2016). The proportion is very high and needs to be addressed as injuries have far reaching effects on individuals, societies and healthcare systems (WHO, 2014; Schuurman *et al*., 2015). The risk of death involving motorcyclists is evident and most fatal cases occur at the site of accident or within 24 hours of such event and it is a public health problem that results in high social and economic costs (Oliveira & Sousa, 2014b).

5.1.4 Factors associated with motorcycle related road traffic accidents

The study measured many factors thought to be associated with motorcycle accidents including road safety measures and non-modifiable characteristics i.e. age, sex, education level, employment, marital status, monthly income and daily income in a developing country where motorcycle accidents are common. In the current study, factors independently associated with motorcycle accidents were alcohol consumption, *Khat* use, driving under alcohol influence and chewing *Khat* while riding.

Alcohol use is a higher risk factor for road traffic accidents and fatal injuries (Jou, Yeh & Chen, 2012; Mir *et al*., 2012). The findings are consistent with other studies that found alcohol and drug use is associated with increased incidences of motorcycle accidents (Tumwesigye, Atuyambe & Kobusingye, 2016, WHO, 2014; Schuurman *et al.*, 2015). Others studies have shown a strong link between drink driving and involvement in accidents by motorcyclists (Owino, 2018). This is attributed to alcohol impairment of judgement and their ability to interpret events correctly which is magnified when combined with fatigue (WHO, 2013b; Ngim & Udosen 2007). It has been reported that alcohol consumption significantly increases accident severity risk because of over-speeding and other safety violations (Albalate & Fernández-Villadangos, 2009).

5.2 Conclusion

The following are the findings of this study:

1) This study established that most of the commercial motorcycle riders are male, those aged 25-34 years were the highest cohort and half have at least secondary education.
2) Majority of the study participants had valid license, had undergone motorcycle riding training, own a reflector jacket and a helmet. A small proportion of the participants use alcohol, use *khat*, drive under influence of alcohol and ride while

chewing *khat*. Majority of the study participants ride their motorcycle at a speed between 50-80 Km/h.

3) The prevalence of commercial motorcycle related road traffic accidents in Embu was at 24%.
4) Major factors independently associated with road traffic accidents among motorcyclists in Embu include use of alcohol, use of *khat*, riding while chewing *khat* and riding under the influence of alcohol

5.3 Recommendations

1) The National Government, County Ministry of Transport and other relevant organisation should consider the influence of socio-demographic and economic factors among commercial motorcycle riders especially among men and young riders.
2) There was tremendous increase in following road safety measures. Therefore, there is need to provide strict punitive measures for those found violating road safety measures such as not wearing reflector, helmet or not having a valid driving license.
3) There was prevalence of commercial motorcycle accidents. Therefore, the National Government, County Ministry of Transport and other relevant organizations whose interest is to support prevention of road accidents should devise mechanisms to reduce motorcycle related accidents.
4) Road safety factors are key in reducing motorcycle related accidents. The National Government road traffic department should enforce road traffic rules especially among commercial motorcycle riders in order to capture the offenders for example random drinking-driving checks for motorcyclists by traffic police. Public health interventions that advocate for behaviour change among motorcyclist such as stoppage of alcohol drinking and chewing *khat* must also be heightened. This can be done through sensitization seminars with motorcyclists that can be held regularly.

5.4 Recommendations for further research

There is a need to conduct further studies on types of injuries associated with motorcycle accidents in Embu town, Embu County.

REFERENCES

Ackaah, W., Afukaar, F., Agyemang, W., Anh, T. T., Hejar, A. R., Abdul, G., ... & Inclán-Valadez, C. (2013). The use of non-standard motorcycle helmets in low-and middle-income countries: a multicentre study. *Injury prevention*. *BMJ Publishing Group Ltd*, *19*(3), 158–163.

Aeron-Thomas, A., Astrop, A. & Jacobs, G. (2000). Estimating global road fatalities. *TRL REPORT* 445. Retrieved from: http://worldcat.org/issn/09684107.

Bachani, A. M., Hung, Y. W., Mogere, S., Akunga, D., Nyamari, J., & Hyder, A. A. (2017). Helmet wearing in Kenya: prevalence, knowledge, attitude, practice and implications. *Public health*, *144*, S23-S31.

Bachani, A. M., Koradia, P., Herbert, H. K., Mogere, S., Akungah, D., Nyamari, J., ... & Stevens, K. A. (2012b). Road traffic injuries in Kenya: the health burden and risk factors in two districts. *Traffic injury prevention*, *13*(sup1), 24-30.

Bachani, A. M., Tran, N. T., Sann, S., Ballesteros, M. F., Gnim, C., Ou, A., ... & Hyder, A. A. (2012). Helmet use among motorcyclists in Cambodia: a survey of use, knowledge, attitudes, and practices. *Traffic injury prevention*, *13*(sup1), 31-36.

Badaru, U. M., Lawal, I. U. & Muhammad, A. U. (2017). 'Pattern of neurologic, orthopaedic and soft tissue injuries sustained in commercial motorcycle accidents in Kano metropolis', *Archives of Physiotherapy & Global Researches*, *21*(3).

Bagenda, B., Ahimbisibwe, A., Tusiime, W., & Moya, M. (2017). Regulation of Boda Boda Operators and Road Accident Reduction in Uganda: A Case of Kampala City Council Authority. *ORSEA JOURNAL*, *5*(1).

Benner, L. (1978). Accident theories and their implications for research. In *AAM/ZAATH Conf* (pp. 10-14).

Berecki-Gisolf, J., Yiengprugsawan, V., Kelly, M., McClure, R., Seubsman, S. A., Sleigh, A., & Thai Cohort Study Team. (2015). The impact of the Thai motorcycle transition on road traffic injury: Thai Cohort Study results. *PloS one*, *10*(3).

Chandran, A., Hyder, A. A. & Peek-Asa, C. (2010). The global burden of unintentional injuries and an agenda for progress. Epidemiologic reviews. *Oxford University Press*, *32*(1), 110–120.

Cheng, L. P., Wang, C. & Lu, J. (2014). 'Examine Factors Associated with Motorcycle Injury and Fatality', in Applied mechanics and materials. *Trans Tech Publ*, 1045–1054.

da Silva, D. W., Andrade, S. M. D., Soares, D. F. P. D. P., Mathias, T. A. D. F., Matsuo, T., & de Souza, R. K. T. (2012). Factors associated with road accidents among Brazilian motorcycle couriers. *The Scientific World Journal*, *2012*, 1-6.

de Almeida, G. C. M., de Medeiros, F. D. C. D., Pinto, L. O., de Oliveira Moura, J. M. B., & Lima, K. C. (2016). Prevalence and factors associated with traffic accidents involving motorcycle taxis. *Revista brasileira de enfermagem*, *69*(2), 359.

de Oliveira, N. L., & de Sousa, R. M. (2012). Risk for injuries among motorcyclists involved in traffic incidents. *Rev Esc Enferm USP*, *46*(5), 1133-40.

de Oliveira, N. L., & de Sousa, R. M. (2012b). Factors associated with the death of motorcyclists in traffic accidents. *Revista da Escola de Enfermagem da USP*, *46*(6), 1379.

del Sol, D. A., & Fernàndez-Villadangos, L. (2009). Exploring Determinants of Urban Motorcycle Accident Severity: The Case of Barcelona. *Documentos de trabajo (XREAP)*, (2), 1-7.

Department of the Environment, Transport and the Regions (DETR). (2011). A further indication that the Boda Boda job is dangerous comes from citing police reports, which reveal that between 2008 and 2012, the injuries among drivers increased from 1795 to 3043 (Gamberini, 2014). London: HMSO (Her Majesty's Stationery Office). Retrieved from: http://www.ocs.politico.it/biblioteca/ mobilita/TomorrowRoads1.pdf.

Diaz Olvera, L., Plat, D., Pochet, P., & Sahabana, M. (2012). *Motorbike taxis in the" transport crisis" of West and Central African cities.* HAL: EchoGéo.

Gathecha, G. K., Ngaruiya, C., Mwai, W., Kendagor, A., Owondo, S., Nyanjau, L., ... & Kibachio, J. (2018). Prevalence and predictors of injuries in Kenya: findings from the national STEPs survey. *BMC public health*, *18*(3), 1222.

Goodfellow, T. & Titeca, K. (2012) 'Presidential intervention and the changing "politics of survival"in Kampala's informal economy, Cities. *Elsevier*, *29*(4), 264–270.

Gudaji, M. I. and Habib, Z. G. (2015). 'Socio-Demographic factors associated with psychoactive substance use among commercial motorcycle operators in Kano, Nigeria', *Open Journal of Psychiatry. Scientific Research Publishing*, *6*(1), 76–85.

Gururaj, G. (2008). Road traffic deaths, injuries and disabilities in India: current scenario, National Medical Journal of India. *Oxford University Press*, *21*(1), 14.

Howe, J. & Maunder, D. (2004) 'Boda Boda-Lessons from East Africa's Growing NMT Industry', in *10th World Conference on Transport Research World Conference on Transport Research Society Istanbul Technical University*.

Hurt, H. H. (1981). *Motorcycle accident cause factors and identification of countermeasures* (Vol.2). Washington DC: Springfield.

Hyder, A. A. (2013). Injuries in low-and middle-income countries: a neglected disease in global public health', *Injury. Elsevier, 44*(5), 579–580.

Jacobs, G., Aeron-Thomas, A., & Astrop, A. (2000). Estimating global road fatalities. Retrieved from: http://trl.demo.varistha.co.uk/uploads/trl/documents/TRL445.pdf

Jou, R. C., Yeh, T. H., & Chen, R. S. (2012). Risk factors in motorcyclist fatalities in Taiwan. *Traffic injury prevention*, *13*(2), 155-162.

Kamulegeya, L. H., Kizito, M., Nassali, R., Bagayana, S., & Elobu, A. E. (2015). The scourge of head injury among commercial motorcycle riders in Kampala; a preventable clinical and public health menace. *African health sciences*, *15*(3), 1016-1022.

Karau, P. B., Ogeng'o, J. A., Okoro, D., Muia, M., & Saumu, M. W. (2015). Risk factor profile of motorcycle crash victims in rural Kenya. *Annals of African surgery*, *12*(1), 645- 649.

Karema, F. M., Irandu, E. M., & Moronge, J. M. (2017). The role of commercial motorcycles in alleviating poverty in rural areas: a case study of Laikipia East Sub-County, Kenya. *World Review of Intermodal Transportation Research*, *6*(2), 155-176.

KNBS, R. (2012). Kenya National Bureau of statistics'. Nairobi: Government printer. Retrieved from: https://www.knbs.or.ke/.

KNBS. (2009). The Kenya Economic Survey 2009. Retrieved from http://www.knbs.or.ke/index.php?option=com_phocadownload&view=category&id=16&Itemid=508#

Komba, D. D. (2007). *Risk factors and road traffic accidents in Tanzania: a case study of Kibaha District*, Unpublished MSc thesis, og teknologiledelse: Fakultet for samfunnsvitenskap og teknologiledelse.

Konings, P. (2006). Solving transportation problems in African cities: innovative responses by the youth in Douala, Cameroon. *Africa today*, 35-50.

Koornstra, M. K. (2003). Transport safety performance in the EU. *Brussels, European Transport safety council, Transport accident statistics Working party*. Brussels: European Transport safety council, Transport

Kual, A., Sinha, U. S., Pathak, Y. K., Singh, A., Kapoor, A. K., Sharma, S., & Singh, S. (2005). Fatal road traffic accidents, study of distribution, nature and type of injury. *Journal of Indian Academy of Forensic Medicine*, *27*(2), 71-76.

Kumar, A. (2011). Understanding the emerging role of motorcycles in African cities. *Sub-Saharan Africa Transport Policy Program* (SSATP) discussion paper; no. 13. World Bank, Washington, DC. Retrieved from: http://documents. worldbank.org/curated/en/391141468007199012/Understanding-the-emerging-role-of-motorcycles-in-African-cities-a-political-economy-perspectiv.

Langley, J., Mullin, B., Jackson, R., & Norton, R. (2000). Motorcycle engine size and risk of moderate to fatal injury from a motorcycle crash. *Accident Analysis and Prevention*, *32*(5), 659-663.

Lett, R. R., Kobusingye, O. C., & Ekwaru, P. (2006). Burden of injury during the complex political emergency in northern Uganda. *Canadian Journal of surgery*, *49*(1), 51.

Liberatti, C. L. B., Andrade, S. D., & Soares, D. A. (2001). The new Brazilian traffic code and some characteristics of victims in southern Brazil. *Injury Prevention*, *7*(3), 190-193.

Lin, M. R., & Kraus, J. F. (2009). A review of risk factors and patterns of motorcycle injuries. *Accident Analysis & Prevention*, *41*(4), 710-722.

Macharia, W. M., Njeru, E. K., Muli-Musiime, F., & Nantulya, V. (2009). Severe road traffic injuries in Kenya, quality of care and access. *African health sciences*, *9*(2).

Mahlstein, M. (2009). *Shaping and being shaped. The regulation of commercial motorcycle operation and social change in Calabar*, Nigeria. Unpublished MA Thesis, Basel: University of Basel.

Matheka, D. M., Omar, F. A., Kipsaina, C., & Witte, J. (2015). Road traffic injuries in Kenya: a survey of commercial motorcycle drivers. *Pan African medical journal*, *21*(1), 342-249.

Michael, C. E., Ojedoku, U. A., & Chinwokwu, E. C. (2013). Abolition of commercial motorbikes and its implication on transportation and criminality in Calabar metropolis. *Int'l J. Soc. Sci. Stud.*, *1*, 206.

Michon, K. (2013). Motorcycle Accidents: Roads Hazards. Retrieved from: http://www.legal-encyclopedia/motorcycle-accidentsroad-hazards-30331-2html,

Mir, M. U., Khan, I., Ahmed, B., & Razzak, J. A. (2012). Alcohol and marijuana use while driving--an unexpected crash risk in Pakistani commercial drivers: a cross-sectional survey. *BMC Public Health*, *12*(1), 145.

Mohan, D. (2002). Road safety in less-motorized environments: future concerns. International journal of epidemiology. *Oxford University Press*, 31(3), 527–532.

Mohtasham-Amiri, Z., Dastgiri, S., Davoudi-Kiakalyeh, A., Imani, A., & Mollarahimi, K. (2016). An epidemiological study of road traffic accidents in Guilan Province, Northern Iran in 2012. *Bulletin of Emergency and Trauma*, *4*(4), 230.

Mullin, B., Jackson, R., Langley, J., & Norton, R. (2000). Increasing age and experience: are both protective against motorcycle injury? A case-control study. *Injury Prevention*, *6*(1), 32-35.

Mutiso, W. & Behrens, R. (2011). *Boda Boda'bicycle taxis and their role in urban transport systems: case studies of Kisumu and Nakuru, Kenya, SATC 2011*. Document Transformation Technologies. Cape Town: University of Cape Town.

Nantulya, V. M., & Reich, M. R. (2002). The neglected epidemic: road traffic injuries in developing countries. *Bmj*, *324*(7346), 1139-1141.

Nesoba, D. (2010). Motorcycle boom tied to increase in road accidents in Kenya. Kenya News Desk Retrieved from: http://globalpressjournal. com/africa/kenya.

Ngim, N. E., & Udosen, A. M. (2007). Commercial Motorcyclists: Do they care about road safety?. *Nigerian Medical Practitioner*, *51*(6), 111-113.

NTSA. (2015). 2015 Road Safety Status Report. Retrieved from http://www.ntsa.go.ke /index.php?option=com_content&view=article&id=203&Itemid=551

NTSA. (2019). 2019 Road Safety Status Report. Retrieved from http://www.ntsa. go.ke/ index.php?option=com_content&view=article&id=213&Itemid=706

Nyachieo, G. M. M. (2013). Creating Employment through Transport; The Youth and Motorcycle (bodaboda) in Kitengela, Kajiado County-Kenya. *Research Journal in Organizational Psychology & Educational Studies*, *2*(4), 154-157.

Odero, W. (2009, December). Motorcycle injuries in East Africa: Magnitude, risk factors and prevention. In *Road Traffic Injuries Research Network (RTIRN) Workshop, Accra, Ghana* (pp. 1-18). Retrieved from: http://rtirn.net/ PDFs/3_ Wilson_

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

Odero, W., Khayesi, M., & Heda, P. M. (2003). Road traffic injuries in Kenya: magnitude, causes and status of intervention. *Injury control and safety promotion*, *10*(1-2), 53-61.

Odiwuor, C. W., Nyamusi, E., & Odero, W. (2015). Incidence of road traffic crashes and pattern of injuries among commercial motorcyclists in Naivasha Town. *Int J App Res*, *1*(11), 541-549.

Ogunmodede, T. A., & Emeahara, E. N. (2016). Influence of demographic variables on the use of road safety information by commercial motorcycle riders in Nigeria. In *The African Symposium (TAS)*, *15*(3), 44-51.

Olubomehin, O. O. (2012). The development and impact of motorcycles as means of commercial transportation in Nigeria. *Research on Humanities and Social Sciences*, *2*(6), 231-239.

Olumide, A. O., & Owoaje, E. T. (2015). Young age as a predictor of poor road safety practices of commercial motorcyclists in Oyo state, Nigeria. *Traffic injury prevention*, *16*(7), 691-697.

Olusayo, A. I., Oyetunde, O. B., Okeibunor, O. L., Adedokun, O. S., & Adedeji, A. S. (2015). Road traffic injury immune delusion syndrome among commercial motorcycle riders in Ogbomoso, Nigeria. *Global Advance Research Journal of Medicine and Medical Science*, *4*(2), 092-097.

Oluwadiya, K. S., Ojo, O. D., Adegbehingbe, O. O., Mock, C., & Popoola, O. S. (2016). Vulnerability of motorcycle riders and co-riders to injuries in multi-occupant

crashes. *International journal of injury control and safety promotion*, *23*(2), 189-196.

Owino, J. O. (2018). *Factors associated with accidents involving commercial motorcycle operators in Migori town, Kenya*, Unpublished MSc thesis, Rongo: Rongo University

Passmore, J. W., Nguyen, L. H., Nguyen, N. P., & Olivé, J. M. (2010). The formulation and implementation of a national helmet law: a case study from Viet Nam. *Bulletin of the World Health Organization*, *88*, 783-787.

Peden, M., Scurfield, R., Sleet, D., Mohan, D., Hyder, A. A., Jarawan, E., & Mathers, C. (2004). *World report on road traffic injury prevention*. Geneva: World Health Organization.

Pojani, D., & Stead, D. (2015). Sustainable urban transport in the developing world: beyond megacities. *Sustainability*, *7*(6), 7784-7805.

Rizzo, M. (2011). The struggles of informal transport workers in Tanzania: Debunking the myth of micro solutions. *Development Viewpoint*, *68*(2011). Retrieved from: soas.ac.uk

Romano, E. O., Peck, R. C., & Voas, R. B. (2012). Traffic environment and demographic factors affecting impaired driving and crashes. *Journal of safety research*, *43*(1), 75-82.

Sanusi, A. A., & Emmelin, M. (2015). Commercial motorcycle drivers' perceptions of risk and road safety in urban Nigeria: an explorative study. *International journal of injury control and safety promotion*, *22*(4), 328-339.

Sass, A. C., & Stang, A. (2013). Population-based incidences of non-fatal injuries-results of the German-wide telephone survey 2004. *BMC public health*, *13*(1), 376.

Schuurman, N., Cinnamon, J., Walker, B. B., Fawcett, V., Nicol, A., Hameed, S. M., & Matzopoulos, R. (2015). Intentional injury and violence in Cape Town, South Africa: an epidemiological analysis of trauma admissions data. *Global health action*, *8*(1), 27016.

Schwellnus, M. P., & Derman, E. W. (2005). Common injuries in cycling: Prevention, diagnosis and management. *South African Family Practice*, *47*(7), 14-19.

Singoro, B. W., Wakhungu, J. & Obiri, J. (2016). Causes and trends of public transport motorcycle accidents in Bungoma County, Kenya. *International Journal of Multidisciplinary Academic Research*, *4*(1), 36–42.

Slesak, G., Inthalath, S., Wilder-Smith, A., & Barennes, H. (2015). Road traffic injuries in northern Laos: trends and risk factors of an underreported public health problem. *Tropical Medicine & International Health*, *20*(11), 1578-1587.

Stewart, K. A. A., Groen, R. S., Kamara, T. B., Farahzad, M. M., Samai, M., Cassidy, L. D., ... & Wren, S. M. (2013). Traumatic injuries in developing countries: report from a nationwide cross-sectional survey of Sierra Leone. *JAMA surgery*, *148*(5), 463-469.

Tongklao, A., Jaruratanasirikul, S., & Sriplung, H. (2016). Risky behaviors and helmet use among young adolescent motorcyclists in Southern Thailand. *Traffic injury prevention*, *17*(1), 80-85.

Tumwesigye, N. M., Atuyambe, L. M., & Kobusingye, O. K. (2016). Factors associated with injuries among commercial motorcyclists: evidence from a matched case control study in Kampala City, Uganda. *PloS one*, *11*(2), e0148511.

Wawira, V. G. (2014). Factors influencing growth of informal transport sector: A Case of Bodaboda Transport in Central Division, Embu West District. *University of Nairobi*. Retrieved from: http://hdl.handle.net/11295/95477.

Wells, S., Mullin, B., Norton, R., Langley, J., Connor, J., Jackson, R., & Lay-Yee, R. (2004). Motorcycle rider conspicuity and crash related injury: case-control study. *Bmj*, *328*(7444), 857.

Williams, M. J., & Hoffmann, E. R. (1979). Motorcycle conspicuity and traffic accidents. *Accident Analysis & Prevention*, *11*(3), 209-224.

Woratanarat, P., Ingsathit, A., Chatchaipan, P., & Suriyawongpaisal, P. (2013). Safety riding program and motorcycle-related injuries in Thailand. *Accident Analysis & Prevention*, *58*, 115-121.

World Bank. (2015). Road crashes have more impact on poverty than you probably thought Transport for Development. Retrieved from http://blogs.worldbank.org /transport/road-crashes-have-more-impact-poverty-you-probably-thought

World Health Organization. (2008). *The global burden of disease: 2004 update*. Geneva: World Health Organization.

World Health Organization. (2011). Motorcycle Related Road traffic Crashes in Kenya facts and figures. Retrieved from: https://www.who.int/violence_injury_ prevention/road_traffic/countrywork/factsheet_kenya.pdf

World Health Organization. (2014). Injuries and violence: the facts 2014. Retrieved from: https://apps.who.int/iris/handle/10665/149798.

World Health Organization. (2015). *Global status report on road safety 2015*. World Health Organization. Retrieved from: https://www.who.int/violence_injury_ prevention/road_safety_status/2015/en/

World Health Organization. Dept. of Violence, Injury Prevention, World Health Organization. Violence, Injury Prevention, & World Health Organization. (2009). *Global status report on road safety: time for action*. World Health Organization. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/44122/9789241563840

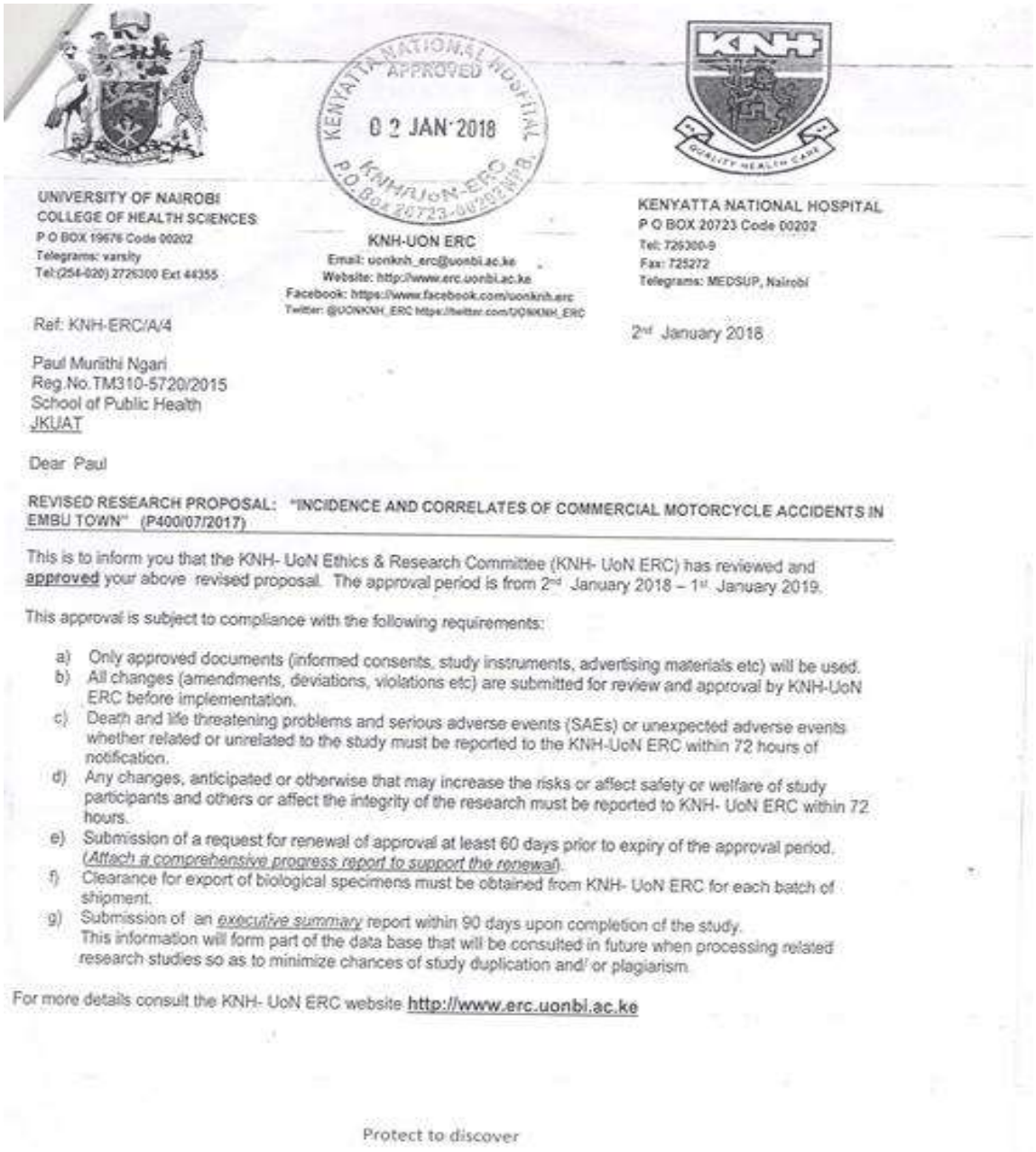
Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). New York: Harper and Row.

Yu, W. Y., Chen, C. Y., Chiu, W. T., & Lin, M. R. (2011). Effectiveness of different types of motorcycle helmets and effects of their improper use on head injuries. *International journal of epidemiology*, *40*(3), 794-803.

Zhang, J., Norton, R., Tang, K. C., Lo, S. K., Jiatong, Z., & Wenkui, G. (2004). Motorcycle ownership and injury in China. *Injury control and safety promotion*, *11*(3), 159-163.

APPENDICES

Appendix I: Human Subjects Training Certificate



KENYATTA NATIONAL HOSPITAL APPROVED 02 JAN 2018 KNH/UoN-ERC P.O. Box 20723-00202 NAIROBI

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/4

2nd January 2018

Paul Murithi Ngari
Reg.No.TM310-5720/2015
School of Public Health
JKUAT

Dear Paul

REVISED RESEARCH PROPOSAL: "INCIDENCE AND CORRELATES OF COMMERCIAL MOTORCYCLE ACCIDENTS IN EMBU TOWN" (P400/07/2017)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above revised proposal. The approval period is from 2nd January 2018 – 1st January 2019.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH-UoN ERC before implementation.
c) Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
f) Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
g) Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Protect to discover

EMBU COUNTY GOVERNMENT
DIRECTOR OF HEALTH

Telephone: 068-31883
Fax: 068- 31791

Email : cdhembu@gmail.com
When replying please quote our reference

COUNTY DIRECTOR OF HEALTH
EMBU COUNTY
P.O. BOX 273
EMBU

Ref: EBU/COH/45/VOL. 1/10

Date: 19th January 2018

TO WHOM IT MAY CONCERN

RE: LETTER OF INTRODUCTION.

This letter is to introduce **Paul Muriithi Ngari, P/No: 2010047070** of Identity Card No. **21730154**, who is a staff in the Department of Health – Embu County. He will produce a staff card, which carries a photograph, as proof of identity.

He is undertaking research leading to the production of a thesis or other publications on the subject of *"Incidence and Correlates of Commercial Motorcycle Accidents in Embu County"* Reference number KNH-ERC/A/4.

He would like to invite you to assist with this project by agreeing to be involved in an interview; completing questionnaires; agreeing to being observed in the workplaces / fields which covers certain aspects of this topic.

Any enquiries you may have concerning the Officer/ this project should be directed to me at the address given above.

Thank you for your attention and assistance.

Sincerely,

DR. S. M. KANIARU
COUNTY DIRECTOR OF HEALTH

CC:
CEC – Health
COH - Health

Appendix II: Informed Consent Form

Title of the study: Incidence and correlates of commercial motorcycle accidents in Embu Town.

Investigator: Paul Murithi Ngari.

Study introduction: There are much traffic crashes happening every day, a significant number emanating from motorcyclists', leading to injury, death, and damage to property. Various factors are believed to contribute to this crisis. This study's objective was to understand the incidence and associated factors of motorcycle accidents in one of the regions in Kenya. The investigator requests volunteering. Before agreeing to take part in the study, please go through the information on this study through the use of this document, the consent form. Please study it carefully and feel free to ask for any clarifications on any element of the study that may not be clear to you. If you agree to our interview, you will be asked to kindly sign this consent form and a copy will be provided to you for safekeeping. Please also note that:

i. Your agreement to participate in this study is voluntary
ii. You may withdraw from the study at any time without necessarily giving a reason for your withdrawal
iii. Refusal to participate in the research will not in any way affect the treatment that is being given in the hospital

Purpose of the study:

The purpose of this project is to determine incidence risk and associated factors in commercial motorcycle-related accidents in Embu Town, Embu County.

Benefits:

This study will help you to learn more about the risks that you might be subjected to as a motorcycle operator in Embu Town. You will have an awareness of potential risks and how to mitigate against them.

Risks:

The only risk is the loss of a few minutes that will be needed for you to respond to the questionnaire.

Compensation mechanism:

There will be no compensation for participating in this study except if the principal investigator deems it necessary.

Alternative treatments:

There will be no alternative treatments in this study.

Voluntary Participation:

Your participation in the study is completely voluntary. You are therefore free not to participate in the study, withdraw participation any time without any loss of benefits from your employer.

Specimen:

This study will not involve the collection of specimens in any way or form.

Confidentiality:

Any information about you that should be kept private like your marks will be kept confidential.

Additional Information:

If you have questions or you require any clarifications, please feel free to ask me. In addition, if you have questions in the future you are also free to directly ask the **Principal Investigator** on 0722930887or any of the following Supervisors: **Dr John Gachohi** Phone Number: 0727 671 796) – Jomo Kenyatta University of Agriculture and Technology, **Prof. Kenneth Ngure** (0722 362 219) – Jomo Kenyatta University of Agriculture and Technology.

You may also contact the **Secretary of the KNH-UoN Ethics and Research Committee, P.O.Box 19676- 00200, Tel: (254-020) 2726300 ext 44355,** if you have any questions regarding this research study that you feel are best addressed by an independent party.

CONSENT FORM FOR THE MOTORCYCLE OPERATOR

I, the undersigned, willingly undertake to participate in this study whose purpose has been explained to me. I understand that any information obtained for the purposes of this study will be held in strict confidentiality.

Name …… Signature …… Date ……

Witnessed by:

Name …… Signature …… Date ……

NOTE: You are not giving up any of your legal rights by signing this informed consent document.

Appendix III: Questionnaire

SERIAL No. _____

QUESTIONNAIRE

Socio-Demographics

The following sections will ask some questions about you generally. Tick as appropriate.

1. What is your age in Years? {18-24} {25 -34} {35-44}, {45-54} {above 55}
2. What is your gender? ___ Male ___ Female
3. What is your Marital Status? ____Single _____Married _____Widowed _____Separated ____ Divorced
4. What is your religion? ___ Christian ___ Hindu ____Muslim ___Other (Specify) _____
5. What is your highest level of Education?
6. __ No formal Education __Primary Education __Secondary Education
7. __ Tertiary Education
8. Do you have any other form of employment or income generating activity other than motorcycle riding?

   ____ Yes ____ No

If Yes, Which One?

___ Farming __Teaching ___Healthcare (e.g., nurse, doctor, public health)

___Casual work __Business ___ Office work __Other (Specify)_____

9. What is your total average income per month in Ksh.? _____

10. What is your daily income due to motorcycle riding in Ksh? _____

11. Did you have a valid driving license? __ Yes __ No
12. Did you undergo formal training in learning how to ride a motorcycle? ___ Yes ___ No
13. What is your average riding speed in Km/Hr during your day-to-day activities? _____
14. Do you own a reflector __ Yes __ No
15. Do you own a helmet __ Yes __ No
16. How many hours of sleep do you get on average, every night? _____

Alcohol and Khat Chew

In this section, tick the most relevant response as it applies to you

17. Do you use Alcohol? ___ Yes ___ No
18. Do you use Khat? ___ Yes ___ No
19. During the past 12 months, how often, on average, did you drink alcoholic beverages?'

__ Everyday ___ 4–6 times/week ___ 2–3 times/week,

__ once a week ___1–3 times a month ___less than once a month ___N/A

20. On the days when you drank how many drinks did you usually have? _____
21. 'During the last 12 months, how often did you have >7 drinks of any kind of alcoholic beverage in a single day that is, any combination of cans of beer glasses of wine, or drinks containing liquor of any kind? ____
22. Have you ever driven under the influence of Alcohol? ___ Yes ___ No
23. While riding, do you do so while or after chewing Khat? ___ Yes ___ No
24. During the past 12 months, how often, on average, did you drink alcoholic beverages?'

__ Everyday ___ 4–6 times/week ___ 2–3 times/week,

__ once a week ___1–3 times a month ___less than once a month ___N/A

Motorcycle Roadworthiness

In this section, tick the most relevant response as it applies to you

25. When was the motorcycle purchased? ____

26. How often do you service your motorcycle?

___ Daily ___Once a week __ Fortnightly __ Once a month ___ Rarely

___ Other (Specify_____

27. When was your last motorcycle servicing? _____

In the section below, rate the condition of your car parts as per your last motorcycle ride. With 1 being very poor and 5 being very good.

	Very poor	Poor	Average	Good	Very good
28. Tires					
29. Brakes					
30. Speedometer					
31. Exhaust system					
32. Engine functionality					

Adherence to Traffic Rules

In this section, rate how often you do what is indicated in the statement given. Indicate if you practice the said area always, often, sometimes, rarely or never.

How often do you…	Always	Often	Sometimes	Rarely	Never
33. Transport more than 1 passenger at a time					
34. Transport passengers together with their heavy luggage					
35. Use a speed of more than 50 Kph					
36. Receive phone calls while driving					
37. Use daytime headlights when riding?					
38. Overtake from the left side of the road					
39. Overtaken near a bend?					
40. Divert to the passenger road when traffic is congested?					
41. Wear a helmet					
42. Provide a helmet for the passengers I am carrying					
43. Wear a reflective jacket					
44. Wear protective boots					
45. Wearing protective gloves					

Road Conditions

In this section, indicate if you strongly agree, agree, are unsure, disagree, or strongly disagree with the given statement with regards to the road conditions in the route you frequently use

	Strongly agree	Agree	Unsure	Disagree	Strongly Disagree
46. The road has several sharp bends					
47. The road has several blind spots					
48. The road is under construction					
49. The road has poor drainage and floods during the rainy season					
50. The road has several potholes					
51. I frequently ride during night hours					
52. The road surface has loose parts such as loose stone and gravel					

53. Do you have any eyesight problems? ____Yes ___ No

If yes, which eyesight problem? _____

54. My eyesight problem affects my ability to see objects on the road

__ Strongly Agree ___ Agree __Unsure ___ Disagree ___Strongly disagree

55. Do you own corrective lenses? ___ Yes ___ No

Accident risk/occurrences

56. Listed below are types of accidents that involve motorcyclists. Please tick the boxes next to the two you think motorcyclists are most at risk from. (Please remember to only tick two boxes)

_ Collisions while overtaking other road users
_ Being hit from behind by other road users (rear-end shunt) p Collisions with right-turning vehicles
_ Collisions with left-turning vehicles
_ Poor riding technique leading to loss of control of the motorcycle p Over-shooting bends in the road

57. The same list of accident types is repeated below. This time please place a tick in the next to the two you think motorcyclists are <u>least at risk</u> from. (Please remember to only tick two options)

_ Collisions while overtaking other road users
_ Being hit from behind by other road users (rear-end shunt)
_ Collisions with right-turning vehicles
_ Collisions with left-turning vehicles
_ Poor riding technique leading to loss of control of the motorcycle p Over-shooting bends in the road

58. Are there any other types of accidents you think motorcyclists are particularly at risk from? (Please indicate in the space below)

_____

_____