OCCURRENCE AND PATTERN OF MAXILLOFACIAL INJURIES CAUSED BY MOTORCYCLE CRASHES PRESENTING AT TWO REFERRAL HOSPITALS IN NAIROBI, KENYA

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Declaration

I, Dr. Nyameino J Simba, do declare that this is my original work and has not been submitted by any other person to any other university for a degree or any other purpose.

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Dedication

I dedicate this dissertation to my parents J. Justus Nyameino Simba, and Jemimah Moraa for their support and encouragement throughout the period of study.

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List of abbreviations

I. ATLS- Advanced Trauma And Life Support

II. KNH-UON ERC -Kenyatta National Hospital and University of Nairobi Research Ethics and Standards committee

III. MLKH - Mama Lucy Kibaki Hospital

IV. MMF-Maxillary- Mandibular Fixation

V. ORIF- Open Reduction And Internal Fixation

VI. RTC- Road Traffic Crashes

VII. RTI-Road Traffic Injuries

VIII. STI –Soft Tissue Injury

IX. UoN - University of Nairobi

X. WHO- World Health Organization

Abstract

Background:

Road Traffic Crashes (RTCs) constitutes a major public health concern especially with the evolution of transport systems and utilization of motorcycle as a means of transport, due to their affordability and convenience. Motorcycle use in Kenya has significantly increased over the last decade. RTCs involving motorcycles have also steadily increased over the years and this has consequently led to an increased burden in management of injuries to the health care system in Kenya. These injuries include cranio-maxillofacial and mandibular trauma. The pattern of maxillofacial injuries and use of protective gear is not well described.

Study Objective:

To determine the occurrence and pattern of maxillofacial injuries among patients involved in motorcycle crashes presenting for treatment at two referral hospitals in Kenya.

Study Setting:

The study was conducted at the Kenyatta National Hospital (KNH) and Mama Lucy Kibaki Hospital (MLKH) in Nairobi between 12th August 2014 to 30th November 2015

Study Design

This was a descriptive cross-sectional prospective hospital based study

Materials and Methods

Data were obtained through interview and physical examination of patients. A questionnaire was used to record patient's biodata; age, gender and residence and treatment administered. Research assistants were trained to assist in data collection. Every tenth patient interviewed and examined by the research assistant was re-examined by the principal investigator to ascertain that the information acquired was accurate, consistent, reproducible and reliable. A sample size of 91 patients was achieved. Data analysis was done using an MS-Excel computer program and SPSS (Statistical Package for Social Sciences) version 16.

Results

Ninety one patients were examined, among whom 76 (83.5%) were males and 15(16.5%) were females (M:F 5:1). The age range and modal age were between 3-62 years and 21- 30 years respectively (mean=29years). Most of the participants were motorcycle riders and businessmen. Majority of the riders (84.2%) had no training or valid motorcycle riding licenses while a minority (15.4%) had a valid motorcycle license. The kind of protective gear used by the participants included the use of jackets (35%), helmets (32.9%), reflective coat (28.8%) and protective trousers (6.8%). There was a significant association between use of protective gear and occupation with motorcycle riders having higher rates of usage of protective gear. Most of the participants(98%) had soft tissue injuries, while (63.7%) of the participants had facial hard tissue injuries; the midface was the most commonly fractured site (38%). The concomitant injuries recorded were; upper limb, head, chest and abdominal injury. The midface fractures were significantly associated with helmet use and mandibular fractures with accident victim class.

Conclusions

Motorcycle related injuries were most common in males aged 21-40 years of age. Motorcycle taxi riders and businessmen were the largest groups of motorcycle crash victims. The midface was the most common facial region injured and the injuries were significantly associated with helmet use where the helmet was protective against the fractures. Low use of protective gear by motorcycle riders and passengers affected the severity of injuries during crashes.

Lack of training and licensing was a common finding among motorcycle riders and most riders had less than 2 year riding experience. Collisions and falls were the most common cause of crashes. There was statistically significant association between the position of participant and severity of soft tissue injuries with the rider having more severe forms of injury. The management of soft tissue injury was by soft tissue stitching. Hard tissue fractures were managed by open reduction and internal fixation.

Recommendations

There is need to focus on strategies that help in prevention of motorcycle crashes and injuries. These include enforcement of the law to ensure good training and licensing of rider . Consistent use of good quality protective crash helmets by motorcyclists to derive maximum protection during a crash needs to be emphasized.

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

Half of the world's road traffic deaths occur among motorcyclists, pedestrians and cyclists[1]. The overall global road traffic fatality rate is 18 per 100 000 population. Moreover, middle-income countries have the highest annual road traffic fatality rates at 20.1per 100 000. The risk of death as a result of a road traffic crash (RTCs) is highest in the African Region (24.1 per 100 000 population), and lowest in Europe (10.3 per 100 000)[1].

In Kenya, RTCs are a major public health concern[3]. The overall road traffic injuries (RTIs) rate in Kenya was 59.96 per 100,000 population in 2009, with vehicle passengers having been the most affected. Notably, injuries to motorcyclists have increased at an annual rate of approximately 29 percent[3]. With the evolution of transportation systems, motor vehicles and motorcycles now form a large percentage of transport modalities. Recently, motorcycles have become very popular as a means of public transportation in Kenya[2]. The number registered rose from 2,084 units in 2003 to 16,293 in 2007, then to 51,412 in 2008 and by 2009 , an average of 7000 motorcycles were being registered every month. The number of motorcycles registered went up by 33.1 per cent in 2012, that is from 93,970 to 125,058 units in 2014 according to the government's economic survey of 2014[4].

The transition to the use of motorcycles has been attributed to a number of socio-economic and political factors ,the argument being that motorcycles are affordable, fuel efficient, cheaper to maintain and can ply on poorly maintained roads in cities, towns and villages with relative ease . Despite the associated advantages, motorcycles can also be a source of disabling injury and death[2].

Several factors contribute to the increased incidence and patterns of maxillofacial injuries Which may include; gender, age, environment and socioeconomic status , where most of the injured are young men of low socioeconomic groups[5]. Motorcyclists and their passengers are also identified as particularly vulnerable victims in RTCs, by virtue of the nature and design of motorcycles and are three times as likely as a passenger car occupant to be injured in a crash[6].

The maxillofacial region occupies a prominent position on the body, where it is vulnerable to injury[6,7,8]. The injuries are associated with high morbidity including functional and cosmetic disfigurement. Motorcycle related facial injuries are mostly soft tissue injuries (STIs) in isolation or in combination with bone injuries, the middle third of the face being the most vulnerable site [8]. The injuries can thus be classified into facial bone fractures, STIs, and dento-alveolar injuries[9,10]

The close association of concomitant body injuries in maxillofacial fracture is well documented due to the region's proximity to vital organs including the brain, spinal cord and eyes[11,12]. Injuries to the brain have been described as the most commonly associated concomitant body injuries with facial fractures[11]. Physiological functions such as airway control and feeding may be compromised[12]. In such injuries management of skeletal and STI of the face constitute a significant portion of treatment offered by maxillofacial surgeons to trauma patients[13]. More than 50% of patients with maxillofacial injuries have other multiple injuries requiring coordinated management with other subspecialities[14]. There is a huge financial cost to be considered as well as morbidity, loss of function and psychological effects to the patient.

Management of maxillofacial injuries is often aimed at restoration of satisfactory facial aesthetics and function[16] .Several treatment modalities are available for the patients; for example for those with mildly displaced fractures, a conservative approach of rest and supportive medications is advised [15]. Those patients who require surgical intervention are treated using the following options: wound debridement, mandibulo-maxillary fixation (MMF) using arch bars or eyelet wiring, open reduction and internal fixation (ORIF), which usually gives good aesthetics and function. Patients from developing countries may unfortunately not afford the latter form of treatment[16].

Majority of maxillofacial injuries from motorcycle accidents are preventable, therefore, the country needs to focus on strategies that will help reduce their occurrence. The other challenge is that there is also limited research on motorcycle injuries from hospital registries hence the police department still remains as the main source of injury data in Kenya.

1.2 Literature review

1.2.1 Epidemiology

The occurrence of the road traffic crashes (RTCs) and deaths as per the World Health Organization (WHO) report on global road safety[1] is as follows: among motorcyclists (23%), pedestrians (22%) and bicyclists (5%).The report, however, shows that there is a significant increase in injury among pedestrians, cyclists and users of motorized two- or three-wheeled vehicles in most low- and middle-income countries[1].

A Tanzanian study showed that motorcycles are responsible for the majority of RTCs accounting for 58.8% of cases[17]. Motorcycle use is also becoming popular in Nigeria and Tanzania because they are cheaper in terms of amount of fare, fuel efficiency, maintenance,

and can access poorly maintained roads in cities, towns, and villages, with relative ease. They are therefore a more convenient form of transport within the cities [17,18].

Motorcycle use has significantly increased over the last decade ending 2014. Fatalities also increased among other road user groups except pedal cyclists over the 5-year period ending 2009 with the greatest increase in RTC fatality rates occurring among motorcyclists (51% annually) and pillion passengers (13% annually)[3]. A report from the road traffic department shows a trend of rising rate of motorcycle crashes (Table 1)[2].

Table 1: Road traffic crashes data for 2004-2013 involving motorcycles in Kenya

TRAFFIC ACCIDENTS, 2004-2013

Table 129 — Number

Description	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013*
Total Number of Reported Accidents	**10,717**	**12,399**	**12,201**	**12,470**	**11,209**	**12,369**	**9,771**	**8,193**	**6,917**	**6,205**
Persons Killed and Injured:										
Killed	2,264	2,531	2,715	2,921	3,158	4,072	3,055	3,302	3,141	3,191
Seriously Injured	6,751	7,899	8,722	8,932	9,206	10,644	9,327	8,647	7,434	6,299
Slightly Injured	11,858	12,341	11,828	13,735	12,162	11,906	9,739	7,144	5,037	4,834
Total	**20,873**	**22,771**	**23,265**	**25,588**	**24,526**	**26,622**	**22,121**	**19,093**	**15,612**	**14,324**
Vehicles Primarily Responsible:										
Motor cars	3,327	3,800	3,813	4,018	3,521	3,432	3,157	2,184	2,123	2,024
Lorries, buses and taxis	2,087	2,639	2,812	3,126	2,442	2,655	2,327	2,078	1,649	1,475
Motor cycles	313	363	346	432	688	1,292	852	622	496	505
Pedal cycles	1,045	1,146	1,193	927	925	810	554	760	589	360
Animals/Hand Carts	197	151	199	224	112	68	48	36	32	47
Matatus	1,680	1,786	1,749	1,463	1,484	2,099	1,025	905	587	488
Others	1,946	2,456	2,089	2,280	1,879	2,013	1,808	1,608	1,441	1,306
Persons Primarily Responsible:										
Drivers (Incl Motor Cyclists)	4,257	5,444	5,646	5,433	5,087	6,075	5,284	4,259	3,486	3,124
Pedestrians	2,628	3,035	2,676	3,089	2,577	2,450	947	1,071	725	620
Pedal Cyclists	1,369	1,545	1,408	1,288	1,343	1,257	1,159	936	912	819
Passengers	505	466	400	601	376	415	401	423	401	421
Other causes	1,958	1,909	2,071	1,790	1,826	2,172	1,980	1,504	1,393	1,221
Times of Accidents:										
Day	6,860	7,999	7,417	7,752	6,981	7,337	6,429	5,125	4,028	4,005
Nights	3,857	4,400	4,784	4,718	4,228	5,032	3,342	3,068	2,889	2,200

Source: *Kenya Facts and Figures, 2014; Kenya national bureau of statistics*[19]

The age and gender of the patients injured in motorcycle crashes show the modal age being young adults with the majority being male. A study in Malaysia showed that the male-to-female (M:F) ratio of motorcycle related injuries was 4.5:1 while the modal age was 21-30 years[20]. In Nigeria it has been shown that the pattern includes male riders aged between 5–70 years whose modal age group was 21–30 years , mean 28.7 years and M;F ratio of 4.5:1 while in Tanzanian study the range was 3-75 years ,the modal age group was 21-30(mean

age of 29.4 years) and a M:F ratio of 2.1:1[10,17]. A Kenyan study showed a modal age of 21-30 years and a mean of 30.78 years[22] and that male riders were the commonest among the injured. The average age and modal ages were 30.78 and 21–30 years, respectively[22].

Most crashes are caused by riders who are not formally trained and licensed. In Nigeria and Tanzania studies showed that few riders had received formal training while the majority was either trained by self or an acquaintance. Training lasted between 1-3 weeks in total and a majority volunteered the positive history of alcohol consumption[10,17]. Lack of proper motorcycle riding training has therefore, compromised riding standards and road safety in general according to the Kenya traffic department[4].

1.2.2 Injuries

The WHO Global status report on road safety (2013) showed that motorcycle deaths in Africa were on rapid increase due to increased motorcycle use. Head and neck injuries in severe form causes disability and death among motorcycle users[1].In Kenya, injuries to motorcyclists increased from 1.23 per 100,000 in 2004 to 3.63 per 100,000 populations in 2009, reflecting an annual rate of increase of approximately 29 percent[2].

The injuries in the maxillofacial region involve the soft and hard tissues of the face extending from the frontal bone superiorly to the mandible inferiorly. They vary from soft tissue lacerations to complex fractures of the maxillofacial skeleton. The pattern of these injuries depends on the mechanism of injury, magnitude and direction of impact force and anatomical site. A Tanzanian study showed that musculoskeletal and head injuries were the most common body injuries, attributing the latter to the low use of motorcycle helmets[17].

Studies in Nigeria showed that most injuries (91.7%)were STIs, followed by injuries in the extremities and then head injuries. Isolated dental injuries and a combination of bone and dental injuries being the least prevalent in that study. In the facial region the mandible (63.3%) recorded the highest incidence of fractures. The pattern of injuries among riders, pedestrians and passengers differed. Generally, the middle third of the face - particularly the central zone recorded more injuries among the pedestrians and passengers while riders had the lower and middle third of their faces equally injured[10]. The other study showed a pattern of injury comprising fractures in the mandible, midfacial region and dentoalveolar fractures. The pattern of mandibular fractures showed the symphyseal /parasymphyseal region being the most commonly fractured at 59.7% followed by the body/ angle region 32.8% and the condyle7.5%. The other fractures noted were Le fort I, II, III, zygomatic, palatal, orbital and nasoethmoidal fractures which accounted for 3.6%, 18.1%, 6.0%, 39.6%, 13.3%, 6.0% and13.3%, respectively. There were associated orofacial soft tissue and concomitant body injuries in 70.9% and 45.6% of patients respectively[11]

In another study, majority of the injuries involved soft tissue followed by the limbs (65%) and then the head [17]. Studies in Tehran and India showed similar injuries in decreasing incidences involving the soft tissues, extremities, craniofacial and the chest.[21,24] In Kenya a study showed that, most injuries were STIs followed by injuries in the extremities at 60.7 % with the head and neck region at 32.7%[22].

1.2.3 Management

Management of maxillofacial injury can be categorized broadly into two groups; emergency treatment and definitive treatment. The Advanced Trauma and Life Support (ATLS) protocol of management is followed strictly in the Accident and Emergency units . During this process

the following important aspects of a patient`s state are examined and urgent interventional measures instituted to save the patient from further deterioration. Airway patency is paramount and can be assisted using a chin lift or jaw thrust maneuver. Airway adjuncts may be required. The clinician should have a high index of suspicion for C-spine injury in all patients with traumatic head and neck injuries and protection by a cervical collar is mandatory until C-spine injury has been ruled out. Hemorrhage should be controlled as it can lead to hypovolemic shock. Large-bore intravenous lines may be established and a crystalloid solution may be given. Resuscitation using colloids and blood transfusion may be instituted in moderate to severe hypovolemic shock. The Glasgow Coma Scale guideline is used to assess and administer appropriate treatment. Appropriate analgesics, antibiotics and vaccines should be given.

Clinical examination of the face should begin with a detailed examination and documentation of the area for localized tenderness, numbness, bleeding, deformity, periorbital edema, ecchymosis, otorrhea , rhinorrhea and facial asymmetry. Evaluation and palpation of the superior and inferior orbital rims, nose, maxilla, zygomatic arch, mandible, and both alveolar ridges should be done[25].

In Sharjah, The United Arab Emirates, a study showed that more than half of all cases were treated by closed reduction (67%)[15]. A Nigerian study showed that patients who required surgical intervention were treated as follows: 30% had MMF plus internal wire suspension/trans osseous wiring, 6.3% had Gilles zygomatic elevation and 6.3% had Open Reduction and Internal Fixation (ORIF) using bone plates[11].A Tanzanian study showed that the most common procedure performed in 81.2% of the patients was wound debridement[17].

ORIF remains the best method of treating maxillofacial fractures [18]. This form of treatment, however , is not commonly used due to the high cost of bone plates coupled with an additional cost of general anesthesia .Complications were reported in 5.6% of patients who were treated using ORIF in Sharjah , in The United Arab Emirates[15].

1.2.4 Prevention of injuries

Majority of RTCs are preventable and thus enforcement of safety rules will help in reducing their occurrence. Campaigns to raise awareness about safety rules targeted at the high risk groups (young adult male, students and businessmen) will also contribute to reducing the RTCs as well as improve on the road safety[17]. The Global status report on road safety of 2013 suggests that helmets must meet recognized safety standards with proven effectiveness in reducing head injuries and impact of motorcycle crash injuries. Wearing a standard, good quality motorcycle helmet can reduce the risk of death by 40% and the risk of serious injury by over 70% [1].In Nigeria a study showed that 20% of RTC victims named a crash helmet as a known safety device, 23.8% had a helmet on at the time the study was conducted and only 3.8% of the motorcyclists who sustained maxillofacial injuries within Ibadan city wore a crash helmet[11]. A Tanzanian study about helmet use by riders and their passengers showed that, 24.7 % of riders had helmets at the time of injury while passengers had no helmets, the riders overloaded passengers, lacked proper training on motorcycle riding and possibly used alcohol and drugs[17]. In Tehran, a study about helmet use noted that only 8.6% of the injured riders and pillion passengers had helmets during the time of injury and the prominent cause of death was head injuries sustained during the crash. Only 2.7% of helmeted riders sustained a head injury compared with 11.2% of riders without a helmet[24].

A study in Kenya has shown that focusing on increasing the use of helmet and reflective clothing, has the potential of preventing severity of injuries sustained .The government has not made any headway in addressing helmet standards and, therefore continuing education and increased awareness among the riders was recommended[3]. Another study done in the same country showed that 20% of the passengers and 50% of the riders wore helmets while 63% of the riders and 1.3% of the passengers had their reflective jackets on at the time of injury[22].Helmets must meet recognized safety standards with proven evidence in reducing head injuries to reduce the impact of RTCs. It is important that during legislation helmet standards that are chosen should be suitable for the traffic and weather conditions of the country*and should also be both affordable and available to users[23]. Unfortunately in both developing and developed countries, there is resistance to legislation on motorcycle helmets and this coexists with debate on the effectiveness of motorcycle helmets in reducing the morbidity and mortality.

1.3 Problem statement

Motorcycle crash injuries form a major proportion of RTCs and cause significant misery, disability and death globally with a disproportionate number occurring in developing countries[17,18]. Injuries among motorcyclists in Kenya more than doubled from 1.23 per 100,000 in 2004 to 3.63 per 100,000 population in 2009, reflecting an annual rate of increase of 29 %.[3]

Head and neck injuries are some of the most severe causes of morbidity, disability and death among motorcycle users .The economic and social implications of maxillofacial injuries resulting from motorcycle accidents have triggered research in many countries concerning incidence, etiology, nature of injuries sustained and how these may be treated or prevented. Management of maxillofacial injuries often demands a high level of expertise[17]. The need for

ORIF in a resource limited country like Kenya leaves a huge socio-economic effect on patients and their families. Majority of maxillofacial injuries are preventable and therefore, the country needs to formulate strategies focusing on prevention of these injuries in order to reduce their occurrence. These strategies however, can only be implemented if there are data available showing the magnitude and pattern of the problem. This study therefore, aims at describing the occurrence and pattern of maxillofacial injuries manifesting in patients involved in motorcycle crashes presenting at two referral hospitals in Kenya.

1.4 Study justification

Motorcycle related maxillofacial injuries are a common cause of trauma and are associated with morbidity and mortality. There is limited knowledge on the pattern of these injuries with a paucity of data on maxillofacial injuries related to motorcycle accidents Studies on their pattern among motorcyclists in Kenya have hardly been done as most studies concentrate on the general pattern of injuries due to motor vehicle RTCs and the associated health burden. The outcome of the present study is expected to help describe the injuries and relate its severity to the failure to use protective gear. The study may provide information which will aid in implementation of safety measures for the rider and the passenger.

1.5. Objectives

1.5.1 General objective

To determine the occurrence and pattern of maxillofacial injuries associated with motorcycle crashes at two referral hospitals in Kenya.

1.5.2 Specific objectives

1. To describe the demographic characteristics of patients with injuries arising due to motorcycle crashes

2. To describe the distribution of maxillofacial injuries by type and other concomitant injuries
3. To determine the factors associated with motorcycle crash injuries
4. To describe the type of protective gear worn by riders and their passengers.

1.6 Study variables

1.6.1 Demographic data

a) Age

b) Gender

1.6.2 Independent variables

a) Nature/type of Motorcycle crashes (Collision, fall)

b) Patient status/Class of Motorcycle crash victim (Rider , pillion passenger or pedestrian)

c) Use of protective gear

d) Training and experience

e) Alcohol consumption

1.6.3 Dependent variables

a) Type of maxillofacial injuries ;soft tissue , hard tissue or both

b) Anatomical site involved

c) Skeletal structures involved; mandible, maxilla, naso-ethmoidal complex

d) Other associated injuries; chest injury, abdominal injury, limbs injury

e) Treatment ;emergency and definitive

CHAPTER TWO

RESEARCH METHODOLOGY

2.1 Study area

The study was conducted at Kenyatta National Hospital (KNH) and Mama Lucy Kibaki Hospital (MLKH). At both the two hospitals, patients involved in trauma were received at the Accident &Emergency Units where initial assessment and diagnosis was done. Treatment was then offered and those who needed inpatient care were transferred to the appropriate wards depending on the types of injuries suffered by the patient. Some patients with minor injuries were also seen and treated as outpatient in the dental clinic. These were included in the study.

2.1.1 Kenyatta National Hospital

KNH is located along Ngong Road about 3 Kilometres from the central business district of Nairobi, the capital city of Kenya (latitude-1.3011S. Longitude 36.8115E). This tertiary care and teaching hospital has a bed capacity of 1800. The hospital provides services as follows; average annual Outpatient attendance: 600,000 visits, average Annual Inpatient attendance: 89,000 patients.

Most complex injuries are referred to KNH for expert management. The hospital has both an inpatient and outpatient facility to cater for patients in need of Oral and Maxillofacial surgery. Nairobi is the most populous city in East Africa with a current estimated population of about 3,200,295 and covers an area of approximately 696 $Km.^2$

2.1.2 Mama Lucy Kibaki Hospital

MLKH is located in Nairobi's Eastlands area known as Umoja 3 approximately 15km East of Nairobi Central Business District in Embakasi District. This is a level 4 referral hospital with a bed capacity of 120. The hospital provides services to the surrounding estates in the eastern side of Nairobi city. It is the main public hospital in the district and a majority of residents seeking medical care visit the facility. The hospital also has a dental unit which attends to patients with maxillofacial injuries.

2.2 Study population

The study population consisted of all patients reporting at the A&E, Maxillofacial , Neurosurgery and Orthopedic wards in addition to the maxillofacial outpatient clinics of the selected two referral hospitals, presenting with maxillofacial injuries due to motorcycle accidents. Patients of all age groups and gender irrespective of the severity of injury who presented to the two hospitals during the period of study and who consented for the study were included.

2.3 Study design

A descriptive cross-sectional prospective study was done. Data were collected from interviews and physical examination with patients from the clinics and from those who had been admitted in the wards .Data were collected from both in /and out patients from the two hospitals.

2.4 Sample size determination

The sample size was calculated using the following Cochran formula (Cochran 1977) as follows;-The Cochran formula was used because it determines the number of subjects who will allow the estimate of a proportion with a given margin of error[26].

$$N = \frac{Z^2\, P(1-P)}{D^2}$$

Where N= Minimum sample size

Z=standard of normal distribution at 5% significance level; 1.96

P=Prevalence of motor cycle injury estimated as 6% [3].

D=Degree of accuracy set at 5%

Therefore, computed from the above formula

$$N = \frac{1.96^2 \times 0.06(1-0.06)}{0.05^2}$$

=90

2.5 Sampling method

All patients presenting with motorcycle related accidents reporting into the A&E Units of the selected hospitals were recruited into the study. The sampling method used was non-probability (convenience) sampling. Patients were screened for inclusion criteria and those who met the criteria were informed and requested to consent to allow participation in the study.

All the patients included in the study were first stabilized in the A&E departments as per the ATLS protocol. Those who required further in-patient care were transferred to the wards or the critical care unit where other important diagnostic investigations and procedures were done.

2.6 Inclusion/Exclusion criteria

Inclusion Criteria

I. Patients involved in motorcycle related accident with maxillofacial injury.

II. Those patients who gave consent or with a relative/guardian capable of giving consent on their behalf.

Exclusion Criteria

Patients who;

I. Had maxillofacial injuries due to other causes.

II. Declined to participate.

III. Were unconscious or were unable to communicate and were not accompanied by a relative / guardian.

2.7 Data collection methods and techniques

Once a patient was identified by the doctor in the A&E Unit and found to have had maxillofacial injuries resulting from a motorcycle accident then the principal investigator or research assistant was informed who proceeded with further investigations. The patient was interviewed with regards to their age, gender, motorcycle riding (for riders), site of injury, patients status; whether rider, pillion passenger or pedestrian, use or nonuse of protective gear at the time of accident. Riders were interviewed on their training, years of experience, alcohol consumption and khat chewing. The responses were recorded in the questionnaire (Appendix 1).

A general clinical examination was done to assess maxillofacial injuries and other injured sites. All the results from clinical examination were recorded in the examination form (Appendix 2).A record of the injuries from the available radiographic investigations (plain x-

ray, computer tomographs (CT scans) and 3- dimensional computer tomographs (3D Images) were also noted.The injuries sustained were recorded and classified accurately into;

1. Soft tissue injury only
2. Soft tissue injury with accompanying fractures;
3. Associated injuries-outside the head and neck injuries

2.8 Reliability and validity

The questionnaires were pretested with a small sample of ten patients from the MLKH, A&E (KNH) and KNH dental clinic and any ambiguity was corrected before the study began. Training by a maxillofacial radiologist was given to the principal investigator on accurate interpretation of x–rays. The filled questionnaire was checked for completeness and accuracy of the data. Confidentiality was emphasized to the respondents in order to encourage them to be sincere when answering the questions.

2.9 Data analysis

Microsoft's statistical package for social sciences version16 (SPSS-16) packages was used to analyze the data collected and, where emphasis was on the following:

I. Distribution of injury by types and specific maxillofacial sites injured
II. Distribution of injury among different age groups, gender, rider, passenger
III. Mean age of patients in years.
IV. Percentage of patients using protective gear; helmet, reflective apron
V. Determine proportion with associated injuries
VI. Tests of significance in analysis

Two main approaches were used in the analysis univariate descriptive analysis and bivariate analysis using chi square and Fishers exact tests. In the descriptive analysis stage, the sample

characteristics were summarized using measures of central tendency (mean) and measures of spread (standard deviation) calculated for continuous variables including the ages of patients. The descriptive analysis of categorical variables was conducted by calculating the frequency distribution of patients with different attributes including gender, occupation, riders and pillion passengers and percentage of patients who sustained different types of fractures, or had protective gear. The bivariate analysis comprised of using the chi square test to compare distribution of maxillofacial injuries sustained according to patient characteristics like age and occupation and also according to accident characteristics (position of patient during injury, time of accident, type of collision). The Fishers exact test was used instead of the chi square test for comparison in cases where the assumption of the chi square test was violated due to small cell counts.

2.10 Data presentation

The analyzed data were presented using tables, bar charts and graphs.

2.11Errors and Bias

Errors and bias were minimized by training and calibration of the interviewer/examiner at MLKH to ensure consistent interpretation of injuries. Standardization of diagnostic criteria by specifying the sets of radiographs required to diagnose injuries, specific methodology in physical examination protocol to rule out errors due to non-diagnosis of specific injuries. Computer aided analysis of all data collected also helped in reduction of errors

2.12 Study limitations

Investigator prescribed questionnaire method also depended on the respondent's ability to have been sincere. This affected the accuracy of the result. To try and overcome this aspect, I

assured the respondents were assured that the information they gave was to be handled with confidentiality. Lack of standard specific set of radiographs on all patients made it difficult to ascertain asymptomatic/minimal hard tissue fractures. Coverage of patients was also not quite representative of the patients in the country as it only involved two hospitals within the Nairobi region chosen for their convenient location.

2.13 Ethical considerations

Clearance was sought from the KNH/UON Ethics and Research committee (P No. 384/06/2014 dated 12th August 2014) before commencement of the study. The objective of the study was explained to the respondents (Appendix 3). They had an option to participate or to decline, and the latter would not prejudice their management. The patients were also consented on publishing the outcome of the study in reputable scientific journals.

Informed consent was obtained from the respondents before commencing the interview (Appendix 4&5). The names of the respondents were not included in the questionnaire. It was affirmed that confidentiality would be strictly maintained and all the data obtained were securely stored. Permission was obtained from the directors of the respective hospitals for the research to be carried out.

CHAPTER THREE
RESULTS

3.1 Demographic characteristics

Ninety one patients with motorcycle crash related maxillofacial injuries were recruited in the study among whom 76 (83.5%) were at KNH and 15(16.5%) at MLKH in Nairobi. Of the participants involved in the study, 51(56%) were inpatients. Most participants (84.6%) had no previous history of involvement in a motorcycle crash. About half of the motorcycle crashes 47 (51.7%) occurred within the County of Nairobi. Twenty nine (31.8%) of the participants were from the neighboring counties. Details of the other counties in which motorcycle crashes occurred are presented in Table A1 (Appendix VI)

3.1.1 Age

The age range of the patients was between 3- 62 years (mean =29 yrs SD=12). Figure 1 presents the frequency distribution of accident casualties according to age .

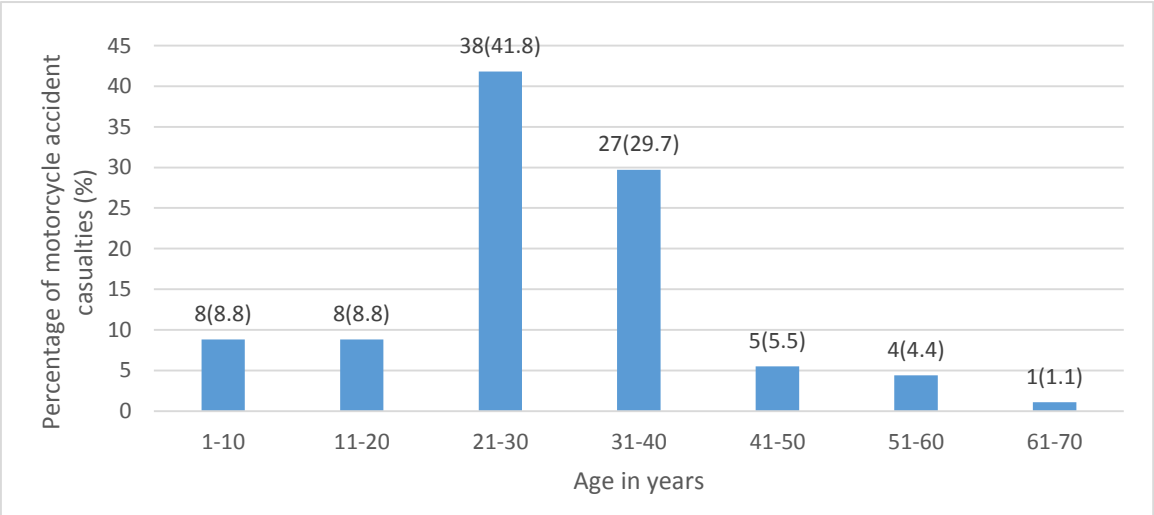

Figure 1: Distribution of motorcycle accident casualties by age

3.1.2 Gender

There were 76 (83.5%) males and 15(16.5%) females .The ratio of female to male accident casualties was approximately 1: 5.

3.1.3 Education

There were 42 (46.2%) participants with primary level education, 39 (42.9%) had secondary level education and the remaining 10 (11%) had tertiary level education (Figure 2).

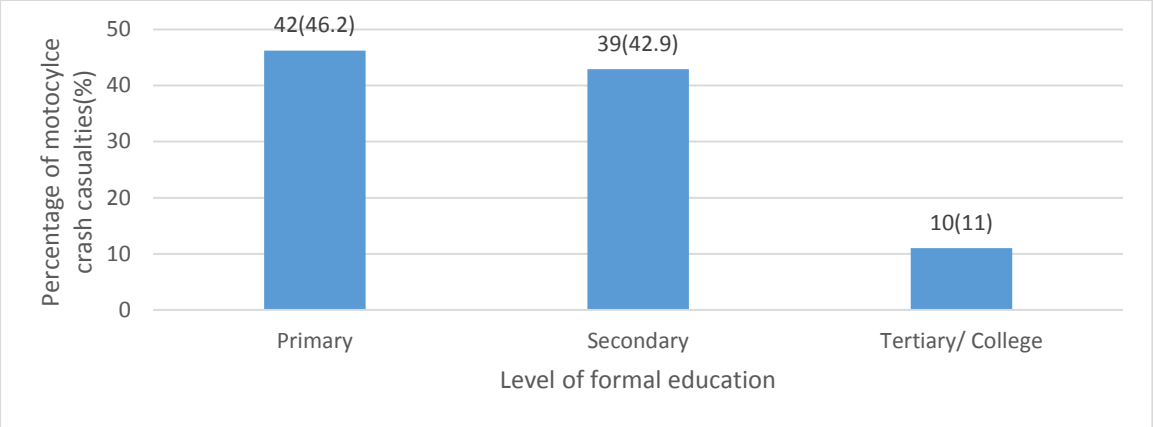

Figure 2: level of education of the study participants

3.1.4 Occupation

Motorcycle taxi operators and small scale business men (61.6%) formed the majority of study participants followed by students (16.5%)(Figure 3). (Detail of specific occupations within each occupation group are presented in Appendix VI, Table A2.)

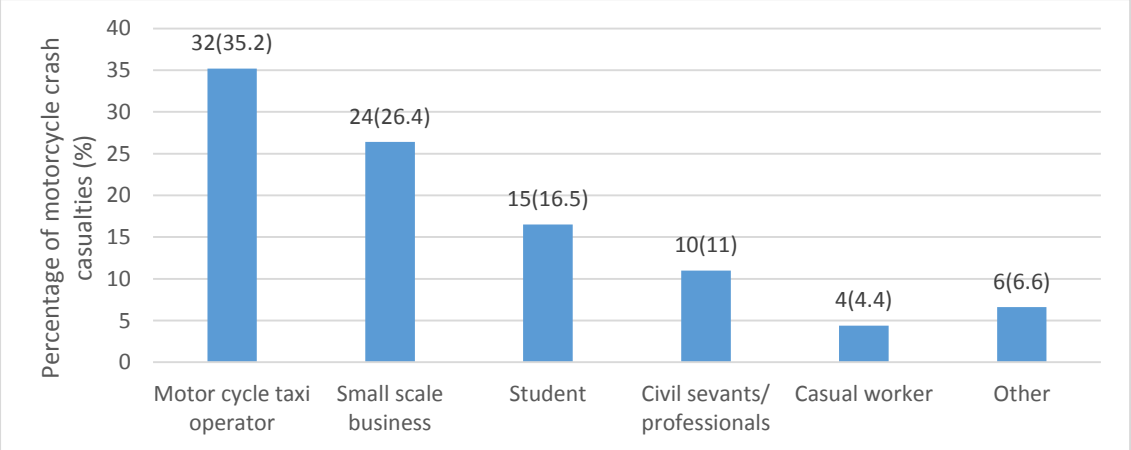

Figure 3: Distribution of participants by occupation

3.2. Day of the week and time of the day when crashes occurred.

3.2.1. Day of the week when the crashes occurred

The distribution of motorcycle crashes according to the day of the week showed that the motorcycle crashes reported during the week from Friday to Monday constituted 68(75%) of all the crashes occurring in a week. Most of these were reported on Sunday 20(22%), Monday 18(19.8%) and Saturday 16(17.6%). A few crashes occurred during the midweek with Tuesday 10(11%), Wednesday 10(11%) and Thursday 3 (3.3%).

3.2.2 Time of the day when crash occurred.

Most of the crashes occurred in the evening, 35 (38.5%) while the least number of crashes occurred in the afternoon 12(13.2%) (figure 4).

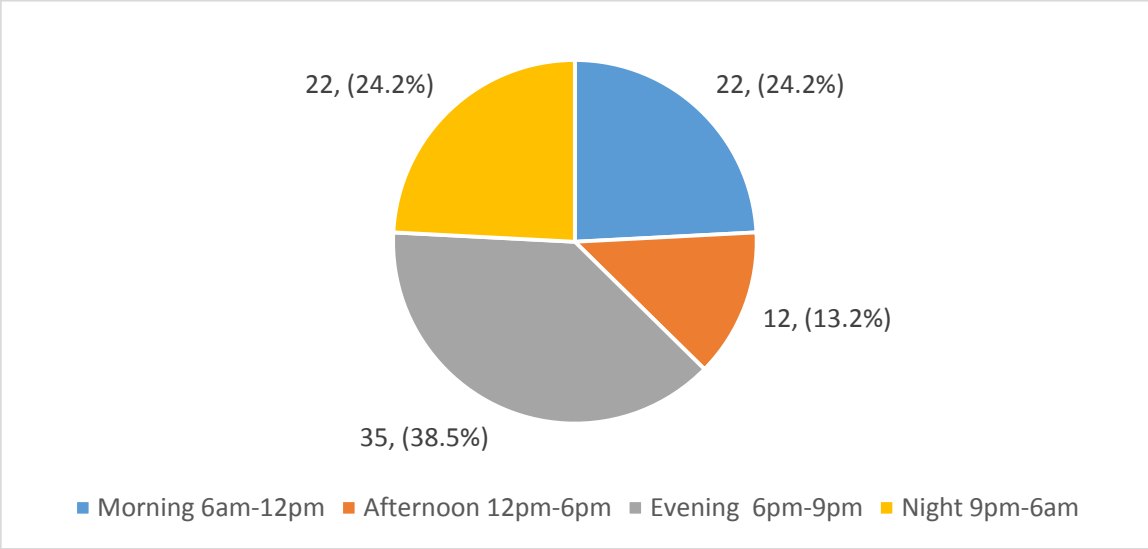

Figure 4: Distribution of casualties according to time of the day when crash occurred.

3.3. Distribution of participants according to origin and destination of journey

At the time when the accident occurred,73(80.3%) of the participants reported that they were either going to work 41.8% or returning home 38.5% (Figure 5).

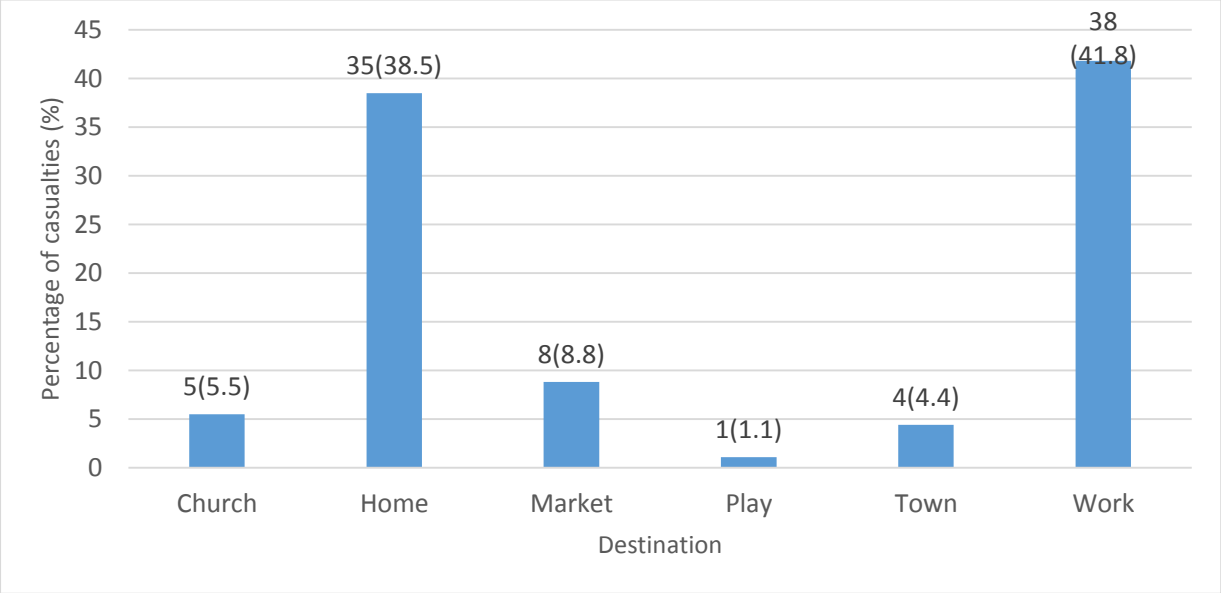

Figure 5: Destination of participants when crash occurred

Most casualties reported that at the time of the accident they were coming from either work 48(56%) or home 32(35.2%) (figure 6).

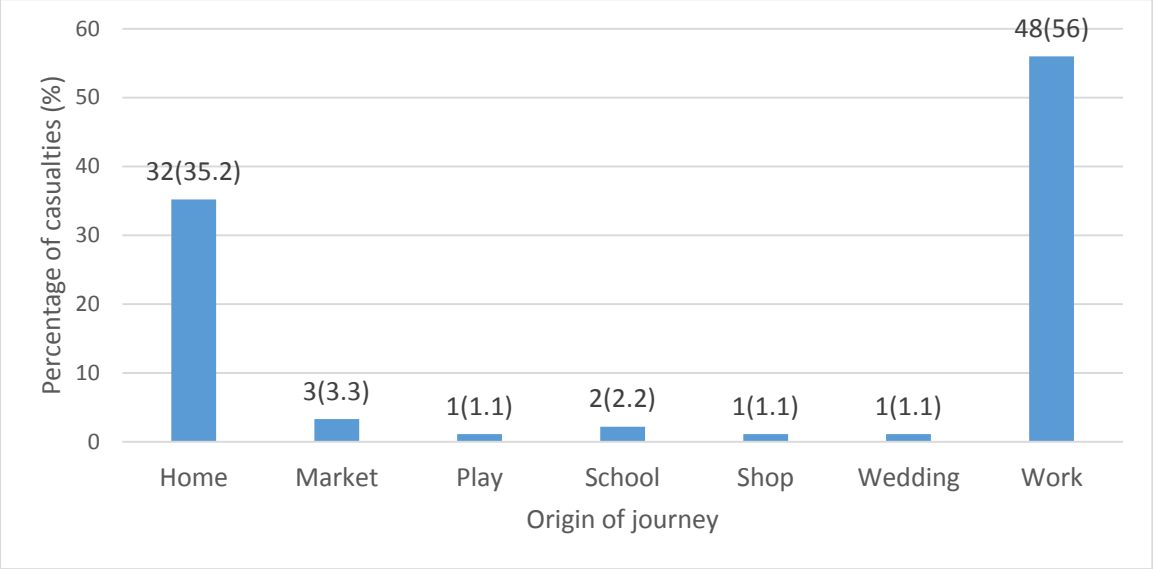

Figure 6: Origin of participants when the crash occurred

3.4 Motorcycle riders experience

3.4.1 Formal training

Out of the 46 motorcycle riders , the majority 39 (84.8%) had no training or valid motorcycle riding license and only 7 (15.2%) had been formally trained

3.4.2 Riding experience

Most of the motorcycle riders (80.4%) reported a riding experience of 2 years or less. The minority (19.6%) had more than 3 years of experience as shown in Fig 7.

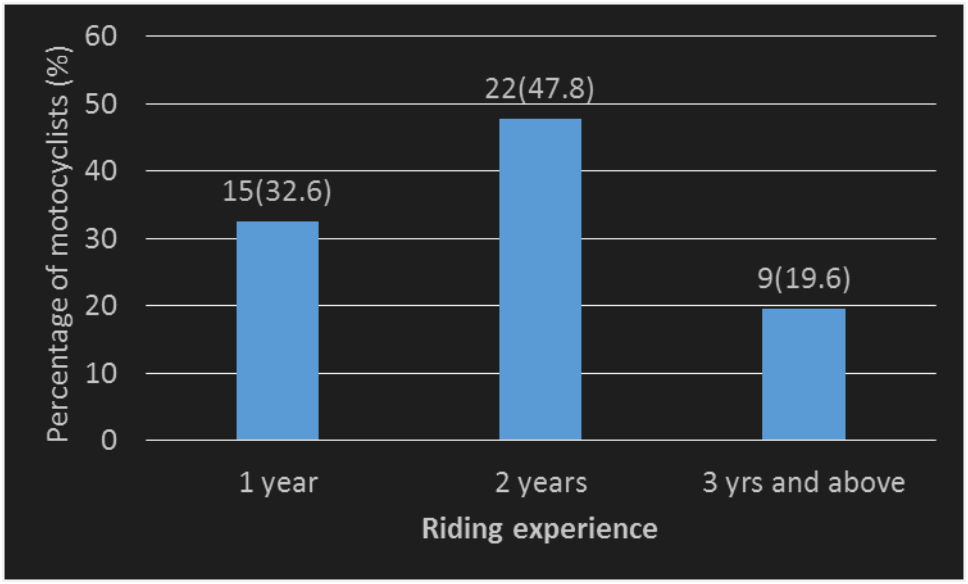

Figure7: Duration of experience among motorcycle riders before current accident occurred.

3.5 Alcohol consumption

Concerning alcohol consumption, (10%) of the participants who were all male reported alcohol use on the day of the crash. Six participants who were drunk on the day of injury were riders while 3 were pedestrians. There was a statistically significant association between alcohol consumption and age (p=0.016 with age group 41-50 reporting 100% alcohol consumption),gender (p=0.022 where the males predominantly reported use of alcohol) but not with occupation or level of education. (Table 2).

Table 2: Association between alcohol consumption and the various demographic characteristics.

Demographic characteristics	Alcohol use		
	Yes	No	P value
Age in years			
1-10	0	8(100.0)	0.016
11-20	3(37.5)	5(62.5)	
21-30	13(34.2)	25(65.8)	
31-40	7(25.9)	20(74.1)	
41-50	5(100.0)	0	
51-60	1(25.0)	3(75.0)	
61-70	0	1(100.0)	
Gender			
Male	28(36.8)	48(63.2)	0.022
Female	1(6.7)	14(93.3)	
Occupation			
Motor cycle taxi operator	12(37.5)	20(62.5)	
Small scale business	10(41.7)	14(58.3)	0.243
Student	2(13.3)	13(86.7)	
Civil servants/ professionals	1(10.0)	9(90.0)	
Casual worker	2(50.0)	2(50.0)	
Other	2(33.3)	4(66.7)	
Education			
Primary	18(42.9)	24(57.1)	0.097
Secondary	8(20.5)	31(79.5)	
Tertiary/ college	3(30.0)	7(70.0)	

3.6 Use of protective gear by the participants

Out of the 91 participants, 73 were either motorcycle riders or pillion passengers. In this group, 45.2% of them reported that they used protective gear when travelling on a motorcycle. The most frequently used protective gears were a jacket (35.6%) or a helmet (32.9%). Overcoats and heavy trousers were used by (28.8 %) and (6.8%) of participants, respectively (Fig. 8).

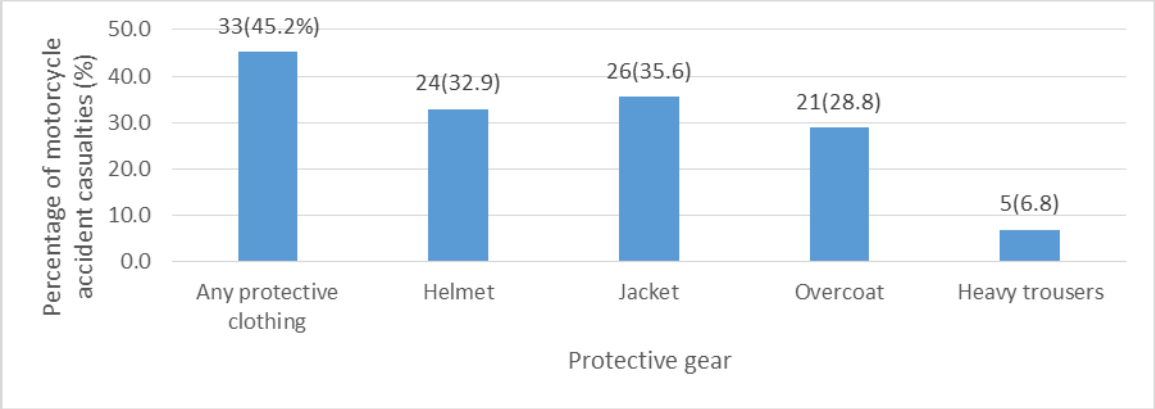

Figure 8: Use of protective gear among motorcyclists and pillion passengers

3.6.1 Use of protective gear among motorcycle riders.

The type of protective gear worn by riders 46(100%) include a heavy jacket worn by 23(50%.) followed by the helmet 19(41.3%) , light luminous overcoat 17(37%) and heavy protective trousers 5 (10%) (Fig. 9).

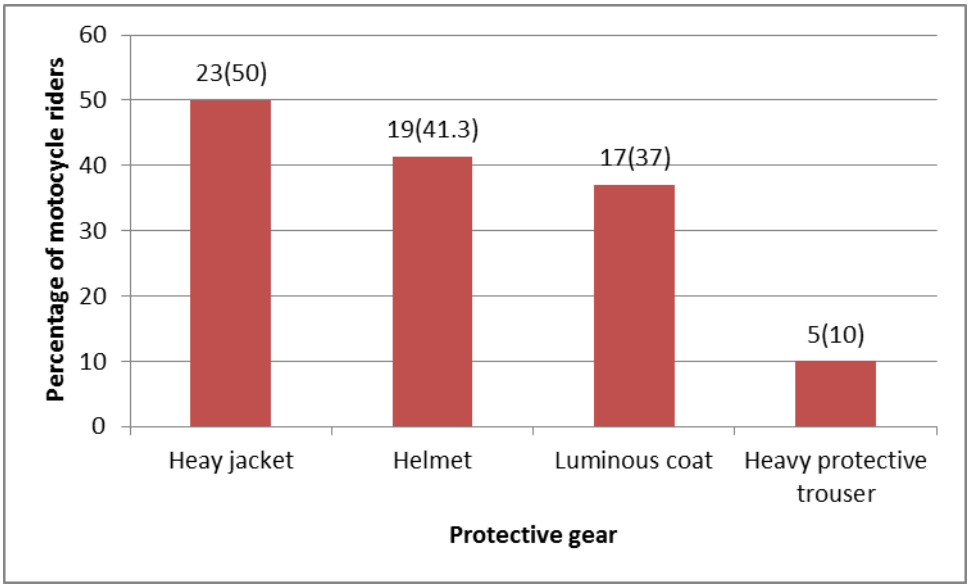

Figure 9: Use of protective gear among riders

There was also a statistically significant association between use of helmets and occupation (p=0.033) as shown in (Table 3)

Table 3: Association between helmet use and the various demographic variables.

Demographic variables	Helmet use		P value
	Yes	No	
Age in years			
1 to 10	1(50.0)	1(50.0)	0.657
11 to 20	1(14.3)	6(85.7)	
21-30	13(38.2)	21(61.8)	
31-40	9(34.6)	17(65.4)	
41-50	0	2(100.0)	
51-60	0	1(100.0)	
Education			
Primary	7(26.9)	19(73.1)	0.597
Secondary	14(38.9)	22(61.1)	
Tertiary/ College	3(30.0)	7(70.0)	
Gender			
Male	20(31.7)	43(68.3)	0.45
Female	4(44.4)	5(55.6)	
Occupation			
Motor cycle taxi operator	16(51.6)	15(48.4)	0.033
Small scale business	2(10.0)	18(90.0)	
Student	2(40.0)	3(60.0)	
Civil servants	2(22.2)	7(77.8)	
Casual worker	0	3(100.0)	
Other	2(50.0)	2(50.0)	

3.6.2 Use of protective gear among the pillion passengers

The type of protective gear worn by passengers (n=27) included the helmet worn by 5(18.5%) of the pillion passengers , light luminous overcoat 4 (14.8%) and heavy jacket 3(11.1 %.). There was no passenger who had heavy protective trousers (Fig. 10).

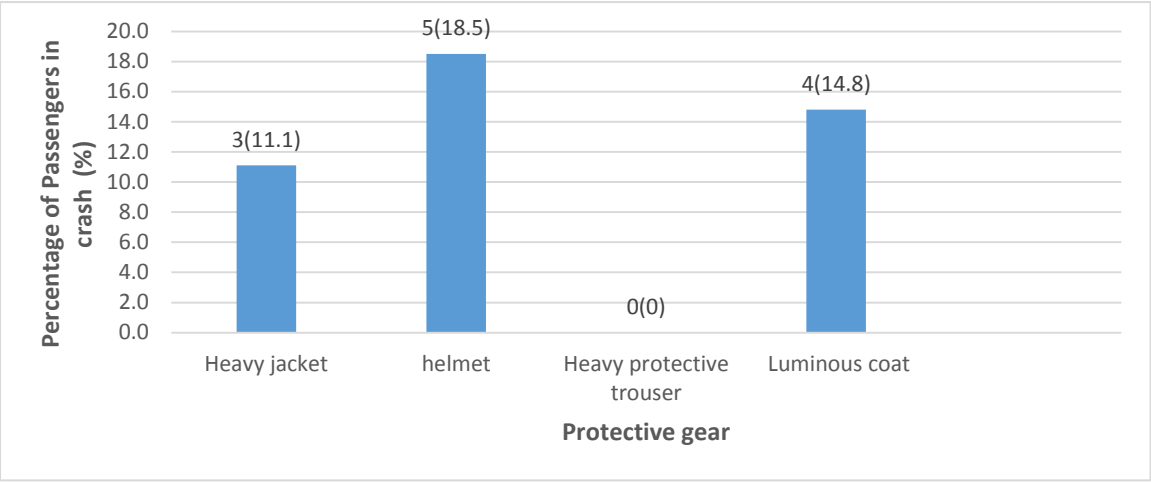

Figure 10: Use of protective gear among pillion passengers

There was a statistically significant association between use of protective gear and occupation (p=<0.001) but not with the other demographic variables such as; gender education and age. (Appendix VI, Table A 3).

3.7 Nature of motorcycle accidents

The most common type of accidents among the casualties of motorcycle crashes was falls which constituted 27.5% of all crashes followed by head on collision with vehicles 19 (20.9%) ,collision with motorcycles 15 (16.5%). Fig. 11 shows the frequency of motorcycle accidents according to the nature of accident.

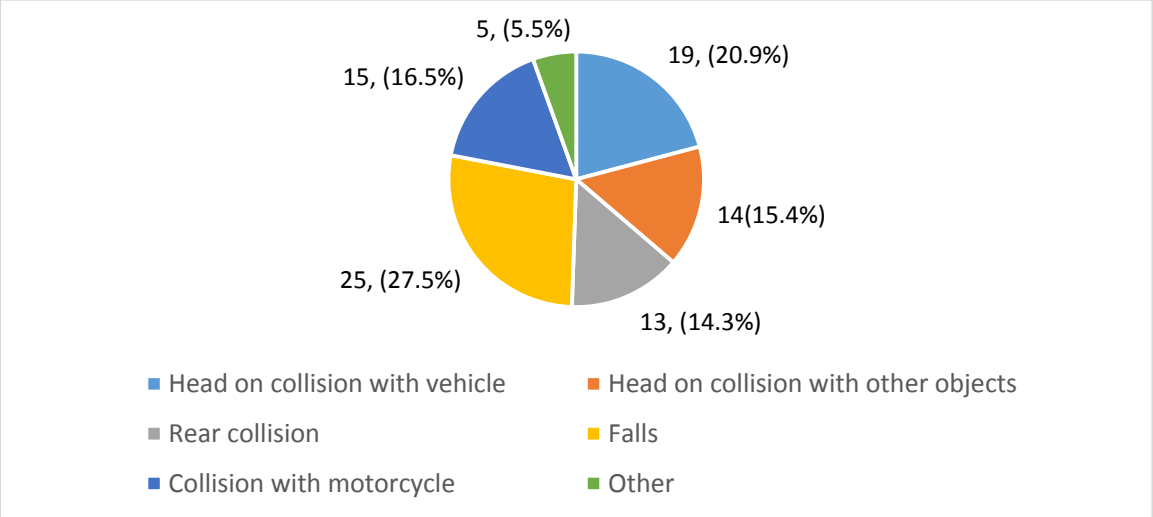

Figure 11: Nature of accidents as reported by the participants

There was a statistically significant association between the type of motorcycle accident and gender, p= 0.006 (Table 4).

Table 4: Nature of motorcycle accidents and casualty characteristics

Casualty characteristics	**Nature of accident**						
	Vehicle	Objects	Rear	Falls	Motorcycle	Other	P value
Age in years							
1 to 10	0	1(12.5)	2(25.0)	1(12.5)	3(37.5)	1(12.5)	0.053
11 to 20	3(37.5)	2(25.0)	1(12.5)	0	1(12.5)	1(12.5)	
21-30	11(28.9)	7(18.4)	1(2.6)	14(36.8)	4(10.5)	1(2.6)	
31-40	3(11.1)	4(14.8)	7(25.9)	10(37.0)	2(7.4)	1(3.7)	
41-50	1(20.0)	0	2(40.0)	0	2(40.0)	0	
51-60	1(25.0)	0	0	0	2(50.0)	1(25.0)	
61-70	0	0	0	0	1(100.0)	0	
Education							
Primary	4(9.5)	5(11.9)	8(19.0)	13(31.0)	9(21.4)	3(7.1)	0.137
Secondary	13(33.3)	5(12.8)	4(10.3)	11(28.2)	4(10.3)	2(5.1)	
Tertiary/ College	2(20.0)	4(40.0)	1(10.0)	1(10.0)	2(20.0)	0	
Gender							
Male	17(22.4)	9(11.8)	11(14.5)	25(32.9)	12(15.8)	2(2.6)	0.006
Female	2(13.3)	5(33.3)	2(13.3)	0	3(20.0)	3(20.0)	
Occupation							
Motor cycle taxi operator	6(18.8)	7(21.9)	5(15.6)	11(34.4)	3(9.4)	0	0.437
Small scale business	7(29.2)	3(12.5)	3(12.5)	7(29.2)	3(12.5)	1(4.2)	
Student	2(13.3)	1(6.7)	3(20.0)	1(6.7)	5(33.3)	3(20.0)	
Civil servants	2(20.0)	2(20.0)	1(10.0)	2(20.0)	2(20.0)	1(10.0)	
Casual worker	0	0	0	3(75.0)	1(25.0)	0	
Other	2(33.3)	1(16.7)	1(16.7)	1(16.7)	1(16.7)	0	

3.8 Class of casualty during injury

The main class of casualties were motorcycle riders, pillion passengers and pedestrians. Motorcycle riders constituted 46(50%) of the participants followed by pillion passengers at 27(29.6%) and pedestrians 18(19.9%) .There was a statistically significant association between the class of casualty and age (p=<0.001), gender (p=0.006), occupation (p=<0.001) and level of education (p=0.002) as shown in (Table 5).

Table 5: Class of motorcycle accident casualties and demographic characteristics

Demographic characteristics	Position of casualty			
	Motorcyclist	Passenger	Pedestrian	P value
Age in years				
1 to 10	1(12.5)	1(12.5)	6(75.0)	<0.001
11 to 20	2(25.0)	5(62.5)	1(12.5)	
21-30	21(55.3)	14(36.8)	3(7.9)	
31-40	20(74.1)	6(22.2)	1(3.7)	
41-50	2(40.0)	0	3(60.0)	
51-60	0	1(25.0)	3(75.0)	
61-70	0	0	1(100.0)	
Gender				
Male	44(57.9)	20(26.3)	12(15.8)	0.006
Female	2(13.3)	7(46.7)	6(40.0)	
Occupation				
Motor cycle taxi operator	26(81.3)	5(15.6)	1(3.1)	<0.001
Small scale business	10(41.7)	11(45.8)	3(12.5)	
Student	3(20.0)	2(13.3)	10(66.7)	
Civil servants	5(50.0)	4(40.0)	1(10.0)	
Casual worker	0	3(75.0)	1(25.0)	
Other	2(33.3)	2(33.3)	2(33.3)	
Education				
Primary	21(50.0)	6(14.3)	15(35.7)	0.002
Secondary	20(51.3)	16(41.0)	3(7.7)	
Tertiary/ College	5(50.0)	5(50.0)	0	

3.9. Maxillofacial injuries sustained during motorcycle crashes.

Of the participants who had sustained maxillofacial injuries, 88(98%) had sustained STI while 58 (63.7%) had sustained hard tissue injuries. Hard tissue injuries comprised of fractures of the midface 34 (38%) , mandible14 (15%) and dentoalveolar 16(18%) as shown in Fig. 12. Associated injuries sustained outside the maxillofacial region were classified as concomitant injuries and affected 63(70%) of 91 participants.

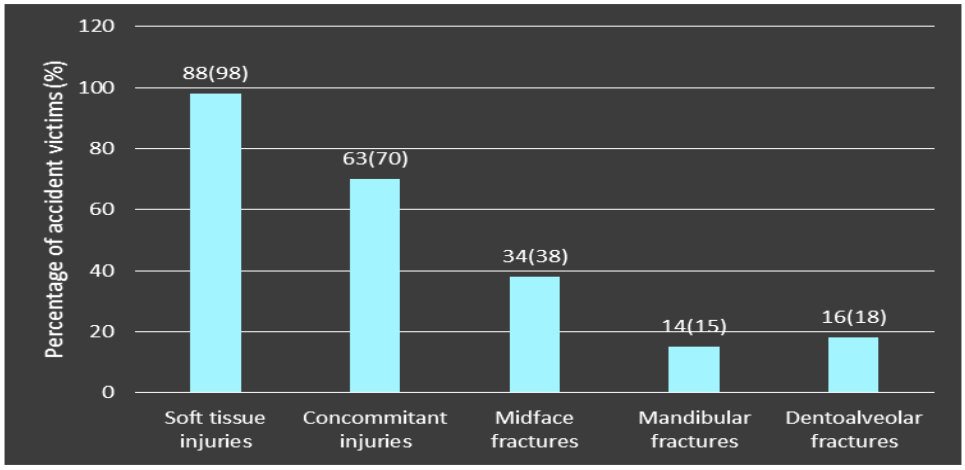

Figure12: Injuries sustained during motorcycle crashes

3.9.1 Soft Tissue Injuries

The type of STI included moderate lacerations 34(37.4%) and through-and-through perforation 30(33%) injuries (Table 6).

Table 6: Distribution of soft tissue injuries among the participants according to severity

Soft tissue injuries	Frequency (n)	Percent (%)
Abrasion	14	15.4
Mild laceration	13	14.3
Moderate laceration	34	37.4
Through and through perforation	30	33

The common sites of STI involved the upper lip (30.8%), cheek (26.4%) and zygomatic region (25.3%), eyebrow injury (13.9 %), lower lip (10%).The least affected was the chin with (6.7%) participants.

3.9.2 Hard tissue injuries

Hard tissue injuries in the maxillofacial region were recorded in (63.7%) of the participants and are described below.

3.9.2.1 Dental and dentoalveolar injuries

Dental injuries included avulsions (33.3%),and subluxation (65.6%). Dentoalveolar bone injuries were present in (16.5%) of the participants (Table 7).

Table 7: Distribution of dental and dentoalveolar injuries among the participants

Type of injury	Frequency (n)	Percent (%)
Dental injuries		
Avulsion	30	33.3
Subluxation	59	65.6
Fracture	1	1.1
Dentoalveolar bone injuries		
Yes	15	16.5
No	76	83.5

3.9.2.2. Mandibular fractures

Mandibular fractures were sustained by 15 (16.5%) of all the participants. Only 9 (19%) of 46 motorcycle riders and 6 (22.2%) of pillion passengers presented with mandibular fractures. There was no pedestrian who sustained a mandibular fracture. Majority of the fractures were in the body 6 (8.5%) and the parasymphysis 6 (8.5%) (Table 8).

Table 8: Pattern of mandibular fractures among all the participants.

Location of fracture	Frequency (n/91)	Percent (%)
Mandible	15	16.5
Fractured sites		
Angle	4	5.6
Body	6	8.5
Condyle	2	2.8
Parasymphyseal	6	8.5
Symphyseal	1	1.4

3.9.2.3. Midface fractures

Midface fractures were sustained by 34(38%) of all participants in this study.

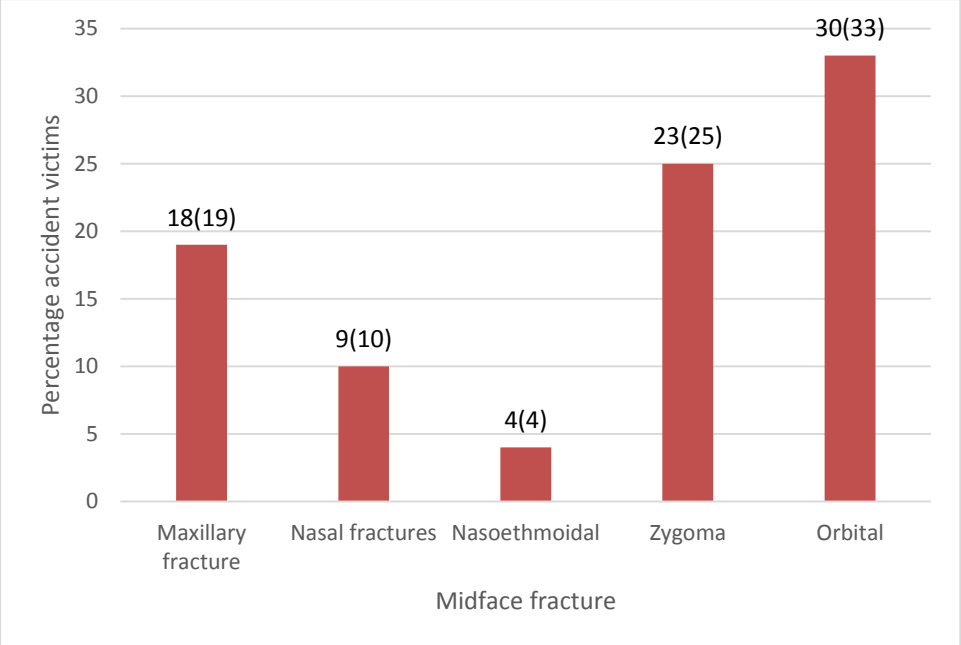

Figure 13: Distribution of midface fractures among the participants

The most common fracture involved the orbit (33%) , followed by fractures of the zygoma (25%), all maxilla (19%), nasal (10%) and naso- ethmoidal bone (4%) (Fig 13).

3.9.2.4 Maxillary fractures

Maxillary fractures (19.8%) were distributed as follows: Le fort I in (5.5%) patients while Le forte II in (14.3%). There were no Le forte III fractures (Table 9).

Table 9: Pattern of maxillary fractures

Type of fracture	Frequency (n/91)	Percent (%)
Maxillary		
LeFort I	5	5.5
LeFort II	13	14.3
Total	18	19.8

3.10 Concomitant injuries

Concomitant injuries sustained outside the maxillofacial region affected 63(69%) of the 91 participants. Most associated injuries were on the upper limb (46%), lower limb (41%) ,other concomitant injuries recorded were head injury (40%), abdomen (20%) and chest (20%) (Fig. 14).

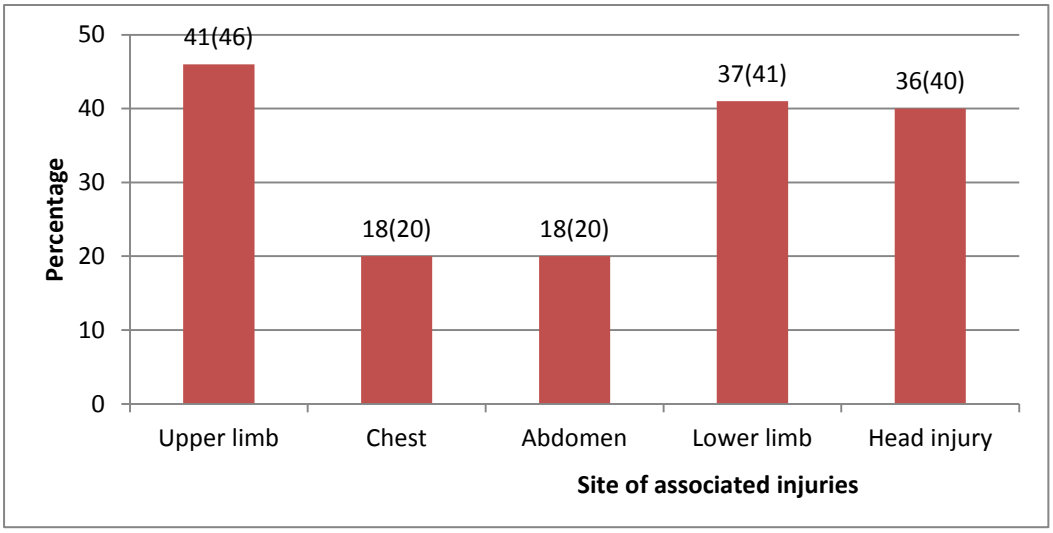

Figure 14: Concomitant injuries

The associated injuries were also classified according to the tissue injured with STI being more prevalent than hard tissue injuries.(Fig. 15)

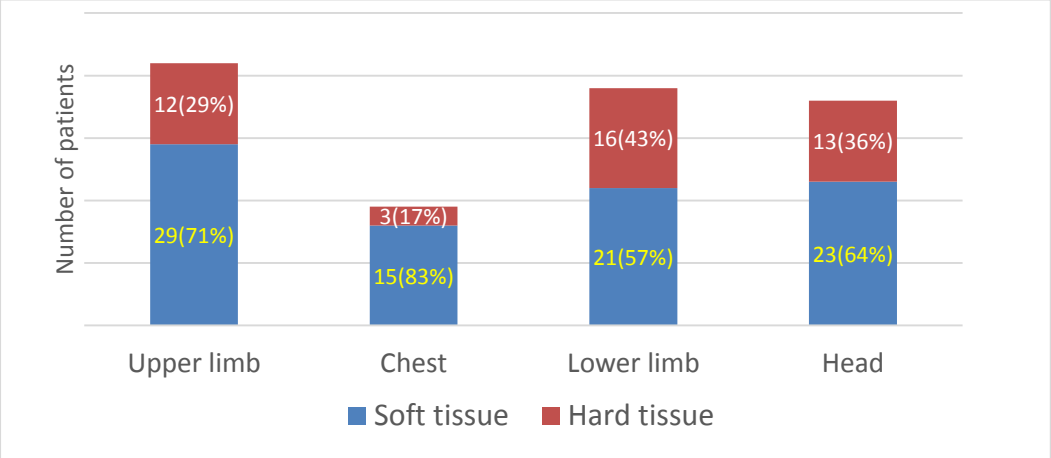

Figure 15: Classification of concomitant injuries on basis of skeletal/soft tissue injury

STI were the most common type among the associated injuries. The upper limb (71%) and the head (64%).

3.10 Modalities of treatment

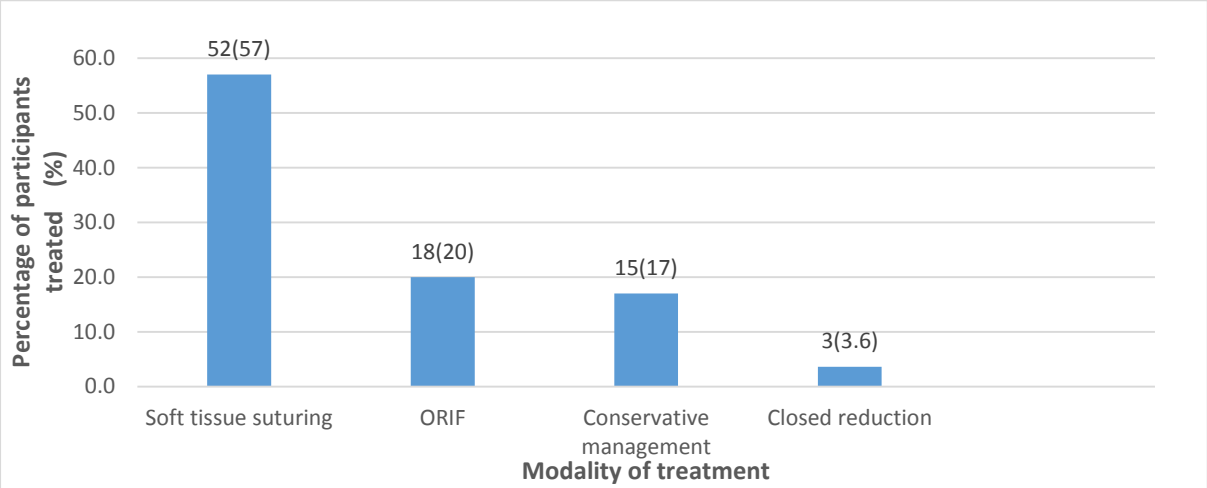

Figure 16: Modalities of treatment.

The major forms of treatment offered was soft tissue suturing (57%), ORIF (20%), conservative management and medication (17%), while a minority of the patients had closed reduction (3.6%) as shown in Fig. 16.

3.11 Associations between the various independent and demographic variables.

3.11.1 Nature of motorcycle accident and casualty characteristics

Most (6,75%) of the children aged 1-10 years involved in the accidents were pedestrians, while for the participants above 40 years, 3(60%) were 41-50 years old and 3(75%) were 51-60 years old and were pedestrians. Twenty (20,74.1%) of the casualties aged 31-40 years were motorcyclists, p <0.001 (Table 5). Females were more commonly pedestrians 6(40%) or passengers 7(46.7%) while most 44(57.9%) of the males were cyclists. Participants with a primary level of education were more likely to report that they were walking on foot 15(35.7%) during the accident compared to those with secondary 3(7%) or tertiary (0%) education,(p = 0.002.Table 5).

3.11.2 Association between alcohol consumption and the various demographic characteristics.

Alcohol use was associated with age (p = 0.016) with the practice having been more prevalent in accident victims aged 41-50 years (100%) compared to other age groups (range: 0-70 years ,Table 2). Alcohol abuse was also more prevalent in male accident victims (36.8%) compared to females (6.7%), p = 0.022. Alcohol abuse did not show significant associations with education (p = 0.097) or occupation (p = 0.243) as shown in Table 2.

3.11. 3 Association between use of protective gear and the various demographic variables.

The use of protective gear was significantly associated with occupation (p < 0.001) with motorcycle riders having higher rates of usage of protective gear (77.4%) compared to other occupations. There was no significant association between use of protective gear and other demographic variables (Appendix VI, Table A3).

3.11.4 Association between helmet use and the various demographic variables.

The use of helmets was significantly associated with occupation (p = 0.033) and was high among motorcycle taxi operators (51.6%) but low among other occupations as shown in Table 3.

3.12. Association between maxillofacial injuries and the various independent variables

3.12.1 Association between severity of soft tissue injuries and the characteristics of motorcycle crash casualty

There was a statistically significant association between position of participant and severity of soft tissue injuries (p=0.002), with the motorcycle rider having more severe forms of soft tissue injuries compared to the passenger and pedestrian (Table 10). Other variables such as riding experience and use of protective gear did not show any statistically significant association with severity of soft tissue injuries.

Table 10: Association between severity of soft tissue injuries and characteristics of motorcycle accident casualty

	Severity of soft tissue injuries				
	Abrasion	Mild	Moderate	Through and through	P value
Class of accident casualty					
Motorcycle rider	7(15.6)	5(11.1)	16(35.6)	17(37.8)	0.002
Pillion passenger	1(3.7)	1(3.7)	14(51.9)	11(40.7)	
Pedestrian	6(31.6)	7(36.8)	4(21.1)	2(10.5)	
Alcohol consumption					
Yes	5(17.2)	5(17.2)	10(34.5)	9(31.0)	0.919
No	9(14.5)	8(12.9)	24(38.7)	21(33.9)	
Riding experience					
1 year	3(18.8)	1(6.3)	4(25.0)	8(50.0)	0.266
2 years	4(20.0)	4(20.0)	7(35.0)	5(25.0)	
3 years or more	0	0	5(55.6)	4(44.4)	
Nature of accident					
Head on collision with vehicle	1(5.3)	2(10.5)	10(52.6)	6(31.6)	0.055
Head on collision with other objects	1(7.1)	1(7.1)	5(35.7)	7(50.0)	
Rear collision	4(30.8)	5(38.5)	0	4(30.8)	
Falls	3(12.0)	2(8.0)	13(52.0)	7(28.0)	
Collision with motorcycle	4(26.7)	1(6.7)	5(33.3)	5(33.3)	
Other	1(20.0)	2(40.0)	1(20.0)	1(20.0)	
Use of protective gear					
Yes	4(12.1)	4(12.1)	13(39.4)	12(36.4)	0.893
No	4(10.0)	3(7.5)	18(45.0)	15(37.5)	

3.12.2 Association between mandibular fractures and helmet use, class of accident casualty.

There was a significant association (Fisher`s exact test p = 0.04) between mandibular fracture and accident casualty class (Table 11). The prevalence of mandibular fracture in different classes of accident victims increased from 0% among pedestrians to 17.4% and 25.9% among motorcycle riders and passengers respectively. There was no statistically significant association between helmet use, nature of accident and prevalence of mandibular fracture.

Table11: Association between mandibular fractures and helmet use, class of accident casualty.

	Mandibular fractures.				
Independent variable	Yes	No	Total	Chi (df)	P value
Class of accident casualty (n= 91)					
Motorcycle rider	8(17.4%)	7(82.6%)	46(100%)	Exact	0.04
Pillion passenger	7(25.9%)	20(74.1%)	27(100%)		
Pedestrian	0(0%)	18(100%)	18(100%)		
Helmet use (n = 73)					
Yes	4(21%)	15(79%)	19(100%)	0.23	0.631
No	15(26.8%)	30(73.2%)	41(100%)		

3.12.1 Association between midface fractures and helmet use, nature of accident, class of accident casualty.

Midface fractures were significantly associated with helmet use (Fisher's exact test p = 0.008, table 12). Helmet appeared to have been protective against midface fractures with only 13.6% of users having had midface fractures compared to 47% in non-users. In addition, midface fracture occurrence was also significantly associated with the nature of accident

(Fisher's exact p = 0.028). The fractures occurred in at least 40% of patients with head on collision or falling off. Forty seven percent (47.4%) of casualties were involved in collisions with vehicles and 64.3% of those involved in collision with other objects sustained midface fractures. Midface fractures were less common in other types of collisions such as rear collision with 8.3% and motorcycle collision with 33.3% (Table 12).

Table12: Association between midface fractures and class of crash victim, helmet use and nature of accident

	Midface fractures				
	Yes	No	Total	Chi (df)	P value
Class of accident casualties (n = 91)					
Motorcyclist	19(41.3%)	27(58.7%)	46(100%)	1.0(2)	0.603
Passenger	10(37.04%)	17(62.96%)	27(100%)		
Pedestrian	5(27.78%)	13(72.22%)	18(100%)		
Helmet use (n = 73)					
Yes	3(13.6%)	19(86.4%)	22(100%)	Exact	0.008
No	24(47%)	27(53%)	51(100%)		
Nature of accident (n = 91)					
Head on collision with vehicle	9(47.4%)	10(52.6%)	19(100%)	12.6(5)	0.028
Head on collision with other objects	9(64.3%)	5(35.7%)	14(100%)		
Rear collision	1(8.3%)	11(91.7%)	13(100%)		
Fall	10(40%)	15(60%)	25(100%)		
Collision with motorcycle	5(33.3%)	10(66.7%)	15(100%)		
Others	0(0%)	5(100%)	5(100%)		

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3.12.4 Association between maxillary fractures and class of crash victim, helmet use and nature of accident

Table 13 shows that the pattern of maxillary fracture was significantly associated with helmet use (p = 0.033), but not significantly associated with the nature of accident (p = 0.443) or class of accident victim (p = 0.320). Helmet use appeared to have been protective against maxillary fractures with a prevalence of 10% and 20% for LeFort I and II fractures, among non-users compared to a prevalence of 4.6% for LeFort I fractures in helmet users. There was no casualty with LeFort II fractures among helmet users

Table13: Association of maxillary fractures with class of crash victim, helmet use and nature of accident

	Maxillary fracture				
	LeFort I	LeFort II	None	Chi (df)	P value
Class of accident victim (n = 91)					
Motorcycle rider	3(6.4%)	9(19.2%)	35(74.5%)	Exact	0.320
Passenger	3(10.7%)	4(14.3%)	21(75%)		
Pedestrian	1(5.6%)	0(0%)	17(94.4%)		
Helmet use (n = 73)					
Yes	1(4.6%)	0(0%)	21(95.4%)	Exact	0.033
No	5(10%)	10(20%)	25(70%)		
Nature of accident (n = 91)					
Head on collision with vehicle	3(15%)	3(15%)	14(70%)	Exact	0.443
Head on collision with other objects	1(7.1%)	3(21.4%)	10(71.4%)		
Rear collision	0(0%)	1(7.7%)	12(92.3%)		
Fall	1(4%)	6(24%)	18(72%)		
Collision with motorcycle	1(6.7%)	0(0%)	14(93.3%)		
Others	0(0%)	0(0%)	5(100%)		

CHAPTER FOUR

DISCUSSION

Demographic variables and casualty characteristics

In this study the distribution of injuries by gender is comparable with other studies in which there there was a higher frequency of injuries in males compared to females[17,20,21,22.].The M: F ratio of 5:1 observed is similar with what was observed in previous motorcycle associated injury studies in Tanzania, Malaysia and in Thailand[17,20,36]. This is attributed to the fact that most motorcycle operators are men from low socioeconomic groups. In addition, men are the primary bread winners of the family and, therefore, tend to remain outdoors for a long period of time, making them susceptible to trauma probably due to fatigue[21].The in-patients were 56% of the study group and this was most probably due to the choice of study sites where the patients in neurosurgical and orthopedic wards with maxillofacial injuries were also included. This compares with a study by Saidi et al, in Kenya (2013) which showed injuries to the lower limbs (56.4%) and the head (31.2%) were the commonest in motorcycle trauma and were associated with the need for surgical intervention while in hospital as inpatients[22].

The pattern of age distribution demonstrated that people of all ages were affected with a peak incidence between 21-30 years (41.8%), followed by those aged between 31-40 years (29.7%).This finding is similar to a number of previous studies in Kenya, Nigeria and Malaysia[22, 10, 20]. The high incidence in this age groups possibly could be due to the fact that they are energetic and utilize motorcycle transport as a source of livelihood. This could be due to the fact that during the third decade, most individuals are engaged in earning a livelihood. In developing countries where unemployment is high among the youth, informal activities tend to keep them outdoors and mobile on the most affordable form of transport which is the motorcycle.

In the present study, majority of the victims had primary school education followed by those with secondary school education and tertiary education. This is similar to a study in Nigeria by Ogunmodede et al (2012), in which majority of the respondents only attended primary school. This may explain the reason why they are prone to accidents because it would be difficult for them to interpret or decode road signs on the highways[32]. The lack of tertiary training may limit the individual's opportunities in employment thus they easily venture into the motorcycle taxi business exposing them to the risk of motorcycle crash injury.

The occupation of the injured; motorcycle riders , businessmen ,and students formed the bulk of this group. These results concur with a study in Tanzania where there was a high incidence of businessmen getting injured[17]. This is because they are often involved in activities which necessitate movement from one place to another and in order to maximize profits, opt for the cheaper means of transport available such as motorcycles. Motorcycle taxi operators were prone to injury by virtue of their work.

Majority of the participants in the study who were injured were from Nairobi County followed by other counties such as Kiambu and Machakos County. This could be due to the close proximity of the 2 hospitals to these counties. According to the findings of this study, majority of the crashes occurred in the morning and in the evening. A study in India by Kapoor et al (2012) and those from Tanzania reported similar findings[21, 17.]This may be explained by the morning and evening rush where there is a substantial increase in traffic before and after office hours, when people are going to work in the morning or returning home in the evenings. Majority of the patients were injured between Friday, Saturday and Sunday ,while the increased incidence on Friday and Saturday is similar to that seen in a study in India and could be attributed to increased alcohol consumption and late night

partying on these days[21].Greater incidence of motorcycle injury on Sunday may also be attributed to the fact that Sunday being a non-working day in Kenya; most individuals may be busy running errands and most often using motorcycles. Alcohol consumption was positive for 11% of the participants of the study. This did not compare well to the result of a study in Nigeria where a majority volunteered positive history of alcohol consumption[10]. This is a low proportion and raises the possibility that the patients may not have been truthful about alcohol intake in such a situation where a crash had occurred.

Alcohol abuse was significantly associated with age ($p = 0.016$) , the practice being more prevalent in accident victims age 41-50 years compared to other age groups. The practice was also more prevalent in male accident victims compared to females and showed no significant association with education or occupation. This may be due to frustrations in life especially if still engaged in the informal sector with no steady revenue.

The riders who did not have any formal training were 85 %(n=46); some had licenses to drive a passenger car, but did not have a motorcycle endorsement. A greater percentage of the riders had an experience of motorcycle riding of less than 2 years. These findings are similar to those in studies done in Nigeria and Tanzania where few riders had received formal training while the majority was either trained by self or an acquaintance and the training had lasted between 1-3 weeks in total[10, 17]. This may reflect on some weak link in licensing of motorcycle taxi operators by the Kenyan road transport authority and laxity in enforcement of the laws requiring acquisition of the license by riders.

Use of the helmet in motorcycle riders and passengers was 43% and 18.5 %, respectively at the time of injury. This rate of use of the helmet was higher compared to those in studies in

Nigeria at 23.8%[11]. In Kenya, there was minimal usage of helmets by passengers'[3]. The lower helmet usage among the passengers compared to the riders in this study may be due to lack of appropriate information/awareness, negligence by the passenger by not requesting for one during the journey and/or dirty helmets which discourage use by passengers due to hygiene concerns. The use of protective gear was significantly associated with occupation; with motorcycle riders having higher rates of usage of protective gear compared to those in other occupations. The increased use of the helmet amongst motorcyclists in Kenya was possibly due to the enforcement of new traffic rules legislated in 2012 which require use of helmet by the rider and passenger .

The most common form of crash in the present study was falls, head on collisions with motor vehicles, collision with stationary objects, collision with motorcycles and being hit from the rear. These results were not in agreement with those from studies in Tanzania by Chalya et al(2012) ,where crash between motorcycle and motor vehicle was the most common cause of injury followed by collision between motorcycle and pedestrians The reason for this observation was due to disregard of safety measures by the majority of the riders leading to motorcycle-vehicle collisions[17]. Poor infrastructure and lack of designated motorcycle sections in our roads may be the cause of the high frequency of falls.

A study in the United States of America showed motorcyclists and their passengers being particularly vulnerable victims in RTCs, by virtue of the nature and design of motorcycles[6]. In Nigeria a study by Wasiu (2005) et al showed that motorcyclists and their passengers were involved in more than 55% of cases of RTC. These findings are similar to those of the present study where the motorcycle rider and the passengers were the majority (79%) of the crash victims. The increase in pedestrian injury is peculiar to the overpopulated cities with few

subways and overhead bridges where it is relatively common for pedestrians to have to compete over the oncoming motorcycles[18].

4.1 Maxillofacial injuries

Sites of STI encountered in the present study in the facial region were the chin, lower lip, upper lip, cheek, eye brow and zygomatic region. The most common site with regards to STI was the upper lip, followed by frontal region. A study in Nigeria showed associated oro-facial STI in the majority of patients reviewed. This compares well with the results of the present study where the prevalence of STI was 98%. Kapoor et al (2012) in India and Fasola et al(2002) in Nigeria established that extensive STI was a remarkable feature of maxillofacial injuries in most reports [21,33].Motorcyclists and passengers were likely to have more severe forms of STIs especially lacerations of the the upper lips, frontal region and cheek, a finding which is in accordance with those of Gassner et al[23](1999). This was probably due to the fact that injuries were sustained in vehicles moving at high speeds and the victims were not protected by any substantive gear.

Dental and dentoalveolar injury is frequently overlooked in surveys that review maxillofacial injuries[18].A study by Gassner (2003) reported similar findings to those of the present study that there was a significant proportion of patients with dental injuries[37]. The alveolar injuries occurred less frequently in this study, a finding similar to that described by Wasiu et al (2005), in Nigeria which showed reduced frequency of dentalveolar injuries. The low incidence of dent alveolar injuries could be due to the fact that the sample size was small as only the analysis of a large number of injuries reveals the risk of suffering from dentalveolar trauma[18].

In this study both motorcycle riders and passengers had mandibular fractures. No pedestrian sustained any mandibular fracture. However, mandible was not the most fractured bone in the maxillofacial region. The findings of this study differ with those from a similar study by Obuekwe et al. (2003), which reported the mandible to be the most often fractured facial bone[35].Mandibular fractures in this study listed in decreasing order of frequency were ; parasymphyseal, body, angle, condylar and symphyseal .This pattern is similar to that reported in a study by Wimon et al (2008), in Thailand [36] .This low prevalence of mandibular injury may be due to methodology bias where seriously injured patients admitted in the neurosurgical and orthopedic wards, and who had moderate maxillofacial injuries were included in this study. The other reason may be due to low utilization of technological advances in the imaging of maxillofacial fractures (for example CT Scan), in earlier studies in Nigeria, especially which may be partially responsible for the observed difference, as the mid-facial skeleton may be more difficult to assess using plain radiography than in the mandible [18] whose fractures can easily be demonstrated with plain x-ray.

Midface fractures comprised the majority of all facial fractures in this study. Most of the mid face injuries presented as maxillary Le forte type I and II, orbital, zygomatic, nasal and nasoethmoidal fractures. The results of this study are in agreement with studies done in Nigeria, where the middle third of the face was the most vulnerable site and recorded more injuries among the riders and passengers. [8, 10.] A study by Ogundipe et al (2012) showed relatively higher prevalence of orbital and nasoethmoidal injuries. He noted that where low prevalence of these injuries as reported could be due to the fact that such injuries are frequently overlooked in surveys that review maxillofacial fractures[11].

In the present study, 70 % of the patients had concomitant injuries. This is similar to a study done by Ongudipe et al[11] (2012) who reported majority of patients with maxillofacial injuries also had other multiple injuries. Although brain injuries have been described as the most commonly associated concomitant body injury with facial fractures[11], the present study found out that injury to the upper limb was the most common, which was similar to a study done in Iran[15].These injuries are encountered as the unprotected victim crushes or falls and the reflexes associated with falling may be the reason the upper limb is more injured in the present study.

The management of maxillofacial injuries observed in this study depended on severity of injury. STI was the most common form of injury, thus, the most common form of treatment was repair of STI in form of wound debridement and suturing. This compares well with the findings of a study in Tanzania where the majority of the patients had wound debridement and stitching done, followed by management of fractures in form of ORIF, and closed reduction. ORIF, conservative management and closed reduction of fractures were also used in management of injuries. The conservative management method was commonly used in patients with head injuries and minimal soft or hard tissue injuries.

Associations between casualty characteristics and demographic variables

The nature of motorcycle accidents showed a significant association with gender ($p = 0.006$). There were however no significant association between nature of accidents and age of casualty, education, or occupation. Females were commonly pedestrians or passengers and most males were cyclists. Primary level educated casualties were more likely to report that they were walking on foot during the accident compared to those with secondary or tertiary education and this may be due to the fact that the children injured were majority pedestrians

crossing the road or playing at the time of injury. The males were more injured due to the fact that most motorcycle operators in our society are men .That men are also primarily the bread winners of their families and therefore, tend to remain outdoors trying to earn a living while using the motorcycle as a form of transportation as seen in similar studies in Nigeria[10].

Association between casualty characteristics and maxillofacial injury

There was no statistically significant association between the severity of STI and; alcohol consumption, riding experience, nature of accident and use of protective gear, however there was a significant association between severity of STI and class of accident victim where motorcyclists and passengers were likely to have more severe forms of STI compared to pedestrians. This may be due to large forces due to the high speeds involved during the injury and lack of substantive protective gear by rider and passenger.

There was a statistically significant association between mandibular fracture and accident victim class where prevalence of mandibular fracture in different classes of accident victims increased from pedestrians to motorcycle riders. However, no significant association was found between riding experience and severity of, mandibular, maxillary and midface fractures as well as between helmet use, nature of accident and prevalence of mandibular fracture.

Helmet use was significantly associated with prevalence of midface fractures and was protective against the fractures. In addition, the nature of accident was associated with midface fracture occurrence as the fractures occurred in participants particularly involved in head on collisions. The midface has bones which are thin; the maxillary antrum also occupies a large volume of the midface thus moderate amounts of force may easily fracture the

midface. The helmet protects and therefore reduces injuries seen in the midface. During head on collisions higher amounts of force is dissipated to the unprotected rider and passenger therefore making injuries more severe.

The limitations faced in the study included study area selection where KNH may be biased due to the fact that severely injured patients are referred there for further treatment which may include need for inpatient monitoring and management. More outpatients were observed at MLKH which has less specialist care capacity and whose severely injured are also referred to KNH as noted during the period of this study. It is also possible that patients with minor injuries may not report to the hospitals, some go to dispensaries and smaller health centers where treatment is cheap, and hence not presented in this study

4.2 Conclusion

Motorcycle related injuries were common in males aged 21-40years of age. Motorcycle taxi riders and businessmen were the largest groups of motorcycle crash victims. The study identified the midface as the most common facial region injured. Midface fractures were significantly associated with helmet use where the helmet was protective against the fractures. Low use of protective gear by motorcycle riders and specifically the passenger affects the severity of injuries during crashes. There was statistically significant association between the position of participant and severity of soft tissue injuries with the rider having more severe forms of injury. The lack of training and licensing is a common practice among motorcycle riders, and most riders had less than 2 year riding experience. Collisions and falls make the most common cause of crashes.

The management of STI was by soft tissue stitching. Hard tissue fractures were managed by ORIF. Limb and head injuries were the most common types of concomitant injury sustained.

4.3 Recommendations

1. There is need to focus on strategies that help in prevention of motorcycle crashes by, enforcement of the law to ensure good training and licensing of rider.
2. Consistent use of good quality protective crash helmets by motorcyclists to derive maximum protection during a crash needs to be emphasized.
3. The management of the concomitant injuries sustained can probably be improved by having a mandatory national medical insurance scheme to cover for the expected costs.

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APPENDICES

APPENDIX I: QUESTIONNAIRE

OCCURRENCE AND PATTERN OF MAXILLOFACIAL INJURIES CAUSED BY MOTORCYCLE CRASH IN SELECTED REFERRAL HOSPITALS IN KENYA

Please tick the correct option or fill the answer in the blank spaces provided.

BIODATA

Age (yrs)____

Gender: male ____female_____

Date of interview_____

Registration number inpatient_____ outpatient_____

Hospital where treated: KNH_____ MLKH_____

Occupation:_____

Level of education: Primary_____ Secondary_____ Tertiary/college_____

1. Date of accident (date, month, year)_____
2. Accident site(road/centre)_____
3. Where do you reside_____
4. Where were you coming from_____ where were you going to_____
5. What time of day was it

   MORNING_____AFTERNOON_____EVENING_____NIGHT_____

6. Which day was it

a) MON

b) TEU

c) WED

d) THUR

e) FRI

f) SAT

g) SUN

Were you;

a) motorcycle rider

b) Passenger

c) Pedestrian

d) Others (specify)_____

If answer to question 7 is b then skip questions 8 and 9

7. Do you have a rider's license? yes / no (tick one)

8. Did you undergo any training in motorcycle riding? yes / no (tick one)

9. Do you usually consume alcohol? yes/ no(tick one)

10. did you take any alcohol on the day of the accident yes / no (tick one)

11. do you usually chew khat YES_____ NO _____

12. did you chew any khat before or on the day of the accident yes / no (tick one)

13. How long have you ridden a motorcycle _____

14. Do you usually wear protective clothing yes / no (tick one)

15. What protective gear were you wearing

I. Helmet_____

II. Heavy jacket_____

III. Light luminous coloured overcoat_____

IV. Heavy protective trousers_____

16. Nature of accident

I. Head on collision with vehicle_____

II. Head on collision with other objects_____

III. Rear collision_____

IV. Falls_____

V. Collision with motorcycle_____

VI. Others_____

17. Have you been previously involved in a motorcycle accident?

Yes _____

No _____

If yes specify year_____

APPENDIX II: CLINICAL EXAMINATION FORM

CLINICAL EXAMINATION FORM

OCCURRENCE AND PATTERN OF MAXILLOFACIAL INJURIES CAUSED BY MOTORCYCLECRASH IN SELECTED REFERRAL HOSPITALS IN KENYA

1. Sites/tissues injured

I. Oral and maxillofacial injuries

a. Soft tissue only; abrasion, laceration-mild, moderate, through and through and avulsion._____

b. Dental injuries ;specify the teeth

1. avulsion_____

2. Subluxation_____

3. Fractures_____.

c.Dentoalveolar bone injuries

d. Teeth and dental alveolar injuries

II. Sites of soft tissue injury, specify sites

a) chin _____

b) lower lip _____

c) upper lip_____

d) cheek_____

e) eye brow _____

f) malar zygomatic region _____

III. Mandibular fracture

a. Symphyseal_____

b. Para symphyseal_____

c. Body_____

d. Angle _____

e. Condylar neck_____

IV. Midface fracture

a. Maxillary fracture le forte1 2 3_____

b. Orbital fracture_____

c. Nasal fracture_____

d. Nasal ethmoidal

IV. Upper facial

Frontal bone injury

2. Treatment offered

I. Soft tissue suturing

II. Closed reduction (CR)

III. open reduction and internal fixation (ORIF)

IV. Medications only

V. No treatment only soft diet

3. Other sites injured

I. upper limb

II. chest

III. Abdomen

IV. lower limb

V. Head Injury-GCS (Score)

4. Other relevant observation

_____

_____

_____

_____

APPENDIX III: CONSENT INFORMATION

Introduction and purpose

I am Dr. Nyameino Simba, a postgraduate student at the University of Nairobi, Department of Oral and Maxillofacial Surgery. I am inviting you to participate in a study I am conducting. The purpose of this study is to determine **occurrence and pattern of maxillofacial injuries caused by motorcycle crash in two referral hospitals in Kenya**.

STUDY BENEFITS

- The findings of this study may not be of immediate/direct benefit to you but in the long run it may help in coming up with policies aimed at preventing similar injuries
- The questions you will be asked and subsequent examination is part of routine diagnosis of your injuries. Please take note that refusal to participate in this study will not in any way affect the quality of treatment offered to you.
- Participating in this study will not result in a financial benefit. You will however not incur any extra financial cost because of participating in this study.
- This study will provide data for health planning and development of prevention programs aimed at the reduction of motorcycle related crashes

Inconvenience, risks and right of withdrawal

- You may experience inconvenience due to being asked so many questions and being examined while you have pain where your condition does not warrant the interview, we will kindly ask for permission to interview your relatives or attendants.
- Your involvement is purely voluntary. At any point during the study you are free to withdraw temporarily or permanently.
- There are no dangers or risks associated with participating in the study.

Duration

The history taking by the investigator will take approximately 30 minutes. This will involve asking questions relating to your injury, examination of the face and other injured sites.

CONFIDENTIALITY

- Privacy and confidentiality of the patient participating in this study shall be maintained. No name shall be written on the questionnaire and all the data obtained shall be securely stored.
- Like all scientific information we will seek to share our findings with other people undertaking similar studies. We may therefore publish our findings in scientific journals or present them in scientific meetings. No information that can identify you will be used in such publications and meetings

INVESTIGATORS

In the event that you need any further information in relation to this study please contact the following;

I. Principal investigator. Dr. Nyameino J. Simba at phone number 0721514894
II. Lead supervisor Dr. Fawzia Butt at The University of Nairobi Dental Hospital P.O Box30197 Nairobi
III. Chairman UON/KNH, Research, Ethics and Standards Committee on 020-2726300 ext. 44355

APPENDIX IV: CONSENT FORM

My name is Dr. Nyameino Simba from the University of Nairobi undertaking a Masters in Dental Sciences. I am conducting a study on pattern of maxillofacial injuries in patients involved in motorcycle accidents in Kenyan referral hospitals.

Methodology: investigator prescribed questionnaires

The results obtained will be presented to the University as well as the Ministry of Health enabling them therefore to provide information which will aid in development of programs on safety measures for the rider and passenger

No injury shall be inflicted on you. Participation is completely voluntary and you are free to withdraw from the study at any point and that would not affect treatment in any way.

I .....have been explained to the purpose and conditions of my involvement in the study.

I agree to the above and give consent to be included in the study.

Name.....

Sign/thumb print of participant.....

Sign /thumb print of guardian……

Date.....

INVESTIGATOR

NYAMEINO J. SIMBA

Signature.....

For further information /enquiries or complaints please contact

I. Principal investigator. Dr.Nyameino J. Simba at phone number 0721514894
II. Lead supervisor. Dr. Fawzia Butt at The University of Nairobi Dental Hospital P.O Box 30197 Nairobi
III. Chairman UON/KNH, Research , Ethics and Standards Committee on 020-2726300 ext. 44355

APPENDIX V : KISWAHILI CONSENT INFORMATION VERSION
MAELEZO KUHUSU IDHINI

Lengo

Kwa majina naitwa Dr NyameinoSimba, mwanafunzi katika chuo kikuu cha Nairobi, Idara ya upasuaji wa midomo na fuu la kichwa (Oral and Maxillofacial surgery).Nakualika kushiriki katika utafiti huu unaolenga kupata habari kuhusu Matukio Na Muundo Wa MajeruhiYa Maxillofacial Yanayosababishwa Na Ajali Za Pikipiki Katika Hospitali Kadha ZilizoteuliwaNchini Kenya.

Faida yautafiti

- Huenda matokeo ya utafiti huu yasikufaidi wewe kibinafsi lakini habari tutakayopata itasaidia kupata njia nzuri zaidi za kutibu majeraha haya.
- Maswali utakayoulizwa pamoja na ukaguzi utakaofanyiwa ni kawaida na itasaidia kuelewa majeraha yako na pia itatumika kuyapanga matibabu yako.
- Kukosa kushiriki hakutadhuru matibabu yako vyovyote vile.
- Hutapata malipo ya kifedha kwa kushiriki. Pia, hutahitaji kakulipa chochote kwa kushiriki.
- Habaritu takayopata pia itasaidia kuweka mikakati muafaka ili kuzuia na kupunguza ajali za pikipiki

Madhara na hatari zinazokusudiwa, kushiriki kwa hiari na kujiondoa katika utafiti

- Kushiriki kwako kutakuhitaji kujibu maswali mengi na kufanyiwa ukaguzi wa majeraha huku ukiwa na maumivu.
- Ikihitajika, tutakuomba ruhusa kuwahoji waliokuleta na wanaokuhudumia kuhusu majeraha yako.
- Kushiriki kwako ni kwa hiari yako.

- Uko huru kukataa kushiriki ama kujiondo akatika utafiti huu wakati wowote ule.
- Hakuna hatari zinazokusudiwa kwa kushiriki katika utafiti huu.

Muda utakaotumia

Mahojiano na ukaguzi na mtafiti itachukua dakika thelathini.

USIRI WA MAHOJIANO

- usiri wa mgonjwa anayehusishwa utatiliwa maanani. Jina lolote halitaandikwa kwenye nakala ya maswali na majibu yote yatakayokusanywa yatawekwa kwa njia salama

Kama habari zingine za kisayansi,tutataka matokeo ya utafiti huu yajulikane na wanasayansi wengine wanaofanya tafiti kama hizi.Kwa hivyo tutachapisha matokeo yetu kwenye vitabu vya sayansi na kutangaza matokeo haya katika mikutano ya kisayansi.

Maelezo kuhusu nafsi yako hayatajumuishwa katika ripoti ya utafiti huu na hivyo hayatajumuishwa katika vitabu na mikutano hizi za kisayansi.Nafsi yako itabakia siri.

Ikiwa utakuwa na maswali ama jambo Lolote ungependelea kujua kuhusiana na haki zako kama mshiriki katika utafiti huu, jisikie huru kuwasiliana na;

1. Dr NyameinoSimba: Nambari ya simu 0721514894
2. Dr. Fawzia Butt SLP 30197 Nairobi
3. Kamati inayochanganuza maswala ya utafiti ya hospitali kuu ya Kenyatta na chuo kikuu cha Nairobi kupitia Sanduku la posta: 20723 Nairobi, Nambari ya simu: 726300-9

KISWAHILI CONSENT VERSION

FOMU YA KUKUBALI KUSHIRIKISHA MGONJWA KATIKA UTAFITI

Mimi, DR. NYAMEINO J. SIMBA ,mwanafunzi katika chuo kikuu cha Nairobi. Ninafanya utafiti katika Hospitali kuu ya Kenyatta unaochunguza Matukio Na Muundo Wa Majeruhi Ya Maxillofacial Yanayosababishwa Na Ajali Za Pikipiki Katika Hospitali Kadha ZilizoteuliwaNchini Kenya. Nitakuhoji kuhusu kuumia uso na sehemu nyingine na nitaandika yale utakayosema kwa shughuli za utafitihuu. Pia mgonjwa atapigwa picha kwa minajili ya utafiti huu.

Uelewe kwamba hakuna malipo ya kushiriki na habari yote utakayopeana itawekwa siri.

Unaweza kujiondoa wakati wowote katika utafiti huu, na hali hiyo haitaathiri matibabu ya

Mgonjwa kwa vyovyote vile.

Jina lako na wala la mgonjwa halita andikwa pahali popote katika makaratasi ya utafiti ila

nambari ya utafiti tu.

Mimi..... (majina kamili kwa herufi kubwa)

nimeelewa maelezo yote ambayo nimepewa. Nimekubali kushiriki katika huu utafiti kama mgonjwa kwa hiari yangu.

JINA LA MSHIRIKI/MLINZI.....

Sahihi/kidole gumba.....Tarehe .....

MTAFITI

NYAMEINO J SIMBA

Sahihi.....

Kwa maelezo zaidi/maswali au malalamishi unaweza kuwasiliana na ;

I. Mtafiti Mkuu. Dr . Nyameino J. Simba at phone number 0721514894

II. Kiongozi Msimamizi.Dr. Fawzia Butt at The University of Nairobi Dental Hospital P.O Box 30197 Nairobi

III. Mwenye kiti kamati ya Chuo Kikuu cha Nairobi na Hospitali Kuu ya Kenyatta, maadili na kamati ya utafiti, kwa nambari ya simu; 020-2726300 ext 44355

APPENDIX VI: RESULTS

Table A1: Motorcycle accident sites according to counties

Site of accident	Number	Percent
Nairobi	47	51.6
Kiambu	16	17.6
Machakos	9	9.9
Kajiado	4	4.4
Meru	3	3.3
Embu	1	1.1
Kirinyaga	1	1.1
Kisumu	1	1.1
Kitui	1	1.1
Molo	1	1.1
Muranga	1	1.1
Mwingi	1	1.1
Naivasha	1	1.1
Nyahururu	1	1.1
Nyeri	1	1.1
Not stated	2	2.2
Total	**91**	**100**

Table A2: Details of occupations of motorcycle accident casualties at KNH and MLKH

	n	%
Occupation		
Motorcycle rider	32	34.8
Business	24	26.5
Student	15	16.7
Employed Professionals		0.0
Teacher	5	5.6
Civil servant	3	2.8
Security personnel	2	2.2
Casual workers		0.0
Tout	1	1.1
Watchman	1	1.1
Factory worker	2	2.2
Other occupation		0.0
Farmer	3	2.8
Driver	1	1.4
Housewife	1	1.4
School worker	1	1.4
	91	100

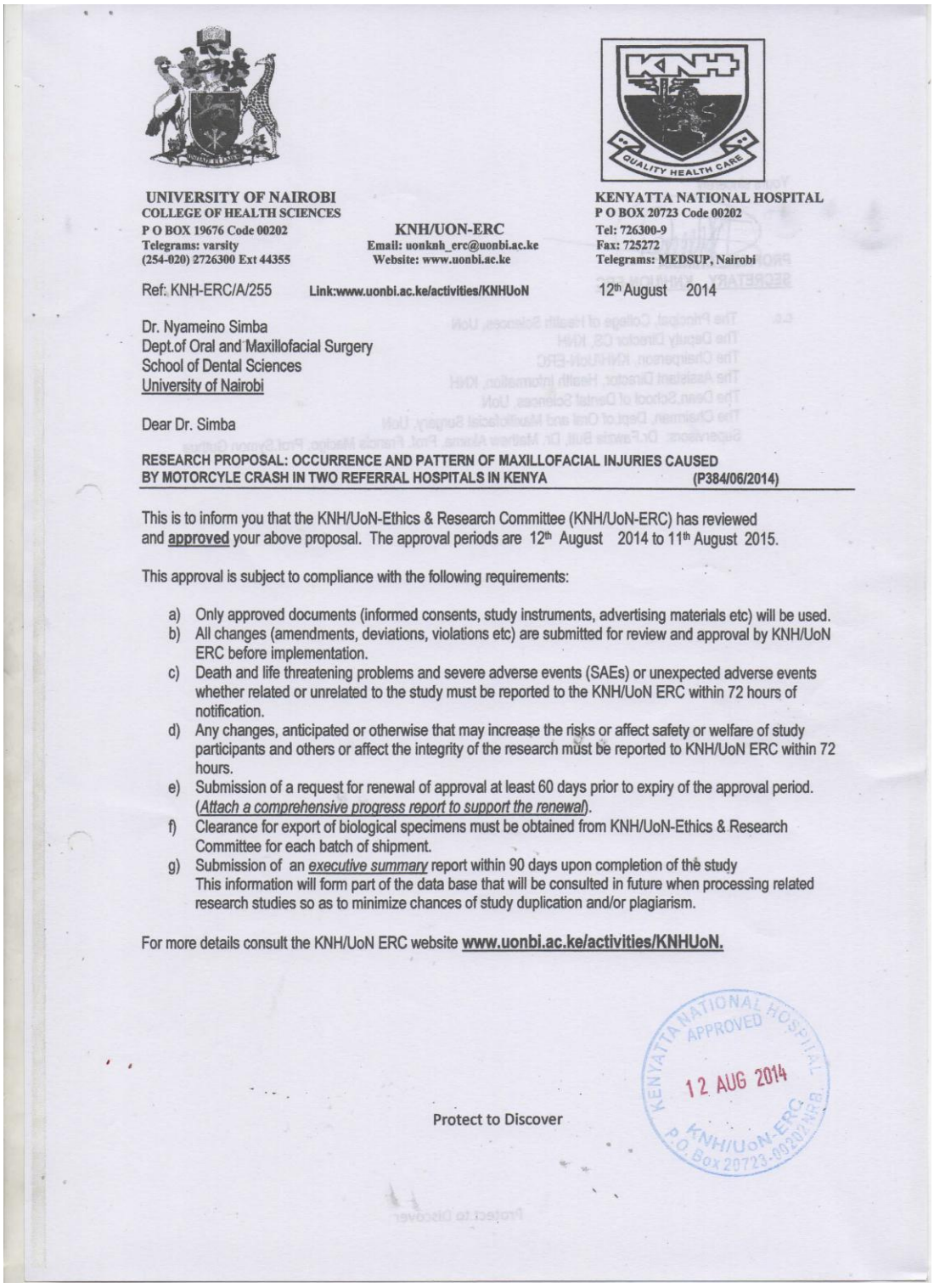
TABLE A3:

Use of protective gear by motorcycle riders and passengers

	Protective gear		**P**
	Yes	**No**	**value**
Age in years			
1 to 10	1(50.0)	1(50.0)	<0.078
11 to 20	0	6(100.0)	
21-30	20(55.6)	16(44.4)	
31-40	12(48.0)	13(52.0)	
41-50	0	2(100.0)	
51-60	0	2(100.0)	
61-70	1(50.0)	1(50.0)	
Gender			
Male	30(46.2)	35(53.8)	0.643
Female	3(37.5)	5(62.5)	
Occupation			
Motor cycle taxi operator	24(77.4)	7(22.6)	<0.001
Small scale business	4(20.0)	16(80.0)	
Student	1(16.7)	5(83.3)	
Civil servants/ professionals	2(22.2)	7(77.8)	
Casual worker	1(33.3)	2(66.7)	
Other	1(25.0)	3(75.0)	
Education			
Primary	13(50.0)	13(50.0)	0.554
Secondary	17(45.9)	20(54.1)	
Tertiary/ College	3(30.0)	7(70.0)	

APPENDIX VII

KNH/ERC AUTHORISATION LETTER TO CARRY OUT RESEARCH



UNIVERSITY OF NAIROBI
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KNH/UON-ERC
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Website: www.uonbi.ac.ke

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

Ref: KNH-ERC/A/255 **Link:www.uonbi.ac.ke/activities/KNHUoN**

12th August 2014

Dr. Nyameino Simba
Dept.of Oral and Maxillofacial Surgery
School of Dental Sciences
University of Nairobi

Dear Dr. Simba

RESEARCH PROPOSAL: OCCURRENCE AND PATTERN OF MAXILLOFACIAL INJURIES CAUSED BY MOTORCYLE CRASH IN TWO REFERRAL HOSPITALS IN KENYA (P384/06/2014)

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 12th August 2014 to 11th August 2015.

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 severe 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-Ethics & Research Committee 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 **www.uonbi.ac.ke/activities/KNHUoN.**

KENYATTA NATIONAL HOSPITAL APPROVED 12 AUG 2014 KNH/UoN-ERC P.O Box 20723-00202 NAIROBI

Protect to Discover

Yours sincerely

PROF. M.L. CHINDIA
SECRETARY, KNH/UON-ERC

c.c. The Principal, College of Health Sciences, UoN
The Deputy Director CS, KNH
The Chairperson, KNH/UoN-ERC
The Assistant Director, Health Information, KNH
The Dean,School of Dental Sciences, UoN
The Chairman, Dept.of Oral and Maxillofacial Surgery, UoN
Supervisors: Dr.Fawzia Butt, Dr. Mathew Akama, Prof. Francis Macigo, Prof.Symon Guthua