EPIDEMIOLOGY AND PREHOSPITAL FACTORS ASSOCIATED WITH INJURY SEVERITY OF MOTORCYCLE RELATED FEMORAL FRACTURES AT MBARARA AND KAMPALA INTERNATIONAL UNIVERSITY TEACHING HOSPITALS

BY

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A RESEARCH DISSERTATION SUBMITTED TO THE FACULTY OF CLINICAL MEDICINE AND DENTISTRY IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF MEDICINE DEGREE IN GENERAL SURGERY OF KAMPALA INTERNATIONAL UNIVERSITY

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DECLARATION

I **Lule Herman** Candidate Number **MMED/0002/142/DU**, hereby declare that except where explicitly acknowledged by citation, this scientific research dissertation is the original true work of my own. The report under description has never been submitted to any Institutional Review Committees or Higher Institutions of Learning for any academic awards. The content of this thesis is entirely the responsibility of the principal investigator and does not reflect official ideas of Kampala International University.

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APPROVAL

I **Prof. Ssebuufu Robinson** the supervisor of **Dr. Lule Herman**, certify that this research dissertation developed under my supervision is now ready for submission to the Internal Review Board and to the directorate of postgraduate studies and research; Faculty of Clinical Medicine and Dentistry of Kampala International University Western Campus.

Signed..... Date.....16:08:17

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DEDICATION

I dedicate this piece of work to my parents, Mr. Ssebuliba Boniface and Mrs. Nakate Anastanzia who together with my wife, Mrs. Nnabagulanyi Mary; have continuously offered me comfort and emotional support from the beginning up to the completion of this project. May the Almighty grant you good health and passionately reward you accordingly.

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LIST OF ABBREVIATIONS AND ACRONYMS

A &E	Accident and Emergency
KIUTH	Kampala International University Teaching Hospital
KTS II	Kampala Trauma Score II
MRRH	Mbarara Regional Referral Hospital
NGO	Non-Governmental Organisation
RTA	Road traffic Accident
UBOS	Uganda Beaural of Statistics
UN	The United Nations
UNDP	The United Nations Development Programme
WHO	The World Health Organization

DEFINITION OF KEY TERMS

Accident: In this study, refers to a collision between two objects in which one is a moving motorcycle and the other is a pedestrian, passenger on motorcycle or bicycle, static object or moving car. Car passengers are beyond the scope of this study.

Economically dependent age group: The number of persons younger than 15 years plus persons aged 65 years and above (Hu & Yang, 2012).

Economically productive age group: Persons between 15 to 64 years of age

Kampala Trauma Score: A physiological injury severity score with respect to age, systolic blood pressure, respiratory rate and neurological status at admission of a trauma patient (Weeks, *et al.*, 2016). This has been shown to compare with other widely accepted trauma scores (Mutooro, *et al.*, 2010; Haac, *et al.*, 2015; Weeks, *et al.*, 2016).

Patterns of fracture of the femur: Anatomical sites of femoral fracture, including neck, trochanter, shaft, supracondylar, and condylar fractures

Pre-hospital factors: Factors, which can significantly influence injury outcome from the time and events around injury to the time when the patient reaches the hospital, include road user category, mode of transportation to the hospital, arrival time interval, access to first aid before arrival and pre-existing medical illnesses before the accident.

Road Traffic Accident Related Disability. Is an important outcome of the accident event that may be temporary or permanent, partial or total (Bambach *et al.*, 2015). In this study, disability refers to the different anatomical patterns of femoral fracture.

Road Traffic Accident Related Morbidity. Refers to the seriousness of the injury sustained following a road traffic accident as determined by the "Abbreviated Injury Scale" (Chekijian, *et al.*, 2014). In this study, morbidity will be defined by the severity of Kampala Trauma Score (KTS II) as mild (10-9), moderate (8-7) or severe (≤ 6).

Road Traffic Crash Related Mortality. Is defined as any person who die on spot or within 30 days from the time of road traffic accident (Babalola, *et al.*, 2015; World Health Organization, 2015). In this study, mortality refers to death within 24 hours from time of admission following motorcycle related road traffic accidents.

Road traffic crash: Is a motorcycle related road traffic accident involving the rider, passenger(s) and / or pedestrians, resulting into injuries (fracture of the femur).

ABSTRACT

Background: Motorcycle related femoral fractures constitute a poorly documented trauma entity in Uganda. There is paucity of data on socio-demographic, anatomical and prehospital determinants of motorcycle related femoral fracture injury severity. Knowledge of most at risk of poor injury outcome in resource limited settings with no formal prehospital care system is not only mandatory for evidence based preventive policy formulation but also guidance of clinical practice.

Objectives: To determine socio-demographic characteristics, anatomical patterns and pre-hospital factors associated with injury severity of motorcycle related femoral fractures at two teaching hospitals in Uganda, using the Kampala Trauma Score II (KTSII).

Methodology: Cross sectional descriptive and analytical hospital based six months study of consecutively recruited patients, using investigator-administered questionnaire at the Accident and Emergency Departments of Mbarara and Kampala International University Teaching Hospitals in Western Uganda, between December 2016 and June 2017. Ethical clearance was obtained from Mbarara University of Science and Technology Research and Ethics Committee (IRB No.19/10-16). Data including history, clinical examination and radiological findings were recorded on a pretested coded questionnaire. Multiple logistic regression analysis and Odds ratios were computed using IBM SPSS 20.0. statistics for windows (Armonk. NY: IBM Corp) at 95% Confidence Interval and $P<0.05$ as statisticaly significant.

Results: Of 230 patients, the mean age was 32 years (Std. Deviation 18.5 years), with male to female ratio of 2.4:1. The femoral shaft 72.6% (n=167) was the most fractured anatomical site. Being a passenger on a motorcycle (OR 1.636; 95% CI [1.261-3.417; P=0.007), receiving no first aid before arrival (OR 2.106; 95% CI [1.818-2.495]; P<0.001), sustaining an open (OR 2.124; 95% CI [1.885-2.427], femoral neck (OR 4.222 [1.294-13.776] 95% CI, P=0.016) and femoral shaft (OR 1.155; 95% CI [1.101-1.902]; P=0.024) fractures, were pre-hospital factors significantly associated with a severe Kampala Trauma Score II amongst patients sustaining femoral fracture secondary to motorcycle accidents. There was no association between means of arrival, prehospital time; pre-existing comorbidities and severity of KTSII in this patient category.

Conclusion: Being a passenger on motorcycle and receiving no first aid before arrival were significant prehospital determinants of motorcycle related femoral fracture injury severity. Road traffic legislative efforts should protect the passenger in the same manner as for riders and pedestrians. There is need to strengthen the prehospital care system in Uganda. Prospective studies are required to determine how these factors impact on long-term femoral fracture outcome

Key words: Accident, Femoral fracture patterns, Motorcycle, Pre-hospital factors, Uganda

CHAPTER ONE

INTRODUCTION

1.0 Introduction to the chapter

More than 1.2 million people die every year due to road traffic accidents, with more than 50 million others injured (World Health Organization, 2015). According to the United Nations Report, more than 90% percent of road traffic related mortality occur in developing countries with no formal standardized prehospital care systems (Toroyan, 2009). The cost of medical care, rehabilitation and funeral expenses related to traffic crashes overwhelmingly burden the affected families (World Health Organization, 2015). These injuries constrain the already constrained health systems in African developing countries since they mostly affect economically productive age groups. Whereas every effort is made to protect car occupants (Toroyan, 2009), to the contrary pedestrians, cyclists and motorcyclists carry the highest road traffic related mortality burden worldwide (World Health Organization, 2015). However, the burden of femoral fractures attributable to motorcycle related accidents and determinants of most at risk of severe injury outcome remain a poorly documented trauma entity in Uganda, despite feasibility of application of physiological trauma scores like the Kampala Trauma Score II, in such resource-limited settings with no formal prehospital care system. This chapter presents the background to the study, problem statement, and purpose of the study, study objectives, study scope, justification and conceptual framework.

1.1 Background

Prehospital care is a major determinant of definitive trauma outcome. In developing countries where there is no formal standardized prehospital care systems, particularly in Africa where there are no emergency helicopters and limited ground ambulances; road user category, mechanism of injury, access to basic first aid, means of transportation to the hospital and pre-existing medical illnesses might significantly impact on injury severity and definitive trauma outcome other than prehospital time. Whereas developed countries like the United States talk of minutes as the national average prehospital time before definitive care (Carr *et al.*, 2006), there are no such studies in Uganda to provide a basis for comparison or setting targets.

In the event of road traffic accident, higher morbidity and mortality occur in developing countries with limited access to ground ambulance systems due to delays related to transportation of injured patients using public taxis amidst traffic jam. The projected increase in level of motorization by 2020 will thus disproportionately significantly increase injury

mortalities in developing countries with traffic congestion related to poor urban plans and road designs, ranking road traffic accidents as third most aetiology of disability adjusted life years lost (DALYs) (Murray, 2015).

Lack of pedestrian facilities, poor road safety measures, inadequate law enforcement and reckless riding have been major driving factors to motorcycle related injuries in developing countries (Hisamuddi *et al.*, 2015). An investment in training resources tailored at engaging lay bystanders on basic life support and first aid would be a valid counter preventive measure (Penumaka *et al.*, 2014); alongside primary prevention. However, such trainings are currently dismal in Uganda and perhaps their success would require some help from developed countries with access to such training resources. This highlights the need to develop resource-limited-specific prehospital evidence based packages rather than relying exclusively on packages relevant to the developed world.

Whilst the United Nations agenda focuses primarily at stabilizing and reducing road traffic deaths by 2020, and providing access to safe, affordable and sustainable transport; with particular attention to the vulnerable groups (World Health Organization, 2015), there is equal need for secondary prevention to ensure adequate medical response to minimize the extent of damage in the event of an injury. The World Health Organisation acknowledges that such secondary prevention can significantly reduce on the incidence of short term disability and improve long term trauma outcome (Sasser *et al.*, 2005). However, in resource-limited settings, one must know most at risk of severe injury outcome to guide triaging, emergency evacuation and prioritizing emergency care. The Kampala Trauma score II is a validated physiological tool in such settings (Weeks *et al.*, 2016) but has been less commonly applied to motorcycle related femoral injuries despite high mortality associated with such fractures (Anyaehie *et al.*, 2015).

Road traffic accidents are the number one cause of lower limb trauma in Uganda (Naddumba, 2008). Motorcycles contribute up to 58% of all traffic accident related injuries (Kamulegeya *et al.*, 2015), and are the leading cause of traumatic brain injury in Uganda (Tran *et al.*, 2015). However, there is paucity of data on motorcycle attributable femoral fractures. Whereas the quality of pre-hospital care given to patients involved in such accidents is an important determinant of their clinical outcome, the World Health Organisation acknowledges that designing an effective organisational structure for effective, adaptable and

sustainable prehospital care system requires research evidence and that such empirical evidence is still lacking in developing countries (Sasser *et al.*, 2005).

A holistic approach to wide accident causation analysis is necessary to execute the most effective counter measures to the most at risk motorcyclists (Tran *et al.*, 2015). Unlike in developed countries (Renault *et al.*, 2008), East African Community has no unified format of recording accident data for the purpose of coordinated analysis and comparisons (O'Reilly *et al*, 2013). Whereas most at risk population groups must be given priority during policy decisions and urban planning in relation to road safety, evidence shows there is paucity of data from trauma registries in developing nations, overemphasizing the need for hospital based mortality and morbidity surveys (Tyson *et al*, 2015).

Availability of such baseline data is mandatory to guide prioritization of preventive strategies in the mostly affected low-income countries that face traffic injury related economic dilemma amidst health budget constraints. This study contributes to the existing data in this aspect by establishing the epidemiology of different anatomical patterns of femoral fractures and pre-hospital factors associated with a severe Kampala Trauma Score II injury outcome amongst patients with motorcycle related femoral fractures attending Mbarara Regional Referral and Kampala International University Teaching Hospitals in Western Uganda.

1.2 Problem statement.

Globally, 1/4 traffic deaths occur to motorcyclists (World Health Organization, 2015) who have 34 fold increased risk of mortality following road traffic accidents compared to other road users (Tumwesigye *et al.*, 2016). African region suffers the highest traffic fatality rate despite having the lowest level of motorization in the world, with over 4 Africans dying every 9 minutes and 650 everyday (World Health Organization, 2015). Incompetent prehospital care systems contribute to high mortality (Jayaraman *et al.*, 2009a; Jayaraman *et al.*, 2009b). Economically productive men 15 and 29 years are the most affected by traffic accident burden, crippling the African economy, projected to be the 3rd cause of DALY by 2020 (World Health Organization, 2015) due to increasing motorisation with no proportionate increase in urban planning, road architectural development and pre-hospital care systems.

Lower limb injuries are the most common motorcycles related musculoskeletal injury amongst multiply injured young male patients in Uganda (Tran *et al.*, 2015; Tumwesigye *et al.*, 2016). Currently motorcycle injuries cost up to 62.5% of the budget for the surgery directorate at the Uganda's National Referral Hospital (Kigera *et al.*, 2010); however, there

is paucity of data to what extent femoral fractures contribute to this burden despite high mortality, morbidity and cost implications associated with these fractures.

Though studies have validated Kampala Trauma Score II (Mutooro *et al.*, 2010) and recommended its use in low income countries (Haac *et al.*, 2015; Weeks *et al.*, 2016), no study has looked at how pre-hospital factors in a resource limited setting and different anatomical sites of femoral fracture impact on severity of KTS II following motorcycle related accidents.

1.3 Purpose of the study

To determine the epidemiology and pre-hospital factors associated with injury severity of motorcycle related femoral fractures at Mbarara and Kampala International University Teaching Hospitals.

1.4 Objectives of the study

I. To determine socio-demographic characteristics associated with injury severity of motorcycle related femoral fractures using the Kampala Trauma Score II

II. To determine anatomical patterns of motorcycle related femoral fractures associated with injury severity using the Kampala Trauma Score II.

III. To establish pre-hospital factors associated with injury severity of motorcycle related femoral fractures using the Kampala Trauma Score II.

1.5 Research Questions

I. What socio-demographic characteristics of patients sustainging motorcycle related femoral fractures are associated with a severe Kampala Trauma Score II?

II. What anatomical patterns of motorcycle related femoral fractures are associated with a severe Kampala Trauma Score II?

III. What pre-hospital factors are associated with a severe Kampala Trauma Score II amongst patients with motorcycle related femoral fractures?

1.6 Scope of the study

1.6.1 Geographical scope

The study was conducted amongst patients presenting at the Accident and Emergency departments of Mbarara Regional Referal Hospital and Kampala International University Teaching Hospitals, with fracture of the femur secondary to motorcycle related accidents.

1.6.2 Content scope

The study mainly focussed on human (host) factors including history on human demograhic data like age, occupation, level of education. Clinical examination and radiological assessment was conducted to probe mechanism of injury. Pre-hospital factors like access to first aid before arrival to the hospital, arrival interval time, mode of transportation to the hospital were obtained. Short term assessment of morbidity based on the Kampala Trauma Severity Score (KTS II) and assesment of mortality as survived or dead with in 24 hours was conducted. The motorvehicular (agent) and environmental factors leading to mororcycle related accidents were beyond the scope of this study.

1.6.3 Time scope

The study is confined to analysing the problem from the time an accident occurs up to the first 24 hours following admission to the accident and emergency departments. Being a cross-sectional study, variables from each study participant were collected once at one point in time.

1.7 Study justification

Evidence based data on the burden of traffic injuries is mandatory to provide a rational basis for policy decisions, particularly in developing countries where vital registration systems provide low quality data on cause of accident related deaths (World Health Organization, 2015). There is need for evidence based primary and secondary prevention strategies to predict particular socio-demographic groups, femoral fracture patterns and prehospital circumstances that might increase risk of injury severity outcome following road traffic accidents. This study provides the current research evidence to guide policy interventions tailored at the most at risk socio-demographic groups and guide establishment of local treatment protocol to characteristically motorcycle related anatomical femoral fracture patterns and pre-hospital factors associated with a severe Kampala Trauma Score II injury outcome in our local context.

1.8 Conceptual framework

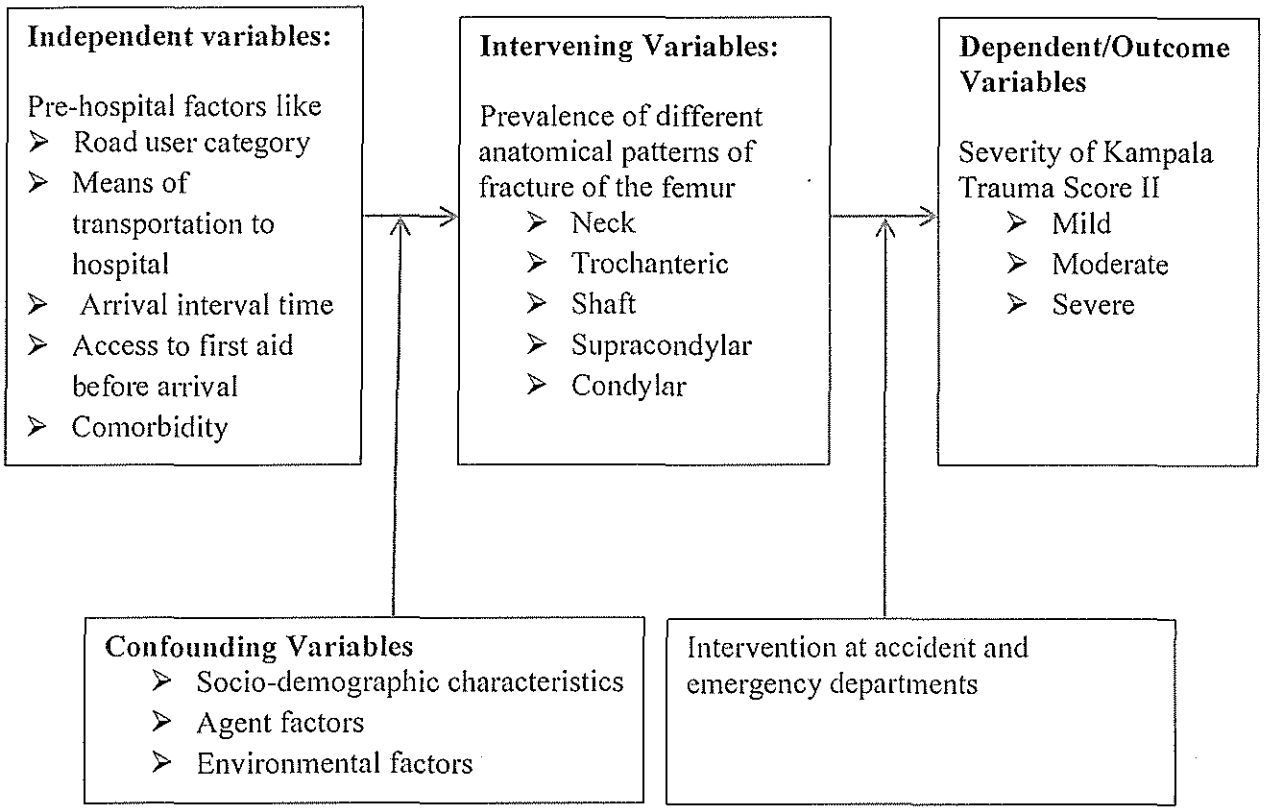

Figure 1: Conceptual framework showing interaction of variables

The study entails dependent variable(s) (severity of Kampala Trauma Score II) amongst patients sustaining fracture of the femur following motorcycle related accidents, that is likely to depend on pre-hospital factors (independent variables) here coceptualised as road user category, mechanism of injury, mode of transportation of the patient to the hospital, arival interval time, access to first aid before reaching the hospital and underlying medical illness before the incident; although the different anatomical sites of femoral fracture may have a bearing on the injury severity oucome (intervening variables) as described in fig.1. The agent and evironmental factors contributing to injury severity are beyond the scope of this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Socio-demographic determinants of motorcycle related femoral fracture severity

Quick and cheap transport is a prereqisite for economic development (World Health Organization, 2015). In a Ugandan context, the commercial motorcycle has served this purpose to provide flexible transport and livelhood to the youths, unlike in developed world where they are used for leisure and sporting (Mcharo, 2012). The popularity of motorcycles is also based on their affordability to the poor, ability to manuever through traffic jam and access to narrower routes which are innaccessible by cars but their safety to the community is questionable. Motorcycles are now like a double edged sword, posing significant death threats to riders, passengers and pedestrians.

Whilist the danger from motorcycles could arise from host factors like individual riding behaviour including overspeeding, overloading, enchroaching on pavements for pedestrians (Tran *et al.*, 2015); environmental factors like poor road designs (Tumwesigye *et al.*, 2016); and or agent factors like increasing unregulated number and licensure (Kamulegeya *et al.*, 2015), socio-demographic variables might have an influence individual's riding behaviour. Whether motorcycle accidents result from host, environment or agent factors, the end result is mortality or non fatal injuries but with significant disability. However the impact of socio-demographic variables on outcome of such non fatal anatomic injuries have not largely been assessed through hospital based surveys using physiological scores as an estimate of functional morbidity in low income settings.

A complex interpaly between socio-demographic variables and outcomes of road traffic related trauma might result from the fact that low income families tend to be in poor health states prior to road traffic accidents and might further succumb to health worker bias of inaccessibility of specialised care away from remote communities where trauma patients have longer commute distances and are unlikely to be medically insured, particularly for motorcyle related lower limb fractures that is percieved to be a burden of the poor and underserved, which further worsens their poverty cycle (Chalya *et al.*, 2012).

In Uganda, there is no existing pre-hospital care system (Jayaraman *et al.*, 2009a), with exception of a few city based pilot studies that have attempted training lay people (Jayaraman *et al.*, 2009a; Jayaraman *et al.*, 2009b); despite pre-hospital care being a known tool in tackling traffic related trauma (Laing *et al.*, 2014). Thus patients with low income socio-demographic profiles often do not afford fuel for ground ambulances to minimize the

prehospital arrival interval time to beat the golden hour instead are often brought to hospitals by commercial motorcycles or vehicles whose owners have no basic training in prehospital care delivery. Such patients may or may not receive first aid from rescuers, which can worsen their immediate injury outcome.

There are largely no community based insurance schemes to improve the quality of specialised care for such unemployed or uneducated patients residing in far remote areas in Uganda. The existing paucity of published data detailing the impact of socio-demographic variables on immediate injury severity outcome and inadequate knowledge of most at risk socio-demographic groups in our local context, could be a contributing factor to inadequate public policy interventions. Despite the fact that greater progress towards harmonising data on road traffic mortality and morbidity is needed for monitoring country level trends and to compare this burden to other causes of mortality (World Health Organization, 2015), to date there is no locally available trauma registry in Western Uganda and such socio-demographic influence on immediate trauma outcome is missing. Understanding that health care management approaches are nowadays patient centered, this study determines the independent effect of socio-demographic variables such as age, sex, education, occupation, marital status and area of geographical of residence on injury severity of motorcyle related femoral fractures, using the Kampala Trauma Score II.

2.2 Anatomical patterns of motorcycle related femoral fracture associated with injury seerity

Mortality ascribable to injuries in Sub-Saharan Africa outnumber that attributable to HIV,TB and malaria combined (Luboga *et al.*, 2009). In Uganda, majority of these injuries are musculoskeletal with most trauma centres admitting a minimum of 150 fractures per month (Luboga *et al.*, 2009) of which 8.9% are femoral (Galukande *et al.*, 2009). Over 41% of all road traffic injuries are attributable to motorcycles in Uganda (Kigera *et al.*, 2010); (Kamulegeya *et al.*, 2015), contributing to significant traumatic bone loss amongst mainly economically productive young male adults of low socio-economic status (Chalya *et al.*, 2012).

Lower limb injuries are the most common motorcycles related musculoskeletal injury amongst multiply injured young male patients in Uganda (Tran *et al.*, 2015; Tumwesigye *et al.*, 2016) and Kenya (Sisimwo, Mwaniki, & Bii, 2014), contributing up to 55% of all injuries sustained sequelae to motorcycle. This figure is similar to that reported in Tanzania (Chalya et al., 2010; Chalya *et al.*, 2012; Chalya *et al.*, 2014), West Africa (Sampson & Tawiah,

2015; Ayinla *et al.*, 2012; Kortor *et al*, 2010; Elachi *et al.*, 2014) and South Africa (Lamont & Lee, 2015), confirming the popularity of motorcycle transport means in Africa. However the African motorcycle reported accident burden, though comparable to 55.2% reported in Brazilian studies (Chandran *et al.*, 2012; De Vasconcellos, 2013; Cavalcanti *et al.*, 2013), is much higher than that reported in United Arab Emirates (Hefny *et al.*, 2012) and developed countries like South Korea (Chung *et al*, 2014) and United States at large (French & Gumus, 2014).

The femur uniquely being the "longest, strongest, largest and heaviest tubular bone in the human body" (Anyaehie *et al.*, 2015); with head, neck, trochanters, shaft and condyles involved in lower extremity load bearing; requires high energy to fracture any of its parts. However, when any of its vascular parts fracture, one does risk up to three litres of blood from their cardiac output (Anyaehie *et al.*, 2015), warrantying the surgeon's time and consumables for fixation without which mortality or morbidity for severely displaced and comminuted fractures would ensue.

However, there is paucity of published data in Uganda on the epidemiology of femoral fractures despite high levels of reported motorcycle ascribable multisystem injuries. Literature from retrospective studies in neighbouring East African countries show that majority of traumatic fractures involve lower limbs, with incidence of road traffic accident femoral fractures in Tanzania reported to be 18% of which 54% of these are related to motorcycle accidents and mainly involve the mid shaft followed by distal third, proximal third and neck (Hollis *et al.*, 2015). These femoral fractures are mainly a burden of males younger than 30 years (Luboga *et al.*, 2009; Hollis *et al.*, 2015), with significant economic implications.

Whether majority of motorcycle related femoral fractures are open or closed and what anatomical sites of fractures are associated with a severe injury outcome remain poorly documented in Uganda despite the diverse trends in management and complications that can occur in these fractures. A Nigerian retrospective study (Anyaehie *et al.*, 2015) rates prevalence of open femoral fractures at 8.4% although motorcycle ascribable fractures could have been under-represented given the fact that the authors' included low energy and stress fractures. Knowledge of what anatomical site is associated with poor injury severity can significantly influence the clinicians' intention to operate or manage the patient conservatively. Patients with femoral fractures in Uganda often fail to access timely surgical care due to resource constraints and some opt out of proper surgical care for traditional bone setters, contributing to poor immediate and long term injury outcome related to neglected

delays of treatment of complex fracture patterns (Naddumba, 2008). Annually, Uganda registers 2.8% permanent disability related to road traffic accidents (Kamulegeya *et al.*, 2015; Murray, 2015) but the burden ascribable to motorcycle related femoral fractures is scanty despite the fact that this unique musculoskeletal injury contributes to the longest bed occupancy amongst patients admitted at the Country's National Referral Hospital, Mulago; with 8.3days average duration of hospitalization (Kigera *et al*, 2010).

The immediate mortality related to hemorrhage of open femoral fractures (Gandhi *et al.*, 2014; Lane *et al.*, 2015), poses additional risk of HIV transmission; in the era of 7.5% HIV prevalence amongst Ugandan motorcyclists (Lindan *et al.*, 2015). Long term avascular necrosis, non-union and osteoarthritis are often reported if the femoral head or trochanteric regions are involved (Min & Kim, 2011; Ai *et al.*, 2013). Such injuries often require expensive dynamic compression screws for proper management (Gandhi *et al.*, 2014) otherwise prolonged skeletal traction along with its thromboembolic complications would be warranted for a good functional outcome (Smith *et al.*, 2011; Magetsari *et al.*, 2014). A long term study of femoral neck fractures by (Singh, 2013) reported complication rates of up to 60% overall, with avascular necrosis occurring on 40% concurrently with non-union. Such complications often require re-operation and revision surgery associated with significant morbidity and mortality particularly (Carpintero *et al.*, 2014; Kates, 2016), alongside cost implication in already constrained health systems in developing countries.

Although there is evidence from Nigeria (Anyaehie *et al.*, 2015) and Tanzania (Hollis *et al.*, 2015), that certain femoral fracture patterns are more prevalent in certain age-groups, with high energy traumatic shaft fractures being more common in the young whereas proximal fractures are more reported in the elderly, these were retrospective studies with record bias and could not account for high energy occult proximal and distal fractures (Rodriguez-Merchan *et al.*, 2013) that can occur due to axial forces transmitted through the hip and knee in the event a young motorcyclist or passenger landed on a flexed knee. It is known that transverse femoral fractures occur upon direct impact whereas oblique patterns result from torsional forces, but it is not clear how these mechanisms might vary between motorcycle riders, passengers and pedestrians. Knowledge of injury mechanisms by which these fractures are sustained will guide counter preventive measures but specifically understanding how different anatomical femoral fracture patterns influence immediate injury outcome would inform clinical practice.

2.3 Pre-hospital factors associated with severity of motorcycle related femoral fractures

In this study, pre-hospital factors refer to those events around an accident that can potentially influence injury outcome from the time of injury to the time when the patient reaches the hospital's emergency department. These include: road user category (passenger, pedestrian, motorcyclist); mechanism of collision (motorcycle-pedestrian, motorcycle-motorcycle, motorcycle-car); mode of arrival to health facility (by ambulance, taxi/motorcycle), access to first aid before arrival, arrival time interval from the time of accident and pre-existing medical illness before the accident. Pre-hospital care refers to care given to the injured patient, in this case with motorcycle related femoral fractures, by a health worker or any bystander before the patient arrives to the accident and emergency departments.

Out of the hospital care has been shown to be a significant determinant of trauma outcome, particularly a core tool in addressing prehospital hypotension, hypoxemia and hypothermia (Tohme *et al.*, 2013). However the concept of prehospital care and prehospital factors around injury remain controversial even in the world's best trauma Centres (Tohme *et al.*, 2013). Part of the controversy and variability of evidence arises from differences in resource availability, since post traffic accident mortality is negatively correlated with the individual country's income status and governance indicators (Grant, 2016). The other controversy arises from different research methodical contexts (Murad *et al.*, 2012a); and definition of key terms such as prehospital time in the various trauma Centres. Whereas such average prehospital time may be a few minutes in countries with emergency air crafts, one may talk of days in resource constrained countries where trauma patients use public transport to arrive at the few trauma Centres (if any).

Thus whereas factors such as prehospital time have not correlated with severity of injury outcome in a Swiss study; where the average prehospital time is reported to be 50 minutes (Tohme *et al.*, 2013), this evidence might not be reproducible in a Ugandan context where there is no formal prehospital care system. Scarcity of ground ambulance system in Uganda guarantees public taxis and motorcycles, which are not exempted, from traffic jam, to ferry trauma patients to emergency departments. Comparable studies in India, that has the most highest reported number of road traffic accidents worldwide have shown that major trauma patients arrive to trauma Centres even after 24 hours (Chandrasekharan *et al.*, 2016) as opposed to the golden hour norm in developed countries.

There is paucity of data to compare Uganda's average prehospital time to the rest of the world, which the study seeks to address. However a multi country study in Kenya, Tanzania, South Africa, Ghana, German and United States has shown that for high energy trauma, the

earlier a patient receives standardized management the better the post injury outcome (Matityahu *et al.*, 2014). This multicentre study demonstrated significant differences amongst these countries between injury admission interval, arrival surgery interval and surgery discharge interval for patients who sustained femoral fractures (Matityahu *et al.*, 2014). As such, these intervals particularly for isolated femoral fractures have been shown to be good predictors of effectiveness of trauma management in a given health system (Matityahu *et al.*, 2014). Late arrival beyond one hour post injury is particularly associated with poor outcome (Scheetz, 2010); as often there is no opportunity to resuscitate the patient to avert life-threatening injuries in the golden hour.

Means transportation to the emergency department by ambulance versus taxi/motorcycle becomes yet another important prehospital variable, since police officers who are often the first responders and assist in the ferrying of injured patients to hospitals are also assigned other pressing responsibilities such as national security but also do not undergo specialized prehospital care training. Arrival of the injured patients by motorcycles or taxis cannot be without risks since drunk and drug riding is not routinely assessed among commercial motorcycle riders (Li *et al*, 2013) yet use of psychoactive substance in this road user category is well documented (Gjerde *et al.*, 2011; Gjerde *et al.*, 2013). This aspect is relevant for Uganda because commercial motorcyclists often respond to such emergencies and are the most accessible means of transport compared to taxis and ground ambulances in the early morning and late evening hours when most accidents are reported to occur (Neeraj *et al.*, 2012). At such times however, motorcycles are likely to suffer complications of fatigue (Balasubramanian *et al.*, 2014) and sleep deprivation during such critical hours (Bougard *et al.*, 2012), particularly to ride on old and ill maintained roads (Theofilatos *et al.*, 2014) where no certification of road worthiness of motorised vehicles has been largely legitimised to simulate the developed world (Polidori *et al.*, 2012).

Whereas elsewhere studies are comparing impacts of physician versus paramedic administered first aid as a prehospital predictor of injury outcome (Grant, 2016), or paramedics versus lay bystanders (Murad *et al.*, 2012a), Uganda's uniqueness is that not even trained bystander rescue teams do exist. It is economically feasible to have such trainings instituted than changing the long-term country's income and governance indicators. Studies have shown that observed trained bystanders' first aid is comparable to that of paramedics without analysing the impact on patients outcome (Bakke *et al.*, 2015). This study however, seeks to compare the injury severity outcome of self-reported basic first aid administered by non-trained bystanders versus health workers as an action point since such trainings have not

largely been undertaken in Uganda, with exception of a few city based pilot studies that have attempted training lay people (Jayaraman *et al.*, 2009a; Jayaraman *et al.*, 2009b).

Since taxi drivers and motorcyclists have no basic training in prehospital care and life support, it is not clear whether such first aid administered by lay bystanders improves or worsens injury outcome and as such should be embraced or abandoned. Despite the fact that standard prehospital care system has been shown to reduce morbidity and mortality amongst trauma patients, based on experience from Iraq (Murad *et al.*, 2012), to date, Uganda does not have an existing prehospital care system. This indirectly translates into morbidity and mortality that is economically devastating to the country (World Health Organization, 2015). Experience from South Africa and European Union show that once a femoral fracture has occurred, the standard operative procedures and cost of care required remains the same despite individual country economic differences (Gross *et al.*, 2010).

Although motor vehicular studies in the developed world have shown no association between mechanism of injury and injury severity in prediction of mortality (Grant, 2016), this might arguably not be valid for two wheelers with no protective casing, as such exposing the rider or passenger to directly absorb the high impact energy in the event of an accident. Also contrary to four wheeler vehicles where front seat occupants have been shown to suffer fatalities than rear seat passengers (Chandrasekharan *et al.*, 2016), the hind passenger on a two wheeler might be sacrificed in the event the rider attempts to save themselves of head-on collisions. In Uganda, it is common for a motorcycle to carry more than one passenger. On the other hand, pedestrians might be the ones more at risk of serious injuries when directly struck while crossing the roads or walking on the pavements. This study thus examines who is most at risk of injury severity of the road user category as motorcycle rider, passenger, or pedestrian and how injury severity might vary by nature of collision as motorcycle-to-motorcycle, motorcycle to pedestrian, motorcycle to car crash or motorcycle hitting a static object. Whereas mechanism of injury might determine outcome (Sartorius *et al.*, 2010), once fracture of the femur has occurred, concurrent trauma such as head injury (Tran *et al.*, 2015), depending on nature of helmet used (Erhardt *et al.*, 2016), have been associated with higher case fatalities. This study used the Kampala Trauma Score II to cater for such additional injuries.

Pre-injury comorbidity has been shown to influence outcome of severely injured patients in trauma setting (Ringdal *et al.*, 2013). However there are concerns regarding reliability and variability in levels of agreement of the pre-injury morbidity grading using the American Society of Anaesthesiologists (ASA) classification based on Norwegian experience (Ringdal

et al., 2013), since particularly in orthopedic trauma which this study evaluates, patients' functional status scores cannot be obtained prior to the injury (Stuart *et al.*, 2015). This makes it difficult to ascertain if patients have returned to their pre-injury level of function in the short-term post injury period. To avoid this bias, only chronic medical comorbidities that could be validated by patients' records and reconfirmed by readily available standardized diagnostic tests including diabetes, hypertension, HIV/AIDS, and Tuberculosis were hypothesized to influence the injury severity and immediate mortality outcome. Such medical conditions may not only potentially influence hospital stay but also have anaesthetic implications.

The other controversy regarding reliability of prehospital factors, as predictors of injury severity and mortality could also be ascribable to differences in injury severity scores used at different trauma Centres. These include the Injury Severity Score (Tay *et al.*, 2004) and New Injury Severity Score (Lavoie *et al.*, 2004); (Eid *et al.*, 2015) used in developed world; versus the Kampala Trauma Score II well validated and adopted in developing countries (Mutooro *et al.*, 2010). However, attempts have been made continuously to harmonize these differences by comparison of these tools (Mutooro *et al.*, 2010; Weeks *et al.*, 2014, 2016). Thus, the present study makes use of the Kampala Trauma Score II and death to determine immediate injury severity outcome for patients sustaining motorcycle related femoral fractures.

Research into appropriate traffic accident preventive strategies has been recommended in Uganda (Tumwesigye *et al.*, 2016), but data on injury severity characteristics is required evidence to estimate the associated health and economic burden in order to advocate for the establishment of institutional and regional trauma registries and for policy formulation. The existing studies are retrospective with record bias and have been conducted in Kampala Capital where there might be easier access to ground ambulances. Such studies do not reflect the burden of motorcycle related injuries in remote settings where motorcyclists are more likely not to have attained post-primary education and standard riding training and as such unlikely to comply by the road safety regulations (Lamont *et al.*, 2015). Experience from Rwanda show that in remote settings, surveys similar to the proposed study provide reliable and inexpensive data useful to mitigate accident occurrence compared to police reports (Staton *et al.*, 2016). Characterisation of femoral injuries and prehospital factors associated with their severity amongst persons to whom this mode of transport is popular does not only act as evidence adjunct to policy formulation and implementation of preventive safety precautions but also guide establishment of local treatment protocols for fracture patterns and prehospital factors characteristically associated with a severe Kampala Trauma Score II.

CHAPTER THREE

METHODOLOGY

3.1 Study design

This was a cross sectional descriptive and analytical hospital based study of all motorcycle related road traffic accident patients presenting with fracture of the femur to the Accident and Emergency departments of Mabarara Regional Referral and Kampala International University Teaching Hospitals for six months period starting 5th December 2016. This is because all patients or legally authorised representative (in case of unconcious patient and minors) following road traffic accidents, pass through the Accident and Emergency departments. The study involved consectutive recruitment of eligible participants who were interviewed using a pretested coded checklist. The Investigator or Research Assistant completed relevant history, physical examination with respect to nature of injuries and radiological findings of the patients on admisssion. For the unconcious patients, consent was obtained from legally authorised representative (LAR). Patients who died before reaching the hospital and those who died before radiological evaluation were excluded from the study.

3.2 Study area

According to ministry of health (http://www.health.go.ug/content/mbarara-regional-referral-hospital [Accessed 4/12/16]), Mbarara Reional Referral Hospital, commonly known as Mbarara Hopsital is a Ugandan government owned referral hospital and a teaching hospital for the medical school of Mbarara University of Science and Technology. This 350 bed capacity hospital was founded in 1940 and is the referral hospital for the western region serving Mbarara, Bushenyi, Mitooma, Rubirizi, Sheema, Ntungamo, Kiruhura, Ibanda, Isingiro and Buhweju districts. The hospital offers specialised services including trauma management and orthopedic surgery, general surgery, Neurosurgery, Opthalmology, Ear Nose and Throat surgery, Obstetrics and gynaecology, Dental Surgery, Peadiatrics, Internal Medicine, Psychiatry, Physiotherapy and Rehabilitalion.

According to (http://ameca.org.uk/directory/listing/kampala-international-university-teaching-hospital-uganda [Accessed 4/12/16]), Kampala International University Teaching Hospital is located in Bushenyi district of Western Uganda (East Africa), along Mbarara-Ishaka highway, 65Km west of Mbarara, the biggest city in western sub region and 340 Km from Kampala, the country's capital. Being a training facility, the institution is a private/public partnership and government aided, with over 700-bed capacity. It offers a good range of specialist services, including Orthopedic Surgery, General Surgery, Physiotherapy,

Ophthalmology, Ear Nose Throat Surgery, Dental Surgery, Paediatrics and Internal Medicine. Being a tertiary teaching hospital on the highway to Democratic Republic of Congo, majority of road traffic accident patients are referred to Kampala International University Teaching Hospital or Mbarara Regional Referral Hospitral for specialist management.

The two hospitals are on highway to Queen Elizabeth National Park and Tourist Centre and their corresponding municipalities serve as a rest point for long route drivers carrying commercial goods from Democratic Republic of Congo, given the universal availability of lodging, alcohol and bar services, which contributes to the existing vehicle congestion.

3.3 Study population

Study subjects were all patients presenting with fracture of the femur bone secondary to motorcycle related road trafffic accidents irrespective of age, gender and injury severity, attending Accident and Emergency Departments during the study period.

3.4 Sample size calculation

The sample size was calculated using the Keish and Leslie (1965) formula as below

$N=Z^2PQ\div D^2$; Where N=Minimum sample size required, Z is the standard normal deviate at α=5% (1.96 at 95% confidence interval), P and Q are the population proportions, where P=Probability of sustaining fracture of the femur secondary to motorcycle, Q is (1-P) and D is the level of precision desired (margin error rate of 0.05). Since the prevalence of road traffic accident related femoral fracture from a Tanzanian survey by (Hollis *et al.*, 2015) was reported to be 18%; then substituting P=0.18;

$$N=\frac{(1.96)^2 x0.18x0.82}{(0.05)^2}=227$$

The minimum sample size for validity of the study was 227 patients. A total of 230 patients were consecutively recruited by the end of the six months study period from the time of commencement, generating a sample size large enough to generalise the findings.

3.5 Inclusion criteria (Case Definition)

In this study, an accident was deemed motorcycle related if the patient reported within 24 hours after sustaining fracture of the femur and: was a passenger on motorcycle, a motorcycle rider, and pedestrian hit by a motorcycle, motorcyclist colliding with static objects or a patient of motorcycle-motor vehicle collision. Since any one can get involved in a road traffic accident, these patients were recruited irrespective of gender, age and level of consciousness. This inclusion criterion had been earlier shown to be effective in screening motorcycle related injuries (Mcharo, 2012).

3.6 Exclusion criteria

I. Passengers or drivers in motor vehicles.

II. Referrals from tertially hospitals whose specialist care had been already initiated.

III. Patients dying on arrival before radiological assessment. These were excluded to ensure completeness of the data tool (KTS II and X-ray result sections).

3.7 Study procedure:

Recruitment of study participants was conducted at the Accident and Emergency Department of Mbarara Regional Referral and Kampala International University Teaching Hospitals, after resuscitation in acccordance with the American College of Surgeons' Advanced Trauma Life Support (ATLS) protocol (Kortbeek *et al.*, 2008; Radvinsky *et al.*, 2012). Patients' pain and or bleeding were managed before enrollment into the study. Every respondent or legalised representative were explained to the purpose of the study in order to endorse an informed consent document with a signature or thumb print. A pretested coded check list of parameters of interest specially designed for this purpose was then administered by the researcher with the help of staff on duty at the accident and emergence departments. A complete history, physical examination and radiological assessment of the fractured limb(s) by use of X-ray was conducted and findings of interest were recorded on the data tool.

3.8 Study variables

The study variables included both independent and dependent. Pre-hospital factors were the independent variables whereas severity of the modified Kampala Trauma Score II was the dependent variable that was used to measure short term physical and functional morbidity. This was to ensure thorough detection of life threatening injuries and that they were treated based on the presumed danger they posed. Percentages were calculated for femoral fractured road traffic accident patients with: Severe Kampala Trauma Score (KTS) II $\leq$ 6, moderate injury 7-8, and mild injury 9-10 as described by (Mutooro *et al*, 2010) and these were correlated with the prehospital factors using Chi sqare, Likelihood ratio tests, Multiple logistic regression and Odds Ratios at 95% Confidence Interval ($p<0.05$).

3.9 Intervening variables

The different anatomical patterns of fracture of the femur categorised as involving the femoral neck, trochanter, shaft, supracondyles or condyles were presumed to have sigificant bearing on the morbidity and theoretical impact on the severity of Kampala Truma Score II.

3.10 Data collection

Data were collected by the Principal Investigator with the help of Research Assistants (Doctors on duty at the Accident and Emegency department depending on the departmental duty roster), using Investigator administered pre-tested questionnare designed in English by the Researcher. The questionnare was interpreted and translated into native language (Runyakole/Rukiiga) by a professional teacher of English who is well conversant with the local language, to cater for the iliterate who could not read or write in English. Quantitative data were obtained using the investigator-administered questionnaire that was completed after primary survey in accordance with ATLS. This method was earlier validated in similar studies done elsewhere using questionnares (Chalya *et al.*, 2014). The questionnaires included closed and open ended questions covering variables that were purposively selected based on the problem statement and study objectives. Data was obtained on socio-demographic variables; circumstances of injury and category of road user, that is rider, passenger, pedestrian (human factors); mode of arrival and arrival interval (time factors) and first aid status. Data were also obtained based on clinical assessment using the Kampala Trauma Score II and radiological patterns of fracture of the femur as determined by X-ray (clinical factors). Research Assistants were trained on emergency care and how to use the data collection tool during training worshops at the begining and middle of study period.

3.11 Data analysis:

Sorting, coding, entry and analysis of data was conducted by the Principal Investigator with the help of a Biostatician under technical supervision by the faculty mentors; using IBM SPSS 20.0. statistics for windows (Armonk. NY: IBM Corp). In order to acheive the first objective, percerntages were computed for femoral neck, trochanteric, shaft, supracondylar and condylar fractures. For the second objective, percentages were calculated for road traffic accident patients with: severe Kampala Trauma Score (KTS) II (≤ 6), moderate (7-8), and mild injury (9-10). With reference to a severe KTSII, multivariate logistic regression and Chi-square (X^2) testing (for paired data) was conducted. Likelihood and Odds ratios were computed to establish sociodemographic variables, patterns of fracture of the femur and pre-hospital factors significantly associated with severe injury outcome as determined by a severe Kampala Trauma Score II, at 95% Confidence Interval; with $P<0.05$ as significant. The null hypothesis was that there was no association.

3.12 Data Management and Presentation

Data files were password protected until the final stage of dissemination. Frequencies, percentages, means and standard deviations were computed for categorical variables. Data are presented in form of graphics and tables as appropriate.

3.13 Study Limitations

It is also difficult to make casual inference from cross sectional studies because it does not give the sequence of events whether the exposure occurred before, during or after the event. However, tests of significance were conducted to detect any association beyond chance. The two facilities had no functional computerised tomographic scan services at the time of the study and as such, smaller fractures could have been missed. Using consecutive recruitment of all eligible study participants could have yielded sampling bias although this was purposively intended to obtain a sample size large enough to generalise results. Assessment of individual's drinking behaviour, motorcycle mechanical status (agent) and environmental factors leading to mororcycle related accidents and how these factors would impact on injury severity outcome were beyond the scope of this study.

3.14 Ethical Considerations

The study strictly followed the National Institute of Health guidelines on research involving use of human subjects and ethical clearance was obtained from Mbarara University of Science and Technology (MUST) Research and Ethics Review Committee (IRB No.19/10-16). Permission to collect data was sought from Kampala International University Teaching Hospital and Mbarara Regional Referral Hospital. The official Mbarara University of Science and Technology Rresearch Ethics Committee consent form document was adopted. Permission and informed consent/assent were obtained from study participants and or legally authorised representative who were asked to indicate their consent and or assent by endorsing predesigned consent and or assent forms using their signatures or thumb print (mark) in the presence of the Principal Investigator.

Where an adult legally authorised representative had consented on behalf of unconscious, informed consent was re-obtained from the patients themselves upon regaining consiousness. For emancipated minors, consent was obtained from the patient. The respondents had the right to decline from participation or withdraw from the study at any time if they wished without explaining their actions. Patients' confidentiality and privacy was highly prioritised. Data were kept in password protected files only known to the researcher until final stages of dissemination. Data records were kept centrally in lockable shelves and were destroyed at the end of the study period to avoid retrieval by non investigators. Study participants will benefit

from the study when recommendations are made to increase vigilance in pre-hospital care for patients sustaining motorcycle related accidents. No radiographs were requested without a clear valid indication of diagnosing a fracture. This investigation was done at the cost of participants because X-rays are standardised procedure for diagnosing fractures with or without the research intervention, but no payment was a prerequisite to partcipate in the study. Readiness to receive disclosure regarding the nature of injuries was assessed by the disclosing physician to minimise distressig post traumatic memories sorrounding the circumstances of road traffic accident that would be triggered by such disclosure. Referrral to psychiatric and counselling services was made to all patients or immediate relatives taking care of the injured patients who were suspected to re-live traumatic experiences.

3.15 Quality control

Pre-tested questionnaire in English were translated into Runyankole by a professional teacher of english well versed with Runyankole/Rukiiga. The questionnare were pre-tested and validated at Ishaka Adventist Hospital, in a similar patient category to minimize errors. Research Assistants [Doctors on duty (roster) at the Accident and Emergency Departments] were trained on emergency resusciation and use of the data collection tool during a one day workshop at begining and middle of study period. Proper patient identification by use of unique out patient and in patient numbers was emphasized to avoid any duplication in recording in case one sustained multiple accident incidents during the study period. All data tools were re-checked for completeness prior to patient discharge. Radiographs of the fracture of the femur pattern were interpreted by two independent orthopedic surgeons. In the event that the two orthopedic surgeons did not agree on a particular fracture pattern, a third opinion was sought from another independent orthopedic consultant. Being a cross section study, the quality and completeness of data collected and designed specifically for this study protocol could easily be controlled. Case-files and medical legal documents of the patients were referred to for collecting any additional information and or verifying the check list. It is also presumed that the consectutive recruitment of all eligible motorcycle related traffic accident patients during the study period yielded a sample size large enough to reliably generalise study findings to patients sustaining motorcycle related accidents.

3.16 Dissemination of results

Before study findings will be presented in scientific conferences and published in a peer reviewed journal, these will be shared with health care teams at the Accident and Emergency and Surgery Departments of Mbarara Regional Referral Hospital and Kampala International University Teahing Hospitals, to discuss recommendations for pre-hospital factors

characteristically associated with severe injury outcome amongst patients sustaining motorcycle related accidents. The final report will be submitted to the main library, Department of Surgery and Internal Review Board of Kampala International University and to authorities including Regional Police Offices and Distric Health Officers. The implication of findings willl be shared with the leaders of the motorcycle riders associations of Mbarara and Ishaka municipalities.

CHAPTER FOUR

PRESENTATION AND INTERPRETATION OF RESULTS

4.1 Socio-demographic characteristics associated with injury severity of motorcycle related femoral fractures

Of the 230 participants, 56.5% (n=130) were recruited from Mbarara Regional Referral Hospital whereas 43.5% (n=100) were from Kampala International University Teaching Hospirtal. Majority 70.9% (n=163) were males giving a male to female ratio of 2.4 : 1. The male gender was more likely to sustain a femoral fracture associated with a severe KTS II (OR 1.934; 95% CI [1.856-2.263]; P=0.022).

Majority 77.0% (n=177) belonged to the Banyankole tribe and were mainly Catholics 57.8% (n=133) (Tab. 1 and 2).

Table 1: Showing Ethnic group of participants

Tribe	Frequency	Percent	Valid Percent	Cumulative Percent
Munyankole	177	77.0	77.0	77.0
Mukiga	21	9.1	9.1	86.1
Muganda	18	7.8	7.8	93.9
Mutooro	3	1.3	1.3	95.2
Other	11	4.8	4.8	100.0
Total	230	100.0	100.0	

Table 2: Showing religious affiliation of participants

Religious Affiliation	Frequency	Percent	Valid Percent	Cumulative Percent
Catholic	133	57.8	57.8	57.8
Protestant	83	36.1	36.1	93.9
Muslim	11	4.8	4.8	98.7
Other	3	1.3	1.3	100.0
Total	230	100.0	100.0	

The age of participants ranged from 3 to 96 years with mean vulnerable age of 32 years (Std. Deviation 18.5 years) as shown in fig.2. Over 77% (n=177) belonged to economically productive age group of (15-64) years whereas 23% (n=53) belonged to economically dependent age group of (<15>64) years (OR 3.347; 95% CI [2.147-6.023], P<0.001). There was no association between age and severity of Kampala Trauma Score II (P=0.385).

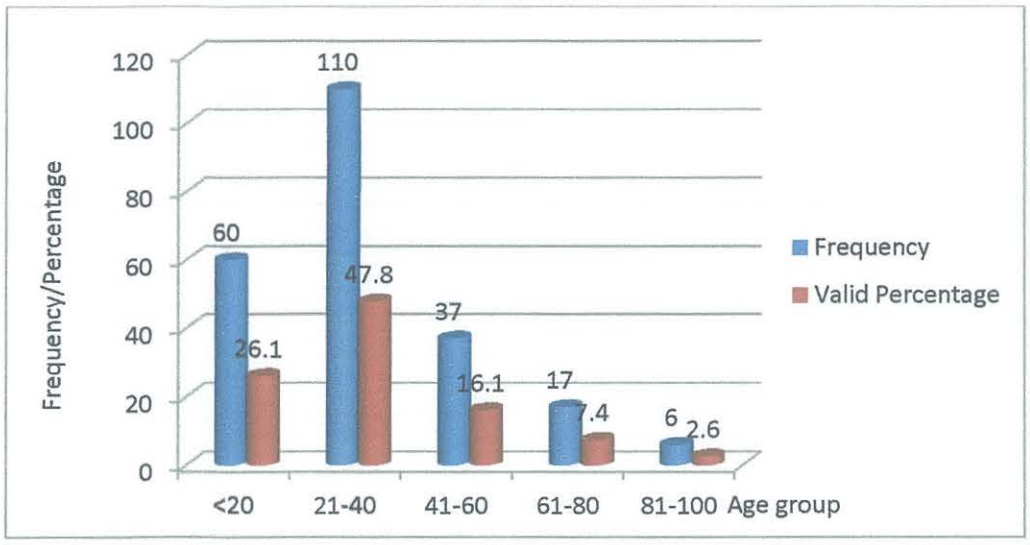

Figure 2: Showing Age groups of participants

Majority of respondents were single 53.9% (n=124) and had attained a secondary level of education 53.5% (n=123) (fig.3). There was no statistically significant association between education level (P=0.180), marital status (P=0.807) and severity of KTS II.

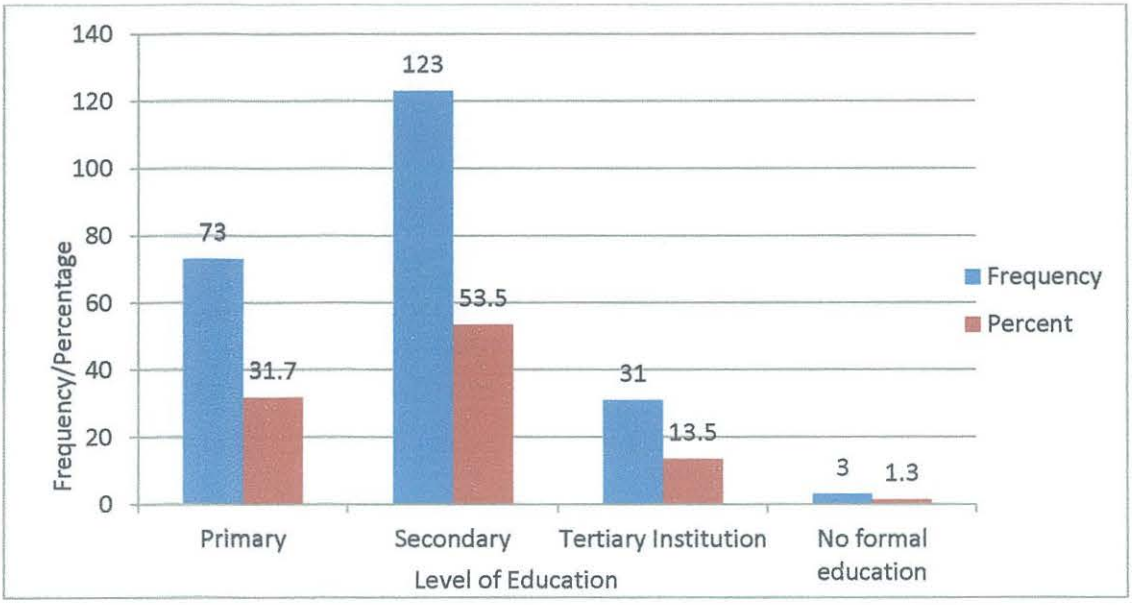

Figure 3: Showing participants' level of education

Majority 62.2% (n=143) of patients involved in motorcycle related accidents in the current study reside within municipalities (urban areas). There was an association between place of residence and severity of Kampala Trauma Score II (X^2=10.424, p=0.005). Those who reside outside the municipality (rural areas) were twice more likely to sustain a femoral fracture associated with a severe KTS II (OR 2.114; 95% CI [1.212-3.687]; P=0.005).

As per occupation, motorcyclists 30.9% (n= 71) were the majority, followed by peasant farmers, students and business men/women in that order as shown in fig.4. There was an association between occupation and severity of Kampala Trauma Score II (X^2=38.045; P<0.001). Motorcyclists had higher odds for a severe KTS II (OR 2.319; 95% CI (1.013-4.102; P<0.001).

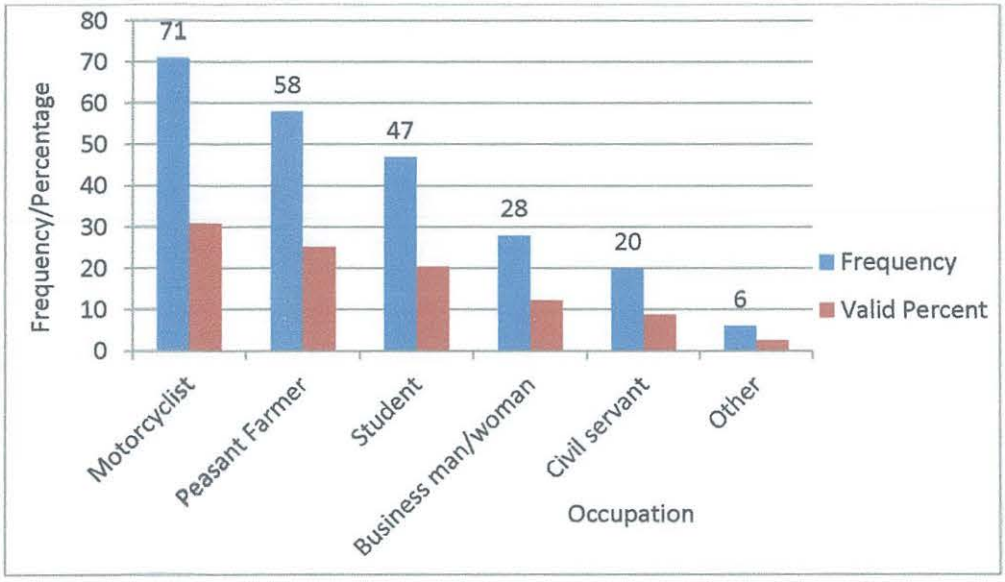

Figure 4: Showing occupation of study participants

4.2 Anatomical patterns of motorcycle related femoral fractures associated with injury severity

Of the 230 patients, majority 65.3% (n=150) sustained an open femoral fracture. Open fractures were associated with higher Odds for a severe KTS II (OR 2.124; 95% CI [1.885-2.427]; P=0.003).

The femoral shaft 72.6% (n=167) was the most commonly fractured anatomical site amongst patients sustaining fracture of the femur secondary to motorcycle related accident, followed by femoral neck 10.9% (n=25) and supracondyles 7.8% (n=18) as shown in fig.5.

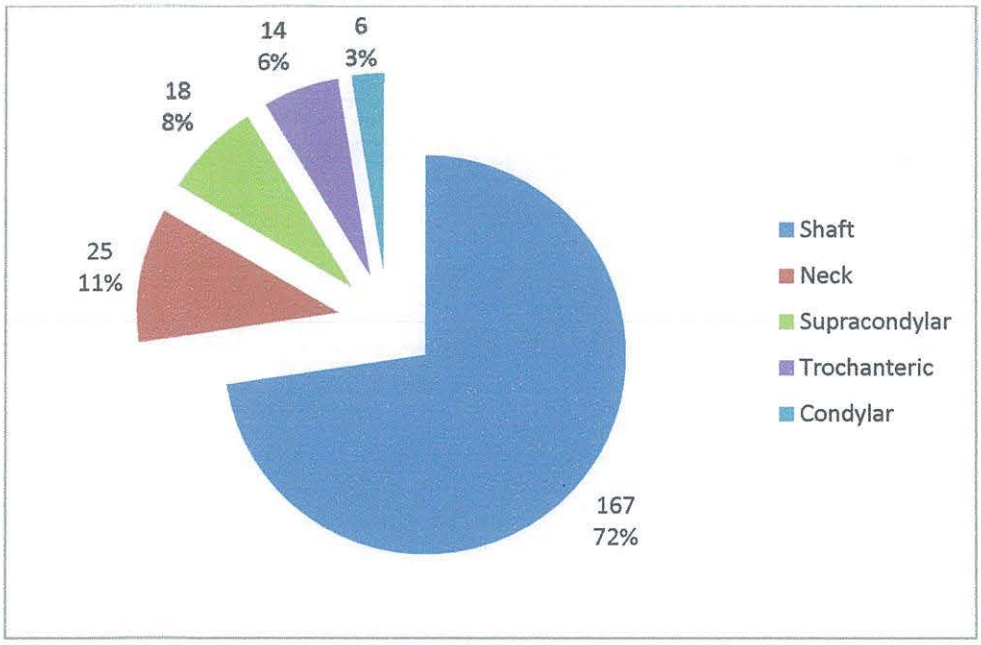

Figure 5: Showing prevalence of different anatomical patterns of femoral fracture amongst patients sustaining motorcycle related accidents

There was an association between the different anatomical sites of femoral fracture and severity of Kampala Trauma Score II (X^2=28.662, P<0.001; df=8). Femoral shaft (OR 1.155; 95% CI [1.101-1.902]; P=0.024); and femoral neck (OR 4.222 [1.294-13.776] 95% CI, P=0.016) fractures were more more likely to be associated with a severe Kampala Trauma Score II (fig.6).

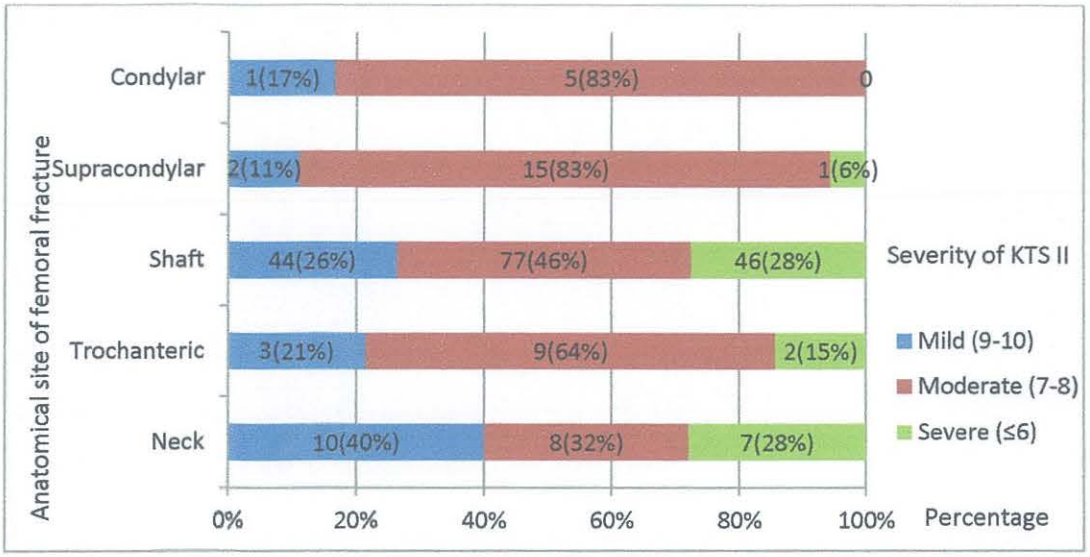

Figure 6: Showing relationship between different anatomical sites of femoral fracture and severity of Kampala Trauma Score II

4.3 Prehospital factors associated with injury severity of motorcycle related femoral fractures

Of the 230 participants, majority 49.6% (n=114) had a moderate Kampala Trauma Score II, whereas 24.3% (n=56) had a severe Kampala Trauma Score as shown in fig.7

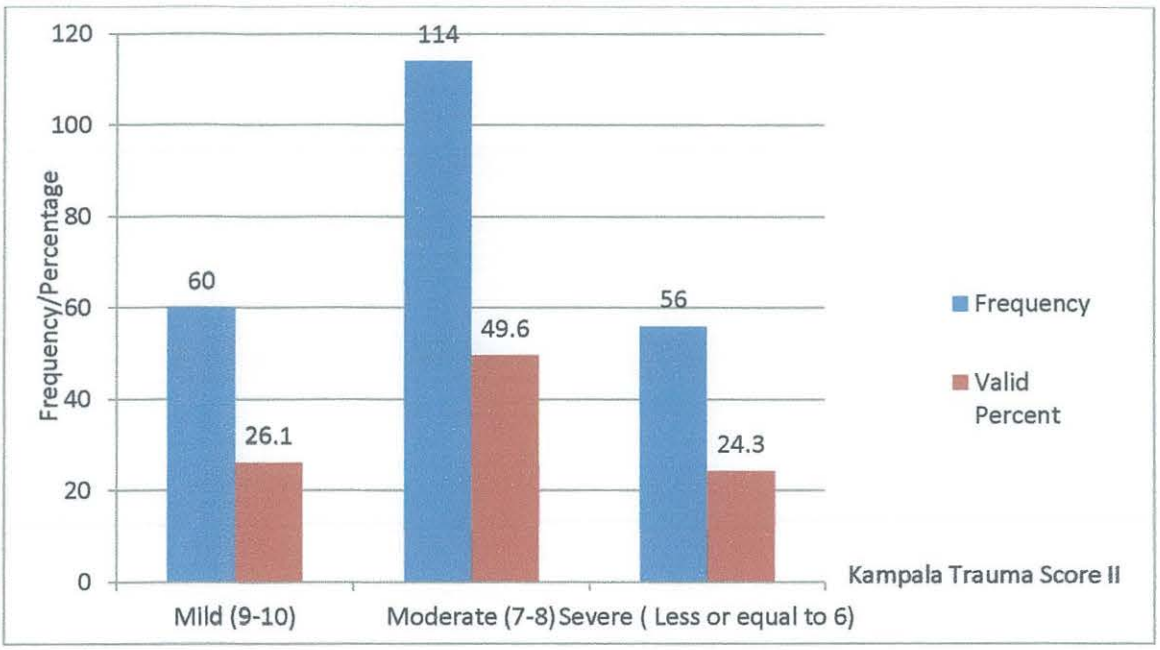

Figure 7: Showing severity of Kampala Trauma Score II amongst patients with femoral fractures secondary to motorcycle related accidents

Mechanism of injury: The motorcycle to motorcycle accident was the most common mechanism of femoral injury 51.3% (n=118) followed by motorcycle-car crash and motorcycle-pedestrian in that order as shown in fig.8. Motorcycle-car crash was associated with higher odds for a severe KTS II (OR 1.193; 95% CI [1.010-3.104]; P=0.017).

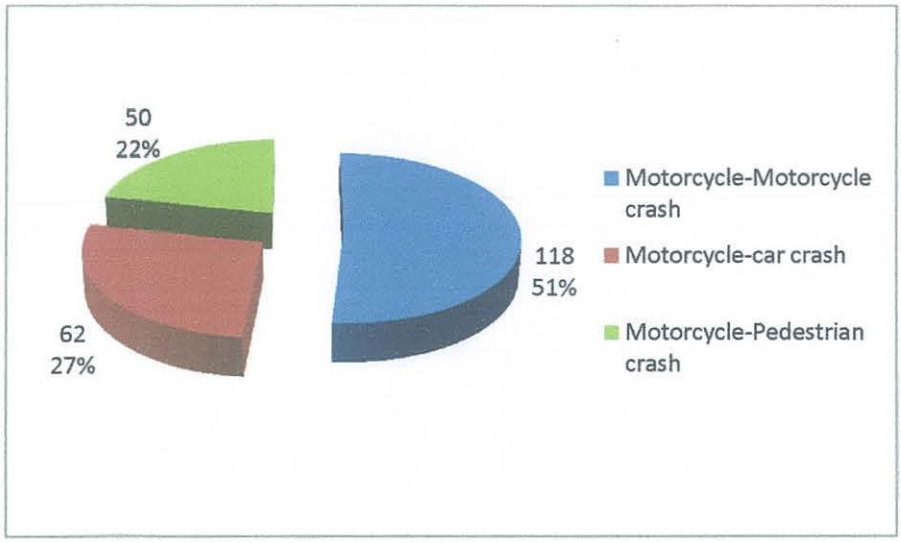

Figure 8: Summarizing mechanism of collision amongst patients presenting with femoral fracture secondary to motorcycle related accidents

Road user category: The most commonly fractured road user was the passenger on the motorcycle 48.3% (n=111) followed by motorcycle rider and pedestrian in that order (fig.9). The passenger on motorcycle also had higher odds for sustaining a femoral fracture associated with a severe KTS II (OR 1.636; 95% CI [1.261-3.417]; P=0.007).

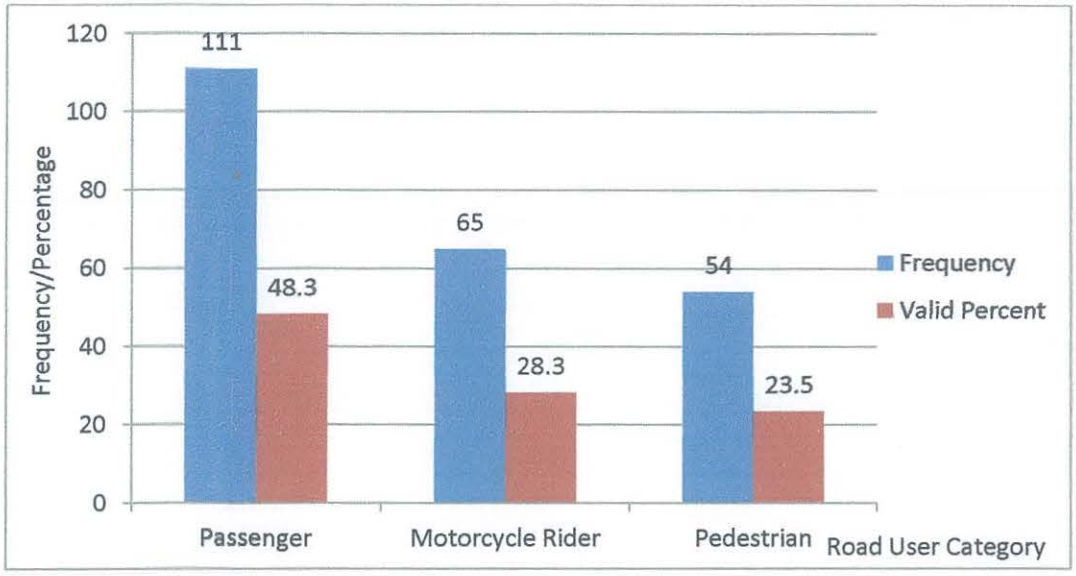

Figure 9: Showing Road User Category amongst Patients Sustaining Femoral Fracture Following Motorcycle Related Accidents

Means of arrival: Of the 230 participants, only 47.4% (n=109) arrived to the health facilities by ambulance whereas majority 52.6% (n=121) arrived by taxi/motorcycle. Arrival by a taxi/mortorcycle was associated with higher Odds for a severe KampalaTrauma Sore II compared to those who arrived by ambulances (OR 1.270; 95% CI [0.915-1.764]) Vs. (OR 0.791; 95% CI [0.595-1.052]) respectivey, however this was not statistically significant (P=0.127).

Interval between accident and arrival to Hospital: Of the 230 participants, only 63.5% (n=109) arrived to the health facilities within one hour from the time of accident incident. The mean travel interval estimate from time of accident incident to arrival at the health facilities was 4.13 Hours (Std. Deviation 3.52 Hours). Arrival to the Hospital beyond one hour was associated with higher odds for a severe KTS II amongst patients with femoral fractures secondary to motorcycle related accidents (OR 1.448; 95% CI [0.916-2.290]), however this was not statistically significant (P=0.115). Patients who used ambulances were

3 times more likely to arrive to the hospital within one hour compared to their counterparts who used public transport (OR 2.939; 95% CI [1.667-5.180]; P=0.000) (fig.10).

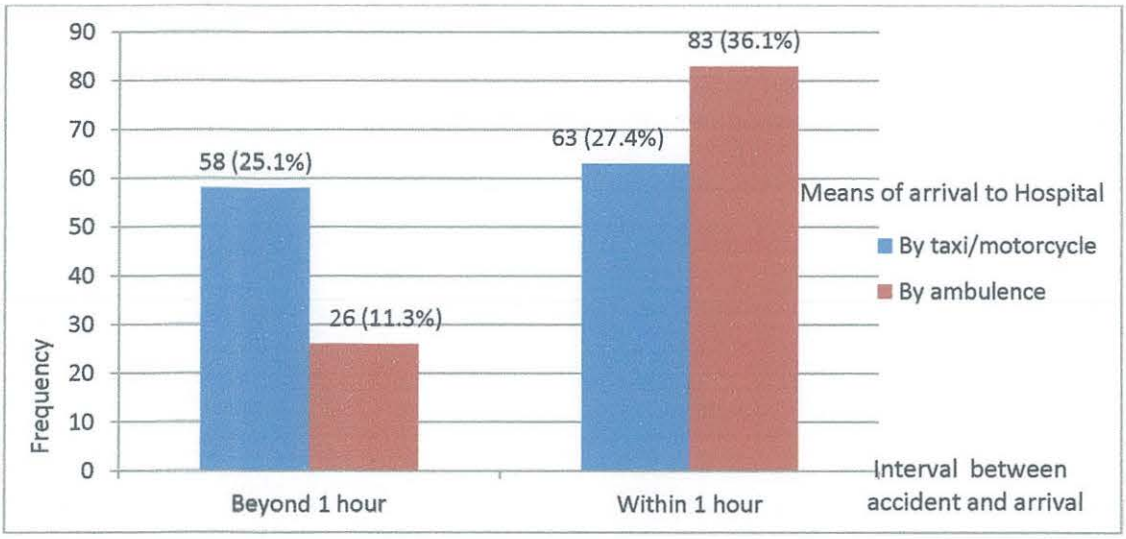

Figure 5: Showing relationship between means of transportation of patients with femoral fractures and prehospital arrival interval

First Aid status: Of the 230 participants, only 47.0% (n=108) received first aid before arrival to the health facilities, of which 70.4% (n=76), the first aid was administered by a health worker whereas 29.6% (n=32) by lay bystanders. Patients who did not receive first aid were more likely to sustain femoral fractures associated with a severe KTS II (OR 1.231; 95% CI [1.067-2.259]; P=0.040; however there was no statistically significant association between who administered the first aid (Health worker Vs. Lay bystander) and severity of KTS II (OR 0.89; 95% CI [0.661-1.219] p=0.573).

Evidence of pre-existing medical illness: Of the 230 participants, 9.1% (n=21) reported having a pre-existing medical illness prior to the accident incident that were validated. The most commonly reported comorbidity was Hypertension followed by a combination of Hypertension and Diabetes Mellitus as shown in fig.11. There was no statistically sigificant association between pre-existing medical condition and severity of Kampala Trauma Score II (OR 0.596; 95% CI [0.228-1.562], P=0.288).

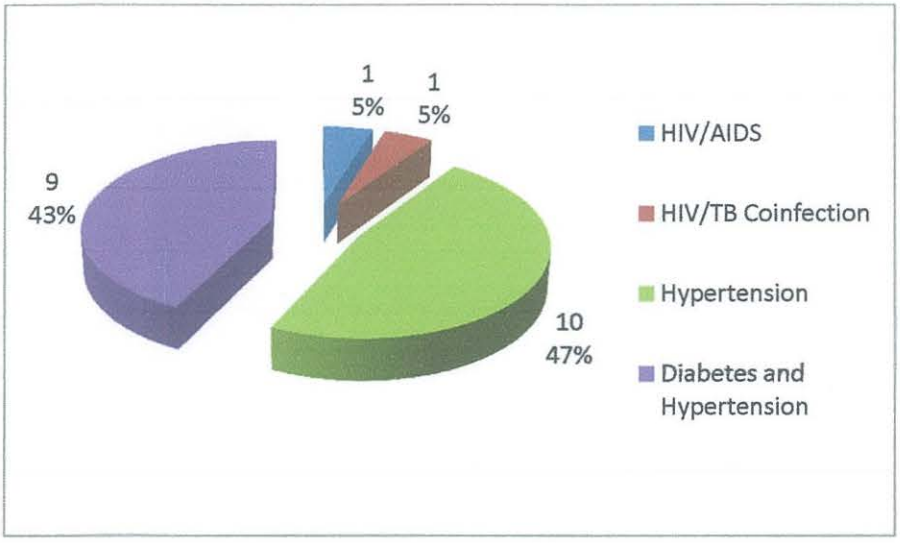

Figure 6: Showing comorbidities of patients presenting with femoral fracture secondary to motorcycle related accidents

Decision on mode of management: Of the 230 participants, majority 51.3% (n=118) were operatively managed by either Open Reduction and Internal or External Fixation whereas 48.7% (n=112) were managed conservatively either by traction or casting. Patients with a mild or moderate KTS II had higher Odds for conservative management (OR 1.168; 95% CI [1.101-1.351]) compared to those with a severe KTS II (OR 0.602; 95% CI [0.371-0.978]). This was statistically significant (P=0.036). Patients sustaining femoral shaft fractures were twice more likely to be treated operatively compared to other anatomical sites (OR=2.305; 95% CI [1.104-4.812]; P=0.024).

The immediate mortality rate within 24 hours in the present study was 3.0% (n=7). Patients with a severe KTS II were twice more likely to die compared to those with mild or moderate KTS II (OR 2.466; 95% CI [1.535-3.376]; P=0.001). The individual differences in health facilities where patients sought care (private for profit vs. government) had statistically no effect on the odds for severity of KTS II (OR 1.101; 95% CI [0.921-2.0401]; P=0.530) and immediate treatment outcome within 24 hours (OR 1.633; 95% CI [0.869-3.066]; P=0.126).

Table 3: Summarizing the likelihood effect of study variables on severity of Kampala Trauma Score II amongst patients with motorcycle related femoral fractures.

Likelihood Ratio Tests *(95% CI, P<0.05)				
Effect of Study Variables on KTS II	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	329.503[a]	.000	0	.
Residential address of participant	339.928	10.424	2	.005*
Anatomical site of femoral fracture	358.165	28.662	8	.000*
Category of fracture (open vs. closed)	341.134	11.631	2	.003*
Road user category	343.474	13.971	4	.007*
Mechanism of injury (Nature of collision)	341.502	11.999	4	.017*
Arrival Interval (prehospital)	331.190	1.687	2	.115
Means of arrival to health facility	334.401	4.898	2	.086
First aid status before arrival	344.847	15.344	2	.000*
First aid administered by health worker vs. lay	342.730	1.114	1	.573
Immediate outcome of injury in 24hours	336.973	7.470	2	.024*
Age group	331.413	1.910	2	.385
Sex	332.171	8.668	2	.026*
Education level	338.384	8.881	6	.180
Marital status	329.931	.428	2	.807
Occupation	367.549	38.045	10	.000*
Medical history (comorbidity)	330.035	1.127	1	.288
Decision on mode of treatment	332.481	4.478	2	.036*
Hospital (KIUTH vs. MRRH)	330.771	1.268	2	.530

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussions

5.1.1 Socio-demographic characterisrtics associated with injury severity of motorcycle relatd femoral fractures

In this study, majority 77.0% (n=177) of participants belonged to the Banyankole tribe because they occupy majority of the communities in Western Uganda and many were Catholics 57.8% (n=133). The muslim faith has been shown to have lower Odds for sustaining motorcyle related accidents, which might be attributed to abstinence from alcohol (Tumwesigye *et al.*, 2016).

Majority of respondents were single. Although earlier studies (Moskal *et al.*, 2012) showed that those who never married had higher Odds for sustaining road traffic related injuries , the present study finds no statistically significant association between single marital status and severity of KTS II after sustaining a motorcycycle related femoral fracture (OR 1.129; 95% CI [0.836-1.524]; P=0.054).

The age of participants ranged from 3 to 96 years. This demonstrates that motorcycle related accidents do not segregate. The mean vulnerable age in the present study was 32 years (Std. Deviation 18.5 years) whereas majority 77% (n=177) belonged to economically productive age group of (15-64) years. A similar study in the Ugandan capital, Kampala by (Tumwesigye *et al.*, 2016) demonstrated that the age group of (25-34) years were most affected by motorcycle related accidents which lies within (21-40) years in the present study, although other studies have quoted a vulnerable age younger than 30 years (Luboga *et al.*, 2009; Hollis *et al.*, 2015). This not only depicts the tendency of risk taking by younger people (Wong *et al.*, 2010), but also failure to obey traffic regulations in this age group (Zamani-Alavijeh *et al.*, 2009; Susilo *et al.*, 2015). The socio-economic loss to Uganda (Kigera, L. Nguku, 2010) and globally (World Health Organization, 2015) that result from motorcycle accident related disability amongst the young productive age group who are the bread winner cannot be underestimated. A study in Ghana showed that the economic burden of motorcycles was up to US$1.2million of which 52% was accident related costs yet very few of such causalities are medically insured (Kudebong *et al.*, 2011). As a public health priority,

the overall net economic benefit of motorcycles to the country should be further validated if we are to continue their use.

The male to female ratio was 2.4 : 1. The male gender was also more likely to sustain a femoral fracture associated with a severe KTS II (OR 1.934; 95% CI [1.846-2.263]; P=0.022). This was statistically significant. Other studies have shown male preponderance to sustaining motorcycle related injuries (Zamani-Alavijeh *et al.*, 2010; Hollis *et al.*, 2015). Men are risk takers but also the sole bread winners in African cultural context (Sathiparsad, Taylor, & Dlamini, 2008), often in rash hour to make ends meet and do consume alcohol than their female counterparts based on the European (Papadimitriou *et al.*, 2014) and UK experience (Atkinson, Kirton, & Sumnall, 2012; Moskal, Martin, & Laumon, 2012). A study in the Middle East has shown that socio-economic daily stress influence men's risky riding behaviour, particularly those from low socio-economic status (Zamani-Alavijeh *et al.*, 2010).

Motorcyclists 30.9% (n= 71) were the most vulnerable to motorcycle related femoral fractures, followed by peasant farmers, students and business men/women in that order (X^2=38.045; df=10; P<0.001). This shows that motorcycle accidents mainly affect people who can least afford the cost implications of health care spent on treating these injuries which further worsens the poverty cycle of the afected families. A study in Thailand has shown that low socio-economic status and lower level of education (Yongchaitrakul *et al.*, 2012) are associated with higher odds for motorcycle related injuries, contrary to an earlier Ugandan study that demonstrated higher odds for motorcycle injuries amongst people earning above US$40 per week (Tumwesigye *et al.*, 2016). In the present study, only 13.5% (n=31) of patients had attained a tertiary level of education, although there was no statistically significant association between severity of KTS II and education level (X^2=8.881, df=6, P=0.180), which was consistent with an ealier study (Tumwesigye *et al.*, 2016). The differences in individual's, countrys' income status and geographical location might have an influence on one's preferred means of transport.

Majority of participants resided within municipality. This could result from increasing level of motorisation without concurrent urban planning and lack of special motorcycle pathways and pedestrian facilities that result into congestion. However those who reside outside the municipality were twice more likely to sustain a femoral fracture associated with a severe KTS II (OR 2.114; 95% CI [1.212-3.687]; P=0.003). A Nigerian study has shown that motorcylists in rural areas are 58 times more likely to lack adequate knowledge to comply to traffic singns comapared to their town counterparts, and ride at higher speeds in abscence of

traffic jam, resulting in fatal accidents (Olumide *et al.*, 2016). The severity of KTS II amongst rural patients can be explained by delayed access to specialised health facilities due to scarcity of ambulance services and public transport in rural settings. In the present study, patients from within municipalities were twice more likely to reach the health facility within one hour following the accident compared to their counter parts residing out side municipalities (OR 2.341; 95% CI [1.295-4.234]; P=0.004).

5.1.2 Anatomical patterns of motorcycle related femoral fractures associated with injury severity

The femoral shaft 72.6% (n=167) was the most commonly fractured anatomical site amongst patients sustaining femoral fracture secondary to motorcycle related accidents, followed by femoral neck 10.9% (n=25), supracondylar 7.8% (n=18) and condylar fractures 3% (n=6) in that order. These findings are comparable to the Tanzanian study (Hollis *et al.*, 2015). There was an association between the different anatomical sites of femoral fracture and severity of Kampala Trauma Score II in the present study (X^2=28.662, p<0.001; df=8). Femoral shaft; (OR 1.155; 95% CI [1.101-1.902]; P=0.024); and femoral neck (OR 4.222; 95% CI [1.294-13.776]; P=0.016) fractures were more more likely to be associated with a severe Kampala Trauma Score II.

Cadaveric studies have shown that there is a difference in microstructure and composition between the femoral shaft, neck and more distal part of the femur (Yeni *et al.*, 2000). The resistance to tensile and shear forces also differ by different anatomical sites of femoral bone, with the femoral neck having the greatest resistance to crack initiation and propagation for both tension and shear loading while the femoral shaft having the least (Brown *et al,* 2000). It has also been shown that the femoral neck and condyles have a higher mineral density, cross-sectional area, and cortical thickness compared to femoral shaft, which makes the femoral shaft more prone to shear forces and energy absorption, thus a high prevalence of femoral shaft fractures (Brown *et al.*, 2000). Motorcycle accidents may worsen the pre-existing tensile strain on the lateral femoral shaft imposed by daily walking (Martelli *et al.*, 2014).

The femur being larger and a stronger vascularised bone with musclar protection, femoral fractures require a large amount of force transmitted from a direct blow like from a motorcycle to motorcycle collision or from indirect force transmitted as when the motorcyclist or passenger lands on the flexed knee. However once a fracture occurs, the protective musculature causes displacement, which might result in neurovascular injury and

significant bleeding worsening the Kampala Trauma Score II, that relies partly on systolic blood pressure. In this case open fractures not only bleed but also add potential risk for infection. The narrow circumference and angle of the neck of the femur allow not only considerable range of motion at the hip joint but also predispose the femoral neck to extraordinary shearing forces. When these forces exceed the strength of the bone, a fracture does ensue. Proximal femoral fractures may disrupt vascular suply provided mainly by branches of the medial and lateral circumflex femoral arteries and to a lesser extent, the foveal artery to the head of the femur thus risking avascular necrosis. Distal femoral condyle fractures accounted for 3% (n=6) of all femural fractures in the present study, resuting from inadvatent landing on a flexed knee. This type of knee injury can potentially result in neurovascular compromise or compartment syndrome, with resultant risk of limb loss.

5.1.3 Pre-hospital factors associated with a severe Kampala Trauma Score II outcome amongst patients sustaining femoral fractures following motorcycle related accidents

Study findings revealed that the most commonly fractured road user was the passenger on the motorcycle 48.3% (n=111) followed by the motorcycle rider and pedestrian in that order. This is noticeably in contrast to an earlier study that evaluated knee injuries amongst road users in which motrocyclists were the most vulnerable (Haasper *et al.*, 2006). There was an association between road user category and severity of KTS II amongst patients who sustained femoral fractures secondary to motorcycle related accidents (X^2=13.971, P=0.007, df=4).

Although carrying a passenger was shown to be protective from motorcycle accidents in earlier studies outside Uganda (Moskal *et al.*, 2012), the present study shows that the most at risk for a motorcycle related femoral fractures associated with a severe KTS II was a passenger on the motorcyle (OR 1.636; 95% CI [1.261-3.417]; P=0.007). This is because its not uncommon in a Ugandan context, for a motorcycle to carry more than one passenger along with heavy laguage, particularly where the rider attempts to protect themselves from fatal accidents, "sacrificing" the hind passenger to fall off in the event of a collision. Of the 111 passengers studied, 70.3% (n=78) reported being knocked from behind of which 29.5% (n=23) had been knocked by cars. An earlier study showed that sharing a motorcycle amongst passengers was an independent risk factor for motorcycle related accidents (Tumwesigye *et al.*, 2016). Strong regulation on overloading and use of pritective gear for passengers could avert such catastrophic consequences.

Majority 52.6% (n=121) arrived to the health facilities by taxi/motorcycle. Arrival by a taxi/mortorcycle was associated with higher odds for a severe KampalaTrauma Sore II compared to those who arrived by ambulances (OR 1.270; 95% CI [0.915-1.764]) Vs. (OR 0.791; 95% CI [0.595-1.052]) respectively, however this was not statistically significant (P=0.127). Due to cost of fuel implications, it is not uncommon that junior clinicians in remote Ugandan settings would refer only critically sick patients by ambulance (if available) whereas they would "just send off" those who are not critically sick to a tertiary facility using public means. Junior clinicians in lower health facilities tend to fear attending to polytrauma patients and often refer them immediately to tertiary centres without initiating treatment, possibly in fear of litigation in the event such mortality of major trauma cases occured in lower level health facilities, yet to the author's knowledge, there are no trained paramedics to be sent along with the ambulances in Uganda. As such standard prehospital surveillance and care may not have been executed despite arrival by ambulance. Thus in the present study, majority 75.2% (n=82) of patients who arrived by ambulance did not receive first aid compared to 21.4% (n=26) who arrived by taxi/motorcycle (OR 11.097; 95% CI [6.004-20.510]; P<0.001).

Studies have shown that transfer delay does not increase in-hospital mortality among trauma patients who received basic emergency trauma rescusitation care at lower centres (Khan *et al.*, 2010). Designing rural trauma team development courses for junior clinicians have shown promising results in gaining self confidence regarding decision to initiate care and timely decision to transfer of emergency trauma patients to definitive tertiary centres (Kappel *et al.*, 2011).

Only 63.5% (n=109) of study participants arrived to the health facilities within one hour from the time of accident incident. The mean travel interval estimate from time of accident incident to arrival at the health facilities was 4.13 Hours (Std. Deviation 3.52 Hours). This was comparable to the 4.7 Hours reported in a Pakistanian study (Khan *et al.*, 2010). Arrival to the Hospital beyond one hour was not significantly associated with a severe KTS II amongst patients sustaining femoral fractures secondary to motorcycle related accidents (OR 1.448; 95% CI [0.916-2.290]; P=0.115). These findings are consistent with those of the Pakistanian study (Khan *et al.*, 2010). In a similar study by (Newgard *et al.*, 2015), there was no association between prehospital time and outcome after adjusting for confounders, for which the author called for redefining the golden hour, although higher mortalities were reported for patients with arriving after one hour (Newgard *et al.*, 2015).

Although aggressive resuscitation averts hypothermia, hypoxia and hypotension in major trauma patients (Lee *et al.*, 2013), a North American study found no association between emergency medical services intervals and mortality among physiologically abnormal injured patients in field settings, after control for field confounders (Newgard *et al.*, 2010). Thus for the present study, field factors like road user category, first aid status and mechanism of injury were better predictors of a severe KTS II than arrival interval itself. A multi country study has shown that for high velocity trauma, the earlier a patient receives treatment the better the outcome (Matityahu *et al.*, 2014), although there was no comparison between injury admission interval and arrival surgery interval to ascertain if the later interval is a better predictor of injury outcome. It is thus imperative to note that whereas the out of major trauma is very time dependent, it is arbitrary to apply the golden hour rule to every patient, given the unique nature of trauma presentation in remote settings with no standard prehospital care systems.

For example, whereas a patient with a gunshot injury to the femoral vessels may have golden minutes, conversely, a patient who sustains an isolated stable femoral fracture secondary to motorcycle accident may have a golden day or two (Rogers *et al.*, 2015). A systematic review has shown that quick prehospital transportation is beneficial for patients suffering neuro and the haemodynamically unstable penetratingly injuries otherwise increased on-scene-time and total prehospital time does not increase odds for death (Harmsen *et al.*, 2015). Thus for haemodynamically stable trauma patients, emphasis should be on the type and quality of care delivered prehospital instead of rapid transportation to tertiary Centres. In the near future, (Rogers *et al.*, 2015) recommend that we look at the evidence-based medicine that either supports or refutes our widely held beliefs. We therefore need to design trauma care systems are patient centred and country specific in our local contexts; as it is unlikely that patients arriving by taxis or motorcycles will reach a referral trauma care Centre in one hour.

Only 47.0% (n=108) received first aid before arrival to the health facilities, of which 70.4% (n=76) received first aid from a health worker whereas 29.6% (n=32) received first aid from lay bystander, who mainly included police officers, taxi drivers and motorcyclsists. Health worker administered first aid included fluids, analgesics, and temporary fracture immobilisation whereas lay person administered first aid included temporary fracture splintage using locally available materials like wood and pressure to control external bleeding. Patients who did not recieve first aid had higher odds for a severe KTS II (OR 2.106; 95% CI [1.818-2.495]; P<0.001), however there was no statistically significant

association between who administered the first aid (Health worker Vs. Lay person) and severity of KTS II (OR=0.89; 95% CI [0.661-1.219]; P=0.573). This implies that all what may be necessary first aid in isolated femoral fractures is fracture splintage (immobilisation) and control of external haemorrhage. Splintage of fractures has been shown to control both haemorrhage and pain (Bumpass *et al.*, 2015), alleviating discomfort and limiting further injury that could result from painful inflammatory cascade, shock, hypothermia and metabolic acidosis (Fitch *et al.*, 2008) while concurrently eliminating the need for local anaesthetic blockage of fascia iliaca compartment (Fujihara *et al.*, 2013) and femoral nerves (Riddell *et al.*, 2016).

The concern for lay person's control of external haemorage is limited knowledge of the tourniquet time in a setting of prolonged prehospital arrival interval, risking compartment sysndrome and inadvertent limb loss. In a Norwegian study, bystanders gave first aid in up to 97% of trauma cases, in which they correctly protected the Airway (76%), correctly controlled external bleeding (81%), and prevented hypothermia for (62%) of patients (Bakke *et al.*, 2015). Although the Norwegian investigators did not assess the effect of bystanders' first aid on patients' outcome, which the present study attempts to address, they noted that among the first-aid providers, 35% had some training in first aid and that bystanders with documented first-aid training gave better first aid than those whose first-aid training status was unknown (Bakke *et al.*, 2015). Since there was no difference between health work and lay bystander administered first aid on the severity of Kampala Trauma Score II outcome, capacity building through formal training of bystanders, police officers , taxi drivers and commercial motorcyclists who are usually the first responders to trauma patients in Ugandan settings where prehospital transport time is long, could significantly improve survival of these patients. Earlier studies have shown a potential for reduction in mortality of trauma patients in which immediate lay first aid is administered (Tannvik *et al.*, 2012
; Murad *et al.*, 2010; Ashour *et al.*, 2007).

Of the 230 participants, 9.1% (n=21) reported having a pre-existing medical illness prior to the accident incident. The most commonly reported comorbidity was Hypertension followed by a combination of Hypertension and Diabetes Mellitus. Although there was no association between pre-existing cormorbidities and severity of KTS II among femoral fractured patients in the immediate post injury period (OR 0.596; 95% CI [0.228-1.562]; P=0.288), it is important for clinicians to routinely assess for these medical conditions as these not only have anaesthesia implications (Liuni *et al.*, 2012) but also significantly affect the cost of hospitalisation, length of hospital stay and the long term out come of trauma patients (Nikkel

et al., 2012). Hypertension could not have been a good predictor of severe KTS II in the present study since the score partly relies on systolic blood pressure and generally these patients were younger (mean age 32 years). Where Tuberculosis and HIV/AIDS are highly prevalent for example in Uganda where the prevalence of HIV is reported to be 7.5% amongst motorcyclists (Lindan *et al.*, 2015), routine screening should be performed not only for precautions of the attending trauma surgeon but also to predict cross contamination and consider HIV post exposure prophylaxis for patients sustaining open fractures.

Motorcycle to motorcycle accident was the most common mechanism of injury 51.3% (n=118), followed by motorcycle-pedestrian and motorcycle-car accident in that order. There was an association between mechanism of injury and severity of the KTS II amongst patients with femoral fractures secondary to motorcycle related accidents (X^2=11.991, P=0.017, df=4), with those involved in a high energy impact motorcycle-car crash having higher odds for a severe KTS II (OR 1.193; 95% CI [1.010-3.104], p=0.017). Motorcyclists do not turn their heads to look for vehicles when entering roads with low volume traffic and often do not comply with the stop line rule, when they approach traffic lights, thus knocking vehicles from the sides, subjecting the passenger to a motorcycle-car crash, as demonstrated in a Malaysian study (Abdul *et al.*, 2015). Most trauma interventions do not primarily focus on motorcyclists, passengers on motorcycles and pedestrians who constitute majority of road traffic accident burden in developing countries and globally, contributing to failure in comprehensively addressing motorcyle related accident dilemma (Ameratunga *et al.*, 2006).

Majority 65.3% (n=150) of patients involved in motorcycle related accidents sustained an open femoral fracture. Patients with open femoral fractures were twice more likely to have a severe KTS II (OR 2.124; 95% CI [1.885-2.427]. This association was statistically significant (P=0.003). This is because besides external bleeding, patients with open fractures were more likely to have more than one injury (polytrauma) compared to those with closed fractures (43.0% vs. 21.0%, P = 0.041), particularly head injuries. It is therefore important that clinicians involved in care of these patients regard open femoral shaft fractures as high-energy surrogate markers of polytrauma in motorcycle related injuries. In addition to localized tissue hypoxia and acidosis in adjacent soft tissues, open femoral fractures are also associated with severe hemorrhage and hypotension, which directly influence severity of the Kampala Trauma Score II. Higher odds for complications has also been earlier reported for open femoral fractures in a multicentre study (Taitsman *et al.*, 2009).

Majority 51.3% (n=118) of patients in the present study were operatively managed by open reduction and internal or external fixation whereas 48.7% (n=112) were managed conservatively, either by traction or casting. Patients with a severe KTS II were more likely to be managed operatively (OR 1.940; 95% CI [1.039-3.622]; P=0.036), making the Kampala Trauma Score a good determinant (predictor) of intention to operate on motorcycle related femoral fractures. The higher operative rate (51.3%) in the present study could be attributed to higher prevalence of open femoral fractures, but also depict the current trends in fracture management. Closed femoral fractures were associated with higher Odds for conservative management (OR 1.643; 95% CI [1.345-2.007]; P<0.001) compared to open femoral fractures (OR 0.3587; 95% CI [0.231-0.552]; P<0.001). Due to inflammatory and localized tissue hypoxia, there is tendency to delay operation or to conservatively manage closed femoral fractures for fear of wound breakdown and deep infection of incisions placed in such compromised tissue (Tull *et al.*, 2003), except when complications like compartment syndrome are imminent. Patients sustaining femoral shaft fracture were twice more likely to be treated operatively compared to other anatomical sites (OR=2.305; 95% CI [1.104-4.812]; P=0.024), thus a total of 56.9% (95/167) femoral shaft fractures were managed operatively.

Although there was an earlier concerns of fat embolic events sequelae to intramedullary reaming and nailing of the femoral shaft (Wolinsky *et al.*, 2002), and high rates of infected non-union (Taitsman *et al.*, 2009), which led to a delay in the nailing of open femoral fractures for one week; there is current evidence that immediate internal fixation for multiple long-bone fractures, including those with bilateral femoral shaft fracture and concomitant injuries is associated with a better treatment outcome (Kumar *et al.*, 2014). In a publication of five hundred and twenty cases, the change to immediate internal fixation of all type-I and II open femoral fractures did not increase the risk of infections (Kumar *et al.*, 2014). This had been evaluated earlier in the paediatric population as well (Pandya & Edmonds, 2012). The second most commonly operated fracture was the supracondylar 50% (9/18), followed by trochanteric 35.7% (5/14), condylar 33.3% (2/6) and femoral neck 28% (7/25) in that order.
In this study, only one major fracture pattern was considered for each individual patient, thus in the event a patient sustained a non-contiguous fracture; the secondary fractures were recorded in the Kampala Trauma Score II as additional injury. In a setting of minimal access to computerized tomographic scanning, injuries such as coronal plane distal femoral fractures may be missed (Nork *et al.*, 2005). However in the event a patient sustains a non-contiguous ipsilateral femoral fracture, the proper management is well described by (Barei *et al.*, 2003).

Although the operative rates seem low for these anatomical patterns of femoral fracture, expensive and technically demanding dynamic compression screws and plates were required to manage these injuries. Authors (Mittal *et al.*, 2012), describe management of trochanteric fractures in detail although there is still a concern of nonunion associated with distal femoral fractures (Ma *et al.*, 2016).

The morbidity of such fractures in terms of implant failure, knee stiffness and chronic traumatic arthritis of the hip and knee joints can financially constrain these patients in the long term (Petsatodis *et al.*, 2010). Few femoral neck fractures were treated operatively given the fact that some of these patients were elderly or young enough to qualify for skin traction. However there is expanding indications for total hip replacement for elderly population and younger patients (Shah *et al.*, 2014), except that for physiologically younger patients, preservation of the natural hip anatomy and mechanics is arguably a priority in management because of their high functional demands (Pauyo *et al.*, 2014).

Although this particular study looked at 24 hour treatment outcome, studies that have evaluated skin traction as conservative method of management of femoral neck fractures have reported higher rates of deep venous thrombosis, pressure sores and prolonged hospital stays compared to those managed operatively (Kigera *et al*, 2010). There is a concern though for periprosthetic fractures amongst patients managed operatively (Shah *et al.*, 2014). The operative standard of care for patients with femoral neck fractures in the present study was by open reduction and internal fixation, with primary intention of risk reduction for avascular necrosis. Avascular necrosis, non-union and osteoarthritis are not uncommon in femoral head or trochanteric fractures (Min *et al.*, 2011; Ai *et al.*, 2013); and often require expensive intramedullary nailing and dynamic compression screws for proper management (Gandhi *et al.*, 2014).

A recent meta-analysis indicated the risk of avascular necrosis of femoral head was significantly higher after closed reduction and internal fixation compared with open reduction and internal fixation, but no association was shown between the healing rate and the two reductions for femoral neck fracture (Wang *et al.*, 2014). These findings are also true for the paediatric population (Song, 2010), although femoral neck shortening (Zlowodzki *et al.*, 2008) and femoral neck fracture can occur following hardware removal (Shaer *et al.*, 2012). Higher complication rates can be expected in Ugandan setting where patients can decide to opt out of proper surgical care for traditional bone setters, contributing to poor injury outcome related to neglected delays (Naddumba, 2008), particularly in a setting of 7.5% HIV prevalence amongst Ugandan motorcyclists (Lindan *et al.*, 2015). HIV patients on protease

inhibitors have been shown to have higher risks for hip fractures (Wensing *et al.*, 2010). The immediate mortality rate within 24 hours in the present study was 3.0% (n=7). Patients with a severe KTS II were more than twice more likely to die compared to those with mild or moderate KTS II (OR 2.466; 95% CI [1.535-3.376]; P=0.001). The individual differences in health two health facilities where the study was conducted (private for profit vs. government aided) did not statistically affect the odds for severity of KTS II (OR 1.101; 95% CI [0.921-2.0401], P=0.312) and immediate treatment outcome within 24 hours (OR 1.633; 95% CI [0.869-3.066], P=0.126). The Kampala trauma score II was thus a good tool in predicting early morbidity and mortality in this patient category.

5.2 Conclusion(S)

The femoral shaft is the most fractured anatomical site amongst patients sustaining motorcycle related femoral fractures, with male preponderance. Being a passenger on a motorcycle, receiving no first aid before arrival and sustaining an open femoral neck or femoral shaft fracture were pre-hospital factors significantly associated with a severe Kampala Trauma Score II amongst patients sustaining femoral fractures secondary to motorcycle related accidents. There was no association between means of arrival, arrival interval; pre-existing comorbidities and severity of KTS II in this patient category.

5.3 Recommendation(S)

This study has established determinants of injury severity of motorcycle related femoral fractures in our setting. These findings are crucial to establish specific road safety measures that are affordable and applicable in resource-limited settings including road-safety education campaigns to protect the passengers who are more at risk of injury severity. Such awareness campaigns targeting vulnerable sociodemographic groups have shown promising results in compliance with safety regulations, based on experience from Ghana (Johnson *et al.*, 2011) and Nigeria (Johnson *et al.*, 2012) could be adopted.

Since the present study demostrates no severe injury outcome associated with lay bystander administered first aid, there is need to embrace this as measure to stregthen the prehospital care system in Uganda, through capacity bulding to extend it beyond pilot studies that were earlier conducted (Jayaraman *et al.*, 2009a; Jayaraman *et al.*, 2009b). This is feasible through training teams of motorcyclists, taxi drivers and police officers through their professional associations, on basic life support, basic long bone fracture splintage and immobilization using locally available resources, in order to design local trauma rescue teams to minimize

delay in initiating quality care for patients with femoral fractures secondary to motorcycle related accidents.

Embracing use of data from further robust epidemiological research including valuable hospital based surveys and police accident statistics is paramount in preventive policy formulation. Future research should be prospective studies to shade light on how sociodemographic, anatomical patterns and prehospital determinants of injury severity in the present study would influence long-term outcome of motorcycle related femoral fractures.

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Appendix I: Work Plan

ACTIVITY	June 2016	July 2016	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2016	Feb 2017	March 2017	April 2017	June 2017
Writing and submission of the research proposal												
Presentation to IRC, ethical approval and clearance												
Data collection and entry												
Data analysis												
Reporting writing												
Presentation of findings to IRC												
Final report submission												
Dissemination of findings												

Appendix II: Budget

Programme Activity	Item	Unit cost	Quantity	Cost (UGX)
Internet charges	Internet café	2000 per hour	100 hours	**200,000**
One day simulative workshop	Training four Accident and Emergence staff in using the Kampala Trauma Score II and emergence resuscitation	Note book 2000 each	4	**8000**
		Pen 500 each	4	**2000**
Stationary	Pre-test questionnaire	2 page	30 copies	**12,000**
	Printing Questionnaires	Sample size 203 200 per page	2pages	**81,200**
	Printing consent form	203 respondents 200 per page	3pages	**121,800**
	Printing introductory letters	203 respondents 200 per page	1 page	**40,600**
	Pens to fill questionnaires	25,000	1 Packet	**25,000**
Surgical examination gloves	Clinical examination of bleeding trauma patients (double gloving)	40,000 per box	40 boxes	**1,600,000**
Equipment	Blood pressure machine Stethoscope Pulse-oximeter Glucometer	300,000 300,000 300,000 800,000	1 1 1 1	**300,000** **300,000** **300,000** **800,000**
TOTAL				**3,790,600**

Appendix III: Budgetary Notes

Internet charges: Internet bundles were required for adequate literature review for result discussion, typing and storage of raw data and further development of reports.

Workshop: Four staffs (2 at each of the accident and emergence departments of the two study sites) underwent training by the investigator in advanced trauma life support protocol, resuscitation and how to use the Kampala Trauma Score II (KTS) as described by (Mutooro *et al*, 2010), during a one day simulative workshop as the beginning and middle of study period. This was not only to ensure quality of data collected to achieve study objective II, but also to ensure patient safety. The staffs at emergence department had not used the KTS II tool before.

Stationary: Printing questionnaires, consent/assent forms, introductory letters from ethical committee, final bound report and buying pens to fill the questionnaire.

Equipment: The investigator and research assistants needed to double glove to assess injured bleeding patients. To execute the measurement of vital signs as required in emergence resuscitation in accordance with advanced trauma life support and the Kampala Trauma Score II to achieve objective II, a pulse ox meter was required to measure pulse rate. Blood pressure machine and stethoscope were prerequisites for blood pressure measurement and a glucometer to test for fasting and random blood sugars to confirm comorbidity for patients who reported being diabetic.

Appendix IV Consent /Assent Form (Adopted from Mbarara University)

MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY
INSTITUTIONAL REVIEW COMMITTEE
P.O. Box 1410, Mbarara, Uganda

Tel: 256-4854-33795 Fax: 256 4854 20782
Email: irc@must.ac.ug mustirb@gmail.com
Web site : www.must.ac.ug

INFORMED CONSENT DOCUMENT

This document outlines the research study and expectations for potential participants. It should be written in layman terms and typed on MUST-IRC letterhead. The wording should be directed to the potential participant NOT to IRC. If a technical term must be used, define it the first time it is used. Also, any abbreviation should be spelled out the first time it is used.

NB: All the sections of this document must be completed without any editing or deletions

Please use a typing font that is easily distinguishable from the questions of the form

Study Title: *It should be the same as on all other documents related to the study*

PRE-HOSPITAL FACTORS ASSOCIATED WITH SEVERITY OF FRACTURE OF THE FEMUR AMONGST PATIENTS PRESENTING AT MBARARA AND KAMPALA INTERNATIONAL UNIVERSITY TEACHING HOSPITALS FOLLOWING MOTORCYCLE RELATED ACCIDENTS

Principal Investigator(s): DR. LULE HERMAN

INTRODUCTION

What you should know about this study:

- You are being asked to join a research study.
- This consent form explains the research study and your part in the study
- Please read it carefully and take as much time as you need
- You are a volunteer. You can choose not to take part and if you join, you may quit at any time. There will be no penalty if you decide to quit the study

Provide here a brief background to the study

Thigh bone injuries are a burden to passengers, motorcycle riders and pedestrians. The increasing number of motorcycles though contributes to livelihood, is a contributing factor. This study looks at factors that might contribute to a poor injury outcome amongst patients sustaining a broken thigh bone as a result of motorcycle related accidents before reaching hospital. For example, road user category (passenger, pedestrian, motor cyclist), how you arrived at the hospital, time interval between accident and arrival and any pre-existing

Leave blank for IRC office only: MUST-IRC Stamp:	IRC OFFICE USE ONLY: APPROVAL DATE: December 5, 2016 APPROVED CONSENT IRB VERSION NUMBER: December 2016 PI NAME: Lule Herman IRB NO: 19/10-16

medical conditions before accident. The study seeks to establish the burden of motorcycle related accident in our local context, contributing factors to poor injury outcome and contribute to management of these injured patient category in this aspect.

Purpose of the research project: *Include a statement that the study involves research, estimated number of participants, an explanation of the purpose(s) of the research procedure and the expected duration of the subject's participation.*

This project is part of requirements for my academic award and is expected to last six months (from December 2016 to May 2017). I hope to research one to two participants per day and in total I am targeting a minimum of 125 participants that will be consecutively recruited.

Why you are being asked to participate: *Explain why you have selected the individual to participate in the study.*

You have been selected because this study is targeting patients involved in motor cycle related accident. If you have a broken thigh bone as result of a motor cyclist knocking another motor cycle, motor cyclist knocked by a car, pedestrian knocked by a motor cycle or passenger on a motorcycle being involved in road traffic accident, you qualify for inclusion.

Procedures: *Provide a description of the procedures to be followed and identification of any procedures that are experimental, clinical etc. If there is need for storage of biological (body) specimens, explain why, and include a statement requesting for consent to store the specimens and state the duration of storage.*

As a participant, your breathing, blood pressure, level of consciousness and serious injuries will be assessed. You will be given emergence treatment like control of your bleeding and pain management based on your injuries until the doctor thinks you are stable. It is only until your pain and bleeding are controlled that you will then be enrolled in the study. You will be asked a few questions regarding your age, profession, level of education, when and where the accident took place, how you arrived to the hospital and any care you received before hospital. Once the doctor suspects you have a broken thigh bone, you will be sent to X-ray to confirm. When you are ready to receive your results, you will be told the results and the next plan of management which the researcher will record on the questionnaire. You will however retain your X-ray film result.

Risks / discomforts: *Describe any reasonably foreseeable risks or discomforts-physical, psychological, social, legal or other associated with the procedure, and include information about their likelihood and seriousness. Discuss the procedures for protecting against or minimizing any potential risks to the subject. Discuss the risks in relation to the anticipated benefits to the subjects and to society.*

Apart from the discomfort that might arise from recalling the bad experience of events that occurred during the accident, there are no additional health risks posed by the study since it only requires you to respond to questionnaire, undergo medical physical examination to detect any life threatening injuries that needs urgent attention and X-ray assessment (if

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indicated) in accordance with trauma management guidelines to ascertain and confirm the nature of your broken thigh bone.

Benefits: *Describe any benefits to the subject or other benefits that may reasonably be expected from the research. If the subject is not likely to benefit personally from the experimental protocol, note this in the statement of benefits.*

As a participant, the benefits that you should expect out of this study include linkage to appropriate care of your injuries, access most recent information about the burden attributed to motorcycle related road traffic accidents and contribute to the existing body of knowledge in this field besides better understanding of the nature of your injuries. In the end, you will benefit when recommendations based on the study findings are implemented by policy makers, regarding prevention and improvement of case management of motorcycle related femoral fractures.

Incentives / rewards for participating: *It is assumed that there are no costs to subjects enrolled in research protocols. Any payments to be made to the subject (e.g., travel expenses, token of appreciation for time spent) must also be stated, including when the payment will be made.*

As a participant, you need to understand that your participation in this study is voluntary and that there is no economic gain from this study.

Protecting data confidentiality: *Provide a statement describing the extent, if any, to which confidentiality or records identifying the subjects will be maintained. If data is in form of tape recordings, photographs, movies or videotapes, researcher should describe period of time they will be retained before destruction. Showing or playing of such data must be disclosed, including instructional purposes.*

As a participant, you need to understand that your name will not be used in any of the reports or publications that shall arise from this study and neither shall there be any information that may publicly expose your identity as a participant in this study. Instead, a study number, which will be only known to the investigators and authorized staff, will be used other than your name and that at no time will this number be stored together with documents bearing your name. In addition, unless you permit, none of your personal information shall be released to anyone other than the authorized staff of this study.

Protecting subject privacy during data collection: *Describe how this will be ensured.*

Data will be entered in a computer with a password known only to the principle investigator (PI). Hard copies of data will be kept in lockable shelves in an office accessible only by the PI. After analysis, the data will be kept for a maximum of six months after which will be deleted and hard copies destroyed to avoid retrieval by non-authorized individuals.

Right to refuse / withdraw: *Include a statement that participation is voluntary; refusal to participate will involve no penalty or loss of benefits to which the subject is otherwise entitled.*

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Since your participation is voluntary, nothing will happen if you refuse to participate in this study; you will not incur any loss to benefits to which you would otherwise be entitled.

What happens if you leave the study? *Include a statement that the subject may discontinue participation at any time without penalty or loss of benefits.*

Nothing will happen if you leave the study; you will not incur any loss or cost and you are free to withdraw from the study at any time without necessarily explaining your actions

Who do I ask/call if I have questions or a problem? *Include contact for researcher or Faculty advisor and Chairman MUST-IRC*

If you have any problem, question or inquiry, you can contact Dr. Lule Herman C/o Department of Surgery, Kampala International University Teaching Hospital- P. O. Box 71 Ishaka or reach him on Tel.0775656222 or on E-mail address lule.herman@gmail.com
OR Contact Professor Rwomushana John, the Chairman of ethical review board of Kampala International University through admin@kiu.ac.ug Tel +256772 387977
OR Contact Dr. Francis Bajunirwe, Chairman MUST IRC P.O.Box 1410 Mbarara Tel: 0485433795

What does your signature (or thumbprint/mark) on this consent form mean?

Your signature on this form means

- You have been informed about this study's purpose, procedures, possible benefits and risks
- You have been given the chance to ask questions before you sign
- You have voluntarily agreed to be in this study

Print name of adult participant	Signature of adult participant/legally Authorized representative	Date
Print name of person obtaining Consent	Signature	Date
Thumbprint/mark	signature of witness	

Leave blank for IRC office only: MUST-IRC Stamp:	IRC OFFICE USE ONLY: APPROVAL DATE: December 5, 2016 APPROVED CONSENT IRB VERSION NUMBER: December 2016 PI NAME: Lule Herman IRB NO: 19/10-16

Appendix V: Investigator Administered Questionnaire (English Version)

Title: Pre-Hospital Factors Associated with Severity of Fracture of the femur amongst Patients Presenting at Mbarara and Kampala International University Teaching Hospitals Following Motorcycle Related Accident

---

Name of the interviewer..... Sign ..... Date .....

Dear respondent, you are willingly requested to participate in this study and you are free to decline your participation at any time. The information that you provide will remain confidential. Please **tick ONLY ONE** most appropriate option, specify where necessary.

Section A: participants' Demographic Data

Participant's Name (Optional): .....Unique serial Number.....

1. Age (years).....
2. i) Dependent age group (<15>64) ☐ ii) Economically productive age group (15-64) ☐
3. Sex; i) M ☐ ii) F ☐
4. Tribe .....
5. Religious Affiliation .....
6. Education level .....
7. Marital status i) Single ☐ ii) married ☐
8. Occupation) .....
9. Address .....i) municipality (Urban) ☐ ii) Outside municipality (rural) ☐

Section B: Patterns of fracture of the femur as determined by X-ray

10. Pattern of # femur i) Neck ☐ ii) Trochanteric ☐ iii) shaft ☐ iv) Supracondylar ☐ v) Condylar ☐
11. Fracture Category i) Open fracture ☐ ii) Closed fracture ☐

Section C: Pre-hospital factors that might influence Kampala Trauma Score outcome

12. Road user category i) Passenger ☐ iii) Pedestrian ☐ iii) Motorcyclist ☐
13. Mechanism of injury i) Motorcycle-motorcycle ☐ ii) Motorcycle-pedestrian ☐ iii) Motorcycle-car crash ☐
14. Mode of arrival i) By ambulance ☐ ii) By taxi/motorcycle ☐ iii) other.....

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15. Arrival time interval i) within 1hr ☐ iii) Beyond 1hr ☐ Interval Estimate.....hrs.

16. Pre-hospital care/First aid given before arrival? i) Yes ☐ No ☐ By HW ☐ Lay ☐

17. Evidence of chronic medical illness i) Yes ☐ ii) No ☐ If yes specify ... .

18. Kampala Trauma Score II* i) Mild 9-10 ☐ Moderate 7-8 ☐ Severe ≤ 6 ☐

*The Kampala Trauma Score II (Total=A+B+C+D); (Mutooro *et al*, 2010)

Category	Clinical Parameters	Description	Score
A	Age (Years)	5-55	1
		<5>55	0
B	Systolic BP on admission	>89mmhg	2
		89-50	1
		<=49	0
C	Respiratory rate on admission	10-29bpm	2
		>=30	1
		<=9	0
D	Neurological status	A	3
		V	2
		P	1
		U	0
E	Score for serious injuries	None	2
		One	1
		>one	0

19. Decision on mode of treatment i) Conservative ☐ ii) Surgery (ORIF) ☐

20. Immediate Injury outcome within 24 hours i) Survived ☐ ii) Died ☐

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B.5 Okusharamu oyekundiire orikwetaba omukucondooza

Entandikyiro

Noshabwa okwetaba omukucondooza oku. Ekipapura ekyi nikyishoborora aha kucondooza okurikuza kukorwa hamwe nekyikweeka kyawe ekyoratugambireho. Noshabwa kukyishoma kurungi narishi okuhurikyiza kurungi aha mucondooza ogu orabe arinaiwe. Nobaasa kumara obwiire bwoona obworikwenda. Okwetaba omukukyondoza oku nokwanyekundiire. Noyikyirizibwa okwanga okugwetabamu, kandi nobuwakuba wagwegaitsiremu nobaasa kurugamu eshaaha yoona. Tihariho kufubirwa kwoona warugamu kandi noguma noheebwa obujanjabi bwawe nkoku oshemeriire kubuheebwa.

Oburugo .

Obuhutaazi ahamaguru nekyizibu kyihango aha bashabazi, abavugyi ba pikipiki kandi hamwe nabantu abarikugyendesa ebigyere. Beitu hoona kandi nobu omubaro gwa pikipiki gurikweyongyera haza obwo zirikuretera abantu entaasya, pikipiki nizimwe ahanshonga ezirikuretera okuhutaara. Okucondooza oku nikureeba zimwe ahanshonga ezi abarweire barikutunga batakahikyiire omwirwariro namunonga abarikuhendeka amagufa g'ebibero okuruga ahazabutandu za pikipiki ekyakubaasa kuba nikyo kyirikuretera okukyira kwabo kutaaba kurungi. Okucondooza oku nikukorwa okugyezaho kureeba ebizibu ebirikuretwa zabutandu za pikipiki omukyanga kyeitu ekyi kandi hoona nokugyezaho kwongyerera ahabujanjabi oburikuhebwa abarwiire abarikutunga obuhuta kuruga aha pikipiki.

Ahabwenkyi washabwa okwegaita omukucondooza oku?

Watoranwa omukucondooza oku ahabwokuba nitukyondooza ahabarweire abatunga obuhuta bwa pikipiki. Kworabe wahendeka e'igufa ry'ekibero kandi obwo kirikurugyirira aha kutomerana kwa pikipiki, pikipiki kutomerwa emotoka, waba notambura ahabigyere watomerwa pikipiki, narishi waaba ori omushabazi ahapikipiki nikwo mukatunga butandu , nooba ohikyire okwegaita omukucondooza oku.

Engyenderwaho

Kworabe watoranwa omukucondooza oku, abashaho nibaza kukukyebera kureeba omutima gwawe okugurikuteera hamwe nokworikwitsya kandi bongyere nokukyebera obuhuta obundi obworabe watunga. Abashaho nibaza kukuhereza obujanjabi bwahonaho, bakuhereze n'emibazi erikukyendeza obusaasi nabwanyiima kworaterere nitwiija kugyira ebibuuzo bikye ebitwakubuuza nka; emyaaka yawe, okwoshomiire, omurimo ogu otendekyirwe, ninkahi kandi niryari ahibutandu yaaba, okuwahika omwirwariro, kandi kuharabe hariho obujanjabi obuwatunga atakahikyire omwirwariiro. Omushaho kwaratekatekye ngu obaasa kuba wahendeka e'igufa ryekibero noija kuterwa ekishushani kya amagufa (x-ray) okwenda kuhamya buzimazima kworabe wahendeka.

Kworabe watebekaine orikubasa kumanya ebyaruga omukuterwa ekyishushani nitwiija kukugambira kandi tukushoborere obujanjabi obworikwetenga obwo kandi turikubihandika aha foomu egyi. Ekyishushani kyawe beitu nogumanakyo.

Ebizibu ebirikubasa kuruga omucukyondooza oku

Okwihaho okugyira ngu noija kwijuka ebizibu ebyabaireho butandu egyi erikuzakubaho tihariho ekyindi ekyishemeriire okukutinissa ahabwokuba noija kugarukamu ebibuuzo ebirakubuzibwe, nokweyongyera kukyeberwa weena kurungi kugyezaho kumanya kuharabe hariho ebindi bicweeka byomubiiri gwawe ebyasisikara, nokuterwa ekyishushani kyaba nikyetengwa okugyira ngu tuhamye ku e'igufa ry'ekibero kyawe ryahendeka.

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Ebirungi ebyorabone kuruga omukucondooza oku

Iwe nkokuwayetaba omukucondooza oku, noza kutunga obujanjabi bwoona okurugyirira ahabuhuta bwawe, kandi otungye nokumanyisibwa okukwatiriine nazabutandu zahanguto ezirikuretwa pikipiki kandi okyenge n'ekyika kyobuhuta obwoyine. Ahamuheru noija kuganyirwamu ahabwokugyira ngu ebyo byoona ebirarugye omukucondooza oku nibyiija kuhamibwa abakozi bebiragyiro, kandi oyongyere nokwegyesibwa ahamuringo oguwakwetantaramu zabutandu za pikipiki kandi hoona nokuwakubasa kujanjabwa nabwanyima yokutunga butangu zahanguto.

Okurinda ebihama byawe

Ebihama byawe byoona ebyoragambe nibiza kubikwa kurungi kandi omuntu ogu orikukurira okucondooza oku niwe aine ekyishumurizo kirikwigura ahiturikubiika ebihama byawe, tayiine orusa kugambira omuntu weena ebirikukukwataho okwihaho waaba niiwe wamwikyiriza kubigamba

Obugabe bwawe nk'omuntu

Oine obugabe kwanga okugumizamu omukucondooza oku. Ahabwokugyira ngu ori nyekundiire omukucondooza oku, tihariho kasiimo koona akorahebwe, oine obugabe okwanga kwetababamu kandi hoona nobuwakuba wayetabiremu nobasa kurireera eshaaha yoona beitu ekyo tikyirakuzibiire kutunga obujanjabi nkoku oshemereire kubutunga.

Ebibuuzo

Waba oine ebibuuzo byoona ebikwatiriine nokucondooza oku nobasa kuterera Dr Lule Herman arikukora omwitagi eryokushemeza ahairwariro rya Kampala International University Teaching Hospital; esimu 0775656222/ 0712278961 narishi Email address lule.herman@gmail.com/ lule.herman@yahoomail.com

Narishi oterere Professor Rwomushana John, mukuru w'entebe yakakiiko kengyenderwaho yamateeka gokura okucondooza ahari Kampala International University orikurabira aha admin@kiu.ac.ug , esimu 0772387977

Narishi oterere Dr Francis Bajunirwe , mukuru w'entebe yakakiiko kengyenderwaho yamateeka gokura okucondooza ahari Mbarara University of Science and Technology P.o Box 1410 Mbarara, esimu 0485433795.

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Appendix Vii: Investigator Administerd Questionnaire (Translated Version)

Section A: Ekicweeka kyokubanza; ebirikukukwataho

Eiziina ryawe (kyiryahariiwe okurigamba narishi okarikeka).....Ekinkumu.....

Enamba(Code).....Ebiro.....

1. Emyaaka.....
2. (i) emyaaka eri ahansi ya 15 narishi ahaiguru ya 64 ☐ (ii) emyaaka eri ahagati ya 15 na 64 ☐
3. (i) Omushaija ☐ (ii) omukazi ☐
4. Oruganda rwawe.....
5. Ediini yawe.....
6. Okashoma kuhika harurengo kyi.....
7. (i) ori omufumbo ☐ (ii) nari torimufumbo ☐
8. Omurimo gwawe.....
9. Ahorikuruga.....(i) omutauni ☐ (ii) Omukyaaro ☐

(Remaining technical sections to be strictly completed by the investigator or research assistant)

Section B: Radiological patterns of fracture of the femur (Based on x-ray)

10. Pattern of # femur i) Neck ☐ ii) Trochanter ☐ iii) shaft ☐ iv) Supracondylar ☐ v) Condylar ☐
11. Category i) Open fracture ☐ ii) Closed fracture ☐

Section C: Pre-hospital factors that might influence Kampala Trauma Score outcome

12. Road user category i) Passenger ☐ iii) Pedestrian ☐ iii) Motorcyclist ☐
13. Mechanism of injury i) Motorcycle-motorcycle ☐ ii) Motorcycle-pedestrian ☐ iii) Motorcycle-car crash ☐
14. Mode of arrival i) By ambulance ☐ ii) By taxi/motorcycle ☐ iii) other.....
15. Arrival time interval i) within 1hr ☐ iii) Beyond 1hr ☐ Interval Estimate.....hr(s)
16. Pre-hospital care/First aid given before arrival? i) Yes ☐ No ☐ By HW ☐ Lay ☐
17. Evidence of chronic medical illness i) Yes ☐ ii) No ☐ If yes specify ... .

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18. Kampala Trauma Score II* i) Mild 9-10 ☐ Moderate 7-8 ☐ Severe ≤ 6 ☐

*The Kampala Trauma Score II (Total=A+B+C+D); (Mutooro *et al*, 2010)

Category	Clinical Parameters	Description	Score
A	Age (Years)	5-55	1
		<5>55	0
B	Systolic BP on admission	>89mmhg	2
		89-50	1
		<=49	0
C	Respiratory rate on admission	10-29bpm	2
		>=30	1
		<=9	0
D	Neurological status	A	3
		V	2
		P	1
		U	0
E	Score for serious injuries	None	2
		One	1
		>one	0

19. Decision on mode of treatment i) Conservative ☐ ii) Surgery (ORIF) ☐

20. Immediate injury outcome within 24 hours i) Survived ☐ ii) Died ☐

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MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY
RESEARCH ETHICS COMMITTEE
P.O. Box 1410, Mbarara, Uganda. Tel: +256 4854 33795,
E-mail: sec.rec@must.ac.ug Fax: +256 4854 20782

Ref: MUREC 1/7 Date: December 5, 2016

Dr. Herman Lule
Postgraduate Student
KIU

Re: Submitted Protocol on "Pre-hospital factors associated with fracture of the femur amongst patients presenting at KIU motor cycle related accident."
No. 19/10-16

Type: [✓] Initial Application
[ ] Protocol Amendment
[ ] Letter of Amendment (LOA)
[ ] Continuing Review
[ ] Material Transfer Agreement
[ ] Other, specify: _____

Reference is made to the above protocol which was resubmitted to the Research Ethics Committee for reconsideration and approval.

It is noted that you have addressed all the concerns earlier raised by the Committee.

I am pleased to inform you that your study has been approved for a period of one year from **December 5, 2016** up to **December 4, 2017.**

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigator must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for review and approval **prior** to the activation of the changes. The REC application number assigned to the research should be cited in any correspondence.
3. Reports of unanticipated problems involving risks to participants or other must be submitted to the REC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for REC review.
4. Only approved consent forms are used in enrolment of participants. All consent forms signed by subjects and/or witness should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Regulations require review of an approved study not less than once per 12-month period. **Therefore, a continuing review application must be submitted to REC eight weeks prior to the above expiration date of December 4, 2017 in order to continue the study beyond the approved period.** Failure to submit a continuing review application in timely fashion may result in suspension or termination of the study, at which point new

KAMPALA INTERNATIONAL
UNIVERSITY- WESTERN CAMPUS

Ishaka Bushenyi PO BOX 71 Ishaka, Uganda
Website: http://www.kiu.ac.ug

OFFICE OF THE DEAN
FACULTY OF CLINICAL MEDICINE & DENTISTRY

February 15th, 2017

To: The Hospital Director
Mbarara Regional Referral Hospital

Dear Sir/Madam,

RE: INTRODUCTORY LETTER FOR LULE HERMAN

I write to introduce to you the above Master of Medicine in General Surgery Candidate Number (MMED/0002/142/DU) of Kampala International University. In the capacity of being his supervisor, I certify that I have read his approved research protocol titled "*Pre-hospital factors associated with severity of fracture of the femur amongst patients presenting at Mbarara and Kampala International University Teaching Hospitals Following Motorcycle Related Accident*"(MUST IRB Approval Number 19/10-06). The candidate is seeking permission to collect data from Mbarara University Teaching Hospital.

For any clarification, please do not hesitate to contact me.

Yours Sincerely,

15 FEB 2017

Prof. Ssebuufu Robinson
Associate Professor of General Surgery, Dean and Executive Director KIU Teaching Hospital;
Email: rssebuufu@gmail.com

18 FEB 2017

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ny correspondence on
subject please quote ref: No. .....

THE REPUBLIC OF UGANDA '

Ministry of Health
MBARARA REGIONAL REFERRAL HOSPITAL
P.O.Box 40,
Mbarara - Uganda

April 6, 2017

Dr. Lule Herman
Postgraduate Student
Kampala International University –Western Campus

Re: Approval of Proposal on Pre-Hospital Factors Associated with Severity of Structure of the Femur Amongst Patients Presenting at Mbarara Regional Referral Hospital following motorcycle related accidents.

Mbarara Regional Referral Hospital has received and reviewed your proposal referenced above and hereby grants approval to conduct this study.

This approval covers the proposal and the accompanying documents listed below:

- Questionnaire for Data Collection (both in English)
- Informed Consent Document (both in English and Runyankole)

This approval is subjected to the following conditions:

1. That you will abide by the regulations governing research in the country as set by the Uganda National Council for Science and Technology.
2. That any changes to the protocol and study documents that you may find necessary to make will be reviewed and approved by relevant authorities.
3. That the conduct of your study shall be monitored by the Mbarara Regional Referral Hospital supervisors in the relevant departments/units.
4. That you provide a copy of the final document of upon completion of the study, including a summary of the results and any publications to Mbarara Regional Referral Hospital.
5. That you will include Mbarara Regional Referral Hospital in your acknowledgements in all your publications.

My best wishes to you.

MBARARA REGIONAL REFERRAL HOSPITAL
10 APR 2017
P.O. Box 40,
Mbarara - Uganda

for: Dr. Barigye Celestine
HOSPITAL DIRECTOR