EPIDEMIOLOGICAL STUDY OF REPORTED ROAD TRAFFIC INJURIES (RTIs) IN SELECTED HOSPITALS IN KAMPALA – UGANDA (2018 - 2022)

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DECLARATION

This dissertation is my original work and has not been presented for a degree in any other University. Whenever the contribution of others are involved, necessary efforts were made to acknowledge them by way of proper citation.

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APPROVAL

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DEDICATION

This dissertation is dedicated to my dear family, especially my wife, for the love, prayers, support and always believing in me and my workmates for the financial help and giving me time to concentrate on my studies.

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ABBREVIATION AND ACRONYMS

ADHD: Attention Deficit Hyperactivity Disorder

BMI: Body Mass Index

DALYs: Disability Adjusted Life Years

DR & GT: Directorate of Research and Graduate Training

GCS: Glasgow Comma Scale

GDP: Gross Domestic Product

GoU: Government of Uganda

HIV/AIDS: Human Immune Virus/ Acquired Immune Deficiency Syndrome

ISS: Injury Severity Scores

LMICs: Low and Middle Income Countries

MoWT: Ministry of Works and Transport

RTA: Road Traffic Accident

RTC: Road Traffic Crashes

RTIs: Road Traffic Injuries

SES: Social Economic Status

UN: United Nations

UPF: Uganda Police Force

WHO: World Health Organisation

DEFINITION OF KEY TERMS

Epidemiological study: Study on human populations, which attempts to link human health effects to a cause

Fatality: A death caused by an accident or by violence

Injuries: Physical harm or damage to someone's body caused by an accident or an attack

Road traffic injuries: Fatal or non-fatal injuries incurred as a result of a road traffic crash

ABSTRACT

RTIs have increased in prevalence over the past few decades and by 2030, it is predicted that they will surpass both diabetes and HIV/AIDS to rank as the fifth biggest cause of death. This study was aimed at determining the epidemiology of reported Road Traffic Injuries (RTIs) in Mulago National Referral Hospital, Lubaga Hospital, Naguru Hospital, and Nsambya Hospital from 2018 to 2022. A facility-based cross-sectional design was used. Data was collected from the hospitals using document review guides. A total of 5,379 documents were reviewed from all the four hospitals. The findings of the study showed that males (80.9%) were more affected than females (19.1%). Individuals aged 21 – 30 years (34.4%) and 31 – 40 years (25.5%) were the most affected ages. Riders (31.2%) and pedestrians (33.0%) were most affected. Time of most accidents was evening and morning. Females were less likely to acquire head injuries than their male counterparts (aOR = 0.512; 95%CI = 0.456 – 0.907) while they were more likely to acquire lower limb injuries (aOR = 1.269; 95%CI = 0.011 – 1.801) and pelvis injures (aOR = 1.930; 95%CI = 1.542 – 2.132) than the male victims. The younger victims were more likely to acquire upper limb injuries (aOR = 1.739; 95%CI = 1.160 – 2.606), head injuries (aOR = 1.356; 95%CI = 1.053 – 1.922) and spine injuries (aOR = 2.163; 95%CI = 1.153 – 4.059) than the elderly victims while they were less likely to acquire lower limb injuries (aOR = 0.346; 95%CI = 1.734 – 3.175) than the elderly victims. The trends of RTIs showed a gradual increase of 0.8% of RTIs cases at the facilities from 2018 to 2022. Lubaga hospital and Naguru hospital RTIs cases showed seasonality with an index of 1.01 and 1.36 respectively. Factors associated with daily RTIs were gender, category of victim, mechanism of injury and time of incident. The study recommended the provision of zebra crossings and pedestrian walkways, use of helmets for both rider and passenger, provision of riding permits to riders, and ensuring the traffic police are available in the morning and evening times of the day.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The study's history, problem statement, research aims, research questions, significance, scope, and conceptual framework are all presented in this chapter.

1.1 Background information

Epidemiology is the study of the diseases and health impacts that affect a community. Road traffic injuries are defined as any injury, regardless of severity, received while riding a bike, walking, or driving a car as a result of an accident involving one or more vehicles (including motorbikes and bicycles) that starts or ends on a roadway (Sadaat & Soori, 2011). Road traffic accidents significantly increase the risk of illness and death in low- and middle-income nations (Alsofayan *et al.*, 2022) which is a public health issue (Zhang *et al.*, 2015). These are of a significant concern especially in developing countries Razzaghi *et al.* (2013) such as Uganda in particular (Kobusingye *et al.,* 2002).

Historically, Uganda’s road network and safety measures have lagged behind the rapid urbanization and increased vehicle ownership, particularly in Kampala. The country's transportation landscape has shifted significantly over the past few decades, with motorcycles increasingly becoming the preferred mode of transport. This shift has been coupled with inadequate road infrastructure, poor enforcement of traffic laws, and insufficient emergency response systems, all of which contribute to high RTI rates (Atuyambe et al., 2018).

Contemporarily, the conceptual framework of this study is grounded in public health and injury prevention. Studies have highlighted the burden of RTIs on healthcare systems, with calls for epidemiological investigations that could inform public health interventions, road safety legislation, and infrastructure improvement (Kiwanuka et al., 2021). The WHO and African Union (AU) have recommended targeted policies and interventions focusing on reducing traffic injuries, which align with the Sustainable Development Goals (SDGs), particularly SDG 3.6, which aims to halve the number of deaths and injuries from RTIs by 2030 (WHO, 2018).

First and foremost, 1.24 million fatalities annually are attributed to road traffic injuries (RTIs) (Lozano *et al.,* 2012). It is the seventh greatest cause of death worldwide and the deadliest for young people (ages 15 to 29) (Zafar *et al.,* 2018). Secondly RTIs have increased in prevalence over the past few decades (Peralta-Santos *et al.* 2022) and by 2030, it is predicted that they will surpass both diabetes and HIV/AIDS to rank as the fifth biggest cause of death (Zafar *et al.,* 2018). Additionally, RTIs rank as the eighth most common cause of Disability Adjusted Life Years (DALYs) (Murray *et al.,* 2012).

Road Traffic Injuries (RTIs) disproportionately impact low- and medium-income countries (LMICs), with middle income nations, particularly in Africa, bearing the most cost (WHO, 2013). In LMICs, 94% of injury-related disabilities and 91% of injury-related fatalities occur (Zafar *et al.,* 2018).

Although the burden is disproportionately large, epidemiological information on RTIs in LMICs is inadequately characterized (Evaniew *et al.,* 2014). The scarcity of data from low-income countries, where case fatality rates are highest, suggests that the full burden of disease may be underestimated. The burden of non-fatal traffic injuries is likewise underreported in low-income countries (Zafar *et al.,* 2018).

Globally, road traffic injuries are a significant public health issue, responsible for approximately 1.35 million deaths annually (World Health Organization [WHO], 2018). In low and middle-income countries, which account for 90% of RTI related deaths, factors such as limited healthcare resources, high traffic density, and insufficient road safety measures exacerbate the issue (WHO, 2019). Regionally, Africa bears the highest rate of RTI fatalities globally, with road injuries accounting for nearly 26.6 deaths per 100,000 people, which is almost twice the global average (Peden et al., 2019).

Uganda has not been spared from this epidemic; the country reported over 12,000 RTIs in 2020 alone, with fatalities steadily increasing (Uganda Bureau of Statistics [UBOS], 2021). Kampala, as the capital and most populous city, bears a disproportionate burden of these incidents, with the majority of cases involving motorcycles and pedestrians (Nantulya et al., 2020). The epidemiological dynamics of RTIs in Kampala suggest patterns of injury severity, age and gender disparities, and specific socioeconomic groups bearing the brunt of the impact. With the majority of RTIs involving economically productive individuals, this has serious implications for Uganda's socioeconomic development, making it critical to understand and address the underlying factors driving these injuries.

Uganda has a poor standard of living, rapid economic growth, a rise in the number of people and vehicles, inadequate road infrastructure, lax enforcement of traffic laws, and poor vehicle quality which all contribute to a high percentage of fatalities in road traffic accidents. According to yearly Police Report Data, the recorded number of fatal collisions in Uganda has climbed 7-fold in 25 years, from 500 in 1991 to 3,503 in 2016 (Luggya *et al.,* 2022). However, the WHO believes that the total number of recorded and unreported traffic fatalities yearly is substantially greater, at 12,036 or 29 per 100,000 people (WHO, 2018). In addition to this alarming incidence of fatalities, 12,754 other serious injuries from collisions were documented in 2013 (Luggya *et al.*, 2022). The true rate is unclear, but it is likely to be substantially higher if all injuries were properly recorded. According to research by Balikuddembe *et al.* (2017), Uganda is one of the nations with the highest burden of these accidents, with RTI fatalities at 28.9 per 100,000 people. The accident severity index is 24 individuals per 100 road collisions according to the United Nations Road Safety Performance Review-Uganda. This means that Uganda loses twelve people on average every day in traffic accidents, making it the worst country in East Africa (The Independent, 2022). This causes significant impact on the society, both economically through loss of income due to loss of productivity, increased need for medical care. It also leads to overcrowding in emergency and causality wards, loss of lives, loss of schooling and these have also been associated with increased government expenditure (Peden *et al.,* 2008).

A report by WHO, 2021, indicated that 3% of Gross Domestic Product (GDP) of majority of nations are thought to be costed by RTIs. To provide improved health care, more accurate and dependable epidemiological data for RTIs are required. The planning and distribution of healthcare resources (money, personnel, and equipment) will depend on accurate epidemiology of patients' hospital intake (Luo *et al.,* 2017). In underdeveloped nations such as Uganda, where medical resources are sparse, there is typically a mismatch between supply and demand due to inadequate medical expenditure and lack of data. This makes accurate predictions of future healthcare demand, supply, and resource availability crucial and essential, and it also enhances the need for good healthcare resource management. The volume of hospital services is directly impacted by the influx of accident patients but information on RTI influx is lacking. Resource allocation based on scientific principles will be considerably impacted or helped by accurate and reliable projections of these circumstances (Luo *et al.,* 2017). It is essential to acquire epidemiological data using information from the past (Soyiri & Redpath, 2013) but also information based on current research. This is crucial for the provision of healthcare services because it improves preventive healthcare, generates alerts for the management of patient inflows, lowers costs related to supplies and staff redundancy, lowers treatment delays, and lowers the risk of medical errors—all of which are based on statistical theory and mathematical theories (Soyiri *et al.,* 2013; Juang*, et al.,* 2017; Zinouri *et al.,* 2018).

Several risk factors contribute to the high incidence of RTIs in Kampala, including: Risky behaviours such as speeding, driving under the influence of alcohol or drugs, and non-use of protective gear, especially by motorcyclists, are significant contributors to RTIs (Kiwanuka et al., 2021). According to recent statistics, about 42% of RTIs in Kampala involve boda boda riders, who often disregard traffic laws and lack appropriate training (Nantulya et al., 2020). The poor condition of roads in Kampala, combined with inadequate traffic signage and lighting, increases the risk of RTIs, the lack of separate lanes for motorcycles and pedestrians and the absence of crosswalks in high traffic areas exacerbate these risks (Atuyambe et al., 2018). Limited enforcement of traffic laws and policies, such as mandatory helmet use for motorcyclists, plays a significant role in RTI rates. The Uganda Police Force (UPF) has been criticized for its weak enforcement of road safety laws, which often go unheeded due to minimal penalties for violations (Kiwanuka et al., 2021).

As urbanization and motorization continue to rise globally, Uganda, and specifically Kampala, has experienced an alarming increase in road traffic injuries (RTIs). This observation is especially pertinent in Kampala, where the influx of vehicles, including motorcycles ("boda bodas") and commercial trucks, has intensified the risk of road traffic accidents. In observing the prevalence of RTIs, the researcher noted a substantial burden on emergency and trauma units in local hospitals, with healthcare workers frequently stretched beyond capacity. Moreover, with road traffic injuries remaining one of the leading causes of morbidity and mortality among productive age groups in Uganda, there is an urgent need to explore epidemiological patterns to inform interventions, policy, and future research. This study aims to highlight critical trends, identify demographic disparities, and inform more effective RTI management strategies at hospital and national levels.

Also despite the significant public health burden posed by RTIs in Kampala, there remains a gap in understanding the detailed epidemiology of these injuries at the local level. Although the Ministry of Works and Transport has initiated policies aimed at improving road safety, such as the National Road Safety Council (Nantulya et al., 2020), there is limited empirical data to assess the impact of these interventions. By investigating the epidemiological patterns of RTIs in selected hospitals, this study aims to fill this gap, providing data to improve injury prevention strategies and to strengthen healthcare systems for better trauma care response. Despite this, Uganda, East, and Central Africa lack epidemiological RTI research hence the need to carry out research on RTIs in selected hospitals in Kampala, Uganda.

1.2 Statement of the problem

Road Traffic Injuries (RTIs) are a leading cause of injury and death in Kampala and surrounding metropolitan areas, with cases consistently reported in high numbers at hospitals such as Mulago National Referral Hospital (Hsia et al., 2010). The influx of RTI cases has created significant strain on health services, resulting in overcrowded casualty wards. This overcrowding has critical implications for patient outcomes, including delayed treatment, increased patient morbidity and mortality, and higher risks of healthcare-associated infections. Furthermore, healthcare providers face increased risk of burnout due to high patient volumes, impacting the overall quality of care and increasing healthcare costs (Boyle et al., 2012; Morley et al., 2018).

Despite the evident impact of RTIs on hospital resources and patient health, limited research has explored the epidemiological patterns of RTIs in Uganda or the broader East and Central African region. Key factors associated with the prevalence and reporting of RTIs remain unclear, and systematic documentation of daily RTI case inflows is lacking. This gap highlights an urgent need for research to better understand the demographic distribution, trends, and contributing factors of RTIs within hospital settings in Kampala. Therefore, this study sought to describe the distribution of RTIs by gender, age, and case frequency; analyse RTI trends; and determine the factors associated with daily RTI cases reported at selected hospitals in Kampala, aiming to inform more effective management and resource allocation in this high-burden region.

1.3 Objectives of the study

1.3.1 General objective

To assess the epidemiological study of reported road traffic injuries (RTIs) in selected hospitals in Kampala – Uganda (2018 - 2022)

1.3.2 Specific objectives

i. To describe the distribution of reported Road Traffic Injuries according to gender, age, and magnitude in Kampala – Uganda.

ii. To analyse the trend of Road Traffic Injuries in Kampala – Uganda.

iii. To determine the epidemiological factors associated with daily reported Road Traffic Injuries in Kampala – Uganda

1.4 Research hypothesis

$H0_1$: There is no significant difference between the distribution of reported Road Traffic Injuries according to gender, age, and magnitude in Kampala – Uganda?

$H0_2$: There is no significant difference between the trends of Road Traffic Injuries in Kampala – Uganda?

$H0_3$: There is no significant differences between the epidemiological factors are associated with daily reported Road Traffic Injuries in Kampala – Uganda?

1.5 Scope of the study

1.5.1 Geographical scope

The research was carried out at the accidents and emergency departments of Mulago National Referral Hospital, Lubaga Hospital, Naguru Hospital, and Nsambya Hospital in Kampala capital city.

1.5.2 Content scope

The research was aimed at describing the distribution of reported RTIs, daily inflow of reported RTI cases and factors associated with daily reported RTIs from 2018 to 2022.

1.5.3 Time scope

The study was carried out and considered hospital data in the selected hospitals from January 2018 to December 2022.

1.6 Significance of the study

The results from this study shall be used as reliable reference by stakeholders in road traffic injury planning and policy making.

The conclusions may also serve as a foundation for an updated evaluation of the worldwide burden of road injuries and for the identification of trends that governments, organizations, and the private sector may find beneficial in reducing the burden of road injuries in the future.

Quality information will be provided to health workers on the distribution of reported RTIs according to age, magnitude, and gender as well as factors associated with daily reported RTIs.

The research findings are expected to be future reference for other research studies, since new body of knowledge is added to the existing knowledge through publications.

The study is also a requirement for the completion of a Master’s Degree of Public Health as prescribed by Kyambogo University.

1.7 Conceptual framework

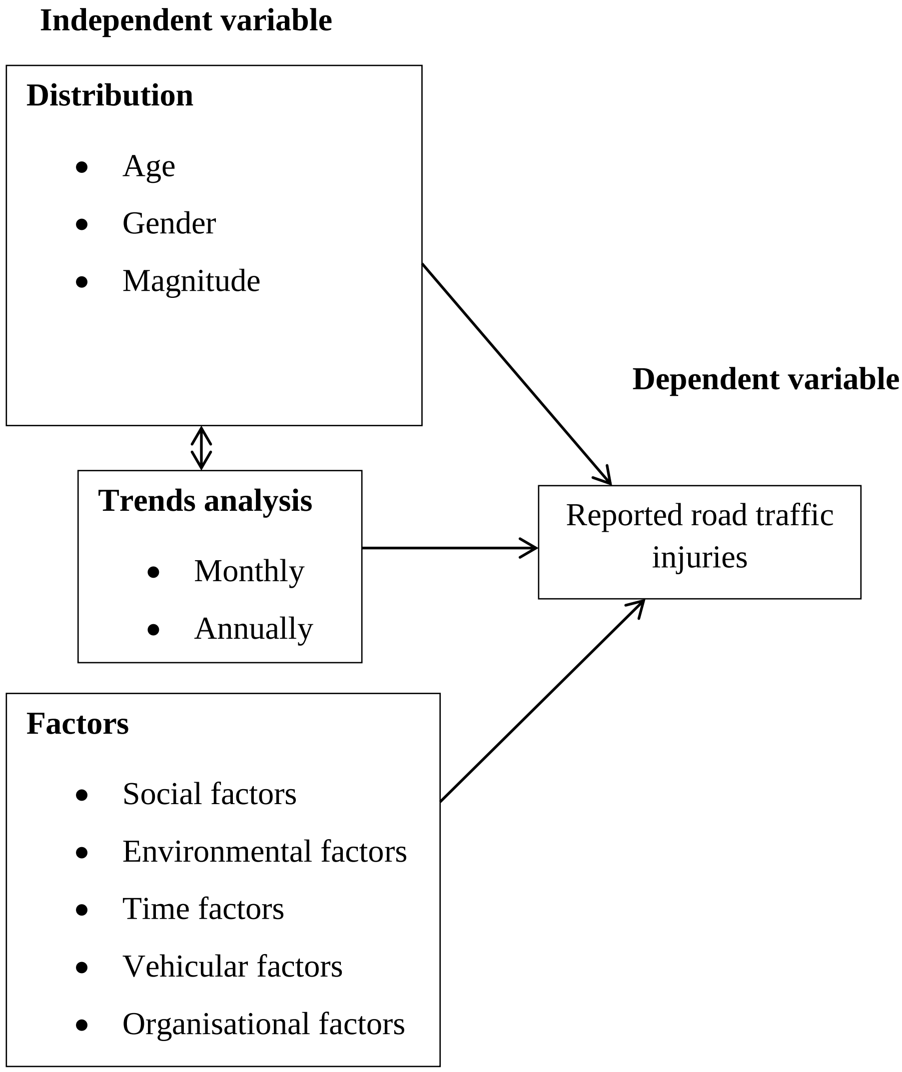

Figure 1.1: Conceptual framework

Source: Vaca *et al.*, (2020)

Narrative

The road traffic injuries can be influenced by several factors like environmental factors, time factors, vehicular factors, and organisational factors. The RTIs can also be distributed by gender, age and their magnitude of severity. They can occur monthly, or annually.

1.8 Conclusion

The purpose of this chapter was to introduce the epidemiology of road traffic injuries. The epidemiology of road traffic injuries was based on the distribution by; age, magnitude and gender, trends of road traffic injuries and factors associated with the daily road traffic injuries. The chapter included a brief introduction of the literature describing the acquisition of road traffic injuries in Africa, locally and globally.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviewed literature on the distribution of reported RTIs and the epidemiological factors associated with RTIs.

2.1 Distribution of reported RTIs

2.1.1 Age and gender distribution

2.1.1.1 Age distribution

The majority of accident casualties, according to research by Nasseri *et al.* (1977) are between the ages of 30 and 39. The average age of trauma patients was discovered to be 23.8 years old during the referral process at hospitals in Tehran, Shiraz, Ahvaz, Tabriz, Qom, and Mashhad (Vafaee – Najar *et al.*, 2011). Interesting research by Majdzadeh *et al.* (2008) revealed that the age group of 25 to 34 years old were the ones who experienced the majority of accidents. According to data from the Safe Community Program, the average age of pedestrian casualties in interventional (Kashmar) and control counties was 28 and 30, respectively (Rahimi – Movaghar, 2010).

The majority of RTI victims in a research by Zargar *et al.* (2003) were pedestrians and occupants, respectively, and ranged in age from 6 to 10 years and 16 to 18 years. Age groups 51-60 years and 21-30 years were most and least common, respectively, according to records of fatal traffic accidents (Montazeri, 2004). It was noted that the most victims, who were aged 21 to

30, and over 65 years old with RTIs fatality were reported to Tehran forensic medicine. According to research by Sanaei-Zadeh *et al.* (2002), the average age of RTI victims was 39 years, and 48% of them were economically engaged and between the ages of 21 and 50. Studies on forensic medicine performed in Kerman revealed that between 2004 and 2007, 40% of fatalities included people between the ages of 15 and 30 (Ghorbanali, 2009). Although the elderly hospitalisation rate for traffic accidents is rising, data from a different study by Bhalla *et al.* (2009) showed that road traffic fatalities were more common in participants aged 15 to 24 and very rare in those 65 to 74 years. According to a study done by Zargar *et al.* (2003), people between the ages of 16 and 18 had 9.9 times more accidents than people of other ages. Another study by Jammohammadi *et al.* (2009) in the province of Mazandaran between the years of 2002 and 2004, the age range of fatalities from motorcycle accidents was 15 to 25. According to road traffic report by Uganda police in Kalerwe and Sentema in 2022, it showed that the highest proportion of deaths was recorded among victims aged 20 to 29 (The Independent, 2023).

2.1.1.2 Gender distribution

Gender was strongly correlated with the number of traffic crashes in addition to age (Ozkan *et al.*, 2006). In a study by Rasouli *et al.* (2008), men were four times more likely to be involved in intercity accidents than women were. Another study by Mohammadi, (2014) males are more likely than females to engage in unsafe driving behaviours, such as using a cell phone or driving without wearing a seatbelt. Karbakhsh *et al.* (2010) also showed that pregnant women avoid using seat belts to minimise harm to the foetus, which may raise the incidence of RTIs. In a Urmia research, a total of 89 people died during that time; 83 of those were men, the remaining were women, and the majority of the female fatalities were riding motorbikes (Jammohammadi *et al.,* 2009). According to road traffic report by Uganda police in Kalerwe and Sentema in 2022 it showed that males accounted for 76% of the reported fatalities (The Independent, 2023).

2.1.2 Most commonly involved organ

According to several researches, head injuries are the most common and one of the leading causes of adult RTI-related deaths (Modarres *et al.,* 2014; Petmani *et al.,* 2012). The most common causes of death among drivers of cars, motorcycle riders, and pedestrians were haemorrhage, head injuries, and numerous fractures (Heydari *et al.,* 2013). Studies conducted in Tehran, Mashhad, and Khorram Abad revealed that lower limb injuries from motorcycle accidents are more prevalent than injuries to other body sections (Torabi *et al.,* 2009; Araqi & Vahedian, 2005). However, head injuries—as a result of not wearing a helmet—were the primary cause of mortality in motorcycle accidents (Pourhossein *et al.,* 2003; Heydari *et al.,* 2012). According to research conducted in Isfahan, the majority of the victims' head and facial injuries were caused by not wearing a helmet (Seiedmoalemi & Dadkhah, 2011).

Wearing a helmet lowers your chance of dying by 40% and your risk of suffering serious injuries by up to 70%.

2.1.3 Severity of injury

According to a hospital-based study by Roudsari *et al.* (2004) male pedestrians and drivers had considerably higher injury severity scores (ISS) than female pedestrians and drivers (7.8 vs. 4.4 vs. 3.7, and 8.2 vs. 6.5 vs. 6.3, respectively). Interestingly, back seat female passengers had higher ISS scores (7.77.5 vs. 6.96.7), although this difference was not statistically significant. Another research revealed that more patients (52% vs. 48%) had a moderate ISS score than those with a severe ISS score (Majdzadeh *et al.,* 2008). According to research of 58013 trauma patients, the percentages of participants having an ISS score of less than 7, between 7 and 12, and greater than 12 were 92%, 6%, and 2%, respectively (Zargar *et al.,* 2001). According to trauma registry data from 1999 to 2004, the mean of ISS was greater in RTIs than in other injuries (Heidari *et al.,* 2010). According to Yousefzadeh *et al.* (2008), the ISS score was below 7 in 78% of children and around 8 in 80% of children. According to a different research, walkers and vehicle occupants have different mean ISS values (7.6 vs. 6.6) (Zargar *et al.,* 2003). According to research from central Iran, the Glasgow Coma Scale (GCS) scores of RTI victims admitted to hospitals were less than 8, between 9 and 12, and 13 to 15, respectively (Moharamzad *et al.,* 2008).

2.1.4 Socioeconomic status

The socioeconomic situation and its connection to RTIs have only been the subject of a few numbers of researches. The bulk of deaths are caused by RTIs involving uneducated victims and the fewest, university graduates, according to nationwide research in Iran and a study in the Fars Province (Sami *et al.,* 2013). According to a study on Iranian families, neither high income nor low-income nations have strong need for child care safety seats (CSS) (Jarahi *et al.,* 2011). According to another study RTIs had a higher incidence and fatality rate in lower economic levels (Sehat *et al.,* 2012). The socioeconomic level of motorcycle riders places them in the poorer sections of the society and indicates that they are frequently poorly educated. According to research done in Kashan, young riders (under 20 years old), employees, and illiterates had a disproportionately high frequency of motorcycle traffic injuries (Moradi *et al.,* 2007). Research in Bandar Abbas that found that just 17.2% of injured motorcycle riders were educated (Aghamolaei *et al.,* 2011). The majority of victims in motor vehicle accidents were illiterate and without jobs (Torabi *et al.,* 2009). Motorcycle accidents are clearly influenced by human variables including young age, single status, poor socioeconomic standing, and a constantly hectic lifestyle (Alavijeh *et al.,* 2010).

2.1.5 Time of injury

The majority of studies discovered that RTI mortality rates among all age groups are greater in the summer (Nasseri *et al.,* 1977). On the other hand, research done on 2,662 trauma patients registered in Tehran revealed that the majority of RTIs happened during the winter (Moini *et al.,* 2000). According to a study by Majdzadeh *et al.,* (2008) the seasons with the highest and lowest frequency of crashes were rainy, foggy and lowest frequency of crashes during sunny season. It's interesting to note that several researches revealed that most accidents happen between 8:00 and 22:00 (Nasseri *et al.,* 1977). Road traffic collision fatalities were more prevalent between 2:00 and 3:59 in the spring and summer, and they were more prevalent between 12:00 and 16:00 in the fall and winter (Moafian *et al.,* 2013). Most motorcycle accidents happen in the spring and summer, especially between the hours of 12:00 and 18:00 and 20:00 and 24:00, according to studies done in Tehran and Sari (Rasouli *et al.,* 2011; Pourhossein *et al.*, 2003). This is because traffic congestion is at its worst during those hours (Vafaee – Najar *et al.,* 2010, Zargar *et al.,* 2006). Another research in Khorram Abad discovered that the summer months saw 41.9% of motorbike accidents (Torabi *et al.,* 2009). Other studies, motorcycle accidents result in the most fatalities throughout the summer, particularly between the hours of 12:00 to 18:00 and 15:00 to 21:00 (Hatamabadi *et al.,* 2012). Additionally, another research revealed that 0.63% of RTI deaths happened in clear weather, out of the 86.9% of all RTIs. However, compared to clear weather, the death rate was 1.35 percent and 1.2 percent higher in stormy and foggy weather, respectively (Lankarani *et al.*, 2014). It was shown that fatalities are linked to 82.8% of collisions happening in the winter, 60.2% in the fall, and 35.8% in the summer (Mehmander *et al.*, 2014). According to road traffic report by Uganda police in Kalerwe and Sentema in 2022 it showed that the biggest number of road crashes occur between 6 and 8 pm but those that claimed the highest number of lives happened between 8 and 10 pm (The Independent, 2023).

2.1.6 Initial contact with health care services

The majority of fatalities, according to national data, happened before hospitalisation (Montazeri, 2004). It was shown that 60% of RTI deaths happened either immediately or while being transported to the hospital. Only

14% of RTI victims were transferred by ambulance, and 10% were saved by skilled people, according to a national survey conducted in 2003 (Naghari *et al.,* 2005). Although there were more ambulances, employees, and dispatch centres, the fatality rate of RTIs was unaffected (Bhalla *et al.,* 2008; Khorasani – Zavareh *et al.,* 2009). According to another registry data, the number of wounded victims who were sent to emergency rooms in Iran over a three-year research from 2005 to 2008 was around 2,991,624 (Rasouli *et al.,* 2004). In North-West Iran, a research found that just 2% of fatalities happened after receiving emergency medical care (Bigdeli *et al.,* 2010). It is interesting to note that the distribution of pre - hospital care for RTI injuries, RTI fatality, and RTI morbidity rates among Iranian regions was not uniform (Haghparast *et al.,* 2011).

2.2 Trends of road traffic injuries

Worldwide, road traffic injuries (RTIs) are a major cause of illness and mortality. The WHO estimates that 1.35 million people died in motor vehicle crashes in 2016 (Vaca *et al.,* 2020). These deaths currently exceed the number of deaths from conventional communicable diseases such as HIV/AIDS and TB (Vaca *et al.,* 2020).

The frequency of RTIs is rising continuously in Uganda. According to estimates, Uganda has one of the highest rates of fatalities per 10,000 vehicles worldwide, with over 190 deaths occurring in Uganda each day (Uganda Police Force statistics, 2022). The Uganda Police reported 53,147 RTIs between 2012 and 2014; of these, 8,906 fatalities were noted (Uganda Police Force: report, 2014). These numbers are thought to represent an underestimate of the workload associated with RTIs because not all traffic accidents are reported to the police because of the concern that they may face criminal prosecution. The majority of people only visit medical institutions to get treated for injuries they sustained in an accident (Oporia *et al.*, 2018).

According to a study conducted by Oporia *et al.*, (2018), they found out that there has been an increase in RTIs in Uganda from 2011 to 2014, with the lowest number (37,219) in 2011 and the highest number (222,267) in 2014. They also discovered that between 2012 and 2013, the number of RTIs remained constant. Between 2013 and 2014, it almost doubled, and in 2015, there was a notable drop (57,149). There was an increase in the number of RTI-related deaths between 2011 and 2014. Over the course of the four years, health facilities recorded 2,807 deaths as a result of RTIs (Oporia *et al.*, 2018).

According to a study by Beyera *et al.* (2024), November 2018 had the largest number of traffic-related injuries, followed by August and October 2018. In addition, there were 866 RTIs from January to December 2018. Seasonality also had an impact on the trends in RTI fatalities (Beyera *et al.*, 2024). In their study on global trends in the mortality from road traffic injuries among adolescents, Khan *et al.* (2021) discovered that, for all road users, the trends in the two age groups were parallel at all income levels, indicating continuous variations in the rates in both age groups. It was discovered that the trends for bikers in High Income Countries (HICs) were not parallel. Additionally, the patterns of motorbike and vehicle usage in Low-Income and Middle-Income Countries (LMICs) and Low-Income Countries (LICs) were essentially unchanged, especially in the 15–19 age range (Khan *et al.*, 2021).

In a study by, Nakao et al., (2023) data from the Japan road Data Base (JTDB) for the previous 15 years to analyse the features and patterns of serious road injuries among children in Japan. Compared to the 1848 cases registered between 2009 and 2013 and the 1852 cases filed between 2014 and 2018, it was discovered that 771 cases were recorded between 2004 and 2008 (Nakao *et al.,* 2023). According to a study by Suriyawongpaisal & Kanchanasut (2003), Thailand's traffic injury rate and number fluctuated from a record low during the 1980s economic recovery to a high record during the bubble economy period, and then began to decline as the nation got closer to the most recent economic crisis in 1997. Suriyawongpaisal and Kanchanasut (2003) report that the most recent data from 2000 shows a rising trend in both crashes and injuries, with 13,899 deaths and 921,352 injuries.

According to Vaca *et al.* (2020), the percentage of motorcycle RTIs (also known as 'boda boda') increased steadily from 24.5% to 33.9% between 2009 and 2017. In contrast, during the same period, the percentage of "motor car" involvement decreased from 37.6% to 33.6%. 2018 data from the tragedy ward of Mulago National Referral Hospital (MNRH) reveals a higher percentage of patients presenting with RTIs than in 2015. This is true for both the overall patient population (2018: 36%, 2015: 10%) and trauma cases (64%, 41%, respectively). This might be an indication of a trend towards more serious injuries or easier access to emergency medical care (Vaca *et al.,* 2020).

2.3 Factors associated with road traffic accidents

Data from the Iran traffic police show that drivers get fairly harsh driving fines, with 4 million fines being recorded between 2006 and 2007 (Shams *et* *al.,* 2009). The failure to use a seatbelt was the most frequent offence. Iran implemented a rule requiring drivers to wear seatbelts in 2001, but it was first disregarded because less than 3% of drivers were doing so at the time of an accident (Rouderi *et al.,* 2004). Additionally, other dangerous behaviours linked to collisions include being trapped in a vehicle, listening to music, the kind of vehicle, and the music being played at the time of the collision (Vafaee – Najar *et al.,* 2011). The bulk of collisions, 88% of which were attributable to inattention, occurred among those in the 30 to 39-year-old age range, according to data on traffic on the roads (Kashani *et al.,* 2011). Skidding off the road and collisions with artificial things, such as traffic signs, are other frequent crash types (Majdzadeh *et al.,* 2008). The order of crashes by vehicle is car, pickup truck, minibus, heavy truck, and light truck, going from highest to lowest frequency. According to a 2008 study, drivers with a history of accidents are more likely to have chronic fatigue, snore, a BMI greater than 30, hypertension, and apnea. When compared to other types of roadways, driving on motorways and freeways considerably raised the likelihood of traffic accidents caused by exhaustion and drowsiness by 2.6 times (Sadeghniiat – Haghighi *et al.,* 2013). Along with weariness, RTIs are strongly linked to long driving hours, smoking, inactivity, musculoskeletal diseases, and a high body mass index (Jahangiri *et al.,* 2015; Attarchi *et al.,* 2011). It is interesting to note that the apnea and insomnia index did not significantly correlate with RTI history during the previous five years (Razmpa *et al.,* 2011). Road traffic accidents involving other cars colliding with another vehicle were more frequent than those involving pedestrians. The study also found a favourable correlation between smoking and daily driving time and collisions. However, there was no connection between RTIs and the vehicle's manufacturing year (Saadat *et al.,* 2010). Furthermore, it was shown that with time, the percentage of drivers involved in RTIs reduced from 15.90% in the first year of getting a license to 3.13% after ten years of driving (Moafian *et al.,* 2013).

In conclusion the recent factors were done outside Uganda thus calling for more studies within Uganda on road traffic injuries.

2.4 Conclusion

In Uganda trends of road traffic injuries has not been fully documented. Several studies have focused on the distribution of accidents by the general socio demographic characteristics. The Uganda Police report of 2021 (The Independent, 2022) emphasized the socio demographic characteristic such as; age and gender versus the accidents acquired the details of the age, gender of the victims and the magnitude versus the specific type of injuries.

Few studies have been undertaken in East Africa on the epidemiology of road traffic injuries. The majority of research conducted in East Africa has discovered elements linked to traffic injuries exclusively in Tanzania (Boniface et al., 2016) and the causes of traffic accidents in South Sudan (Akway et al., 2017) and Uganda (Niwagaba, 2021).

Moreover, little attention has been given to the distributions of road traffic injuries, trends of injuries and factors associated with road traffic injuries more so in Uganda. The research study therefore concentrated its research activities towards filling these gaps by identifying the epidemiological patterns of road traffic injuries.

CHAPTER THREE

MATERIALS AND METHODS

3.0 Introduction

This chapter describes the procedures followed in order to conduct the suggested study, including the study population, research design, sample size computation, sampling procedures and methodologies, data collection instruments and techniques, quality control, data analysis, and ethical issues.

3.1 Study area

The study was carried out on daily reported RTIs in selected Hospitals in Kampala – Uganda. The hospitals included Lubaga, Mulago, Naguru, and Nsambya.

The reason for selection of the study area was that Kampala, as Uganda's capital and largest urban area, experiences the country's highest rates of road traffic injuries (RTIs) due to rapid urbanization, increased vehicle use, and high population density. This combination of factors places the city at the epicentre of RTIs in Uganda, creating a critical need for comprehensive data on the epidemiological patterns of these injuries. Given Kampala's metropolitan status, it has a diverse demographic, which allows for capturing variations in RTI occurrences across different population segments and socioeconomic statuses. The city's complex traffic environment, with a high prevalence of motorcycles (boda bodas), public taxis, and commercial vehicles, is a primary contributor to RTIs, making Kampala a vital area for studying the scope and impact of traffic-related injuries.

The study focused on four key hospitals in Kampala’s five divisions which were chosen based on firstly each hospital served a significant population segment in Kampala’s divisions, allowing for a balanced representation of RTI data across the city. This strategic distribution helps in capturing comprehensive epidemiological patterns relevant to all city regions, minimizing geographic bias. Secondly the hospitals were among the most resource-equipped and have higher trauma care capacities, making them primary centers for treating RTIs. Focusing on these hospitals ensures that data is collected from facilities capable of managing and recording RTIs accurately, enhancing data reliability. Lastly as major hospitals, they receive a high volume of RTI cases daily, including cases from different income levels, age groups, and backgrounds. This diversity offers a richer dataset and insights into the different demographics affected by RTIs, which would be less feasible in smaller health centres.

Mulago National Referral Hospital is Uganda's biggest public hospital. The distance from the cetral business district of Kampala is around 5 kilometres by vehicle. Mulago National Referral Hospital’s location may be found at 0°20'16.0"N and 32°34'32.0"E. (Latitude: 0.337786; Longitude: 32.575550). Mulago National Referral Hospital has the Directorate of Surgical Services which houses the Department of Accidents and Emergency where data for the study was obtained.

The western section of Kampala is home to Lubaga Hospital, which is situated on Lubaga Hill in the Lubaga Division. Situated southwest of Mulago National Referral Hospital, it is roughly 5.5 kilometres away. The central business district of Kampala is about 5 km (3 km) to the west of this location.

The location of Lubaga Hospital is 0°18'15.0"N, 32°33'10.0"E, or latitude 0.304167 and longitude 32.552778. In December 2019, there were 274 beds available at the hospital. During that time, 83.3 percent of the hospital's annual revenue came from patient user fees, while 1.4 percent came from government subsidies in Uganda. From Monday through Sunday, including holidays, Lubaga Hospital sees an average of 450 outpatients per day, or 164,008 outpatients annually. It's a government aided hospital with about 274 beds, 250 staff, 25 private in – patients' rooms and 500 outpatient consultations on a daily basis.

Naguru Hospital, also known as China-Uganda Friendship Hospital Naguru, is a Ugandan hospital. Reconstructed between 2009 and 2012, it is a city-based general hospital. The Chinese government created the hospital as a gift to the government of Uganda. Situated along Naguru Road, on Naguru Hill, in Nakawa Division, Kampala District, is the hospital. Kampala is the capital and largest city of Uganda. By road, the financial district of Kampala is about 2 miles (4 km) to the east of this location.

The distance between St. Francis Hospital Nsambya and the Kampala city's central business centre is 2.7 km, via Ggaba Road, Hanlon Road, and Kevina Road on Nsambya Hill. Makindye Division is one of the five administrative divisions of the city. At 0°18'06.0"N, 32°35'10.0"E (latitude: 0.301667; longitude: 32.586112), you can find Nsambya Hospital.

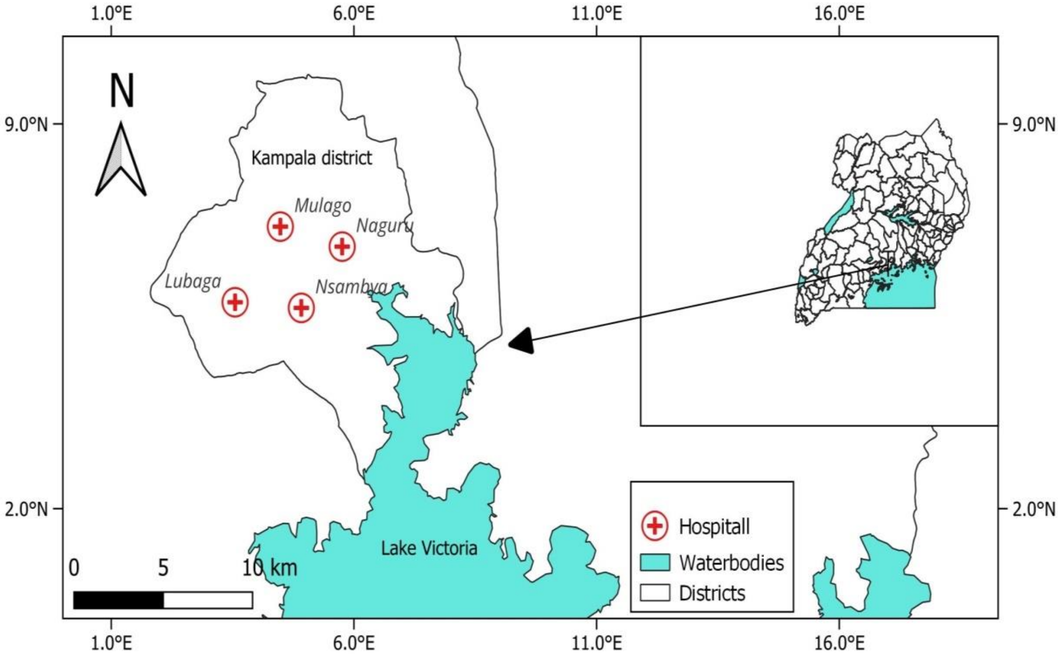

Figure 3.1: Map showing the location of study areas

3.2 Study population

The study was limited to casualty register or records for each patient reported in the Accident and Emergency Departments from selected hospitals of Mulago National Referral Hospital, Lubaga Hospital, Naguru Hospital, and Nsambya Hospital from January 2018 to December 2022.

3.3 Research Design

A cross sectional retrospective design was used in this investigation because it was going back in time to collect records of data for analyses that was archived at the time. This design provided greater depth and understanding of the topic and analysis of data from the study population at a specific point and same time.

3.4 Eligibility criteria

3.4.1 Inclusion criteria

Records of patients who came to the accidents and emergency ward of the above-mentioned hospitals and records that was within the study period stated (2018 - 2022)

3.4.2 Exclusion criteria

Records of patients who had an injury on the road that wasn't caused by a car, such as someone who slipped, fell, and was hurt, or someone who were hurt by a stationary vehicle (e.g. persons getting injured while washing or loading a vehicle)

3.5 Choosing a sample size

The four hospitals were selected using simple random sampling technique. All the road traffic injury records from January 2018 to December 2022 were used in the study. The data available for Naguru Hospital, was from 2021 to 2022 of which over 70% of the data was for 2022 mainly because the other years were not properly captured due to restriction of movement during the COVID – 19 pandemic. Data available for 2018 to 2022 for the admitted patients in Nsambya and Lubaga Hospitals were used. In Mulago I first obtained a sample size of 385 by Krejcie & Morgan (1970) and then for each year did purposive sampling through the 12 months to pick 385 documents for the alive people. The second sample of data from Mulago was a summary for time series data from the system.

3.6 Study variables

The dependent variable in this study was reported road traffic injuries while the independent variables were age, gender, magnitude, and other factors.

3.7 Data collection methods

Document review was used to collect information from the registers at the hospitals for the three objectives.

3.8 Data collection instruments

A document review guide was used to collect the data from the registers.

3.9 Data analysis

Each register was cross checked to acquire the information required for the study. The data was entered into a computer by using MS Excel and then data was exported to SPSS for analysis. The Pearson chi-square test, binary logistic regression and multinomial logistic regression were used for analysis. Also, frequencies, percentages and proportions were calculated.

3.9.1 Distribution of reported RTIs

The distribution of the reported RTIs was done according to gender, age, and magnitude for each of the four selected hospitals; Mulago National Referral Hospital, Lubaga Hospital, Naguru Hospital, and Nsambya Hospital. This distribution was done using frequency tables and relative frequency tables as well as percentages. The data was therefore presented in form of tables and figures. The chi – square test and multinomial logistic regression were used to find the association between the dependent and independent variables. Significance was at a p value < 0.05.

3.9.2 The trend of RTIs

Analysis of the trend of RTIs in Mulago National Referral Hospital, Lubaga Hospital, Naguru Hospital, and Nsambya Hospital were done using time series graphs. The data was first cleaned and presented in form of graphs to show the trends of RTIs monthly from 1st January 2018 to 31st December 2022. The decomposition method was used to check for stationarity, seasonality and autocorrelation of the RTIs over the years using IBM SPSS v20.

3.9.3 Factors associated with the daily RTIs cases

Determination of the factors associated with daily reported RTIs cases in each of the selected hospitals was done. This evaluation helped in investigating risk factors associated with daily reported cases of RTIs. Factors linked to the daily RTI events were found using binary logistics and multinomial logistic regression, with a 5% level of statistical significance (p-value of 0.05) applied.

3.10 Quality control

Data was collected by a group of research assistants who were first oriented and trained on the purpose of the study. The emphasis of the training was on the variables to be collected for the study, the components of the document review guide and their role in data collection. The pre-test of the tools was done at Mengo Hospital. This gave a better idea of the type of data available.

3.10.1 Reliability and validity

Validity of the instrument is the degree to which instrument used during the study measures the issue they are intended to measure (Mugenda and Mugenda, 2003). content validity was established by first giving the questionnaire to a team of experts, thereafter, a content validity index (CVI) was computerized, 0.91 was obtained which is above 0.7, the instruments were declared valid as given by Amin, (2005).

A research instrument is considered dependable by Mugenda & Mugenda (2003) if the same results are obtained from repeated measurements made under identical conditions. A few case files that were sampled before the study were used for piloting the instrument. To ensure reliability, the research instrument was pre-tested at Mengo Hospital to ensure consistency and comprehensiveness giving a reliability of more than 80%. In addition, certain discussions regarding the study instrument were held with supervisors and other researchers. Cronbach's coefficient Alpha was used to determine the degree of dependability, and the result was an 86% reliability.

3.11 Ethical considerations

The study was approved ethically by the Uganda Christian University (UCU) Research Ethics Committee with the clearance number (UCUREC – 2022 – 341). A letter of introduction from Kyambogo University was given to take to the respective offices. Prior to reviewing the documents, permission was acquired from the officers in charge of data management at Mulago National Referral Hospital, Lubaga Hospital, Naguru Hospital, and Nsambya Hospital. Patient’s data was kept confidential as no names of the causalities were required. All data were extracted and kept on password protected computers. The entire research team received all relevant training in ethical research conduct prior to involvement in study activities.

3.12 Conclusion

The current study, including the participants, the data collection process, and the sampling criteria, were provided in this chapter. The technique and data analysis steps were also described and provided with academic references. The study's findings are presented in the next chapter.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

4.0 Introduction

This chapter presents the results for the distribution of RTIs, analysis of time series trends and factors associated with RTIs. It will consider demographic characteristics, patient characteristics and other patient characteristics. The findings are presented in tables, box and whisker plots and line graphs.

4.1 Demographic, patient and other patient characteristics

More than three quarters of the patients (80.9%) were male, with only 19.1% of the patients being female. Majority of the patients (34.0%) were aged 21 – 30 years, (25.5%) were aged 31 – 40 years, and only (20.6%) of the patients were aged > 40 years while the least percentage (8.3%) of the patients were of the age group < = 10 years. Majority of the patients (66.3%) were self-employed, only (5.7%) of the patients were children, (7.8%) were students, (2.3%) were government employees and (0.1%) were religious leaders (Table 4.1).

Majority of the patients (60.3%) were in the inpatients treatment category, while the least treatment category was of the outpatients with only (17.6%) of the patients. More than half of the patients (62.5%) were not referral cases, only (33.6%) of the patients were referral cases. Majority of the patients (86.5%) never got the accident under the influence of alcohol or drugs, only (7.0%) of the patients got the accident under the influence of alcohol or drugs. Majority of the patients (33.0%) had moderate severity of the injury. Majority of the patients (97.8%) had a systolic blood pressure of > 89, only (0.7%) of the patient's systolic blood pressure was 50 - 89. Majority of the patients (69.3%) were alert, (28.6%) of the patients were unconscious. Majority of the patients (72.3%) were admitted, (17.0%) of the patients were treated and sent home, (9.1%) died in the casualty, (0.7%) were referred to another institution (Table 4.1).

Majority of the patients (33.8%) were pedestrians, (31.2%) were motorcycle riders, and only (19.8%) of the patients were passengers while the least category was of the drivers with only (1.9%) of the patients. Majority of the patients (45.7%) were walk – in patients, (39.2%) of the patients were brought by private transport, (6.1%) each were brought to the facility by police and public transport. Majority of the patients (60.7%) got injured by a motorcycle, (22.4%) of the patients got injured by a vehicle, (4.1%) were not specific of the mechanism of the injury, (1.9%) got injured by a bicycle. Majority of the patients (28.5%) got the injury in the evening (4:00 pm to 7:00pm), (25.8%) of the patients got the injuries in the morning (5:00am to 12:00pm), (13.6%) got the injuries in the afternoon (12:00pm to 4:00pm), (12.0%) got the injuries in the night (7:00pm to 5:00am). More than half of the patients (75.8%) lived, only (23.3%) of the patients died. More than half of the patients (65.9%) never received surgical procedure, only (31.2%) of the patients received surgical procedure (Table 4.1).

Table 4.1: Demographic, patient and other patient characteristics

Variable	Categories	Lubaga	Mulago	Naguru	Nsambya	Total
		n (%)	n (%)	n (%)	n (%)	n (%)
Gender	Female	187 (28.0)	533 (15.4)	220 (24.0)	88 (25.7)	1028 (19.1)
	Male	481 (72.0)	2919 (84.6)	697 (76.0)	254 (74.3)	4351 (80.9)
Age	<= 10 years	57 (8.5)	356 (10.3)	20 (2.2)	11 (3.2)	444 (8.3)
	11 - 20 years	60 (9.0)	419 (12.1)	96 (10.5)	32 (9.4)	607 (11.3)
	21 - 30 years	218 (32.6)	1141 (33.1)	378 (41.2)	112 (32.7)	1849 (34.4)
	31 - 40 years	175 (26.2)	804 (23.3)	288 (31.4)	102 (29.8)	1369 (25.5)
	> 40 years	158 (23.7)	732 (21.2)	135 (14.7)	85 (24.9)	1110 (20.6)
Occupation	Child	10 (1.5)	278 (8.1)	18 (2.0)	1 (0.3)	307 (5.7)
	Government	50 (7.5)	31 (0.9)	22 (2.4)	20 (5.8)	123 (2.3)
	House wife	5 (0.7)	0(0.0)	1 (0.1)	0 (0.0)	6 (0.1)
	Not specific	18 (2.7)	9 (0.3)	6 (0.7)	3 (0.9)	36 (0.7)
	Peasant	0 (0.0)	6 (0.2)	0 (0.0)	0 (0.0)	6 (0.1)
	Private employee	57 (8.5)	185 (5.4)	91 (9.9)	90 (26.3)	423 (7.9)

	religious leader	3 (0.4)	1 (0.0)	1 (0.1)	0 (0.0)	5 (0.1)
	Self employed	434 (65.0)	2346 (68.0)	654 (71.3)	130 (38.0)	3564 (66.3)
	Student	75 (11.2)	212 (6.1)	105 (11.5)	27 (7.9)	419 (7.8)
	Missing	16 (2.4)	384 (11.1)	19 (2.1)	71 (20.8)	490 (9.1)
Treatment category	Death register	1 (0.1)	1183 (34.3)	0 (0.0)	2 (0.6)	1186 (22.0)
	Inpatient	667 (99.9)	2262 (65.5)	1 (0.1)	315 (92.1)	3245 (60.3)
	Outpatient	0 (0.0)	5 (0.1)	916 (99.9)	25 (7.3)	946 (17.6)
	Missing	0 (0.0)	2 (0.1)	0 (0.0)	0 (0.0)	2 (0.0)
Referral case	No	481 (72.0)	1843 (53.4)	904 (98.6)	132 (38.6)	3360 (62.5)
	Yes	136 (20.4)	1484 (43.0)	10 (1.1)	180 (52.6)	1810 (33.6)
	Missing	51 (7.6)	125 (3.6)	3 (0.3)	30 (8.8)	209 (3.9)
Alcohol or drug use	No	549 (82.2)	2957 (85.7)	882 (96.2)	266 (77.8)	4654 (86.5)
	Yes	90 (13.5)	194 (5.6)	21 (2.3)	72 (21.1)	377 (7.0)
	Missing	29 (4.3)	301 (8.7)	14 (1.5)	4 (1.2)	348 (6.5)
Severity	Not sure	11 (1.6)	43 (1.2)	6 (0.7)	0 (0.0)	60 (1.1)
	Fatal	5 (0.7)	981 (28.4)	2 (0.2)	2 (0.6)	990 (18.4)
	Mild	142 (21.3)	154 (4.5)	406 (44.3)	109 (31.9)	811 (15.1)
	Moderate	425 (63.6)	806 (23.3)	391 (42.6)	152 (44.4)	1774 (33.0)

	Severe	85 (12.7)	1468 (42.5)	112 (12.2)	79 (23.1)	1744 (32.4)
Systolic blood pressure	>89	661 (99.0)	3344 (96.9)	914 (99.7)	340 (99.4)	5259 (97.8)
	1-49	0 (0.0)	6 (0.2)	0 (0.0)	0 (0.0)	6 (0.1)
	50-89	0 (0.0)	38 (1.1)	0 (0.0)	1 (0.3)	39 (0.7)
	Missing	7 (1.0)	64 (1.9)	3 (0.3)	1 (0.3)	75 (1.4)
Neurological status	Alert	619 (92.7)	1882 (54.5)	900 (98.1)	325 (95.0)	3726 (69.3)
	Responds to painful	0 (0.0)	1 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)
	Responds to verbal	0 (0.0)	5 (0.1)	1 (0.1)	1 (0.3)	7 (0.1)
	Unconscious	42 (6.3)	1479 (42.8)	4 (0.4)	16 (4.7)	1541 (28.6)
	Unresponsive	1 (0.1)	29 (0.8)	0 (0.0)	0 (0.0)	30 (0.6)
	Missing	6 (0.9)	56 (1.6)	12 (1.3)	0 (0.0)	74 (1.4)
Patient disposition in the casualty	Admitted	655 (98.1)	2906 (84.2)	34 (3.7)	295 (86.3)	3890 (72.3)
	Dead on arrival	0 (0.0)	16 (0.5)	2 (0.2)	0 (0.0)	18 (0.3)
	Died in casualty	4 (0.6)	480 (13.9)	1 (0.1)	2 (0.6)	487 (9.1)
	others specify	1 (0.1)	2 (0.1)	0 (0.0)	0 (0.0)	3 (0.1)
	Referred to other	0 (0.0)	0 (0.0)	4 (0.4)	34 (9.9)	38 (0.7)

	Treated	5 (0.7)	20 (0.6)	876 (95.5)	11 (3.2)	912 (17.0)
	Missing	3 (0.4)	28 (0.8)	0 (0.0)	0 (0.0)	31 (0.6)
Category of victim	Driver	18 (2.7)	45 (1.3)	5 (0.5)	33 (9.6)	101 (1.9)
	Passengers	197 (29.5)	689 (20.0)	70 (7.6)	109 (31.9)	1065 (19.8)
	Pedestrian	174 (26.0)	1451 (42.0)	108 (11.8)	83 (24.3)	1816 (33.8)
	Rider	110 (16.5)	1099 (31.8)	359 (39.1)	109 (31.9)	1677 (31.2)
	Missing	169 (25.3)	168 (4.9)	375 (40.9)	8 (2.3)	720 (13.4)
Mode of transport to facility	Ambulance	20 (3.0)	36 (1.0)	26 (2.8)	2 (0.6)	84 (1.6)
	Other enforcer	1 (0.1)	13 (0.4)	0 (0.0)	0 (0.0)	14 (0.3)
	Police	3 (0.4)	295 (8.5)	30 (3.3)	2 (0.6)	330 (6.1)
	Private transport	62 (9.3)	1175 (34.0)	680 (74.2)	193 (56.4)	2110 (39.2)
	Public transport	17 (2.5)	190 (5.5)	49 (5.3)	74 (21.6)	330 (6.1)
	Walk in	560 (83.8)	1715 (49.7)	113 (12.3)	71 (20.8)	2459 (45.7)
	Missing	5 (0.7)	28 (0.8)	19 (2.1)	0 (0.0)	52 (1.0)
Mode of injury	Bicycle	11 (1.6)	81 (2.3)	1 (0.1)	10 (2.9)	103 (1.9)
	Motor cycle	328 (49.1)	2220 (64.3)	502 (54.7)	217 (63.5)	3267 (60.7)
	Not specific	168 (25.1)	53 (1.5)	0 (0.0)	0 (0.0)	221 (4.1)
	Train	0 (0.0)	3 (0.1)	0 (0.0)	1 (0.3)	4 (0.1)

	Vehicle	155 (23.2)	902 (26.1)	40 (4.4)	107 (31.3)	1204 (22.4)
	Missing	6 (0.9)	193 (5.6)	374 (40.8)	7 (2.0)	580 (10.8)
Time of incident	Afternoon	142 (21.3)	397 (11.5)	146 (15.9)	44 (12.9)	729 (13.6)
	Evening	163 (24.4)	1121 (32.5)	174 (19.0)	74 (21.6)	1532 (28.5)
	Morning	90 (13.5)	972 (28.2)	225 (24.5)	103 (30.1)	1390 (25.8)
	Night	192 (28.7)	259 (7.5)	161 (17.6)	32 (9.4)	644 (12.0)
	Missing	81 (12.1)	703 (20.4)	211 (23.0)	89 (26.0)	1084 (20.2)
Discharge status	Alive	658 (98.5)	2184 (63.3)	909 (99.1)	326 (95.3)	4077 (75.8)
	Dead	7 (1.0)	1240 (35.9)	3 (0.3)	2 (0.6)	1252 (23.3)
	Missing	3 (0.4)	28 (0.8)	5 (0.5)	14 (4.1)	50 (0.9)
Surgical procedure	No	128 (19.2)	2531 (73.3)	624 (68.0)	263 (76.9)	3546 (65.9)
	Yes	530 (79.3)	796 (23.1)	288 (31.4)	62 (18.1)	1676 (31.2)
	Missing	10 (1.5)	125 (3.6)	5 (0.5)	17 (5.0)	157 (2.9)

4.2 Distribution of reported RTIs

The distribution of the reported RTIs was done according to gender, age, and magnitude for the four selected hospitals. Cross tabulation with the use of Pearson Chi – square test was used to find the association between the variables. The data was therefore presented in form of tables.

4.2.1 Gender

The distribution of the reported RTIs was done according to gender for the four selected hospitals.

Head injury was the most experienced road traffic injury during the study with 4,073 of the patients experiencing it of which the males (83.3%) acquired it more than the female patients (16.7%). About 3,535 patients experienced skin injury of which the male patients (82.0%) experienced it more than the female patients (18.0%). This was followed by 1,261 who experienced lower body injury and 1,093 who experienced chest injury of which the male patients (83.3%) experienced the injury more than the female patients (16.7%). The least acquired road traffic injury was genital injury with 10 patients (Table 4.2).

Table 4.2: Reported RTIs by gender

Injury	Female n (%)	Male n (%)	Total	Chi	P - value
Head	681 (16.7)	3392 (83.3)	4073	52.801	**0.000**
Neck	36 (17.9)	165 (82.1)	201	0.085	0.770
Chest	182 (16.7)	911 (83.3)	1093	3.834	0.050
Abdomen	99 (19.4)	411 (80.6)	510	0.190	0.663
Upper limb	117 (19.1)	497 (80.9)	614	0.059	0.808
Lower limb	264 (20.9)	997 (79.1)	1261	5.530	**0.019**
Spine	47 (19.6)	193 (80.4)	240	0.130	0.718
Pelvis	46 (26.0)	131 (74.0)	177	6.414	**0.011**
Genital	3 (30.0)	7 (70.0)	10	0.842	0.359
Skin	637 (18.0)	2898 (82.0)	3535	3.506	0.061
Systemic	8 (20.5)	31 (79.5)	39	0.085	0.770

The study further found a significant relationship between head injury and the gender of the patients (P < 0.05) in that female patients were 0.512 times less likely to acquire head injury than the male patients (95%CI; 0.456 – 0.907). There was also a significant relationship between lower body injury and the gender of the patients (P < 0.05) in that female patients were 0.209 times less likely to acquire lower body injury than the male patients (95%CI; 0.311 – 0.809). There was also a significant relationship between pelvis injury and the gender of the patients (P < 0.05) in that female patients were 0.420 times less likely to acquire pelvis injury than the male patients (95%CI; 0.342 – 0.712) (Table 4.3)

Table 4.3: Relationship between RTIs and gender

Injury		**B**	**Std. Err**	**df**	**Sig.**	**OR**	**95% CI for OR**	
							Lower	Upper
Head	Female	-0.441	0.175	1	0.012	0.512	0.456	0.907
	Male	0^b	0.	0	0.	0.	0.	0.
Lower limb	Female	-0.190	0.081	1	0.019	0.209	0.311	0.809
	Male	0^b	0.	0	0.	0.	0.	0.
Pelvis	Female	0.595	0.083	1	0.000	0.420	0.342	0.712
	Male	0^b	0.	0	0.	0.	0.	0.

In summary the male patients were more prone to acquiring the road traffic injuries in the study. Head injury, lower limb and pelvis injuries were significant with gender.

4.2.2 Age

The distribution of the reported RTIs was done according to age for the four selected hospitals.

Table 4.4: Reported RTIs by age

Injury	<= 10	11 - 20	21 - 30	31 - 40	> 40	Total	Chi	Sig.
	n (%)	n (%)	n (%)	n (%)	n (%)			
Head	393 (9.7)	477 (11.7)	1366 (33.5)	986 (24.2)	851 (20.9)	4073	43.016	**0.000**
Neck	13 (6.5)	28 (13.9)	73 (36.3)	47 (23.4)	40 (19.9)	201	3.051	0.549
Chest	83 (7.6)	121 (11.1)	340 (31.1)	306 (28.0)	243 (22.2)	1093	10.071	**0.039**
Abdomen	34 (6.6)	48 (9.4)	164 (32.2)	160 (31.4)	104 (20.4)	510	12.822	**0.012**
Upper body	32 (5.2)	77 (12.5)	198 (32.2)	179 (29.2)	128 (20.9)	614	14.499	**0.006**
Lower body	61 (4.7)	117 (9.3)	437 (34.7)	354 (28.1)	292 (23.2)	1261	43.187	**0.000**
Spine	12 (5.1)	26 (10.8)	61 (25.4)	80 (33.3)	61 (25.4)	240	18.062	**0.001**
Pelvis	6 (3.4)	18 (10.2)	62 (35.0)	48 (27.1)	43 (24.3)	177	7.338	0.119
Genital	1 (10.0)	0 (0.0)	1 (10.0)	4 (40.0)	4 (40.0)	10	5.481	0.241
Skin	270 (7.6)	431 (12.2)	1230 (34.8)	906 (25.6)	698 (19.7)	3535	27.353	**0.000**
Systemic	2 (5.1)	3 (7.7)	13 (33.3)	11 (28.2)	10 (25.6)	39	1.583	0.812

Head injury

Head injury was the most experienced road traffic injury during the study with 4073 of the patients experiencing it of which majority (33.5%) had an age of 21 – 30 years followed by those with 31 – 40 years (24.2%) (Table 4.4). The study further found a significant relationship between head injury and the age of the patients ($P < 0.05$) in that patients with <= 10 years were 0.216 times less likely to acquire head injury than the patients with > 40 years (95%CI; 0.155 – 0.731) and patients with 31 – 40 years were 1.082 times more likely to acquire head injury than the patients with > 40 years (95%CI; 1.235 – 1.731) (Table 4.5).

Chest

Over 201 patients experienced chest injury of which majority of the injured (36.3%) were 21 - 30 years (Table 4.4). The study also found a significant relationship between chest injury and the age of the patients ($P< 0.05$) in that patients with 31 – 40 years were 1.218 times more likely to acquire chest injury than the patients with > 40 years (95%CI; 1.011 – 1.467) (Table 4.5).

Upper limb

The study also found a significant relationship between upper limb injury and the age of the patients ($P < 0.05$) in that patients with <= 10 years were 0.739 times less likely to acquire upper limb injury than the patients with > 40 years (95%CI; 0.160 – 1.606) and cases aged 31 – 40 years were 1.064 times more likely to acquire upper limb injury than the patients with > 40 years (95%CI; 0.840 – 1.349) (Table 4.5).

Lower limb injury

Over 1261 patients experienced lower body injury of which majority of the injured (34.7%) were 21 – 30 years followed by (28.1%) in the age range of 31 - 40 years and 23.2% were > 40 years (Table 4.4). The study also found a significant relationship between lower limb injury and the age of the patients ($P < 0.05$) in that patients with < 20 years were less likely to acquire lower limb injury than the patients with > 40 years (Table 4.5).

Spine

The study also found a significant relationship between spine injury and the age of the patients ($P < 0.05$) in that patients with <= 10 years were 0.163 times less likely to acquire spine injury than the patients with > 40 years (95%CI; 0.153 – 0.059) (Table 4.5).

Skin

Over 3535 experienced skin injury of which majority of the injured (34.8%) were of age 21 – 30 years followed by 31 - 40 years (25.6%) then > 40 years (19.7%) (Table 4.4). The study also found a significant relationship between skin injury and the age of the patients ($P < 0.05$) in that patients with 11 – 20 years were 0.662 times less likely to acquire skin injury than the patients with > 40 years (95%CI; 0.528 – 0.831), patients with 21 – 30 years were 1.785 times more likely to acquire skin injury than the patients with > 40 years (95%CI; 0.682 – 2.706) and patients with 31 – 40 years were 1.911 times more likely to acquire skin injury than the patients with > 40 years (95%CI; 1.696 – 3.081) (Table 4.5).

Table 4.5: Relationship between age and RTIs

Injury		B	Std. Err	df	Sig.	OR	95% CI for OR	
							Lower	Upper
Head	<= 10	.252	.102	1	.000	0.216	0.155	0.731
	11 – 20	-.134	.135	1	.320	.875	.671	1.139
	21 – 30	.089	.098	1	.363	1.093	.902	1.325
	31 – 40	-.808	.180	1	.014	1.082	1.235	2.421
	> 40	0[b]	0.	0	0.	0.	0.	0.
Chest	<= 10	.238	.142	1	.094	1.269	.960	1.677
	11 – 20	.120	.126	1	.339	1.128	.881	1.443
	21 – 30	-.038	.098	1	.696	.962	.794	1.166
	31 – 40	.197	.095	1	.038	1.218	1.011	1.467
	> 40	0[b]	0.	0	0.	0.	0.	0.
Abdomen	<= 10	.254	.206	1	.217	1.290	.861	1.933
	11 – 20	.187	.183	1	.307	1.205	.842	1.724
	21 – 30	.039	.132	1	.765	1.040	.803	1.347
	31 – 40	-.258	.133	1	.053	.772	.595	1.003
	> 40	0[b]	0.	0	0.	0.	0.	0.
Upper limb	<= 10	.553	.206	1	.007	0.739	0.160	1.606
	11 – 20	-.109	.155	1	.480	.897	.662	1.214
	21 – 30	-.154	.124	1	.213	.857	.672	1.093
	31 – 40	.062	.121	1	.607	1.064	.840	1.349
	> 40	0[b]	0.	0	0.	0.	0.	0.
Lower limb	<= 10	.853	.154	1	.000	.346	1.734	3.175
	11 – 20	.409	.124	1	.001	.505	.200	1.010
	21 – 30	.120	.088	1	.176	.127	.048	.740
	31 – 40	.012	.093	1	.899	.012	.041	.224
	> 40	0[b]	0.	0	0.	0.	0.	0.
Spine	<= 10	.772	.321	1	.016	0.163	0.153	0.548
	11 – 20	.263	.240	1	.274	1.301	.812	2.082
	21 – 30	.515	.185	1	.006	1.673	1.163	2.406
	31 – 40	-.075	.175	1	.671	.928	.658	1.309
	> 40	0[b]	0.	0	0.	0.	0.	0.
Skin	<= 10	.178	.118	1	.132	.195	.948	1.507
	11 – 20	-.412	.116	1	.000	.662	.528	.831
	21 – 30	-.242	.084	1	.004	1.785	0.682	2.706
	31 – 40	-.188	.089	1	.035	1.911	1.696	3.081
	> 40	0[b]	0.	0	0.	0.	0.	0.

In summary with respect to age of the patients the upper part of the body and the head it’s those < 10 years and 11 – 20 years most prone and the rest it is the 21 – 30 years and 31 – 40 years who are most prone to getting injuries.

4.2.3 Magnitude

The distribution of the reported RTIs was done according to magnitude of severity.

Table 4.6: Reported RTIs by magnitude

Injury	Not sure	Fatal	Mild	Moderate	Severe	Total	Chi	Sig.
	n (%)	n (%)	n (%)	n (%)	n (%)			
Head	46 (1.1)	955 (23.4)	392 (9.6)	1152 (28.3)	1528 (37.5)	4073	572.821	**0.000**
Neck	0 (0.0)	35 (17.4)	16 (8.0)	58 (28.9)	92 (45.8)	201	16.881	**0.002**
Chest	8 (0.7)	314 (28.7)	85 (7.8)	292 (26.7)	394 (36.1)	1093	110.489	**0.000**
Abdomen	3 (0.6)	165 (32.4)	35 (6.9)	120 (23.5)	187 (36.7)	510	82.700	**0.000**
Upper body	6 (1.0)	216 (35.2)	44 (7.2)	152 (24.8)	196 (31.9)	614	121.734	**0.000**
Lower body	11 (0.9)	348 (27.6)	92 (7.3)	409 (32.4)	401 (31.8)	1261	100.551	**0.000**
Spine	1 (0.4)	76 (31.7)	13 (5.4)	54 (22.5)	96 (40.0)	240	42.706	**0.000**
Pelvis	0 (0.0)	64 (36.2)	13 (7.3)	47 (26.6)	53 (29.9)	177	35.693	**0.000**
Genital	0 (0.0)	5 (50.0)	0 (0.0)	1 (10.0)	4 (40.0)	10	7.935	0.095
Skin	30 (0.9)	819 (23.2)	430 (12.2)	1057 (29.9)	1199 (33.9)	3535	125.888	**0.000**
Systemic	0 (0.0)	13 (33.3)	1 (2.6)	11 (28.2)	14 (35.9)	39	7.901	0.095

Head injury

Head injury was the most experienced road traffic injury during the study with 4073 of the patients experiencing it with the most (37.5%) acquiring severe head injury and (28.3%) had moderate head injury (Table 4.6). The study further found a significant relationship between head injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 5.717 times more likely to acquire head injury than the patients with severe injuries (95%CI; 4.590 – 7.122) and patients with moderate injuries were 3.861 times more likely to acquire head injury than the patients with severe injuries (95%CI; 3.207 – 4.650) (Table 4.7)

Neck

The study also found a significant relationship between neck injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 0.322 times less likely to acquire neck injury than the patients with severe injuries (95%CI; 0.042 – 1.007).

Patients with mild injuries were 0.315 times less likely to acquire neck injury than the patients with severe injuries (95%CI; 0.218 – 0.622) and patients with moderate injuries were 0.384 times less likely to acquire neck injury than the patients with severe injuries (95%CI; 0.135 – 0.540) (Table 4.7).

Chest

Over 1093 patients experienced chest injury (Table 4.6). The study also found a significant relationship between chest injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 0.115 times less likely to acquire chest injury than the patients with severe injuries (95%CI; 0.036 – 0.421) and patients with moderate injuries were 0.423 times less likely to acquire chest injury than the patients with severe injuries (95%CI; 0.133 – 0.678) (Table 4.7).

Abdomen

The study also found a significant relationship between abdomen injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 0.481 times less likely to acquire abdomen injury than the patients with severe injuries (95%CI; 0.200 – 0.671). Patients with moderate injuries were 0.594 times less likely to acquire abdomen injury than the patients with severe injuries (95%CI; 0.254 – 0.726) (Table 4.7).

Upper limb

The study also found a significant relationship between upper limb injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 1.803 times more likely to acquire upper limb injury than the patients with severe injuries (95%CI; 1.283 – 2.534). Patients with moderate injuries were 0.350 times less likely to acquire upper limb injury than the patients with severe injuries (95%CI; 0.039 – 0.625) (Table 4.7).

Lower limb injury

The study also found a significant relationship between lower limb injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 0.781 times less likely to acquire lower limb injury than the patients with severe injuries (95%CI; 0.469 – 1.208) (Table 4.7)

Spine

There was a significant relationship between spine injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 0.446 times less likely to acquire spine injury than the patients with severe injuries (95%CI; 0.639 – 0.820) and patients with moderate injuries were 0.780 times less likely to acquire spine injury than the patients with severe injuries (95%CI; 0.273 – 1.422) (Table 4.7).

Pelvis injury

There was also a significant relationship between pelvis injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 1.584 times more likely to acquire pelvis injury than the patients with severe injuries (95%CI; 0.858 – 2.925) (Table 4.7).

Skin

Over 3535 patients experienced skin injury (Table 4.6). There was a significant relationship between skin injury and the magnitude of the injury of the patients ($P < 0.05$) in that patients with fatal injuries were 0.238 times less likely to acquire skin injury than the patients with severe injuries (95%CI; 0.022 – 0.499) and patients with moderate injuries were 0.379 times less likely to acquire skin injury than the patients with severe injuries (95%CI; 0.195 – 0.592) (Table 4.7).

Table 4.7: Relationship between magnitude of severity and RTIs

		B	Std. Err	df	Sig.	OR	95% CI for OR	
							Lower	Upper
Head	Not sure	.256	.413	1	.536	1.292	.575	2.904
	Fatal	1.743	.112	1	.000	5.717	4.590	7.121
	Mild	-1.226	.194	1	.000	.293	.201	.429
	Moderate	1.351	.095	1	.000	3.861	3.207	4.650
	Severe	0[b]	0.	0	0.	0.	0.	0.
Neck	Not sure	20.388	.000	1	.	$7.150x10^8$	$7.150x10^8$	$7.150x10^8$
	Fatal	.438	.203	1	.031	.322	.042	1.007
	Mild	.823	.275	1	.003	0.315	0.218	0.622
	Moderate	.463	.171	1	.007	0.384	0.135	0.540
	Severe	0[b]	0.	0	0.	0.	0.	0.
Chest	Not sure	.523	.388	1	.178	1.687	.788	3.608
	Fatal	.700	.130	1	.000	0.115	0.036	0.421
	Mild	-.441	.089	1	.000	.590	.540	.767
	Moderate	.351	.086	1	.000	0.423	0.133	0.678
	Severe	0[b]	0.	0	0.	0.	0.	0.
Abdomen	Not sure	.717	.599	1	.231	2.049	.633	6.635
	Fatal	.780	.190	1	.000	0.481	0.200	0.671
	Mild	-.489	.115	1	.000	.666	.312	.855
	Moderate	.466	.122	1	.000	0.594	0.254	0.726
	Severe	0[b]	0.	0	0.	0.	0.	0.
Upper limb	Not sure	.015	.440	1	.972	1.015	.429	2.406
	Fatal	.589	.174	1	.001	1.803	1.283	2.534
	Mild	-.769	.108	1	.000	.463	.375	.573
	Moderate	.262	.114	1	.021	0.350	0.039	0.625
	Severe	0[b]	0.	0	0.	0.	0.	0.
Lower limb	Not sure	.158	.343	1	.645	1.171	.598	2.297
	Fatal	.632	.126	1	.000	0.781	0.469	1.208
	Mild	-.572	.088	1	.000	.564	.475	.670
	Moderate	-.051	.081	1	.528	.950	.812	1.113
	Severe	0[b]	0.	0	0.	0.	0.	0.
Spine	Not sure	1.130	1.015	1	.265	3.097	.424	22.641
	Fatal	1.080	.299	1	.000	0.446	0.639	0.820
	Mild	-.336	.159	1	.035	.715	.523	.976
	Moderate	.582	.174	1	.001	0.780	0.273	1.422
	Severe	0[b]	0.	0	0.	0.	0.	0.
Pelvis	Not sure	19.937	.000	1	.	$4.554x10^8$	$4.554x10^8$	$4.554x10^8$

	Fatal	.460	.313	1	.142	1.584	.858	2.925
	Mild	-.771	.190	1	.000	.462	.318	.671
	Moderate	.104	.203	1	.608	1.110	.745	1.654
	Severe	0[b]	0.	0	0.	0.	0.	0.
Skin	Not sure	.591	.282	1	.036	1.806	1.039	3.140
	Fatal	.214	.098	1	.029	0.238	0.022	0.499
	Mild	-.721	.100	1	.000	.486	.400	.591
	Moderate	.322	.073	1	.000	0.379	0.195	0.592
	Severe	0[b]	0.	0	0.	0.	0.	0.

In summary with respect to the magnitude of injury head injury and upper limb injury were more likely to be fatal than severe.

4.2.4 Distribution of RTIs by year

2018

The RTIs in Mulago National Referral Hospital were over 3% greater on average than the cases from Lubaga hospital and (10%) greater on average than the cases from Nsambya hospital. Lubaga hospital had an average of (20.1%) while Mulago National Referral Hospital had an average of 23.0% and Nsambya hospital had an average of 13.3% (Figure 4.1).

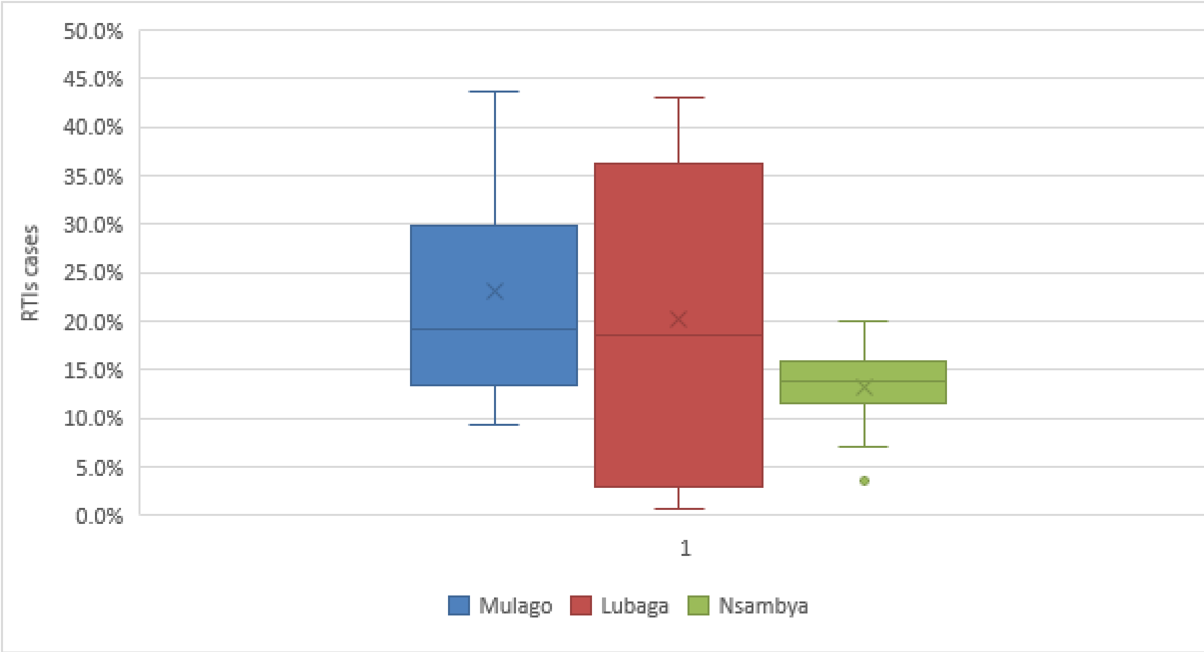

Figure 4.1: Distribution of RTIs in 2018

2019

The RTIs in Nsambya hospital were over 10% greater on average than the cases from Mulago National Referral Hospital and 5% greater on average than the cases from Lubaga hospital. Lubaga hospital had an average of 16.4% while Mulago National Referral Hospital had an average of 21.8% and Nsambya hospital had an average of 31.7% (Figure 4.2).

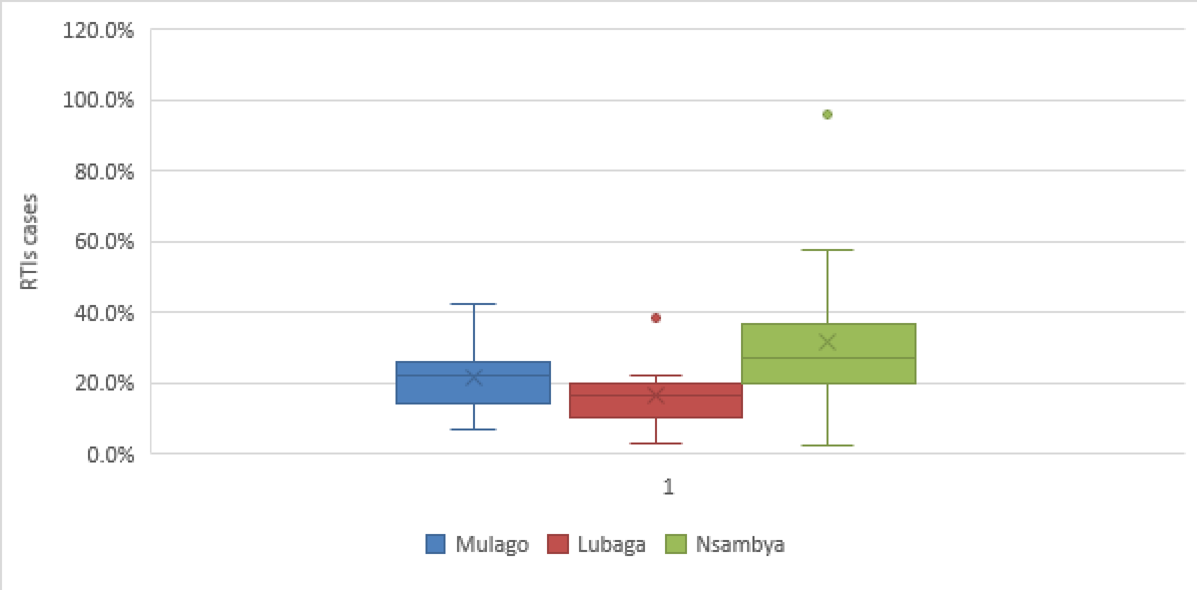

Figure 4.2: Distribution of RTIs in 2019

2020

The RTIs in Lubaga hospital were over 9% greater on average than the cases from Mulago National Referral Hospital, 14% greater on average than the cases from Nsambya hospital and Naguru hospital. Lubaga hospital had an average of 24.4% while Mulago National Referral Hospital had an average of 15.3%, Naguru hospital had an average of 10.6% and Nsambya hospital had an average of 10.0% (Figure 4.3).

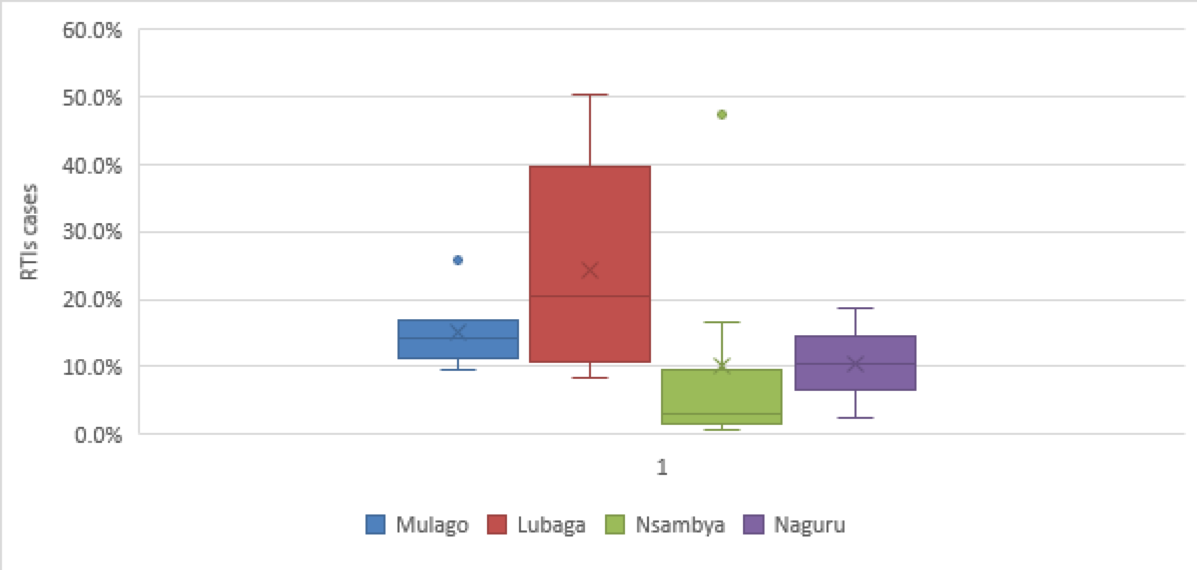

Figure 4.3: Distribution of RTIs in 2020

2021

The RTIs in Lubaga hospital were about 10% greater on average than the cases from Mulago National Referral Hospital, 14% greater on average than the cases from Nsambya hospital and 10% greater on average than the cases from Naguru hospital. Lubaga hospital had an average of 26.1% while Mulago National Referral Hospital had an average of 16.7%, Naguru hospital had an average of 16.7% and Nsambya hospital had an average of 12.6% (Figure 4.4).

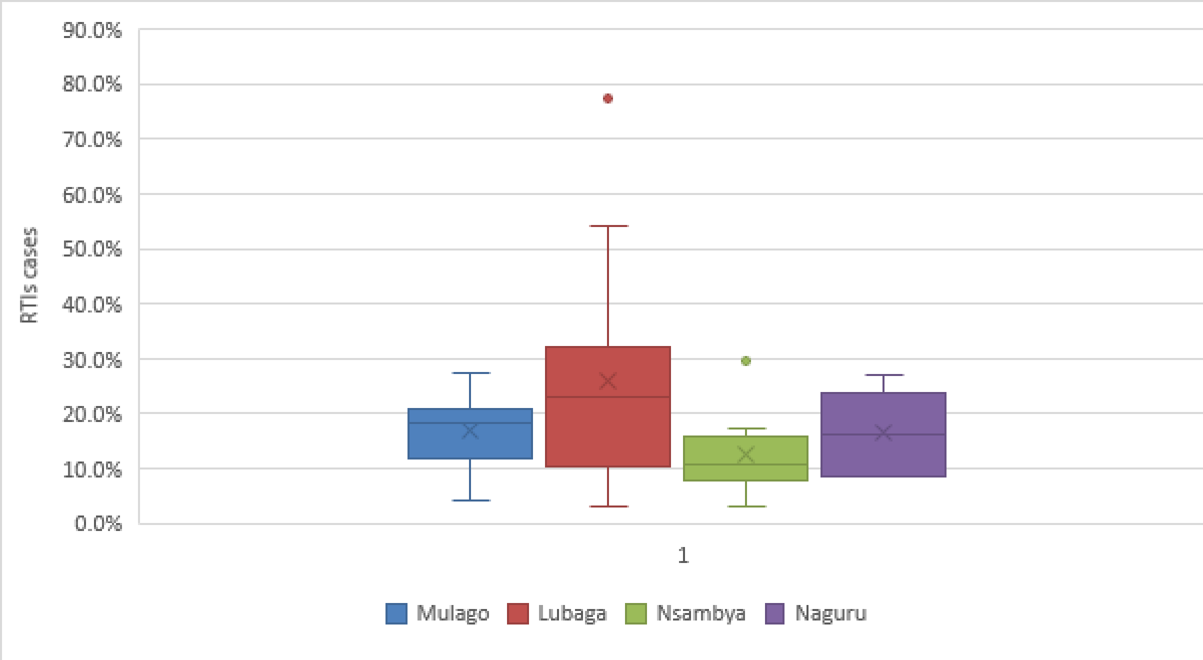

Figure 4.4: Distribution of RTIs in 2021

2022

The RTIs in Naguru hospital were over 30% greater on average than the cases from Mulago National Referral Hospital, 35% greater on average than the cases from Nsambya hospital and 33% greater on average than the cases from Lubaga hospital. Lubaga hospital had an average of 17.2% while Mulago National Referral Hospital had an average of 14.4%, Naguru hospital had an average of 43.6% and Nsambya hospital had an average of 8.4% (Figure 4.5).

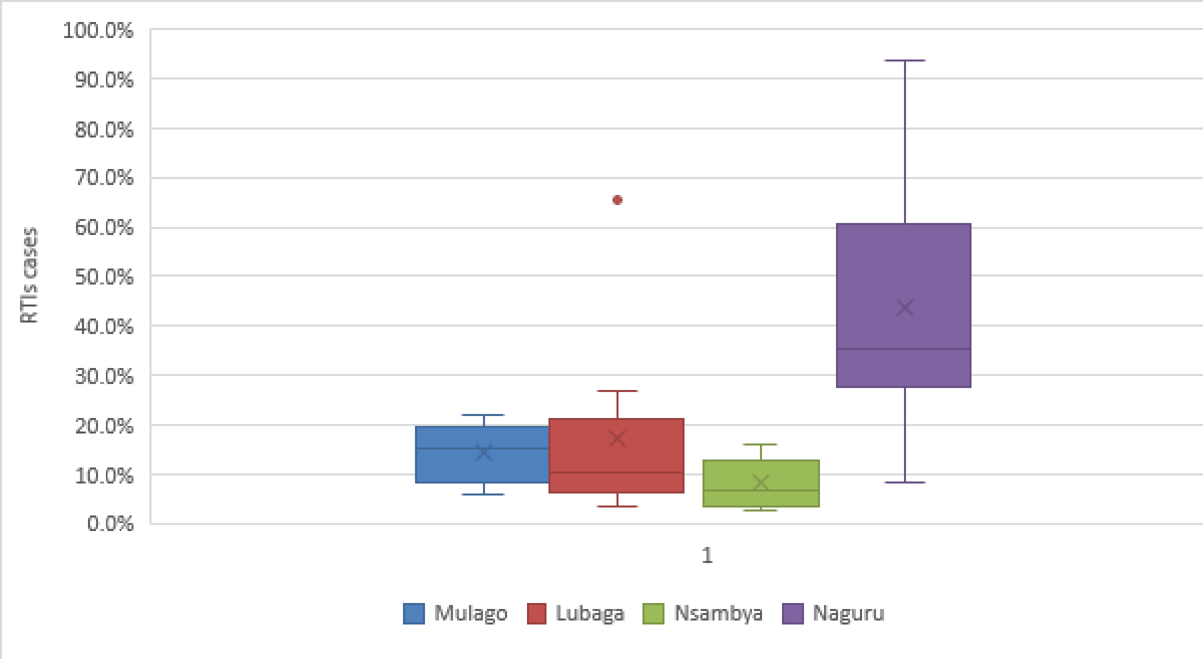

Figure 4.5: Distribution of RTIs in 2022

4.2.4.1 Distribution of RTIs by year

2018

The Mulago National Referral Hospital RTIs had a standard deviation of 0.117 while Lubaga hospital RTIs had a standard deviation of 0.200 whereas Nsambya hospital RTIs had a standard deviation of 0.049. The Lubaga hospital RTIs having a higher standard deviation shows that the RTIs are more dispersed than the RTIs for Mulago and Nsambya hospitals. The Mulago and Lubaga hospital RTI cases are positively skewed while those of Nsambya hospital are negatively skewed (Table 4.8).

2019

The Mulago National Referral Hospital RTIs had a standard deviation of 0.1 while Lubaga hospital RTIs had a standard deviation of 0.106 whereas Nsambya hospital RTIs had a standard deviation of 0.250. The Nsambya hospital RTIs having a higher standard deviation shows that the RTIs are more dispersed than the RTIs for Mulago and Lubaga hospitals. The RTI cases from all the hospitals were positively skewed (Table 4.8).

2020

The Mulago National Referral Hospital RTIs had a standard deviation of 0.056 while Lubaga hospital RTIs had a standard deviation of 0.157 whereas Nsambya hospital RTIs had a standard deviation of 0.150 and Naguru hospital had a standard deviation of 0.114. The Lubaga hospital RTIs having a higher standard deviation shows that the RTIs are more dispersed than its RTIs for Mulago, Naguru and Nsambya hospitals. The RTI cases for Mulago, Lubaga and Nsambya hospitals were positively skewed while the cases for Naguru were not skewed (Table 4.8).

2021

The Mulago National Referral Hospital RTIs had a standard deviation of 0.078 while Lubaga hospital RTIs had a standard deviation of 0.215 whereas Nsambya hospital RTIs had a standard deviation of 0.073 and Naguru hospital had a standard deviation of 0.089. The Lubaga hospital RTIs having a higher standard deviation shows that the RTIs are more dispersed than the RTIs for Mulago, Naguru and Nsambya hospitals. The RTI cases for Naguru, Lubaga and Nsambya hospitals from all the hospitals were positively skewed while the cases for Mulago National Referral Hospital were negatively skewed (Table 4.8).

2022

The Mulago National Referral Hospital RTIs had a standard deviation of 0.058 while Lubaga hospital RTIs had a standard deviation of 0.171 whereas Nsambya hospital RTIs had a standard deviation of 0.052 and Naguru hospital had a standard deviation of 0.258. The Naguru hospital RTIs having a higher standard deviation shows that the RTIs are more dispersed than the RTIs for Mulago, Lubaga and Nsambya hospitals. The RTI cases for Naguru, Lubaga and Nsambya hospitals from all the hospitals were positively skewed while the cases for Mulago National Referral Hospital were negatively skewed. Most of the data for Naguru hospital was obtained in 2022, thus a high value of cases as compared to the other facilities (Table 4.8).

In summary Lubaga hospital showed the highest deviation from the mean for the 2018, 2020 2021 while Nsambya hospital showed a highest deviation from the mean for the year 2019 and Naguru hospital showed the highest deviation from the mean for the year 2022. Majority of the hospital showed a positive skewness through their data except for Naguru hospital. Lubaga hospital had more cases in the years of 2018, 2020 and 2021 while Nsambya hospital had highest number of cases in the year of 2019 and Naguru hospital had the highest number of cases in the year of 2022.

Table 4.8: Distribution of RTIs by year

	Mulago	Lubaga	Nsambya	Naguru
	n (%)	n (%)	n (%)	n (%)
2018				
Mean	794 (23.0)	134 (20.1)	45 (13.3)	0 (0.0)
Median	661 (19.2)	124 (18.5)	47 (13.9)	0 (0.0)
Minimum	324 (9.4)	5 (0.7)	12 (3.5)	0 (0.0)
Maximum	1505 (43.6)	288 (43.1)	69 (20.1)	0 (0.0)
Standard deviation	0.116867	0.196743	0.048951	0
Variance	0.013658	0.038708	0.002396	0
Skewness	0.815948	0.09604	-0.59873	0
Kurtosis	-0.53617	-2.99004	0.002851	0
2019				
Mean	753 (21.8)	109 (16.4)	109 (31.7)	0 (0.0)
Median	754 (21.9)	109 (16.3)	92 (27.0)	0 (0.0)
Minimum	235 (6.8)	19 (2.9)	9 (2.5)	0 (0.0)
Maximum	1460 (42.3)	255 (38.2)	328 (95.8)	0 (0.0)
Standard deviation	0.099719	0.105814	0.25009	0
Variance	0.009944	0.011197	0.062545	0
Skewness	0.540547	0.820388	1.607163	0
Kurtosis	0.303845	1.526306	3.475189	0
2020				
Mean	527 (15.3)	163 (24.4)	34 (10.0)	97 (10.6)
Median	488 (14.2)	136 (20.4)	10 (2.9)	97 (10.6)
Minimum	331 (9.6)	55 (8.3)	3 (0.8)	23 (2.5)
Maximum	904 (26.2)	336 (50.3)	162 (47.3)	171 (18.6)
Standard deviation	0.056213	0.157448	0.149882	0.113844
Variance	0.00316	0.02479	0.022465	0.012961
Skewness	1.170098	0.610178	2.344268	
Kurtosis	0.525426	-1.34238	5.854649	
2021				
Mean	577 (16.7)	174 (26.1)	43 (12.6)	153 (16.7)
Median	630 (18.3)	154 (23.0)	37 (10.9)	150 (16.4)

Minimum	142 (4.1)	22 (3.3)	11 (3.2)	77 (8.4)
Maximum	949 (27.5)	518 (77.5)	101 (29.4)	247 (26.9)
Standard deviation	0.07786	0.215259	0.072692	0.089016
Variance	0.006062	0.046337	0.005284	0.007924
Skewness	-0.31722	1.420918	1.100339	0.072296
Kurtosis	-0.80927	1.982269	1.914211	-3.09143
2022				
Mean	497 (14.4)	115 (17.2)	29 (8.4)	399 (43.6)
Median	525 (15.2)	70 (10.5)	23 (6.8)	325 (35.4)
Minimum	200 (5.8)	24 (3.6)	9 (2.5)	78 (8.5)
Maximum	756 (21.9)	438 (65.6)	55 (16.0)	857 (93.5)
Standard deviation	0.058587	0.171286	0.052405	0.257707
Variance	0.003432	0.029339	0.002746	0.066413
Skewness	-0.21659	2.312212	0.245978	0.47744
Kurtosis	-1.55388	6.203297	-1.80498	-0.2219

4.3 Trend analysis of RTIs

The trend of the reported RTIs was produced for the four selected hospitals using line graphs. The data was presented in form of figures. The forecasting was done using straight line method.

4.3.1 Time series of RTIs by Hospital

Mulago National Referral Hospital

For Mulago National Referral Hospital three categories of data were acquired; the sampled data, time series data from the system for admissions and time series data from the system for the outpatient department (OPD).

Mulago National Referral Hospital sampled data

The Figure 4.6 below showed that the trends of RTIs from January 2018 to December 2022 in Mulago National Referral Hospital. The cases of RTIs were highest (43.6%) in September 2018 followed by 42.8% in January 2018. The month of December 2021 had the least percentage (4.1%) of the RTIs cases followed by 5.3% in June 2021. The forecast showed a decrease in the cases of RTIs.

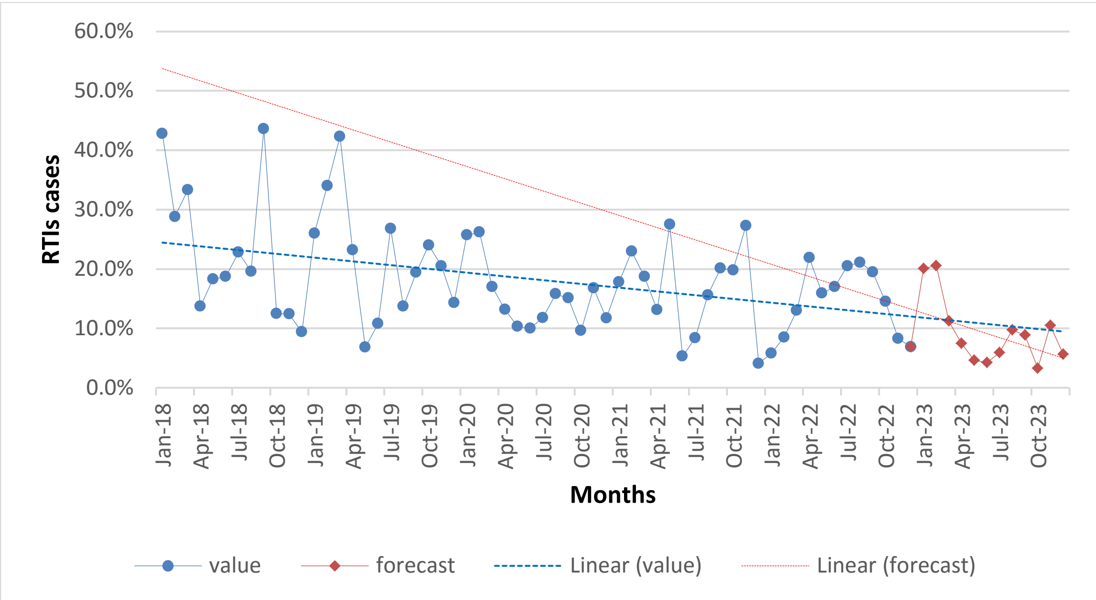

Figure 4.6: Trends of RTIs in Mulago National Referral Hospital sampled data

Mulago National Referral Hospital time series data for admissions

The Figure 4.7 below showed that the cases of RTIs were highest in January 2021 followed by March 2018. The month of December 2019 had the least of the RTIs cases while the data set showed no cases for the months of January 2020, March 2020, September 2020, April 2022, May 2022, October 2022 and November 2022. The forecast showed an increase in the cases of RTIs.

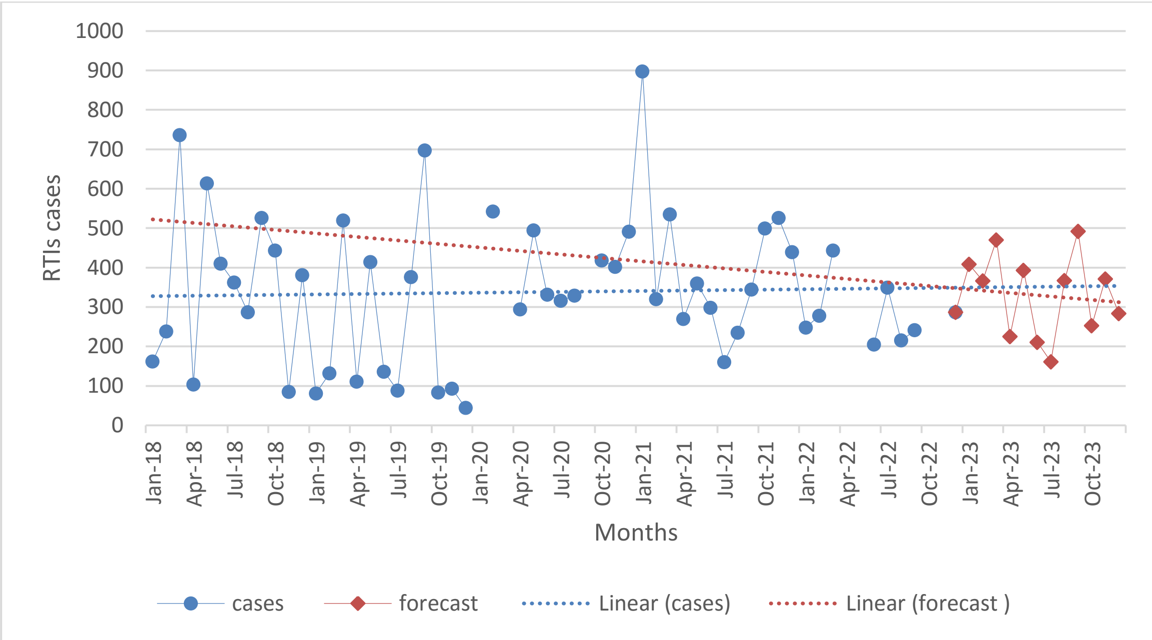

Figure 4.7: Trends of RTIs in Mulago National Referral Hospital time series data for admission

Mulago National Referral Hospital time series data for OPD

The Figure 4.8 below showed that the cases of RTIs were highest in March 2018 followed by March 2021. The month of June 2019 had the least of the RTIs cases while the data showed no cases for the months of December 2019 to July 2020, November 2020 and October 2022. The forecast showed an increase in the cases of RTIs.

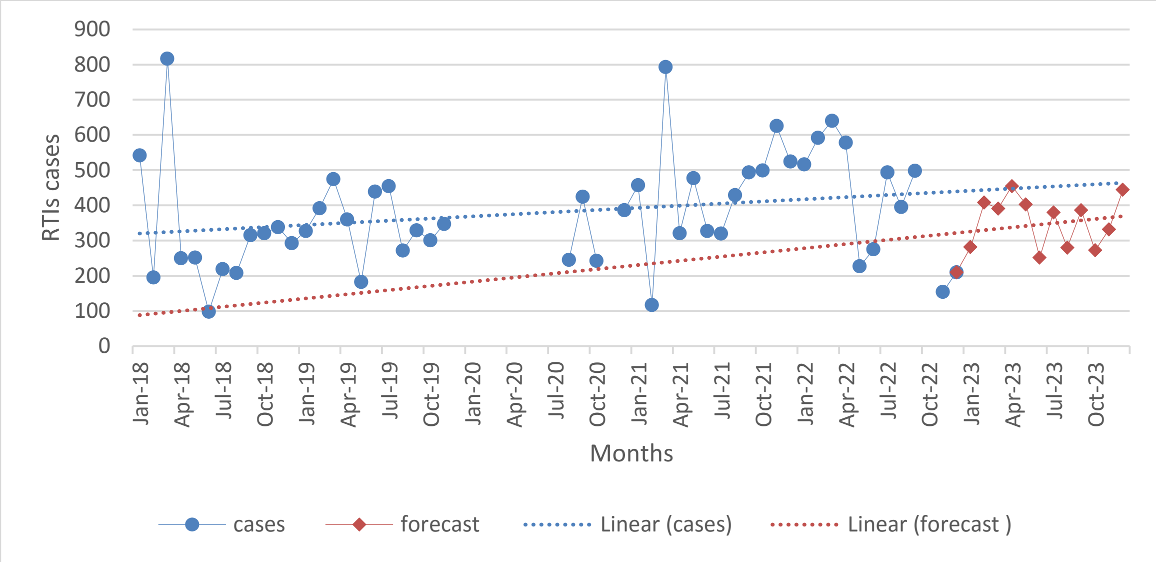

Figure 4.8: Trends of RTIs in Mulago National Referral Hospital OPD data

Lubaga Hospital

The Figure 4.9 below showed the trends of RTIs from January 2018 to December 2022 in Lubaga Hospital. The cases of RTIs were highest (77.5%) in January 2021 followed by 65.6% in May 2022. The month of May 2018 had the least (0.7%) of the RTIs cases followed by 2.7% in March 2018. The forecast showed a gradual increase in the cases of RTIs.

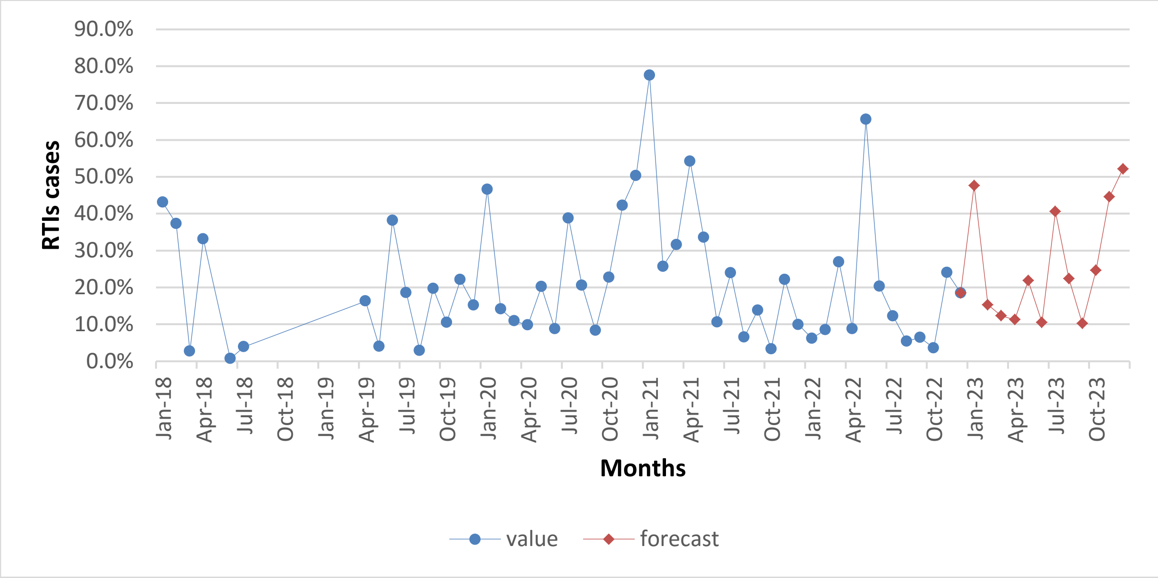

Figure 4.9: Trends of RTIs in Lubaga Hospital

Naguru Hospital

The Figure 4.10 below showed the trends of RTIs from January 2020 to December 2022 in Naguru Hospital. The cases of RTIs were highest (68.3%) in October 2022 followed by 64.6% in November 2022. The month of October 2020 had the least (2.5%) of the RTIs cases followed by 8.4% in February 2021 and March 2021. The forecast showed a gradual increase in the cases of RTIs.

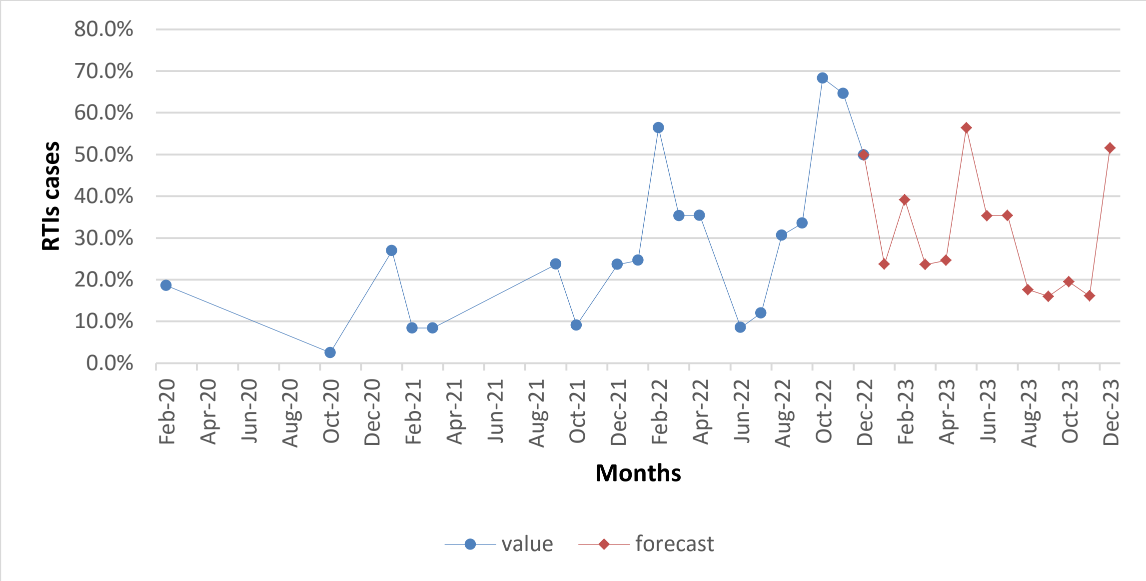

Figure 4.10: Trends of RTIs in Naguru Hospital

Nsambya Hospital

The Figure 4.11 below showed the trends of RTIs from January 2018 to December 2022 in Nsambya Hospital. The cases of RTIs were highest (95.8%) in February 2019 followed by 57.7% in January 2019. The months of April 2020 and August 2020 had the least (0.8%) of the RTIs cases followed by 1.5% in December 2020. The forecast showed a gradual decrease in the cases of RTIs.

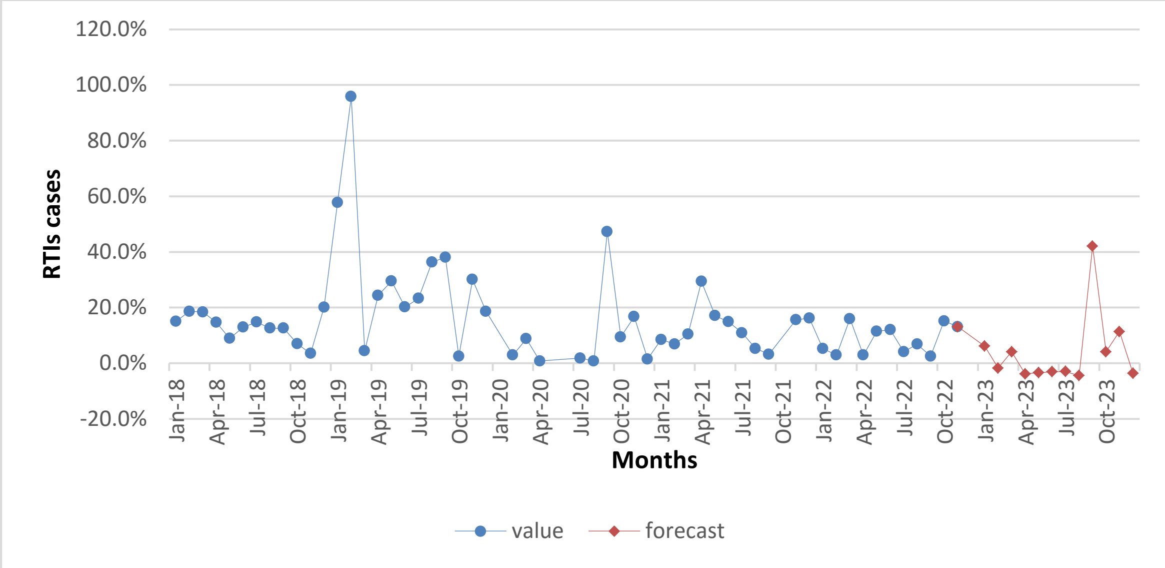

Figure 4.11: Trends of RTIs in Nsambya Hospital

4.3.2 Percentage change in the cases

There was a gradual decrease in the cases of RTIs throughout the hospitals in the year of 2020 and a gradual increase generally in the 2022 throughout the hospitals (Table 4.9).

Table 4.9: Percentage change in RTIs at the hospitals

	2018 – 2019	2019 – 2020	2020 – 2021	2021 – 2022	Average
Mulago	1.8	-2.5	0.8	2.6	0.675
Lubaga	0.6	-0.8	1.2	1.7	0.675
Naguru			1.6	2.1	1.85
Nsambya	2.5	-0.4	1.6	0.3	1
Average	1.633	-1.233	1.300	1.675	

4.3.3 Seasonality of RTIs

The seasonality of the time series was acquired through the autocorrelation function using IBM SPSS v20 software. Table 4.10 shows that seasonality indices of Lubaga hospital and Naguru hospital are higher than average while those of Mulago National Referral Hospital and Nsambya are lower than average.

Table 4.10: Seasonality of the RTIs

	Mulago	Lubaga	Nsambya	Naguru
Seasonality index	0.87	1.01	0.75	1.36

In summary the data for Lubaga hospital and Naguru showed seasonality. Most data were missing in some months more so in 2020 to 2021 due to the effect of the COVID – 19 pandemic where people were not allowed to move therefore no data captured. The festive season had less cases of RTIs reported as compared to other months.

4.4 Factors associated with RTIs

The factors associated with daily reported RTIs were acquired through a relationship between the demographic characteristics and acquisition of injuries by use of the binary logistic regression.

4.4.1 Binary logistic regression

The binary logistic regression helps to find the relationship between the independent and the dependent variables. It was used because the independent variables; gender, age, time of incident, category of victim, alcohol use, mechanism of injury were categorical and the dependent variable was dichotomous.

Table 4.11: Binary regression for factors associated with daily reported RTIs

	Wald	df	Sig.
Gender	15.552	1	**0.000**
Age	20.885	1	**0.000**
Category of victim	70.451	4	**0.000**
Alcohol and drug use	28.083	2	**0.000**
Mechanism of injury	25.776	5	**0.000**
Time of incident	37.373	4	**0.000**

The study found a significant relationship between the gender of patients and daily acquisition of RTIs (P < 0.01) (Table 4.11) whereby the female patients were 0.218 times less likely to acquire the road traffic injuries than the male patients (95% CI; 0.068 – 0.724) (Table 4.12).

There was a significant relationship between the category of victims and daily acquisition of RTIs (P < 0.01) (Table 4.11) whereby the passengers were 0.666 times less likely to acquire the road traffic injuries than the riders (95% CI; 0.541 – 0.820) and pedestrians were 0.630 times less likely to acquire the road traffic injuries than the riders (95% CI; 0.518 – 0.766) (Table 4.12).

There was a significant relationship between alcohol and drug use and daily acquisition of RTIs (P < 0.01) (Table 4.11) whereby the patients who were not sure whether they take alcohol or drugs were 0.542 times less likely to acquire the road traffic injuries than those who use alcohol and drugs (95% CI; 0.357 – 0.823) (Table 4.12).

There was a significant relationship between mechanism of injury and daily acquisition of RTIs (P < 0.01) (Table 4.11) whereby the patients who got the injury using motorcycle were 1.578 times more likely to acquire the road traffic injuries than those who got using a vehicle (95% CI; 1.296 – 1.921) (Table 4.12).

There was a significant relationship between time of incident and daily acquisition of RTIs ($P < 0.01$) (Table 4.11) whereby the patients who got the injury in the evening (4:00pm – 7:00pm) were 1.354 times more likely to acquire the road traffic injuries than those who got at night (7:00pm – 5:00am) (95% CI; 1.902 – 3.119) and patients who got the injury in the morning (5:00am – 12:00pm) were 1.051 times more likely to acquire the road traffic injuries than those who got at night (95% CI; 1.116 – 2.003) (Table 4.12).

4.4.2 Multinomial logistic regression

In cases where the outcome variable under prediction is nominal and comprises more than two categories lacking a specific rank of order, multinomial logistic regression is utilised to determine the correlation between the dependent and independent variables. It was employed because identifying the precise causes of the dependent variable from the independent variables was necessary.

Table 4.12: Multinomial regression for factors associated with daily reported RTIs

	B	Std. Err	df	Sig.	OR	95% CI for OR	
						Lower	Upper
Gender							
Female	.334	.091	1	.000	0.218	0.068	0.724
Male	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Age							
<= 10 years	.321	.141	1	.023	1.379	1.046	1.817
11 - 20 years	-.179	.130	1	.167	.836	.649	1.078
21 - 30 years	.029	.094	1	.762	1.029	.855	1.238
31 - 40 years	-.075	.101	1	.461	.928	.761	1.132
> 40 years	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Category of victim							
Not sure	.930	.221	1	.000	2.534	1.644	3.905
Driver	.427	.247	1	.084	1.532	.944	2.489

Passengers	-.406	.106	1	.000	.666	.541	.820
Pedestrian	-.462	.100	1	.000	.630	.518	.766
Rider	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Alcohol and drug use							
Not sure	-.612	.213	1	.004	.542	.357	.823
No	.236	.139	1	.089	1.266	.965	1.661
Yes	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Mechanism of injury							
Not sure	.710	.224	1	.002	2.034	1.311	3.154
Bicycle	.437	.251	1	.081	1.548	.947	2.531
Motor cycle	.456	.100	1	.000	1.578	1.296	1.921
Not specific	.562	.234	1	.016	1.754	1.109	2.772
Train	-18.402	.000	1	.	1.019E-8	1.019E-8	1.019E-8
Vehicle	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Time of incident							
Not sure	-.192	.117	1	.102	.826	.656	1.039

Afternoon	.036	.127	1	.780	1.036	.808	1.330
Evening	-.440	.114	1	.000	1.354	1.902	3.119
Morning	-.480	.116	1	.000	1.051	1.116	2.003
Night	ref.	ref.	ref.	ref.	ref.	ref.	ref.

In summary socio demographic factors were more that influenced the RTIs cases than the environmental factors and the vehicular factors. The males were more likely to acquire injuries and those who were 21 – 30 years were more likely to acquire injuries than the elderly, the motorcyclist were more likely to acquire injuries than those that used vehicles and injuries were more likely in the evening and morning hours of the day. Alcohol and drug use was not significant

In conclusion in relation to the distribution of traffic injuries, the study evaluated the epidemiology of these injuries. This indicated that those between the ages of 21 and 30 were more likely to get injuries from traffic accidents; men were also more likely to sustain these injuries, and most of them were serious—the only exceptions being fatal injuries to the head and upper limbs. The primary variables linked to injuries sustained in traffic were the victim's gender, age, and category.

4.5 Discussion

4.5.1 Distribution of reported RTIs cases

Gender

The cases in the study comprised more males (80.9%) than the females (19.1%) which denotes that more than two thirds of the RTI victims were male. This finding was consistent with studies in other countries (Perysinakis *et al.,* 2021; Roy *et al.,* 2021; Al – Zamanan *et al.,* 2018; Ngunde et al., 2019). The study also revealed a male to female ratio of 4.23:1 (Table 4.1), which is in line with findings from other studies (Chichom-Mefire et al., 2015; Nwadiaro et al., 2011; Hefny et al., 2012) that indicated male to female ratios ranging from 2.5/1 to 46.5/ 1. A significant male predominance over 95% is reported by several (Crandon et al., 2009; Hefny et al., 2012). This is consistent with other earlier studies conducted worldwide and is feasible in Kampala. Male victims are more susceptible to RTIs since most drivers and riders in Uganda are men and were most affected. Additionally, because men are naturally more active than females, they are also more likely to sustain injuries (Ngunde et al., 2019). Men may act dangerously due to a variety of causes, including gender role socialisation, the link of masculinity with risk-taking activity, acceptance of risk, and a contempt for pain and harm. Men may spend significantly more time in moving vehicles than women in areas where women's mobility is traditionally restricted, and men are more likely than women to own automobiles and motorcycles in all contexts save the small economic elite. Men are also more likely to work as mechanics and drivers in automobiles and trucks, especially long-haul vehicles, which require driving for multiple days and nights. Because of this, male drivers would be more vulnerable to traffic injuries, which is undoubtedly related to the disparities in the roles that men and women play in society (WHO, 2012). However, to the contrary studies by González-Sánchez *et al.,* (2021); Islam & Brown, (2017) found that women are more at risk of minor car injuries, they further supported the claim on the fearfulness or lack of experience of females.

Age

Meningitis, HIV/AIDS, malaria, respiratory infections, anaemia and infections are among the top 10 causes of death in Uganda for people of all ages, including RTIs (Balikuddembe et al., 2017). In this study, the cases in the study comprised more of 21 – 30 years (34.4%) followed by 31 – 40 years

(25.5%) which denoted more than two thirds of the RTI victims being young. This finding was consistent with studies in other countries (Roy et al., 2021; Al-Zamanan et al., 2018; Mashreky et al., 2010). According to Hokkam et al. (2015), similar results were also observed in Jazan, Saudi Arabia, where roughly half of the patients were between the ages of 18 and 30 (25.3 ± 16.8 years, mean ± S.D.), and in Arar, Northern Saudi Arabia, where RTAs were common among young people under the age of 35 (70.8%) (Alshammari et al., 2017). The risk of RTI for both minor and major or fatal injuries is greater in younger victims. This result is somewhat in line with one from a US study (Zwerling et al., 2005) on fatal driver injuries that employed trip distance as a proxy for exposure. The elevated risk observed in younger patients was explained by studies in the literature, as they are more prone to drive recklessly or aggressively (Oltedal & Rundmo, 2006; Rhodes & Pivik, 2011). Not only that, but at this age, a driver has had no prior driving experience (Al Reesi et al., 2016; Oviedo-Trespalacios & Scott-Parker, 2018). Younger people have also been found to be more likely than older people to drive while intoxicated (Sjogren et al., 2006; Robertson et al., 2017). The children (<= 10 years) were more manifested as head injuries than any other age group. For the young (11 – 20 years) neck injuries were more dominant than any other age group. For the middle aged (31 – 40 years) presented more dominant injuries on the chest, abdomen and upper limb than any other age group. While the elderly (>40 years) injuries most recorded in the lower limb, spine, pelvis, genital and skin injuries than any other age group. Age of an individual (<40 years) was found to be a protective factor to acquiring the lower limb injuries and skin injuries since the elderly were more likely to acquire them than the young victims in this study. This contradicted finding from two studies: one by Talving et al. (2010), which concentrated on the anatomical region injured and showed that patients older than 55 years old had a significantly higher risk of suffering severe head injuries, chest injuries, and spinal fractures. The other study by Dischinger et al., (2006) showed that victims older than 40 years old had a significantly higher incidence of multiple thoracic injuries. Additionally, it contradicted a study by Shamim (2017) and Ranjana et al. (2014) who reported that individuals in the active and productive age range (20 < 40) were the most likely to sustain lower limb injuries. According to Doroudgar et al. (2017), older people may be more susceptible to RTIs due to their slower reaction times and decreased capacity to keep a safe distance from the car in front of them. Along with the presumptions mentioned above, people become more delicate and susceptible to traffic accidents as they age due to a decline in their physical condition (Forman et al., 2015).

Severity

The cases in the study comprised more of moderate injuries (33.0%) followed by severe injuries (32.4%), then fatal injuries (18.4%) which denoted a high impact of the road traffic accidents on the victims. In this study the fatal injuries were dominated by the head, chest, abdomen, upper limb, lower limb, spine, pelvis, genital and skin while the severe injuries were dominated by neck. The finding was consistent with a study by Okemwa et al., (2008) that found head injuries to be highly fatal. Limb fractures made for 48.4% of all documented injuries among admitted road accident patients at Kenyatta National Hospital in Nairobi, compared to head injuries, which accounted for just 22.8% of all fatalities (Muyembe, 1992). This finding was not consistent with a study by Granieri et al., (2020) who found the subset of severe injuries to be chest injuries (33.1%) and head injuries (23.6%) mostly and in another study by Page et al., (2012) where lower limbs and upper limbs, and head and thorax were more severe regions.

4.5.2 Trend of RTIs

Mulago had the highest cases of injuries due to accidents in September 2018 and the least in December 2021, Lubaga hospital had the highest cases in January 2021 and the least in May 2018, Naguru hospital had the highest cases of injuries in October 2022 and the least cases in October 2020 whereas Nsambya hospital had the highest cases of injuries in February 2019 and the least in April 2020 and August 2020. The data for Lubaga hospital and Naguru showed seasonality. Generally, there was an increase in the injuries cases throughout the hospitals in the year 2018 to 2022.

With an estimated 29 vehicle deaths per 100,000 people, Uganda is among the nations with the highest traffic death rates according to the WHO. This result is extremely alarming because it is higher than the average death rate for the world (18.0 per 100,000 people) and the African region (24.1 per 100,000 people), respectively. Additionally, the number of road crashes is rising more quickly (Razzaghi et al., 2020). Additionally, Uganda has seen a noticeable rise in traffic accidents in the past few months (March to May 2022), which has significantly increased the country's death, injury, morbidity, trauma, and disability rates (Uganda Police Force database, 2022). The data from this study indicates that the number of patients at the hospital gradually increased, especially for Mulago cases that were referrals. Uganda has one of the highest rates of car mortality worldwide, with an estimated 190 deaths per 10,000 vehicles every day.

The Uganda Police Force (UPF) Annual Report of 2021 states that there were 17,443 traffic crashes in 2021 compared to 12,249 in 2020, a 42% increase. 4616 crashes were minor while 3757 crashes resulted in fatalities over that time. In 2021, there were 18,305 crash-related deaths, which is an 11% drop. (Uganda Police Force Annual Report, 2021) The number of fatalities dropped by 6%, the number of badly injured dropped by 13%, and the number of minor injuries dropped by 17%. Evidence from this study showed that there was a gradual decrease of 1.6% in the number of cases throughout the hospital from 2020 to 2021, this was mainly due to the reduced movement during the period due to the lockdown brought about by the COVID 19 pandemic. From 2021 to 2022 there was an increase of 1.6% in accidents due to the free movement of vehicles after a long period of the lockdown.

This study embarked mainly on the trends of the injuries sustained during these crashes and it showed that there was an increase in the head injuries from 2018 to 2022, slight increase in the neck injuries, uniform cases of the neck injuries, a decrease of the abdomen injuries, slight decrease of the upper limb injuries, uniform cases of the lower limb injuries, a sharp decrease of the spine injuries, a decrease of the pelvis injuries, uniform cases of the genital injuries, an increase in the skin injuries. The number of injuries according to the Uganda police crime report (2018 – 2020) showed a gradual increase in the serious injuries acquired from the road traffic injuries from 2,356 in 2018 to 2,456 in 2019 and 2,883 in 2020 (Uganda police crime report, 2020). A number of factors, such as reckless driving, careless driving (which is linked to distracted driving due to using hand-held devices and apps while driving or riding), alcohol influence, and could be the reasons for the increase in head, neck, and skin injuries. The results may also be explained by the fact that Ugandan boda bodas lack official training; their riders are unregulated, self-taught, and frequently carry many passengers in addition to not wearing helmets when driving. The results of this investigation align with those of previous studies conducted by Vaca et al., 2017; Niwagaba, 2021; Walekwa et al., 2022; Temizel et al., 2021.

The decrease in the spine injuries, pelvis, upper limb, and abdomen injury could be attributed to the victims using more of the cars which are enclosed thus minimising injuries on the body parts as the motorcycles are the most injury prone means of transport as evidenced in the Uganda police crime report, 2020. Other research supports this claim. For instance, it is mentioned that boda-boda transportation is more reasonably priced for most Ugandans than more costly motorised transportation (Balikuddembe et al., 2017; Thanni, 2011). Boda-bodas are an inexpensive and efficient mode of transportation, but despite efforts to address the issue, they have become a silent killer for a large number of Ugandans (Gukande et al., 2009).

4.5.3 Factors associated with daily reported RTIs

This study has illustrated the factors responsible for road traffic injuries among RTAs victims using a facility-based study.

Age

According to this study, 34.4% of the casualties were between the ages of 20 and 30, which is in line with the findings of previous studies (Alfalahi et al., 2018; Mishra et al., 2010). The age groups between 31 and 40 years old (25.5%) were the next most affected. Studies carried out in Nepal by Jha and India by Pathak produced findings similar to these (Pathak et al., 2014; Jha, 1997). One probable explanation for this age group's propensity to disregard traffic laws and regulations could be their disregard for safety measures such as helmets, seatbelts, and restraints, as well as their tendency to speed. This indicates that the most engaged in RTAs are those which are the most productive and active in their age group, which represents a significant financial loss to the community. One of the characteristics contributing to road traffic injuries in this study was age, which was shown to be consistent with research done in Gondar, Ethiopia (Abaynew et al., 2020) and Juba, South Sudan (Akway et al., 2017). In risk compared to elderly cases, age <= 10 years were 1.379 times more likely to acquire road traffic injuries as compared to the elderly cases. This high chance to injuries could be attributed to child neglect by the parents. As this study showed that most children and students were knocked while coming from school.

Gender

According to the current study, 80.9% of the victims involved in RTIs were men. According to research done in other nations, this is a similar scenario (Degais et al., 2018; Farooqui et al., 2013; Rameshkrishnan et al., 2013). Additionally, this study discovered a substantial gender effect in injury, with men showing a higher probability of suffering an RTI as a result of an RTA than women. Numerous domestic and foreign investigations (Bashah et al., 2015; Alfalahi et al., 2018; Shrestha et al., 2017; Singh et al., 2014; Boniface et al., 2016; Ghaffar & Ahmed, 2015) corroborate this conclusion. Male travel risk and emotional and risk-taking behaviour are similar to those of females, which may account for the higher risk in males and the higher exposure to RTIs. Male drivers were also shown to spend more time behind the wheel, wear safety equipment less frequently, and be more likely to speed or drive while intoxicated, according to other studies (Abegaz & Gebremedhin, 2019; Mohamed & Bromfield, 2017; Zuwairy et al., 2020; Shaadan et al., 2021). In Uganda, men are more likely than women to ride motorcycles, with women typically favouring vehicles or public transportation (Rahman et al., 2016; Rahman et al., 2019) thus putting men at risk of injuries as evidenced in this study that most 60.7% of the injuries were due to motorcycles.

Alcohol and drug use

One-third of vehicle-related incidents in the US are caused by drunk driving, which is a frequent contributing factor in crashes worldwide (DeNicola et al., 2016). Drinking alcohol and using psychoactive drugs pose a serious risk to road traffic safety both personally and as a society (Lin and Kraus, 2009; Staton et al., 2018). Because there were so few cases where alcohol was used, the study discovered that non-drinkers had a 1.266-fold increased risk of developing an RTI, however this difference was not statistically significant. This was not the case for a Minnesota study that found drinking increased the chance of harm by 1.79 times (Prekker et al., 2009). Which corroborated by WHO findings that up to 45% of injured patients admitted to drinking alcohol before suffering their injuries (Bashah et al., 2015). This could be explained by the fact that drinking alcohol impairs focus and raises the risk of sensory and motor dysfunction, including increased reaction times and loss of balance (Lin and Kraus, 2009; Woratanarat et al., 2009).

Time of incident

The results of this study showed that 28.5% of RTIs occurred in the evening, between 4:00 and 7:00 p.m. These results were consistent with those of studies carried out in other nations (Mishra et al., 2010; Neeraj et al., 2012). Nonetheless, alternative research indicates that RTIs occurred in the afternoon (Singh et al., 2015). A little variation in work culture may be the cause of the time differences when compared to our study. Another important factor that contributed to the traffic collision on the road was the time of day. Road traffic injuries were significantly correlated with the morning aOR (95% CI) = 1.051 (1.116 - 2.003) and evening aOR (95% CI) = 1.354 (1.902 - 3.119). This result was in line with research from the Tikur Anbesa Specialised Hospital in Ethiopia (Bewket & Berhanu, 2014), however it was at odds with research by Osoro & Ng'ang'a (2011) in Thika, Kenya, which found a substantial correlation between nighttime driving and traffic accidents. In this study, long drives during the morning and evening hours could be caused by traffic jams, which could be the cause of RTIs. Due to commuters travelling to and from workplaces, factories, schools, and other business locations, these are the busiest hours.

Mechanism of injury

In this study, 60.7% of all reported RTIs were attributable to motorcycles; this was found to be similar to a study by (Saadat & Soori, 2011). This result was not consistent with the study conducted in (Choulagai et al., 2015) whereby six wheelers were found to be more involved. The study further found that the traffic injury due to collision for motorcycles (aOR: 95% CI) = (1.578: 1.296 -

1.921) and bicycle occupants (aOR: 95% CI) = (1.548: 0.947 - 2.531) were strongly associated with road traffic injuries more than other vehicle type occupants. This may be explained by un-safe driving behaviour of motorcycle riders. In accordance with research by (Isa et al., 2022; Jha et al., 2004), riders of motorcycles and bicycles had a significantly higher risk of injury when involved in rear-end collisions (RTIs) than occupants of other vehicles. This is because of their increased exposure to the possibility of direct physical contact during accidents. This aligns with the research conducted by (Isa et al., 2022). The fact that motorised two-wheelers carry three risks explains this. They are exposed in the first place, somewhat unsteady in the second place, and riders have a propensity to ride them faster in the third place. All of this adds up to a higher mechanical energy impact during the collision, which frequently results in severe injuries.

Category of victim

The bulk of RTI cases in this study were riders (31.2%) and pedestrians (33.8%). These findings were consistent with research done in low- and middle-income nations, where riders, bicyclists, and pedestrians were the most vulnerable road users (Mohan 2002; Nantulya and Reich 2003; Peden et al., 2004). Low Social Economic Status (SES) pedestrians are most vulnerable to RTA-related injuries and fatalities in low- and middle-income countries (LMIC) (Peralta-Santos et al., 2022). The high death toll is partly caused by pedestrians' unsafe actions. In a study published in 2018, Alfalahi et al. found that pedestrians' negligence was the most dangerous activity. According to earlier research, more than 75% of pedestrians involved in traffic accidents were struck while crossing the street outside of a crosswalk. Over 34% of the fatalities from these crashes were caused by head and neck injuries (Hassan et al., 2013). According to Crankson (2006), children are more likely to sustain injuries as pedestrians than as passengers in cars; these injuries frequently occur when unsupervised kids are playing in the streets and are hit by oncoming cars (Al-Naami et al., 2010). Head trauma claims the lives of numerous youngsters or causes permanent neurological damage (Crankson, 2006).

In conclusion Socio demographic factors most influenced the RTIs cases than the environmental factors and the vehicular factors whereby the gender of patients, age of patients, mechanism of injury, category of victim and the time of incident were the factors that majorly influenced the acquisition of road traffic injuries.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The study's results and potential recommendations are presented in this chapter.

5.1 Summary

The study assessed the epidemiology of road traffic injuries with respect to distribution of the road traffic injuries which showed that the younger victims (21 – 30 years) were more prone to acquiring the road traffic injuries, males were more likely to acquire the injuries and majority of the injuries were severe except for head and upper limb injuries that were fatal. The gender, age, category of the victim, mechanism of injury and time of incident were the major factors for the road traffic injuries in the study. However, there were few cases of patients that consumed alcohol, this further showed no significance with the RTI cases.

5.2 Conclusions

Distribution of reported RTIs cases

Age: Younger patients (21 – 30 years) were more prone to acquiring most of the road traffic injuries in the study.

Gender: The male patients were more prone to acquiring the road traffic injuries in the study. Head injury, lower limb and pelvis injuries were significant with gender.

Magnitude: Head injury and upper limb injury were more of fatal than severe while neck injury, chest injury, abdomen, lower limb, spine, pelvis and skin injuries were more of severe.

Trend of RTIs

Decrease in RTI cases from 2019 to 2020, this was mainly due to the reduced movement during the period due to the lockdown brought about by the COVID 19 pandemic.

Increase in RTI cases from 2021 to 2022 was mainly due to the free movement of vehicles after a long period of the lockdown.

Generally, there was an increase of 0.8% in the cases of the road traffic injuries throughout the hospitals from 2018 to 2022 more so after the festive season (January and February) and in the middle of the year (May to July).

Factors associated with daily reported RTIs

Male patients were more likely to acquire injuries, those with 21 – 30 years were more likely to acquire injuries than the elderly. Pedestrians followed by the riders were more likely to acquire injuries. The motorcyclists were more likely to acquire injuries than those that used vehicles. Injuries were more likely to occur in the evening and morning hours of the day. Head injuries were the most common injuries.

5.3 Recommendations

Distribution of reported RTIs cases

Given the high prevalence of RTIs among younger individuals (ages 21–30), there is need to implement age-targeted road safety campaigns focusing on safe driving behaviors, helmet and seatbelt use, and reducing risky practices like speeding and drunk driving. Collaborating with schools, universities, and workplaces could extend outreach to this age group effectively.

Since males are disproportionately affected by RTIs, there is need to develop prevention programs that address common causes of accidents among men, such as aggressive driving and the use of motorcycles (boda bodas) without protective gear. Encourage partnerships with boda boda associations to increase compliance with helmet usage and other safety measures.

Ensure hospitals and emergency responders are equipped and trained to handle high fatality injuries like head and upper limb trauma. Emergency care units could benefit from specialized equipment, resources, and training for the treatment of head injuries, which could potentially improve patient outcomes.

For injuries that tend to be severe, such as neck, chest, abdomen, and lower limb injuries, there is need to establish trauma response protocols that prioritize rapid assessment and intervention. Improving access to imaging technology and trauma kits in emergency departments could enhance care for severe injuries and potentially reduce long term disabilities.

To prevent injuries involving lower limbs, spine, and pelvis, there is need to prioritize road safety enhancements in accident-prone areas, such as installing speed bumps, clear signage, and barriers. Increased traffic law enforcement could deter dangerous driving behaviours and reduce the incidence of severe injuries on busy roadways.

Trend of RTIs

Since RTI cases tend to spike after the festive season (January–February) and midyear (May–July), traffic authorities should increase patrols and implement stricter speed and alcohol checks during these high-risk times. This can also include campaigns to remind drivers to practice safe driving as they return from holidays or during periods of increased travel.

There is need to conduct community outreach programs before anticipated high risk months to educate the public on the dangers of speeding, impaired driving, and distracted driving. These campaigns should be reinforced annually, targeting common periods of RTI increases.

To address the predictable increase in RTI cases during certain months, hospitals should consider temporarily increasing resources and staffing in emergency departments to accommodate the higher demand. This proactive approach can help improve patient outcomes by reducing overcrowding and enhancing patient care efficiency.

COVID – 19 lockdowns demonstrated a clear link between vehicle movement and RTI rates. Post lockdown, authorities could consider implementing permanent speed restrictions and high risk area monitoring based on traffic density data. Areas with historically high RTI rates should be prioritized for safety interventions like improved signage, speed humps, and clear road markings.

Given the increase in RTI cases as movement restrictions lifted, reviewing and strengthening traffic regulations could mitigate the adverse effects of increased road usage. Introducing or reinforcing penalties for speeding, distracted driving, and lack of helmet/seatbelt use may help reduce RTIs as more vehicles return to the roads.

To reduce road congestion and potential RTIs, urban planning authorities should promote the use of safe public transportation, bike lanes, and pedestrian friendly zones, especially in high density areas. Encouraging alternatives can reduce vehicular traffic and minimize the overall risk of RTIs.

Factors associated with daily reported RTIs

Given that young male patients, especially motorcyclists and pedestrians, are at higher risk of RTIs, there is need to implement targeted safety education and outreach programs for these groups. Partnering with motorcycle (boda boda) associations could help promote helmet use, safe riding practices, and adherence to traffic rules. Pedestrian safety campaigns should also highlight the importance of using crosswalks and staying alert in high traffic areas.

Since most injuries occur during the morning and evening hours, local traffic authorities should increase patrols and safety checks during these peak times. This could include sobriety checkpoints, speed monitoring, and ensuring motorcyclists wear helmets and obey traffic signals.

Prioritize the construction and maintenance of sidewalks, pedestrian crossings, and clear signage in high traffic areas to reduce pedestrian injuries. Installing pedestrian bridges or underpasses in areas with heavy foot traffic could also help in minimizing collisions between pedestrians and motorized vehicles.

Since head injuries are the most common, healthcare facilities should be equipped with adequate trauma and neurology resources to manage these cases. Emergency medical personnel should receive specialized training in handling head trauma cases to improve patient outcomes. Additionally, policy initiatives to mandate and enforce helmet use for both motorcycle riders and their passengers can be impactful.

Developing and enforcing mandatory training programs for motorcyclists on defensive driving, helmet use, and road safety could help reduce accident rates. Licensing authorities could implement regular safety training as part of license renewals to keep motorcyclists informed of safety protocols and regulations.

Implement traffic calming measures like speed bumps, rumble strips, and traffic lights in areas with high pedestrian and motorcycle traffic. Better street lighting and visible road signs can also help reduce accidents during high-risk evening hours.

5.4 Suggestion for further study

A more detailed qualitative study is required among the accident victims admitted at the facilities to identify the factors that could lead to accidents

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UGANDA CHRISTIAN UNIVERSITY

A Centre of Excellence in the Heart of Africa

26/08/2022

To: Doreen Mbabazi Ssebuliba

Kyambogo University
+256782734682

Type: Initial Review

Re: UCUREC-2022-341: Forecasting Model For Reported Road Traffic Injuries (RTIs) in Kampala, Uganda (2010 – 2021), 2, 2022-08-12

I am pleased to inform you that the Uganda Christian University REC, through expedited review held on **18/08/2022** approved the above referenced study.
Approval of the research is for the period of **26/08/2022** to **26/08/2023.**

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

1. All co-investigators 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 re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **26/08/2023** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Uganda Christian University REC:

DATA COLLECTION FORM

Qn1. Hospital name

☐ Nsambya

☐ Mulago

☐ Lubaga

☐ Naguru

Qn2. Date of accident
yyyy-mm-dd

Qn3. Time of incident
hh:mm

qn4. Date of admission
yyyy-mm-dd

qn5. Time of admission
hh:mm

qn6. Date of discharge
yyyy-mm-dd

qn7. Time of discharge
hh:mm

qn9. Date of death
if any
yyyy-mm-dd

qn10. Time of death
hh:mm

Patient profile

qn11. Gender of the patient

☐ Female

☐ Male

Qn12. Age group

- ☐ >5 years
- ☐ 5-<10
- ☐ 10-<19
- ☐ 20-<29
- ☐ 30-<39
- ☐ 40-<49
- ☐ 50-<59
- ☐ >60

Qn13. Occupation

- ☐ Government employee
- ☐ Private employee
- ☐ Self employed
- ☐ Others specify

Qn14. Others specify

………
……………………

Qn15. Method of reaching hospital

- ☐ Ambulance
- ☐ Police
- ☐ Private transport
- ☐ Public transport
- ☐ Walk in
- ☐ Other law enforcer

Qn16. Others specify

………
…………………

Qn16. Place where accident occurred

………
…………………

Qn17. Category of the victim injured

☐ Driver

☐ Passengers

☐ Pedestrian

Qn18. Alcohol or drug use by patient

☐ Yes

☐ No

Qn19. Mechanism of injury

☐ Bicycle

☐ Motor-cycle

☐ Vehicle

☐ Others (specify)

Qn20. Others specify

………
………

Qn22. Severity of injury

☐ Mild

☐ Moderate

☐ Severe

☐ Fatal

Qn23. Outcome

☐ Out-patient

☐ In-patient

☐ Specialist unit

☐ Mortuary

Qn24. Anatomical area affected

☐ Head

☐ Neck

☐ Chest

☐ Abdomen

☐ Upper limb

☐ Lower limb

☐ Spine

☐ Pelvis

☐ Genital

☐ Skin

☐ General/systemic

☐ Others (specify)

Qn25. Others (specify)

……
………………

Qn26. Systolic blood pressure

☐ >89

☐ 50-89

☐ 1-49

Qn27. Respiratory rate (breathing/min)

☐ 10-29

☐ >-30

☐ <-9

Qn28. Neurological status

☐ Alert

☐ Responds to verbal stimuli

☐ Responds to painful stimuli

☐ Unresponsive

Qn29. Laboratory investigations/specimens

☐ Alcohol

- [ ] Ballistics
- [ ] DNA
- [ ] Drug levels
- [ ] Enzymes
- [ ] Full blood count
- [ ] HIV
- [ ] Liver function test
- [ ] Microbiology
- [ ] Toxicology
- [ ] Urea and electrolytes
- [ ] Urinalysis
- [ ] X-rays
- [ ] Others (specify)

Qn30. Others (specify)

………
……………………

Medical treatment

Qn31. Antibiotic

- [ ] Yes
- [ ] No

Qn.32 Tetanus toxoid

- [ ] Yes
- [ ] No

Qn33. Post-coital contraceptives

- [ ] Yes
- [ ] No

Qn34. Sexually transmitted infections (STI)

☐ Yes

☐ No

Qn35. Not applicable

……
…………………………..

Qn36. Patient disposition in the casualty

☐ Treated and sent home

☐ Admitted

☐ Died in causality

☐ Referred to another institution

☐ Dead on arrival

☐ Others specify

Qn37. Others specify

……
…………………..

Qn38. Outcome after two weeks

☐ Discharged

☐ Died

☐ Still at hospital

Qn39. Surgical procedure performed

☐ Yes

☐ No

Thank You!