CRITICAL CARE SERVICES AND HEALTH OUTCOMES AMONG ROAD TRAFFIC ACCIDENT PATIENTS MANAGED AT KENYATTA NATIONAL HOSPITAL NAIROBI, KENYA

EUNICE IBANDA CHELOGOI

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Critical Care Services and Health Outcomes among Road Traffic Accident Patients Managed at Kenyatta National Hospital Nairobi, Kenya

Eunice Ibanda Chelogoi

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DECLARATION

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

Signature ---------- Date ----------

Eunice Ibanda Chelogoi

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

Signature ---------- Date ----------

Prof. Simon Karanja, PhD

JKUAT, Kenya

Signature ---------- Date ----------

Dr. Yeri Kombe, PhD

KEMRI, Kenya

DEDICATION

This work is dedicated to my husband Jacob, Children Joseph, Steven, Catherine, Tony and my parents for their unconditional support during my research.

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LIST OF ABBREVIATIONS / ACRONYMS

AKI	Acute Kidney Injury
ATLS	Advanced trauma life support
CCU	Critical Care Unit
CDC	Centers of Disease Control and prevention
CT	Computed Tomography
CT SCAN	Computed Tomography Scan
DALYs	Disability Adjusted Life Years
DIR	Division of Injury Response
EBIC	European Brain Injury Consortium
ED	Emergency department
EOC	Emergency Operations Centre
EU	European Union
GCS	Glasgow Coma Scale
HCW	Health care workers
ICU	Intensive care Unit
ISS	Injury Severity Score
JH-IIRU	John Hopkins International Injury Research Unit
KNH	Kenyatta National Hospital

LMICs	Low and middle income countries
MRI	Magnetic Resonance Imaging
MVA	Motor vehicle accidents
ROSNEK	Road safety network of Kenya
RTA	Road traffic accident
RTI	Road traffic injuries
SHI	Severe head injury
SPSS	Statistical Package for Social Science
TBI	Traumatic brain injury
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Critical Care Unit: Critical care units (CCUs) are specialized hospital wards. They provide intensive care (treatment and monitoring) for people in a critically ill or unstable condition**.** CCUs are also sometimes known as Intensive Care Units (ICUs) or intensive therapy departments or part of a ward

Critical Care Unit Services: Services provided to critically ill patients including mechanical ventilation, Cardiac monitoring, hemodialysis, various urgent investigations, specific treatments and nursing care

Mechanical Ventilation: Can be defined as the technique through which gas is moved toward and from the lungs through an external device connected directly to the patients

RTA proportion: Proportion of RTA patients in CCU during the study period.

Length of CCU admission: Period taken from when a patient is admitted to CCU till discharge to the ward or death in CCU.

Severe Head Injuries: Head injury with a GCS of below 8

Disability: An individual's inability to carry out a normal range of daily activities due to physical and/or psychological sequelae.

CT scan:	A painless X-ray test in which a computer generates cross-section views of a patient's anatomy that can identify normal and abnormal structures
Tracheostomy:	Artificial airway created to the trachea to provide alternative passage of air
Craniotomy:	Surgical incision to the cranium
Patient outcomes:	Denotes the result of treatment that includes recovery and subsequent discharge to the wards or death in CCU
Glasgow coma scale:	A neurological scale which aims to give reliable and objective way of recording the conscious state of a person for initial as well as subsequent assessment

ABSTRACT

Road traffic accidents (RTA) are rapidly growing posing a public health problem since it is projected to become the third leading cause of morbidity and mortality by the year 2020 (WHO, 2013). There is inadequacy of public health infrastructure in providing treatment for road traffic injured patients in developing countries. Kenyatta National Hospital (KNH) receives the bulk of Road traffic accident patients due to its public status and proximity to major highways and has a 21 bed general Critical Care Unit (CCU). Despite prevention measures, RTAs have increased sharply placing a heavy toll on KNH. It is likely that CCU services are overstretched. The aim of this study was to determine adequacy of critical care services and health outcomes of RTA patients managed at KNH. A retrospective cohort study was adopted. Qualitative data was collected through in-depth interviews with CCU managers. Quantitative data was collected through a desktop review of patients' files, admission and discharge record book using a data collection sheet. The study was carried out in the Critical care unit at KNH on RTA patients admitted to the CCU in 2013. Quantitative data was analyzed using SPSS version 21 and Chi square tests, while qualitative data was analyzed using thematic analysis. Descriptive statistics, pie charts and bar graphs were used to present data. Head Injuries accounted for up to 97.5% of all RTA patients in CCU. The number of males was significantly higher (78.9%) compared to female, χ^2 0.05, 1, = 23.7, P <0.005. The mean age of the RTA patients was 30 years. Age below 40 years was significantly associated with GCS below 8 on admission, P< 0.01. Majority of the patients (49.3%) had primary school level of education while 36.6% had secondary school level of education. Those who were self-employed accounted for 40.8% of the total patients while 38% were unemployed. Most patients (69%) were referred from other hospitals which was significantly associated with GCS below 8 (p<0.05). The average waiting time to CCU admission was 80.2 minutes. The mean CCU stay was 18 days. Mortality rate among the RTA patients was 36.6%. Complications recorded among the patients included Sepsis (35.2%), electrolyte imbalances (35.2 %) and anemia (22.5%). The overall CCU services included CT scans (95.8%), X-Rays, Blood work up, Physiotherapy, Surgery, Nursing, Nutritional and Medical. The most common consultations were Neurosurgical (57.7%) and Orthopedic (31%). Challenges of caring for RTA patients included; Shortages of equipment like beds, suction machines, infusion pumps, patient feeds and drugs. Lack of team work, low staff to patient ratios, long stay patients and inability to pay for services were reported. The mean cost of CCU management was Ksh .450, 195.67. Road traffic injuries remain a huge burden in CCU's in Kenya due to high morbidity, high cost of management and mortality. More resource allocation to referral and county CCU's, team work, decentralization of CCU's and enhanced evacuation can improve the outcomes of the patients.

CHAPTER ONE

INTRODUCTION

1.1 The Background

According to the global status report on road safety 2013, a Road Traffic Injury (RTI) is a fatal or non-fatal injury incurred as a result of a collision on a public road involving at least one moving vehicle. Children, pedestrians, cyclists and the elderly are among the most vulnerable road users (WHO, 2013; Kariuki, 2013). Lives of almost 1.24 million people are cut short as a result of road traffic crashes annually. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury (WHO, 2013; Shrivastava et al., 2014). Road traffic injuries are predictable and largely preventable yet neglected from the global health agenda. Evidence from many countries show that dramatic success in preventing road traffic crashes can be achieved through concerted efforts that involve the health sector and other sectors (WHO, 2002).

Only 28 countries, covering 7% of the world's population, have comprehensive road safety laws on five key risk factors: drinking and driving, speeding, and failing to use motorcycle helmets, seat-belts, and child restraints (WHO, 2013). RTAs are a major cause of severe head injuries (SHI) among Kenyan citizens mostly in the productive age comprising 14.3% of adult ICU/HDU admissions, most frequently in young men (Kariuki, 2013). Traumatic brain injury (TBI), according to the World Health Organization (WHO), will surpass many diseases as the major cause of death and disability by the year 2030. About 10 million people are affected annually by TBI imposing a burden of mortality and morbidity on society, making TBI a pressing public health and medical problem (Hyder et al., 2007). The burden of this often neglected injury disproportionately affects low and middle income countries (LMICs) which face a higher risk for TBI and also have less developed health systems to deal with the

associated health outcomes (Hyder et al., 2007; Prasanthi & Hyder, 2008). Therefore, both the incidence of TBI and the case-fatality from TBI can be high and devastating (Hyder et al., 2007; Prasanthi & Hyder, 2008).

Currently, Kenya ranks among countries with the highest rate of road traffic crashes globally with an average of 3,400 deaths annually (WHO, 2013). A report released by JICA indicated that there has been an increase in serious and fatal RTIs comparing 2012 to 2014 statistics (Saidi et al., 2014). However, Comparative Statistics from the National Transport and Safety Authority (NTSA) show that there has been a decline in the number of RTAs in Kenya. Daily reports indicated that by 12th august 2014, the number of victims involved in RTA was 9079 in 2013 compared to 7206 by august 2014. The report further indicated that the mortality from RTA was 1954 by August 2013 compared to 1717 by august 2014 (NTSA, 2014).

1.2 Statement of the Problem

Low and middle income countries face a higher risk for TBI and therefore the incidence of TBI and the case-fatality from TBI can be high and devastating (Hyder et al., 2007; Prasanthi & Hyder, 2008). The total annual costs of road crashes to low-income and middle-income countries are estimated to be about US$ 65 billion, which is more than the total annual amount received in development assistance. Road crashes in developing countries are more than double that in developed countries at 13.4/100,000 and 32.2/100,000 people in Europe and Africa respectively (Kariuki, 2013).

The picture in Kenya is not any different from the findings in other countries. Road traffic injuries (RTI) are on the increase in developing countries putting pressure to health care facilities which are poorly equipped to provide the needed services (Macharia et al., 2009). Though there have been improvements in health care delivery systems in Kenya, many hospitals still refer patients to hospitals with better facilities like KNH (Muga, et al., 2004).

Road traffic accidents have continued to occur despite the current prevention strategies. This sharp rise of RTAs has taken a heavy toll on KNH (Jamah, 2012). Kenyatta National Hospital (KNH) receives eight cases of serious injuries on average every day (Jamah, 2012). These state makes it difficult for doctors to attend to other needy cases as their time and theatre is taken up by the trauma cases, many of which are avoidable road accident cases (Jamah, 2012). Studies have shown that trauma was the leading cause of admission to ICU especially patients with head injuries and was associated with very high mortality rates (Ebrim & Ojum, 2012). Disability may occur after the initial head injury and surviving patients with brain injury are more impaired than patients with injuries to other parts of the body (Bowley & Boffard, 2002).

As a national referral hospital managing other terminal medical conditions, the continued operations disruption caused by road traffic accident victims, is alarming and it is a high time to seek a multi-sector approach to curb these accidents (Jamah, 2012). The management of road accident victims remains a highly expensive and disruptive effort given that normal services such as scheduled theatre services have to be postponed to attend to the critically injured victims. The cost on the economy is also high as accident victims management involves Intensive Care Unit facilities, expensive medical consumables and recalling of off duty clinical staff to attend to the injured. Lack of proper medical finance schemes has also put a heavy financial strain on KNH as most of the patients seen in KNH are unable to pay for the services (Jamah, 2012). Globally, poor population groups tend to bear a disproportionately higher burden of road traffic injury morbidity and mortality (Macharia et al., 2009).

1.3 Justification

According to road safety network Kenya statistics 2013, approximately 26,000 crashes occur annually with over 3000 fatalities and 9000 serious injuries (Kariuki, 2013). Kenya has one of the highest road fatality rates in Africa with 68 deaths per 10,000 registered vehicles (Kariuki, 2013). However, some road crashes are not reported to the

police; particularly crashes involving vulnerable road users such as pedestrians, pedal cyclists and motorcyclists, as well as victims who have mild injuries (Osoro et al., 2011). Reports have shown that serious injuries from RTA have increased from 2030 in 2012 to 2624 in 2013. Fatal and serious injuries have also increased from 4106 in 2012 to 5533 in 2013 (Japan International Cooperation Agency, 2013).

World Health Organization has realized the magnitude and the global distribution of the problem and supports the current decade 2011-2020 as the Decade of Action for road safety, with a target of stabilizing and decreasing the estimated magnitude of morbidity and mortality by intensifying the global efforts on national and international platform (WHO, 2013). The primary step is to develop a surveillance network for data collection to identify the causative factors and estimate the accurate magnitude of RTA so that rational policy can be planned for achieving the best possible allocation of limited resources, especially in developing countries (WHO, 2013).

A Sharp rise in road traffic accidents in the month of April 2013, took a heavy toll on KNH (WHO, 2013). Kenyatta National Hospital is a preferred hospital for many people in Kenya because of its proximity and public status. The hospital receives the bulk of road accident victims from Nairobi and its environs which is a region with a high rate of road accidents from surrounding major highways (WHO, 2013). The hospital spends Sh10 million every week to treat victims of road accidents (Odero et al., 2013). The hospital was reported to receive up to 40 injured patients from several accidents in a span of 12 hours in one night and about 216 accident victims in three weeks which was alarming (Odero et al., 2013). Most of the RTA patients are unable to pay for the ICU and treatment services. Medical staffs have to work extra hours attending to the patients.

The cost of dealing with the consequences of these crashes, including trauma care, is in the billions of dollars. While road safety issues have recently begun garnering more attention, the reality is that road injuries are responsible for more than one third of the world's injury burden. These shocking numbers are unacceptable and represent a call to action for the global health community (John Hopkins International Injury Research Unit, 2013). Severely injured RTA patients require quality care in the CCU to improve their outcomes. Studies have indicated that institution safety measures should be complemented with satisfactory treatment facilities for victims and have advocated for improved equipment and better training for ICU personnel (Ebrim & Ojum, 2012). This research aims at assessing the critical care services and health outcomes of RTA patients at KNH Considering the fact that KNH is a National referral hospital that serves both local and international patients and has a general CCU.

1.4 Research Questions

1. What are the types and severity of injuries among RTA patients managed in CCU at Kenyatta National Hospital?
2. What are the CCU services provided to RTA patients at KNH?
3. What are the health outcomes of road traffic accident patients in CCU at KNH?
4. What are the challenges encountered by health care workers caring for RTA patients in CCU-KNH

1.5 Objectives

1.5.1 Broad Objective

To determine the Critical Care services and health outcomes among road traffic accident patients managed at Kenyatta National Hospital

1.5.2 Specific Objectives

1. To determine the types and severity of injuries among RTA patients managed in CCU at Kenyatta National Hospital
2. To determine adequacy of Critical Care Unit services offered to road traffic accident patients in Kenyatta National Hospital
3. To determine the health outcomes of RTA patients managed at CCU in KNH
4. To determine the challenges facing health care workers caring for patients with road traffic injuries in CCU.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The world health organization Global Status on the road safety (WHO, 2009), reports that approximately 1.3 million lives are lost annually due to road traffic accidents across the globe. The report termed this ironical as 90% of the accidents occur in developing countries a region which only consists of 48% of the vehicles registered in the world (WHO, 2009). Road traffic injuries are on the increase in developing countries including Kenya and critical care services need to be satisfactory in order to reduce morbidity and mortality in CCU. Increase in RTAs is likely to affect the health care services in terms of required emergency and critical care services to manage victims of Road Traffic Injuries (RTIs) hence poor health outcomes (Hunter New England Planning Unit New South Wales, 2006).

2.2 Types and severity of injuries

Patients who sustain serious injuries that compromise cardiac, respiratory and brain functions require admission to CCU for stabilization and mechanical ventilation. A research carried out in Tanzania concluded that trauma resulting from road traffic crashes is a leading cause of intensive care utilization in the hospital (Ebrim & Ojum, 2012; Chalya et al., 2012).

Urgent preventive measures targeting reduction of the occurrence of RTAs are necessary to reduce ICU trauma admissions. Improved pre- and in-hospital care of trauma victims will improve the outcome of trauma patients admitted to ICU (Chalya et al., 2012; Gilyoma et al., 2011). Most of the patients admitted in CCU have severe head injuries. Studies done in other countries have shown that head and neck injuries from road traffic

accidents are the most common cause of morbidity and mortality in most developing countries and may also result in temporary or permanent disability (Bener et al., 2008).

Other Studies indicate that head and neck injuries are followed by lower extremity injuries (Bener et al., 2008). This is consistent with findings in New Delhi where the most common pattern of injury was head (18.9%) followed by fractures of lower limb (17.8%) (Osoro et al., 2011). Head injuries are commonly associated with facial fractures which can be markers for brain injury (Chandra & Reddy, 2008).

In the western world, the most common cause of death after trauma is severe brain injury. The incidence of death from head injury is approximately 7 per 100,000, and the severely brain-injured also have the highest mean length of stay and mean hospital costs (Bowley & Boffard, 2002). In the European Brain Injury Consortium (EBIC) study, 52% of head injuries were related to Motor Vehicle Accidents (MVAs). Head injury is a major cause of morbidity and disability in survivors. Surviving patients with brain injury are more impaired than patients with injuries to other parts of the body. Patients with mild head injuries may also deteriorate worsening the situation (Bowley & Boffard, 2002). A prospective study of nearly 3000 head injuries from Scotland showed that 1260 (90%) out of 2668 with mild head injuries became disabled (Bowley & Boffard, 2002).

The United States Major Trauma Outcome Study estimated the incidence of acute spinal-cord injury to be 2.6% of blunt trauma patients. The average lifetime costs of treating an individual with traumatic spinal-cord injury is estimated to be between US$500 000 and US$2 million (Bowley & Boffard, 2002). Rehabilitation after spinal injury requires a multidisciplinary approach to reduce morbidity from the psychological and physical problems which demands huge resources that are unaffordable to developing countries (Bowley & Boffard, 2002). Injury to the carotid and vertebral arteries after blunt trauma can lead to severe neurological complications in survivors and has a mortality rate of 31%. A high index of suspicion for these injuries and early

treatment with systemic heparinization improves patient outcomes (Bowley & Boffard, 2002).

In modern day civilian trauma centers, thoracic injury accounts for 20-25% of deaths due to trauma; thoracic injury or its complications are a contributing factor in a further 25% of trauma deaths. The mainstays of management are supplemental oxygen, intercostal drainage, good physiotherapy and pain control (Bowley & Boffard, 2002).

Fractures of the pelvis are increasingly recognized as a marker of severe injury, as the force required to disrupt the pelvic ring is substantial. A high index of suspicion must be maintained for pelvic fracture, based on the history of the accident (Bowley & Boffard, 2002). External fixation of an unstable pelvic fracture should be considered as early as possible. Returning the bony components of the pelvis into stable apposition enables hemostasis to occur. Angiography and selective embolization of bleeding vessels is an important adjunctive maneuver in major pelvic fracture. Assessment of the abdomen by diagnostic peritoneal lavage or CT scan for significant intra-abdominal injury is important (Bowley & Boffard, 2002). A study carried out in Bugando in Tanzania found that patients with severe trauma and those with long bone fractures stayed longer in hospital (Chalya et al., 2012). It further reported that age of patient, severe trauma admission blood pressure of below 90 mmhg (systolic) influenced mortality significantly (Chalya et al., 2012).

2.3 Critical Care services

CCU is a specially designed unit with fitted equipment like monitors, oxygen points and ventilators. Considering the delicate state of health of patients requiring admission to CCU, there must be a confirmed ready bed to admit the patient before any transfer is made from the emergency room, operating room or the ward.

Kenya has limited ICU facilities compared to its population. Currently the Kenyan population of 40 million people has 37 functional ICU beds in public hospitals and a

further 57 bed in private and mission hospitals (www.criticalcarekenya.org).WHO recommends that for every 50 patients in general wards, there should one ICU bed (www.criticalcarekenya.org).

Each ICU bed is set up with a ventilator, a cardiac monitor, at least 2 drug pumps and suction apparatus (www.criticalcarekenya.org). Close monitoring of the patient may include using machines such as cardiac monitors to monitor the heart's output, respiratory ventilator to help the patient breathe and hemodialysis machine to provide the kidney function when the kidney functions are affected. Suction machines are used to clear secretions in patients who are unable to cough (www.criticalcarekenya.org).

According to the critical care Kenya organization (CCK), some machines that should be available in ICU include; a portable x-ray machine, ultrasound/Doppler machine, a 12 Lead ECG machine, a hemodialysis machine and should be near a CT scan machine (www.criticalcarekenya.org). ICU also works closely with other specialties in the hospital to provide everyday care to the patients, ensuring comfort, privacy and dignity. Nurse to patient ratio in CCU should normally be one to one (1:1) (www.criticalcarekenya.org; Middleton, 2012) to ensure hygiene standards are maintained, such as nursing care, washing and mouth care. Physiotherapy is used to help increase the patient's mobility, breathing capability or muscle development (www.criticalcarekenya.org; Middleton, 2012).

Hughes reports that some Care that is provided for patients in CCU includes the following;

- Hemodynamic and fluid volume monitoring
- Temperature control to reduce oxygen demand
- Respiratory care through mechanical ventilation to prevent hypoxia commonly caused by inadequate airway clearance
- Blood sugar control and monitoring

- Sedation to control environmental stimulation of patients.
- Positioning patients depending on the diagnosis (Hughes, 2002).

Management of a trauma patients requires a team of specialized doctors; Neurosurgeons will examine the patient to determine the extent of the brain injury; trauma surgeons will examine the patient for additional injuries. Internal medicine doctors, ophthalmologists (eye doctors), or neurologists, may be called in to examine the patient. During hospital care, intravenous lines and fluids will be started (Puri et al., 2013). The patient will have blood tests, x-rays, CT scans and MRIs to see if there are any fractures, swelling or bleeding of the brain. Both the CT scan and MRI can be very useful and may be done several times while the patient is in the ICU. The machines that perform the CT scans and the MRIs may not be located in the ER or ICU so the patient may need to be transported in their bed to the X-ray department. Nursing and other staff will take the patient to these tests and stay while the tests are being performed. This means that there must be adequate staff allocation to be able to meet all the patient needs. Movement of such patients who are mechanically ventilated requires a team of well-trained experts in critical care (Puri et al., 2013).

A public health emergency operations center (EOC) is a central location for coordinating operational information and resources for strategic management of public health emergencies and events. The operations center provides communication and information tools and services and a management system during a response to an emergency or event. They also provide other essential functions to support decision-making and implementation, coordination, and collaboration. Because CDC recognizes that injuries continue to occur, despite efforts on prevention the Division of Injury Response (DIR) at CDC's Injury Center seeks to improve outcomes for those who have survived severe injuries and to improve acute injury care practices (Center for Disease Control and Prevention, 2014). To meet this challenge, DIR works with national and international organizations spanning the continuum of injury prevention and acute injury care, including those responsible for emergency medical services and emergency

medicine and trauma surgery, other public health organizations, other federal agencies, and the corporate sector (Center for Disease Control and Prevention, 2014).

According to a research carried out in both public, private and faith based health care institutions, RTIs are on the increase in developing countries. Health care facilities are poorly equipped to provide the needed services (Macharia et al., 2009). It further concluded that availability of basic trauma care medical supplies in public facilities was highly deficient (Macharia et al., 2009).

Studies suggest that the inadequate medical and technical equipment of most ICUs in low resource economies substantially contribute to the high mortality rate of critically ill patients in such countries (Hunter New England Planning Unit New South Wales, 2006). Facilities in the Tanzanian ICU were reported to be limited and obviously insufficient to cope with the number of patients being admitted (Gilyoma et al., 2011). Professional bodies and associations in the UK recommend that every patient in a critical care unit has access to a nurse with a post-registration qualification in the specialty, and that there is a ratio of 1:1 for ventilated patients (Lagarde, 2007).

Low-cost improvements in training have led to a decreased mortality rate due to injuries. This has worked in the Trinidad where they implemented a two-day-in-service course in the Advanced Trauma Life Support (ATLS) which decreased mortality rate among the most severely injured patients from 67% to 34% (Ali et al., 1993; American College of Surgeons Committee on Trauma, 1997).

Lack of proper planning when it comes to the vital resources required for the treatment of the life-threatening injuries is one of the factors that increase mortality rate (Quansah, 2001). Another study conducted in Khon Kaen in Thailand stated that administrative changes including improving the communications within the hospital setting, stationing of the fully trained surgeons in the emergency room during the peak periods of the accidents or tragedy, improved trauma orientation for junior doctors, and improved

reporting through a trauma registry led to the decreased mortality rate from 6.1% to 4.4% (Chardbunchachai et al., 2002).

The general outcome of RTA patients in CCU is poor. Limitations that explain the poor outcome for people involved in RTA in Africa have been identified as; lack of trained surgeons, intensive care staff, field paramedics, inappropriate dedicated transportation and disorganized or nonexistent emergency and trauma services (Largade, 2007).

2.3.1 Waiting time

A Waiting time of 30 minutes for a general outpatient clinic was considered as reasonable (Jamah, 2012), but should be shorter for emergency visits. Waiting time in emergency department may stretch up to 3 hours before completion of necessary procedures. Heavy workload, unavailability of essential trauma management resources and low staff morale can cause long waiting time observed in outpatient departments (Jamah, 2012).

According to an audit report on KNH in 2012, it was noted that KNH had not established and documented important operational standards and guidelines essential for efficient delivery of services. Among the missing operational standards are those on waiting-time as well as policies and guidelines on admission and discharge of patients.

2.3.2 Emergency Care Services

Generally, during emergencies, patient care should be attended to according to severity of their injuries or illness. Patients with severe injuries that are life threatening should be given first priority. Many health institutions response to care for injured patients is slow and haphazard (Macharia et al., 2009).

2.3.3 Laboratory and Radiological Investigations

Diagnostic investigations done on RTI casualties include: X- ray, CT scans, MRI, blood counts, grouping and cross matching. These investigations are costly and usually a patient needs to pay for them before they are done. The availability of computed tomography (CT) scanning has been shown to reduce mortality in patients with acute extradural hematoma, as the time taken to diagnose and evacuate an intracerebral hematoma is critical in determining outcome. However, the majority of patients with brain injury do not have a lesion suitable for neurosurgical intervention (Bowley & Boffard, 2002).

An understanding of the concept of secondary brain injury, caused by hypotension and hypoxia is fundamental in the management of all trauma patients. Treatment of a head-injured patients should emphasize early control of the airway (while immobilizing the cervical spine), ensuring adequate ventilation and oxygenation, correcting hypovolemia and prompt imaging by CT scan (Bowl ey & Boffard, 2002).

2.3.4 Surgery and Theatre Service

These should be available as needed since it is a life saving measure. The hospital has three theatres; for trauma cases, maternity cases and a general theatre. The surgeries required by RTA patients include; Craniotomies, evacuation of hematomas, elevation, Burr holes, internal /external fixation, surgical debridement, surgical toilet, open reduction of fractures and tracheostomies.

2.4 Outcomes of RTA patients

2.4.1 Proportion of RTA patients

In Tanzania, road traffic accidents account for 56% of all patients admitted to Muhimbili Medical Centre due to injuries (Museru et al., 2002). Road accident victims in KNH were reported to be taking up to 98 per cent bed occupancy at the expense of open-heart surgery, kidney transplant and neuro-surgery patients (Museru et al., 2002). Patients who sustain life threatening injuries are admitted in CCU. The patients take a long time to recover and so end up occupying the beds for longer.

The anticipated duration of hospital stay among in patients for over one month was 51.9 % of RTI patients (Macharia et al., 2009). Casualties affected by RTA account for 45-60 % of all admissions in surgical Wards in Kenya and up to 75% in national spinal injury placing a high demand on hospital resources (Odero et al., 2013). There is also a tendency towards transfer of long stay patients from private to public hospitals due to financial constraints (Macharia et al., 2009). Studies have reported that patients with head injuries are the most likely trauma patients to be transferred to KNH for specialized investigation and critical care (Saidi et al., 2014).This transfers further increases the bed occupancy and duration of stay since these patients are usually chronically sick.

2.4.2 Mortality due to road traffic injuries

Mortality in the Intensive care unit is high because of the number of admissions at the facility (Tomlison et al., 2013). Another study stated that the length of stay in Intensive care unit is also associated to the mortality rate (Size et al., 2005).This is as a result of the critical conditions in which the patients are admitted with and hence they are irreversible (Size et al., 2005).

Mortality rate is also associated to the weaknesses in the scoring of the severity of the injuries as a result of the accidents in the resource-limited countries due to the lack of or inadequate laboratory services which are able to score the severity of the injuries (Ilori & Kalu, 2012; Klenke, 2008).

There are three phases of deaths from severe injuries;

Phase 1.Deaths occur immediately or occur quickly as a result of overwhelming injury;

Phase 2 Deaths occur during the intermediate or sub-acute phase. These deaths occur within several hours of the event and are frequently the result of treatable conditions;

Phase 3 Deaths are delayed. Deaths during this phase often occur days or weeks after the initial injury and are the result of infection, multisystem failure or other late complications of trauma (Hughes, 2002).

2.5 Challenges Facing Health Care Workers

By 2020, road traffic injuries have been forecasted to become the second leading cause of Disability-Adjusted Life Years lost in developing countries and decreasing the burden of injuries is one of the main challenges for public health in the next century (WHO, 2013). RTA patients with severe injuries requiring CCU admission are likely to die from the injuries. For those who survive, recovery takes long. Their treatment in CCU is also very costly. The cost of the many radiological investigations, laboratory investigations and prolonged hospital stay also contributes to the high cost. An interview by the daily nation dated 26th Aug 2013 with an ICU expert revealed that the minimum daily cost of an ICU bed is Ksh.3000 and Ksh.30, 000 in public and private hospitals respectively. Lack of trained staff was also named as a challenge (NSO, 2011).

Patients are also predisposed to nosocomial infections because of many invasive treatments like central venous catheters, urinary catheterization and prolonged intubation. Accidents are straining KNH and University of Nairobi School of Health Sciences medical staffs who work extra hours attending to the victims. Patients with injuries from RTA are at risk of sudden deterioration especially those with traumatic brain injuries. This calls for the critical care staff to have a thorough knowledge of dynamics of intracranial pressure and the factors associated with its increase to properly manage it (Hughes, 2002).

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter explains the research methodology used in conducting the research.

3.2 Study Site

The study was carried out at the Kenyatta National Hospital in the Critical Care Unit. Kenyatta National Hospital is located in Nairobi, about 3 km from the city Centre off Ngong road along hospital road. It is the largest referral hospital in east and central Africa serving both local and international citizens. It offers specialized medical and surgical services. It is also a training institution for medical personnel as well as a research institution. Kenyatta National Hospital participates in national policy formulation. The hospital has a staff capacity of about 6,000 and a bed capacity of 1800. Kenyatta National Hospital attends to 600,000 out patients and 89,000 in patients annually. The CCU in the hospital has a general 21 bed capacity where all critically ill patients are attended to. The unit admits cardiovascular, neurological, medical, Obstetric and surgical cases. Both adult and pediatric patients are admitted.

3.3 Study Design

The study was a retrospective cohort study where both quantitative and qualitative methods were used to determine adequacy of Critical care services and health outcomes among road traffic accident patients managed at Kenyatta National Hospital. Quantitative data was gathered from the CCU admission and discharge registers for patients admitted from January 2013 to December 2013. A desk review of Patients' files was used to collect specific patient information that included, age, gender, type and severity of injuries, waiting time to CCU admission, length of CCU stay, cost of CCU

management and health outcomes of the patients. A designed data collection sheet was used to record data from the files. In depth interviews were carried out with the CCU managers who included the consultant in charge, nurse in charge, physiotherapist in charge and nutritionist using an interview guide. These managers were purposively selected because they had the required information. The information sought included data on adequacy and availability of services for RTA patients admitted to CCU and challenges encountered during the study period.

3.4 Study Population

The study population was RTA patients admitted to the Critical Care Unit between January 2013 to December 2013 and the four CCU staff that were in charge of health care personnel who included doctors, physiotherapists, nurses and nutritionists. Files of 113 RTA patients' admitted to CCU between January and December 2013 formed a sampling frame and were used to calculate the sample size. In-depth interview participants were selected purposively because they had the information required for the study.

3.5 Inclusion and exclusion criteria

3.4.1 Inclusion Criteria

- Patients admitted in the critical care unit with road traffic injuries from the beginning of January 2013 and end of December 2013.
- Managers of CCU staff who were involved in direct patient care and consented to participate in the study. These were the Unit Nurse in charge, consultant In charge, physiotherapist and nutritionist In charge

3.5.2 Exclusion Criteria

- Managers in CCU who declined to consent to participate in the study.

3.6 Sample size determination and sampling procedure

The sample population to be used to calculate sample size was all RTA patients admitted in CCU from January 2013 to December 2013.

Sample size determination

Sample size was determined by the formula of Cochran, 1977

$$n=Z^2 (p*(1-p))/d^2$$

Where n = sample size

Z = 1.96 (95% Confidence Interval)

P = 0.143, the proportion of RTA patients admissions in ICU/HDU (Kariuki, 2013).

d= 0.05, degree of desired accuracy

$$n= 1.96^2 * 0.143 * 0.857 / 0.05^2$$

n= 188

CCU- KNH records showed that 113 RTA patients were admitted to the unit in 2013.

Therefore the desired sample size (nf) was determined by the following finite method as used by Cochrane since the population was below 10000.

$nf = n/1_{+}n/N$

$nf = 188/1_{+}188/113$

$nf = 70.57$ or 71

Therefore 71 patients comprised the sample size.

Sampling Procedures

Computer generated numbers were used to randomly select 71 patient files. The patient records/files were used to collect quantitative data using a prepared data collection sheet. CCU is managed by a team comprising of anesthetists, nurses, nutritionists and physiotherapists, laboratory technologists and supportive staff. The team managers of those who are involved in the direct care for the patients were interviewed. Four unit In-charges were purposively selected for In Depth Interview. These were the consultant in charge (Anesthetist), nurse in charge, and physiotherapist in charge and nutritionist in charge. During the interview the participants were tape recorded.

3.7 Variables under study

The dependent variables included patient outcomes such as complications arising, recovery and discharge or death in CCU and length of CCU stay. The independent variables were demographic characteristics, Critical Care Unit services, types and severity of the road traffic injuries and referral status.

3.8 Data Collection Methods and Research Instruments

In depth interview was carried out by the principal researcher where the four CCU in-charges were interviewed using a prepared interview guide. The designed interview guide was used to gather qualitative data about adequacy of critical care unit services, equipment and medications/treatment required staffing issues and challenges encountered while caring for RTA patients.

Quantitative data was gathered from the CCU admission book and patients files which were used to get information on the types and severity of injuries, demographic data, length CCU admission and the outcomes of the patients. A pretest of the checklist and interview guide was carried out in the Emergency ward in the KNH Emergency department which receives similar patients and was not part of the study area. The sample size for the pretest was 10% of the total respondents (7 questionnaires and one interview schedule were used). This was to ensure that the data collected was accurate and reliable. The necessary adjustments on the tools were done accordingly before data collection. Data was collected by the researcher and an assistant who was a nurse. The research assistant was trained on how to collect and enter the data using the checklist. Ethical principles were also explained to the research assistant.

3.9 Data Management and analysis

The principal researcher ensured that all the completed checklists were entered into the statistical software. Data security was maintained through computer backup and a password to protect data from unauthorized manipulation. In-depth interviews were conducted in English. Interviews were recorded. Data analysis was performed by the principal researcher with help of a statistical analyst. Qualitative data obtained from the in-depth interviews was analyzed using thematic analysis.

Quantitative data was analyzed with SPSS version 21.0. Descriptive statistics was used to describe GCS, types and severity of the injuries and length of CCU stay and other outcomes. Chi square tests were used to test for associations. Data was presented in form of tables, bar charts, pie charts and in text form.

3.10 Validity and Reliability of study

Internal validity of the study was achieved by severally reviewing the information collected and recorded during the interviews and also from the patient files. In this study, the external validity was achieved through the use of a randomly selected sample and a wide range of secondary data sources as supported by (Yin, 2003).

Since this research was both quantitative and qualitative in nature, the research was made auditable by frequently checking that interpretations are transferable, credible, confirmable and above all dependable. In addition, the research achieved the reliability by providing an in-depth explanation on the underlying theories and perspectives of the study, and details regarding interviewees' selection and background.

3.11 Ethical Considerations

Clearance for the study was sought from the Ethical Review Committee at KNH – (KNH/UON- ERC). Right to privacy for respondents and strict anonymity and confidentiality was observed on the hospital records. Consent to use hospital records of both adults and children recruited for the study was sought from the KNH management on behalf of the patients. Emphasis on issues of confidentiality and privacy were made clear at the time of consenting to participate in the study. Verbal and written informed consent was sought from all participants to who took part in the In-depth Interviews and for the interview to be recorded. Digital recordings of interviews and transcripts were stored in password-protected computers accessible only by the principal researcher. All the names of participants and places were removed from the transcripts and replaced by unique identifiers. Relevant authorities were notified prior to the data collection.

3.12 Limitations of the Study

Due to limited funds this research did not include other areas where patients who sustain road traffic injuries are cared for including the surgical wards.

CHAPTER FOUR

RESEARCH FINDINGS

4.1 Introduction

This chapter presents the detailed results, analysis and discussions of the research. The raw data collected from the patients' files and CCU admission register was entered into a prepared data sheet. The data comprised of demographic characteristics, types and severity of injuries, Glasgow coma scale on admission and upon discharge, services that were offered to the patients, cause of the accident, Length of hospital admission, referral status , any complications that arose in the course of management and the cost of management.

An in depth interview with CCU managers was conducted using an interview schedule. The information sought related to the challenges facing health care worker caring for RTA patients in CCU. This interviews were recorded and later transcribed and translated where necessary

All the quantitative data was entered on SPSS software and data analysed, Chi square tests were also conducted.

Qualitative data from the interviews were used to create themes related to challenges in RTA patient care

4.2 Baseline Enrolment characteristics

A total of seventy one (71) patient files were reviewed. The patient files were selected randomly using computer generated random numbers.

4.2.1 Age of study participants

The mean age of study participants was 30.3 ± 2.14 (27-32) years. Majority of the participants were aged between 21-40 years (49.3%) while those above 40 years comprised 26.8 %. Those aged 0-20 years constituted 23.9% of the participants. The minimum age was two (2) years while the maximum age of the patients was 72 years.

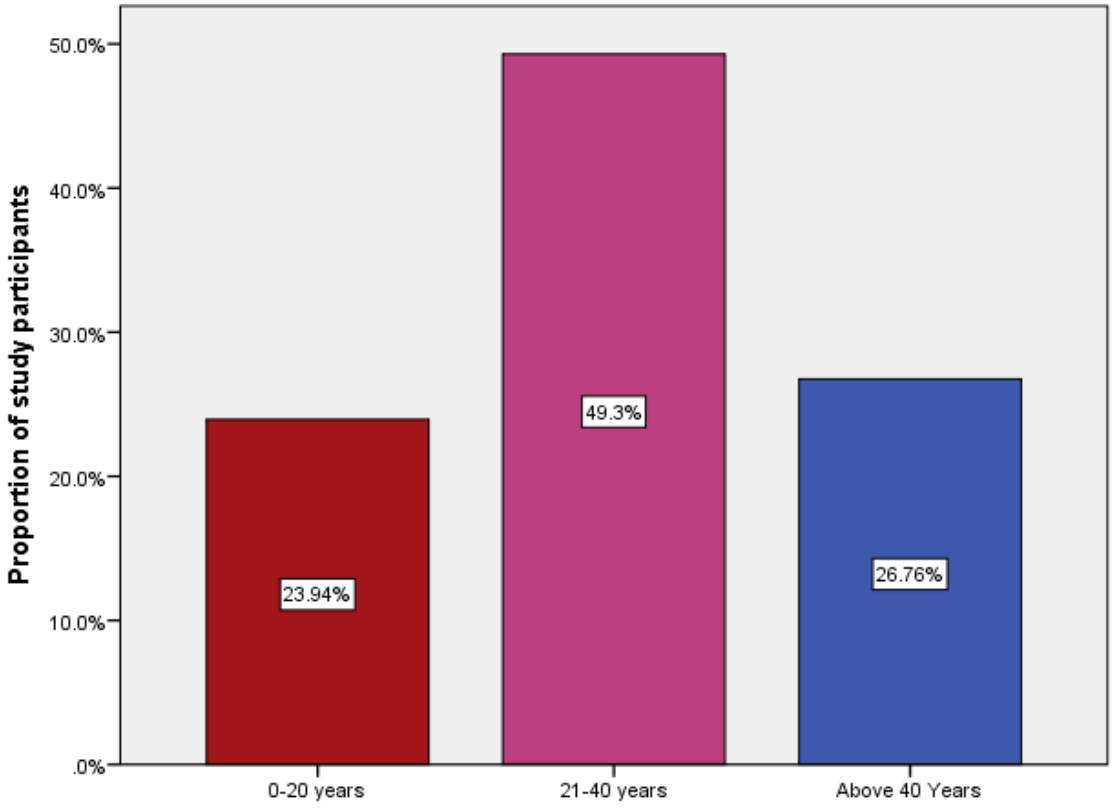

Figure 4.1: Distribution of RTA patients managed in CCU -KNH with regard to age

Figure 4.1: Distribution of RTA patients managed at CCU –KNH with regard to age

4.1.2 Gender of study participants

The number of male patients who were managed in CCU with road traffic injuries was significantly higher (78.9%) than the number of the female patients who were (21.1%) (χ^2 = 23.7, p<0.001). The male to female ratio was 3.5:1. (Figure 4.2)

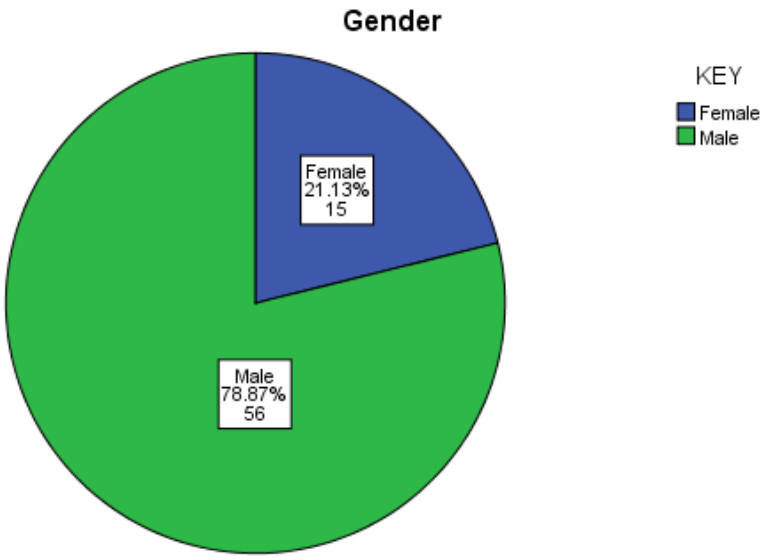

Figure 4.2: Distribution of RTA patients managed at CCU –KNH with regard to gender.

4.1.3 Marital Status of study participants

Out of 71 patients, 48 (67.6%) were single while those that were married were 20 (28.2%), divorced were 2 (2.8%) and separated being 1 (1.4%). (Figure 4.3).

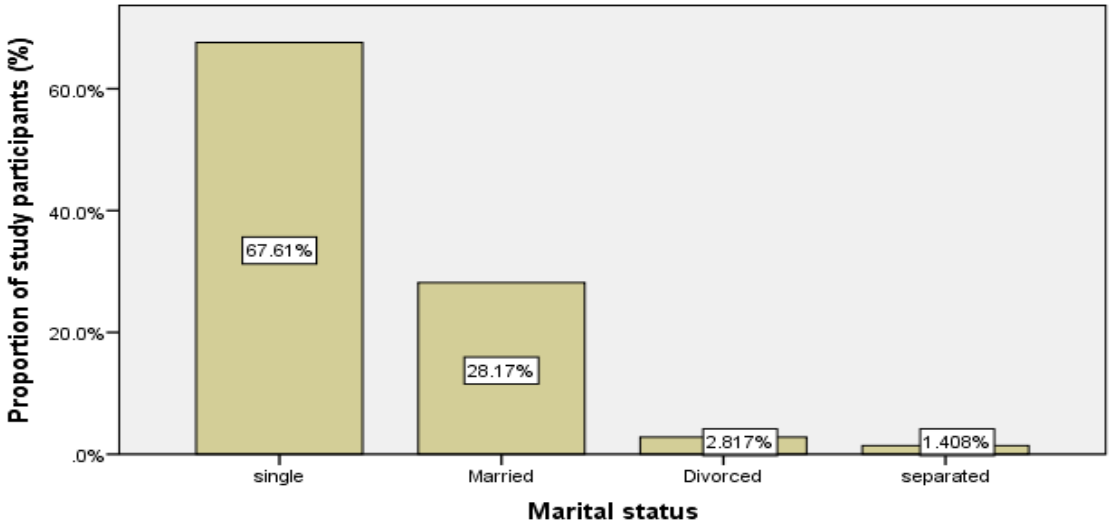

Figure 4.3: Distribution of RTA patients managed in CCU- KNH with regard to marital status

4.1.4 Level of education of study participants

Most of the patients, 49.3% had primary school education level, 36.6 % had secondary education level , 5.6 % had college education level while 1.4% had University education level (Table 4.1).

Table 4.1: Level of education of RTA patients managed at CCU - KNH

Level of education	Frequency	Percent
NONE	5	7.0
Primary	35	49.3
Secondary	26	36.6
College	4	5.6
University	1	1.4
Total	71	100.0

4.1.5 Occupational status of study participants

Out of the 71 study participants, 29 (40.9%) were self-employed, 27 (38.0%) were unemployed, 13 (18.3%) were casual laborers, while only 2 (2.8%) were formally employed (Figure 4.4.)

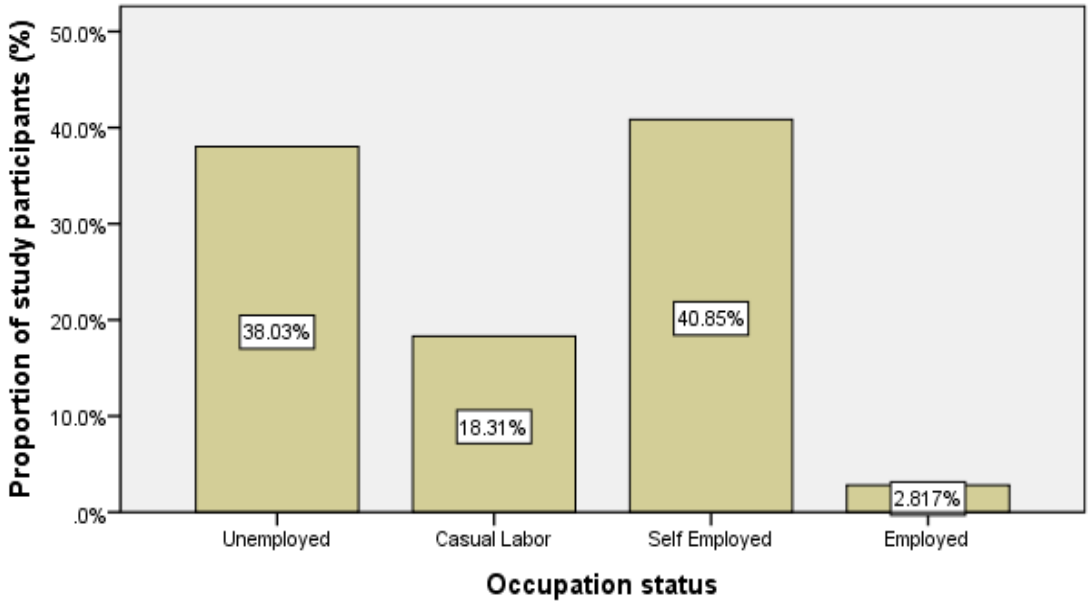

Figure 4.4: Distribution of RTA patients managed at CCU-KNH with regard to Occupation status.

4.1.6 Religion of study participants

Out of the 71 study participants, 68 (95.8%) were Christians with the remainder 3 (4.2%) being Muslims. (Figure 4.5)

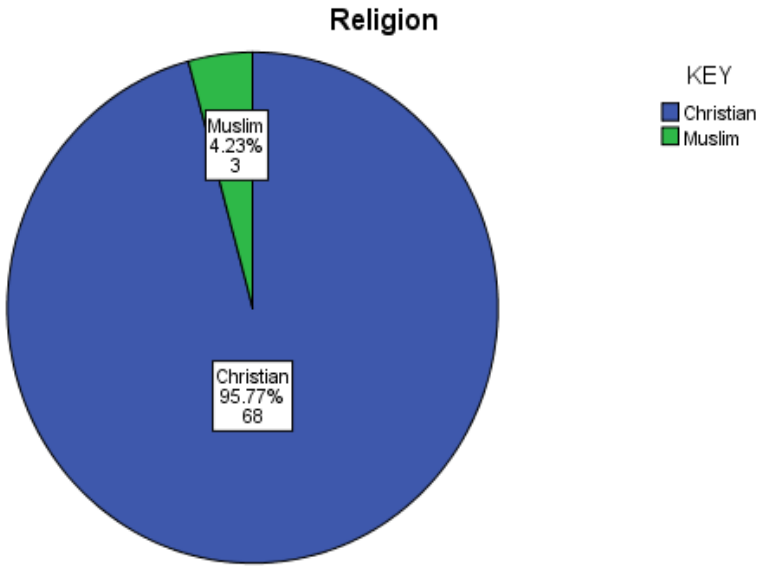

Figure 4.5: Religion of RTA patients managed at CCU- KNH.

4.1.7 County of Residence of RTA patients in CCU-KNH

Out of 71 study participants, majority 32 (45.1%) were residents of Nairobi County. Residents of Kiambu and Machakos Counties were 7 (9.9%) each while Murang'a County had 5 (7.0%), Kajiado and Embu Counties had 4 (5.6%) each.

4.1.8 Referring Hospital for the study participants

Out of the 71 study participants, 49 (69%) were referrals from other hospitals while those who were not referrals were 22 (31%). Hospitals from within Nairobi county contributed to most of the referrals accounting for 18 (36%) of the referrals. Mama Lucy Kibaki and Machakos county hospitals contributed the highest number of referrals with 6 (8.5%) and 4 (5.6%) of the patients respectively. (Table 4.2).

Table 4.2: Hospitals referring RTA patients to CCU-KNH

Hospitals grouped in counties	Frequency (n)	Percent (%)
Patients not referred	22	31.0
Hospitals within Nairobi county	18	1.4
Hospitals within Machakos county	6	8.5
Hospitals within Kiambu county	7	2.8
Hospitals within Muranga county	4	4.2
Hospitals within Garissa county	2	1.4
Hospitals within Embu county	3	3.8
Hospitals within Meru county	2	1.4
Hospitals within Kajiado county	4	1.4
Hospitals within Nakuru county	2	1.4
Hospitals within kitui county	1	2.8
Total	71	100

4.1.9 Scene of accident for the study participants

Out of 71 patients, majority, 40 (56.3%) were involved in accidents within Nairobi county. Those who were involved in accidents in Kiambu county were 4 (5.6%) while those who were involved in accidents in Machakos and Nakuru counties were 7(9.8%) and 6 (8.5%) respectively (Table 4.3.)

Table 4.3: Scene of Accident for the study participants

Scene of accident for the study participants	Frequency	Percent
Nairobi County	40	56.3
Kiambu	4	5.6
Machakos	7	9.8
Nakuru	6	8.5
Muranga	3	4.2
Embu	3	4.2
Kajiado	2	2.8
Meru	2	2.8
Garissa	2	2.8
Makueni	1	1.6
Kitui	1	1.6
Total	71	100.0

4.1.10 Time Taken before a Patient is Reviewed by a Doctor in Accident and Emergency Department

The mean time taken by the patients in the Accident and Emergency department before they were reviewed by a doctor was 80.2 minutes. The range was 473 minutes (Approximately 8 hours). The standard deviation was very high at 110.88 Minutes.

4.2 Type and severity of injuries sustained by the study participants

Out of 71 patients, those who sustained severe head injury only were 39 (54.9%), whereas those who sustained moderate to mild head injury with other multiple injuries were 30 (42%). The remainder who were 2 (2.8%) sustained fracture femur. (Figure 4.6).

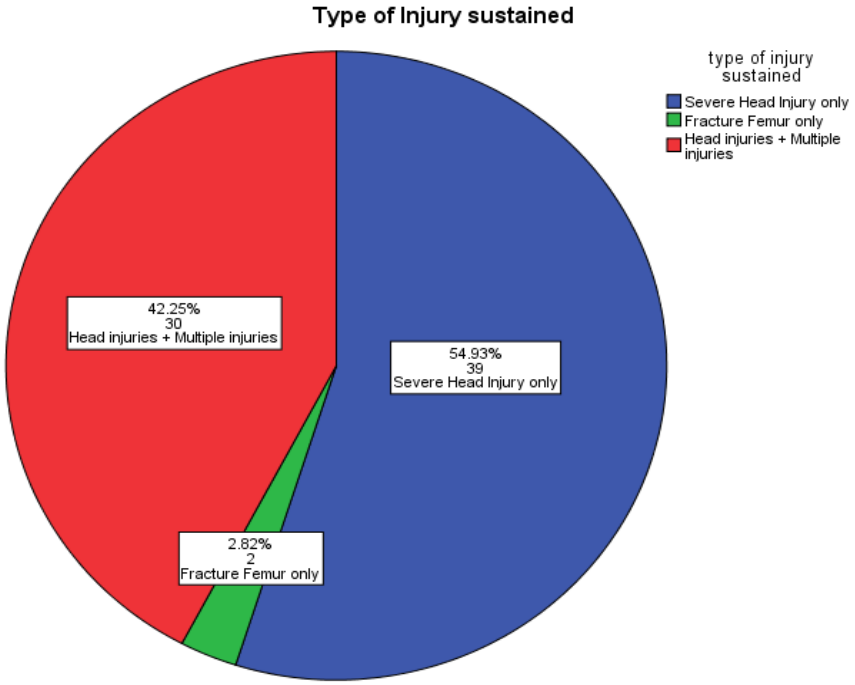

Figure 4.6: Type of injury sustained after RTA among the study participants

4.2.1 Cause of injury to the study participants

Out of the 71 patients, majority of the accidents 23 (34.9%) were caused by hit and run vehicles/ motor cycles. It was therefore unclear whether the accident was attributed to motor vehicle or motor cycle. Motor cycles were attributed to 27.3% of the accidents

while motor vehicles caused 30.3% of the accidents. Train crashes caused 1 (1.5%) of the accidents. (Figure 4.7).

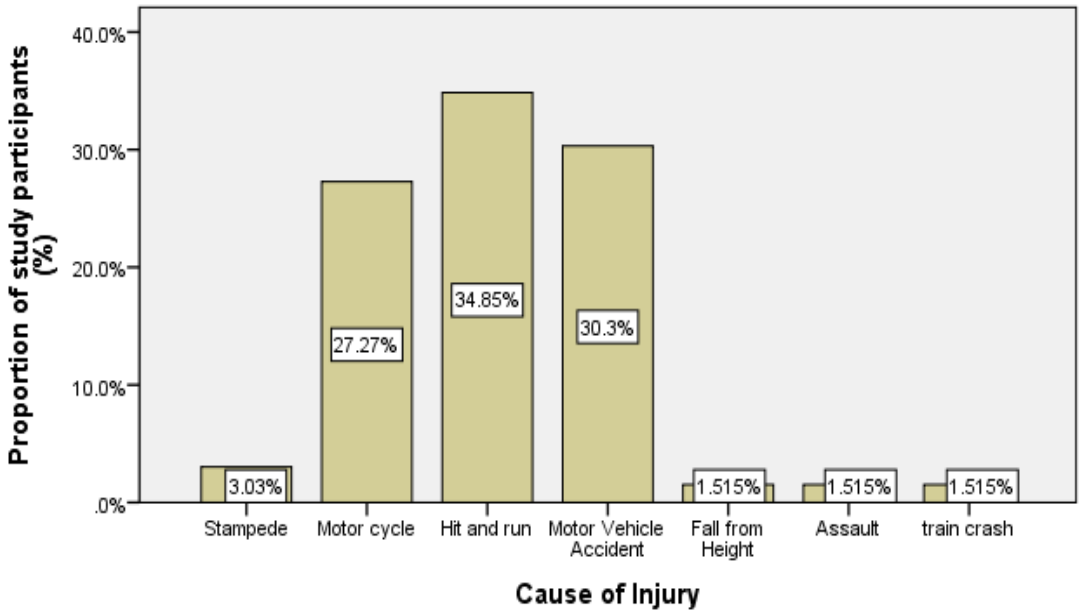

Figure 4.7: Cause of road traffic injuries among patients managed in CCU-KNH.

4.2.2 Glasgow Coma Scale on Admission to CCU

Out of 71 patients, majority 58 (81.7%) had a Glasgow Coma Scale (GCS) of 8/15 and below which indicated severe head injury while 9 (12.7%) had moderate head injury (GCS of 9/15 - 12/15). Only 4 (5.6 %) had mild head injuries (GCS of 13/15 to 15/15). Table 4.4 indicates the distribution of GCS on admission for the patients admitted in KNH CCU. (Table 4.4)

This goes hand in hand with the responses from the interview highlighted by the CCU managers: "*Patients admitted to CCU have Glasgow Coma Scale less than 8 (usually 3-8).*"

Table 4.4: Glasgow Coma Scale of study participants on admission to CCU-KNH

Glasgow Coma Scale	**Frequency (n)**	**Percent (%)**
3 – 8	58	81.7
9-12	9	12.7
13-15	4	5.6
Total	71	100

4.2.3 Glasgow Coma Scale of study participants on discharge from CCU

Out of 71 patients, majority were weaned to the general wards with an improved Glasgow Coma Scale (GCS) of which 32.6% had a GCS of 15/15 which can be termed as Normal while 3 (7%) had GCS of 14/15. However, 34.8% had GCS of 10/15 and below. (Figure 4.8)

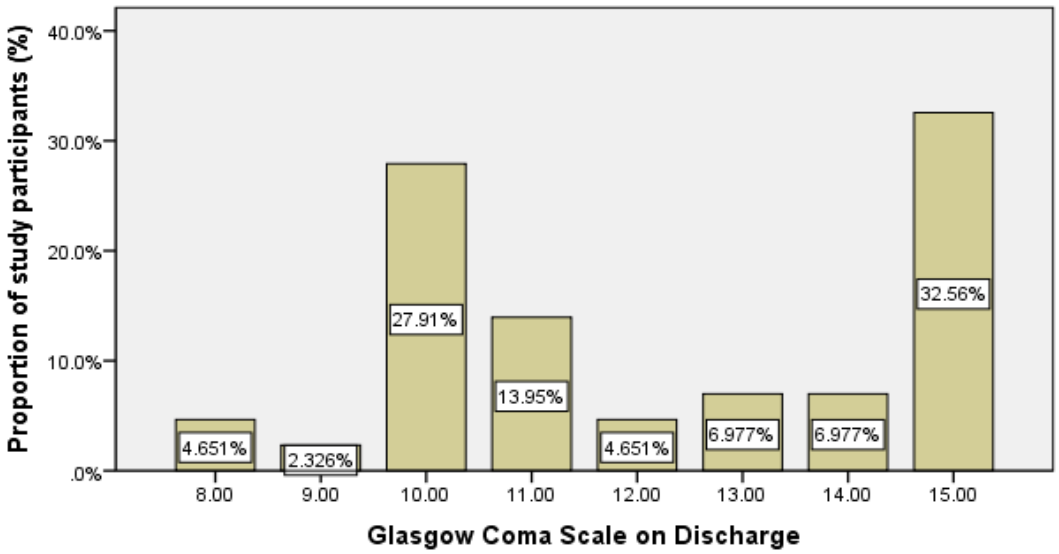

Figure 4.8: Glasgow Coma Scale of RTA patients on weaning from CCU-KNH

4.3 Cost of hospital management of RTA patients managed in CCU-KNH.

The Mean cost for the CCU management was Kenya shillings 450195.67. (KSH.12, 280 to 4,208,265). This included daily bed charges, radiological and laboratory charges, medication, surgery and nursing charges. The Standard deviation was high at KSH. 608935.4.

4.3.1 Mode of Payment

Out of 71 respondents, majority, and 35 (55.6%) were offered credit facilities to clear outstanding bill later. Only 4 (6.4%) cleared the bills by cash while 20 (31.8%) were assisted by the National Hospital Insurance Fund (NHIF). Only 1(1.6%) patient cleared using other insurance covers. (Figure 4.9.).

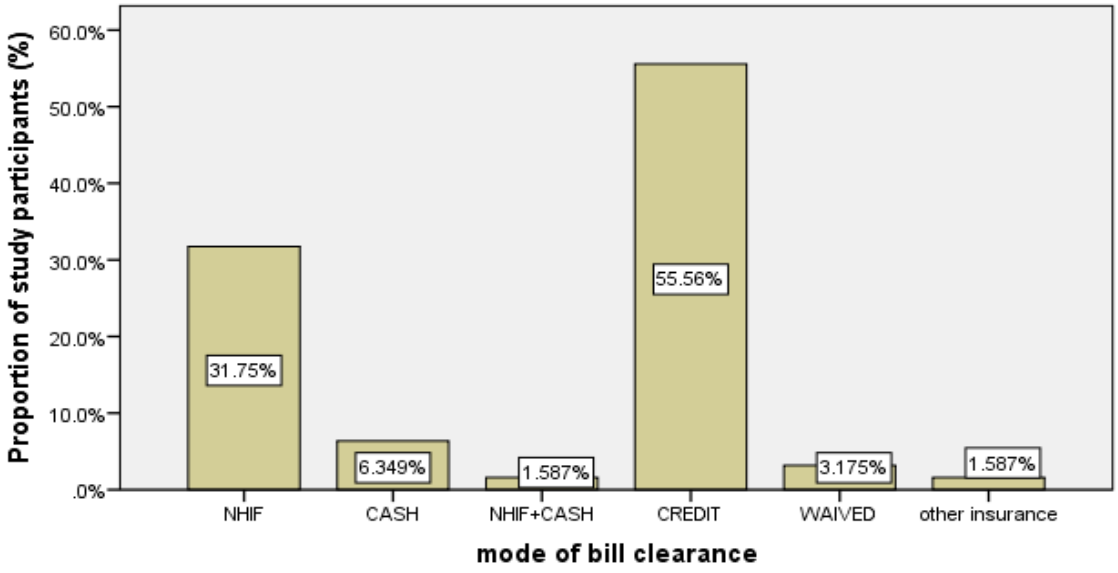

Figure 4.9: Mode of hospital bill clearance among RTA patients managed at CCU-KNH

4.4 Length of ICU Stay for RTA patients in CCU-KNH

The mean length of stay in ICU was 18 days, with a standard deviation of 24 days. The range was 120 days.

The length of stay of the patients in the CCU was determined by the following responses from the interview with the CCU managers:

> *"The length of stay is affected by the duration taken before the CCU admission and the pre-hospital care given to the patient."* (CCU, 1)

> *"Generally severe head injury takes over 1 month for the patient to recover if admitted within 72 hours from the time of injury."* (CCU, 2)

> *"If there is no development of the second degree injuries within 72 hours the patient will recover within 2 to 4 weeks."* (CCU, 3)

> *"Spinal cord injuries take more than 1 month to recover. C-spine injuries take less than 2 weeks to recover or deteriorate."* (CCU, 4)

4.5 Critical Care Services Offered to accident patients in Kenyatta National Hospital Critical care Unit

4.5.1 Radiological services offered to RTA patients managed in CCU

The following radiological services were offered; Computerized Axial Tomography was offered to 95.8 % of the clients admitted post- accident. X-Ray service (78.9%) of the clients admitted with injuries while abdominal Ultra-Sound was offered to 5.6% of the clients (Table 4.5).

Table 4.5: Radiological services offered to RTA patients managed in CCU-KNH

Radiological services		Frequency (n)	Percent (%)
Computerized Axial Tomography of the Head	No	3	4.2
	Yes	68	95.8
X-Ray	No	15	21.1
	Yes	56	78.9
Abdominal Ultrasound	No	67	94.4
	Yes	4	5.6
	Total	71	100.0

4.5.2 Laboratory services offered to RTA patients in CCU

The following were the services offered to the patients: Full haemogram (FHG) (81.7 %), Grouping and Cross-Matching (29.6%), Urea and Electrolytes (77.5%), Coagulation profile (1.4%) and Arterial Blood Gas Analysis (87.3%) (Table 4.6)

Table 4.6: Types of Laboratory services offered to RTA patients

Type of laboratory services offered		Frequency (n)	Percent (%)
Full Haemogram	No	13	18.3
	Yes	58	81.7
Grouping and Cross matching	No	50	70.4
	Yes	21	29.6
Urea and Electrolytes	No	16	22.5
	Yes	55	77.5
coagulation profile	No	70	98.6
	Yes	1	1.4
Arterial Blood gas analysis	No	9	12.7
	Yes	62	87.3
	Total	71	100.0

4.5.3 Nursing Services offered to RTA patients

All the patients admitted in the Critical care Unit received nursing services. All of the patients needed; mechanical ventilation , fluid volume maintenance, vital sign observation and ECG monitoring, feeding, suction, daily bed baths, pressure area care and treatment, dressing, central venous pressure monitoring, medication, psychotherapy and proper documentation .This was also confirmed by the CCU managers who agreed that "*all the patients admitted in the Critical Care Unit were offered nursing services. The nurse to patient ratio is 1 nurse: 2 patients."*

4.5.4 Physiotherapy services offered to RTA patients.

Out of 71 patients, 69 (97.2%) received physiotherapy services while 2(2.8%) did not. (Figure 4.10.)

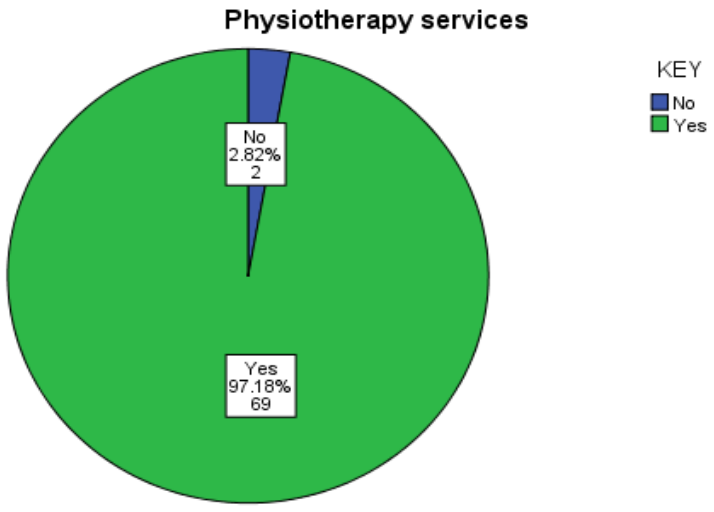

Figure 4.10: Physiotherapy service offered to RTA patients in CCU

4.5.5 Surgical Services

Out of 71 patients, 50 (70.4 %) of the patients underwent surgical services while 21 (29.6%) did not. (Figure 4.11.)

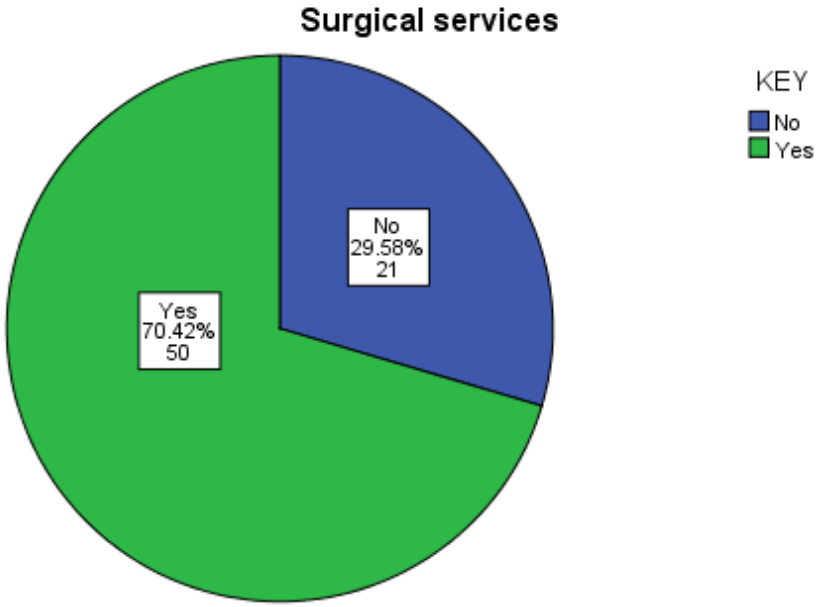

Figure 4.11: Surgical services offered to RTA patients managed in CCU-KNH.

4.5.6 Medical Services offered to RTA patients managed in CCU-KNH.

All the patients admitted in the unit received medical services as daily review by the anesthetists.

4.5.7 Nutritional Services offered to RTA patients

All the Patients admitted in the Unit were offered nutritional services. Out of 71 respondents, majority 44 (62.9%) were fed via nasogastric tube feeding, 9(12.9%) were

fed by intravenous feeding, while 2 (2.9%) were fed orally and by gastrostomy feeding. (Figure 4.12).

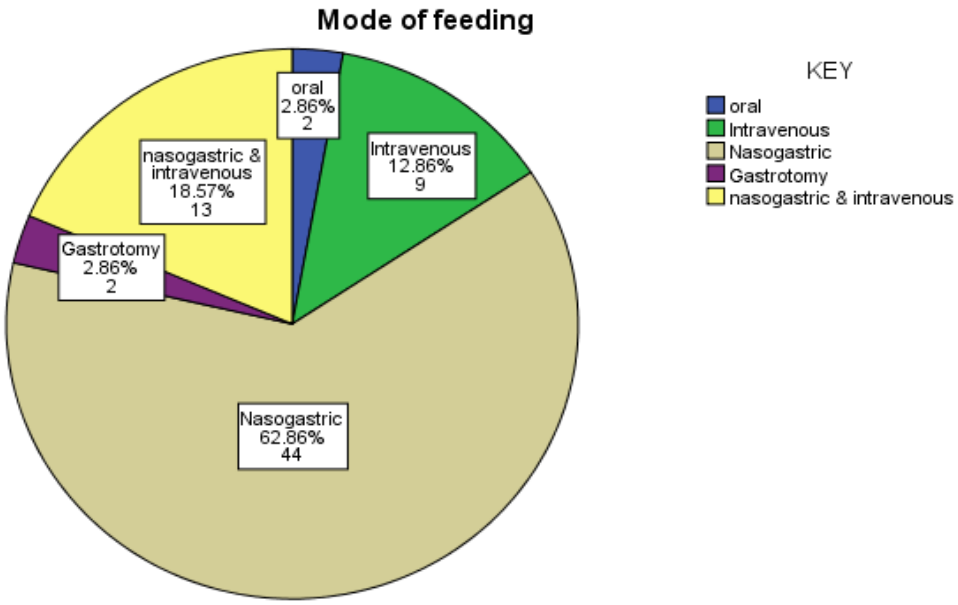

Figure 4.12: Mode of feeding for RTA patients managed at CCU- KNH

4.5.8 Services Scheduled for RTA IN CCU and not Rendered

Out of 71 patients, 21 (29.6%) did not receive all prescribed medication due to unavailability of some of the drugs ordered while 9 (12.7%) missed Surgery or a radiological service that was scheduled. Only 1 (1.4%) missed laboratory test. (Figure 4.13).

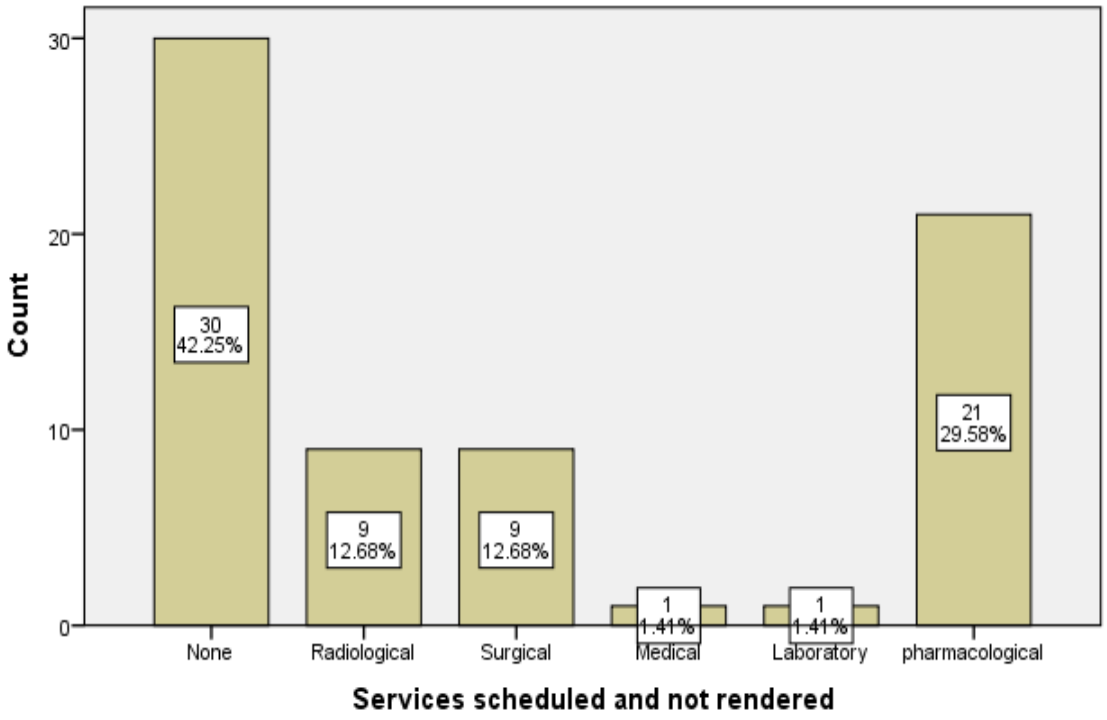

Figure 4.13: Services scheduled and not rendered to RTA patients managed in CCU-KNH.

4.5.9 Consultant Services ordered on admission of RTA Patients in CCU-KNH

Out of 71 respondents, 41 (57.7%) required neuro surgical services while 22 (31%) required orthopedic services. (Table 4.7)

Table 4.7: Consultative services ordered for RTA patients during CCU admission

Consultative services ordered during CCU admission	Frequency (n)	Percent (%)
None	11	15.5
General surgery	1	1.4
Neuro surgery	41	57.74
Urologist	2	2.8
ENT	3	4.2
Orthopedic surgery	22	30.98
Cardiothoracic surgery	7	9.9
Medical	2	2.8
Paediatric	1	1.4
Hematology	2	2.8
Total	71	100.0

4.6 Complications associated with RTA patients managed in CCU-KNH

Out of 71 patients, 16 (22.5%) suffered anemia as a complication while 25 (35.2%) suffered from sepsis and electrolyte imbalances. Of the remainder, 10 (14.1%) and 8 (11.3%) suffered from ventilator acquired pneumonia and shock respectively while 2 (2.8%) had acute renal failure (Table 4.8).

CCU managers unanimously agreed and stated that "*infections, wound sepsis, nosocomial infections, renal failure, bedsores, trachea-esophageal fistula, Mechanical Ventilation complications and permanent disability*" were the main complications that arose.

Table 4.8: Complications associated with RTA patients managed in CCU-KNH

Complications arising among RTA patients		Frequency (n)	Percent (%)
Anemia	No	55	77.5
	Yes	16	22.5
Electrolyte Imbalance	No	46	64.8
	Yes	25	35.2
Sepsis	No	46	64.8
	Yes	25	35.2
Shock	No	63	88.7
	Yes	8	11.3
Ventilator Acquired Pneumonia	No	61	85.9
	Yes	10	14.1
Acute Renal Failure	No	69	97.2
	Yes	2	2.8
Bedsores	No	64	90.1
	Yes	7	9.9

4.7 Health outcomes of the RTA Patients managed in CCU- KNH

Out of the 71 respondents, majority who were 45 (63.4%) improved and were transferred to the general wards while 36.6% died while in CCU (Figure 4.14.)

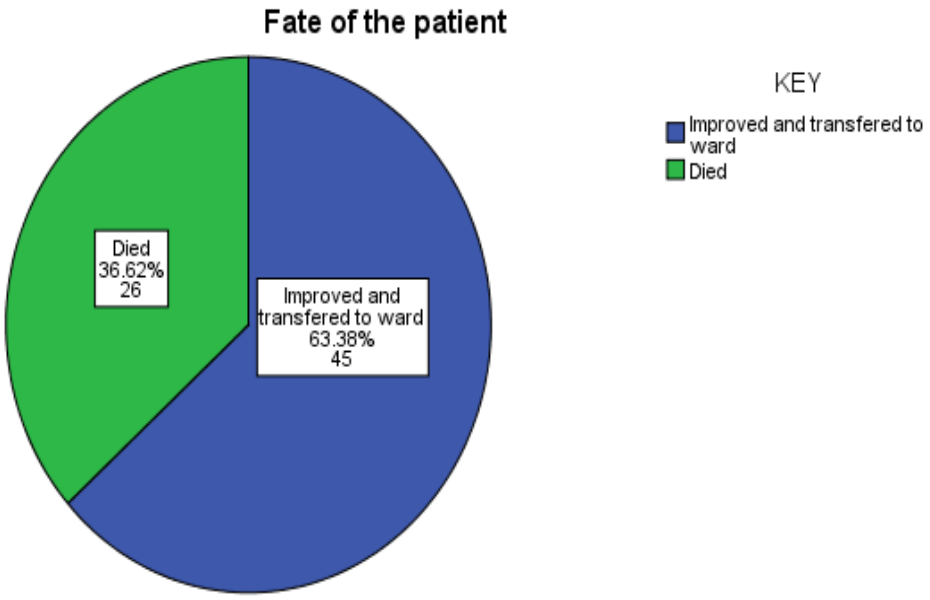

Figure 4.14: Health Outcomes of RTA patients managed at CCU-KNH

4.8 Tests for association for various variables

The chi-square test shows that there is significant association between GCS at admission and age of the patients admission (χ^2 = 10.056, p<0.01). Other demographic variables were insignificant. There was a significant relationship between GCS at admission and type of injury sustained admission (χ^2 = 9.423, p<0.01). This indicates that most patients with head injuries and multiple injuries had a GCS score below 8 (Table 4.9).

Table 4.9: Relationship between GCS on admission and socio demographic characteristics of RTA patients admitted in CCU at KNH.

Variables		GCS at admission		Total	Chi-square value	Df	P-value
		8 and below	Above 8				
Age	0-20 years	16 (22.5%)	1 (1.4%)	17 (23.9%)	10.056	2	.007
	21-40 years	31 (43.7%)	4 (5.6%)	29 (49.3%)			
	Above 40 Years	11 (15.5%)	8 (11.3%)	19 (26.8%)			
Marital status	Single	40 (56.3%)	8 (11.3%)	48 (67.6%)	1.692	3	.639
	Married	16 (22.5%)	4 (5.6%)	20 (28.2%)			
	Divorced	1 (1.4%)	1 (1.4%)	2 (2.8%)			
	Separated	1 (1.4%)	0 (0.0%)	1 (1.4%)			
Education level	NONE	4 (5.6%)	1 (1.4%)	5 (7.0%)	1.212	4	.876
	Primary	28 (39.4%)	7 (9.9%)	35 (49.3%)			
	Secondary	21 (29.6%)	5 (7.0%)	26 (36.6%)			
	College	4 (5.6%)	0 (0.0%)	4 (5.6%)			
	University	1 (1.4%)	0 (0.0%)	1 (1.4%)			
occupation status	Unemployed	25 (35.2%)	2 (2.8%)	27 (38.0%)	4.460	3	.216
	Casual Laborer	10 (14.1%)	3 (4.2%)	13 (18.3%)			
	Self Employed	21 (29.6%)	8 (11.3%)	29 (40.8%)			
	Formal Employment	2 (2.8%)	0 (0.0%)	2 (2.8%)			
Gender	Female	13 (18.3%)	2 (2.8%)	15 (21.1%)	.315	1	.575
	Male	45 (63.4%)	11 (15.5%)	56 (78.9%)			
Type of injury sustained	Severe Head Injury	32 (45.1%)	7 (9.9%)	39 (54.9%)	9.423	2	.009
	Fracture Femur	0 (0.0%)	2 (2.8%)	2 (2.8%)			
	Multiple injuries	26 (36.6%)	4 (5.6%)	30 (42.3%)			
Cause of Injury	Stampede	0 (0.0%)	2 (3.0%)	2 (3.0%)	11.377	6	.077
	Motor cycle	16 (24.2%)	2 (3.0%)	18 (27.3%)			
	Hit and run	20 (30.3%)	3 (4.5%)	23 (34.8%)			
	Motor Vehicle	16 (24.2%)	4 (6.1%)	20 (30.3%)			
	Fall from Height	1 (1.5%)	0 (0.0%)	1 (1.5%)			
	Assault	1 (1.5%)	0 (0.0%)	1 (1.5%)			
	train crash	1 (1.5%)	0 (0.0%)	1 (1.5%)			
ICU stay	Less than 20 days	43 (60.6%)	11 (15.5%)	54 (76.1%)	.640	1	.424
	Above 20 days	15 (21.1%)	2 (2.8%)	17 (23.9%)			
Total		58 (81.7%)	13 (18.3%)	71 (100%)			

4.9 Relationship between referral status and GCS on admission

There is significant association between referral status and GCS at admission (χ^2 = 6.716, p<0.05). This indicate that most of the patients who were referred had a GCS below 8 on admission.

Table 4.10: Relationship between Referral status and other variables among RTA patients managed in CCU at KNH

Variables		Referral status		Total	Chi-square value	Df	p-value
		No	Yes				
Waiting time	Less than 30 min	6 (12.2%)	20 (40.8%)	26 (53.1%)	2.125	2	.346
	31-60 min	1 (2.0%)	5 (10.2%)	6 (12.2%)			
	More than 60 min	7 (14.3%)	10 (20.4%)	17 (34.7%)			
Total		14 (28.6%)	35 (71.4%)	49 (100%)			
GCS at admission	Below 8	14 (20.0%)	43 (61.4%)	57 (81.4%)	6.716	1	.010
	Above 8	8 (11.4%)	5 (7.1%)	13 (18.6%)			
Total		22 (31.4%)	48 (68.6%)	70 (100%)			
Fate of the patient	Improved and transferred to ward	16 (22.5%)	29 (40.8%)	45 (63.4%)	1.200	1	.273
	Died	6 (8.5%)	20 (28.2%)	26 (36.6%)			
Total		22 (31.0%)	49 (69.0%)	71 (100%)			
ICU stay	Less than 20 days	16 (22.5%)	38 (53.5%)	54 (76.1%)	.194	1	.660
	Above 20 days	6 (8.5%)	11 (15.5%)	17 (23.9%)			
Total		21 (31.0%)	50 (69.0%)	71 (100%)			

4.10 Relationship between GCS on admission and services offered in CCU

There is significant association between GCS at admission and computerized axial tomography of the head χ^2 = 13.975, p<0.05). This indicates that patients who had GCS at admission below 8 were more likely to undergo computerized axial tomography of the head as compared to those who had GCS above 8.

Table 4.11: Relationship between GCS of RTA patients on admission and services given in CCU - KNH

Variables		GCS at admission		Total	Odds Ratio	Chi-square value	df	P-value
		Below 8	Above 8					
Computerized Axial Tomography of the Head	No	0 (0.0%)	3 (4.2%)	3 (4.2%)	6.800	13.975	1	.000
	Yes	58 (81.7%)	10 (14.1%)	68 (95.8%)				
X-Ray	No	12 (16.9%)	3 (4.2%)	15 (21.1%)	.870	.036	1	.849
	Yes	46 (64.8%)	10 (14.1%)	56 (78.9%)				
Full Hemogram	No	10 (14.1%)	3 (4.2%)	13 (18.3%)	.694	.242	1	.623
	Yes	48 (67.6%)	10 (14.1%)	58 (81.7%)				
Grouping and Cross matching	No	39 (54.9%)	11 (15.5%)	50 (70.4%)	.373	1.539	1	.215
	Yes	19 (26.8%)	2 (2.8%)	21 (29.6%)				
Urea and Electrolytes	No	12 (16.9%)	4 (5.6%)	16 (22.5%)	.587	.618	1	.432
	Yes	45 (64.8%)	9 (12.7%)	55 (77.5%)				
Arterial Blood gas analysis	No	7 (9.9%)	2 (2.8%)	9 (12.7%)	.755	.105	1	.745
	Yes	51 (71.8%)	11 (15.5%)	62 (87.3%)				
Abdominal Ultrasound	No	56 (78.9%)	11 (15.5%)	67 (94.4%)	5.091	2.846	1	.092
	Yes	2 (2.8%)	2 (2.8%)	4 (5.6%)				
Total		58 (81.7%)	13 (18.3%)	71 (100%)				

4.11 Relationship between health outcomes of RTA patient and other variables

The chi-square test show that there is no significant relationship between fate of the patient, age, gender, type of injury sustained and ICU stay ($p>0.05$).

Table 4.12: Relationship between health outcomes of RTA patients managed in CCU at KNH and other variables

Variables		Outcomes of the patient		Total	Chi-square value	df	P value
		Improved and transferred to ward	Died				
Age	0-20 years	11 (15.5%)	6 (8.5%)	17 (23.9%)	.341	2	.843
	21-40 years	23 (32.4%)	12 (16.9%)	35 (49.3%)			
	Above 40 years	11 (15.5%)	8 (11.3%)	19 (26.8%)			
Gender	Female	12 (16.9%)	3 (4.2%)	15 (21.1%)	2.263	1	.132
	Male	33 (46.5%)	23 (32.4%)	56 (78.9%)			
Type of injury sustained	Severe Head Injury	24 (33.8%)	15 (21.1%)	39 (54.9%)	1.213	2	.545
	Fracture Femur	2 (2.8%)	0 (0.0%)	2 (2.8%)			
	Multiple injuries	19 (26.8%)	11 (15.5%)	30 (42.3%)			
ICU stay	20 days and less	37 (52.1%)	17 (23.9%)	54 (76.1%)	2.565	1	.109
	Above 20 days	8 (11.3%)	9 (12.7%)	17 (23.9%)			
Total		45 (63.4%)	26 (36.6%)	71 (100%)			

4.12 Challenges experienced by health care workers as reported through key informant interview

The challenges experienced by health care workers when taking care of the RTA patients in the CCU included the following:

> One CCU manager stated that "*Various disease processes in CCU cause changes in substrate metabolism which leads to changes in body composition and ultimately relative deficiencies of some important nutrients. Patients also do not receive their target intake because of intolerance, interruptions and inadequate*

stock of food. Catabolic depletion of the protein reserves is also another challenge."

Another CCU manager stated that "*there is lack of multidisciplinary team support in the CCU and health care personnel take too long to review the patients*."

CCU manager also stated that "*the ratio of nurses to patients was way below the recommended WHO standards and that lack of adequate beds, suction machines, skin care equipment and ripple mattresses in CCU affects the care of patients. Long stay of the patients in the CCU also consumes a lot of resources and of the patients are unable to pay for services rendered"*.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Introduction

Kenya ranks among countries with the highest rate of road traffic crashes globally with an average of 3,400 deaths annually by the year 2013

Previous studies have shown that RTAs are a major cause of Severe Head Injuries (SHI) among Kenyan citizens of productive age comprising 14.3% of adult ICU/HDU admissions.

Road traffic injuries (RTI) are on the increase in developing countries putting pressure to health care facilities which are poorly equipped to provide the needed services despite prevention strategies that exist. Patients who suffer severe injuries are best managed in an intensive care unit for stabilization and specialized care

With the rising numbers of road traffic crashes comes with the increasing motorization, there is need to provide quality care in CCU to decrease morbidity and mortality among patients with RTI's.

5.2 Summary

Kenya has limited ICU facilities compared to its population. Currently the Kenyan population of 40 million people has 37 functional ICU beds in public hospitals and a further 57 bed in private and mission hospitals (www.criticalcarekenya.org). WHO recommends that for every 50 patients in general wards, there should 1 ICU bed (www.criticalcarekenya.org).

The increasing number of RTA cases poses a challenge of provision of adequate services to the patients due to limited resources in low and middle income countries including Kenya.

Findings of this study have identified young men of productive age as the most vulnerable group. The commonest injury was head injuries. Low levels of education was a common factor among the patients. Majority of these patients were referred from hospitals within Nairobi County. Most services were provided but deficiencies were reported. The cost of management is high for the common citizen. Electrolyte imbalances and infections were the most common complications. Prevention measures, highway patrols, training, team work, resource re- allocation to hospitals and improved staffing can improve outcomes

5.3 Discussion

The study was conducted among 71 RTA patients admitted to the CCU at KNH in 2013. A research conducted by WHO reported that Kenya was ranked among countries with the highest rate of road traffic crashes globally with an average of 3,400 deaths annually (WHO, 2013). The study was supported by a research carried out in Tanzania which concluded that trauma resulting from road traffic crashes was a leading cause of intensive care utilization in the hospital (Ebrim & Ojum, 2012; Chalya et al., 2012).

This study found that majority of the patients admitted in the CCU with RTIs were male (78.08%). This was significantly higher than the number of females (χ^2 0.05, 1, = 23.7, $p<0.05$). The male to female ratio was 3.5:1. The mean age was 30 years with a range of 2 to 72 years. Majority of the patients (49.3%) had primary school level of education while 36.6% were of secondary school level of education, only 5.6% and 1.6 % had college and university level of education respectively. Most of the patients were single (67.6 %) while those that were married were 28.2%. Only 2.8% of the respondents had formal employment, 40.9% were self-employed while 38% were unemployed. The

finding is similar to a study that reported that RTAs were a major cause of severe head injuries (SHI) among Kenyan citizens mostly young men in the productive age comprising 14.3% of adult ICU/HDU admissions (Kariuki, 2013). Another study conducted in Tanzania by (Museru et al., 2002) found that road traffic accidents accounted for 56% of all patients admitted to Muhimbili Medical Centre due to injuries. The high prevalence of RTA is similar to the global status report by World Health Organization which indicated that approximately 1.3 million lives are lost annually due to road traffic accidents across the globe (WHO, 2009).

This study revealed that Nairobi and counties neighboring Nairobi contributed the bulk of the patients admitted in KNH compared to the ones further away. Majority of the patients (69%) treated at the Kenyatta National Hospital were referrals. Patients are generally referred to KNH for specialized services. Majority of the patients were referred from hospitals within Nairobi County (32.7%) n=16 with Mama Lucy Kibaki hospital contributing to the highest number of referrals (7.5%). Kiambu and Machakos counties contributed to 14.3% and 12.2% respectively. Other counties included Muranga (8.2%), Kajiado (8.2%), Embu (6.1%), Meru (4.1%), Garissa (4.1%), Nakuru (4.1%) and Kitui (2%). Qualitative data from CCU managers confirmed that the source of patients was mostly referral from other hospitals through casualty and that most referrals were admitted for specialized treatment.

This study found that the mean waiting time for the patients in the Accident and Emergency department before they were reviewed by a doctor was 80.2 $\pm$ 16.54 minutes with a range of 473 minutes (Approximately 8 hours). A study conducted by Jamah collaborates with the findings where they reported that a waiting time of 30 minutes for a general outpatient clinic was considered as reasonable (Jamah, 2012), but should be shorter for emergency visits. The study also reported that the waiting time in ED may stretch up to 3 hours before completion of necessary procedures because of the heavy workload, unavailability of essential trauma management resources and low staff morale

which leads to long waiting time observed in outpatient department (Jamah, 2012). It is likely that this factors contributed to the long waiting time.

Chi square tests revealed that referral status was significantly associated with GCS below 8 admission (χ^2 =6.716, P<0.01. Glasgow Coma Scale below 8 was significantly associated with computerized tomography scan on admission (χ^2 = 13.975, p < 0.01). The finding collaborates with Macharia, Njeru and Nantulya (2009) who reported that road traffic injuries (RTI) are on increase and thus puts more pressure to health care facilities which are poorly equipped to provide the needed services. Despite improvement in health care delivery systems in Kenya, many hospitals still refer patients to hospitals with better facilities like KNH (Muga et al., 2004). Studies have reported that patients with head injuries are the most likely trauma patients to be transferred to KNH for specialized investigation and critical care (Saidi et al., 2014). Transfer of RTA patients to KNH further increases bed occupancy and duration of stay since these patients are usually chronically sick. The process of transfer of patients is likely to cause deterioration of GCS and delayed CCU care. If this services were available in the neighboring hospitals and at the county level, RTA patients would receive ICU care promptly thereby improving the outcomes.

The results of this study found that majority of the patients sustained head injuries only (55.0%), multiple injuries plus head injuries 42.5% and only a few patients sustained fracture femur only (2.5%). Among these patients, 81.7 % had a GCS of below 8 (severe head injuries) 11.4% had moderate head injuries and 6.4% had mild head injuries. There was a significant relationship between GSC below 8 and age below 40 years (p<0.02). Criteria for CCU admission is that patients with a low Glasgow coma scale below 8/15 need admission to CCU. The finding collaborates with (Bener et al., 2009) who reported that most of the patients admitted in CCU have severe head injuries. They went further and reported that head and neck injuries from road traffic accidents are the most common cause of morbidity and mortality and temporary or permanent disability in

most developing countries. The finding is also consistent with a study in New Delhi, which found that the most common pattern of injury was head, followed by fractures of lower limb (Osoro et al., 2011). A study conducted in South Africa found that the incidence of death from head injury is approximately 7 per 100,000 (Bowley & Boffard, 2002).

Upon discharge, 33.3% of the patients improved the GCS to 15/15 and were weaned to the general wards. In general, 63.4% of the patients improved and were discharged while 36.6 % (n=26) died. Motor vehicles and motor cycles accounted for 30.3% (n= 20) and 27.3% (n=18) of the patients respectively. The cause of the injuries in 34.9% of the patients was not clear as these patients were brought to hospital by police and good Samaritans having been abandoned at the accident scene by the drivers /cyclists. Considering the number of passengers carried on a motor cycle at a given time compared to motor vehicles, the number of motorcycle accidents are quite high and more needs to be done to curb the accidents. However, there was no significant association between GCS and cause of injury. Hit and run incidents can be associated with delays in getting to hospital and commencement of treatments. A study conducted by European Brain Injury Consortium (EBIC), reported 52% of head injuries were related to Motor Vehicle Accidents (MVAs) (Bowley & Boffard, 2002).

Length of stay is affected by the duration taken before CCU admission and the pre-hospital care given to the patient. Improved pre- and in-hospital care of trauma victims will improve the outcome of trauma patients admitted to ICU (Chayla et al., 2012; Gilyoma et al., 2011). This study found that majority of the patients admitted in CCU had a mean hospital stay in CCU of 18 days with those with severe head injuries staying for more than a month. The length of CCU stay was not significantly associated with mortality ($p>0.05$). Qualitative analysis indicated that the length of hospital stay was affected by delay in initiation of services, prehospital care and development of secondary injuries following the primary Injuries. The most common complications among the patients were electrolyte imbalance accounting for 35.2%. Infections were

detected in tracheal aspirate or urine in 35.2% of patients. Anemia occurred in 22.5% while bedsores and ventilator acquired pneumonia was reported in 9.9% and 14.1% of patients respectively. These complications are likely to have affected the length of CCU admission and mortality rate. Studies from other countries have shown a shorter length of stay in CCU. A study in Italy reported that the length of stay in CCU was 11.1 days (ISTAT 2008). Other studies in Africa reported a shorter length of stay ranging between 5 to 7 days (Eleni et al., 2014; Alferid 2014). Other researchers reported that patients who stayed for long had a better outcome (Tobi, 2016). A study reported that the incidence of electrolyte disturbance varied and was associated with bad outcomes (Taha & Ammar, 2015). This study found that bedsores occurred in 7 of RTA patients (9.9%). A study in Greece reported that the overall pressure ulcers in CCU in Greece was 29.6% (Eleni et al., 2014). The study is in collaboration with a study conducted by Macharia et al., 2009) who reported that anticipated duration of hospital stay among in patients for over one month was 51.9 % of RTI patients.

The study established that the services offered to patients in CCU included radiological services which included Computerized Axial Tomography (96.3%), X-ray (76.3%), Abdominal Ultra-Sound (8.8%); laboratory services; Full haemogram (FHG), Grouping and Cross-Matching, Urea and Electrolytes, Coagulation profile, and Arterial Blood Gas); Nursing services ; All patients required mechanical ventilation, fluid volume maintenance, vital sign observation and ECG monitoring, feeding, suction, daily bed baths, pressure area care and treatment, dressing, central venous pressure monitoring, medication, psychotherapy and proper documentation which were provided: physiotherapy services, surgical and medical services were also provided. However, 26.5% of patients missed a drug or more due to unavailability, 15 % missed or delayed to undergo scheduled surgery and 13.8 % missed or delayed to have a radiological test. Regarding nutritional support, 62% of patients were on exclusive nasogastric tube (NG) feeding, 11.3% on intravenous feeding (IV), oral and gastrostomy feeding was 2.53% the remainder had mixed methods where both NG and IV were combined. The finding is similar to Hughes who reported that some of the services provided to patients in CCU

included Hemodynamic and fluid volume monitoring; Temperature control to reduce oxygen demand; Respiratory care through mechanical ventilation to prevent hypoxia commonly caused by inadequate airway clearance; Blood sugar control and monitoring; Sedation to control environmental stimulation of patients; and Positioning patients depending on the diagnosis (Hughes, 2002).

This study found that most patients required neurosurgery consultation (57.7%), orthopedics consultation (30.9%) and cardiothoracic consultation (9.9%).

This study found that 63.4 % of the patients improved and were weaned to the general wards while 36.6 % of the patients died. There was no significance in the relationship between age and length of CCU stay with mortality, $p>0.05$. This finding represent a high but comparable outcome to countries in the region. A study in Mulago hospital found an overall mortality rate in ICU to be 40.1% which was higher than that in high income regions who have reported mortality rates of 10-20.9% (Kwizera et al., 2012). Studies in Nigeria reported mortality rate in ICU as 52.2%- 53.2% with RTA being responsible for 68.6% of the deaths (Adeneka & Faponle, 2002). Another study reported that mortality rate in a Surgical ICU in Addis Ababa was 31.5% with RTA patients constituting 48% of the death where 13 out of 27 RTA patients died (Alferid, 2014). A local study in Tenwek hospital in Kenya reported that general overall mortality in ICU was 26.1% (Ong'ongi et al., 2016). Previous studies have found that mortality rate from severe traumatic brain injury was 31% in Argentina (Rondina *et al.*, 2005). Previous studies have suggested that inadequate medical and technical equipment in most ICU in low resource economies contributes to high mortality rates among critically ill patients (Luis & Redson, 2014). However this study only considered patients admitted with road traffic injuries to CCU.

The mean cost of hospital management was Ksh.450, 195.67. This translates to a daily cost of Ksh. 25,010. Only 6.4% of the respondents cleared their hospital bills by cash. Credit facilities were given to 55.6% while National Health Insurance Fund (NHIF)

cleared for 31.8% of the respondents. The cost is high considering the demographic characteristics of those affected and this may explain the mode of bill clearance through credit facilities. Severely brain-injured patients had the highest mean length of stay and mean hospital costs. The average lifetime costs of treating an individual with traumatic spinal-cord injury are estimated to be between US$500 000 and US$2 million (Bowley & Boffard, 2002). The high cost of hospital bill is as a result of the services given to patients. Casualties affected by RTA account for 45- 60 % of all admissions in surgical Wards in Kenya and up to 75% in national spinal injury placing a high demand on hospital resources (Odero et al., 2013). There is also a tendency towards transfer of long stay patients from private to public hospitals due to financial constraints. It was also noted that the failure to clear bills as attributed to the fact that majority of the patients were young and with no formal employment (Macharia et al., 2009).

The finding is similar to the study conducted in Malawi which found that recovery of the RTA patients takes long and this contributes to a lot of resources because of the cost incurred as a result many radiological investigations, laboratory investigations and prolonged hospital stay also contributes to the high cost. The study also found that lack of trained staff was also among the challenges facing the CCU patients (NSO, 2011). Patient are also predisposed to nosocomial infections because of many invasive treatments like central venous catheters, urinary catheterization and prolonged intubation (Museru et al., 2002)

Accidents are straining KNH and University of Nairobi School of Health Sciences medical staffs who work extra hours attending to the victims. Patients in CCU are at risk of sudden deterioration especially those with traumatic brain injuries. Lack of adequate knowledge among critical care nurses of dynamics of intracranial pressure and the factors associated with its increase can hinder proper management of patients (Hughes, 2002).

The challenges experienced by health care workers caring for RTA patients in the CCU included: poor staffing, lack of multidisciplinary team support in the CCU and health care personnel taking too long to review the patients. The ICU team is comprised of Physicians/ Intensivists, Respiratory therapist, Clinical pharmacist, Dieticians, bedside nurses, clinical psychologists and clinicians undergoing training. Team work is essential for ensuring the quality and safety of health care delivery in ICU.

Lack of skin care equipment and ripple mattresses were also reported. Various disease processes in CCU also cause changes in substrate metabolism which leads to changes in body composition and ultimately relative deficiencies of some important nutrients. Other challenges included development of nosocomial infections and other complications. Long stay of the patients in the CCU also consumes a lot of resources and majority of the patients were unable to pay the hospital bills. Patients do not also receive their target intake because of intolerance, interruptions and inadequate stock of food. Catabolic depletion of the protein reserves is also another challenge.

5.4 Conclusions

- The study found that RTA patients were admitted to CCU mostly due to head injuries. Majority of the patients had a Glasgow coma scale below 8/15 as per admission protocol to CCU.
- Young males in the reproductive age with low education level and unemployed were the most affected by RTA.
- Most of the RTA patients were referrals from other hospitals. The referrals were mostly from hospitals within Nairobi County and its environs. Patients who were referred were significantly associated with a low GCS. Patients were mostly referred for specialized services and financial reasons.
- The Critical Care Unit services provided to RTA patients included radiological services (Computerized Axial Tomography, X-ray and abdominal ultra-sound), laboratory services (Full haemogram, Grouping and Cross-matching, Urea and

electrolytes, coagulation profile and arterial blood gas analysis), Nursing, Physiotherapy, Surgical, Medical, and Nutritional services.

- The most common consultation service was neurosurgery and orthopedic surgery.
- The mean length of CCU stay long.
- The cost of management was high for the common citizen and majority of the patients were offered credit facilities.
- Mortality rate of RTA patients admitted to CCU was high.
- The complications among RTA patients in included; electrolyte imbalance, sepsis, anemia, trachea esophageal fistula, trauma to the bladder, shock, pneumothorax, Haemothorax, contractures, bedsores and permanent disability.
- Critical care services were generally inadequate especially equipment including CCU beds, suction machines, feeding pumps, infusion pumps, ripple ,mattresses, patient feeds and some drugs.
- Staffing ratios were below WHO standard of 1:1 for nurses to mechanically ventilated patients
- A long waiting time in emergency department was established.
- Challenges facing health care workers included; Lack of multidisciplinary support, long duration of hospital stay, catabolic depletion among patients and inability to pay for services.

5.5 Recommendations

The following are some of the recommendations that can improve health outcomes:

- There is need to decentralize ICU services to various departments such as neuro surgery, cardiology and medicine
- Improved staff to patient ratios, adequate provision for inadequate equipment and facilities can improve outcomes

- There is need for resources to be allocated to CCUs in the county hospitals and hospitals in Nairobi to cater for patients who need ICU care, CT scan services and other special treatment to reduce delay in the emergency department as well as reduce the number of referrals to KNH and similar entities.
- Multidisciplinary team support as well as refresher trainings on advanced cardiac life support, advanced trauma life support, pediatric advanced life support, and neurological critical can improve the outcomes of the RTA patients in the CCU.
- Raising public awareness on the effects and health outcomes of RTAs may help to educate young people to embark more on prevention.
- The government should re enforce measures to make motorcycle use safer since the percentage of accidents caused by motorcycles is almost equal to motor vehicle considering the capacity differences of the two means of transport.
- There is need to enroll more young people with NHIF and other health insurance covers to help them bear the economic burden of illness including RTAs.
- Highway patrols and effective evacuation of RTA patients can reduce delay for treatment.
- Further studies are recommended to determine the role of low education level on RTA.
- Further studies are recommended to determine the nutritional deficiencies affecting RTA patients.

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APPENDICES

Appendix I: Consent form for In Depth Interview for CCU Managers

Dear participant,

My name is Eunice Chelogoi. I am a student at Jomo Kenyatta University of Agriculture and Technology pursuing a Master's of Science degree in Public Health. I am carrying out a study on Critical Care Unit services among road traffic accident patients in KNH as part of my academic requirements. I am kindly requesting you to take part in this study. The following guideline is given to you as a guide in making a decision in whether or not to participate in this study. Participation is voluntary.

Title of the research project: Critical Care Unit Services among RTA Patients at KNH.

Principal investigator: Eunice Chelogoi

Contact: 0721928611

KNH/UON research ethics and review committee contact: 254-020 2726300 Ext- 44355

Supervisors

1. Dr. Yeri Kombe- 0734257864
2. Prof Simon Karanja - 0726424669

Objective of study: To assess the CCU services among RTA patients in KNH.

Procedure: You will be interviewed by the principal investigator who will be guided by an interview guide. The interview will also be recorded using a tape recorder to ensure accuracy of information given.

Benefits: The information obtained will be conveyed to CCU management team and KNH to help in the planning, policy formulation and resource allocation to improve CCU services for Road Traffic Accident patients admitted to the CCU.

Risks: There are no risks involved in this study.

Confidentiality: All the information given will be regarded as confidential. The interview will be recorded so that the information is more accurate. The recorded information is also confidential and will be used for study purpose only.

Voluntary participation/ refusal/ discontinuation: Participation the study is voluntary and you have a choice of participating or declining without any penalty.

You may make inquiries or seek clarification about this study using the contacts given above.

Participant statement

I understand that my participation is voluntary and that I may refuse to participate or withdraw my consent or stop participating in the study at any time without any penalty.

Participant signature……..Date…….….

Investigators sign…….Date……..…..

Thank you

Appendix II: In-depth interview schedule for CCU managers

1. Where do you admit RTA patients from?

……
……

2. What are the commonest diagnoses of patients admitted in the ICU?

……
……

3. What considerations do you check before admitting a patient to CCU?

……
……

4. How frequent do you admit patients with Road Traffic Injuries in the unit?

……
……

How available are ICU beds for RTA patients in CCU?

……
……
……

5. What is the approximate proportion of RTA patients in the ICU at any one given time?

……
……
……

6. Approximately how long do RTA patients admitted in the unit take before discharge/ death?

……
……

7. How do the services in CCU affect duration of stay among RTA patients?

……
……

8. What services do you provide for patients who have RTI in CCU?

……
……

9. In your view, do you have adequate resources to care for RTA patients in terms of :

a) Equipment(beds, ventilators ,cardiac monitors, suction machines, hemodialysis machines)

……
……

b) Personnel(doctors, specialists, nurses, physiotherapists, nutritionist, occupational therapists, laboratory technicians)

……
……
……

c) Treatments(medications, theatre, dressings , general care, CT scan/ X-ray, laboratory services eg arterial blood gases, urea and creatinine, full hemogram, feeds)

……
……
……

10. Describe the staff to patient ratio in comparison to what is recommended and the work load involved in RTIs.

……
……
……

11. Describe the recovery process of patients with RTIs.

……
……
……
……

12. Describe the other specific medical and surgical management given to RTA patients apart from the mainstay treatments.

……
……

13. What preparation do you have in place to care for mass accidents:

……
……

14. a) Do you have any refresher courses on how to manage RTIs.

YES ☐

NO ☐

b) If NO, Do you consider such courses necessary?

YES ☐

NO ☐

c) What trainings would you recommend to improve outcomes of RTA patients?

……

……

15. How do RTA patients pay for the services rendered?

……

……

16. How does the hospital ensure that patients who are unable to pay for services get the necessary treatments and investigations?

.....

.....

.....

17. What are your experiences/ challenges in caring for RTA patients in the unit?

……

……

18. What is the prognosis of RTA patients in CCU

……

……

19. What are the common complications that occur to RTA patients?

……

……

20. How do CCU services affect the outcome of the RTA patient in CCU?

……

……

21. What recommendations would you give on CCU services to help improve the outcomes for RTA patients in the unit?

……

……

Appendix III: Patient Records data Sheet

Part A: Demographic Details

1. Age in years……..……
2. Residence …….……
3. Referral from…….…….
4. Place where accident occurred……..

5. Marital Status

a) Single 1

b) Married 2

c) Widowed 3

d) Divorced 4

e) Separated 5

6. Education Level

a) None 1

b) Primary 2

c) Secondary 3

d) Mid-level college 4

e) University 5

7. Occupation

a) none 1

b) Casual laborer 2

c) Self-employed 3

d) Formal employment 4

e) Other (specify) 5

8. **Religion**

a) None 1

b) Christian 2

c) Muslim 3

d) Other (specify) 4

9. **Gender**

a) Female 1

b) Male 2

Part B: patients' records

10. Date of arrival …… Time of arrival……

11. Time of initial review by doctor…….

12. Type of injuries sustained/ diagnosis:

....……

……

Cause of injury/RTA……..

13. Glasgow Coma Scale on admission……..

14. Glasgow Coma Scale on discharge……..

15. Diagnostic investigation done during admission

Date……time……..……

Date……time……

Date…..……time……

Date…….time……

16. Date admitted to ICU……. Time ……...

17. Waiting time to investigations……

18. Waiting time to doctors review……

19. Waiting time to ICU admission…….

20. Duration of ICU admission……..

21. List of CCU services rendered……

……

……

22. Services scheduled but not provided in time. eg missing drugs.

……

……

23. Any other specific medication or procedures/surgeries ordered during ICU admission

……..……

……

……

24. Mode of feeding in CCU…….……

Date initiated …….

25. Reason for the type of feeding……..

26. Patient discharged to…….date…….....

27. Basis for discharge consideration……

……

28. Any complications arising during CCU admission…….....

……date…….

……date…….

……date……

29. Any special consultations for specialist doctors.

Date requested…….……

Date reviewed……..

Date requested……

Date reviewed…… …….....

Date requested ……

Date reviewed …….…

30. Accrued hospital bill in KSH…….……..

31. Mode of clearance of hospital bill……Date…….

32. Other specific comments…….

……
……

Appendix IV: Request to use Hospital Records

Eunice I. Chelogoi

P.O Box 2455-00202

Nairobi

6th November 2014

The Chief Executive Officer

Att. Research Committee

Kenyatta National Hospital

P.O Box 20723

Nairobi,

Dear sir/madam,

RE: REQUEST TO USE PATIENT HOSPITAL RECORDS FOR RESEARCH PURPOSE

I am an employee of KNH currently pursuing a Masters degree in public health at Jomo Kenyatta University of Agriculture and Technology.

I am carrying out a study on Critical care unit services among road traffic accident patients in KNH

I am therefore requesting for your authorization to use hospital records of both adults and children admitted in CCU with RTA related injuries from January 2013 to December 2013 for my study.

Thank you in advance

Yours faithfully

EUNICE I. CHELOGOI.

Appendix V: Letter to Ethics Review Committee

EUNICE. I. CHELOGOI
P.O BOX 2455-00202
NAIROBI.
06/11/2014
THE RESEARCH ETHICS REVIEW COMMITTEE,
KNH/UON
PO BOX 20723- 00202
NAIROBI,
Dear sir/ madam,

RE: REQUEST FOR AUTHORITY TO CONDUCT RESEARCH IN KNH.

I am a student at Jomo Kenyatta University of Agriculture and Technology undertaking a Master of Science degree in public health.

I am requesting for your authorization to carry out research on the **Effects of Road Traffic Accidents on Critical Care Unit Services at Kenyatta National Hospital** as part of my academic requirements.

Attached is a copy of my research proposal for your perusal.

Thank you in advance

Yours faithfully

EUNICE I. CHELOGOI

REG NO. TM310 -1041/2013