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DEPARTMENT OF ORTHOPEDIC SURGERY

MORTALITY RATE AND ASSOCIATED FACTORS AMONG POLYTRAUMA PATIENTS WITH ORTHOPEDIC INJURIES MANAGED AT MULAGO NATIONAL REFERRAL HOSPITAL

BY

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DECLARATION

I, Ocung Samuel hereby declare that the information presented in this dissertation is my original work and has never been submitted either in part or as a whole to any university for an award.

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DEDICATION

I dedicate this work to Wu Qi Yun and my family, whose unwavering support, encouragement, and sacrifices are unforgettable.

I dedicate this work to all road traffic accident victims in Uganda, whose experiences and challenges inspired this research. May this study contribute to improving trauma care and outcomes for all individuals affected by accidents in our country.

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LIST OF ABBREVIATIONS

A&E: Accident and Emergency

AO/OTA: Arbeitsgemeinschaft für Osteosynthesefragen / Orthopaedic Trauma Association

ATLS: Advanced Trauma Life Support

CHS: College of Health Sciences

CI: Confidence Interval

GCS: Glasgow Coma Scale

HDU: High Dependency Unit

ICU: Intensive Care Unit

IQR: Interquartile Range

IRB: Institutional Review Board

KTS: Kampala Trauma Score

MNRH: Mulago National Referral Hospital

PI: Principal Investigator

RR: Relative Risk

SD: Standard Deviation

SOMREC: School of Medicine Research Ethics Committee

OPERATIONAL DEFINITIONS

Polytrauma: Was defined as the presence of two or more injuries involving different body regions or organ systems, with at least one orthopedic injury.

Orthopedic injury: Referred to any injury involving the long bones, pelvis and spine, confirmed through clinical assessment and/or radiological investigations.

Polytrauma patient with orthopaedic injuries: Referred to a patient with two or more severe injuries occurring in at least two different body regions/systems, with at least one major musculoskeletal injury.

Severe injury: Was considered for any injury with Kampala Trauma Score II (KTS II) ≤6 (Mutooro, Mutakooha, & Kyamanywa, 2010).

Mortality: Was defined as death occurring during hospital admission, as recorded in the patient's medical chart or discharge/death register.

Mortality rate: Referred to the number of deaths among polytrauma patients with orthopaedic injuries admitted at Mulago National Referral Hospital during the study period.

ABSTRACT

Background: Polytrauma remains a major cause of morbidity and mortality worldwide, with a particularly high burden in low and middle income countries like Uganda. Orthopedic injuries are among the most common and resource-intensive components of polytrauma. This study aimed to determine the in-hospital mortality rate and associated factors among polytrauma patients with orthopedic injuries managed at Mulago National Referral Hospital.

Objective: To determine the mortality rate and associated factors among polytrauma patients with orthopaedic injuries managed at Mulago National Referral Hospital.

Methods: A prospective cohort study was conducted between January and March 2026, enrolling 160 polytrauma patients with orthopedic injuries from the Accident and Emergency unit at MNRH. Polytrauma was defined as two or more severe injuries in at least two body regions, with at least one major musculoskeletal injury. Mortality was considered for any death occurring during hospital stay. Data collection included medical record review, head-to-toe physical examination, and follow-up until discharge, death, or study conclusion Kaplan-Meier survival analysis estimated survival probability, and logistic regression identified factors independently associated with mortality.

Results: Of the 156 patients analysed (four lost to follow-up; response rate 97.5%), the median age was 32 years (IQR 25–40) and 82.1% were male. The in-hospital mortality rate was 16.03% (95% CI: 11.1%–22.6%), with over half of all deaths occurring within the first 24 hours of admission. Kaplan-Meier analysis showed a 7-day survival probability of 81.8%, with 96% of deaths occurring within the first seven days. Multivariate analysis identified advanced age (≥60 years, AOR=5.6), GCS <8 on admission (AOR=19.6), presence of tachypnea at admission (AOR=16.7), and unmet blood transfusion indication (AOR=13.7) as factors independently associated with mortality.

Conclusion: Polytrauma patients with orthopaedic injuries at MNRH experience high in-hospital mortality, with virtually all deaths occurring within the first seven days. Mortality was associated with advanced age, severe neurological compromise, respiratory distress, and unmet transfusion need. These findings highlight the need for early resuscitation, age-specific care protocols, timely transfusion, and enhanced patient support to improve outcomes.

Keywords: Polytrauma, Orthopedic injuries, Mortality, Uganda.

CHAPTER ONE: INTRODUCTION

1.1 Background

Trauma remains a major global health burden, with road traffic accidents (RTAs) alone contributing to over 1.2 million deaths annually and two-thirds of these deaths occur among people of working age, causing tremendous social and economic harm to societies globally (WHO, 2023). Up to 90% of global trauma deaths occur in low-and middle income countries (WHO, 2023). In Uganda and other sub-Saharan African countries, the burden of trauma continues to rise due to increasing motorization, poor road infrastructure, limited enforcement of traffic regulations, and constrained emergency response systems (Jean, Priti, & Paul, 2018). According to the Uganda Police Annual Crime Report (2025), RTAs are the leading cause of injury-related deaths, disproportionately affecting young adult males in their most economically productive years.

Polytrauma, defined as the simultaneous occurrence of injuries to multiple body systems (Marsden & Tuma, 2020), is a significant global healthcare burden, accounting for 25% of all major trauma admissions Hardy et al (2024) and a large proportion of trauma-related morbidity and mortality (B. M. Hardy, K. L. King, N. Enninghorst, & Z. J. Balogh, 2024; Iyengar et al., 2023; WHO, 2023). In Uganda, a study done at MNRH showed that 34.9% of trauma patients had polytrauma (Kalanzi et al., 2023). Motorcycle accidents (Boda boda), contribute substantially to this burden, representing 48% of road traffic injuries at Mulago Hospital, with a substantial proportion of victims experiencing polytrauma (Kamulegeya, Kizito, Nassali, Bagayana, & Elobu, 2015).

Polytrauma patients are at risk of physiological deterioration, increased risk of systemic inflammatory response syndrome (SIRS) and multiple organ failure (MOF) (Benjamin Maurice Hardy, Kate Louise King, Natalie Enninghorst, & Zsolt Janos Balogh, 2024). They require multidisciplinary teams to manage the competing priorities of different body systems and often consume considerable healthcare resources, which may overwhelm less coordinated systems (Benjamin Maurice Hardy, Kate Louise King, et al., 2024). Orthopaedic injuries including long bone fractures, pelvic injuries, and spine fractures are among the most frequent components of polytrauma and they contribute substantially to both early deaths and long-term disability (Zheng et al., 2021).

In the developed countries where organised trauma management systems are effective, a reduction in mortality of polytrauma patients is consistently being reported (Coccolini et al., 2021; Gomez et al., 2019; Hardy, Enninghorst, King, & Balogh, 2024; Jenkins et al., 2016). For example, Hardy et al., (2024) reported on the mortality of major trauma cases managed over 20 years in a level I trauma centre in Australia, they noted a significant reduction in mortality rate from 11.3% to 9.4%; mainly attributable to improvements in trauma management system (Benjamin Maurice Hardy, Natalie Enninghorst, et al., 2024). The situation is however different for LMICs where mortality of major-trauma patients is in excess of 40% (Luggya et al., 2021; Messelu et al., 2023). Limitations in healthcare resource envelope and fragmented trauma care systems in LMIC settings explain the disparity in trauma outcomes compared to High Income Countries (Jean et al., 2018).

Several studies, mainly from high-income countries (HICs) have extensively explored factors influencing outcomes in polytrauma including socio-demographic factors, comorbidities, injury-related, physiologic/clinical, and management related factors (Corbella et al., 2024; Rob de Vries et al., 2018; Vorbeck, Bachmann, Düsing, & Hartensuer, 2023). However research data from Uganda and similar LMIC settings on this remain limited.

This study aimed to determine the mortality rate and associated factors among polytrauma patients with orthopaedic injuries admitted in Mulago National referral Hospital (MNRH), Uganda. The findings are expected to provide a foundation for improving trauma care protocols and guiding policy interventions to reduce preventable deaths and disabilities in this high-risk population.

1.2 Problem Statement

Globally, trauma accounts for 5 million deaths per year, representing 9% of all global deaths, with more than 90% of traumatic injuries and deaths occurring in low- and middle-income countries (Omondi, 2024; World Health Organization, 2014). Polytrauma patients represent about 25% of the major trauma admissions in Africa and is one of the major causes of death in young people aged below 40 years (B. M. Hardy et al., 2024).

In Uganda, road traffic injuries remain a major cause of trauma, with hospital admissions due to road traffic crashes increasing from 77 per 100,000 population in 2012 to 116 per 100,000 population in 2023 (Kamukama et al., 2024). Road traffic crashes account for 61% of injury admissions, with orthopaedic injuries representing 37% of cases (Jayaraman et al., 2015). Among motorcycle accident victims specifically, 20% present with polytrauma, with open tibia fractures being the most common injury (21%) (Naddumba, 2014). The burden is substantial, with approximately 2,000 annual deaths from road traffic accidents in Uganda (Naddumba, 2014). Outcomes for polytrauma admitted cases remain unacceptably poor in Uganda, with hospital mortality rate reported at 40% according to a study done at Mulago National Referral Hospital (MNRH) (Luggya et al., 2021). Multiple systemic challenges contribute to this high mortality rate, including dysfunctional referral pathways, limited pre-hospital emergency care, critical shortages of medical resources, and the absence of coordinated, multidisciplinary trauma care teams (Jean et al., 2018; Luggya et al., 2021; Zheng et al., 2021).

Despite these known challenges, there is limited local data on the specific outcomes of polytrauma management, particularly among patients with orthopaedic injuries. Most of the available evidence comes from high-income countries, whose trauma care systems differ significantly from Uganda's in terms of infrastructure, workforce capacity, and rehabilitation services; limiting the applicability of their findings in the Ugandan context. Also, the specific factors that determine survival outcomes vary widely across settings due to differences in patient profiles, healthcare infrastructure, and resource availability. In Uganda, and particularly at Mulago National Referral Hospital, these factors remain poorly defined.

Without a clear understanding of the magnitude and determinants of mortality in this group, it becomes difficult to develop evidence-based interventions to improve trauma care outcomes, allocate resources efficiently, and strengthen emergency response systems. Consequently, preventable deaths may continue to occur, and quality improvement efforts within orthopaedic and trauma services may remain poorly targeted. Therefore, this study sought to determine the

mortality rate and associated factors among polytrauma patients with orthopaedic injuries managed at Mulago National Referral Hospital. This can provide valuable insights into the burden of injury as well as identify areas of improvement in the current trauma care system.

1.3 Justification for the study

In Uganda, trauma represents a significant and growing burden on the healthcare system, with evidence indicating a rising incidence of serious injuries. Despite this, few local studies have comprehensively examined polytrauma, and even fewer have focused specifically on the outcomes related to orthopaedic injuries within this context.

Findings from this study will provide policymakers with reliable mortality estimates and highlight key determinants of death, which can inform national injury prevention strategies, trauma system strengthening, and targeted interventions within Uganda's health policy framework. The study will provide insights that can guide medical practitioners in early risk assessment, prioritization of care, and adoption of evidence-informed clinical pathways such as modified trauma protocols. Ultimately, this will contribute to reducing preventable mortality, improving outcomes, and optimizing the use of limited hospital resources. Also, this study will fill a critical knowledge gap by generating prospective evidence on mortality rates and associated factors in polytrauma patients with orthopaedic injuries. It will also provide locally validated data that can serve as a baseline for future multicentre or regional studies, facilitate comparison with global data, and contribute to the academic discourse on trauma care in low-resource settings.

Overall, the findings will align with the national trauma care priorities, such as improving trauma system efficiency, standardizing emergency management, and reducing preventable deaths. This evidence will guide resource allocation, staff training, and implementation of standardized trauma care pathways, ultimately enhancing patient outcomes.

1.4 Study questions

1. What is the mortality rate for polytrauma patients with orthopaedic injuries managed in MNRH?
2. What are the factors associated with mortality among polytrauma patients with orthopaedic injuries managed in MNRH?

1.5 General Objective

To determine the mortality rate and associated factors among polytrauma patients with orthopaedic injuries managed at Mulago National Referral Hospital

1.6 Specific objectives

1. To determine mortality rate for polytrauma patients with orthopaedic injuries managed in MNRH.
2. To determine the factors associated with mortality among polytrauma patients with orthopaedic injuries managed in MNRH.

1.7 Conceptual framework

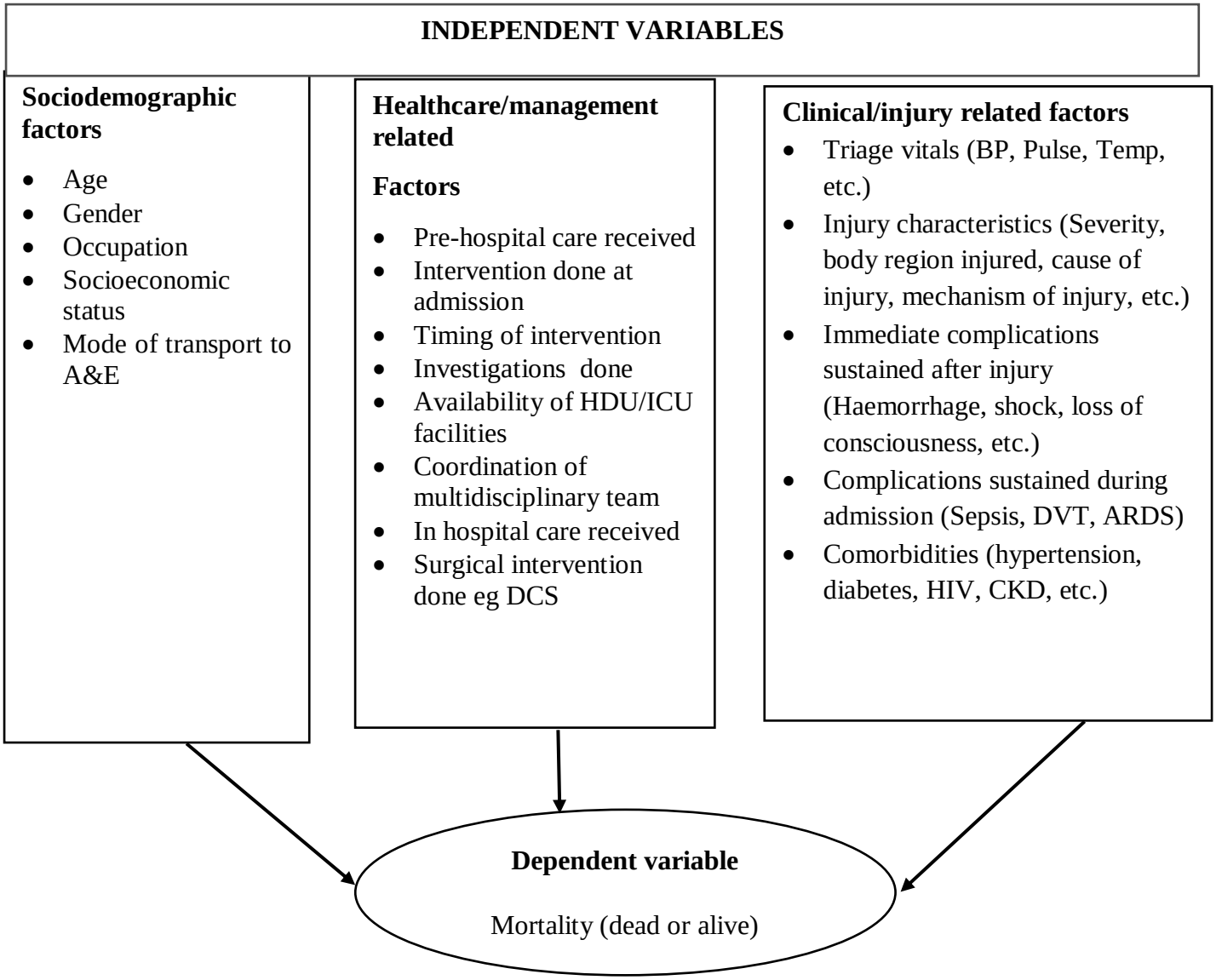

Figure 1. Conceptual framework for mortality in polytrauma patients with orthopaedic injuries.

Narrative of conceptual framework

The conceptual framework illustrates the interaction between patient-related, Care/management -related, and clinical factors in determining the outcome of mortality among polytrauma patients with orthopedic injuries. Patient-related factors such as age, gender, occupation, socioeconomic status, and mode of transport influence both the severity of injury and the timeliness of receiving care. These factors affect the risk of mortality by determining exposure to trauma, resilience to injury, and access to healthcare services. Healthcare care/management-related factors play a critical role in the continuum of trauma care. The

nature of pre-hospital care, timing and type of interventions undertaken, availability of diagnostic investigations, and access to high-dependency or intensive care units (HDU/ICU) directly impact survival. Furthermore, coordination of multidisciplinary teams, the time taken from injury to admission-golden hour, and delays in diagnosis of polytrauma significantly influence patient outcomes. Clinical factors represent the direct physiological and pathological responses to trauma. Injury-related characteristics such as severity, body region affected, and mechanism of injury are primary determinants of outcome. Immediate complications including haemorrhage, shock, and loss of consciousness, as well as complications sustained during hospital admission such as sepsis, deep vein thrombosis (DVT), or acute respiratory distress syndrome (ARDS), further affect survival. In addition, the presence of comorbidities (e.g., hypotension, diabetes, hypoxia), pre-hospital and referral delays, surgical interventions, and initial triage vital signs (blood pressure, pulse, temperature, respiratory status) all contribute to the likelihood of mortality. These three factors may interact and collectively determine the dependent variable, which is mortality (classified as dead or alive).

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The term polytrauma refers to the condition in which an individual sustains multiple traumatic injuries that occur simultaneously or in quick succession and involve more than one body region or organ system one of the injuries being life threatening and often resulting in significant physiological derangement (Pape et al., 2014). Patients with polytrauma have significantly higher mortality rates, a greater likelihood of ICU admission, and longer ICU stays compared to those with single body system injuries (Rau et al., 2017).

2.2 Epidemiology of polytrauma

Trauma is a leading cause of morbidity and mortality worldwide, particularly among young adults in their productive years (WHO, 2023). Over all, traumatic injuries claim approximately 4.4 million lives globally each year, accounting for nearly 8% of all deaths. Injuries and violence are also responsible for an estimated 10% of all years lived with disability. Beyond the human toll, they impose a substantial economic burden on national economies, costing billions of US dollars annually in healthcare expenditures, lost productivity, and law enforcement efforts (WHO, 2023).

According to the World Health Organization (WHO), over 90% of trauma-related deaths occur in LMICs. Road traffic accidents (RTAs), falls from heights, industrial accidents, and interpersonal violence are the most common mechanisms leading to trauma (Soni et al., 2022; WHO, 2023). In sub-Saharan Africa, RTAs are the leading contributors, with pedestrians, motorcycle users, and young male drivers being the most affected (Diamond et al., 2018; Luggya et al., 2022).

In Uganda, the burden of trauma continues to rise due to urbanization, increasing motorization, and poor road safety measures (Jean et al., 2018). The Uganda Police Force reports (2022) that RTAs are responsible for thousands of injuries and deaths annually, with a significant proportion resulting in multiple injuries consistent with polytrauma (Kalanzi et al., 2023).

Orthopaedic injuries including long bone fractures, pelvic injuries, and spinal trauma are among the most frequent injuries observed in trauma cases (Zheng et al., 2021).

2.3 Mortality among polytrauma patients

All-cause mortality among polytrauma patients remains significantly high, despite advances in trauma care. Current literature reports mortality rates ranging from 10% to 30%, depending on geographic location, injury severity, and the quality of trauma care systems (Ciechanowicz, Samojło, Kozłowski, Pakulski, & Żyluk, 2020; El Mestoui, Jalalzadeh, Giannakopoulos, & Zuidema, 2017; Vorbeck et al., 2023). In high-income countries (HICs), well-established trauma systems have contributed to a decline in mortality through improvements in pre-hospital care, timely resuscitation, surgical interventions, and critical care services. A systematic review of 30 studies involving 82,272 ICU-admitted polytrauma patients between 1966 and 2020 reported an average annual decline in all-cause mortality of 1.8% (95% CI: 1.6–2.0%) (van Breugel et al., 2020).

In contrast, low- and middle-income countries (LMICs) such as Uganda continue to report disproportionately high mortality rates; often exceeding 30% due to systemic delays, limited resources, inadequate infrastructure, and fragmented trauma care systems (Luggya et al., 2021; Madane et al., 2018; Seidu, Alhassan, & Buunaaim, 2024).

In terms of cause-specific mortality of polytrauma, there has been a shift in the primary causes of death over time with orthopaedic injuries significantly contributing to mortality in polytrauma patients. In a study conducted in the geriatric polytrauma patients (≥65 years), it was found that orthopaedic injuries worsen outcomes, with femur, clavicle, and scapular fractures showing increased mortality rates (Abdelfattah, Core, Cannada, & Watson, 2014). The same study revealed that pelvic/acetabular fractures requiring surgery and nonoperatively treated spine fractures were also associated with higher mortality (Abdelfattah et al., 2014).

However, it has been shown that appropriate orthopaedic management can improve survival outcomes. In a study done by (Nandi & Das, 2025), it was revealed that damage control orthopaedics using early external fixation for femur fractures in severe polytrauma patients demonstrated reduced mortality. The timing and approach to orthopaedic intervention however remains controversial, with ongoing debate between Early Total Care and Damage Control Orthopaedics strategies (Dabetic et al., 2025).

2.4 Other common complications in polytrauma patients with orthopaedic injuries.

Orthopaedic injuries are among the most common presentations in polytrauma patients and are frequently associated with significant morbidity (Devendra, Nishith P, Dilip Chand Raja, Dheenadhayalan, & Rajasekaran, 2021; Gray et al., 2018). While these injuries may not always be the immediate cause of death, they contribute substantially to the burden of complications, prolonged hospitalization, disability, and delayed recovery (Gray et al., 2018). Complications can arise from the initial trauma, delays in care, complex surgical interventions, and systemic effects of multi-organ injury. Common complications in polytrauma patients with orthopaedic injuries include:

Haemorrhage

Haemorrhage represents the most critical complication in polytrauma patients with orthopaedic injuries, accounting for up to 40% of trauma-related deaths and serving as the most common preventable cause of early mortality (Giordano, Giannoudis, & Giannoudis, 2020; Karthik Vishwanathan, Sunil Chhajwani, Amit Gupta, & Raju Vaishya, 2021). The haemostatic balance is severely compromised by trauma and shock, with patients often developing coagulopathy and surgically uncontrollable haemorrhage (Savioli, Ceresa, Caneva, Gerosa, & Ricevuti, 2021). Pelvic fractures causing cavity enlargement and femur fractures are particularly life-threatening sources of bleeding requiring immediate stabilization (Guerado, Bertrand, Valdes, Cruz, & Cano, 2015). Management emphasizes damage control principles, avoiding crystalloid overload in favour of balanced resuscitation with blood products, maintaining permissive hypotension, and preventing the lethal triad of hypothermia, acidosis, and coagulopathy (Giordano et al., 2020; Karthik Vishwanathan et al., 2021). Coagulopathy in trauma is multifactorial, with disseminated intravascular coagulation frequently manifesting, while aggressive crystalloid resuscitation can lead to complications including abdominal compartment syndrome and multiple organ failure (Savioli et al., 2021).

Compartment Syndrome

Acute compartment syndrome (ACS) is a limb-threatening condition often associated with fractures of the tibia, femur, or forearm (Raza & Mahapatra, 2015). Prompt diagnosis and surgical management are key for optimal outcomes in these patients yet in polytrauma setting where the patients are often obtunded, intubated, and/or unable to cooperate with an examination, early recognition of compartment syndrome is particularly problematic and

requires a high index of suspicion (Mauffrey, Hak, & Martin III, 2019). A study done in in Switzerland reported significantly longer duration from admission to diagnosis of compartment syndrome among multiply injured patients compared to those with single injuries (Mittlmeier, Pape, Neuhaus, & Canal, 2024).

Venous Thromboembolism (VTE).

Polytrauma patients with orthopaedic injuries are at high risk of deep vein thrombosis (DVT) and pulmonary embolism (PE) due to prolonged immobilization, inflammatory response, and vascular injury. Lichte and colleagues evaluated post-traumatic thromboembolic events in a large data base of polytrauma patients in Germany. They found a 2.8% incidence of VTE. Cases with higher injury severity score, major pelvic injuries and those who had one or more surgical interventions were at a significantly higher risk of VTE events (Lichte et al., 2015). Chowdhury et al (2021), in a prospective observational study to evaluate the incidence of VTE events in 169 pol-trauma patients admitted in the trauma unit of a tertiary centre in Riyadh, Saudi-Arabia found an overall incidence of 4.2% VTE events. Deep venous thrombosis occurred in 1.8% of cases while pulmonary embolism (PE) had an incidence of 2.4% (Chowdhury, Alrawaji, & Leenen, 2021). Recently, Chen and colleagues reported higher incidences of DVT (26%) and PE (6.9%) in a multicentre study in China. Also in this study polytrauma cases with traumatic brain injury (TBI) had significantly higher VTE incidences compared to those without TBI the authors attribute this higher VTE incidences to delayed thrombo-prophylaxis (Chen et al., 2023).

Infections

Infections are one of the most significant complications, particularly in open fractures, compound injuries, and cases where surgical interventions are delayed. The incidence of deep infections following orthopaedic procedures in polytrauma patients can range from 5% to 30%, depending on injury severity, timing of debridement, and local healthcare infrastructure. Halvachizadeh and colleagues in an analysis of database of over 3600 polytrauma patients managed in a level I trauma centre in Switzerland reported development of pneumonia in 19.0% cases, Sepsis in 14.9% and septic shock in 3.2% cases (Halvachizadeh et al., 2020). A recent systematic review and meta-analysis of 16 studies and a total of over 22,000 orthopaedic trauma surgery patients found a 6.7% incidence of deep tissue infections (Liu, Wang, Xing, Chang, & Pan, 2024)

Fat Embolism Syndrome (FES)

Fat embolism syndrome is a potentially fatal complication of long bone or pelvic fractures, often presenting within 12–72 hours of injury. Classic features include respiratory distress, petechial rash, and neurological dysfunction (Kwon & Coimbra, 2024). In polytrauma setting, FES diagnosis is often missed due to its subclinical presentation or as a result of its clinical signs being masked by other injuries (Timon, Keady, & Murphy, 2021). One systematic review of 15 studies that assessed incidence of fat embolism and associated factors among femoral fracture patients found nearly double the incidence of FES among multiply injured cases compared to single femoral fracture cases (4.6% versus 2.9%) (Lempert et al., 2021)

Multiple Organ Dysfunction Syndrome and Systemic Inflammatory Response Syndrome

Multiple Organ Dysfunction Syndrome (MODS) and Systemic Inflammatory Response Syndrome (SIRS) represent critical complications in polytrauma patients, arising from complex pathophysiological cascades. Following initial trauma, both primary injuries and secondary insults trigger systemic inflammatory responses characterized by pro-inflammatory cytokine release, complement activation, and coagulation system dysfunction (Rowe et al., 2024). This inflammatory response occurs alongside a compensatory anti-inflammatory response syndrome (CARS), and the imbalance between these dual responses contributes to organ dysfunction and increased infection susceptibility (Rowe et al., 2024). The pathogenesis involves endothelial damage, leukocyte accumulation, disseminated intravascular coagulation, and microcirculatory disturbances leading to cellular apoptosis and necrosis (Rowe et al., 2024). MODS carries high mortality rates of 30-80% depending on the number of failed organs (Asim, Amin, & El-Menyar, 2020). The host inflammatory response, rather than the initial trigger, is the primary determinant of patient outcomes (Zhao et al., 2021). Treatment focuses on damage control procedures, metabolic support, and restoration of oxygen transport (Zhao et al., 2021).

2.5 Factors influencing mortality in polytrauma patients

Several studies conducted predominantly in high-income countries (HICs) have explored multifactorial determinants of short-term mortality in polytrauma patients. Corbella et al. (2024), for instance, in a study to compare survival and outcomes in polytrauma cases in Italy reported that advanced age, low Glasgow Coma Scale (GCS) scores, high Injury Severity Scores, and deranged physiological parameters such as hypotension and hypoxia were all

strongly associated with increased mortality (Corbella et al., 2024). Their findings emphasized the prognostic utility of combining demographic and clinical indicators to guide early trauma care interventions.

De Vries et al. (2018), using data from the Dutch Trauma Registry, demonstrated a significantly higher mortality rate among patients aged 60 years and older (19.8%) compared to those under 60 (9.6%), even when injury severity was similar. They attributed this disparity to the reduced physiological reserve and higher burden of chronic diseases typically found in older populations, reinforcing age as a major independent predictor of trauma-related death (Rob de Vries et al., 2018).

Vorbeck et al. (2023) conducted a comprehensive analysis of risk factors associated with 30-day mortality in polytrauma cases and identified several independent predictors, including coronary artery disease, hypotension on admission, and low GCS scores at admission (Vorbeck et al., 2023). Notably, they observed that patients presenting with coagulopathy or other signs of systemic physiological derangement were significantly more likely to die within the early post-trauma period.

Shu et al. (2022) investigated the influence of pre-existing comorbidities and found that diabetes mellitus nearly doubled the odds of early mortality following polytrauma. Furthermore, cardiovascular disease increased the risk of death nearly six-fold (Shu et al., 2022). The authors emphasized the critical importance of identifying and managing comorbid conditions in trauma patients from the point of first contact.

(Mijaljica et al., 2022) explored both physiological and systemic predictors of polytrauma mortality and reported that patients with an ISS of 16 or more had a threefold increased risk of death compared to those with less severe injuries. They also identified the need for massive blood transfusion, hypotension, and low oxygen saturation (SpO_2 <90%) as significant contributors to early mortality, suggesting that early recognition and correction of these physiological derangements could improve outcomes (Mijaljica et al., 2022).

Di Saverio et al. (2014) emphasized the compounding effect of traumatic brain injury on outcomes, noting that patients with GCS scores of 8 or less were more likely to develop complications such as aspiration pneumonia, pressure ulcers, and respiratory failure, all of which contributed to elevated mortality. They also highlighted sepsis and intra-abdominal

injuries as important secondary factors worsening short-term outcomes (Di Saverio et al., 2014).

Lichte et al. (2015) found that polytrauma patients undergoing multiple surgical interventions had higher complication rates and mortality. Their study stressed the importance of carefully selecting candidates for surgery and optimizing their physiological status prior to operative management, particularly in resource-limited settings (Lichte et al., 2015).

Alamshah et al. (2010), in a study conducted in Iran, examined the timing of intervention and showed that delays exceeding five hours from injury to definitive care significantly increased the likelihood of death. Their work affirmed the principle of the "golden hour" in trauma care and called for the strengthening of pre-hospital systems and emergency triage in lower-resourced healthcare environments (Alamshah, Pipelzadeh, Mousavi, Baharanfar, & Rezapour, 2010).

The timing of the intervention for polytrauma patients has also been reported as a critical factor influencing patient outcomes. According to literature, in polytrauma, definitive fixation should be performed between the 4th or 5th day and the 10-12th from trauma, as this window has showed the lowest rate of complications rate (*e.g.* systemic inflammatory response syndrome and acute respiratory distress syndrome) (Aprato, Ruscitti, Racca, Grosso, & Masse, 2024). The concept of damage control orthopaedics (DCO) has however been advocated in orthopaedic profession, which suggests a temporary fracture stabilization for the most critical and unstable patients and allowing for the stabilization of the patient's hemodynamics as well (Dei Giudici et al., 2015). It is further recommended that Damage Control Orthopaedics (DCO) (external fixation, short procedures) when the patient is physiologically unstable, HCWs should proceed to Early Appropriate Care (definitive fixation within 24–36 hours) once resuscitation targets are met (e.g., normalized lactate/base deficit/temperature) (Choi, Jung, Kyoung, & Choi, 2019). Early definitive fixation in appropriately resuscitated patients reduces pulmonary complications and LOS (Choi et al., 2019).

According to (Giannoudis, Rodham, Giannoudis, & Kanakaris, 2023), modern management of severely injured patients should start with immediate life saving actions such as assessment of ABCD within the first 60 minutes (golden hour), followed by damage control surgery in 0-24 hours and early appropriate care which includes definitive fixation within 36 hours (Giannoudis et al., 2023). Patients not fit for early appropriate care should however receive a staged

definitive care that includes continued ICU optimisation and correction of physiological derangements before and definitive/corrective surgery can be performed (Giannoudis et al., 2023).

2.6 Gap in literature

While multiple studies in high-income settings have explored outcomes of polytrauma and risk factors for poor outcomes especially mortality, limited research exists from sub-Saharan Africa, including Uganda. Local studies have mostly focused on epidemiology or individual body system injuries, often neglecting the broader polytrauma context. Moreover, context-specific factors such as poor patient referral systems, limited prehospital care, delays in definitive management as well as less robust trauma care systems may influence outcomes differently in Uganda.

There is a pressing need for locally generated data to support trauma system development, inform clinical practice, and optimize resource use. This study aims to address these gaps by investigating the mortality rate and the factors associated with mortality in orthopaedic patients with polytrauma in a Ugandan tertiary hospital setting.

CHAPTER THREE: METHODS

3.1 Study Design

This was a prospective cohort study. Participants were enrolled from the Accident and Emergency unit at Mulago National Referral Hospital (MNRH) and followed from admission until death, discharge, or study conclusion.

3.2 Study Period

The study was conducted over three months, from January 2026 to March 2026. All eligible participants were recruited and followed up throughout their entire hospital stay during this period.

3.3 Study Setting

The study was conducted at the A&E unit (commonly known as casualty) at Mulago National Referral Hospital (MNRH) and patients were followed up in their respective wards on transfer out from the A&E unit. The hospital is the main national referral hospital in Uganda and serves as the teaching hospital for the College of Health Sciences, Makerere University. It is located on Mulago hill approximately five kilometres northeast of Kampala city Centre in Kawempe division- Kampala district. Most patients attending the hospital are from Kampala and the neighbouring districts like Wakiso, the diverse health units across Uganda as well as from the neighbouring countries.

This hospital has a bed capacity of approximately 1,790 beds and employs a wide range of medical staff, including over 600 doctors and 1,200 nurses, as well as allied health professionals such as anaesthetists, physiotherapists, orthopaedic officers, and laboratory personnel who work in rotating shifts. The A&E unit has a total bed capacity of 56 beds where 10 beds are the HDU section (red zone), 12 in the triage section and 36 in the yellow zone (holding area for 24 hour patient monitoring). The A&E unit has 3 functional emergency operating room, designated for orthopedics, general surgery and neurosurgery patients. The unit also has a point of care x-ray machine and ultrasound scan for Extended Focused Assessment with Sonography in Trauma (E-FAST). The A&E unit is currently headed by a consultant orthopedic surgeon and is operated by 2 permanent surgeons (one orthopedic and one general surgeon), 34 nurses, 13 medical officers, 2 emergency physicians, 5 orthopedic officers, 2 radiographers, 1 physiotherapists and 3 records assistants.

MNRH manages a high volume of trauma and orthopaedic cases, including polytrauma patients from across Uganda and referrals from regional and district hospitals. Anecdotal data shows that the A&E unit receives over 100 polytrauma patients every month, who are managed with both surgical and non-surgical interventions. The hospital's large catchment area, multidisciplinary staff, and large number of polytrauma patients make it an ideal setting to study mortality and associated factors among polytrauma patients with orthopaedic injuries.

3.4 Population

3.4.1. Target population

All adult polytrauma patients with orthopaedic injuries (≥18 years of age) admitted to A&E unit at Mulago National Referral Hospital during the study period. This study did not consider children because of their differences in physiological response to trauma as compared to adults, which could introduce heterogeneity in outcome assessment.

3.4.2. Accessible population

All adult polytrauma patients admitted to the A&E unit at Mulago National Referral Hospital during the study period.

3.4.3. Study population

All adult polytrauma patients with orthopaedic injuries above 18 years admitted to the A&E unit at Mulago National Referral Hospital during the study period who met the inclusion criteria and consented for the study.

3.5 Eligibility Criteria

3.5.1. Inclusion criteria

All polytrauma patients with orthopaedic injuries of age 18 years and above admitted to the A&E unit at MNRH during the study period. Polytrauma patient with orthopaedic injuries referred to a patient with two or more severe injuries (KTS II ≤6) occurring in at least two different body regions/systems, with at least one orthopaedic injury involving the axial skeleton, and appendages (spine, pelvis and long bones).

3.5.2. Exclusion criteria

- Unidentified unconscious patients as these could not provide verifiable data necessary for reliable analysis.
- Repeat admissions for the same injury episode to avoid duplication of data, which could bias the assessment of mortality and associated factors.

3.6 Study variables

3.6.1 Independent variables

The independent variables comprised sociodemographic, clinical, and care-related factors. Sociodemographic factors included age, gender, occupation, socioeconomic status, and mode of transport to the Accident and Emergency (A&E) unit. Clinical factors included triage vital signs such as blood pressure, pulse rate, and temperature; injury-related characteristics including injury severity, body region injured, mechanism and cause of injury, and injury patterns; immediate post-injury complications such as haemorrhage, shock, and loss of consciousness; in-hospital complications including sepsis, deep vein thrombosis, and acute respiratory distress syndrome; and pre-existing comorbidities such as hypertension, diabetes mellitus, HIV infection, and chronic kidney disease. Care and management-related factors included receipt of pre-hospital care, interventions performed at admission, timing of interventions, investigations undertaken, availability of high dependency or intensive care unit facilities, coordination of multidisciplinary team input, in-hospital care received, and surgical interventions such as damage control surgery.

3.6.2 Dependent (outcome) variables

The primary outcome was mortality among **polytrauma patients with orthopaedic injuries**, defined as death occurring during hospital admission (in-hospital mortality), as recorded in patient files. Mortality was measured as a binary variable (Yes/No), established at the time of death, discharge or end of the study.

Secondary outcomes included time to death, survival probability and Length of hospital stay for those discharged alive.

These secondary outcomes were assessed to provide a more complete characterisation of the mortality burden and hospital experience of polytrauma patients, in direct support of Specific Objective 1.

3.7 Sampling strategy

3.7.1 Sampling technique

Consecutive sampling of eligible polytrauma patients with orthopaedic injuries presenting during the study period until the required sample size was achieved.

3.7.2 Sample size estimation

Objective one: Mortality rate

The sample size was calculated using the formula for estimating a proportion in a single population study, given the objective of determining the mortality rate among polytrauma patients with orthopaedic injuries.

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{d^2}$$

Where Z = 1.96 (95% confidence level), p = 0.40 (estimated mortality rate based on Luggya et al., 2021, who reported 40% hospital mortality among trauma patients at MNRH), and d = 0.05 (5% margin of error). Substituting: n = ($1.96^2 \times 0.40 \times 0.60$) / 0.05^2 = **369**.

Objective two: Factors associated with mortality

Sample size was determined using the two-proportion formula:

$$N = \frac{[Z_{\alpha/2}\sqrt{2p_1(1-p_1)} + Z_{\beta}\sqrt{p_1(1-p_1) + p_2(1-p_2)}]^2}{(p_1 - p_2)^2}$$

Where $Z_{\alpha/2}$ = 1.96 (standard normal value corresponding to 5% level of significance), Z_{β} = 0.84 (standard normal value corresponding to 80% power of the study), and using traumatic brain injury (TBI) as a significant predictor mortality in polytrauma patients, P_1 is the proportion of polytrauma patients with TBI who die (88.4%) while P_2 is the proportion of polytrauma patients without TBI who die (56.8%) (da Costa et al., 2017).

On substitution, sample size=20

The final sample size of the study was 369 as it is considered sufficient to answer all study objectives.

Definite sample size

A finite population correction was applied because the study population was finite and known. Based on hospital records indicating an average of 94 polytrauma patients per month, the expected number over 3 months was N = 282 eligible patients. Applying the correction formula:

n_∞ = n / (1 + (n−1) / N) = 369 / (1 + 369/282) = 160

The corrected target sample size was therefore 160 patients.

Response rate and loss to follow-up

Of the 160 patients recruited, four (2.5%) were lost to follow-up during the study period. Their files could not be traced at the time of outcome ascertainment and their discharge or mortality status could not be determined. These patients were excluded from the final analysis, giving an analysed sample of 156 patients and a response rate of 97.5%. This loss to follow-up rate is well within the conventionally accepted threshold of 10–20% for prospective cohort studies.

3.8 Data Collection and study Procedures

Following ethical approval from Makerere University School of Medicine Research and ethics committee (SOMREC) and administrative clearance from Mulago National Referral Hospital, research assistants were trained and deployed at the A&E unit. Eligible patients were identified upon admission to the A&E unit of Mulago National Referral Hospital, and screened using the inclusion and exclusion criteria. Informed consent was obtained from patients or their legally authorized representatives prior to enrolment. Two prior trained research assistants (medical doctors) screened and recruited participants on a daily basis. Data collection involved both abstracting information from patient's charts, performing a head-to-toe physical examination and face to face interviews with the participants or their care takers. These were done immediately the patient was recruited into the study and was done by the research assistants who were medical officers employed at Mulago hospital, supervised by the principle investigator.

The information abstracted from patients' medical charts included sociodemographic and clinical variables routinely documented in hospital records. These comprised age, gender, occupation, date and time of admission, mechanism and cause of injury, and documented comorbidities. Clinical parameters extracted included Glasgow Coma Scale (GCS), vital signs at the time of admission such as blood pressure, pulse rate, respiratory rate, oxygen saturation, and temperature, as well as the Kampala Trauma Score II (KTS II) where available. Additional data obtained included referral status, surgical or non-surgical interventions performed during admission, and patient disposition, including admission to the intensive care unit, orthopaedic ward or discharge/death outcomes as recorded in the file. However, where these parameters were not documented in the patient files, the research assistants performed direct clinical

assessments where feasible, including evaluation of the GCS, vital signs, and KTS, to supplement missing clinical information.

The trained medical officers then performed a head-to-toe physical examination for each patient as follows:

- The patient was carefully exposed, ensuring their privacy is respected, for clinical examination.
- The researcher performed a head-to-toe examination for every patient (using inspection, palpation, percussion, and auscultation depending on the system being examined) starting from the head and neck, chest, abdomen, pelvis, extremities (upper and lower limb), and spine. This intended to identify injuries in the different body regions and was noted on the questioner.

In the event of discrepancies between the recorded notes and the findings of the physical examination, the researcher informed the medical team involved in the patient care about the inconsistency but only documented his or her findings and did not record in patient files.

Any death due to polytrauma orthopaedic injury was only recorded where a patient was recruited into the study.

Immediate complications recorded in the patients' charts by the attending emergency physician, resident, or surgeon from time of admission up to discharge were also captured in the data collection tool.

For patients with polytrauma who were initially missed due to overlooked injuries, every effort was made to identify such cases through follow-up especially as the patients' imaging investigations were performed during the course of their care.

Every study participant was followed up prospectively until when they died or got discharged from the hospital. Participants were reviewed once every week to ascertain their current status and presence of any complications. For patients who were not on ward (discharged or died), their medical files were traced and details captured. During the follow-up, participants were assessed for the interventions done, presence of any complications such as pulmonary embolism, respiratory distress syndrome, etc and their status (alive or dead) based on what is documented in the patient records made by the treating clinical team.

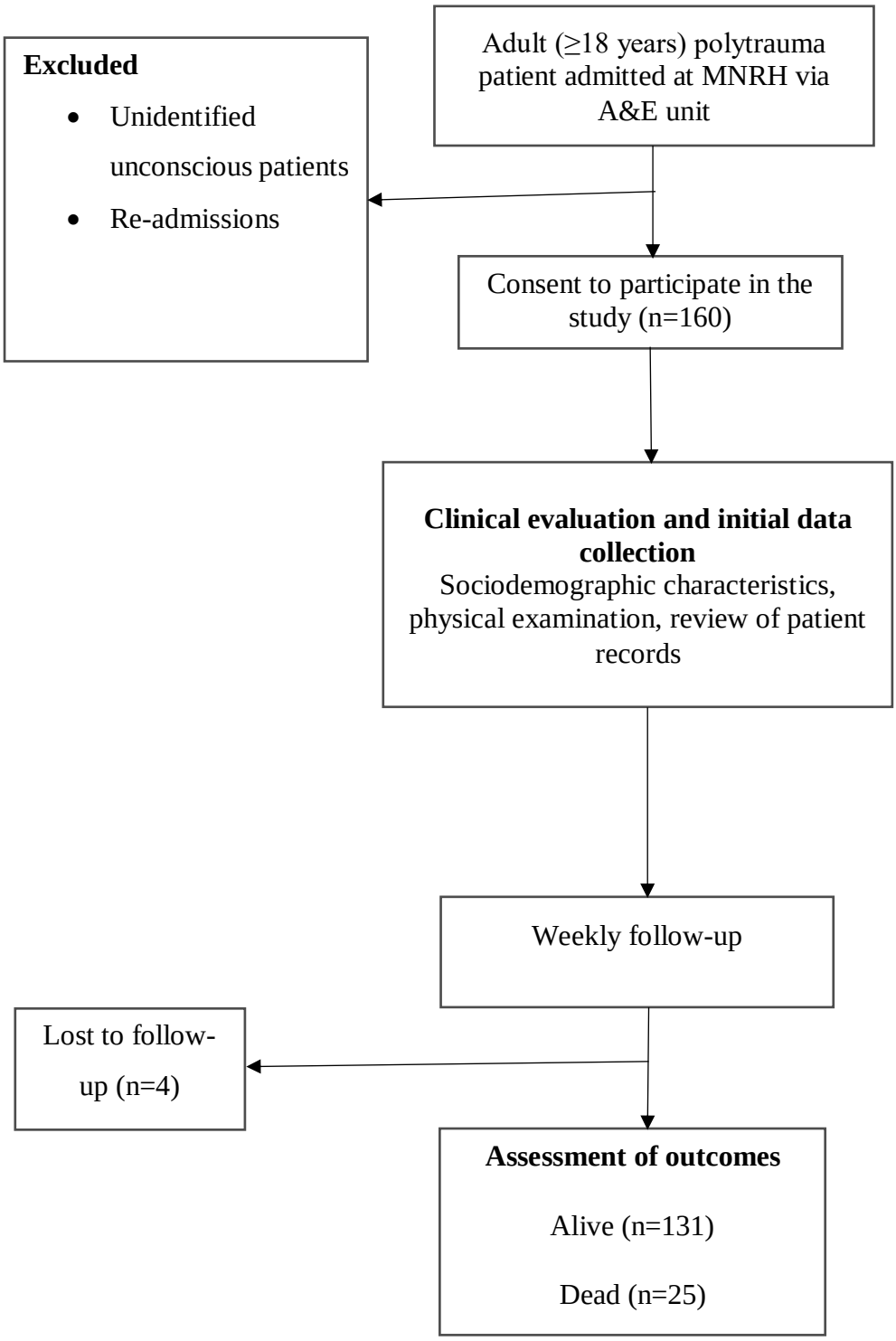

Figure 2. Flow-chart showing patient recruitment steps for the study.

3.9 Data management

Data collected at admission using printed questionnaires and at follow-up visits were entered digitally using Kobocollect, a secure mobile data collection platform. The principle investigator (PI) reviewed data entries daily on the Kobocollect dashboard and resolved discrepancies promptly. Data were subsequently exported to Microsoft Excel for preliminary review and then to Stata version 16 for cleaning and analysis by a biostatistician.

Participant anonymity was maintained by assigning unique study identifiers to each participant. No names or other identifying information were stored in the electronic dataset. Electronic datasets were password-protected and accessible only to the principal investigator. Hardcopy questionnaire with patient data were stored in locked cupboard at the office of the principle investigator.

3.10 Data Analysis

Descriptive statistics

Continuous variables such as mean, blood pressure and others were summarised using medians and interquartile ranges (IQR) where data were skewed, and means with standard deviations where normally distributed. Categorical variables such as gender, level of education, mechanism of injury and others were summarised as frequencies and percentages.

Objective one: mortality rate and survival analysis

The in-hospital mortality rate was calculated as the number of deaths divided by the total number of patients analysed, expressed as a percentage with a 95% Wilson confidence interval.

Kaplan-Meier survival analysis was performed on all 156 patients to estimate the probability of survival over time. All surviving patients were treated as censored observations at their last observed time point (discharge date, or study end date of 28 March 2026 for those still on the ward). A 7-day administrative censoring window was applied as the primary survival analysis. This window was chosen because 96% of all in-hospital deaths occurred within the first seven days of admission, meaning the 7-day risk set was substantially more complete than at any longer time point. Survival probabilities with 95% confidence intervals were estimated at Days 1, 2, 3, 5, and 7 using the complementary log-log method. The median survival time and time-to-death distribution were also described.

Objective two: factors associated with mortality

To identify factors independently associated with in-hospital mortality, a two-stage logistic regression approach was used.

Bivariate analysis: Each independent variable was analysed individually against the mortality outcome using simple logistic regression. Crude odds ratios (COR) with 95% confidence intervals and p-values were reported. Variables with a p-value of less than 0.20 on bivariate analysis, or with established biological plausibility for association with mortality, were considered for inclusion in the multivariate model. A threshold of $p<0.20$ rather than $p<0.05$ was used at this stage to avoid excluding potentially important variables whose effect may be attenuated in a small sample.

Multivariate analysis: All variables meeting the bivariate screening criterion were entered simultaneously into a multiple logistic regression model. Adjusted odds ratios (AOR) with 95% confidence intervals were reported. Confounding was assessed using the 10% change-in-estimate method: a variable was considered a confounder if its inclusion changed the AOR of the main predictor by more than 10%. Statistical significance was determined at $p<0.05$.

3.11 Quality assurance and control

Completeness and accuracy of data was ensured by double data entry for each study participant by two independently operating research assistants. On a daily bases, the PI would review both sets of data entered and resolve cases of discrepancies as soon as possible. Both the electronic and hard copies of the data was kept under password and lock and key respectively to ensure data safety. Research assistants were trained on the data collection process and the data collection was pre-tested before using them for final data collection.

3.12 Ethical Considerations

Permission to conduct this study was sought from the department of Orthopedic surgery at Makerere University School of Medicine and the director Mulago hospital. Ethical approval was sought from the School of Medicine Research and Ethics Committee (SOMREC) of Makerere University.

Patients who were conscious, alert, and able to understand the study information would provide written informed consent themselves before they are recruited to the study. For patients who were unconscious, severely injured, or otherwise incapacitated, proxy consent was sought from the patient caretaker. Patients initially enrolled with proxy consent were re-consented personally once they regain capacity, and given the option to continue or withdraw from the

study. Where no caretaker was available at the time of admission, participants were enrolled by consent deferred until when the patient regained consciousness and capacity to give an informed consent. Patients who declined participation after regaining consciousness would have their data removed from the study, and their clinical care would not be affected.

Right to privacy for respondents and strict anonymity plus confidentiality was observed. Unique study identifiers were assigned to every study participant and no participant was identified by any study reports or publications.

All study related documentation were safely stored in cabinets with restricted access and all electronic datasets were password-protected with access restricted to the principal investigator.

The results are of potential benefits to the general public, policy makers and researchers since the study document mortality among polytrauma patients with orthopedic injuries.

CHAPTER FOUR: RESULTS

4.1 Study profile

A total of 2930 patients presented to the A&E between January and March 2026, of whom 215 (7.3%) had polytrauma with orthopedic injury. Thirty one (14.4%) were confirmed dead on arrival, and were not considered for recruitment. A total of 184 (85.6%) were therefore eligible and 160 (87%) were recruited by consecutive sampling. Of these, 4 (2.5%) patients were lost during follow-up and the final sample contained 156 patients. Of these, 25 (16.03%) died during admission, 81 (51.92%) were discharged while 50 (32.05%) were still on ward at the time of conclusion of the study.

4.2 Sociodemographic characteristics of the participants

The median age of the participants was 32 years (interquartile range 25–40 years) and majority were males 128/156 (82.1%). The majority had primary 44 (28.21%) or secondary education 68 (43.59%). These engaged in various occupations with 16 (10.3%) being boda boda riders, 13 (8.3%) were construction workers or machine operators and 11 (7.1%) were drivers. The most common cause of injury was road traffic accident 123 (78.85%) followed by fall 14 (8.97) and assault 13 (8.33).

Table 1. Sociodemographic characteristics of polytrauma patients with orthopaedic injuries at MNRH (N=156)

Variable	Options	Frequency (n, %)
Age (in years)	Median (IQR)	32 (25- 40)
	18–34	91 (58.33)
	35-60	59 (37.82)
	>60	6 (3.85)
Gender	Female	28 (17.95)
	Male	128 (82.05)
Occupation	Boda boda rider	16 (10.26)
	Businessman/woman	36 (23.08)
	Construction worker/machine operator	13 (8.33)
	Motor vehicle driver	11 (7.05)
	Formal/professional employment	10 (6.41)
	Others (specify)	32 (20.51)
	Unemployed	38 (24.36)
Education level	None	9 (5.77)
	Primary	44 (28.21)
	Secondary	68 (43.59)
	Tertiary	35 (22.44)
Cause of injury	Road traffic accident	123 (78.85)
	Fall	14 (8.97)
	Assault	13 (8.33)
	Others	6 (3.85)

IQR = interquartile range. Median age IQR reported to nearest whole year.

4.3 Mortality rate among polytrauma patients

In-hospital mortality rate

The in-hospital mortality rate among polytrauma patients with orthopaedic injuries was 16.03% (95% CI: 11.1%–22.6%), with 25 deaths recorded among 156 patients analysed.

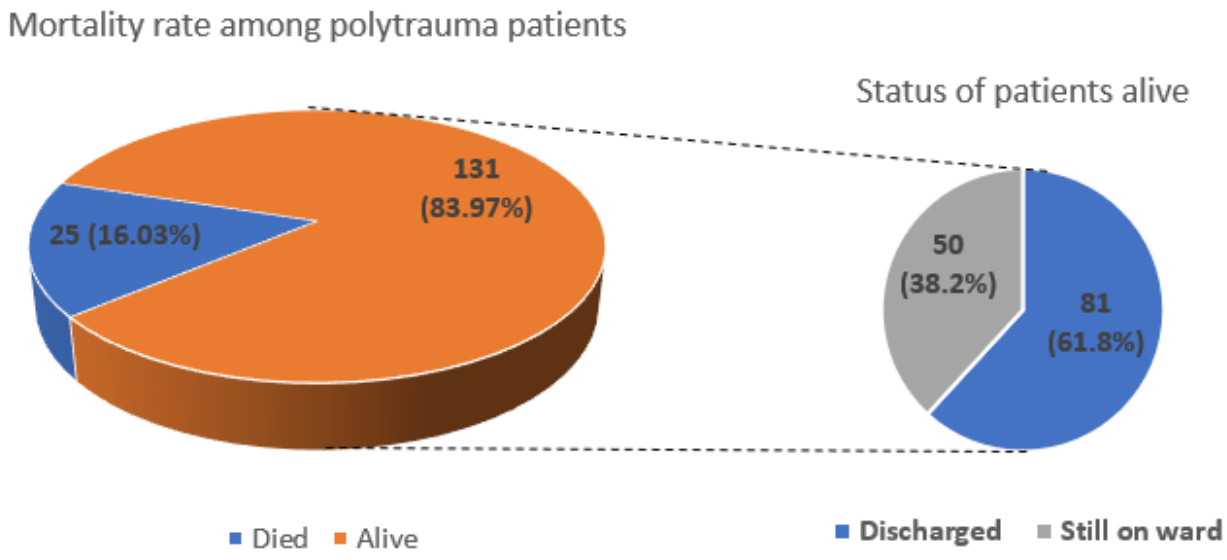

Figure 3. Mortality rate among polytrauma patients.

7-day Kaplan-Meier survival analysis

A secondary Kaplan-Meier analysis was performed with a 7-day administrative censoring window to provide a more conservative survival estimate grounded in the period of highest mortality risk. 24 of 25 deaths (96%) occurred within the first seven days of admission, meaning the 7-day analysis captures the full mortality burden of the acute phase.

Survival at Day 1 was 91.7% (95% CI: 86.1%–95.1%), declining to 90.2% at Day 2, 88.6% at Day 3, and 83.0% at Day 5. By Day 7, the survival probability was 81.8% (95% CI: 73.8%–87.6%), corresponding to a 7-day mortality of 18.2% (Figure 3).

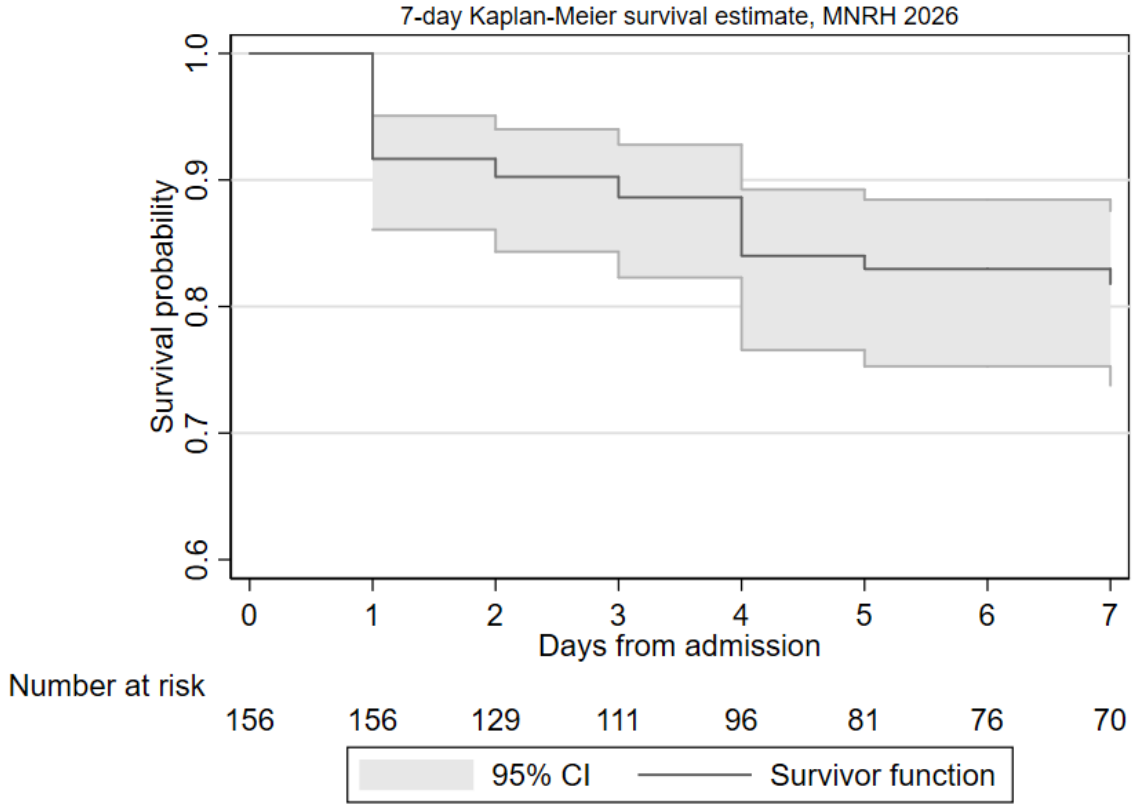

Figure 4. 7-day Kaplan-Meier survival estimate among polytrauma patients with orthopaedic injuries

Time from admission to mortality

For the 25 patients who had died, more than half of the patients died within the first 24 hours (n=13/25, 52%), two patients (8%) died on day 2 and day 3, while only 2 (8%) died after 7 days.

Table 2. Time from admission to mortality for patients of polytrauma patients with orthopaedic injuries at MNRH (N=25)

Duration from Admission to Death (days)	Frequency, n (%)
Median	1 (1-4)
1	13 (52.00)
2	2 (8.00)
3	2 (8.00)
4	5 (20.00)
5	1 (4.00)
7	1 (4.00)
38	1 (4.00)

Length of hospital stay (LOS) for the patients discharged

Among 81 patients who were discharged, the median length of stay was 15 days (IQR 7 - 24) and majority 52 (64.2%) were admitted for 15-30 days. Only 13 patients (16%) were discharged within one week, while 3 patients stayed for more than 30 days.

Table 3. Length of hospital stay (LOS) for the patients discharged

Length of Hospital Stay (Days)	Frequency (n)	Percentage (%)
2-7	3	3.7
8-14	13	16.0
15-30	52	64.2
31-60	13	16.0
Total	**81**	**100.00**

Status of patients discharged

Among the patients discharged, it was noted that a significant proportion 25 (30.86%) leave the hospital against medical advice, while 14 (17.28%) were transferred to another facility/unit and 42 (51.85%) were discharged home.

Table 4, Status of patients discharged

Discharge status	Freq.	Percent
Discharged home	42	51.85
Left against medical advice (LAMA)	25	30.86
Transfer to another facility/ward	14	17.28
Total	**81**	**100.00**

4.4 Factors associated with mortality among polytrauma patients with orthopedic injuries.

Binary logistic regression was used to estimate crude and adjusted odds ratios for mortality in polytrauma patients with orthopedic injuries using bivariate and multivariate analyses. The reference categories were selected based on the most clinically appropriate or most commonly occurring category within each variable to ensure meaningful comparison between exposure groups and a stable baseline for odds ratio estimation. Statistical significancy was considered for $P<0.05$.

Bivariate analysis of sociodemographic factors associated with mortality among polytrauma in patients with orthopedic injuries at MNRH.

The bivariate analysis revealed that patients aged over 60 years were six times more likely to die compared to those aged 18–34 years [COR=6.6, 95% CI 1.189–36.459, P=0.031]. Male patients had over twice the odds of mortality compared to females [COR=2.8, 95% CI 0.631–12.856, P=0.174]. Regarding occupation, motor vehicle drivers were three times more likely to die compared to unemployed participants [COR=3.0, 95% CI 0.676–13.747, P=0.147], whereas participants engaged in business appeared less likely to die [COR=0.2, 95% CI 0.017–1.335, P=0.089]. These findings suggest that older age, male gender, and certain occupations may be associated with higher risk of mortality, while business occupation may be protective, although not all associations reached conventional statistical significance. ***Table 5***

Table 5. Bivariate analysis of sociodemographic factors associated with polytrauma in patients with orthopaedic injuries at MNRH

Variable	Options	TOTAL n (%)	Status (n)		COR [95% CI]	P-value
			Alive	Dead		
Age (in years)	18–34	91 (58.33)	79	12	Ref	
	35-60	59 (37.82)	49	10	1.3 (0.540–3.344)	0.526
	>60	6 (3.85)	3	3	6.6 (1.189–36.459)	**0.031**
Gender	Female	28 (17.95)	26	2	Ref	
	Male	128 (82.05)	105	23	2.8 (0.631–12.856)	**0.174**
Occupation	Boda boda rider	16 (10.26)	11	5	2.4 (0.616–9.543)	0.205
	Business man/woman	36 (23.08)	35	1	0.2 (0.017–1.335)	**0.089**
	Construction worker	13 (8.33)	12	1	0.4 (0.048–4.086)	0.474
	Motor vehicle driver	11 (7.05)	7	4	3.0 (0.676–13.747)	**0.147**
	Formal employment	10 (6.41)	8	2	1.3 (0.225–7.890)	0.751
	Others (specify)	32 (20.51)	26	6	1.2 (0.355–4.271)	0.744
	Unemployed	38 (24.36)	32	6	Ref	
Education level	None	9 (5.77)	7	2	1.1 (0.193–6.752)	0.883
	Primary	44 (28.21)	39	5	0.5 (0.147–1.783)	0.294
	Secondary	68 (43.59)	57	11	0.8 (0.270–2.206)	0.629
	Tertiary	35 (22.44)	28	7	Ref	
Marital status	Divorced/Widowed	12 (7.69)	11	1	Ref	
	Married	78 (50)	66	12	2.0 (0.236–16.957)	0.525
	Single	66 (42.31)	54	12	2.4 (0.287–20.788)	0.413

Bivariate analysis of injury related factors associated with mortality among polytrauma in patients with orthopedic injuries at MNRH

In the bivariate analysis, polytrauma patients who sustained abdominal injuries [COR=3.8, 95% CI 1.143–12.931, P=0.030], Pelvic injuries [COR=2.9, 95% CI 0.809–10.600, P=0.102] and clavicle fractures [COR=3.4, 95% CI 0.766–15.421, P=0.107] were more likely to die as compared to patients who had not sustained such injuries. The analysis also showed that those who sustained limb injuries had a 30% reduced likelihood of mortality [COR=0.3, 95% CI 0.142–0.845, P=0.020] as compared to those who had other injuries. The risk of mortality was also high in those who had pelvis [COR=4.8, 95% CI 1.191–19.340, P=0.027), clavicle [COR=3.4, 95% CI 0.766–15.421, P=0.107) and those who had sustained a combination of open and closed fractures [COR=1.1 , 95% CI 0.291–4.524, P=0.843). ***Table 6***

Table 6. Bivariate analysis of injury related factors associated with mortality among polytrauma in patients with orthopaedic injuries at MNRH

Variable	Options	TOTAL n (%)	Status (n)		COR [95% CI]	P-value
			Alive	Dead		
Cause of injury	Others[1]	6 (3.85)	4	2	6.0 (0.422–85.248)	0.186
	Assault	13 (8.33)	12	1	Ref	
	Fall	14 (8.97)	12	2	2.0 (0.159–25.115)	0.591
	RTA	123 (78.85)	103	20	2.3 (0.287–18.942)	0.429
Body region injured[2]	Head	118 (75.64)	99	19	1.0 (0.376–2.784)	0.964
	Chest	61 (39.1)	50	11	1.3 (0.536–3.022)	0.585
	Abdomen	13 (8.33)	5	5	3.8 (1.143–12.931)	**0.030**
	Pelvis	12 (7.69)	8	4	2.9 (0.809–10.600)	**0.102**
	Spine	22 (14.1)	17	5	1.7 (0.556–5.059)	0.359
	Limbs (extremities)	117 (75)	103	14	0.3 (0.142–0.845)	**0.020**
Anatomical site of major orthopedic injury[2]	Femur	26 (16.67)	21	5	1.3 (0.442–3.877)	0.626
	Tibia/Fibula	70 (44.87)	62	8	0.5 (0.211–1.298)	0.162
	Acetabulum	1 (0.64)	1	0	NA	
	Pelvis	9 (5.77)	5	4	4.8 (1.191–19.340)	**0.027**
	Spine	27 (17.31)	21	6	1.7 (0.591–4.632)	0.338
	Humerus	7 (4.49)	5	2	2.2 (0.401–11.983)	0.365
	Clavicle	8 (5.13)	5	3	3.4 (0.766–15.421)	**0.107**
Nature of injury	Closed injury	99 (63.46)	80	19	Ref	
	Combination of both	14 (8.97)	11	3	1.1 (0.291–4.524)	0.843
	Open injury	43 (27.56)	40	3	0.3 (0.088–1.131)	**0.077**

[1] *Diving injury, Gun shot, Mixture machine fell on him,*

[2]*The reference category was defined as the absence of injury to the respective anatomical region because it represents the baseline (unexposed) group, allowing comparison of mortality risk among patients with and without specific skeletal injuries.*

Bivariate analysis of clinical and management related factors related associated with mortality among polytrauma in patients with orthopedic injuries at MNRH

The analysis showed that mortality was more likely in patients admitted with GCS<8 [COR=21.5, 95% CI 5.562–82.754, P<0.001] and KTS score that was≤6 [COR=9.5, 95% CI 1.080–84.139, P=0.042] as compared those who had normal GCS and KTS scores respectively. The risk of mortality was also high in patients who required airway interventions [COR=9.3, 95% CI 3.635–23.854, P<0.001], and specifically oxygen administration [COR=11.6, 95% CI 4.423–30.420, P<0.001] and intubation [COR=11.3, 95% CI 0.984 – 129.832, P=0.052) as compared to those who did not require such interventions. The analysis also showed that tachypnea at admission (>20 breaths/min) was associated with 10 times higher odds of

mortality [COR=10.0, 95% CI 2.222–44.999, P=0.003], while low oxygen saturation (<90%) dramatically increased the likelihood of death by 21 times [COR=20.9, 95% CI 4.261–102.086, P<0.001] and borderline saturation (90–94%) increased it by nearly nine times [COR=8.7, 95% CI 2.105–35.872, P=0.003]. The analysis also showed that patients who required breathing support through mechanical ventilation [COR=9.8, 95% CI 3.786–25.588, P=<0.001] and 16-fold [COR=16.1, 95% CI 2.928–88.810, P=0.001] and chest tube insertion [COR 3.7, 95% CI 0.587 – 23.441, P=0.163) were more likely to die as compared to those who did not require such interventions. Hemodynamic instability was also important, with diastolic blood pressure <60 mmHg associated with eight times higher odds of death [COR=7.8, 95% CI 2.312–26.121, P=0.001], tachycardia (>100 bpm) associated with nearly 15 times higher odds [COR=14.9, 95% CI 3.804–58.030, P<0.001] while blood transfusion was associated with a 13 times higher likelihood COR=13.2, 95% CI 3.313–52.418, P<0.001]. The analysis further showed that mortality was more likely in patients where ICU was recommended but patients were not admitted [COR=52.7, 95% CI 6.106–454.972, P<0.001] as compared to when ICU was provided [COR=3.8, 95% CI 0.324–43.766, P=0.290] or when it was not indicated (reference). ***Details in table 7 below***

Table 7. Bivariate analysis of clinical and management related factors associated with mortality among polytrauma patients with orthopaedic injuries at MNRH

Variable	Options	TOTAL n (%)	Status (n)		COR [95% CI]	P-value
			Alive	Dead		
GCS at admission	<8	12 (7.69)	4	8	21.5 (5.562–82.754)	**<0.001**
	8-12	15 (9.62)	9	6	7.2 (2.146–23.831)	**0.001**
	13–15	129 (82.69)	118	11	Ref	
KTS at admission	1-6	28 (17.95)	15	13	9.5 (1.080–84.139)	**0.042**
	7-8	116 (74.36)	105	11	1.2 (0.136–9.787)	0.897
	9-10	12 (7.69)	11	1	Ref	
Required airway intervention	Yes	37 (23.72)	21	16	9.3 (3.635 – 23.854)	**<0.001**
	No	119 (76.28)	110	9	Ref	
Airway intervention[3]	Suction	4 (2.56)	0	4	NA	
	Oxygen	30 (19.23)	15	15	11.6 (4.423 – 30.420)	**<0.001**
	Intubation	3 (1.92)	1	2	11.3 (0.984 – 129.832)	**0.052**
Cervical spine immobilization	No	77 (49.36)	67	10	Ref	
	Not indicated	60 (38.46)	50	10	1.3 (0.518 – 3.465)	0.546
	Yes	19 (12.18)	14	5	2.4 (0.708 – 8.091)	**0.160**
Respiratory rate at admission (b/min)	Not assessed	105 (67.31)	92	13	1.4 (0.377 – 5.296)	0.608
	12 – 20	33 (21.15)	30	3	Ref	
	> 20	18 (11.54)	9	9	10.0 (2.222 – 44.999)	**0.003**
Oxygen saturation at admission	Not assessed	56 (35.9)	49	7	1.5 (0.492 – 4.513)	0.481
	< 90%	9 (5.77)	3	6	20.9 (4.261 – 102.086)	**<0.001**
	90–94%	11 (7.05)	6	5	8.7 (2.105 – 35.872)	**0.003**
	≥ 95%	80 (51.28)	73	7	Ref	
Require breathing intervention	Yes	44 (28.21)	27	17	8.2 (3.194 – 20.974)	**<0.001**
	NO	112 (71.79)	104	8	Ref	
Breathing interventions[3]	Oxygen support	29 (18.59)	15	14	9.8 (3.786 – 25.588)	**<0.001**
	MV	7 (4.49)	2	5	16.1 (2.928 – 88.810)	**0.001**
	Chest tube	5 (3.21)	3	2	3.7 (0.587 – 23.441)	**0.163**
SBP at admission	<90 mmHg	54 (34.62)	48	6	Ref	
	90–139 mmHg	4 (2.56)	0	4	NA	
	≥140 mmHg	98 (62.82)	83	15	1.4 (0.526 – 3.975)	0.475
DBP at admission	<60	15 (9.62)	7	8	7.8 (2.312 – 26.121)	**0.001**
	60–89	58 (37.18)	52	6	0.8 (0.268 – 2.298)	0.658
	≥90	83 (53.21)	72	11	Ref	
HR at admission	Not measured	67 (42.95)	58	9	1.4 (0.505 – 4.114)	0.495
	<60	4 (2.56)	3	1	3.1 (0.283 – 33.905)	0.355
	60–100	72 (46.15)	65	7	Ref	
	>100	13 (8.33)	5	8	14.9 (3.804 – 58.030)	**<0.001**

[3]The reference category was defined as patients who did not require the respective airway or breathing intervention, as this represents the baseline clinical state without the exposure, allowing comparison of mortality risk between patients who required and those who did not require the intervention.

MV-Mechanical ventilation, SBP-Systolic blood pressure, DBP-Diastolic blood pressure, HR-Heart rate

Table 7 continued

Variable	Options	TOTAL n (%)	Status (n)		COR [95% CI]	P-value
			Alive	Dead		
Haemorrhage controlled within 24 hours	No	11 (7.05)	10	1	0.7 (0.082 – 6.154)	0.756
	Not indicated	62 (39.74)	50	12	1.7 (0.683 – 4.250)	0.253
	Yes	81 (51.92)	71	10	Ref	
Fluid resuscitation done at admission	Not indicated	18 (11.54)	16	2	0.9 (0.070 – 11.221)	0.927
	No	10 (6.41)	9	1	1.7 (0.356 – 7.745)	0.519
	Yes	128 (82.05)	106	22	Ref	
Blood transfusion done	Not indicated	137 (87.82)	123	14	Ref	
	Not done (indicated)	9 (5.77)	4	5	11.0 (2.638 – 45.721)	0.001
	Yes	10 (6.41)	4	6	13.2 (3.313 – 52.418)	<**0.001**
Neurological intervention done at admission	No	37 (23.72)	28	9	2.3 (0.721 – 7.023)	**0.163**
	Not indicated	48 (30.77)	42	6	Ref	
	Yes	71 (45.51)	61	10	1.1 (0.387 – 3.399)	0.804
Imaging ordered appropriately	No	17 (10.9)	16	1	Ref	
	Not indicated	3 (1.92)	2	1	8.0 (0.347 – 184.365)	**0.194**
	Yes	136 (87.18)	113	23	3.3 (0.411 – 25.794)	0.263
Comorbidities	Yes[1]	14 (8.97)	11	3	1.5 (0.384–5.768)	0.566
	No	142 (91.03)	120	22		
ICU admission	Not indicated	145 (92.95)	128	17	Ref	
	Indicated & provided	3 (1.92)	2	1	3.8 (0.324–43.766)	0.290
	Indicated but not provided	8 (5.13)	1	7	52.7 (6.106–454.972)	<**0.001**
DCS performed	Not indicated	94 (60.26)	79	15		
	Yes	55 (35.26)	48	7	0.8 (0.292–2.018)	0.592
	Indicated but not done	7 (4.49)	4	3	4.0 (0.801–19.476)	**0.092**
Definitive surgery done	Yes[2]	123 (78.85)	104	19		
	No	33 (21.15)	27	6	1.2 (0.443–3.342)	0.704

[1]Diabetes, Hypertension, HIV, CVD, Renal disease, Lung disease, mental health disorder, assessed by reviewing patient medical history in the file and on interview.

[2]ORIF, External fixation, Amputation, Decompression & stabilization, POP cast, Traction (skin/skeletal)

Bivariate analysis of health system related factors related associated with mortality in polytrauma in patients with orthopedic injuries at MNRH.

In the bivariate analysis of health system-related factors, patients transported to the hospital by police van had three times higher odds of mortality compared to those arriving by private car [COR=2.9, 95% CI 0.665–12.267, P=0.158], although this did not reach statistical significance. The time to be attended to after admission was inversely associated with mortality, where patients seen within one to two hours of arrival at the hospital [COR=0.6, 95% CI 0.036–1.056, P=0.058] and those seen after two hours [COR=0.8, 95% CI 0.075–0.589, P=0.003] were less likely to die as compared to those attended to within one hour of arrival. These findings suggest that timely post-admission care may substantially reduce mortality risk, while mode of transportation could also influence outcomes.

Table 8. Bivariate analysis of health system related factors associated with mortality among polytrauma in patients with orthopaedic injuries at MNRH

Variable	Options	TOTAL n (%)	Status (n)		COR [95% CI]	P-value
			Alive	Dead		
Time from injury to hospital arrival	Less than 1 hour	16 (10.26)	12	4	1.9 (0.482–7.296)	0.365
	1–12 hours	87 (55.77)	74	13	1.0 (0.380–2.569)	0.981
	After 12 hours	53 (33.97)	45	8	Ref	
Mode of transportation	Ambulance	80 (51.28)	65	15	1.8 (0.567–6.016)	0.309
	Motorcycle	21 (13.46)	20	1	0.4 (0.042–3.839)	0.427
	Police van	19 (12.18)	14	5	2.9 (0.665–12.267)	**0.158**
	Private car	36 (23.08)	32	4	Ref	
Time to be attended after admission	<1 hour	124 (79.48)	103	21	Ref	
	1–2 hours	18 (11.54)	16	2	0.6 (0.036–1.056)	**0.058**
	After 2 hours	14 (8.97)	12	2	0.8 (0.047–1.441)	**0.123**

Multivariate analysis of factors associated with mortality among polytrauma patients with orthopedic injuries at MNRH

In the multivariate logistic regression analysis, advanced age, severe neurological compromise, deranged respiratory status, and delayed blood transfusion were found to independently predict mortality among polytrauma patients. Patients aged above 60 years were 5.6 times more likely to die compared to those aged 18–34 years [AOR=5.6, 95% CI 1.265–9.169, P=0.032]. Patients who had GCS <8 on admission [AOR=19.6, 95% CI 11.048–38.865, P<0.001] and those with tachypnea [AOR=16.7, 95% CI 2.444–29.825, P=0.007] showed a high likelihood of mortality as compared to patients who had normal GCS or respiratory rate. Patients who had an indication for blood transfusion but did not receive it were 13.7 times more likely to die [AOR=13.7, 95% CI 4.916–19.027, P<0.001] compared to those with no transfusion indication or those who received transfusion as **indicated.**

Table 9. Multivariate analysis of factors associated with mortality among polytrauma in patients with orthopaedic injuries at MNRH

Variable	Options	COR [95% CI]	P-value	AOR [95% CI]	P-value
Age (in years)	18–34	Ref			
	35-60	1.3 (0.540–3.344)	0.526	1.1 (0.306–4.013)	0.876
	>60	6.6 (1.189–36.459)	0.031	5.6 (1.265–24.791)	**0.032**
GCS at admission	<8	21.5 (5.562–82.754)	<0.001	19.6 (11.048–38.865)	**<0.001**
	8-12	7.2 (2.146–23.831)	0.001	11.7 (2.237–61.216)	**0.004**
	13–15	Ref			
Respiratory rate at admission	Not assessed	1.4 (0.377 – 5.296)	0.608	4.5 (0.579–35.042)	0.150
	12 – 20 b/min	Ref			
	> 20 b/min	10.0 (2.222 – 44.999)	0.003	16.7 (2.444–114.112)	**0.007**
Blood transfusion done	Not indicated	Ref			
	Indicated, not given	11.0 (2.638 – 45.721)	0.001	13.7 (4.916–38.179)	**<0.001**
	Indicated, given	13.2 (3.313 – 52.418)	<0.001	21.1 (3.598–123.493)	0.201

CHAPTER FIVE: DISCUSSION

5.0 Introduction

This discussion interprets the findings of the study aimed at determining the mortality rate and associated factors among polytrauma patients with orthopedic injuries managed at Mulago National Referral Hospital**.** Key findings revealed an in-hospital mortality rate of 16.03% with over half of all deaths occurring within 24 hours of admission and almost all deaths occurred within 7 days of admission. Independent factors associated with mortality identified through multivariate logistic regression included advanced age (≥60 years), severely depressed Glasgow Coma Scale (GCS) score, having tachypnea on admission, and an unmet need for blood transfusion. The study also showed prolonged hospital stays, averaging two weeks, and a notable proportion of patients leaving against medical advice before completing definitive treatment. These findings are highly relevant as they provide insight into critical factors associated with mortality and systemic challenges in trauma care**,** highlighting areas where targeted interventions and improvements in early resuscitation, critical care, and hospital management could substantially reduce preventable deaths and improve outcomes for polytrauma patients in Uganda.

5.1 Demographic characteristics of the participants

The majority of patients with polytrauma and orthopaedic injuries were young adult males, with a median age of 32 years. Boda boda riders, motor vehicle drivers, and construction workers made up a notable proportion of the cohort, reflecting occupational predilection for polytrauma with orthopedic injuries. Similar demographic patterns have been reported among trauma patients in Uganda. Kalanzi et al. (2023) observed that patients with severe injuries at MNRH had a median age of 32 years and were predominantly male, while Galukande et al. (2009) documented a male-to-female ratio of approximately 3.5:1 among boda boda injury patients at the same institution.

The predominance of young males is explained by their disproportionate exposure to high-risk occupations and transport environments. Boda boda riding, driving, and construction work all involve sustained contact with road traffic or physically dangerous conditions. (Naddumba, 2004) reported that boda boda riders involved in road traffic injuries in Uganda were predominantly young men, with a significant proportion sustaining multiple injuries. The rapid expansion of commercial motorcycling as a livelihood for young men in urban Uganda often practised without adequate training, protective equipment, or adherence to traffic regulations

continues to drive the burden of polytrauma presenting to facilities such as MNRH (Galukande, Jombwe, Fualal, & Gakwaya, 2009).

Beyond road safety, the demographic profile of this cohort carries direct implications for how MNRH should organise and resource its trauma services. A median age of 32 years indicates that polytrauma injuries predominantly affect young adults, showing a significant burden within a highly mobile and socially active age group that is frequently exposed to road traffic and other environmental risks (Mulugeta, Zewdie, & Deressa, 2026). The marked male predominance (82.1%) further reflects the known gender distribution in trauma epidemiology, where males are more frequently involved in high-risk activities and occupational and transport-related exposures such as boda boda driving (Vaca et al., 2020). Given that these injuries affect individuals in their most active life stage, these may result in prolonged loss of productivity with significant socioeconomic impact at household and community levels, particularly where recovery is incomplete or complications persist (Mulugeta et al., 2026; Vaca et al., 2020).

5.2 Mortality rate among polytrauma patients with orthopedic injuries

In-hospital mortality rate

The present study found that among polytrauma patients with orthopedic injuries managed at Mulago National Referral Hospital, the in-hospital mortality rate was 16.03%. This finding is comparable to several studies conducted within Uganda and other low- and middle-income countries (LMICs), although some variations exist depending on injury severity, patient population, and level of care available. A prospective study of chest trauma patients at MNRH reported an in-hospital mortality rate of 17% (Sifa, 2022) while studies from other SSA countries show that mortality rate from orthopedic injuries range from 10% to 30%, depending on geographic location, injury severity, and the quality of trauma care systems (Ciechanowicz et al., 2020; El Mestoui et al., 2017; Vorbeck et al., 2023). This similarity suggests that mortality among trauma patients in SSA remains consistently high across different injury patterns, reflecting systemic challenges in trauma care such as delayed presentation, limited critical care capacity, and resource constraints.

The 16.03% mortality reported in this study is notably lower than the 40% hospital mortality previously reported at MNRH by Luggya et al. (2021). This can be explained by the fact that our study was restricted to polytrauma patients with a confirmed major orthopaedic injury component, whereas Luggya et al. included all trauma admissions regardless of injury pattern,

a broader case mix that incorporates patients with catastrophic isolated injuries such as severe traumatic brain injury which carry higher individual mortality. In addition, the prospective design with daily PI review and active follow-up may have facilitated more timely detection of clinical deterioration among enrolled patients. Taken together, these differences in case definition, exclusion criteria, and study design rather than a genuine improvement in trauma outcomes most plausibly explain the lower mortality observed in this cohort.

However, higher mortality rates have been reported in studies involving more severe injury subsets. For example, a study on severe traumatic brain injury (TBI) at Mulago reported a mortality rate of 25.8% , while another large neurosurgical registry reported in-hospital mortality of 23.7% among TBI patients (Jin et al., 2021; Tran et al., 2015). Likewise in this study, head injuries contributed to the largest portion of patients that died (16.1%). The higher mortality in these studies compared to the current study can be explained by the inclusion of patients with isolated severe head injuries, which are known to carry a worse prognosis than mixed polytrauma with orthopedic injuries (Beucler et al., 2022; Mateo-Sierra et al., 2025).

In contrast, studies from high-income countries typically report lower in-hospital mortality rates for polytrauma patients, often below 10%. A systematic review of 30 studies involving 82,272 ICU-admitted poly trauma patients between 1966 and 2020 reported an average annual decline in all-cause mortality of 1.8% (95% CI: 1.6–2.0%) (van Breugel et al., 2020). This difference is largely attributable to well-developed trauma systems, including organized pre-hospital emergency services, rapid transport, advanced imaging, and specialized trauma teams. Additionally, access to intensive care and timely surgical intervention is more readily available in these settings, significantly improving survival outcomes.

Pattern and timing of in-hospital deaths

The most striking finding in relation to mortality was its concentration within the first week of admission. More than half of all deaths occurred within 24 hours, and by Day 7, 96% of all deaths had been recorded. . The Kaplan-Meier survival curve dropped steeply over the first seven days before plateauing completely, with no further deaths recorded thereafter. This pattern establishes that the acute resuscitation period, the first 24 to 72 hours of admission is the critical window during which virtually all in-hospital mortality in this cohort was determined.

This temporal clustering of deaths is consistent with the compressed bimodal distribution of trauma deaths described in resource-limited settings. In high-income countries with organised trauma systems, trauma deaths follow a trimodal distribution immediate deaths at the scene, early deaths within hours, and late deaths from complications. In LMIC settings, the absence of effective pre-hospital care and resuscitation capacity compresses this into a bimodal pattern, with a dominant early peak of deaths within the first 24 to 72 hours driven by haemorrhage and severe head injury (Sobrino & Shafi, 2013). Comparing with other studies, a closely related Ugandan multicenter prospective cohort study on road traffic injury patients reported a 24-hour mortality rate of 14.69%**,** highlighting that a substantial proportion of trauma deaths occur within the first day of care (Kamabu et al., 2023).

Although the proportion in the current study appears higher, the Ugandan study similarly emphasizes that early deaths are common and strongly associated with injury severity and motorcycle-related road traffic crashes, especially high-energy collisions involving riders and pedestrians. The difference in magnitude may be explained by the present study focusing specifically on polytrauma with orthopedic injuries, which often coexist with severe injuries such as traumatic brain injury and hemorrhage, both major drivers of early mortality. The clustering of deaths within the first 24 hours reflects a pattern of early in-hospital mortality commonly reported in severe trauma populations which maybe due to rapid physiological decompensation that characterize major polytrauma presentations. This therefore demonstrates the importance of rapid identification of severely injured patients and prompt initiation of resuscitative care upon arrival in the emergency units.

Secondary outcomes: length of hospital stay and discharge status

For the patients discharged, the average length of stay at the hospital was 2 weeks, showing that polytrauma is associated with prolonged hospitalizations. This is also supported by findings of a study done from Uganda which reported a median length of stay of 14 days among severely injured patients, particularly those requiring surgical intervention (Kirya, Kijjambu, & Ezati, 2002). Similarly, a study from Ghana reported a mean hospital stay of 16.54 ± 27.97 days, among patients with musculoskeletal injuries requiring operative management and rehabilitation (Torgbenu, Ashigbi, Opoku, Banini, & Prempeh, 2019). The prolonged length of stay observed in this study can be explained by the fact that patients in this study had multiple injuries that required staged or sequential management, some of whom necessitated prolonged immobilisation and rehabilitation. In trauma care, the presence of injuries involving more than

one anatomical region often prevents single-stage definitive treatment due to physiological instability and competing priorities in acute care. As a result, initial management is frequently focused on life-saving resuscitation and temporary stabilization of fractures, while definitive surgical fixation is delayed until the patient is haemodynamically stable and medically optimized (Ali, 2016). This eventually contributes to prolonged hospitalisation of the affected patients.

In this study, it was also noted that a significant proportion of patients left against medical advice, which represents an important challenge in trauma care. Patients leaving prematurely can have serious implications, including incomplete treatment, higher risk of complications, delayed recovery, and potentially increased mortality. Similar patterns have been reported in other low- and middle-income countries, where financial constraints, lack of social support, long hospital stays, and perceived quality of care are common reasons for leaving against medical advice (Yusuf et al., 2023; Holden et al., 2022). This behavior specifically in this may be attributed to financial constraints common among patients in this setting, where out-of-pocket payments are often required for essential components of care, including implants such as nails, plates, and screws used for definitive fracture fixation. The inability to meet these costs may lead patients to discontinue treatment prematurely. This pattern reflects the socioeconomic barriers to accessing complete trauma care and may negatively influence recovery and functional outcomes in this patient population.

5.3 Factors associated with mortality among polytrauma patients with orthopedic injuries

After multivariate analysis, this study found that patients aged above 60 years were significantly more likely to die compared to those aged 18–34 years**,** indicating that advanced age is an independent predictor of mortality among polytrauma patients with orthopedic injuries. This association aligns with extensive trauma research showing that mortality risk rises substantially with increasing age. For example, analysis of trauma registry data in the United States demonstrated a significant increase in mortality beginning at age 60 years, and this threshold is often recommended for defining elderly trauma patients because age itself contributes independently to the risk of death, even after adjusting for injury severity and physiologic parameters (e.g., Glasgow Coma Score, ISS) (Campbell-Furtick et al., 2016). Similarly, a European study found that elderly polytrauma patients had an overall in-hospital mortality of 36.3%, with the rate increasing further in those aged ≥75 years, and age itself was identified as a strong risk factor for death and complications (R. de Vries et al., 2019). The

increased mortality seen with advancing age is likely multifactorial as elderly patients have reduced cardiopulmonary reserve, higher rates of comorbid conditions, and impaired response to shock and surgical stress, all of which compromise recovery from severe trauma and are well documented contributors to poor outcomes in the geriatric trauma literature (Braun et al., 2016).

In this study, mortality was significantly more likely in patients presenting with very low Glasgow Coma Scale (GCS) scores and those with tachypnea, identifying both severe neurological impairment and respiratory compromis**e** as strong predictors of poor outcomes among polytrauma patients with orthopedic injuries. A low GCS at admission has been consistently associated with increased mortality in trauma populations worldwide, as it often reflects severe traumatic brain injury (TBI) or compromised airway protective reflexes. For instance, retrospective and registry-based analyses have shown that trauma patients with a GCS ≤8 have dramatically higher odds of death compared with those with higher scores, independent of injury severity, because low GCS indicates critical neurologic dysfunction and risks for secondary brain injury without prompt airway and neuroprotective interventions (Corbella et al., 2024; Vorbeck et al., 2023). Likewise, studies in sub-Saharan Africa have reported that low initial GCS is a strong predictor of in-hospital mortality among severely injured patients, particularly in settings with limited neurosurgical and critical care capacity (Sawe et al., 2020). Tachypnea, often a marker of respiratory distress, shock, or significant thoraco-abdominal injury, has also been linked to worse outcomes in trauma patients. Evidence from trauma outcome studies shows that abnormal respiratory rates (including elevated rates) are associated with increased risk of mortality, likely because they reflect inadequate ventilation, underlying chest injury, shock, or inadequate physiologic compensation (Kibu et al., 2025).

The association of low GCS and tachypnea with increased mortality in the current study highlights the need for rapid identification and stabilization of neurologic and respiratory dysfunction in polytrauma care. Early airway protection, ventilation support, and aggressive management of shock are critical because delays in addressing these physiologic derangements can quickly lead to irreversible secondary injury, organ failure, and death, especially in settings where pre-hospital care and critical care resources are limited.

This study also found that patients who required a blood transfusion but did not receive one were 13 times more likely to die compared to those who either did not need transfusion or

received it. This finding demonstrates the critical role of timely blood replacement in trauma care, particularly for patients with hemorrhagic shock, which is a leading cause of early mortality in polytrauma. Similar findings have been reported in LMICs, where delayed or unavailable transfusions significantly increase the risk of death among severely injured patients (K. Vishwanathan, S. Chhajwani, A. Gupta, & R. Vaishya, 2021). The result highlights the urgent need to strengthen blood availability, transfusion protocols, and rapid recognition of hemorrhage to reduce preventable trauma deaths.

5.4 Strengths of the study

This study employed a prospective cohort design, which allowed real-time data collection through structured interviews, head-to-toe clinical examination, and chart abstraction at the time of patient admission. This approach minimises the recall bias and incomplete documentation that commonly affect retrospective studies of trauma outcomes in resource-limited settings, where medical records are often sparse or inconsistently kept.

The study was conducted at Mulago National Referral Hospital, the largest and most specialised trauma facility in Uganda, which receives polytrauma patients from across the country and from neighbouring nations. This setting provides a large and diverse patient population representative of the most severe end of the trauma spectrum in Uganda, enhancing the relevance of the findings to national trauma policy.

The analytical approach was rigorous and appropriate for the study design. Bivariate screening using a $p<0.20$ threshold followed by multivariate logistic regression with adjustment for confounders is the methodologically correct approach for identifying independent factors associated with a binary outcome in a prospective cohort. The inclusion of both crude and adjusted odds ratios in the results allows readers to appreciate the effect of confounding adjustment on each variable.

5.5 Study limitations

The study was conducted at a single centre, MNRH, which may limit generalisability to patients managed at lower-level or regional facilities where resources and patient profiles differ.

No post-discharge follow-up was conducted. Patients who were discharged alive, left against medical advice, or were transferred to other facilities may have died after leaving MNRH. The 14 patients transferred to other facilities are of particular concern as their outcomes are unknown. This means the reported in-hospital mortality rate may underestimate the true mortality in this population.

A large proportion of patients had vital signs that were not assessed or documented at admission, including respiratory rate (67.3% not assessed) and oxygen saturation (35.9% not assessed). These missing values may have affected the precision of clinical variable estimates in the bivariate analysis.

Also not note, this study did not assess for some health system factors such as staffing levels, patient load, bed occupancy, and provider-to-patient ratios as these could not be provided by patients. Consequently, the study was unable to evaluate the potential influence of these factors on patient outcomes and mortality among polytrauma patients with orthopedic injuries.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study demonstrates that polytrauma patients with orthopaedic injuries at Mulago National Referral Hospital experience a substantial in-hospital mortality rate of 16.03%, with over half of deaths occurring within the first 24 hours. Mortality was significantly higher among older patients (≥60 years), those presenting with very low Glasgow Coma Scale scores, tachypnea, or an indication for blood transfusion that was not fulfilled. The study also shows that survivors of polytrauma have prolonged hospitalization, with an average length of stay of two weeks, and that a notable proportion of patients left against medical advice, indicating both clinical and systemic challenges in trauma care.

6.2 Recommendations

1. There is need to strengthen early trauma care and resuscitation at MNRH, including rapid assessment and stabilization of patients presenting with low GCS or abnormal vital signs, to reduce early mortality within the first 24 hours.
2. The Ministry of Health, in collaboration with Makerere University College of Health Sciences and Mulago National Referral Hospital, should establish a dedicated multidisciplinary trauma centre at MNRH with 24-hour specialist coverage, a designated trauma team, defined triage protocols, and integrated critical care capacity.
3. The facility should improve blood transfusion services, ensuring timely availability of blood products for patients with hemorrhagic shock to prevent deaths related to unmet transfusion needs. MNRH is advised to consider establishing a dedicated trauma blood bank The Ministry of Health should prioritize blood supply chains to referral hospitals, and ATLS-based massive transfusion protocols should be formally adopted.
4. The hospital should develop age-stratified care pathways, recognizing that patients over 60 years require earlier ICU consideration and more aggressive resuscitation.
5. Multicenter studies across Uganda's referral network are needed to generate nationally representative data.

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APPENDICES

APPENDIX I: DATA COLLECTION TOOL

Study Title: MORTALITY AMONG POLY-TRAUMA PATIENTS WITH ORTHOPEDIC INJURIES MANAGED IN MULAGO NATIONAL REFERRAL HOSPITAL.

Patient ID: _____ Study ID_____

Contact number(s) for follow-up:_____

Section A: Socio-Demographic Information

Variable	Response Options
Age (in years)	
Gender (tick)	☐ Male ☐ Female
Occupation	☐ Boda boda rider ☐ Motor vehicle driver ☐ Machine operator ☐ Construction worker ☐ Formal/professional employment ☐ Business ☐ Unemployed ☐ Others (specify)…….
Education level (tick)	☐ None ☐ Primary ☐ Secondary ☐ Tertiary
Marital status	☐Single ☐Married, ☐ Divorced/Separated ☐ Widowed

Section B: Injury and Pre/in hospital Information.

Variable	Response Options
How much time did it take you (in hours) from when you got the injury to when you arrived at Mulago National Referral Hospital.	☐ Less than one hour ☐ 1-12 hours ☐ After 12 hours ☐ Un able to tell

What mode of transportation did you use to come to the hospital	☐ Ambulance ☐ Private car ☐ Motorcycle ☐ Other: _____
How long did it take to be attended to from the time of admission?	☐ Immediately ☐ Within one hour ☐ 1-2 hours ☐ After 2 hours ☐ Un able to tell
Cause of injury	☐ RTA ☐ Fall ☐ Assault ☐ Other: _____
Body regions injured (tick all that applies)	☐ Head ☐ Chest ☐ Abdomen ☐ Pelvis ☐ Spine ☐ Limbs (specify): _____
Anatomical site of the orthopedic injury/fracture sustained	Femur; ☐ left ☐ Right ☐ Bilateral Tibia/Fibula; ☐ left ☐ Right ☐ Bilateral Acetabulum; ☐ left ☐ Right ☐ Bilateral Pelvis ring ☐ Spine; ☐ Cervical ☐ Thoracic ☐ Lambo-sacral Humerus; ☐ left ☐ Right ☐ Bilateral Clavicle; ☐ left ☐ Right ☐ Bilateral Others (specify)
Pattern of the injury	☐ Open injury ☐ Closed injury ☐ Combination of both If open injury, Gustilo classification as documented in patient file or assessed by the researcher _____
GCS on admission	_____
Kampala trauma Score II (KTS) [*Documented in the file/assessed by the RA*]	

Hospital care (ATLS protocol) provided and documented?	**Airway** Airway assessed immediately upon arrival? ☐ Yes ☐ No Cervical spine immobilization applied? ☐ Yes ☐ No ☐ Not indicated Airway interventions performed? ☐ Suction ☐ Oxygen_____ state dose ☐ Intubation ☐ None ☐ Other: _____ **Breathing and ventilation** Respiratory rate assessed? ☐ Yes_____ state rate ☐ No Oxygen saturation measured? ☐ Yes Spo2_____ % ☐ No Interventions for breathing provided? ☐ Oxygen supplementation_____ ☐ Mechanical ventilation ☐ Needle decompression ☐ Chest tube ☐ None ☐ Other: _____ **Circulation and hemorrhage control** Vital signs measured immediately? BP: _____ mmHg; HR: _____ bpm; ☐ Not assessed Hemorrhage controlled? ☐ Yes ☐ No ☐ Not indicated If yes, how was it controlled?

	☐ Direct pressure ☐ Pelvic binder ☐ Torniquet ☐ Others _____ IV access established? ☐ Yes ☐ No Fluid resuscitation indicated? ☐ Yes ☐ No Was it done ☐ Yes ☐ No Blood transfusion indicated? ☐ Yes ☐ No Was it done ☐ Yes ☐ No If yes, how many units _____ **Disability** GCS assessed ☐Yes ☐ No; State the GCS parameter scores_____ Pupillary reaction assessed? ☐ Yes ☐ No Intervention done for neurological compromise? ☐ Yes ☐ No ☐ Not indicated **Secondary Survey** All injuries identified in the secondary survey? ☐ Yes ☐ No ☐ Partially Head-to-toe examination done on admission ? ☐ Yes ☐ No Imaging investigations ordered appropriately? ☐ Yes ☐ No ☐ Not indicated

Section C: Clinical Characteristics and Management

Variable	**Response Options**
Comorbidities (tick all that apply)	☐ None ☐ Diabetes ☐ Hypertension ☐ HIV ☐ CVD ☐ Renal disorders ☐ Lung diseases ☐ Mental health disorders (specify): _____ Others: _____
Was ICU admission recommended?	☐ Yes ☐ No, If yes was patient admitted to ICU? ☐ Yes ☐ No If yes, how long it take to be admitted in ICU after it was recommended ☐ Immediately ☐ Within 6 hours ☐ 7-12 hours ☐ >12 hours
Was Damage Control Orthopedic Surgery indicated & provided?	Indicated: ☐ Yes ☐ No If yes, was it done: ☐ Yes ☐ No State the procedure performed_____ How long did it take for DCS to be performed after it was recommended ☐ Immediately ☐ Within 6 hours ☐ 7-12 hours ☐ >12 hours
Investigations performed:	☐ Xray, ☐ EFAST, ☐ Abdominal USS, ☐ CT Scan, ☐ MRI, ☐ Angiography, ☐ ECG ☐ ECHO ***LAB.*** ☐ RBS, ☐ CBC, ☐ RFT, ☐ LFT, ☐ ABG,

Time taken from admission to obtaining baseline investigations	☐ PT+INR _____
Time from admission to definitive treatment (other system injuries) (days)	_____
Time from admission to definitive treatment (orthopedic injury) (days)	_____
Type of definitive orthopedic procedure	☐ ORIF ☐ External fixation ☐ Amputation ☐ Decompression & stabilization ☐ POP cast ☐ Traction (skin/skeletal) ☐ Other: _____ ☐ None

THE END

THANK YOU FOR PARTICIPATING

SECTION D: FOLLOW-UP FORM.

Patient ID: _____ Study ID_____

Date of review: __/__/____

1. Patient status

    ☐ Still on ward

    ☐ Discharged

    ☐ Died

If still on ward

2. Current state

    ☐ Stable/recovering

    ☐ Critical/admitted to ICU

    ☐ Pending investigations

    ☐ Pending surgery

    ☐ Others _____

3. Any definitive orthopedic procedure done

☐ ORIF ☐ External fixation ☐ Amputation ☐ Decompression & stabilization ☐ POP cast ☐ Traction (skin/skeletal) ☐ Other: _____ ☐ None

4. Any complications developed during hospital admission

☐ Infection ☐ Deep Vein Thrombosis, ☐ Pulmonary Embolism, ☐ ARDS

☐ Compartment syndrome ☐ Pressure Ulcers, ☐ Others: specify _____

5. Current vital signs

Axillary temperature to one decimal point (°C): _____

Respiratory rate (breaths/min): _____

Oxygen saturation (SpO_2, %): _____

Blood pressure **(**mmHg) _____

Heart rate (beats/min): _____

6. If discharged

☐ Discharged home

☐ Transfer to another facility/ward

☐ Left against medical advice (LAMA)

Date of discharge _____

Total length of hospital stay _____

7. If deceased;

Date of death**:** _____

Cause of death if documented _____

Duration from admission to death**:** _____ days

THE END

LUGANDA TRANSLATED DATA COLLECTION TOOL

EKYOKUGATTAKO I: FFOOMU Y'OKUKUNG'AANYA AMAWULIRE AG'OKUNOONYEREZA

Omutwe gw'okunoonyereza: OKUFA MU BALWADDE ABAFUNYE OBUVUNE BUNGI MU DDWAALIRO LYA MULAGO NATIONAL REFERRAL HOSPITAL..

Ennamba y'omulwadde: _____ Ennamba y'okunoonyereza_____

Ennamba y'essimu:_____

Ekitundu A: Ebikwata ku muntu eyeetabye mu kunoonyereza

Ebibuuzo	**Eby'okuddamu**
Emyaaka	
Obutonde	☐ Omusajja ☐ Omukazi
Omulimu	☐ Omuvuzi wa boda boda ☐ Ddereeva ☐ Omukozi w'ekyuma ☐ Omukozi w'okuzimba ☐ Omulimu omutongole/ogw'ekikugu ☐ Bizinensi ☐ Abatalina mirimu ☐ Ebirala (lambika).....
Omutendera gw'ebyenjigiriza	☐ Tewali ☐ Pulayimale ☐ Secondary ☐ Tertiary
Embeera y'obufumbo	☐Si mufumbo ☐Mufumbo ☐ Yanoba/Ayawukana ☐ Nnamwandu

Section B: Injury and Prehospital Information.

Ebibuuzo	**Eby'okuddamu**

Kyakutwalira obudde bwenkana wa (mu ssaawa) okuva lwe wafuna obuvune okutuuka lwe watuuka mu ddwaaliro.	☐ Ezitakka wansi wa ssaawa emu ☐ essaawa 1-5 ☐ essaawa 6-12 ☐ essaawa 13-24 ☐ Oluvannyuma lw'essaawa 24 ☐ Simanyi
Engeri ki gye wakozesaamu okujja mu ddwaaliro	☐ Ambyulensi ☐ Emmotoka ey'obwannannyini ☐ Pikipiki ☐ Ebirala: _____ .
Kyatwala bbanga ki okulabibwa omusawo okutuuka okuva lwe yatuuka mu ddwaaliro?	☐ Amangu ago ☐ Mu ssaawa emu ☐ essaawa 1-2 ☐ Oluvannyuma lw'essaawa 2 ☐ Simanyi
Obuvune wabufuna otya	☐Akabenje ku luguudo ☐ Okugwa ☐ Okukubwa ☐ Ebirala: _____
Ebitundu by'omubiri ebifunye ebisago	☐ Omutwe ☐ Ekifuba ☐ Olubuto ☐ Ekisambi ☐ Omugongo ☐ Amaguru ☐ Ebirala: _____
Obuvune mu magumba bwe wafuna	Ekisambi; ☐ kkono ☐ Ku ddyo ☐ Enjuyi zombi amagumba wakati w'okugulu n'enkizi: ☐ kkono ☐ Ku ddyo ☐ Enjuyi zombi Socket y'ekisambi; ☐ kkono ☐ Ku ddyo ☐ Enjuyi zombi

	Essowaani y'ekisambi: ☐ kkono ☐ Ku ddyo ☐ Enjuyi zombi Ekisambi (Pelvis). Omugongo; ☐ Ekitundu eky'okungulu ☐ ekitundu eky'omu makkati ☐ ekitundu ekya wansi Eggumba wakati w'ekibegabega n'enkokola: ☐ kkono ☐ Ku ddyo ☐ Enjuyi zombi Eggumba ly'omu bulago: ☐ kkono ☐ Ku ddyo ☐ Enjuyi zombi Ebirala (lambika)…….
Ekika ky'obuvune	☐ Obuvune obuggule ☐ Obuvune obuggaddwa ☐ Okugatta byombi Singa obuvune obuggule, . Okugabanya kwa Gustilo _____ .
Embeera y'okutegeera (GCS) mu kiseera ky'okujja mu ddwaaliro	_____
Obubonero bwa Kampala trauma Score II (KTS)	
Obulabirizi mu ddwaaliro (ATLS protocol) buweereddwa era ne buwandiikibwa?	**Omukutu gw'empewo** Omukutu gw'empewo gwakeberebwa amangu ddala nga batuuse mu ddwaaliro? ☐ Yee ☐ Nedda Okuziyiza omugongo?

	☐ Yee ☐ Nedda ☐ Tekyetaagisa Kyakolebwa okulongoosa okussa? ☐ Okusonseka ☐ Oxygen_____ ☐ Okuyingiza mu nnyindo ☐ Tewali ☐ Ebirala: _____ . Okussa n'okuyingiza empewo Omuwendo gw'okussa gwekenneenyezebwa? ☐ Yee_____ ☐ Nedda Oxygen epimiddwa? ☐ Yee Spo2_____ % ☐ Nedda Ebiyamba mu kussa biweereddwa? ☐ Okwongera oxygen_____ ☐ Okuyingiza empewo mu byuma ☐ Okukendeeza ku puleesa y'empiso ☐ Tubu y'ekifuba ☐ Tewali ☐ Ebirala: _____ Okuziyiza Okufuga entambula y'omusaayi n'okuvaamu omusaayi Obubonero obukulu obupimiddwa amangu ddala? BP: _____ mmHg, HR: _____ bpm ☐ Tekyekenneenyezebwa Okuvaamu omusaayi kufugibwa? ☐ Yee ☐ Nedda ☐ Tekyetaagisa

	Bwe kiba nti yee, kyafugibwa kitya? ☐ Okunyigirizibwa obutereevu ☐ Ekisiba ekisambi ☐ Ekyuma ekikuba ttooki ☐ Ebirala _____ . Cannula yateekebwawo? ☐ Yee ☐ Nedda Amazzi aga IV gaali geetaagisa? ☐ Yee ☐ Nedda Kyakolebwa ☐ Yee ☐ Nedda Okuteekebwamu omusaayi kyali kyetaagisa? ☐ Yee ☐ Nedda Kyakolebwa ☐ Yee ☐ Nedda Bwe kiba nti yee, yuniti mmeka _____ . **Obulemu** GCS yakeberebwa ☐Yee ☐ Nedda; Yogera ku GCS_____ . Enkola y'amaaso (pupillary reaction) ekebereddwa? ☐ Yee ☐ Nedda Okuyingira mu nsonga okukolebwa olw'okukosebwa kw'obusimu? ☐ Yee ☐ Nedda ☐ Tekyetaagisa Okunoonyereza okw'okubiri Ebisago byonna ebyazuulibwa mu kunoonyereza okw'okubiri? ☐ Yee ☐ Nedda ☐ Ekitundu

	Okukeberebwa okuva ku mutwe okutuuka ku bigere? ☐ Yee ☐ Nedda Okunoonyereza ku bifaananyi kulagirwa mu ngeri esaanidde? ☐ Yee ☐ Nedda ☐ Tekyetaagisa

Ekitundu C: Ebyobulamu ne'ngeri y'obujjanjabi

Ebibuuzo	**Eby'okuddamu**
Endwadde endala	☐ Tewali ☐ Ssukaali ☐ Puleesa ☐ Siriimu ☐ CVD Obuzibu mu kibumba ☐ Endwadde z'amawuggwe ☐ Obuzibu mu bwongo (lambika): _____ Ebirala: _____
Okuyingizibwa mu ICU	☐ Yee ☐ Nedda Bwe kiba nti yee omulwadde yaweebwa ekitanda mu ICU? ☐ Yee ☐ Nedda Bwe kiba nti yee, kitwala bbanga ki okuweebwa ekitanda mu ICU ☐ Amangu ago ☐ Mu ssaawa 6 zokka ☐ essaawa 7-12 ☐ >essaawa 12
Damage Surgery yali yeetaagibwa era nga ekoleddwa	Kyali kyetaagisa: ☐ Yee ☐ Nedda Bwe kiba nti yee, kikoleddwa: ☐ Yee ☐ Nedda Yogera enkola ekoleddwa_____ . Kyatwala bbanga ki DCS okukolebwa oluvannyuma lw'okusemba

	☐ Amangu ago ☐ Mu ssaawa 6 zokka ☐ essaawa 7-12 ☐ >essaawa 12
Okunoonyereza kukoleddwa Ebiseera ebitwalibwa okuva ku kuyingizibwa okutuuka ku kufuna okunoonyereza okusookerwako	☐ Xray, ☐ EFAST, ☐ USS y'omu lubuto, . ☐ CT Scan, ☐ MRI, ☐ Okukebera emisuwa, ☐ ECG ☐ ECHO LAB. ☐ RBS, ☐ CBC ,, ☐ RFT, ☐ LFT, ☐ ABG, . ☐ PT+INR _____ .
Ebiseera okuva ku kuweebwa ekitanda okutuuka ku bujjanjabi obukakafu lw'obuvune obulala (ennaku) .	_____
Ebiseera okuva ku kuweebwa ekitanda okutuuka ku bujjanjabi obukakafu olw'obuvune mu magumba (ennaku) .	_____
Ekika ky'okulongoosa amagumba	☐ ORIF ☐ Okunyweza amagumba ebweru ☐ Okusalako ☐ Okwoza ☐ Ebirala: _____ . ☐ Tewali Obudde okuva ku kuyingizibwa mu dwaliro okutuuka ku kulongoosebwa (essaawa) . _____ .

TUKOMEKKEREZZA

WEBALE

EKITUNDU D: FOOMU Y'OKUKOLA.

Ennamba y'omulwadde: _____ Ennamba y'okunoonyereza_____

Olunaku lw'okuddamu okwetegereza: __/__/__

1. Embeera y'omulwadde

☐ Akyali ku waadi

☐ Bamusiibuddwa

☐ Afudde

Bw'oba akyali ku waadi

2. Embeera eriwo kati

☐ Okutebenkera/okudda engulu

☐ Critical/aweereddwa ekitanda mu ICU

☐ Nga balindirira okunoonyereza

☐ Nga balindirira okulongoosebwa

☐ Abalala _____ .

3. Enkola yonna ey'amagumba enkakafu ekoleddwa

☐ ORIF ☐ Okunyweza ebweru ☐ Okusalako ☐ Okukendeeza ku kunyigirizibwa & okutebenkeza ☐ POP cast ☐ Okusika ☐ Ebirala: _____ ☐ Tewali

4. Ebizibu byonna ebibaawo nga baweereddwa ekitanda mu ddwaaliro

☐ Infekisoni ☐ Okusannyalala kw'emisuwa emiwanvu, ☐ Okuzimba amawuggwe, ☐ ARDS

☐ Obulwadde bw’ekisenge ☐ Amabwa ga puleesa, ☐ Ebirala: lambika _____ .

5. Obubonero obukulu obuliwo kati

Ebbugumu (℃): _____ .

Omutindo gw’okussa (okussa/eddakiika): _____ .

Okujjula kwa okisigyeni (SpO2, %): _____ .

Puleesa (mmHg) _____ .

Okukuba kw’omutima (okukuba/eddakiika): _____ .

6. Singa asiibulwa

☐ Basiibuddwa awaka

☐ Okukyusibwa okugenda mu kifo/waadi endala

☐ Yesiibudde nga tafunye magezi g’abasawo .

Olunaku lw’okusiibulwa _____ .

Obuwanvu bwonna awamu obw’okubeera mu ddwaaliro _____ .

7. Bw’aba nga mugenzi;

Olunaku lw’okufa: _____

Ekivaako okufa singa kiwandiikibwa _____ .

Ebbanga okuva lwe yaweebwa ekitanda okutuuka ku kufa: _____

ENKOMERERO

APPENDIX II: KAMPALA TRAUMA SCORE II (KTS II) TOOL

	Category	Criteria	Score
A	Age (in years)	5–55 < 5 or > 55	1 0
B	Systolic blood pressure on admission (mmHg)	< 89 89–50 > 49	2 1 0
C	Respiratory rate	9–29 /min > 30 /min ≤ 9 /min	2 1 0
D	Neurological status	Alert Responds to verbal stimuli Responds to painful stimuli Unresponsive	3 2 1 0
E	Score for serious injury	None One injury More than one injury	2 1 0

Kampala Trauma Score II total = A+B+C+D+E. _____ / 10

Interpretation

Score 9-10: Mild injury

Score 7-8: Moderate injury

Score ≤6: Severe Injury

APPENDIX III: GLASGOW COMA SCALE

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1

Total: _____ / 15; E___ V___ M___

APPENDIX IV: GUSTILO-ANDERSON CLASSIFICATION SYSTEM FOR OPEN FRACTURES

Type	Characteristics
I	Puncture wound <1cm Minimal contamination Minimal soft tissue damage
II	Laceration >1cm but <10cm Moderate soft tissue damage Adequate bone coverage Minimal comminution
IIIA	Laceration > 10cm Extensive soft tissue damage Adequate bone coverage Segmental/severely comminuted fractures or heavily contaminated wounds
III B	As a Gustilo type IIIA injury, but with periosteal stripping and bone exposure
III C	Any open fracture with vascular injury requiring repair

APPENDIX V: INFORMED CONSENT FORM

Title of the proposed study: MORTALITY AMONG POLY-TRAUMA PATIENTS WITH ORTHOPEDIC INJURIES MANAGED IN MULAGO NATIONAL REFERRAL HOSPITAL: A PROSPECTIVE COHORT STUDY.

Investigators:

Principle investigator:

DR. SAMUEL OCUNG, MAKERERE UNIVERSITY COLLEGE OF HEALTH SCIENCES, TEL. NUMBER: +256773836545; E-MAIL ADDRESS: samuelocung@gmail.com

Background and rationale for the study:

Injuries involving 2 or more body parts remains a leading cause of death and much suffering globally, with an especially heavy burden in poor countries like Uganda. Bone injuries are among the most common in this patient and cost a lot to treat. However, little is known about the outcomes and factors influencing outcomes in patients with multiple injuries in Uganda. We believe this information is important for improving the care for multiply injured patients and all future injured patients in Uganda.

Study sponsor:

This study is entirely sponsored by the principal investigator Dr. Samuel Ocung

Purpose:

This study aims to assess the incidence of mortality and the influencing factors among multiply injured patients with bone injuries at Mulago National Referral Hospital (MNRH). This information is important for improving care for injured patients in the future; potentially leading to good patient recovery and satisfaction.

The estimated duration the research participant will take to in the research project:

Your participation in this study will continue from the date of your admission to the hospital (Mulago Hospital) up to discharge.

Procedures:

A research assistant will request to include you in this study. If you accept to participate in this study, he/she will ask general questions about yourself, your existing medical conditions before the accident, circumstances involving your accidents and he or she will also request to look into your admission files for further information about your current condition. In addition,

he/she will request to carry out a full medical examination on you. The research assistant will check on you every week until your discharge from Mulago hospital.

Who will participate in the study?

The study will recruit all adults (age 18 years and above) who have multiple injuries including at least one bone injury and are admitted at Mulago hospital for management. We shall recruit 190 adult patients with multiple injuries.

Risks/Discomforts:

Participation in this study carries no major risks. However, some participants may feel discomfort when discussing their medical condition and during medical examination. We request that you openly communicate any distress/ disconfort during your interaction so that an appropriate help may be rendered to mitigate this.

Benefits:

There are no direct benefits to you as a result of participating in the study, however, your input will contribute to understanding and improving care for future multiply injured patients in Uganda.

Confidentiality

Your names will not appear anywhere on the study forms. A study identification number will instead be used. Your records will only be accessed only by the research team, School of Medicine Research Ethics Committee and Uganda National Council for Science and Technology (UNCST) when need arises. The information will only be used for the purpose of this study and no publication of this study will use your name or identify you personally. Data storage of hard copies will be under lock and key vermin proof cabins while the soft copies will be password protected with password only accessible to the principal investigator.

Alternatives

Your participation in this study is completely voluntary. You have the right to withdraw at any time you wish without any negative effect to your treatment and ongoing care.

Cost

There will be no extra cost on you as a result of participating in this study.

Compensation for Participation

Participants will receive a small token of appreciation (UGX 10,000) for their time and contributions to the study.

Questions about the study:

If you have any questions or concerns regarding the study, please contact the Principal Investigator Dr .Samuel Ocung on telephone number +256773836545 any time.

Questions about participants rights:

For questions regarding your right as a study participant, you may contact Prof . Ponsiano Ocama, Chair, Makerere University School of Medicine Research and Ethics Committee (SOMREC) on the telephone number 0772421190

Statement of Voluntariness

Your participation is entirely voluntary, and you have the right to withdraw from the study at any

time without any penalty.

Dissemination of Results

The results of this study will be prepared in a report and submitted as part of a dissertation. A copy will be made available in the library at Makerere University and shared with relevant stakeholders.

Ethical Approval

This study has received ethical approval from the School of Medicine Research and Ethics Committee.

STATEMENT OF CONSENT

..... Has described to me what is going to be done, the risks, the benefits involved and my rights regarding this study. I understand that my decision to participate in this study will not alter my usual medical care. In the use of this information, my identity will be concealed. I am aware that I may withdraw at any time. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Name of the participant ……..

Signature/thumb print of participant ……..……Date ……..…..…

Name of the witness (if applicable)……

Signature of witness……...…Date……..…..…

Name of the interviewer …….……

Signature of interviewer……..……..…Date ……..…….

LUGANDA TRANSLATED CONSENT FORM

EKYOKUGATTAKO III: FOOMU Y'OKUKIRIZA OKW'AMATEEKA.

Omutwe gw'okunoonyereza okuteeseddwa: Okufa mu Balwadde Abafunye Obuvune Bungi mu Ddwaaliro lya Mulago National Referral Hospital.

Abanoonyereza:

Omunoonyereza omukulu:

DR. SAMUEL OCUNG, MAKERERE UNIVERSITY COLLEGE OF HEALTH SCIENCES, TEL. NUMBER: +256773836545; E-MAIL ADDRESS: samuelocung@gmail.com

Ensibuko n'ensonga lwaki okunoonyereza kuno:

Obuvune obuzingiramu ebitundu by'omubiri bibiri oba okusingawo bwe businga okutta abantu n'okuleeta okubonaabona okuyitiridde mu nsi yonna, ng'omugugu munene naddala mu mawanga amaavu nga Uganda. Obuvune bw'amagumba bwe bumu ku businga okubeera mu mulwadde ono era okujjanjaba ssente nnyingi. Wabula kitono ekimanyiddwa ku bivaamu n'ensonga ezikwata ku bivaamu mu balwadde abalina obuvune obw'enjawulo mu Uganda. Tukkiriza nti amawulire gano makulu mu kulongoosa endabirira y'abalwadde abalumizibwa emirundi mingi n'abalwadde bonna abafunye obuvune mu biseera eby'omu maaso mu Uganda.

Abawagira okunoonyereza

Okunoonyereza kuno kwonna kwawagirwa omunoonyereza omukulu Dr. Samuel Ocung

Omugaso:

Okunoonyereza kuno kugenderera okwekenneenya omuwendo gw'abafa n'ensonga ezikwata ku balwadde abalumizibwa emirundi mingi nga balina obuvune bw'amagumba mu ddwaaliro lya Mulago National Referral Hospital (MNRH). Amawulire gano makulu mu kulongoosa mu kulabirira abalwadde abalumizibwa mu biseera eby'omu maaso; ekiyinza okuvaako omulwadde okuwona obulungi n'okumatizibwa.

Ebbanga eribalirirwamu eyeetabye mu kunoonyereza ly'agenda okumala mu pulojekiti y'okunoonyereza:

Okwetaba kwo mu kunoonyereza kuno tekujja kugenda mumusao okuva waweebwa ekitanda mu ddwaaliro mpaka nga osibudwa.

Enkola:

Omuyambi w'okunoonyereza ajja kusaba okukuyingiza mu kunoonyereza kuno. Bw'oba okkirizza okwetaba mu kunoonyereza kuno, ajja kukubuuza ebibuuzo eby'awamu ebikukwatako, embeera z'obujjanjabi zo eziriwo nga akabenje tekunnabaawo, ebikwata ku kabenje kofunye era ajja kusaba n'okutunula mu fayiro zo eze'ddwaaliro okumanya ebisingawo ku mbeera gy'olimu kati. Okugatta ku ekyo, ajja kusaba okukukeberebwa mu bujjuvu. Omuyambi w'abanoonyereza ajja kukukebera buli lunaku okumala wiiki emu n'oluvannyuma buli wiiki okutuusa lw'osiibulwa mu ddwaaliro e Mulago.

Ani agenda okwetaba mu kunoonyereza kuno?

Okunoonyereza kuno kwakuyingiza abantu abakulu (emyaka 18 n'okudda waggulu) abalina obuvune mu bitundu by'omubiri ebisukka mu kimu omuli n'obuvune bw'amagumba era nga baweebwa ekitanda mu ddwaaliro e Mulago okuddukanyizibwa. Tujja kuyingiza abalwadde abakulu 190 abalina ebisago ebingi.

Obulabe/Obutabeera bulungi:

Okwetaba mu kunoonyereza kuno tekulina bulabe bwa maanyi. Kyokka, abamu ku beetabye mu kunoonyereza bayinza okuwulira obubi nga bateesa ku mbeera yaabwe ey'obujjanjabi era nga bakeberebwa abasawo. Tusaba nti owuliziganya mu lwatu okunyigirizibwa/ obutabeera bulungi bwonna mu kiseera ky'okukolagana kwo olwo obuyambi obutuufu busobole okuweebwa okukendeeza ku kino.

Emigaso:

Tewali migaso gya butereevu gy'oli olw'okwetaba mu kunoonyereza, wabula, ebiteeso byo bijja kuyamba okutegeera n'okutumbula okulabirira abalwadde abafuna obuvune obusukka mu bumu mu Uganda

Okukuuma ebyama

Amannya go tegajja kulabika wonna ku foomu z'okunoonyereza. Mu kifo ky'ekyo ennamba y'okunoonyereza ejja kukozesebwa. Ebiwandiiko byo bijja kufunibwa ttiimu yokka ey'abanoonyereza, akakiiko akakwasisa empisa mu kunoonyereza ku ssomero ly'obusawo ne Uganda National Council for Science and Technology (UNCST) nga waliwo obwetavu. Amawulire ago gajja kukozesebwa mu kigendererwa ky'okunoonyereza kuno kwokka era tewali kitabo kyonna kya kunoonyereza kuno kijja kukozesa linnya lyo oba okukumanyisa omuntu. Amawulire agakung'aanyiziddwa gajja kukuumibwa mu kabada ezisibiddwa ne kompyuta eziriko ebigambo ebikusike.

Enkola endala

Okwetaba kwo mu kunoonyereza kuno kwa kyeyagalire ddala. Olina eddembe okuvaamu essaawa yonna gy'oyagala awatali buzibu bwonna ku bujjanjabi bwo n'okulabirira okugenda mu maaso.

Omuwendo

Tewajja kubaawo nsaasaanya yonna ku ggwe ng'ekivudde mu kwetaba mu kunoonyereza kuno.

Okuliyirira olw'okwetabamu

Abeetabye mu kunoonyereza kuno bajja kufuna okusiima okutono (UGX 10,000) olw'obudde bwe bamaze mu kunoonyereza kuno.

Okuddizibwa ssente.

Tewali ngeri yonna ey'okuddiza ssente ekwatagana n'okwetaba mu kunoonyereza kuno kubanga ojakubera mu ddwarilo.

Ebibuuzo ebikwata ku kunoonyereza kuno:

Bw'oba olina ekibuuzo kyonna oba ekikweraliikiriza ku kunoonyereza kuno, tuukirira omunoonyereza omukulu Dr .Samuel Ocung ku nnamba y'essimu +256773836545 essaawa yonna.

Ebibuuzo ebikwata ku ddembe ly'abeetabye mu kunoonyereza kuno:

Okufuna ebibuuzo ebikwata ku ddembe lyo ng'omuntu eyeetabye mu kunoonyereza, oyinza okutuukirira akulira akakiiko akafuga okunoonyereza ku yunivasite y'e Makerere school of medicine Prof . Ponsiano Ocama ku nnamba y'essimu 0772421190

Ekiwandiiko ky'Obwannakyewa

Okwetaba kwo kwa kyeyagalire ddala, era olina eddembe okuva mu kunoonyereza ekiseera kyonna awatali kibonerezo kyonna.

Okubunyisa Ebivuddemu

Ebinaava mu kunoonyereza kuno bijja kutegekebwa mu lipoota era biweebwe ng'ekimu ku bigenda okukolebwa mu dissertation. Kopi ejja kuteekebwa mu tterekero ly'ebitabo ku yunivasite y'e Makerere era egabane n'abakwatibwako abakwatibwako ensonga eno.

Okukkirizibwa okw'Empisa

Okunoonyereza kuno kufunye olukusa olw'empisa okuva mu School of Medicine Research and Ethics Akakiiko ne Uganda National Council of Science and Technology.

EKITABO KY'OKUKKIRIZA

…….annyonyodde ebigenda okukolebwa, akabi, emigaso egirimu n'eddembe lyange ku bikwata ku kunoonyereza kuno. Ntegedde nti okusalawo kwange okwetaba mu kunoonyereza kuno tekijja kukyusa bujjanjabi bwange obwa bulijjo. Mu kukozesa amawulire gano, endagamuntu yange ejja kukwekebwa. Nkimanyi nti nnyinza okuvaamu essaawa yonna. Ntegedde nti bwe nssa omukono ku ffoomu eno, siva ku ddembe lyange lyonna ery'amateeka wabula ntegeeza kyokka nti ntegeezeddwa ku kunoonyereza ate nenzikirizza okwetabamu kyeyagalire. Kopi ya foomu eno ejja kunweebwa.

Erinnya ly'omuntu eyeetabye mu kunoonyereza……..
Omukono/engalo ensajja ey'omuntu eyeetabye mu kunoonyereza ……
Olunaku olw'omweezi …….……..

Erinnya ly'omujulizi……
Omukono gw'omujulizi ……
Olunaku olw'omweezi……..……

Erinnya ly'oyo abuuza ebibuuzo…….
Omukono gw'oyo abuuza ebibuuzo.....
Olunaku olw'omweezi ……..

APPENDIX VI: ADMINISTRATIVE CLEARANCE LETTER FROM MNRH

TELEPHONE: +256-41455400811
FAX: +256-414-5325591
E-mail: admin@mulago.or.ug
Website: www.mulago.or.ug

IN ANY CORRESPONDENCE ON THIS SUBJECT PLEASE QUOTES NO.....

MULAGO NATIONAL REFERRAL HOS
P. O. Box 7051
KAMPALA, UGANDA

7th January 2026

Dr. Ocung Samuel
Principal Investigator
Department of Orthopedic Surgery
MakerereUniversity

Dear Dr. Ocung,

RE: ADMINISTRATIVE CLEARANCE TO CONDUCT A STUDY AT MULAGO NATIONAL REFERRAL HOSPITAL.

The Mulago Hospital Management is pleased to inform you that you have been offered clearance to conduct the study titled **MHREC 3083: "Mortality rate and associated factors among Poly-Trauma patients with orthopedic injuries managed in Mulago National Referral Hospital".**

The above clearance is granted to you on the following conditions;

- That you will follow the research ethical processes
- Agreed to comply with all institutional policies and regulations of Mulago National Referral Hospital
- Agreed to provide end of study report and acknowledge Mulago hospital in all publications
- Submit a copy of filled in participant compensation log after recruiting one quarter of the approved research sample size.

Administrative clearance is valid for one (1) year effective from 7th January 2026 to 6th January 2027.

By copy of this letter, we reiterate our commitment to support this study.

DR. BYANYIMA ROSEMARY
EXECUTIVE DIRECTOR
MULAGO NATIONAL REFERRAL HOSPITAL

Copied to;

1. **Incharge – Accident and Emergency Unit**

Vision: "To be the leading centre of Health Care Services"

APPENDIX VII: SOMREC APPROVAL LETTER

MAKERERE UNIVERSITY
P.O. Box 7072 Kampala, Uganda
E-mail: rresearch9@gmail.com
Phone: 256 414 533541
Fax: 256 414 541036/0414 532204
COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICINE
RESEARCH ETHICS COMMITTEE

10/12/2025
To: OCUNG SAMAUEL

0773836545

Review Type: Initial Review

Re:Mak-SOMREC-2025-663: MORTALITY RATE AND ASSOCIATED FACTORS AMONG POLY-TRAUMA PATIENTS WITH ORTHOPEDIC INJURIES MANAGED IN MULAGO NATIONAL REFERRAL HOSPITAL

I am pleased to inform you that at the **209** convened meeting on **14/10/2025**, the MAK School of Medicine REC (Mak-SOMREC) meeting voted to approve the above referenced application.
Approval of the research is for the period of **10/12/2025** to **10/12/2026.**

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

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **10/12/2026** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by MAK School of Medicine REC (Mak-SOMREC):

No.	Document Title	Language	Version Number	Version Date
1	edited protocol clean copy	English	004	--
2	edited protocol clean copy	English	003	--

3	edited consent forms	English	003	---
4	workplan	English	001	---
5	Data collection tools	Luganda	001	---
6	Data collection tools	English	001	---
7	COVID-19 & EBOLA risk management plan	English	001	---

Yours sincerely,

Prof. Ponsiano Ocama
For: MAK School of Medicine REC (Mak-SOMREC)