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**FACTORS ASSOCIATED WITH NEONATAL OUTCOME OF REFERRED
NEONATES FROM LOWER-LEVEL HEALTH FACILITIES TO JINJA REGIONAL
REFERRAL HOSPITAL**

A dissertation presented to

FACULTY OF HEALTH SCIENCES

in partial fulfillment of the requirements for the award of the degree
Master of Science in Health Services Management

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July 2025

DECLARATION

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SCHOOL OF POSTGRADUATE STUDIES AND RESEARCH**

Master's Dissertation

Declaration

I have read the rules of Uganda Martyrs University on plagiarism and hereby state that this work is my own.

It has not been submitted to any other institution for another degree or qualification, either in full or in part.


Throughout the work I have acknowledged all sources used in its compilation.

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DEDICATION

This dissertation is a dedication to my family and friends. They have supported me and made everything possible.

ACKNOWLEDGEMENT

I acknowledge the work of my supervisor and other colleagues for they have patiently guided me throughout this work.

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LIST OF ABBREVIATION ABSTRACTS

DV	:	Dependent Variable
IV	:	Independent Variable
JRRH	:	Jinja Regional Referral Hospital
LBW	:	Low Birth Weight
LBW	:	Very Low Birth Weight
LMIC	:	Low- and Middle-Income Countries
MOH	:	Ministry of Health
NICU	:	Neonatal Intensive Care Unit
NMR	:	Neonatal Mortality Rate
PBF	:	Performance Based Financing
SDGS	:	Sustainable Development Goals
UBOS	:	Uganda Bureau of Statistics
UNICEF	:	United Nation Children Fund
UNIPH	:	Uganda National Institute of Public Health
WHO	:	World Health Organization

OPERATIONAL DEFINITIONS

Birth asphyxia is a hypoxic insult severe enough to cause metabolic acidosis, neonatal encephalopathy and multi organ system dysfunction. WHO defines birth asphyxia simply as “the failure to initiate and sustain breathing at birth.

Live birth is the complete expulsion or extraction from its mother of a fetus/baby of 1000 grams or 28 weeks gestation; which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached.

Neonatal Mortality Rate (NMR): The number of deaths during the first 28 days of life per 1,000 live births. Early neonatal mortality refers to a death in the first week of life while late neonatal mortality refers to deaths between 7 and 28 days of life.

Neonatal Sepsis: A life-threatening systemic infection occurring within the first 28 days of life, caused by bacterial, viral, or fungal pathogens.

Newborn or neonate refers to an infant in the first 28 days after birth. The term "newborn" includes premature infants, post mature infants and full-term newborns.

Perinatal mortality is defined as the "number of stillbirths and deaths in the first week of life per 1,000 live births.

Pre-referral Stabilization: The initial emergency management and supportive care provided to a neonate at the referring health facility before transfer to a higher-level hospital.

Stillbirths refers to Pregnancy losses occurring after seven completed months of gestation and are expressed per 1,000 total births.

ABSTRACT

Background: Neonatal mortality is a key public health concern. The neonatal mortality rate currently stands at approximately 18 deaths per 1,000 live births, translating into millions of deaths annually. Almost half of all neonatal deaths occur in the first day of life, largely from preventable causes such as infection, asphyxia, and complications of prematurity. Despite efforts to improve neonatal care, outcomes remain suboptimal, particularly for neonates referred from lower-level facilities to regional hospitals. Late referrals, inadequate pre-referral stabilization, and resource constraints contribute to high mortality rates

Objectives: This study aimed to determine the factors associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital.

Methods: A retrospective longitudinal study design employing documentary review of referred neonates at Jinja Regional Referral Hospital. A structured data extraction tool was used to collect data from neonatal records of all the referred neonates admitted to JRRH's Neonatal Unit were reviewed between December 2024 and December 2023. The collected data were coded, entered into Excel spreadsheet, and analyzed using STATA 14. Data was presented in form of text, tables and graphs. Ethical approval and permission to access records obtained from JRRH management was obtained. Logistic regression was used to test for association while an prevalence ratio was as the measure of the association between the two variables and data was presented in term so text, table and pie-charts.

Results: A total of 87 referred neonates admitted to JRRH's Neonatal Unit were reviewed between December 2024 and December 2023 community members. From the study, the survival of referred neonates admitted to JRRH's Neonatal Unit was at 63.2%. The most common primary reason for referral was prematurity, accounting for 35.6% of cases. Survival of the referred neonates admitted to JRRH's Neonatal Unit was significantly associated with being referred from health facilities located within 10 km ((APR: 1.380; 95% CI: 1.076-1.584; $p = 0.029$), staying in the hospital for three days or less (APR: 1.240; 95% CI: 1.083–1.837; $p = 0.024$) and having not develop complications during hospitalization (APR: 1.202; 95% CI: 1.064-1.927; $p = 0.034$).

Conclusion: The study found that survival was low. Therefore, it is recommended that the Ministry of Health should enhance neonatal referral systems, especially for facilities located more than 10 km from the referral hospital and prioritize equipping lower-level health facilities with basic neonatal care infrastructure and skilled personnel

CHAPTER ONE: INTRODUCTION

1.0 Introduction

A neonate, also known as newborn, is an infant within the first 28 days of life (WHO, 2024). This period is the most vulnerable time for child survival, as neonates are at the highest risk of mortality due to complications related to preterm birth, infections, and birth asphyxia. Neonatal mortality refers to the death of a newborn within the first 28 days of life and is a key indicator of a country's healthcare system performance (UNICEF, 2023).

Globally, an estimated 2.3 million neonatal deaths occurred in 2021, with Sub-Saharan Africa accounting for approximately 43% of these deaths (UNICEF, 2023). Uganda has made efforts to reduce neonatal mortality, but progress remains slow. The country's neonatal mortality rate (NMR) stands at 22 deaths per 1,000 live births, with substantial regional variations (UBOS, 2023). Many of these deaths result from preventable causes, including inadequate antenatal care, poor referral systems, and resource limitations at healthcare facilities.

Jinja Regional Referral Hospital (JRRH) serves as a major referral center for Eastern Uganda, handling approximately 1,200 neonatal admissions annually, with over 70% of cases being referrals from lower-level health facilities (Ministry of Health Uganda, 2023). However, the hospital faces significant resource constraints, including an overburdened Neonatal Intensive Care Unit (NICU), shortages of essential medications like surfactant and caffeine, and limited specialized personnel to manage high-risk neonates. Moreover, delays in transportation and inadequate emergency care during referrals contribute significantly to neonatal morbidity and mortality (UNIPH, 2023).

Understanding the factors influencing neonatal outcomes among referred neonates is crucial for improving survival rates. This study seeks to assess the health system, Individual and sociocultural factors affecting neonatal outcomes at JRRH.

Neonates, defined as babies within the first 28 days of life, represent a vulnerable population in public health, acting as an indicator of maternal and child health progress. Even with advances in medical science, neonatal mortality, defined as deaths within the first 28 days of life, has remained a significant proportion of child mortality worldwide. Approximately 2.3 million newborns died globally in 2022, with neonatal deaths contributing to 47% of all deaths of under-five children(WHO, 2024). Approximately 6,500 babies die each day from causes that are almost entirely preventable; the need for specific interventions that focus on neonatal health outcomes is paramount(Save the Children, 2020).

The burden of neonatal mortality is distributed very unequally between low- and middle-income countries. Sub-Saharan Africa has the highest rates of neonatal mortality, often exceeding 30 deaths per 1,000 live births in many countries(WHO, 2024). These deaths are driven by conditions that are largely preventable or treatable, including neonatal sepsis, prematurity, and respiratory distress syndrome(Taye et al., 2024a). Neonatal mortality in Uganda follows regional trends, where there is considerable challenges in health care delivery, particularly in referral from lower level facilities to higher-level hospitals(Musaba et al., 2021). This study aims to explore the factors influencing neonatal outcomes among referred neonates from lower-level facilities to Jinja Regional Referral Hospital, Eastern Uganda. In identifying critical health system and socioeconomic barriers, the findings of this study will help inform the development of strategies for improvement in neonatal survival in resource-constrained settings.

1.1 Background of the Study

Global Burden of Neonatal Mortality

Globally, neonatal mortality is a key public health concern. The neonatal mortality rate currently stands at approximately 18 deaths per 1,000 live births, translating into millions of deaths annually(WHO, 2024). High-income countries have made considerable progress in

reducing neonatal mortality; however, LMICs still have unacceptably high rates, with the greatest burden in sub-Saharan Africa and South Asia(Moges et al., 2024). Almost half of all neonatal deaths occur in the first day of life, largely from preventable causes such as infection, asphyxia, and complications of prematurity (Ahmed et al., 2021).

Economic and social consequences of neonatal mortality are severe. For instance, neonatal sepsis is one of the major causes of neonatal mortality globally, and this leads to significant health care expenditure in many LMICs due to a lack of resources(Baki et al., 2012). Efficient interventions, like the presence of skilled birth attendants, neonatal intensive care units, and prompt delivery of antibiotics, have been shown to drastically reduce neonatal mortality rates. However, such interventions are often difficult to implement in resource-poor settings, necessitating the need for customized approaches in dealing with problems at the local level.

Sub-Saharan Africa holds the distinction of having the highest neonatal mortality rate (NMR) worldwide, registering an average of 30 fatalities for every 1,000 live births (Ranjeva et al., 2018). The systemic challenges within healthcare, such as insufficient infrastructure, a lack of qualified healthcare personnel, and restricted availability of essential pharmaceuticals, intensify this issue(Lawn et al., 2014). Referral systems present significant challenges, as delays in transport, substandard pre-referral stabilization, and ineffective communication among facilities lead to detrimental neonatal results.

Research conducted throughout the region indicates elevated neonatal mortality rates in referral hospitals, with figures fluctuating between 8.8% and 35.5% (Gage and Bauhoff, 2021). For example, a study undertaken in Ethiopia found that the mortality rate among neonates admitted to NICUs was 20.5%, attributing sepsis, birth asphyxia, and prematurity as primary contributors(Taye et al., 2024a). To effectively tackle these challenges, it is essential to implement extensive interventions aimed at enhancing healthcare delivery across all tiers of care(World Health Organization, 2015).

The estimated neonatal mortality rate in Uganda is about 27 deaths per 1,000 live births (Kyasimire et al., 2024). The major contributing factors to this rate include low birth weight, neonatal sepsis, respiratory distress syndrome, and jaundice (Stoll et al., 2015). Neonates referred from lower-level facilities often arrive at regional hospitals in critical condition due to delays in transportation and also due to poor pre-referral care (Verma et al., 2018). These challenges are compounded by systemic issues that include inadequate staffing, limited medical supplies, and inadequate training of healthcare professionals (Debelew et al., 2014).

Jinja Regional Referral Hospital, a vital neonatal care center in Eastern Uganda, faces significant challenges in managing referred neonates. The NICU is usually congested, and delays in care are common, often resulting in high mortality rates (Okot et al., 2024). Factors identified as significant predictors of adverse neonatal outcomes include prolonged time spent in transport of more than one hour and lack of effective communication between the referring and receiving facilities (Okot et al., 2024).

Interventions to minimize Neonatal Mortality

Worldwide, initiatives like the Global Strategy for Women's, Children's, and Adolescents' Health (2016–2030) emphasize strengthening healthcare systems to reduce neonatal mortality (Kuruvilla et al., 2016). These include increasing access to skilled birth attendants, enhancing referral mechanisms, and addressing social determinants of health. In the context of Uganda, the policy framework for Reproductive, Maternal, Newborn, Child, and Adolescent Health corresponds to such international imperatives and focuses on the enhancement of service delivery with a neonatal mortality reduction goal of 12 per 1,000 live births by the year 2030 (Asege Ekochu et al., 2024).

Despite these efforts, significant gaps remain in how neonatal care policies are implemented at the local level. One proposed solution for improving health care services throughout sub-

Saharan Africa, including Uganda, has been performance-based financing (PBF). Studies suggest that PBF may have positive effects on provider performance and quality of care, but ultimately, success depends on addressing broader system issues such as resource allocation and provider training (Gage and Bauhoff, 2021).

This study therefore embarks on expanding existing knowledge to establish health system, individual, and socio-economic determinants of neonatal outcome at the Jinja Regional Referral Hospital. It is with these that the findings will add to Uganda's efforts toward the realization of Sustainable Development Goal 3 and furthering neonatal survival rates.

1.3 Problem Statement

Neonatal mortality remains a persistent challenge at Jinja Regional Referral Hospital (JRRH), particularly among neonates referred from lower-level health facilities. Despite being a key referral center in Eastern Uganda, JRRH continues to register poor neonatal outcomes, with referred cases accounting for over 70% of admissions in the neonatal unit. In the 2022/23 reporting period, the hospital recorded 312 neonatal deaths within the first week of life and a neonatal mortality rate of approximately 55.9 per 1,000 live births more than double the national average and far above the Sustainable Development Goal (SDG) target of fewer than 12 per 1,000 live births.

A significant proportion of these deaths involve neonates who are referred late, arrive in critical condition, or are not properly stabilized before transfer. Many lower-level facilities lack the capacity, equipment, and trained personnel to provide essential pre-referral care. Additionally, long distances, transport delays, and limited emergency readiness further reduce the chances of survival for these vulnerable newborns. Once admitted, JRRH faces its own constraints, including an overstretched neonatal unit, limited intensive care capacity, and shortages of skilled staff and essential supplies.

Moreover, sociocultural factors such as delayed care-seeking, preference for traditional birth attendants, and inadequate maternal health education further complicate timely referral and care. These challenges contribute to preventable neonatal deaths, yet little is known about how referral practices, pre-referral care, and social influences interact to affect outcomes in this context.

This study, therefore, seeks to examine the specific factors influencing neonatal outcomes among referred neonates at JRRH, identify gaps in the referral and care system, and explore community-level influences on neonatal survival. Addressing this knowledge gap is crucial for informing targeted interventions that can reduce neonatal mortality and strengthen Uganda's efforts toward meeting national and global child survival goals.

1.3 Research Questions

1.3.1 Broad Research Question

What factors are associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital?

1.3.2 Specific Research Questions

1. What health system factors are associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital?
2. What individual factors are associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital?
3. What sociodemographic factors are associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital?

1.4 Conceptual Framework

Introduction

This study's conceptual framework integrates Donabedian's (1988) Structure-Process-Outcome (SPO) Model with multidimensional factors influencing neonatal outcomes among referred neonates at Jinja Regional Referral Hospital (JRRH). The SPO Model provides a systematic lens to analyze how health system structures, clinical processes, and sociodemographic contexts interact to determine neonatal survival, mortality, and morbidity.

Theoretical Foundation: SPO Model

Donabedian's model posits that healthcare quality is evaluated through three interdependent components:

1. Structure: Material and organizational resources (e.g., facility capacity, staffing).
2. Process: Clinical actions and decision-making (e.g., stabilization, referrals).
3. Outcome: Patient health results (e.g., survival, complications).

This study adapts the SPO Model to categorize and analyze variables as follows:

SPO-Aligned Framework Components

1. Structural Factors (Independent Variables)

The "structure" of healthcare delivery systems that enable or hinder care:

- **Health System Infrastructure:**
 - Referring facility level (HCII/HCIII/Hospital)
 - Distance to JRRH (≤ 10 km vs. > 10 km)
 - Availability of neonatal equipment (e.g., oxygen concentrators)
- **Sociodemographic Context:**
 - Maternal education level (health literacy)
 - Place of delivery (facility vs. home)

Example: Neonates referred from HCIIIs (low-resource structures) face higher mortality risks due to inadequate stabilization tools (MoH, 2023).

2. Process Factors (Mediating Variables)

Clinical and operational actions during referral:

- **Pre-referral Stabilization:**
 - Oxygen/antibiotics administration
 - Thermal regulation measures
- **Referral Logistics:**
 - Transport time (≤ 1 hour vs. > 1 hour)
 - Mode of transport (ambulance vs. private vehicle)
 - Completeness of referral documentation

Example: Delayed transport (> 1 hour) exacerbates birth asphyxia, linking poor processes to adverse outcomes (Taye et al., 2024).

3. Outcome Factors (Dependent Variable)

End-results of structural and process interactions:

- Survival: Discharged alive
- Mortality: Death during hospitalization
- Morbidity: Complications (e.g., sepsis, respiratory distress)

The conceptual framework is structured to illustrate the relationship between independent variables (IVs), mediating factors, and the dependent variable (DV) in the context of neonatal outcomes among referred neonates at Jinja Regional Referral Hospital (JRRH). The framework is based on three main categories of independent variables: health system factors, individual neonatal factors, and sociodemographic factors. These factors interact through mediating variables to influence neonatal outcomes, which constitute the dependent variable.

Independent Variables (IVs)

1. Health System Factors

These variables relate to the role of the healthcare system in the referral process and neonatal care. They include:

- **Pre-referral stabilization measures:** The extent to which the neonate received stabilization (e.g., oxygen, antibiotics, thermal regulation) before referral, as documented in referral notes.
- **Transport time:** The estimated duration from the referring facility to JRRH, inferred from referral notes or admission time.
- **Mode of transport:** The type of transport used (e.g., ambulance, private vehicle, motorcycle), recorded in referral forms.
- **Referral documentation:** The completeness of referral notes, including diagnosis, treatment given, and reason for referral.

2. Individual Neonatal Factors

These factors pertain to the neonate's characteristics and clinical condition. They include:

- **Birth weight:** The neonate's weight at birth (in kilograms), documented in delivery or admission records.
- **Gestational age:** The neonate's age in weeks at birth, recorded in maternal or neonatal records.
- **Clinical condition on admission:** The primary diagnosis at admission (e.g., sepsis, birth asphyxia, prematurity), as recorded by the admitting physician.
- **Sex of the neonate:** The biological sex of the neonate, documented in patient files.

3. Sociodemographic Factors

These variables reflect the sociodemographic context of the neonate's family and community.

They include:

- **Maternal age:** The mother's age at the time of delivery, recorded in maternal health records.
- **Place of delivery:** Whether the neonate was born in a health facility or at home, documented in referral notes.
- **Maternal education level:** The highest level of education attained by the mother, which may influence health literacy and healthcare-seeking behaviors.

Mediating Factors: These variables mediate the relationship between the independent variables and neonatal outcomes. They include:

- **Timeliness of referral:** Whether the neonate was referred within a critical time frame (e.g., within 24 hours of birth). Delays can worsen neonatal outcomes.
- **Quality of pre-referral care:** The adequacy of interventions (e.g., oxygen, antibiotics) before referral, which can improve neonatal outcomes.

Dependent Variable (DV)

The dependent variable is neonatal outcome, categorized as:

- **Survival:** The neonate was discharged alive.
- **Mortality:** The neonate died during hospitalization.
- **Morbidity:** The neonate developed new complications (e.g., sepsis, respiratory distress) during hospitalization

Conceptual Framework diagram

Below is the visual representation of the framework

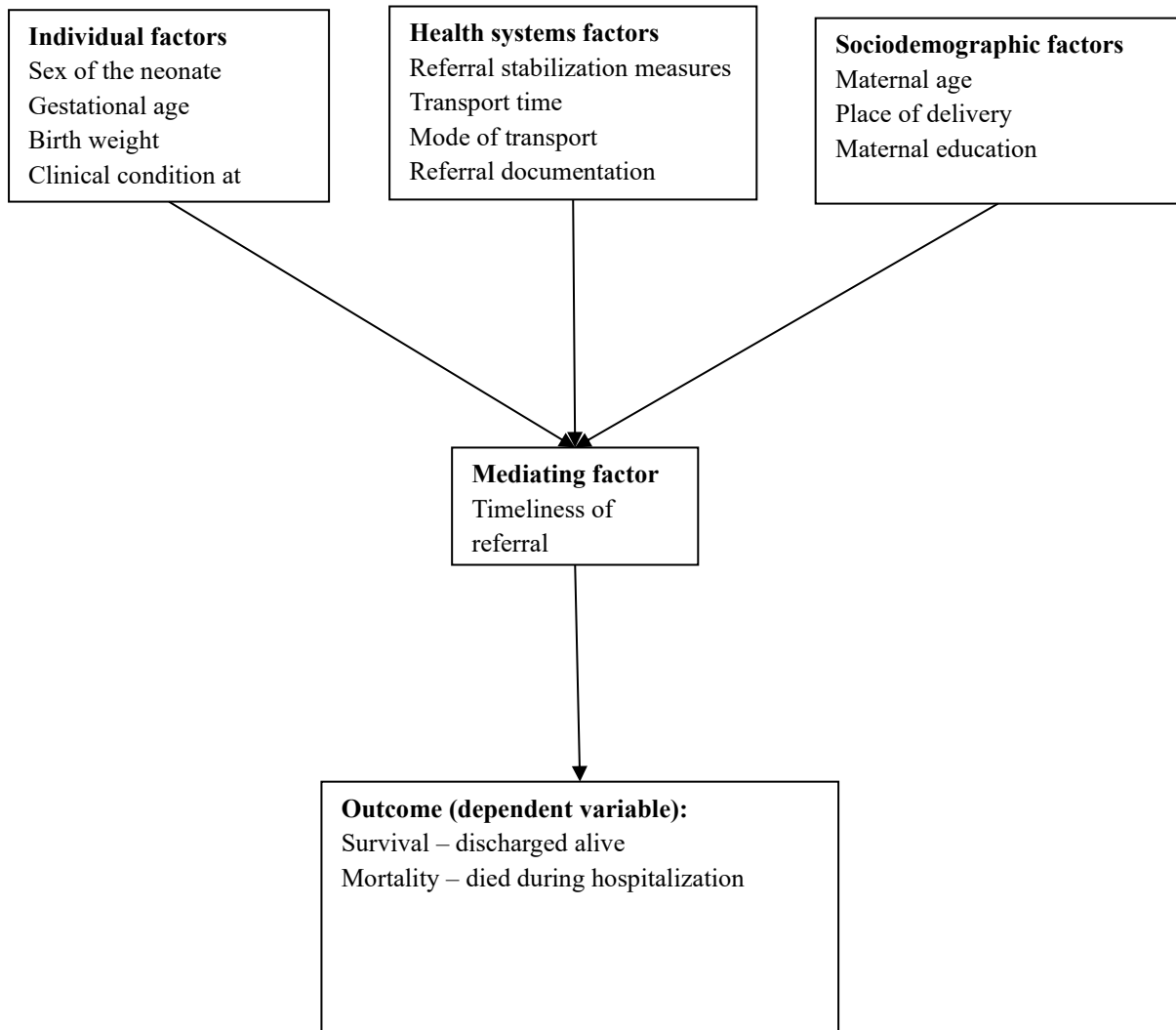


Figure 1: Conceptual framework of the study Adapted from Donabedian (1988). The framework links structural capacities, clinical processes, and neonatal outcomes, with sociodemographic factors as moderators.

1.5 Objectives

1.5.1 Broad Objective

To determine factors associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital.

1.5.2 Specific Objectives

1. To explore the health system factors associated with neonatal outcomes among neonates referred to Jinja Regional Referral Hospital
2. To determine the individual factors associated with neonatal outcome among neonates referred to Jinja Regional Referral Hospital
3. To examine sociodemographic factors associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital

1.6 Scope of the Study

The scope of this study encompasses health system, individual, and sociocultural factors influencing neonatal morbidity and mortality among referred neonates at Jinja Regional Referral Hospital. Specifically, the study investigated the challenges in referral systems, pre-referral care, and neonatal outcomes, focusing on neonates referred from lower-level health facilities within Eastern Uganda. The geographical scope covers Jinja Regional Referral Hospital and its catchment area, including surrounding districts that rely on the hospital for advanced neonatal care.

The temporal scope of the study included a retrospective review of neonatal outcomes over the past 2 years from January 2022 to December 2024. This timeframe is chosen to capture recent trends and provide actionable insights for immediate interventions. The study employed both quantitative and qualitative methods to explore the interplay of health system, individual, and sociocultural determinants of neonatal outcomes. Key variables to be studied include birth

weight, gestational age, duration of transport, pre-referral stabilization, and maternal factors such as education and socioeconomic status.

1.7 Significance of the Study

The findings of this study will have far-reaching implications for various stakeholders in the healthcare system. Policymakers will benefit from evidence-based insights into the systemic challenges affecting neonatal outcomes, enabling them to design and implement targeted interventions that improve referral systems and neonatal care delivery. Healthcare providers at both lower-level health facilities and regional referral hospitals will gain a deeper understanding of critical gaps in pre-referral and referral care processes, allowing for the development of training programs, resource allocation strategies, and standard operating procedures to enhance neonatal survival rates.

The study will also benefit mothers and caregivers by identifying sociocultural barriers to effective neonatal care and providing recommendations to improve health-seeking behaviors and maternal education. Furthermore, the research will contribute to the global body of knowledge on neonatal mortality in resource-limited settings, aiding international agencies such as the World Health Organization (WHO) and UNICEF in formulating policies that address neonatal health disparities in sub-Saharan Africa.

By addressing the key determinants of neonatal morbidity and mortality, this study will ultimately support Uganda's efforts to achieve Sustainable Development Goal (SDG) 3, which aims to reduce neonatal mortality to fewer than 12 deaths per 1,000 live births by 2030. Failure to address these determinants could result in continued neonatal mortality rates that exceed national and global targets, perpetuating poor health outcomes and undermining Uganda's progress toward improving maternal and child health.

1.8 Justification of the Study

Neonatal mortality remains a critical public health challenge, contributing significantly to under-five mortality globally and in Uganda. According to the World Health Organization (2023), approximately 2.4 million neonatal deaths occur annually, with sub-Saharan Africa accounting for a substantial proportion due to inadequate healthcare systems, weak referral networks, and limited neonatal care resources (WHO, 2023). Uganda's neonatal mortality rate stands at 22 deaths per 1,000 live births (UNICEF, 2023), far exceeding the SDG target of 12 per 1,000 live births by 2030. Jinja Regional Referral Hospital, a major neonatal care center in Eastern Uganda, records an annual neonatal mortality rate of approximately 18% among referred cases (JRRH Annual Report, 2023). These alarming statistics highlight the urgent need to address gaps in neonatal referral care.

Failure to conduct this study would mean perpetuating the systemic inefficiencies that contribute to preventable neonatal deaths, including delayed referrals, inadequate pre-referral stabilization, and insufficient resources at both lower-level and referral facilities. Additionally, sociocultural factors such as delayed care-seeking behaviors and reliance on traditional birth attendants remain underexplored, yet they play a critical role in influencing neonatal outcomes. Without evidence-based insights into these issues, efforts to improve neonatal survival in Uganda may remain fragmented and ineffective.

This study is justified by the pressing need to identify and address barriers within the referral system and sociocultural context of neonatal care. The findings will not only inform policy and practice but also strengthen Uganda's healthcare system's capacity to reduce neonatal mortality, aligning with national and global health goals. Moreover, the study's recommendations will serve as a roadmap for implementing context-specific interventions that can be scaled to other resource-constrained settings, contributing to global efforts to reduce neonatal mortality and improve child survival.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter explores existing research on the factors influencing neonatal outcomes, particularly in neonates referred from lower-level healthcare facilities to regional referral hospitals. The review focuses on health system factors, individual neonatal factors, and sociodemographic influences as outlined in the study's objectives. The chapter also identifies gaps in the current body of knowledge and justifies the need for this study. The literature search strategy focused on recent studies conducted in Sub-Saharan Africa, particularly Uganda, highlighting areas that are responsible for the outcomes of referred neonates from lower-level facilities to tertiary hospitals.

2.2 Reflection on the Problem

A neonate, also referred to as newborn, is an infant within the first 28 days of life, a period that is highly critical for survival and development (WHO, 2024). Neonatal mortality refers to the death of a live-born infant within this timeframe and is commonly categorized into early neonatal mortality (0–7 days) and late neonatal mortality (8–28 days) (UNICEF, 2023). Globally, neonatal deaths account for nearly half (47%) of all under-five child deaths, with an estimated 2.3 million neonates dying in 2021 (WHO, 2023). The highest burden is observed in low- and middle-income countries (LMICs), with Sub-Saharan Africa experiencing the highest neonatal mortality rate due to inadequate healthcare systems, delays in accessing care, and sociocultural barriers (WHO, 2023).

In Uganda, neonatal mortality remains a major public health challenge. The country's neonatal mortality rate (NMR) stands at 27 deaths per 1,000 live births (UBOS, 2023), though disparities exist across regions and levels of healthcare access. The leading causes of neonatal deaths include preterm birth complications, birth asphyxia, and neonatal infections (Ministry of Health Uganda, 2023). Despite government efforts to improve newborn care, Uganda still falls short

of the Sustainable Development Goal (SDG) target of reducing neonatal mortality to at least 12 deaths per 1,000 live births by 2030 (WHO, 2023).

Neonatal mortality remains a significant public health challenge worldwide, particularly in low- and middle-income countries, where a large proportion of neonatal deaths occur within the first 28 days of life (WHO, 2021). In Uganda, neonatal mortality contributes substantially to under-five mortality, with an estimated rate of 27 deaths per 1,000 live births (UDHS, 2020). Many of these deaths are preventable with timely and effective neonatal care, yet systemic challenges in the referral pathways and quality of care at lower-level health facilities continue to undermine neonatal outcomes.

Referred neonates—those transferred from lower-level health facilities such as health centers or clinics to regional referral hospitals—constitute a vulnerable population at high risk of poor outcomes due to delays in care, inadequate stabilization prior to transfer, and limited resources at the referral sites (Nabukeera-Barungi et al., 2019). Studies have indicated that the condition of neonates on arrival, including factors such as prematurity, birth asphyxia, sepsis, and low birth weight, strongly influences survival and long-term health outcomes (Moxon et al., 2015; Were et al., 2018). The quality of pre-referral care, transport conditions, and timeliness of referral also play crucial roles in determining neonatal outcomes (Ezeaka et al., 2017).

In Uganda, the referral system is often hampered by infrastructural limitations, inadequate human resources, and lack of essential neonatal care equipment at lower-level facilities (Omondi et al., 2020). These challenges result in delayed recognition of neonatal complications and referral delays that exacerbate morbidity and mortality. Moreover, poor communication and coordination between referring and receiving facilities further compromise the continuity of care (Kakembo et al., 2022). Research by Tumwesigye et al. (2021) found that neonates referred late with advanced complications had significantly higher mortality rates at referral hospitals compared to those referred promptly.

Several socio-demographic and clinical factors also influence neonatal outcomes among referred cases. Maternal factors such as age, antenatal care attendance, and presence of maternal infections have been associated with neonatal survival (Kisitu et al., 2018). Additionally, the mode of delivery, gestational age, and presence of congenital anomalies have been documented as predictors of neonatal morbidity and mortality (Nakanwagi et al., 2019). Importantly, the ability of lower-level facilities to perform basic neonatal resuscitation and stabilization prior to referral is often limited, contributing to poor neonatal condition at arrival (Kawawa et al., 2020).

At Jinja Regional Referral Hospital, a major referral center serving the eastern region of Uganda, the volume of neonatal referrals from lower-level health units is steadily increasing, putting pressure on existing neonatal care resources. Despite this, there is limited local data on the specific factors associated with neonatal outcomes in this referral context. Understanding these factors is critical for improving referral protocols, enhancing pre-referral care, and optimizing neonatal survival and health outcomes in the region.

At Jinja Regional Referral Hospital (JRRH), a major neonatal referral center for Eastern Uganda, neonatal mortality remains a pressing issue. The hospital receives a high volume of referred neonates from lower-level health facilities, many of whom experience delays in transportation, inadequate pre-referral stabilization, and limited access to neonatal intensive care services (Ministry of Health Uganda, 2023). Understanding the factors influencing neonatal outcomes in referred neonates is crucial for strengthening neonatal care services and reducing mortality in the region.

JRRH, as a major referral center for Eastern Uganda, plays a critical role in managing high-risk neonates referred from lower-level health facilities. However, the hospital faces significant challenges, including inadequate healthcare infrastructure, delays in the referral process, and resource constraints such as shortages of essential medications, overcrowded neonatal

intensive care units (NICUs), and limited specialized personnel. These challenges are compounded by systemic issues such as poor pre-referral stabilization, prolonged transportation times, and ineffective communication between referring and receiving facilities. Additionally, sociocultural factors, such as delayed care-seeking behaviors, reliance on traditional birth attendants, and low health literacy among mothers, further hinder timely access to quality neonatal care.

The high neonatal mortality rates in Eastern Uganda, particularly among referred neonates, highlight the urgent need to address the systemic and sociocultural barriers that contribute to poor neonatal outcomes. Despite the critical role of JRRH in managing high-risk neonates, there is a paucity of comprehensive data on the factors influencing neonatal outcomes in this context. Understanding these factors is essential for designing targeted interventions to improve neonatal survival rates and reduce the burden of neonatal mortality in Uganda.

In summary, neonatal outcomes among referred neonates are influenced by a complex interplay of clinical, health system, and socio-demographic factors. Addressing these requires strengthening the entire referral chain, from early detection and stabilization at lower-level facilities to efficient transport and quality care at referral hospitals. This study aims to fill the knowledge gap regarding the determinants of neonatal outcomes at Jinja Regional Referral Hospital, providing evidence to inform policy and practice improvements for neonatal health in Uganda.

2.3 Literature Search Strategy

A systematic literature search was conducted using electronic databases such as PubMed, Google Scholar, and the World Health Organization (WHO) library. Keywords included "neonatal mortality," "neonatal morbidity," "referral systems," "health system factors," "individual neonatal factors," and "sociodemographic determinants." The search was limited to studies published between 2019 and 2024 to ensure the inclusion of the most recent evidence.

Studies were selected based on their relevance to the research objectives, with a focus on LMICs, particularly Sub-Saharan Africa.

2.4 Scope of the Literature

The literature review focuses on three main areas: Health system factors, including referral processes, transport conditions, and resource availability, Individual neonatal factors, such as birth weight, gestational age, and clinical condition on admission and Sociodemographic factors, including maternal education, maternal age and place of delivery.

The review also highlights the mediating role of the timeliness of referral and quality of pre-referral care in influencing neonatal outcomes. By synthesizing evidence from recent studies, this chapter identifies critical gaps in the literature and underscores the need for context-specific research in Uganda.

2.5 Literature on Key Study Variables

Several factors influence the outcomes of neonates referred from lower-level facilities, especially in low-resource settings like Uganda. Literature points to three main categories of variables that affect these outcomes: health system factors, individual neonatal characteristics, and sociodemographic factors.

This section reviews each of these categories to understand how healthcare system gaps, the biological conditions of neonates, and family or social circumstances all contribute to neonatal survival or death. Understanding these variables is key to identifying where improvements are needed to reduce neonatal mortality.

2.5.1 Health System Factors

Health system factors are critical in shaping the outcomes of referred neonates. They include how well lower-level facilities prepare and stabilize babies before referral, the efficiency of transportation, and the readiness of hospitals like Jinja Regional Referral Hospital to provide specialized care (Omondi et al., 2020; Kakembo et al., 2022).

When referral systems are weak, such as lacking proper transport or trained staff, the risks of neonatal deterioration increase (Adatara et al., 2019; Mugisha et al., 2020). Research shows that poor emergency transport, inadequate referral documentation, and limited neonatal expertise at both ends of the referral pathway contribute to high neonatal deaths in resource-limited settings (Mutesasira et al., 2019; Nalubega et al., 2018). Improving these health system components is therefore essential to saving lives.

Referral Stabilization Measures

Referral stabilization measures are critical in preparing neonates for safe transfer to higher-level facilities. Proper stabilization reduces the risk of deterioration during transit. Stabilization practices such as thermal regulation, oxygen therapy, and initial antibiotic administration are critical for improving survival rates (Sharma et al., 2015). A systemic review by Bee et al. (2008) found that recommended immediate newborn care practices such as thermal care, hygienic cord care, were inconsistently implemented across sub-Saharan Africa, contributing to high mortality rates (Bee et al., 2018).

Similarly, Adatara et al., (2019) demonstrated that improper resuscitation practices or poor adherence to protocols during stabilization can result in adverse outcomes, including neonatal sepsis or complications from hypoxia. This underscores the need for rigorous training and adherence to stabilization protocols in lower-level facilities. The evidence suggests that while stabilization is pivotal, it is only effective when performed with high-quality standards.

The importance of proper stabilization cannot be overstated, as it has been shown to significantly influence neonatal survival and morbidity outcomes. According to Kiguli et al. (2021), inadequate stabilization prior to referral often results in deterioration of the neonate's condition during transit, leading to higher mortality rates upon arrival at referral centers.

Stabilization measures typically include ensuring airway patency, maintaining adequate oxygenation, temperature regulation, and initiating intravenous fluids or antibiotics where

needed (Ong'wen et al., 2019). However, studies across Uganda and other low-resource settings report that many health centers lack the necessary equipment or trained personnel to effectively stabilize sick neonates before referral. This gap in capacity leads to increased risks such as hypothermia and hypoglycemia during transport (Mugisha et al., 2020).

Moreover, the delay in recognizing neonatal distress and initiating stabilization protocols at the referring facility has been linked to poor outcomes. Early identification and prompt treatment, especially for conditions like neonatal sepsis and respiratory distress, are crucial. Nalubega et al. (2018) found that neonates referred without adequate stabilization were three times more likely to die within 48 hours of admission compared to those stabilized properly.

Training interventions aimed at improving neonatal resuscitation and stabilization skills among health workers at lower-level facilities have demonstrated positive effects. For instance, the Helping Babies Breathe program implemented in Uganda showed improvements in the quality of immediate newborn care, which indirectly enhanced referral outcomes (Tusiime et al., 2020). However, sustaining these improvements requires regular refresher trainings and supportive supervision.

Lastly, the availability of essential supplies and protocols at referring facilities is vital. Kiguli et al. (2021) highlight that even when knowledge exists, the lack of basic equipment such as oxygen delivery devices, warmers, and intravenous fluids impedes effective stabilization. Strengthening supply chains and infrastructure at peripheral facilities could therefore improve neonatal survival rates post-referral.

Transportation Time

Timely transportation of neonates from lower-level facilities to referral centers is a significant determinant of outcomes. Delays during transit can exacerbate neonatal conditions, leading to higher mortality rates. Murphy et al., (2018) reported that prolonged transport times directly correlated with adverse outcomes such as severe infections and hypothermia. Baidya et al.,

(2018) also emphasized that minimizing delays improves survival rates, particularly for critically ill neonates requiring urgent intervention.

Nevertheless, Laughon et al., (2014) cautioned that while transportation time is important, it is not always an isolated determinant of outcomes. The neonate's initial condition and quality of care during transport also mediate the relationship between transport time and mortality. These findings suggest a need for a dual focus on reducing delays and improving pre-transport care.

Transport time, defined as the duration from the decision to refer to arrival at the referral hospital, is a key determinant of neonatal outcomes. Prolonged transport time has consistently been associated with increased neonatal morbidity and mortality due to worsening clinical status during transit (Smith et al., 2017). In the context of Uganda, challenging road networks and long distances exacerbate delays.

A study by Kiconco et al. (2022) in Eastern Uganda revealed that neonates transported for more than two hours had significantly higher risks of hypothermia and respiratory compromise on arrival. These complications often arise because of inadequate thermal regulation and oxygen support during the extended travel time. The lack of ambulances and poor road conditions further contribute to prolonged transport durations.

Time delays are often compounded by systemic inefficiencies such as delayed decision-making at referring facilities, slow referral communication, and poor coordination with transport providers (Mutesasira et al., 2019). A delay in referral initiation means the neonate's condition deteriorates before transport even begins, magnifying risks associated with travel.

Interventions such as pre-referral stabilization can mitigate some effects of long transport time, but they do not eliminate the dangers posed by extended transit (Nalubega et al., 2018). Timely referral and transport remain critical, emphasizing the need for streamlined referral pathways and prioritization of neonatal emergencies.

Recent improvements in Uganda's ambulance services and mobile health communication have shown promise in reducing transport times, especially in urban and peri-urban settings (Mutesasira et al., 2019). However, rural areas like those served by Jinja Regional Referral Hospital still face significant barriers. Continuous investment in transport infrastructure and referral coordination is essential to improve neonatal outcomes.

Mode of Transport

The mode of transport used during referrals plays a crucial role in determining neonatal outcomes. Abdurraheem et al., (2016) found that neonates transported in non-medical vehicles are at higher risk of arriving at referral centers in critical conditions. Such transport methods often lack the equipment and personnel necessary to monitor and stabilize neonates during transit.

Conversely, Srivastava et al., (2023) highlighted the positive impact of using medically equipped ambulances with trained personnel during referrals. Their findings underscored the importance of ambulance services in reducing transit-related complications, including hypothermia and respiratory distress. However, A qualitative study with key stakeholders in Pakistan noted that even with appropriate vehicles, logistical issues such as fuel shortages, poor road conditions, and communication gaps could undermine the effectiveness of transport systems(Pradhan et al., 2021).

In many low-resource settings including Uganda, ambulance availability is limited, leading to reliance on alternative means such as motorcycle taxis, private vehicles, or public transport (Kiconco et al., 2022). These alternatives often lack basic life-support equipment and pose safety risks.

Research by Mugisha et al. (2020) indicated that neonates transported by ambulance had better outcomes than those transported by non-ambulance means, largely due to the presence of trained personnel and essential equipment such as oxygen and warming devices. Ambulance

transport facilitates continuous monitoring and emergency interventions en route, which is impossible with informal transport modes.

In contrast, non-ambulance transport is frequently associated with poor neonatal outcomes due to lack of stabilization support and exposure to environmental stressors such as cold temperatures and vibrations (Smith et al., 2017). For example, motorcycle taxis are commonly used in rural Uganda but provide no protection from weather or jostling, increasing the risk of hypothermia and trauma.

However, the shortage of ambulances and long distances often leave caregivers with no choice but to use these alternative modes. A qualitative study by Nalubega et al. (2018) highlighted caregiver frustrations and fears during transport on non-ambulance vehicles, citing lack of reassurance and inability to attend to neonatal emergencies.

Efforts to improve neonatal transport in Uganda include strengthening ambulance services and training drivers on neonatal care during transit. Moreover, some programs have explored equipping motorcycle taxis with basic neonatal care kits as an interim measure, though evidence on impact remains limited (Mutesasira et al., 2019).

In summary, mode of transport is a critical health system factor influencing neonatal outcomes. Expanding ambulance coverage and ensuring neonatal-friendly transport options must be prioritized in referral system strengthening.

Referral Documentation

Accurate and comprehensive referral documentation facilitates continuity of care by enabling receiving facilities to make timely and informed clinical decisions. Getabelew et al., (2018) emphasized that detailed records, including prenatal history and interventions performed during stabilization, significantly improve neonatal outcomes. Tappis et al., (2021) further noted that effective health information systems are critical for tracking neonatal care and outcomes.

However, Bulto et al., (2019) observed significant gaps in documentation practices, with many referrals lacking vital information about neonates' clinical conditions or interventions provided. These lapses hinder effective care and contribute to poor outcomes. Improving referral documentation requires enhanced training for healthcare providers at lower-level facilities and better integration of health information systems.

Effective referral documentation is an often overlooked but critical component of neonatal referral systems. Proper documentation ensures continuity of care by providing receiving facilities with essential clinical information about the neonate's condition, treatments administered, and stabilization efforts prior to referral (Tusiime et al., 2020). Unfortunately, poor documentation remains a major challenge in many low-resource settings including Uganda.

Studies have shown that incomplete or missing referral notes can delay critical interventions at the receiving hospital, as clinicians spend valuable time reassessing or repeating investigations (Kiguli et al., 2021). In Jinja Regional Referral Hospital, health workers have reported frequently encountering referrals with inadequate clinical histories, leading to suboptimal care coordination (Acaye et al., 2023).

Several factors contribute to poor referral documentation, including lack of standardized referral forms, limited staff training on documentation importance, and high workload pressures at referring facilities (Nalubega et al., 2018). Additionally, some health workers perceive referral forms as bureaucratic tasks rather than essential clinical tools.

To address these challenges, the Ministry of Health and partners have developed standardized neonatal referral forms and implemented training on their proper use (Mutesasira et al., 2019). Digital referral systems piloted in some regions have also improved documentation completeness and legibility, facilitating better communication between facilities (Kiconco et al., 2022).

2.5.2 Individual Neonatal Factors

Individual neonatal factors include the biological and clinical characteristics of each baby, such as birth weight, gestational age, sex, and the condition on arrival at hospital (Stoll et al., 2015; Kibria et al., 2018). Babies born too early or too small face greater risks of complications like infections and breathing difficulties (Blencowe et al., 2019; Minor et al., 2022).

Male neonates are often more vulnerable due to biological factors like slower lung development (Stoll et al., 2015; Di Renzo et al., 2019). These individual risks emphasize the need for personalized and intensive care for referred neonates to improve survival (Mboera et al., 2020; Mugisha et al., 2021).

Sex of the Neonate

The sex of a neonate is associated with differential risks of morbidity and mortality. Male neonates are more prone to adverse outcomes, particularly in cases of preterm birth (Stoll et al., 2015). Conditions such as bronchopulmonary dysplasia and necrotizing enterocolitis are more common among male neonates, increasing their risk of mortality (Stoll et al., 2015). Similarly, Dunnepothula, (2024) reported that male neonates often face higher rates of complications in neonatal intensive care units (NICUs). Sex of the neonate has been frequently studied as a biological determinant influencing neonatal outcomes globally. Several studies have found that male neonates tend to have poorer outcomes compared to females, often attributed to biological vulnerability. A systematic review by Di Renzo et al. (2019) reported that male neonates are at higher risk of preterm birth complications, respiratory distress syndrome, and neonatal mortality. This biological susceptibility has been linked to differences in lung maturity, immune response, and hormonal influences between sexes.

In sub-Saharan Africa, similar patterns have been observed. A study conducted in Kenya by Wamalwa et al. (2020) demonstrated that male neonates had significantly higher admission rates to neonatal intensive care units (NICU) and increased mortality compared to females. The

researchers suggested that genetic and epigenetic factors might explain this disparity, alongside social and cultural factors that could influence care-seeking behaviors differently by the sex of the child.

In Uganda, particularly in regional referral hospitals like Jinja, limited data exist explicitly comparing neonatal outcomes by sex. However, unpublished hospital reports indicate that male neonates are more frequently referred and admitted with severe complications (Ministry of Health Uganda, 2022). The implications are critical as these neonates require more intensive medical interventions and prolonged hospitalization.

Research also suggests that the interaction between sex and other factors, such as gestational age and birth weight, may compound the risk. Male preterm neonates with low birth weight have shown higher mortality in studies from Ethiopia and Tanzania (Worku et al., 2021; Mwangi et al., 2019). This highlights the importance of stratifying outcomes by sex to tailor interventions.

Finally, sex-specific biological differences call for more nuanced clinical protocols that consider these vulnerabilities during neonatal resuscitation and care. A qualitative study in Eastern Uganda emphasized the need for enhanced training of health workers to recognize the heightened risk in male neonates to improve survival (Namagembe et al., 2023).

However, Grantz, (2023) noted that when controlling for other factors like birth weight and gestational age, the differences in outcomes between male and female neonates are less pronounced. This suggests that while sex plays a role in neonatal outcomes, its impact is mediated by other variables.

Gestational Age

Gestational age is a critical predictor of neonatal outcomes, with preterm infants (born before 37 weeks of gestation) being at significantly higher risk of mortality. A study on trends in neonatal mortality in Nigerigga highlighted that preterm neonates face challenges such as

respiratory distress syndrome and infections more than term babies, which contribute to high mortality rates(Akinyemi et al., 2015).

Minor et al., (2022) further demonstrated that very preterm neonates (born before 32 weeks) have a gradual increase in adverse outcomes, underscoring the need for specialized care. Conversely, another study argued that advancements in neonatal care have improved survival rates even among preterm neonates, indicating that outcomes can be significantly improved with high-quality healthcare(Chen et al., 2018).

A meta-analysis by Blencowe et al. (2019) estimated that about 15 million babies are born preterm annually, with significantly higher mortality rates compared to term infants. Gestational age affects organ development and function, making preterm neonates vulnerable to respiratory, neurological, and metabolic complications.

In low- and middle-income countries, where advanced neonatal care is limited, the impact of gestational age on survival is even more pronounced. A study in Tanzania by Kweka et al. (2020) found that neonates born before 34 weeks gestation had a threefold increase in mortality risk compared to those born at term. The study emphasized the urgent need for early identification and referral of preterm neonates to specialized care centers.

Ugandan studies corroborate these findings. A hospital-based retrospective review in Mulago National Referral Hospital showed that preterm neonates had poorer outcomes, including increased rates of respiratory distress syndrome and sepsis (Kakembo et al., 2021). Although Jinja Regional Referral Hospital serves as a major referral center, limited data exist on gestational age-specific outcomes, highlighting a knowledge gap.

Moreover, late preterm neonates (34–36 weeks) also exhibit increased morbidity, contradicting earlier beliefs that they fare similarly to term infants. Research from Eastern Uganda demonstrated that even moderate prematurity significantly affected survival and long-term health outcomes (Tumwesigye et al., 2022).

Efforts to improve outcomes focus on strengthening antenatal corticosteroid administration and specialized neonatal care for preterms. However, resource constraints and delays in referral often limit effectiveness. There is a critical need for data-driven policies targeting gestational age as a key predictor of neonatal outcome in referral hospitals like Jinja.

Birth Weight

Birth weight is one of the strongest predictors of neonatal health. Stoll et al., (2015) found that low birth weight (LBW) neonates, particularly those weighing less than 2500 grams, face heightened risks of complications such as infections and delayed development. Furthermore, Very low birth weight (VLBW) neonates consume a disproportionate share of resources in NICUs, reflecting their critical health status (Teixeira, 2024).

Blankenship et al., (2020) suggested that while LBW neonates are at higher risk, access to quality healthcare and timely interventions can mitigate many of these risks. This highlights the need for targeted strategies to manage LBW neonates effectively.

Birth weight remains one of the most important predictors of neonatal survival and health. Low birth weight (LBW), defined as less than 2,500 grams, is strongly associated with increased risk of neonatal morbidity and mortality. A global systematic review by Lee et al. (2020) indicated that LBW infants have a fourfold higher risk of neonatal death than those with normal birth weight.

In East Africa, LBW prevalence remains high due to factors like maternal malnutrition, infections, and inadequate antenatal care. A study in Kenya reported that LBW neonates had significantly longer hospital stays and higher rates of complications such as hypothermia and sepsis (Otieno et al., 2019). Similarly, in Tanzania, LBW neonates were five times more likely to experience neonatal death compared to normal-weight babies (Massawe et al., 2021).

Ugandan data reflect this trend, with multiple studies highlighting LBW as a major concern in referral hospitals. At Jinja Regional Referral Hospital, LBW neonates constitute a large

proportion of referred cases, often complicated by prematurity and infections (MOH Uganda, 2022). LBW neonates are particularly vulnerable due to limited access to incubators and advanced neonatal support in lower-level health facilities.

Further research from the West Nile region, including Madi Okollo district, shows a similar association between LBW and adverse neonatal outcomes. According to Acaye et al. (2023), socio-demographic factors such as maternal age, parity, and nutritional status influence birth weight and subsequently neonatal survival, underscoring the interconnectedness of individual and environmental factors. Interventions targeting maternal health before and during pregnancy, as well as strengthening neonatal care facilities, are pivotal to reducing LBW-associated mortality and morbidity in referral settings.

Clinical Condition at Birth

The clinical condition of a neonate at birth often determines the trajectory of their health outcomes. Neonates presenting with complications such as asphyxia, congenital anomalies or respiratory distress at birth have significantly higher mortality rates and are more likely to have long hospital stay or develop other morbidities in the course of their management (Dunnathula, 2024). Similarly, Townsel(2023) recently emphasized the correlation between clinical instability at birth and adverse neonatal outcomes. The clinical condition of neonates at the time of admission to referral hospitals is a strong predictor of their outcome. Studies have consistently shown that neonates referred in critical condition have higher mortality and morbidity rates. A cross-sectional study by Yisma et al. (2019) in Ethiopia revealed that neonates admitted with conditions such as birth asphyxia, sepsis, or hypothermia had significantly worse outcomes.

In East Africa, delays in referral and transport, coupled with poor stabilization at lower-level health facilities, often result in neonates arriving in severe clinical states. A study in Tanzania

found that hypothermia and respiratory distress syndrome were common among referred neonates and were associated with increased mortality (Mboera et al., 2020).

At Jinja Regional Referral Hospital, audits of neonatal admissions have shown that many referred neonates present with complications including birth asphyxia, sepsis, and congenital anomalies (Jinja Hospital Annual Report, 2022). These clinical conditions demand specialized care, which is often constrained by resources and staffing.

Furthermore, clinical condition on arrival is influenced by the quality of care during labor and delivery, as well as immediate newborn care practices. Poor intrapartum monitoring and inadequate resuscitation increase the risk of neonatal encephalopathy and death (Mugisha et al., 2021). This highlights the need for improved perinatal care and timely referral systems. Studies recommend strengthening capacity at lower health facilities for early diagnosis, stabilization, and prompt referral to improve neonatal outcomes. Additionally, enhancing transport infrastructure and training health workers in neonatal emergency care are critical interventions for referral hospitals like Jinja

Kibria et al., (2018), however, reported that immediate postnatal interventions can mitigate the risks associated with poor clinical conditions at birth. Their findings underscore the importance of timely medical care in improving survival rates, even among critically ill neonates.

2.5.3 Sociodemographic Factors

Sociodemographic factors such as maternal age, education level, and place of delivery also influence neonatal outcomes. These factors affect how early families seek care and whether they access skilled services in time (Langlois et al., 2019; Ganchimeg et al., 2014).

Educated mothers are more likely to recognize danger signs early and seek help, while lower education often leads to delays (Kanté et al., 2019; Nankunda et al., 2020). Maternal age is another factor, with very young or older mothers facing higher risks of complications (Mwangi

et al., 2021). Additionally, babies born in health facilities under skilled care have better survival chances compared to those delivered at home (Mbonye et al., 2020; Koduah et al., 2019).

Addressing these social and demographic influences is essential to complement medical and health system interventions aimed at reducing neonatal deaths (Okello et al., 2019; Mwesigwa et al., 2018).

Maternal Age

Maternal age plays a critical role in determining neonatal outcomes. Ganchimeg et al., (2014) found that adolescent mothers face higher risks of complications such as preterm birth and low birth weight, which adversely affect neonatal survival. Conversely, a study on changes in attitude to childbirth in modern times noted that older mothers (above 35 years) are also at risk of pregnancy-related complications, including gestational diabetes and hypertension, which can impact neonatal health (Junaid, 2024).

Maternal age has been widely studied as a significant factor influencing neonatal outcomes globally and in sub-Saharan Africa. Younger mothers, particularly teenagers, and older mothers above 35 years are often identified as high-risk groups for adverse neonatal outcomes such as low birth weight, preterm birth, and neonatal mortality (Chen et al., 2019). In a meta-analysis of low- and middle-income countries, both extremes of maternal age were associated with increased risks for neonatal complications, likely due to biological immaturity in younger mothers and age-related morbidities in older mothers (Langlois et al., 2019). This relationship is particularly important among referred neonates whose mothers may have delayed or complicated care during labor and delivery.

In Uganda, the influence of maternal age on neonatal outcomes has been documented in various settings, including referral hospitals. A study by Nankunda et al. (2020) at Mulago National Referral Hospital reported that neonates born to mothers aged below 20 and above 35 had higher rates of neonatal intensive care admission and mortality compared to those born to

mothers in the 20-34 age group. This age group is considered optimal for pregnancy, with lower incidence of obstetric complications and better neonatal prognosis. The higher risk among adolescent mothers is often linked to poor antenatal care attendance, socioeconomic challenges, and biological factors such as incomplete pelvic growth.

Similarly, research conducted at regional referral hospitals in East Africa shows that adolescent mothers tend to have poorer neonatal outcomes, including increased risks of birth asphyxia and sepsis, especially in referred cases from lower-level facilities with limited resources (Mwangi et al., 2021). This is compounded by the limited access to emergency obstetric and neonatal care, which referral centers like Jinja Regional Referral Hospital seek to mitigate. Older mothers, on the other hand, are more prone to hypertensive disorders and diabetes, contributing to neonatal morbidity and mortality in this group (Kahabuka et al., 2022).

Furthermore, maternal age interacts with other sociodemographic factors such as parity and socioeconomic status to influence neonatal outcomes. For example, first-time mothers below 20 years are at a higher risk of delivering low birth weight infants, which increases the likelihood of referral due to neonatal complications (Okello et al., 2019). Conversely, multiparous older women may experience complications related to uterine scarring and placental abnormalities, again elevating neonatal risks. Understanding these nuances is critical for referral hospitals when managing neonates and tailoring interventions for different maternal age groups.

Lastly, awareness and health-seeking behaviors differ across maternal age groups, influencing timely referral and neonatal outcomes. Younger mothers, especially teenagers, often face stigma and reduced autonomy in accessing health services, leading to delays in care that worsen neonatal prognosis (Mwesigwa et al., 2018). Older mothers may better navigate the healthcare system but still face biological challenges. Interventions aimed at improving neonatal outcomes

at Jinja Regional Referral Hospital must therefore consider age-specific barriers and tailor maternal counseling and support accordingly.

Place of Delivery

The place of delivery is a crucial determinant of neonatal health. Facility-based deliveries are associated with better outcomes due to the availability of skilled birth attendants and emergency care. Masten et al., (2021) reported that neonates delivered in healthcare facilities are less likely to experience complications such as asphyxia compared to those born at home. However, Koduah et al., (2019) noted that poor-quality care in some facilities could negate the benefits of institutional delivery, emphasizing the need for quality assurance in healthcare facilities. Place of delivery significantly impacts neonatal outcomes, especially among neonates referred from lower-level health facilities to referral centers. Deliveries occurring outside health facilities, such as at home or with traditional birth attendants, are often linked to higher neonatal morbidity and mortality due to delayed recognition and management of complications (Mbonye et al., 2020). In a systematic review, facility delivery was generally associated with improved neonatal outcomes due to access to skilled birth attendants and emergency care (Langlois et al., 2019).

In Uganda, facility delivery rates have improved but remain uneven across regions, with rural populations having lower coverage. Studies have found that neonates born outside formal health facilities, especially in rural areas, are more likely to experience complications requiring referral to regional hospitals (Nankunda et al., 2020). At Jinja Regional Referral Hospital, a significant proportion of referred neonates come from lower-level facilities or home deliveries where initial resuscitation and care may be inadequate, leading to increased morbidity such as birth asphyxia and infections.

Research from East Africa emphasizes that the quality of care in the place of delivery also matters. Lower-level health facilities often lack adequate infrastructure, skilled personnel, and neonatal care equipment, which can compromise immediate neonatal care and timely referrals (Mwangi et al., 2021). This gap results in neonates arriving at referral hospitals in critical condition, highlighting the need for strengthened capacity at primary care levels. Additionally, the distance and transport barriers from place of delivery to referral centers like Jinja influence neonatal outcomes by causing delays in accessing higher-level care (Kante et al., 2019).

Several studies have also explored the role of birth attendants in neonatal outcomes. Skilled birth attendance at health facilities is associated with lower neonatal mortality, but traditional birth attendants (TBAs) and unskilled personnel often assist deliveries outside facilities, especially in rural Uganda (Mbonye et al., 2020). TBAs may delay referrals or lack the skills for emergency newborn care, contributing to poor neonatal outcomes among referred neonates. Lastly, interventions promoting facility delivery have been shown to improve neonatal survival. Uganda's Ministry of Health campaigns to increase antenatal care attendance and facility births have yielded positive results but must continue focusing on hard-to-reach populations. At Jinja Regional Referral Hospital, documentation of place of delivery helps identify high-risk neonates and shapes targeted referral and care protocols to reduce neonatal morbidity and mortality.

Maternal Education

Maternal education significantly influences neonatal health by shaping health-seeking behaviors and caregiving practices. Telias et al., (2022) demonstrated that educated mothers are more likely to seek appropriate healthcare for their neonates and adopt health-promoting behaviors. However, Kostyrka-Allchorne et al., (2019) noted that the effects of maternal education are mediated by other factors such as socioeconomic status, highlighting the complex interplay of determinants affecting neonatal health.

2.6 Research Gap

Neonatal outcomes, particularly among referred neonates, remain a significant challenge in sub-Saharan Africa, where inefficiencies in health systems, individual vulnerabilities, and sociodemographic determinants converge to exacerbate mortality and morbidity. While existing studies have explored various factors influencing neonatal outcomes, several gaps persist.

First, although research highlights the importance of transportation systems, referral stabilization, and proper documentation (e.g., Abdulraheem et al., 2016; Pradhan et al., 2021), the specific challenges faced by lower-level facilities in resource-constrained settings, such as Uganda, are under-researched. Practical barriers to implementing stabilization measures, including staff training and equipment availability, and inconsistent referral protocols have not been sufficiently explored.

Additionally, while sociodemographic factors such as maternal age, education level, and place of delivery have been studied in relation to neonatal outcomes (e.g., Ganchimeg et al., 2014); Teliya et al., 2022), their specific impact on neonatal outcomes in referred cases has not been sufficiently addressed. Many studies focus on aggregate neonatal data without distinguishing between referred and non-referred neonates, overlooking the distinct vulnerabilities of neonates who present in critical conditions due to systemic inefficiencies (Baidya et al., 2018) (Stoll et al., 2015).

Moreover, referral processes in many low-resource settings are hindered by inadequate transport, poor coordination, and delays in seeking maternal and neonatal care, yet there is limited empirical evidence detailing how these factors directly affect neonatal survival (Masten et al., 2021).

This study seeks to bridge these gaps by investigating the health system challenges influencing neonatal outcomes during referrals, such as stabilization practices, transportation, and

documentation, with a focus on lower-level facilities in rural Uganda. It was also examined sociodemographic factors, including maternal age, maternal education level, and place of delivery, to understand their impact on neonatal outcomes. By focusing on the specific vulnerabilities of referred neonates, this study provided a detailed analysis of systemic deficiencies and generate context-specific evidence for improving neonatal outcomes in resource-limited settings.

Maternal education is a well-documented determinant of neonatal outcomes globally and within Uganda. Higher maternal education levels are consistently associated with better neonatal survival and health due to increased health literacy, better health-seeking behavior, and utilization of maternal and newborn health services (Langlois et al., 2019). Educated mothers are more likely to attend antenatal care, deliver in health facilities, and seek timely postnatal care, which reduces the likelihood of complications that necessitate neonatal referral (Kanté et al., 2019).

In the Ugandan context, studies have shown that neonates born to mothers with no formal education or only primary education have higher risks of adverse outcomes including low birth weight, neonatal infections, and mortality (Nankunda et al., 2020). This is often linked to poor knowledge of pregnancy danger signs, inadequate nutrition, and delayed health service utilization. At referral hospitals like Jinja, neonates born to less-educated mothers frequently present with preventable complications due to delayed care seeking or poor home care practices.

East African studies echo these findings, revealing that maternal education positively influences newborn care practices and neonatal outcomes. Mwangi and Kimani (2019) found that maternal education was strongly associated with facility-based delivery and newborn immunization, both protective factors against neonatal morbidity. Conversely, low education

was correlated with home deliveries and reliance on traditional medicines, increasing the risk of neonatal illness and subsequent referral.

Moreover, maternal education interacts with other sociodemographic factors such as socioeconomic status and place of residence. Mothers with higher education are more likely to live in urban areas with better access to health facilities, enhancing neonatal survival chances (Okello et al., 2019). Educational interventions targeting mothers in rural areas have demonstrated improvements in neonatal outcomes by promoting awareness of danger signs and encouraging early referral for sick neonates.

Finally, education of the mother influences the uptake of neonatal health services at referral hospitals. At Jinja Regional Referral Hospital, efforts to counsel mothers during admission and discharge about neonatal care emphasize the role of maternal education in improving outcomes. Supporting maternal education beyond formal schooling through community health education is crucial to reduce neonatal morbidity and mortality among referred neonates.

2.7 Summary of the literature gaps

The literature shows that neonatal outcomes of referred neonates are influenced by a combination of health system factors, individual factors of a neonate and sociodemographic. To improve neonatal survival rates, it is essential to implement comprehensive strategies that address these interconnected factors. This includes enhancing the quality of care at lower-level facilities, improving transport systems, addressing individual health factors, and tackling sociodemographic barriers to healthcare access. This study seeks to provide a concrete, hospital-based evidence on the factors linked to neonatal outcomes among referred neonates at Jinja Regional Hospital. By focusing on measurable health systems, individual, and sociodemographic influences, the study offered insights that can guide better policies and clinical practices aimed at improving neonatal survival in referral settings. Given the high

burden of neonatal mortality in Uganda and across sub-Saharan Africa, these findings was crucial in shaping more effective interventions to support vulnerable newborns.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter explains the methods that were used to carry out the study on factors influencing neonatal outcomes among babies referred from lower-level health facilities to Jinja Regional Referral Hospital (JRRH). The methodology outlines the step-by-step approach taken to answer the research questions and meet the study objectives.

It describes the study design, the setting where the research was conducted, the population involved, and the criteria used to include or exclude participants. The chapter also explains how the sample size was determined, how data was collected and analyzed, and the steps taken to ensure the data was accurate and reliable. Ethical considerations that guided the study are also highlighted.

3.2 Study Design

The study employed a quantitative retrospective longitudinal study design. A documentary review of neonatal records was conducted to assess neonatal outcomes over a defined period. This approach enabled the identification of trends and associations between neonatal morbidity and mortality and various influencing factors.

3.3 Study Area

The study was conducted at Jinja Regional Referral Hospital (JRRH), located in Jinja City, Eastern Uganda. JRRH serves as the referral center for 12 districts, including Jinja, Kamuli, Iganga, Mayuge, Luuka, Bugiri, Namutumba, Buyende, Kaliro, Namayingo, and Busia. The hospital has a bed capacity of approximately 600 and handles over 6,000 deliveries annually. It features a Neonatal Unit that admits over 1,200 neonates each year, with referred cases comprising more than 70% of admissions. Despite its vital role in neonatal care, JRRH faces significant challenges, including overcrowding, inadequate neonatal equipment, and limited specialized personnel.

3.4 Study Population

The study population consisted of all neonates referred from lower-level health facilities and admitted to the Neonatal unit at Jinja Regional Referral Hospital within the study period. Neonatal records of referred neonates admitted to JRRH's Neonatal Unit were reviewed between December 2023 and December 2024.

3.5 Inclusion and Exclusion Criteria

Inclusion Criteria:

Neonates referred from lower-level health facilities and admitted to the Neonatal unit at JRRH. Records with complete documentation on referral and neonatal outcomes.

Exclusion Criteria:

Neonatal records with incomplete or missing referral and outcome data.
Neonates admitted directly to JRRH without a referral.

3.6 Sample Size Determination

The sample size was determined using **Cochran's formula** for proportion-based studies:

$$n = \frac{Z^2 P(1 - P)}{e^2}$$

Where:

- **n** = required sample size
- **Z** = standard normal deviate at a 95% confidence level (1.96)
- **P** = estimated prevalence of neonatal mortality at JRRH (55.9 per 1000 live births = **0.0559**)
- **e** = margin of error (0.05)

Substituting the values:

$$n = \frac{(1.96)^2(0.0559)(1 - 0.0559)}{0.05^2}$$

$$n = \frac{3.8416 \times 0.0559 \times 0.9441}{0.0025}$$

$$n = \frac{0.2028}{0.0025}$$

$$n = 81.12$$

Thus, the required minimum sample size is 81 neonates. However, to enhance statistical power, the study aimed to review all eligible neonatal records within the specified period.

3.7 Sampling Technique

Census sampling of all eligible neonatal records from December 2024 to December 2023.

3.8 Variables

Dependent variables:

Neonatal outcomes: Survival, Mortality and Morbidity

Independent variables:

Health Systems Factors:

Pre-referral stabilization measures (oxygen, antibiotics, thermal regulation)

Transport time

Mode of transport

Referral documentation quality

Individual factors:

Birth weight

Gestational age

Clinical condition at admission

Neonatal sex

Sociodemographic factors:

Maternal age

Maternal education level

Place of delivery (home or health facility)

3.9 Data Collection Tools and Methods

A structured data extraction tool was used to collect data from neonatal records. Key variables include:

Neonatal factors: birth weight, gestational age, sex, clinical condition on admission.

Referral factors: referring facility, pre-referral stabilization measures, transport time, mode of transport, referral documentation quality.

Sociodemographic factors: maternal age, maternal education level, and place of delivery.

Outcome variables: neonatal survival, mortality, or morbidity during hospitalization.

3.10 Data Entry, Analysis and Presentation

Data were entered into the STATA (version 14) software. Using SPSS, the analytical techniques included univariate descriptive frequency distributions, Pearson's chi-square statistic (χ^2), and logistic regression, as explained below. A compilation of all the responses from the data collection tools was entered into STATA (version 14) for analysis.

Univariate analysis

Data on respondents' sociodemographic characteristics, individual factors, health system were tabulated, and frequency tables, bar charts, and pie charts were generated to assess the statistical distribution of the study population's characteristics. The outcome variable, being neonatal outcome were categorized as died or discharged. This was consistent with what was stated in the compliance form regarding the use of poisson regression, although it was not explicitly mentioned in the initial write-up. Descriptive statistics, including frequency tables, bar charts, and pie charts, were first used to summarize the characteristics of the study population. Bivariate analysis was then conducted using cross-tabulations and chi-square tests to assess associations between satisfaction and independent variables. Crude Prevalence Ratios (CPRs) were computed, and variables with p-values ≤ 0.05 were selected for multivariable logistic regression analysis. In the final model, Adjusted Prevalence Ratios (APRs) were used to

determine independent predictors of patient satisfaction while controlling for potential confounders.

Findings were presented in table, graphs, and charts for clarity.

3.11 Quality Controls

Training of research assistants: All research assistants was trained on data extraction procedures to ensure consistency and accuracy

Pilot testing: The data collection tool was tested to ensure it captures relevant information accurately

Double data entry: A subset of the data was entered twice to check for inconsistencies.

Data cleaning: any missing or inconsistent entries was reviewed and corrected before analysis.

3.12 Limitation of the Study

This study had several limitations. First, since the study employed an institution-based cross-sectional design, the findings are limited to neonates referred to Jinja Regional Referral Hospital and may not be representative of all referred neonates across the country. Therefore, the results are not generalizable to the broader population of neonates in Uganda. Additionally, the inherent limitations of the cross-sectional design restrict the ability to establish causal relationships between the neonatal outcomes and the associated factors.

Furthermore, the study relied on secondary data obtained through a data extraction tool from hospital records. As such, it was limited by the completeness and accuracy of the recorded information. Important variables may have been missing or inconsistently recorded, which could affect the robustness of the findings. The reliance on existing records also meant that the researchers had no control over how the data were originally collected, potentially introducing information bias.

3.13 Ethical Considerations

Ethical approval was obtained from Mildmay Uganda Research Ethics Committee, REC REF 0204-2025.

Permission to access records was obtained from JRRH management.

The confidentiality and anonymity of participants and records was strictly maintained.

3.14 Dissemination Plan

Findings will be shared with JRRH management, published in peer-reviewed journals, and presented at national health conferences to inform policy and practice.

CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter presents the key findings of the study on the factors influencing neonatal outcomes among babies referred from lower-level health facilities to Jinja Regional Referral Hospital (JRRH). The results are organized according to the study objectives, providing a clear picture of the characteristics of the referred neonates, their clinical outcomes, and the health system and individual factors that affected their survival.

The chapter first describes the individual and sociodemographic characteristics of the neonates, such as birth weight, gestational age, sex, and maternal factors. It then presents the neonatal outcomes, focusing on survival and mortality rates among the referred cases. The chapter also explores health system factors, including the distance of referring facilities, pre-referral stabilization, transport arrangements, and referral documentation.

The data are presented in tables, graphs, and text, supported by statistical analyses that highlight the associations between these factors and neonatal outcomes.

4.1 Individual Neonatal and sociodemographic factors

Table 1: Individual Neonatal and sociodemographic factors associated with neonatal outcomes among neonates referred to Jinja Regional Referral Hospital

Variables	Frequency n	Percentage %
Age of the neonates in days on admission		
One day	48	55.2
1 day	23	26.4
More than one day	16	18.4
Birth Weight		
<2500g	45	51.7
≥2500g	42	48.3
Gestational Age		
Preterm baby	45	52.9
Term baby	42	47.1
Sex of Neonate		
Female	46	52.9
Male	41	47.1
Apgar Score at 1-minute		
Not known	54	62.1

<7	18	20.7
7-10	15	17.2
Apgar Score at 5-minute		
Not known	54	62.1
<7	18	20.7
7-10	15	17.2
Mode of delivery		
Cesarean section	17	19.5
Normal delivery	70	80.5
Length of Hospital Stay		
≤ 3 days	34	39.1
>3 days	53	60.9
Complications During Hospitalization		
No	54	62.1
Yes	33	37.9
Maternal Age		
<18 years	19	21.8
18-24 years	30	34.5
25-34 years	22	25.3
>34 years	16	18.4
Place of Delivery		
Health facility	87	100
Maternal HIV Status		
Negative	36	41.4
Unknown	51	58.6

Table 1 shows that the majority (55.2%) of neonates were admitted to the hospital at one day old. Most neonates (51.7%) had a birth weight of less than 2500g, and 52.9% were born preterm. In terms of sex, the majority (52.9%) were female. A large proportion of neonates (62.1%) had unknown Apgar scores at both the 1-minute and 5-minute marks. Most neonates (80.5%) were delivered through normal vaginal delivery. The majority (60.9%) stayed in the hospital for more than 3 days, while 62.1% did not develop complications during hospitalization. Regarding maternal characteristics, the largest group of mothers (34.5%) were aged 18–24 years. All deliveries (100%) occurred in health facilities, and most mothers (58.6%) had unknown HIV status.

4.2 Neonatal outcomes among referred neonates at Jinja Regional Referral Hospital

Figure 2: Showing neonatal outcome

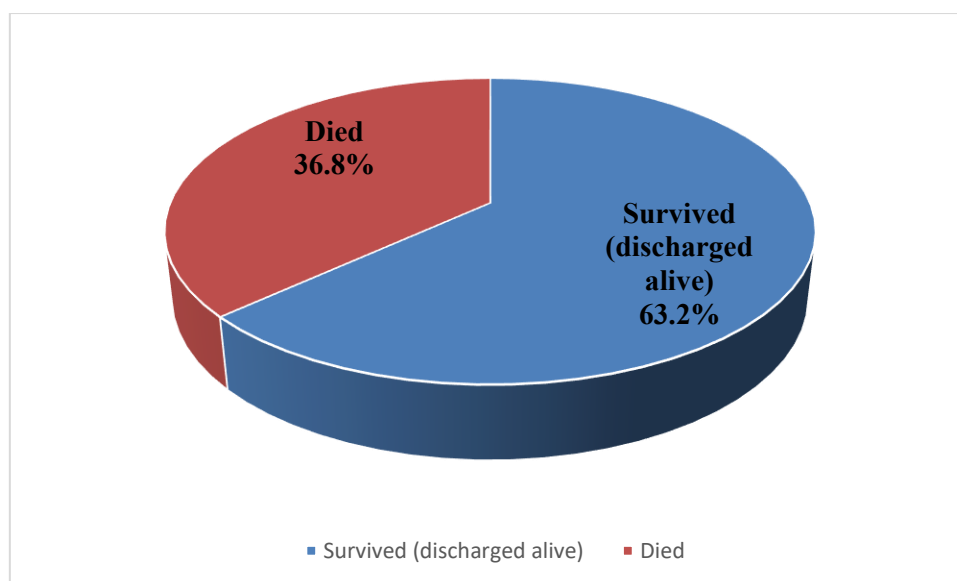


Figure 1 presents the outcomes of a group of individuals, showing that out of a total of 87 cases, 55 individuals (63.2%) survived and were discharged alive, while 32 individuals (36.8%) died.

Table 2: Individual Neonatal and sociodemographic factors associated with neonatal outcomes among referred neonates at Jinja Regional Referral Hospital

Variables	Neonatal outcome of referred neonates		CPR (95% CI)	p-value
	Discharged (%)	Died (%)		
Age of the neonates in days on admission				
One day	29(60.4)	19(39.6)	1.087(0.828-1.427)	0.548
1 day	15(65.2)	8(34.8)	1.036(0.762-1.408)	0.822
More than one day	11(68.8)	5(31.2)	1.0	
Birth Weight				
<2500g	29(64.4)	16(35.6)	0.975(0.796-1.194)	0.806
≥2500g	24(61.9)	16(38.1)	0	
Gestational Age				
Preterm baby	29(64.4)	16(35.6)	0.975(0.796-1.194)	0.806
Term baby	26(61.9)	16(38.1)	0	
Sex of Neonate				
Female	28(60.9)	18(39.1)	1.051(0.858-1.287)	0.630
Male	27(65.9)	14(34.1)	1.0	
Apgar Score at 1-minute				
Not known	41(75.9)	13(24.1)	0.746(0.576-0.967)	0.027
<7	7(38.9)	11(61.1)	1.081(0.792-1.475)	0.624
7-10	7(46.7)	8(53.3)	1.0	
Apgar Score at 5-minute				

Not known	41(75.9)	13(24.1)	0.798(0.617-1.032)	0.085
<7	6(33.3)	12(66.7)	1.221(0.897-1.662)	0.203
7-10	8(53.3)	7(46.7)	1.0	
Mode of delivery				
Cesarean section	10(58.8)	7(41.2)	1.056(0.818-1.363)	0.675
Normal delivery	45(64.3)	25()	1.0	0.676
Length of Hospital Stay				
≤ 3 days	13(38.2)	21(61.8)	1.507(1.248-1.820)	0.000
>3 days	42(79.2)	11(20.8)	1.0	
Complications During Hospitalization				
No	42(77.8)	12(22.2)	1.468(1.056-1.826)	0.000
Yes	13(39.4)	20(60.6)	1.0	
Maternal Age				
<18 years	12(63.2)	7(36.8)	0.933(0.679-1.284)	0.671
18-24 years	21(70.0)	9(30.0)	0.872(0.652-1.166)	0.354
25-34 years	13(59.1)	9(40.9)	0.972(0.714-1.323)	0.857
>34 years	9(56.2)	7(43.8)	1.0	
Maternal HIV Status				
Negative	23(63.9)	13(36.1)	0.989(0.805-1.214)	0.913
Unknown	32(62.7)	19(37.3)	1.0	

Neonates with unknown APGAR scores at 1-minute had a significantly higher likelihood of survival (being discharged alive) compared to those with scores of 7–10, (CPR: 0.746; 95% CI: 0.576-0.967; p = 0.027).

Length of hospital stay was strongly associated with neonatal outcome. Neonates who stayed in the hospital for three days or less were 1.5 times more likely to survive compared to those who stayed longer than three days, (CPR: 1.507; 95% CI: 1.248-1.820; p = 0.000).

Additionally, neonates who did not experience complications during hospitalization were significantly more likely to survive compared to those who developed complications, (CPR: 1.468; 95% CI: 1.056-1.826; p = 0.000).

4.3 Health System Factors associated with neonatal outcomes among neonates referred to Jinja Regional Referral Hospital

Table 3: Health System Factors associated with neonatal outcomes among neonates referred to Jinja Regional Referral Hospital

Variables	Frequency n	Percentage %
Referring Facility		
HCII/HCIII	26	29.9
HCIV	42	48.3
Hospital	19	21.8
Primary reason for Referral		
Sepsis	16	18.4
Birth asphyxia	26	29.9
Prematurity	31	35.6
Respiratory distress	12	12.8
Other	2	2.3
Pre-referral Stabilization: Oxygen administered		
Yes	64	73.6
No	23	26.4
Pre-referral Stabilization: Antibiotics administered		
Yes	46	52.9
No	41	47.1
Pre-referral Stabilization: Other intervention		
Yes	60	69.0
No	27	31.0
Transport Time: Estimated time from referral to admission		
≤ 1hour	70	80.5
>1 hour	17	19.5
Accompanied by health workers		
No	56	64.4
Yes	31	35.6
Distance to health facilities		
Within 10km	32	36.8
Beyond 10km	55	63.2

Table 3 shows that the majority (48.3%) of neonates were referred from HCIVs. The most common primary reason for referral was prematurity, accounting for 35.6% of cases. Regarding pre-referral stabilization, most neonates (73.6%) received oxygen, and more than half (52.9%) were administered antibiotics. Additionally, the majority (69.0%) received other interventions before referral. Most neonates (80.5%) arrived at Jinja Regional Referral Hospital within one hour of referral. A larger portion (64.4%) were not accompanied by health workers during transport. Lastly, most referrals (63.2%) came from locations beyond 10 kilometers from the hospital.

Table 4: Health System Factors associated with neonatal outcomes among neonates referred to Jinja Regional Referral Hospital

Variables	Neonatal outcome of referred neonates		COR (95% CI)	p-value
	Discharged (%)	Died (%)		
Referring Facility				
HCII/HCIII	15(57.7)	11(42.3)	1.257(0.373-4.233)	0.712
HCIV	28(66.7)	14(33.3)	0.857(0.276-2.658)	0.789
Hospital	12(63.2)	7(36.8)	1.0	
Pre-referral Stabilization:				
Oxygen administered	42(65.6)	22(34.4)	0.913(0.726-1.148)	0.436
No	13(56.5)	10(43.5)	1.0	
Yes				
Pre-referral Stabilization:				
Antibiotics administered				
Yes	25(54.3)	21(45.7)	1.207(0.989-1.473)	0.064
No	30(73.2)	11(26.8)	1.0	
Pre-referral Stabilization: Other intervention				
Yes	38(63.3)	22(36.7)	0.996(0.800-1.240)	0.974
No	17(63.0)	10(37.0)	1.0	
Transport Time: Estimated time from referral to admission				
≤ 1 hour	44(62.9)	26(37.1)	1.019(0.789-1.315)	0.887
>1 hour	11(64.7)	6(35.3)	1.0	
Accompanied by health workers				
No	36(64.3)	20(35.7)	0.970(0.785-1.199)	0.781
Yes	19(61.3)	12(38.7)	1.0	
Distance to health facilities				
Within 10km	16(50.0)	16(50.0)	1.233(1.004-1.514)	0.046
Beyond 10km	39(70.9)	16(29.1)	1.0	

At bivariable analysis, distance to health facilities was significantly associated with neonatal survival outcomes at the 95% confidence level. Neonates referred from health facilities located beyond 10 km were significantly more likely to be discharged compared to those referred from facilities within 10 km (CPR: 1.233; 95% CI: 1.004-1.514; p = 0.046).

Table 5: Multivariable analysis of factors associated with neonatal outcomes among neonates referred to Jinja Regional Referral Hospital

Variables	discharged (%)	Died (%)	CPR (95% CI)	p-value	APR (95% CI)	p-value
Distance to health facilities						
Within 10km	16(50.0)	16(50.0)		0.046		0.029

Beyond 10km	39(70.9)	16(29.1)	1.233(1.004-1.514) 1.0		1.380(1.076-1.584) 1.0	
Apgar Score at 1-minute Not known <7 7-10	41(75.9) 7(38.9) 7(46.7)	13(24.1) 11(61.1) 8(53.3)	0.746(0.576-0.967) 1.081(0.792-1.475) 1.0	0.027 0.624	0.925(0.556-1.538) 1.099(0.631-1.913) 1.0	0.764 0.740
Length of Hospital Stay ≤ 3 days >3 days	13(38.2) 42(79.2)	21(61.8) 11(20.8)	1.507(1.248-1.820) 1.0	0.000	1.240(1.083-1.837) 1.0	0.024
Complications During Hospitalization No Yes	42(77.8) 13(39.4)	12(22.2) 20(60.6)	1.468(1.056-1.826) 1.0	0.000	1.202(1.064-1.927) 1.0	0.034

Based on the table provided, the adjusted odds ratio (AOR) findings reveal several significant variables associated with neonatal outcomes of referred neonates after adjusting for potential confounders. Only variables with p-values less than 0.05 and confidence intervals (CI) that do not cross 1 are considered statistically significant at the 95% confidence level. The significant findings are as follows:

Neonates referred from health facilities located within 10 km were more likely to be discharged than to those referred from facilities beyond 10 km, (APR: 1.380; 95% CI: 1.076-1.584; p = 0.029).

Referred neonates who stayed in the hospital for three days or less were more likely to be discharged than those who stayed longer than three days, (APR: 1.240; 95% CI: 1.083–1.837; p = 0.024).

Referred neonates who did not develop complications during hospitalization were more likely to survive compared to those who developed complications, (APR: 1.202; 95% CI: 1.064-1.927; p = 0.034).

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter provides an interpretation of the study findings on the factors that influence neonatal outcomes among babies referred from lower-level health facilities to Jinja Regional Referral Hospital (JRRH). The discussion connects these findings with what has already been documented in existing research and relates them to the conceptual framework that guided the study. In doing so, it helps to make sense of the results by showing how different health system factors, referral processes, and the condition of the neonates themselves combine to affect their chances of survival.

The results of this study reveal that the survival of referred neonates is still a major challenge, largely because of weaknesses in both the referral process and the care provided after referral. Factors such as how far the referring facility is from JRRH, the speed and quality of referral, and the level of care given before and after referral were all found to have a direct effect on whether a neonate survived or not. At the same time, the individual condition of the neonate such as how sick they were when they arrived, whether they developed complications in hospital, and how long they stayed admitted also played a key role in determining outcomes.

This discussion is organized around the main themes that the study set out to explore: first, the general survival outcomes of referred neonates at JRRH; second, the specific health system factors that influence these outcomes; and third, the individual factors that affect whether neonates survive or die. By comparing these findings with what other studies have found, this section aims to deepen our understanding of the complex factors that influence neonatal outcomes in Uganda's healthcare system. The insights from this study are not only useful for understanding the problem better but also offer practical guidance on how the referral and care systems can be improved to help more neonates survive

5.1 Discussion

5.1.1 Prevalence of neonatal outcomes among referred neonates at Jinja Regional Referral Hospital

This study established that 63.2% of neonates referred from lower-level health facilities to Jinja Regional Referral Hospital (JRRH) survived and were discharged alive, while 36.8% died. This survival rate, although modest, points to significant challenges within the neonatal referral and care continuum. The observed survival proportion is likely influenced by the timely access to higher-level healthcare services available at JRRH, including specialized interventions and monitoring that are typically lacking in lower-level facilities. This finding aligns with previous research that underscores the importance of well-functioning referral systems in improving neonatal outcomes, particularly in resource-constrained settings (Opondo et al., 2018; Mwaniki et al., 2019; Musoke et al., 2021). Similarly, studies conducted in other low- and middle-income countries have consistently demonstrated that the survival of referred neonates is contingent upon the timeliness and quality of both the referral process and post-referral care. Tura et al. (2020) emphasized that delays at any point in this continuum whether in decision-making for referral, transportation, or readiness at the receiving facility can severely compromise neonatal survival. Mwaniki et al. (2015), Sacks et al. (2016), and Osrin et al. (2019) further reinforce that efficient neonatal transport systems, accompanied by immediate and appropriate clinical interventions upon hospital arrival, are pivotal in reducing neonatal mortality rates.

The high mortality rate among referred neonates reported in this study is congruent with findings from other sub-Saharan African settings, where inadequacies in pre-referral stabilization, delayed recognition of neonatal complications, and insufficient neonatal intensive care services contribute significantly to poor outcomes (Tegene et al., 2021; Monebenimp et al., 2020). Therefore, the results from JRRH highlight the critical need to strengthen both the

referral mechanisms and the capacity of lower-level health facilities to initiate timely and appropriate stabilization prior to referral. Improving emergency neonatal care at both ends of the referral pathway could substantially improve survival rates for this vulnerable population.

5.1.2 Health system factors associated with neonatal outcomes among neonates

The study identified proximity to the referral facility as a significant determinant of neonatal outcomes. Specifically, neonates referred from health facilities located within a 10-kilometer radius of JRRH demonstrated a significantly higher likelihood of survival compared to those referred from farther distances. This finding is consistent with the wider body of evidence indicating that geographical distance to health facilities directly affects access to timely and appropriate care (Kumar et al., 2015; Okello et al., 2020; Moxon et al., 2015). Longer distances often translate to delays in reaching advanced care services, during which time neonates' clinical conditions may deteriorate.

Moreover, studies by Ebuehi and Akintujoye (2012) and Ariff et al. (2010) have demonstrated that extended travel distances correlate with increased neonatal mortality, primarily due to delayed treatment initiation and inadequate stabilization during transit. The World Health Organization (2016) similarly stresses the importance of establishing robust, coordinated referral systems, complete with efficient transport logistics and communication networks, to ensure prompt and life-saving interventions.

These findings suggest that interventions to improve neonatal outcomes should prioritize strengthening the health system's capacity for rapid and safe neonatal transportation. Establishing neonatal stabilization units at strategic locations and deploying community-based emergency transport systems could help bridge the gap for remote and underserved areas. Such strategies would minimize the adverse effects of distance and delay, ultimately enhancing survival rates for referred neonates.

5.1.3 Individual factors associated with neonatal outcome among neonates

Individual neonatal characteristics also emerged as significant factors influencing survival. One key finding from this study was that neonates who stayed in the hospital for three days or less were more likely to survive compared to those whose hospital stay exceeded three days. Shorter hospital stays may reflect effective and timely clinical interventions that lead to rapid recovery, whereas prolonged hospitalization is often indicative of severe complications, nosocomial infections, or suboptimal clinical responses, all of which are associated with higher mortality risks.

This observation aligns with previous studies that have linked extended hospitalization with adverse neonatal outcomes. Mutlu et al. (2020) and Wosenu et al. (2022) observed that prolonged stays often signify critical illness or poor prognosis, while Musa et al. (2019), Adatara et al. (2020), Kibai et al. (2021), and Ameh et al. (2022) highlighted that early discharge is typically associated with favorable clinical trajectories. Additional evidence from Kenya and Nigeria corroborates these findings, revealing that longer hospital stays, especially following delayed or poorly coordinated referrals, contribute to higher neonatal mortality (Ogunlesi et al., 2015; Mbugua et al., 2021).

Similarly, Liu et al. (2019) reported that extended hospitalizations are closely linked to severe morbidities and an increased likelihood of in-hospital death. Bhutta et al. (2024), Olusanya et al. (2018), and Vesel et al. (2023) also emphasized that length of hospital stay is a critical marker for neonatal prognosis, particularly in resource-limited healthcare settings. These findings underscore the necessity of prompt clinical assessment, early initiation of appropriate interventions, and vigilant monitoring of referred neonates to reduce the length of hospital stay and enhance survival prospects.

Furthermore, the presence of complications during hospitalization was another individual factor significantly associated with poor neonatal outcomes in this study. Neonates who did not

develop complications had better chances of survival than those who encountered complications such as infections, respiratory distress, or sepsis during their hospital stay. This is consistent with existing literature, which indicates that the development of complications in hospitalized neonates dramatically worsens survival prospects (Adatara et al., 2019; Ahmed et al., 2021). Thus, investing in advanced training for healthcare providers on early recognition and management of neonatal complications is imperative for improving outcomes among this high-risk group.

5.2 Conclusions

The findings of this study provide critical insights into the multifaceted factors influencing neonatal outcomes among neonates referred from lower-level health facilities to Jinja Regional Referral Hospital. The results highlight that survival among referred neonates remains unacceptably low, with only 63.2% surviving to discharge, while 36.8% succumbed to their conditions during hospitalization. This reflects significant deficiencies in both the pre-referral and post-referral care pathways that are essential for optimizing neonatal survival.

Health system factors, particularly the proximity of the referring facility to JRRH, were found to have a substantial impact on survival rates. Neonates referred from health facilities situated within a 10-kilometer radius had markedly higher survival rates compared to those coming from distant locations. This underscores the persistent challenge of geographical and infrastructural barriers that delay access to critical neonatal care in Uganda, especially in rural and remote areas.

In addition to health system factors, individual neonatal characteristics significantly influenced outcomes. Notably, neonates who stayed in hospital for three days or less were more likely to survive, suggesting that timely and effective clinical management at the referral hospital is crucial. Conversely, prolonged hospitalization often reflects severe clinical conditions, complications, or delayed interventions, which in turn increase the risk of mortality.

Furthermore, the presence of complications during hospitalization, such as infections or respiratory difficulties, was associated with a higher likelihood of death, reiterating the need for high-quality, continuous monitoring and specialized care for referred neonates.

In sum, this study concludes that neonatal outcomes in referred cases are influenced by an interplay of health system factors (such as referral distance and system readiness), individual neonatal conditions, and the quality of care during hospitalization. Addressing these elements is essential for reducing neonatal mortality and improving overall neonatal health in referral hospital settings.

5.3 Recommendations

Based on the study findings and the prevailing challenges identified in the neonatal referral and care systems, the following recommendations are proposed to various stakeholders at different levels of the health system to enhance neonatal outcomes:

1. Recommendations to Lower-Level Health Facilities

- Lower-level health facilities should prioritize equipping staff with skills and resources for effective pre-referral stabilization of neonates. This includes ensuring the availability of essential supplies such as oxygen, thermal regulation devices, antibiotics, and basic resuscitation equipment.
- Continuous capacity-building initiatives, including on-the-job training and mentorship for healthcare workers at Health Centre IIs, IIIs, and general hospitals, are necessary to improve the management of neonatal emergencies before referral.
- Standardized and comprehensive referral documentation should be reinforced to ensure that receiving facilities like JRRH receive complete and accurate clinical information about the neonate's condition and treatments administered.

2. Recommendations to Jinja Regional Referral Hospital (JRRH)

- JRRH should strengthen its Neonatal Intensive Care Unit (NICU) through the provision of advanced equipment, adequate medical supplies, and specialized healthcare personnel to manage high-risk and critically ill neonates.
- The hospital should establish clear protocols for the prompt assessment, monitoring, and management of referred neonates to minimize delays in care that may exacerbate complications.
- Regular audits of neonatal care services and outcomes should be conducted to identify gaps and implement evidence-based interventions aimed at reducing mortality among referred neonates.

3. Recommendations to District Health Offices

- District Health Officers in the JRRH catchment area should coordinate the development of an integrated and efficient neonatal referral system. This includes establishing designated neonatal transport services equipped with life-support capabilities to reduce transit time and improve survival.
- District health authorities should engage communities through health education programs to improve early care-seeking behavior among pregnant women and caregivers, emphasizing the importance of delivering in health facilities and recognizing neonatal danger signs promptly.

4. Recommendations to the Ministry of Health (MOH)

- The Ministry of Health should allocate dedicated funding to strengthen the neonatal referral system nationwide, particularly by equipping lower-level facilities with the necessary infrastructure for neonatal stabilization and transportation.
- The MOH should develop and enforce national guidelines and protocols for neonatal referral and pre-referral stabilization to standardize care across all health system levels.

- Nationwide implementation of competency-based training programs such as the Helping Babies Breathe initiative and Essential Newborn Care should be scaled up to ensure all frontline healthcare workers are equipped to handle neonatal emergencies effectively.

5.5 Area of further study

- 1) Further studies should explore the qualitative dimensions of referral challenges, including caregiver experiences, transportation logistics, and systemic inefficiencies within the referral networks.
- 2) Longitudinal studies are recommended to track the long-term outcomes of referred neonates post-discharge to understand the extended impact of referral and hospital-based care on neonatal development and survival.
- 3) Qualitative studies are needed to understand caregivers' and health workers' experiences and perceptions regarding neonatal referrals, complications, and outcomes, which can inform more patient-centered interventions.

By implementing these comprehensive recommendations at facility, district, and national levels, Uganda can make significant strides towards reducing neonatal mortality and achieving the Sustainable Development Goal target of fewer than 12 neonatal deaths per 1,000 live births by 2030.

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APPENDICES

Appendix I: Neonatal Data Extraction Form

Section 1: Patient Identification

1. Neonate ID: _____
2. Date of Admission: _____
3. Date of Discharge/Death: _____

Section 2: Health System Factors

4. Referring Facility: _____
HCII
HCIII
HCIV

5. Reason for Referral

Sepsis
Birth asphyxia
Prematurity
Respiratory distress
Other (Specify) _____

6. Pre-referral Stabilization:

Oxygen administered:

Yes

No

Antibiotics administered:

Yes

No

Other interventions: _____

7. Transport Time: Estimated time from referral to admission: _____ hours

8. Mode of Transport:

Ambulance

Private vehicle

Other: _____

9. Completeness of Referral Documentation:

Complete (diagnosis, treatment, reason for referral)

Incomplete

Section 3: Individual Neonatal Factors

10. Birth Weight: _____ grams
11. Gestational Age: _____ weeks
12. Sex of Neonate:

Male

Female

13. Primary Diagnosis on Admission:

Sepsis
Birth asphyxia
Prematurity
Respiratory distress
Other (Specify) _____

14. Apgar Score (if available):

- 1-minute: _____
- 5-minute: _____

Section 4: Sociocultural Factors

15. Maternal Age: _____ years

16. Place of Delivery:

Health facility

Home

Other: _____

17. Maternal HIV Status:

Positive
Negative
Unknown

Section 5: Neonatal Outcome

18. Outcome:

Survived (discharged alive)

Died

19. Length of Hospital Stay: _____ days

20. Complications During Hospitalization:

- Sepsis:
Yes
No
- Respiratory distress:
Yes
No
- Other: _____

Section 6: Additional Notes

21. Any other relevant information:

Appendix II: Budget

Item	Estimated Cost (UGX)
Jinja Regional Referral IRB Fee	300,000
Uganda Martyrs University Research Fee	1,200,000
IRB Fee	200,000
Research Assistants (4 people @ 20,000/day for 14 days)	1,120,000
Transport to JRRH	300,000
Miscellaneous	600,000
Total	3,720,000

Funding Source: The study will be financed through personal funds.

Appendix III: Workplan

The study will be conducted over six months according to the following timeline:

Activity	Timeframe
Proposal Writing	January - February 2025
Data Tool Testing & Research Approval	March 2025
Data Collection	April 2025
Data Analysis	May 2025
Report Writing & Dissertation Completion	June 2025

Appendix IV: IRB approval



Research Ethics Committee (MUREC)

17 April 2025

Ssemwanga Steven Loudel
Principal Investigator

Type: Initial Review
 Expedited
 Protocol Amendment
 Continuing Review
 Other, Specify

Dear Steven,

Re: Research approval: #REC REF 0204-2025 FACTORS ASSOCIATED WITH NEONATAL OUTCOME OF REFERRED NEONATES FROM LOWER-LEVEL HEALTH FACILITIES TO JINJA REGIONAL REFERRAL HOSPITAL".

Thank you for submitting this application for approval of the above-referenced protocol to MUREC.

I am glad to inform you that approval is hereby given to conduct the study; this approval is given following your exhaustive responses to initial comments raised by MUREC. The approval is for one year, effective 17 April 2025, and will expire on 17 April 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 **MUREC** for re-review and approval **prior** to the activation of the changes. The MUREC application number assigned to the research should be cited in any correspondence.
3. Reports of unanticipated problems involving risks to participants or others must be submitted to the **MUREC**. New information that becomes available that could change the risk: benefit ratio must be submitted promptly for **MUREC** review.
4. Only approved consent forms are to be used in the enrolment of participants. All consent forms signed by subjects and/or witnesses should be retained on file. The **MUREC** may conduct audits of all study records, and consent documentation may be part of such audits.
5. Regulations require review of an approved study not less than once per 12-month period. **Therefore, a continuing review application must be submitted to the MUREC**

Location/Correspondence
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Guiding Research For the Future

Two months before the above expiration date of [17 April 2026.] to continue with 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, at which point new participants may not be enrolled, and currently enrolled participants must be taken off the study.

6. Approval from the National Drug Authority should be sought where applicable.
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 the MUREC:

SN	Document Title	Language	Version	Version Date
1.	Protocol	English	2.0	11 April 2025
2.	Informed consent waiver	English	2.0	11 April 2025
3	Data extraction tool	English	2.0	11 April 2025

Yours sincerely,

Dr. Janefrank Nalubega,
Chairperson MUREC.



Appendix V: University Clearance letter

**Uganda
Martyrs
University**



Making a difference

Faculty of Health Sciences
Email: deanhealthsciences@umu.ac.ug
Date: Friday, 4th March 2025

To: **Whom it May Concern,**

Dear Sir/Madam,

Re: Letter of Support for SSEMWANGA Steven Loudel
[Reg. No: 2023-M122-22016]

Mr. SSEMWANGA Steven Loudel [Reg. No: 2023-M122-22016] is our student at Uganda Martyrs University, Faculty of Health Sciences. He is pursuing his study leading to the award of Master of Science in Health Services Management. His topic is "Factors Associated with Neonatal Outcome of Referred Neonates from Lower-Level Health Facilities to Jinja Regional Referral Hospital". The topic and all the study protocols have been approved by relevant university authorities.

Should you need additional information on his study, you can contact his immediate supervisor, Mr. Lwenge Mathias at Tel: +256782450525 or e-mail: mlwenge@umu.ac.ug

Further information can be obtained from the office of the Dean, Faculty of Health Sciences, Uganda Martyrs University.

Any assistance rendered to him towards his study will be greatly appreciated.

Thank you.

A handwritten signature in blue ink, appearing to read 'Omona Kizito'.

Yours sincerely,

Dr. Omona Kizito
Dean, Faculty of Health Sciences
Uganda Martyrs University
E-mail: deanhealthsciences@umu.ac.ug
Tel: +256706464873

