PREVALENCE AND FACTORS ASSOCIATED WITH NEONATAL MORTALITY AT NDOLA TEACHING HOSPITAL, NDOLA ZAMBIA

BY

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DECLARATION

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DEDICATION

This study is dedicated to all my beloved family and friends for their understanding, support, prayer and encouragement throughout the course of my studies and this project in particular;

Mr Longa Derick my dear husband, our three (3) lovely daughters, Mumbi, Zhuana, Bwalya and my family at large.

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ABSTRACT

Background: The impact of neonatal mortality continues to be a challenge worldwide. Globally, 2.4 million children died in the first month of life in 2020, representing 6,500 neonatal deaths every day. Some of the causes of neonatal deaths include; preterm birth, infections and asphyxia neonatorum among others. The aim of the study was to determine the prevalence and factors that were associated with neonatal mortality at Ndola Teaching Hospital in Zambia.

Methodology*:* A case series retrospective quantitative analytical study design was used. Data were collected using a structured questionnaire from 169 case notes from January to December, 2021 that were randomly selected from Neonatal Intensive Care Unit at Ndola Teaching Hospital. Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 26 Chi-square test was used to test associations' between variables and the level of significance was set at 0.05 and at 95% confidence interval.

Results*:* The prevalence of neonatal mortality was 8.9%. A significant proportion 98.8% of the neonates admitted to the NICU at Ndola Teaching Hospital originated from antenatal clinics. Concerning neonatal characteristics, 60.2% were male, and the most common length of stay in the NICU was less than 5 days representing 75.7%. There was an association between being born preterm or very preterm and neonatal mortality (P-value= 0.001). Neonates who were resuscitated at birth and Neonates who were admitted at birth with subnormal temperatures (35 degrees or below) were more likely die (P-value= 0.0001).

Conclusion: The study revealed that Neonatal mortality is very high among hospitalized neonates at Ndola Teaching Hospital in Zambia. The factors associated with neonatal mortality were multiple. Therefore, there is need to scale up interventions such as; strengthening antenatal care attendance by pregnant women, staff to be familiar with resuscitation of neonates and employing infection prevention measures to mitigate risk factors to neonatal mortality.

Keywords: *Neonate, mortality, Prevalence, factors associated with neonatal mortality.*

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LIST OF ABBREVIATIONS

ANC	:	Antenatal clinic
ART	:	Antiretroviral therapy
CBU	:	Copper belt University
DBS	:	Dried Blood spot
DRC	:	Democratic Republic of Congo
GBD	:	Global Burden of Disease
HIE	:	Haemolytic Ischaemic Encephalopathy
HIV	:	Human Immunodeficiency Virus
KMC	:	Kangaroo Mother Care
MCH	:	Maternal and Child Health
MDG	:	Millennium Development Goals
MOH	:	Ministry of Health
NHRA	:	National Health Research Authority
NICU	:	Neonatal Intensive Care Unit
NMR	:	Neonatal Mortality Rate
NTH	:	Ndola Teaching Hospital
RDS	:	Respiratory Distress Syndrome
SD	:	Standard Deviation
SDG	:	Sustainable Development Goals
SPSS	:	Scientific Package for Social Sciences
UNICEF	:	United Nations International Children's Emergency Fund

UNZA	:	University of Zambia
UNZABREC	:	Biomedical Research Ethics Committee
WHO	:	World Health Organization
ZSA	:	Zambia Statistics Agency

CHAPTER ONE: INTRODUCTION

1.0 Overview of the chapter

Neonatal mortality is a global problem especially in developing counties and it contributes to under five mortality. Chapter one gives background information to the study and describes the statement of the problem, justification of the study, the conceptual framework, research question, research objectives, research hypothesis, conceptual and operational definitions and study variables, indicators and cut off points. The focus of this study is on prevalence and factors associated with neonatal mortality.

1.1 Background Information

The World Health Organization (WHO) defines neonatal mortality as the number of deaths during the first 28 completed days of life per 1000 live births in a given year or period (WHO, 2020). Neonatal mortality is classified as early neonatal mortality when a death of a newborn occurs before 7 days and late neonatal mortality when the death occurs after 7 days but before 28 days of life (WHO, 2020). The first 28 days of life is the most vulnerable time for a child's survival. The causes of death may be associated with lack of quality care at or immediately after birth (WHO, 2022). Globally, 2.4 million children died in the first month of life in 2020, representing 6,500 neonatal deaths every day (UNICEF, 2021). Neonatal mortality rate is the probability that a child born in a specific year or period will die in the first 28 days of life that is expressed per 1000 live births (UNICEF, 2022).

The WHO also reports that nearly half of the under 5 deaths occurred in the neonatal period an increase from 40% in 1990 globally (WHO, 2020). Though a decline in neonatal deaths was recorded from 5 million in 1990 to 2.4 million in 2020, the reduction has been very slow (WHO, 2022). In sub-Saharan Africa, 27 deaths per 1000 live births were recorded with 43% of global newborn deaths followed by Central Africa and Asia representing 23 deaths per 1000 live births with 36 % of global new deaths. Some of the causes of neonatal deaths include; preterm birth, infections, birth defects and childbirth-related complications such as asphyxia neonatorum (WHO, 2022).

A study that was conducted by Kibria et al (2018) in Bangladesh, revealed that 98% of neonatal deaths occurred in developing countries, South Asia experienced 40% of these deaths. In this regard, the Millennium Development Goal 4 (MDG-4) aimed to reduce under-five mortality by two thirds between 1990 and 2015. Many countries failed to achieve this target due to slower Neonatal Mortality Rate (NMR) reduction. Later, Sustainable Development Goals (SDGs) stated the need to reduce the NMR where SDG 3.2 aims to reduce NMR to less than 12 per 1000 live births worldwide by 2030 (Kibria et al., 2018). In the same study, it was indicated that increasing currently available, feasible and cost-effective interventions such as cord care with chlorhexidine, kangaroo mother care (KMC) or the use of corticosteroids could reduce neonatal mortalities by about three-fourths. Risk factors can be identified and addressed through evidence-based interventions in order to avoid unwanted and preventable deaths.

In Bangladesh, Kibria et al (2018) further reported that in 2014, the estimated Neonatal mortality rate (NMR) in that country was 28 per 1000 live births. Most of the reported cases were from rural areas, therefore, reducing neonatal mortality still remains a challenge in low- and middle-income countries. This can be achieved by adopting a comprehensive strategy to address the individual, maternal and intra-partum factors that are associated with neonatal mortality by prioritizing the management of preterm deliveries and delivery complications that are common among pregnant women (Kibria et al., 2018).

According to a study that was conducted by Santiago et al (2019), significant factors that contributed to neonatal mortality were identified as: absence of a partner, maternal age above 35 years, multiple gestation, very low birth weight, gestation age of less than 37 weeks and absence of prenatal care among others. In the same study, it was observed that some of these factors could be modified and hence allowing for real reduction in neonatal mortality in that country (Santiago et al., 2019).

Strategies to reduce neonatal mortality include; providing skilled care at birth, postnatal care of the mother and the baby as well as improving care of small and sick newborns. In addition, encouraging facility-based births almost 80% globally, providing essential newborn care, identifying and managing high risk newborns (Sander, 2018). After delivery, women stay in the

facility for 24 hours and this is the most critical period in which complications may occur in the mother and the baby. The WHO also recommends 4 postnatal contacts at health facility or home visits should be conducted in order to reach the newborns and their families (WHO, 2022).
A study that was conducted by Masaba and Mmusi in Kenya reported that the neonatal mortality in sub-Sahara Africa in 2018 was 28 deaths per 1000 live births. South Africa had 10.7 neonatal deaths per 1000 live births in 2018. In the same study, about 99% of neonatal deaths occurred in the poorer countries particularly sub-Saharan Africa and South Asia. Further, Hadgu et al (2020) reported that the neonatal period is the most vulnerable time of human life for diseases and that neonatal morbidity and mortality significantly contribute to under-five morbidity and mortality in sub-Saharan Africa. The findings of this study were that NMR was highly associated with primipara, prematurity, low birth weight, perinatal asphyxia, respiratory distress syndrome, neonatal sepsis and duration of hospital stay. These deaths could be prevented by improving antenatal care follow-up, emergency obstetric care services, enhancing management of the sick neonates and neonatal resuscitation skills (Hadgu et al., 2020).

In Zambia, the neonatal mortality rate stands at 22 deaths per 1000 live births (ZSA, 2023). The figures have remained in the same level from 24 in 2013-2014 and 27 in 2018. According to the 2023 Zambia Statistics Agency (ZSA), Zambia faces challenges in relation to neonatal and child care which include high poverty levels, increased disease burden of preventable diseases such as tuberculosis, poliomyelitis, diphtheria, measles, whooping cough among others. Other factors that have contributed to increased neonatal mortality in Zambia include inadequate infrastructure, challenges accessing services and quality care.

The Ministry of Health (MOH) has developed measures to reduce the neonatal mortality by developing the Essential Newborn Care Guidelines in 2014 (MOH, 2018). Other solutions that have been put in place include; increasing the number of women attending antenatal care visits to 80%, skilled birth attendance to 80%, children to be fully immunized by their first birthday to 80% among others (UNICEF, 2021). The aim of this study was to determine the prevalence and factors associated with neonatal mortality at Ndola Teaching Hospital. This study has generated knowledge on the prevalence and factors that are associated with neonatal mortality at Ndola Teaching Hospital. The knowledge has contributed to providing insight on the prevalence and

factors that are associated with neonatal mortality, guiding policy making, improvement in neonatal care and subsequently reduction in neonatal mortality.

1.2 Statement of the problem

The World Health Organization (WHO) has prioritized the provision of quality maternal and child health care in order to improve survival and the health of newborns and end preventable deaths (WHO, 2022). This can be achieved by ensuring high quality antenatal care, skilled care at birth, postnatal care for the mother, small and sick newborns (Erchick, 2022). When newborn health is addressed, it will serve as a catalyst for the improvement of maternal and child health for accelerating progress towards the SDG number 3.2 (WHO, 2022).

The curricula for nurses and midwives provide for training in basic maternal and neonatal care. According to the UNICEF (2022) midwifery students are trained in assessment of a newborn, physical examination of a newborn baby and neonatal resuscitation which are necessary skills for health workers to avert newborns mortalities. In addition, when health workers are well trained, deployed in adequate numbers and appropriately supported to provide quality health care, approximately two thirds of preventable maternal and newborn deaths can be avoided (UNICEF, 2022). Other solutions to reducing neonatal mortality include improving infrastructure, improving antenatal care support, improving communication and referrals for newborns who need specialized care (Akombi et al., 2019).

In Zambia, the Ministry of Health (MOH) had provided guidelines on the provision of quality maternal and child health services in the National maternal and neonatal referral guidelines of 2018. In this document, guidelines had been given in order to strengthen the referral system for newborn survival, reduce referral delays, improve pre-referral care, triage, ambulance transportation, communication, and enhance preparedness for referral and feedback at the receiving center (MOH, 2018). Despite these efforts, it is unclear whether health care providers were utilizing these guidelines appropriately owing to the fact that the neonatal mortality continues to be high at 22 per 1000 live births (ZSA, 2023).

Ndola Teaching Hospital (NTH) has continued to record high numbers of neonatal mortality as shown in the table below. The increase in neonatal mortality could be attributed to a number of factors some of which could be categorized as service related and client. Members of staff that provide neonatal care include Pediatricians, General Doctors, Nurses and Midwives. Some of these nurses are trained pediatric and critical care nurses. Hence this study endeavored to determine the prevalence and factors that are associated with neonatal mortality at Ndola Teaching Hospital.

Table 1: Neonatal mortality cases at Ndola Teaching Hospital

YEAR	NEONATAL ADMISSIONS	NEONATAL MORTALITY	PERCENTAGE
2017	2,364	201	8.5 %
2018	1,754	185	10.5 %
2019	3,106	240	7.7 %
2020	1,399	102	7.2 %
2021	3,343	251	7.5 %

This table shows the neonatal admissions, neonatal mortalities from 2017 to 2021 at Ndola Teaching Hospital in Neonatal Intensive Care Unit (NICU). The neonatal mortalities are represented by percentages to show the magnitude of the problem.
(Source: Ndola Teaching Hospital Maternal statistics Summary Report, 2017-2021)

1.3 Theoretical Framework

The theoretical framework that guided this study was the Mosley and Chen Framework which was developed in 1984 with a focus on the Socioeconomic determinants of neonatal mortality such as ethinicity/culture, religion/conceptions, education/skills and economy/wealth; Proximate determinants such as maternal, neonatal factors, delivery factors and postnatal care; Interventions such as temperature control, resuscitation, exclusive breastfeeding and infection management;

Outcome of the child that could be survival or mortality. The framework has been used to analyze neonatal mortality risk factors with a focus on specific areas such as Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS), Neonatal health and Maternal mortality (Izulla et al, 2023). The constructs that were used in this study are; proximate determinants: maternal, neonatal factors and delivery factors.

These determinants are interrelated and affect each other as shown by the arrows. The influence of maternal educational level on child health has been explored in many studies. For example, Sheyab et al (2020) in a study titled Rate, Risk factors and causes of Neonatal Deaths in Jordan: Analysis of Data from Jordan Still birth and neonatal Surveillance System (JSANDS) reports that educated mothers who have attained tertiary education from a college are able to understand and use the health system, compared to their less educated mothers who have not attained tertiary education. These mothers are able to adopt and utilize the knowledge on health care that could benefit themselves and their newborn babies.

In this model, the proximate determinants are divided into five categories: maternal factors, health system factors, neonatal factors, delivery factors, and postnatal care. There is no strict hierarchy that is followed however, by putting maternal and health system factors above the other groups indicate and acknowledges that these two have a significant impact not only on the outcome but also on the three other groups. The woman has the ability to decide where to attend antenatal care services and where the delivery will take place. In addition, the characteristics of the health system such as the attitudes of health workers and availability of resources such as good infrastructure and drugs greatly influence the place of delivery and the postnatal care. Notable are neonatal factors such as the sex of the baby may have a considerable impact on the postnatal care that can affect neonatal child survival. Measures to reduce neonatal mortality are not costly nor complicated instead simple which may include encouraging pregnant women to attend antenatal clinic where they are screened against preventable diseases such as hypertension, diabetes mellitus and sexually transmitted infections. The interventions in the model are examples based on priorities made by WHO (WHO, 2022).

1.3.1 Conceptual Framework (adopted from Socioeconomic and Proximate determinants framework)

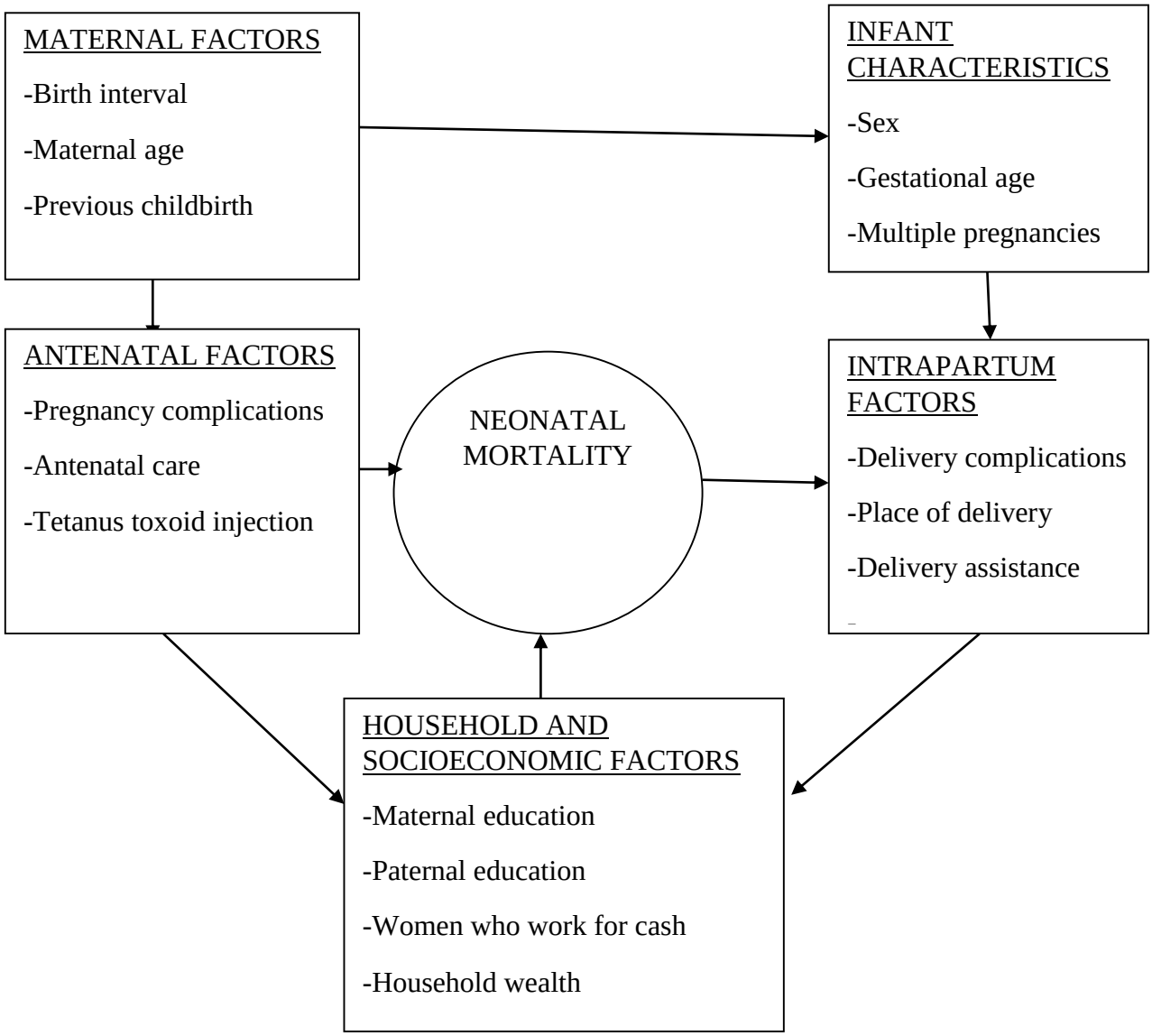

Figure 1 : Socioeconomic and Proximate determinants framework (Source: Izulla et al, 2023)

1.3.2 Application of the Theoretical Framework to the Study

In this study, factors that could be associated with neonatal mortality such as maternal, fetal and socioeconomic could influence the prevalence of neonatal mortality. These factors and how they are associated with neonatal mortality were discussed as follows:

Maternal factors are those that can affect a woman and they can include birth interval, maternal age, mid-upper arm circumference, previous child death among others. Babies that were born to teen mothers tended to be premature as the mothers do not reach full physical or reproductive maturity before pregnancy (Tavares, 2022). It is imperative to delay the first pregnancy and also educate first- time mothers of antenatal interventions (Tekelab et al, 2019). In the case of this study, teenage mothers and women who became pregnant at 30 years and above, their neonates were more likely to die and neonatal mortality is associated with a mother of high parity above 5 pregnancies have an increased risk of the neonates dying (Kibria et al., 2018). In relation to this study, better outcomes are possible when mothers have adequate birth preparedness (Wolde, 2019). In Zambia, most mothers who live in urban areas have access to health information rather than their counterparts who live in rural areas who may not access health services easily due to long distance to the health facility and lack of urgency for health information among others (Mukosha et al, 2021).

Antenatal factors: These included pregnancy complications, antenatal care, tetanus toxoid vaccination and tobacco consumption. Sellers, (2018) reported that in multiple pregnancy, one fetus may be deprived of nutrients in a condition known as twin-to-twin transfusion hence increasing the rate of mortality in a neonate. Multiple pregnancy with twin fetuses usually leads to prematurity and underweight which are common causes of neonatal death (Konstantnyner, 2023). In the case of this study, antenatal utilization improves pregnancy outcomes thus it helps to detect complications of pregnancy that can contribute to neonatal mortality (Sobhy et al, 2019). In an event that complications were detected, there is a better chance of resolving the problem which can contribute to providing quality essential newborn care which could increase neonatal survival. In this instance, adequate birth preparedness by mothers can prevent neonatal deaths as reported by Shiferaw, (2022).

Infant characteristics: Sex, gestational age, birth rank. Neonatal mortality occurs more in the male than female child and smaller than larger infants have 1.319 times more likely to die in the neonatal period (Kibria et al., 2018). In the case of this study, premature infants had an increased risk of infections, hypoglycaemia and hypothermia due to physical immaturity. Kibria et al., (2018) also reported that prevention of prematurity is crucial through discouraging smoking and use of progesterone supplementation among others. Kangaroo Mother Care (KMC) had proved to be helpful as it was cheap and may be implemented without difficulty. Studies had shown that male neonates were more susceptible to infections and immunodeficiency (Hug, 2019). In a study that was conducted by de almeida, (2023), male neonates also had an increased chance of having congenital anomalies that could lead to death. With regard to this study, the male child was identified to be at risk of dying from prematurity. Therefore, it is significant to give the male neonate greater attention to prevent mortality.

Intra-partum factors: Delivery complications, place of delivery, delivery assistance and season of birth. Some women experienced prolonged labour, instrumental delivery and delivery by operative means such as caesarean section (Maia, 2022). These subject the newborn to damage to the cerebral structures of the newborn leading to birth injuries that can contribute to neonatal deaths (Sellers, 2018). In the case of this study, deliveries that were conducted in the health facility by skilled health workers were likely to be successful than those conducted in the home setting (Desalew, 2020). In this instance, skilled health workers that include trained Doctors, Nurses and Midwives were expected to provide quality and professional health care for the benefit of the client.

Household and socioeconomic factors: These are maternal education, paternal education, women who work for money and maternal decision about treatment of children among others. Concerning socioeconomic factors (Liu et al,2014-2018), they could influence neonatal mortality for example; individuals who are poor live below the poverty line and as such may have poor sanitary conditions that predispose infants to infection and may not afford balanced meals for good health (Silva, 2022). In the case of this study, some infections could arise from lack of use of sterile material to clean the umbilical cord or use of herbal medication in order to allow the umbilical stump heal quickly. This may put the newborns at a high risk of dying in the first month of life (Sheyab et al., 2020). In relation to this study, the level of education increased the knowledge about child health,

health care services and improved the health seeking behaviors for children and parents themselves (Kibria et al., 2018). A male parent was considered the head of the family and if he assumed a good job, he was likely to earn a good salary to support the family (Niewoudt, 2022). The educated tended to live in rich communities that had access to good and timely quality health care (Geruso, 2018). The effect of household economy on the survival of neonates could be in various ways. In Zambia, households are encouraged to have health insurance such as National Health Insurance Scheme (NHIMA) in order to access health services easily (ZSA, 2018). They are expected to contribute a certain amount of money on a monthly basis towards this scheme. However, if a family is poor, the social welfare comes in to assist by giving an exemption though the process is not smooth. Religious beliefs and customs also affect neonatal health and the chances for survival. In Zambia, the husband is expected to make decisions on behalf of the family in matters such as whether the child should be transfused with blood in an event that the child has anemia as well as consent for operation.

Antenatal complications, pregnancy complications such as vaginal bleeding, convulsions, swelling of the face among others; number of antenatal visits received a tetanus injection, tobacco consumption in pregnancy (Matin, 2023). Moreover, delivery complications such as excessive bleeding, convulsions, retained placenta, abnormal presentation, prolonged labour, premature rupture of membranes, place of delivery hospital or home delivery, delivery assistance by skilled birth attendants such as doctors and nurses, socioeconomic and household factors: maternal education, women who work for cash, women's decision making power about treatment of children, paternal education and household economic status (Mahtab, 2023).

The WHO (2022) had spearheaded an increase in facility births where there was a great opportunity to provide essential newborn care and high-risk newborn babies could be identified early. Further, WHO recommended the following: Low birth weight and preterm babies required increased attention to keep warm, assistance with initiation of breastfeeding and extra attention to identify danger signs; Sick newborns: Identify danger signs as soon as possible and give appropriate health care service. If the baby was sick at home, the family needed help to transport the baby to the hospital or health facility for care; Newborns of Human Immune Deficiency Virus (HIV) infected mothers: preventive antiretroviral treatment (ART) for the mother and newborn,

counseling and support to mothers for infant feeding among others. In order to reduce the neonatal mortality, it is important to understand the prevalence and the factors that are associated with neonatal mortality. This study endeavored to explore the prevalence and factors that are associated with neonatal mortality at Ndola Teaching Hospital and recommended possible solutions to policy makers on the findings of the study.

1.4 Justification

The WHO (2022) had accelerated progress for the survival of neonates by promoting the health and wellbeing of neonates through strengthening quality of health care provision. Some of the strategies that had been put in place included the introduction of newborn care where every newborn must have received: thermal protection, hygiene and umbilical care and early and exclusive breastfeeding among others (WHO, 2022). These measures could help to reduce neonatal mortality.

In sub-Saharan Africa, neonatal morbidity and mortality were identified as significant contributors to under-five morbidity and mortality (Hadgu et al., 2020). In this study factors that were associated with neonatal mortality were identified as perinatal asphyxia, congenital anomaly, sepsis (early and late) and gestational age among others. Neonatal deaths could have been prevented if antenatal care, follow up and emergency obstetric care services were improved. In this regard, research was conducted to determine the prevalence and factors that were associated with neonatal mortalities at Ndola Teaching Hospital.

Neonatal mortality is a major public health problem worldwide and it accounts for one third of the deaths of children under the age of five (5) (Akombi et al., 2019). In Zambia, the neonatal mortality continues to be high at 22 per 1000 live births (ZSA, 2023). This study was conducted in response to an the urgent need to identify and document the prevalence and factors that were associated with neonatal mortality at Ndola Teaching Hospital that could help to generate evidence-based protocols for monitoring neonates. If this problem was not addressed, it could be a huge financial burden on the economy of the country as well as wiping out the younger generation that are likely to take up adult roles in future. The neonatal mortality rate will consistently remain high. The

hospitals and other health care service providers may lose trust and credibility from the community that they serve.

The government of the Republic of Zambia, Ministry of Health (MOH) in collaboration with other partners such as UNICEF and WHO help to implement maternal child health programmes in order to reduce maternal and neonatal mortality. The COVID pandemic could have also contributed to the neonatal deaths (Mascio,2020). The findings from the study provides valuable reference to the scientific community and the body of knowledge as far as the prevalence and factors that are associated with neonatal mortality. In addition, recommendations would be made on how to intensify neonatal care to policy makers, maternal and Child Health (MCH) Coordinators, Nurse Managers, Nurses, midwives, other health care professionals as well as Non-Governmental Organizations and the community at large in order to design strategies that can help neonatal mortality to identify factors that are associated with neonatal mortalities. The findings from the study would also provide a critical appraisal of the current protocols for management of neonates and generate recommendation to improve these protocols. Therefore, the research was conducted in order to determine the prevalence and actual factors that are associated with neonatal mortality. Furthermore, studies have been conducted to explore the prevalence and factors associated with neonatal mortality, however, no such study had been conducted in Ndola. This study determined the prevalence and factors that were associated with neonatal mortality at Ndola Teaching Hospital.

1.5 Research Question

What is the prevalence and factors that were associated with neonatal mortality at Ndola Teaching Hospital?

1.6 Objectives of the study

1.6.1 General Objective

The general objective of this study is to determine the prevalence and factors that are associated with neonatal mortality at Ndola Teaching Hospital.

1.6.2 Specific objectives

The specific objectives of the study were:

1. To establish the prevalence of neonatal mortality at Ndola Teaching Hospital.
2. To determine factors that were associated with neonatal mortality at Ndola Teaching Hospital (NTH).

1.7 Conceptual definitions

Prevalence: It is the proportion of a population who have a specific characteristic in a given time period (Stoppler, 2021).

Neonate: This refers to a newborn baby within 28 days (Hadgu et al., 2020).

Neonatal Mortality: This is the death of a newborn in the first 28 days of life (UNICEF, 2021).

Factors: This is a fact or situation that influences the result of something (Cambridge, 2022).

Asphyxia Neonatorum: This is a condition that occurs when the neonate fails to initiate or sustain respirations at birth (Sellers, 2018).

Prematurity: A baby that is born after 28 weeks of gestation but before 37 weeks of gestation as calculated from the first day of the last normal menstrual period regardless of birth weight (WHO, 2020).

Neonatal Sepsis: This is a systemic infection occurring in infants at ≤28 days of life due to invasion of the blood stream by bacteria characterized by fever, irritability and inability to suck (Sellers, 2018)

Congenital birth defects: These are defects in the structure of the different parts of the body which are present at birth (Sellers, 2018).

1.8 Operational definitions

Prevalence:	In this study, it was the number of neonatal deaths that were recorded at Ndola Teaching Hospital.
Neonatal mortality rate:	It referred to the number of deaths of newborn babies that occurred in the first 28 days of life per 1000 live births.
Associated factors:	These were things or diseases that contributed to neonatal deaths.
Asphyxia Neonatorum:	A newborn baby who failed to cry at birth spontaneously.
Prematurity:	A baby that was born before nine (9) complete months of pregnancy.
Neonatal Sepsis:	A condition in which a newborn baby experienced a rise in body temperature that caused it to be irritable and to cry excessively.
Congenital birth defects:	These are different abnormalities that a baby was born with.

1.9 Variables

1.9.1 Dependent Variable

The dependent variable for the study was neonatal mortality

1.9.2 Independent Variable

The independent variables for the study were:

- Demographic and biological data, including gestational age, newborn sex, birth weight, and neonate's age.
- Socioeconomic factors: Maternal age, maternal parity, place of residence,
- Antenatal care and delivery: Number of antenatal visits, type of delivery, place of delivery.
- Exposures and health conditions: Maternal chronic condition , Maternal HIV status.
- Factors such as prematurity, asphyxia, Haemolytic Ischaemic encephalopathy (HIE), sepsis, respiratory distress syndrome and congenital anomalies among others.

Table 2: Variables, Indicators and Cut off points

Variable	Indicators	Cut off	Question Number	Type of Variable
Dependent Variable				
Neonatal mortality	This refers to whether a neonate survived or died	Survived Died	18	Categorical
Independent Variables **Demographic and biological data**				
Gestational age	The duration of the pregnancy in weeks	Less than 37 weeks Greater than 37 weeks	13	Categorical
Sex of newborn	The gender of the newborn whether male or female	Male Female	1	Categorical(nominal)
Age of newborn	The exact age of the neonate at death	Less than a week Greater than 7 days	2	Categorical
Birth weight	The weight of the baby at birth measured in kilograms	Less than 2.5 kg Greater than 2.5 kg	14	Categorical
Exposure to HIV	A Child who is born from an HIV infected mother	Not exposed Exposed No information	12	Categorical
Temperature on admission	This is the measure of the body whether cold or hot using a thermometer	Less than 36.5 degrees celsius Greater than 37.2 degrees Celsius	13	Categorical
Socioeconomic factors				
Maternal age	This is the age of the mother during pregnancy and delivery in years	15-19 years 20-24 years 25-29 years 30-34 years 35 years and above	4	Categorical
Maternal parity	This is the number of live births that the woman has had	1-2 3-4 5-6 7-8 9-10	6	Discreet

Place of residence	The place where the mother stays	Urban Rural	3	Categorical (nominal)
Antenatal care and delivery				
Type of delivery	The mode of delivery of the baby	Spontaneous vaginal delivery Assisted vaginal delivery Caesarean section	9	Categorical (nominal)
Place of delivery	The place where the delivery was conducted from	Home Health facility	10	Categorical (nominal)
Antenatal visits	The number of visits that a pregnant woman made to the antenatal clinic	Yes No	7	Discreet
Exposures and health conditions				
Maternal chronic illness	This refers to any chronic illness that the mother suffered from	Yes No	11	Categorical
Cause of Neonatal mortality				
Prematurity	A baby born after 28 weeks of gestation but before 37 weeks of gestation	Late: 34-36 weeks Moderate:32-34 weeks Very: less than 32 weeks Extreme: Before 2 weeks	18	Categorical
Asphyxia neonatorum	The failure of the baby to initiate or sustain respirations at birth	Severe: 1-4 Mild: 5-7	18	Categorical
Neonatal Sepsis	A condition in a neonate characterized by fever	Early: 0-7 days Late: 7-90 days	18	Categorical
Congenital birth defects	A neonate born with either a missing body part or defective in function or presence of additional defect.	Mild Moderate Severe	18	Categorical

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This literature review focused on research findings on the prevalence and associated factors of neonatal mortality that were retrieved mainly from published scholarly articles, books and education journals. The objective of this review was to develop a strong knowledge base on the prevalence and factors that were associated with neonatal mortality internationally, regionally and locally. In order to access the information, search engines such as Google scholar were used to access information using Medline, Hinari and Pubmed data bases. The literature review is structured as follows: overview of prevalence and factors that were associated with neonatal mortality, existence of neonatal guidelines and factors influencing neonatal mortality.

2.1 Overview of Neonatal Mortality

The WHO reported that globally 2.4 million children died in the first month of life in 2020. Most of these neonatal deaths occur in the first week of life. In 2019, about 1 million newborns died within the first 24 hours of life. The causes of neonatal mortality were identified as prematurity, childbirth related complications such as asphyxia, infections and birth defects (WHO, 2022).
In line with the Sustainable Development Goals (SDG), neonatal mortality rate was expected to be reduced to less than 12 per 1000 live births by 2030 (Kibria et al., 2018). This could be done by improving health care delivery through interventions such as Kangaroo mother care (KMC) and care of the umbilical cord by cleaning with appropriate solutions such as Chlohexidine. Training of skilled health care providers, improving postnatal care and care of sick infants could greatly reduce neonatal mortality (WHO, 2022).

In a study that was conducted in Bangladesh by Kibria et al (2018) on the rates and determinants of neonatal mortality in two rural districts of Sylhet, it was observed that reducing NMR still remained a challenge in many low- and middle-income countries including Bangladesh. The findings from this study revealed that NMR was high in rural areas. In another study that was conducted by Weddih et al (2019) on the prevalence and factors that were associated with neonatal mortality among neonates hospitalized at the National Nouakchott, Mauritania, neonatal mortality

remained a significant public health concern with about 4 million deaths per year. In the same study, factors that were associated with neonatal mortality were identified as socioeconomic, clinical and delays in transportation of sick neonates to health facilities for treatment. The findings from this study were consistent with the study that was conducted in Bangladesh (Kibria et al., 2018).

In a study conducted by Sheyab et al. (2020) in Jordan, it was reported that 27.8 million neonates will die between 2018 and 2030 in an event that no improvements were done in neonatal and maternal care. These revelations pointed to how large the issue of neonatal mortality was. In the same study, neonates who were admitted died of respiratory and cardiovascular disorders whereas others died of low birth weight and prematurity. Maternal conditions that could have contributed to these deaths were noted as complications of the cord, complications of pregnancy and other medical and surgical conditions. However, the main cause of neonatal death were low birth weight and prematurity. In the same study, it was observed that extensive progress had been made in reducing neonatal mortality, however, neonatal mortality continued to be high. Majority of the neonatal deaths occurred in low and middle income countries with prematurity being a significant factor. It was difficult to confirm the cause because there were many factors that could have been linked to neonatal mortality other than prematurity. Efforts needed to be increased to achieve the 2030 SDG target 3.2 even though there was a global decline in neonatal mortality, the decline was considerably slower. In the same study, it was observed that the information on the timing of death for neonates was sparse and less reliable because of uncertain estimates. This posed a substantial challenge to generate evidence based interventions that may help to prevent neonatal deaths. Therefore, generation of data, reporting and management needed to be improved as it was key to the development of specific strategies to combat neonatal mortality (Kibria et al, 2018). In Jordan, an electronic stillbirths and neonatal death surveillance system was developed in 2019 owing to the fact that almost all (99.7%) births occurred in hospitals. Therefore, improving the reporting system of neonates was critical for tracking progress and taking appropriate action in Jordan (Sheyab et al, 2020).

In Ethiopia, a study that was conducted to determine the prevalence and factors that were associated with Neonatal Mortality at Ayder Comprehensive Specialized Hospital, neonatal period

was the most vulnerable time of human life for the occurrence of diseases. Significant contributors to under five morbidity and mortality were neonatal morbidity and mortality in sub-Saharan Africa (Hadgu et al., 2020). Another study that was conducted in Kenya and South Africa, majority of children (99%) who died in the first 4 weeks of life occur in sub-Saharan Africa and South Asia. Sub- Saharan Africa recorded 28 deaths per 1000 live births in 2018 where Kenya and South Africa are found (Masaba and Mmusi, 2020). The findings of this study were that neonatal mortality for Kenya had fallen gradually from 35.4 deaths per 1000 live births in 1975 to 19.6 per 1000 live births in 2018.

In South Africa neonatal mortality dropped from 27.9 deaths per 1000 live births in 1975 to 10.7 deaths per 1000 live births in 2018 (WHO, 2022). Most of these deaths were as a result of preterm birth complications and that the neonates born in South Africa were likely to survive than those born in Kenya. This study did not state why neonates born in South Africa were likely to survive than those born in Kenya. Furthermore, WHO, (2020) reported that in the African Region, 1.12 million newborn deaths occurred every year with the main causes being prematurity, low birth weight, lack of oxygen at birth and infections among others.

In Zambia, Miyoshi et al., (2019) reported that in 2014, the neonatal mortality rate was at 24 per 1000 live births. These deaths occurred in rural areas due to limited access to medical care, lack of appropriate infrastructure and inadequate health care workers in the available health facilities. Most pregnant women delivered at home (42%), some delivered in hospitals (56.3%) (Miyoshi et al., 2019). Families were responsible for transportation of the pregnant woman to the health centre, Doctors were not found at these centers', and equipment such as ultrasound scan were not available.

Despite these limitations, some health centers' had mothers shelters where pregnant women living far from the health centre lodged free of charge awaiting the onset of labour (WHO, 2020). When a pregnant woman had or was expected to have complications, referral to a district hospital was done by the nurse or midwife using an ambulance or transport arranged by the family. Neonatal deaths were likely to reduce if there was efficient use of limited resources and also preventable causes of deaths were identified early. The Ministry of Health, (2018) also proposed that education of nurses and midwives in emergency obstetric care at health centers and hospitals could be the primary way to address neonatal mortality, assess patients that were at risk and referred them in a

timely manner, educate pregnant women on the importance of preventing neonatal mortality by encouraging them to attend antenatal care clinics and managing problems before the obstetrician arrived. This study was limited as it focused on the rural area, Zimba of southern province, Zambia only.

At Ndola Teaching Hospital, neonatal deaths were high ranging between 102 (7.2%) to 185 (10.5%) from 2017 to 2021. These statistics were not convincing as some of the information was missing particularly in 2018 for January to March, 2017 for January and 2020 for July to December (NTH, 2022). This could mean that the current neonatal deaths are not a true reflection of what was prevailing at the institution.

2.2 Factors influencing Neonatal Mortality

According to WHO, (2022) the causes of neonatal deaths were identified as preterm birth, asphyxia, infections and birth defects. In a study that was conducted by Kibria et al., (2018) it showed that male neonates were more susceptible to infections and immunodeficiency. They also had an increased chance of having congenital anomalies that could lead to death. From this perspective, it was significant to give the male neonate greater attention to prevent mortality. Newborns who were premature infants had an increased risk of infections, hypoglycaemia and hypothermia due to physical immaturity. Smoking among pregnant women was identified as a major contributor to prematurity. Therefore, discouraging smoking and use of progesterone supplementation among others, promoting Kangaroo Mother Care (KMC) could contribute to reduction in neonatal mortality (Kibria et al., 2018).

In addition, Sellers, (2018) identified pregnancy complications such as multiple pregnancy, high parity and age above 30 to contribute to neonatal mortality. Newborns from teen mothers tended to be premature as the mothers did not reach full physical or reproductive maturity before pregnancy. Pregnant women who were adequately prepared for delivery by attending antenatal clinic were likely to contribute to low neonatal deaths and better pregnancy outcomes. Multiple pregnancy with twin foetuses usually led to prematurity and underweight which were common causes of neonatal death. Antenatal utilization improved pregnancy outcomes thus helped to detect

complications of pregnancy that could contribute to neonatal mortality. In an event that complications were detected, there would be a better chance of resolving the problem which could contribute to providing quality essential newborn care and subsequently increase neonatal survival.

In another study that was conducted by Sheyab et al., (2020) delivery complications of pregnant women or fetal anomalies, place of delivery, delivery assistance, season of birth, prolonged labour, instrumental delivery and delivery by operative means such as caesarean section were notable contributors to neonatal mortality. These subjected the newborn to damage to the cerebral structures of the newborn leading to birth injuries that contributed to neonatal deaths (Sellers, 2018).

In the same study maternal education, paternal education, women who worked for cash and maternal decision about treatment of children were noted to contribute to neonatal mortality. The level of education increased the knowledge about child health, health care services and could have improved the health seeking behaviors for children and parents themselves (Kibria et al., 2018). A male parent was considered the bread winner of the family. His earning was expected to be sufficient enough to support the family. The educated had access to good and timely quality health care. Those who lived below the poverty line did not afford balanced meals for good health and had poor sanitary conditions that predisposed infants to infections. Some infections could arise from lack of use of sterile material to clean the umbilical cord or use of herbal medication in order to allow the umbilical stump heal quickly.

The main causes of neonatal mortality were explained as follows:

2.2.1 Neonatal factors

Prematurity is when a baby is born alive before the 37 weeks of pregnancy are completed classified as extremely preterm (less than 28 weeks), very preterm (28 to 32 weeks), moderate to late preterm (32 to 37 weeks) (WHO, 2018). The WHO (2018) reported that preterm complications contributed to deaths among children under five years and approximately 1 million deaths occurred in 2015. The report further went on to state that about 15 million babies were born too early each year. Those that survived ended up with a life time disability that could have affected their ability to see or hear. Worldwide, prematurity is a leading cause of death under the age of 5 years. Some of the

causes of preterm births included infections, maternal conditions such as diabetes and hypertension, genetics and multiple pregnancies among others.

In Kenya, a study that was conducted by Olack et al., (2021) on causes of preterm and low birth weight neonatal mortality in a rural community in Kenya: evidence from verbal and social autopsy; findings were that neonatal mortality occurred due to prematurity among neonatal sepsis, hypothermia and asphyxia neonatorum. The study concluded that prematurity and low birth weight contributed greatly to neonatal mortality. Recommendations were made to enhance implementation of existing facility-based intra-partum and postnatal care interventions that could aim at addressing asphyxia, hypothermia, sepsis, respiratory distress syndrome. In addition, this study did not report information on the neonatal mortality that occurred at home, therefore the findings could not be generalized to the entire population.

In a similar study, Muhe et al., (2019), prematurity was identified to be a leading cause of neonatal mortality and that 47% of all deaths occurred in children under five years globally. In order to reduce neonatal mortality, it was important to understand the causes and factors that contributed to neonatal mortality. Contributors to neonatal mortality in this study were found to be prematurity, respiratory distress syndrome, sepsis and meningitis among others. The study recommended that interventions to treat these conditions needed to be scaled up and that further research was needed in order to develop effective and affordable interventions to avert preventable deaths (WHO, 2022).

Asphyxia Neonatorum: Globally, birth asphyxia accounted for one million neonatal deaths per year reports WHO,l (2020). In the same study, high numbers of neonatal deaths occurred in low resource settings and that Asphyxia Neonatorum occurred when a newborn failed to initiate or sustain respirations at birth. Asphyxia can occur as a result of a compromise in placental blood flow and the infant redistributes cardiac output to protect vital organs such as the brain, heart, kidney and the skin. Hypoxaemia and pulmonary vasoconstriction contribute to this response (Moshiro et al., 2019). The findings of this study were that most of the neonates that died had a normal fetal heart during labour. The recommendations were that health workers needed to identify

a severely academic state in the newborn which could have helped to differentiate a truly asphyxiated baby that may result in mortality.

In Brazil, Kawakami et al., (2021) reported that decreasing neonatal mortality in middle-income countries continued to be a challenge and that birth asphyxia was a significant contributor to these deaths. In the same study, birth asphyxia occurred as a result of intrauterine hypoxia or aspiration of meconium. Other factors that contributed to neonatal deaths were prematurity and congenital malformations. Brazil's neonatal mortality dropped from 1.38% in 2004 to 0.95% in 2013. In addition, the reduction started in 2008 for neonates with 32-41 weeks, in 2009 for 28-31 and in 2011 for 22-27 weeks (Kawakami et al., 2021). In the same study, it was concluded that although there was a reduction in neonatal mortality due to perinatal asphyxia for 10 years in Sao Paulo state of Brazil, factors that were associated with neonatal deaths highlighted the need to improve quality of care through implementation of public health policies.

In another study that was conducted by Mekasha et al., (2020) on factors associated with neonatal mortality, 15 million babies were born preterm each year, 1 million died of preterm birth and other related complications. Neonatal mortality had declined in Ethiopia by 1.9% per year for 1995 to 2010 though this decline was slow. Africa and Asia continued to record high preterm births at 85% because the health care systems were weak and access to health services was limited (WHO., 2020). Most of the preterm infants died of neonatal infections thus contributing to high mortality rates.

Mekasha et al., (2020) observed that many studies had been conducted to address the risk factors for preterm infant deaths, however, the findings were varied such that in Trinidad and Tobago; birth weight, length of time on the ventilator and obstetric complications were closely related to neonatal mortality. In China; the shorter gestation, lower birth weight and lower income influenced neonatal mortality. In Iran; low gestational age, low birth weight, low Apgar scores, need for intensive supports and history of disease in the mother predicted the occurrence of death in premature infants. In East Africa; moderately preterm babies were at an increased chance of dying as they were also small for gestational age. Ethiopia, perinatal asphyxia, sepsis, jaundice, low gestational age, respiratory distress syndrome (RDS) and hypothermia were factors that were associated with neonatal mortality.

In this regard, it could be noted that factors that are associated with neonatal mortality vary from place to place. The variation could be due to the difference in the income of a particular country and the type of hospital where an infant was receiving treatment from (Mekashi et al., 2020). Also what was notable from this study was that risk factors for neonatal death were easily preventable such as neonatal feeding problems and lack of appropriate Antenatal care (ANC). Maternal and neonatal factors needed to be addressed to decrease the high rate of preterm death. It was therefore, relevant to study the prevalence and factors that were associated with neonatal mortality in Zambia as it had unique socio-economic and cultural factors.

Neonatal sepsis is common and often lead to mortality (Fleischmann et al., 2021). The incidence of neonatal sepsis was unknown in most countries. The Global Burden of Disease (GBD) estimated that 1.3 million annual cases of neonatal sepsis and 203, 000 were linked to sepsis (Rent,2000-2019). Significant causes of neonatal mortality included neonatal infection and sepsis were not captured in the GBD. In this study, it was observed that some data from different countries were lacking, prompting further epidemiological research that would guide the interventions to reduce neonatal mortality.

There was need to standardize the diagnostic criteria for neonatal sepsis that could be applicable in all resource settings and in all preterm infants. A lot needed to be done to prevent neonatal infections and subsequently the evolution of sepsis complications. The WHO recommended key prevention measures such as improved early recognition, appropriate treatment and recommendations for essential newborn care that included exclusive breastfeeding, skin to skin contact with the mother from birth and use of antibiotic treatment for neonates with severe infection. In the community, families were to be educated on recognition of sepsis by a trained health worker. Fleischmann et al (2021) reported that numerous studies reported the incidence of neonatal sepsis by excluding diseased infants outside the hospital setting. The findings from this study could not be generalized as data inputs were from 14 countries only.

In a study that was conducted by Liang et al (2018), 6 million annual deaths of under five children comprised of neonatal and infant deaths. Most of these deaths occurred in low and middle income countries and they could have been prevented. In this study, risk factors for neonatal mortality

varied according to the study population. Significant factors to neonatal mortality were; prematurity, low birth weight and young age of the mother. It was concluded that risk factors for mortality varied. The data collected could be a starting point for development of individualized predictive models for in hospital and post discharge and to develop interventions to improve neonatal outcomes. It was worth noting that targeted, evidence based interventions had the potential to reduce the burden of preventable mortality among neonates.

In the Democratic Republic of Congo (DRC), a study that was conducted by Nyenga et al (2021), showed that the incidence of Neonatal Sepsis varied from 1 to 170 per 1,000 live births. In Lubumbashi, the incidence was 31.39% and it still remained a significant cause of neonatal death. Sepsis remained a common concern despite significant advances in diagnosis, therapeutic and prevention strategies in low-resource countries. In the same study, it was found that most of the cases of Neonatal Sepsis occurred in the male newborn, those with low birth weight and those born through the spontaneous vaginal route. Additionally, the study revealed that neonatal mortality was a reliable criterion for assessing overall progress of perinatal care.

Congenital Birth Defects: According to WHO (2020), 240,000 newborns died worldwide in the first 28 days of life and these defects caused death in over 170,000 children between the ages of 1 month and 5 years. These defects could have a long term effect on the individual, families, health care systems and societies at large. The most common birth defects were heart defects, neural tube defects and Down syndrome. Some of these defects could have been prevented through vaccinations, adequate folic acid or iodine through fortification of foods that were locally available as well as adequate care of pregnant women during antenatal. Birth defects are also known as congenital abnormalities, congenital disorders or congenital malformations. Birth defects could be classified as structural or functional anomalies that occur during intrauterine life that could have been identified antenatally, at birth and during infancy (Weddih et al., 2019). The WHO (2022) further reported that defects would have occurred as a result of genetic abnormalities, for example, Down syndrome or trisomy 21and single gene abnormalities such as cystic fibrosis. Parents who were related by blood (consanguinity) had an increased chance of having rare genetic birth defects that could ultimately lead to childhood death and intellectual anomalies among others.

According to the WHO (2022), factors that increased the risk of birth defects included socioeconomic and demographic, environmental and unknown causes. These defects could subsequently contribute to neonatal mortality. The socioeconomic factors were low income due to possible lack of nutritious foods by pregnant women, exposure to alcohol and infection. Advanced maternal age increased the risk of chromosomal abnormalities such as Down syndrome, environmental factors such as maternal infections (syphilis and rubella), exposure to radiation, certain pollutants, maternal nutritional deficiencies of iodine and folate would have increased the risk of birth defects. Unknown causes of birth defects may lead to congenital heart defects, cleft lip and clubfoot among others.

In a study that was conducted by Adane et al., (2020) to determine the prevalence of birth defects and the associated factors in sub-Saharan Africa, birth defects were the most serious causes of infant mortality and disability. In the same study, the Southern African Region was stated to have the highest prevalence of 43 per 1,000 with the musculo-skeletal system accounting for most of them while the least was Down syndrome (Adane et al., 2020). Other birth defects that were prevalent were lack of folic acid supplementation, presence of chronic disease and intake of drugs by pregnant women that could be teratogenic.

In Africa, Eliyu (2019) reported that annually an estimate of 7.9 million children were born with serious birth defects that were genetic in origin. Over 1 million were born with serious birth defects of post conception origin including those that resulted from maternal exposure to environmental agents that could be teratogenic such as alcohol, rubella, and syphilis and iodine deficiency. Therefore, an estimated 9 million infants (7%) of births were born with birth defects annually where the anomaly would kill them or they would live with a long life disability.

Further, in the same study, multiple factors that influenced the health of the pregnancy were identified as poverty, ignorance, superstitious beliefs, bad cultural practices and poorly developed infrastructure. Sub-Saharan Africa had the lowest contraceptive prevalence of 13% and unmet needs for family planning at 28%. Infections, infestations, lack of immunization against diseases and exposure to harmful substances increased the risk of fetal anomalies (WHO, 2020) which could lead to neonatal mortality. Eliyu (2019) recommended that pooling of resources was required

to create referral hospitals to provide one stop shop for care and management of fetal congenital anomalies. All stakeholders that included the governments, communities, professional societies and non-governmental organizations needed to be involved to develop strategies that could be employed to prevent birth defects.

2.3 Summary

Multiple factors were identified to have contributed to neonatal mortality and they varied from country to country. These needed to be addressed individually by training health care providers on how to identify them appropriately. Many studies have been conducted on the factors that were associated with neonatal mortality but the decline in neonatal mortality had been slow. Few studies have reported how prenatal care could be intensified. Inadequate infrastructure, limited human resource, delays in identification and referral of high risk neonates continue to yield poor neonatal outcomes. Therefore, it was imperative to conduct research to determine the prevalence and factors that were associated with neonatal mortality at Ndola Teaching Hospital.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This Chapter discusses the steps, procedures and strategies for gathering and analysis of data. The research methodology include research design, study setting and population, sample selection, data collection tools and analysis of data, validity and reliability of tools for data collection, pilot study, data analysis, presentation of findings and ethical considerations (Park et al, 2020).

3.1 Research Paradigm

A research paradigm is a set of beliefs that guide action. It can also be called epistemologies, entomologies or broadly conceived research methodologies (Creswell, 2009). Paradigms are world views about the general orientation about the world and the nature of the research that the researcher holds. It is shaped by the discipline area of the student, beliefs of advisers and the faculty in a student's area and also includes past experiences. The importance of a paradigm is to substantiate the quality of findings that support scientific studies, identify gaps in generating sound evidence (Park et al, 2020). A paradigm holds four (4) different world views namely: Post positivism, constructivism, advocacy/participatory and pragmatism. The goal of post positive paradigm is to generate explanatory associations or causal relationships that ultimately lead to prediction and control of the phenomena in question (Creswell, 2009).

In this study, the researcher adopted the Post positivistic views that is based on the following assumptions: determination, reductionism, empirical observation and measurement and theory verification. The researcher conducted a study on the prevalence and factors that are associated with neonatal mortality at Ndola Teaching Hospital. The assumptions for the post positivism are derived from quantitative research. It is sometimes called the scientific method or science research, positivist/post positivist, empirical science and post positivism. It is referred to as post positivism because it represents positive thinking. Park et al.,2020 reports that the assumptions for this paradigm is one of deterministic philosophy in which causes probably determine effects and outcomes and the need to identify and assess the causes that influence outcomes. The other assumption is the reductionist in which the intention is to reduce the ideas into small discrete set

of ideas to test variables that comprise of hypotheses and research questions. The knowledge in the post positivism is based on careful observation and measurement of the objective reality that exists out there in the world. It begins with a theory, collecting data that either supports or refutes theory creating room for necessary revisions.

Further, the foundations of the post positive paradigm include:

Ontology; nature of reality. The assumption is that tangible reality exists and can be understood, identified and measured. This allows explanation and prediction of a causal framework that can operate naturally (Park et al, 2020).

Epistemology; nature of knowledge. The assumption is that knowledge must be developed objectively, without values of the researchers and participants influencing the development of knowledge when appropriately generated (Park et al, 2020).

Axiology-values of research process; The assumption is that subjective experiences and values of research participants and researchers are seen as unimportant to the positivist. The researcher is expected to be objective and should not interact with participants during data collection. In this study, the researcher collected data from the case notes of the neonatal mortalities.

Methodology-How to conduct scientific research; Post positivistic view emphasizes engaging in research setting where variables can be controlled and manipulated. The focus is to examine the explanatory or causal relationship between variables in a study. The findings of the research are used to confirm, refine theories or review hypotheses.

Rigor-criteria for evaluating quality of research. The goal is to isolate and control the influence of factors so that key variables of interest are studied. Further interest is on internal validity through history that is events that take place during research that can influence the research results, the instrument that is used, statistical regression and participant attrition among others (Park et al ,2020).

3.2 Research design

A quantitative descriptive design was used. The researcher used this study design to determine the prevalence and factors that were associated with neonatal mortality. This study design allowed the

researcher to study data in retrospective that gave a wide view of the problem of neonatal mortality at Ndola Teaching Hospital. The researcher conducted a retrospective study at Ndola Teaching Hospital in Neonatal Intensive Care Unit (NICU). Data was retrieved for the period 1st January to 31st December 2021 from the NICU's admission registers, discharge registers, neonatal mortality summary sheets and annual reports. The information that was retrieved included the following details: date of admission, date of death, year of admission, duration of stay in NICU, sex, age at presentation, age of death, mode of delivery, weight at birth, gestational age at birth and the final diagnosis. This information was entered in Statistical Package for Social Sciences (SPSS). Thereafter, meanings were drawn, and conclusions were made that showed links between the dependent variable; neonatal mortality and the independent variables such as prematurity, sepsis and asphyxia among others.

3.3 Research setting

The study was conducted at Ndola Teaching Hospital (NTH), Ndola District, Zambia. Ndola Teaching Hospital is the second largest tertiary hospital after the University Teaching Hospital (UTH). Ndola Teaching Hospital provides services such as internal medicine, general surgery, obstetrics and gynaecology, ear, nose and throat, eye, dental and psychiatry care services. The hospital is the main centre for clinical teaching of medical students from the Copper-belt University (CBU) and Nursing students from public and private nursing schools. The Neonatal Intensive Care Unit (NICU) has 4 working incubators 2 resuscitation machines, with 2 Kangaroo rooms that have 6 beds. The NICU is staffed by 2 consultant pediatricians, 2 registrars, 7 paediatric nurses and 4 Registered nurses and 1 critical care nurse. Sick neonates are also referred from the rural and urban clinics who require advanced medical care in form of ventilatory support.

3.4 Study population

In this study, study population referred to all the case records of neonatal admissions that occurred at Ndola Teaching Hospital from January to December 2021. The target population in this study were all neonatal admissions from January to December 2021 in Neonatal Intensive Care Unit (NICU) at Ndola Teaching Hospital.

3.5 Sampling

Simple random sampling method(lottery) was used to select the case records that were available to ensure representativeness. This method relied on data that was selected by those who provided it, in this case the nurses and the medical records clerks that handle case notes for the patients. The researcher worked with the clerks and nurses to identify case notes of the neonatal mortalities. The case notes were retrieved from the medical records department which comprised 3,346 admissions, including 251 deaths. A lottery method was used where each neonatal case record was assigned a unique number, papers were folded and later picked. The papers where then picked until the desired sample size was achieved, ensuring that each newborn had an equal chance of being included in the case group.

3.5.1 Inclusion criteria

This specified the characteristics of the population. The researcher included all the case notes of neonatal admissions that were delivered after 28 weeks of gestation from January to December, 2021. According to World Health Organization (WHO), a fetus is viable by 28 weeks of gestation.

3.5.1 Exclusion criteria

The case notes that had inadequate or incomplete information such as missing diagnosis, those out of the study time and all unregistered mortalities were excluded from the study.

3.6 Sample Size

In this study, case notes of neonatal admissions from January 2021 to December, 2021 made up the sample size.

The sample size was calculated using the Krejcie and Morgan (1970) formula for the final population as follows:

$n=Z2N\ P\ (1-P)/d2\ (N-1) + Z2\ P\ (1-P)$

P=the prevalence, in this study the prevalence 50% is expressed as 0.5 in decimals.

Z=1.96 is the standard normal variate at 95% confidence level

d=±5%=±0.05 is the degree of accuracy (5%), expressed as a proportion (0.05); It is the standard of error

N=Population size

n=Z2 N P (1-P)/ d2 (N-1) + Z2 P (1-P)

n=1.96x1.96x251x0.5 (1-0.5)/0.05x0.05 (251-1) +1.96x1.96x0.5 (1-0.5)

=3.8416x251x0.5x0.5/1.5854

=241.0604/1.5854

=152

Adjusting for 10% dropouts and to increase the power of the sample:

152/0.90=168.8

Therefore, the sample size of the case notes that was reviewed was 169.

Sample size calculation for prevalence

$$N=\frac{\left[(\square_1-\square/_2)^2\square(1-\square)\right]}{\square^2}$$

In Zambia, Neonatal mortality stands at 24.6% (World Bank, 2021)

P= prevalence of the event in the study group 24.6 %

d= expected absolute allowable error 10%

z = 1.96

$$=\frac{\left[(1.96)^2 0.246\ (0.754)\right]}{0.10^2}$$

= 71

The single proportion to study prevalence was 71 neonatal deaths.

The sample size for the proportion of association that was reviewed was 169 as this was a bigger sample.

3.7 Data collection

Data collection was done by the researcher from 1st June to 31st August, 2023. This was after obtaining ethical clearance and permission from relevant authorities.

3.7.1 Data collection tool

In this study, the researcher used a questionnaire (Appendix I) as a data collection tool. This tool was used to extract data from the case notes in order to identify factors contributing to neonatal mortalities at Ndola Teaching Hospital. A questionnaire is useful for quick identification of errors that may affect patient care, guides decision making and focuses on a wide range of issues. In this study, a questionnaire was used to identify factors that could have contributed to neonatal mortalities at Ndola Teaching Hospital. The questionnaire comprised of four sections. Section A had questions on demographic data of the mother and neonates; Section B had questions on maternal health related conditions; Section C had questions on Fetal health conditions; Section D had questions on causes of neonatal mortality.

3.7.2 Data collection procedure

The researcher started by introducing herself and the purpose of the study to research assistants. The hospital registers were accessed to retrieve information on the admission of neonates and mortality summary sheets were also accessed. The researcher worked with the clerk and the nurse in charge to retrieve case notes for the neonatal mortalities under study. A structured questionnaire was used collect data (Appendix I). The researcher spent about 15 minutes on each case note to extract data and move to the next. The researcher with research assistants collected case notes from the storeroom, checked them for completeness. The case notes that had complete information were numbered and data was then extracted and entered on the questionnaire. Those case notes that had inadequate information were not numbered and no information was obtained from them.

3.8 Validity of the Study

Validity was maintained by reviewing literature extensively on the variables of interest. To ensure validity of the instrument in this study, questions were specific, simple and brief. The staff who used the questionnaire were oriented on the use of the tool to avoid frustration, disinterest and subsequent abandonment of the task. The data collectors were supervised and data collected were checked for completeness. The questionnaire was also pretested. The researcher consulted current sources of literature and experts on the topic.

3.8.1 Reliability of the Study

In this study the researcher ensured reliability by standardizing the measurement. The research tool was tested before the main study was conducted using a pilot study in an environment with similar characteristics as the environment in which the main study was conducted. This was done to ensure stability of the data collection tool. The instrument was able to bring out the accurate information whereby if the same instrument were to be used after some time, it would produce the same responses. Inaccuracies in the instrument were corrected where necessary in order to eliminate biases and minimize errors during data collection. The Cronbach's alpha was used to ensure reliability as it measured the hidden unobservable variables. It ranges between 0 to 1. The higher the score, the more reliable the tool is. Cronbach's alpha was calculated at 0.77344 indicating the reliability of the data collection tool. It also tested how closely related neonatal mortality was to the factors that were associated with neonatal mortality such as prematurity, asphyxia neonatorum and sepsis among others.

3.9 Pilot study

A pilot study was conducted at another health institution with similar characteristics, in this case, Kitwe Teaching Hospital, on the Copper belt province of Zambia. The pilot study was conducted on 10% of the total sample size which was 16.9 rounded off to 17 case notes. After the pilot study, the questions in the questionnaire were checked for completeness and appropriateness. Some adjustments were made to the questionnaire. These include: removal of question five (5) which was focused on the number of neonatal mortalities that occurred from 2017 to 2021, question 13 was adjusted as follows: term of the neonate, preterm and very preterm, the temperature was adjusted as follows: below 35degrees Celsius, 35-36degrees Celsius, 36-37.2 degrees Celsius, 37.2-38 degrees Celsius and above. Following these adjustments, data was collected from the research setting, Ndola Teaching Hospital-Neonatal Intensive Care Unit (NICU).

3.10 Ethical Considerations

A waiver of consent to conduct the study was obtained from the University of Zambia Biomedical Research Ethics Committee (UNZABREC) approval number 3785/2023, the National Health

Research Authority (Appendix III) and Ndola Teaching Hospital (see Appendix III). All the data collectors were informed as soon as permission to handle the patients' case notes was granted. They were required to adhere to the rules and regulations of the institution concerning handling of patients' case notes. Since data was collected from the patient's case notes, there was no need for written consent to the participants. Confidentiality of data was observed by limiting the data to the researcher and research assistants, avoiding unauthorized access to the data by persons who were not part of the data collection process and case notes were kept under lock and key in the clerks office. The questionnaires were anonymous as no names were entered on them and only case note numbers were used.

CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.0. Introduction

This chapter outlines the analysis of data and presentation of research findings aimed at establishing the prevalence of neonatal mortality and determining factors associated with neonatal mortality at Ndola Teaching Hospital (NTH) in Ndola, Zambia. Data were collected from a sample of 169 mothers and neonates, representing a 100% response rate.

4.1. Data processing and presentation

4.1.1 Analysis

The data collected were checked for completeness and consistency, and then responses were coded appropriately according to the variables, indicators, and cut-off points set in Table 1.2. The raw data was exported into SPSS version 26.0 for processing and analysis. Variables were summarized using frequencies and percentages. To estimate the prevalence of neonatal mortality, the total number of neonates who died was divided by the total sample size. Other variables of interest were measured as indicated in Table 1.2.

Appropriate statistical tests (chi-squared and Fisher's exact test) were adopted in testing for associations between variables. Univariable and multivariable binary logistic regression analysis were employed in identifying the factors associated with neonatal mortality using an investigator-led backward-stepwise approach, guided by various fit statistics, such as AIC, BIC, and the likelihood ratio test. All statistical analyses adopted a 5% significance level cut-off. Thus, only test results with p-values < 0.05 were regarded as significant.

Study findings were presented using tables and charts and outlined according to the sections and sequence in the data collection tool

4.2. Findings

4.2.1. Demographic characteristics

This section focuses on demographic characteristics of mothers and neonates which include maternal age, maternal residence, age of neonate and sex of neonate.

Table 3: Maternal and neonatal demographic characteristics (n=169)

Variable	Category	Frequency (n)	Percent (%)
Maternal age group	15 – 19 years	22	13.0
	20 – 24 years	51	30.2
	25 – 29 years	40	23.7
	30 – 34 years	36	21.3
	Over 35 years	20	11.8
Maternal residence	Rural	24	14.2
	Urban	145	85.8
Age of neonate	Less than 7 days	169	100.0
Sex of neonate	Female	52	30.8
	Male	117	69.2

Table 3 shows that most of the mothers who participated in this study were in the 20 – 24 age groups (31.8%, 51) and 25 – 39 age groups (23.7%, 40), and 85.8% (145) resided in urban areas. All the neonates were less than 7 days old, and 69.23% (117) were male.

4.2.3. Clinical characteristics

This section highlights the maternal and neonatal clinical characteristics which include multiple pregnancies, number of pregnancies, antenatal attendance, mode of delivery, place of delivery, presence of maternal chronic illness. Neonatal clinical characteristics focused on HIV exposure, birth weight, gestation age and resuscitation at birth.

Table 4a: Maternal clinical characteristics (n=169)

Variable	Category	Frequency (n)	Percent (%)
Multiple pregnancies	Yes	03	1.8
	No	166	98.2
Number of Pregnancies	1 – 2	96	56.8
	2 – 4	54	31.9
	5 – 6	19	11.2
Antenatal care attendance	Yes	167	98.8
	No	02	1.2
Mode of Delivery	Spontaneous	44	26.0
	Assisted	16	9.5
	Caesarean	109	64.5
Place of Delivery	Facility	169	100.0
Presence of chronic Illness	Yes	40	23.7
	No	129	76.3

Table 4a shows maternal clinical characteristics. The data in the table indicate that most mothers, 98.2% (166), had singleton pregnancies, while 1.8% (3) had multiple pregnancies. About 57% (96)

had 1 to 2 previous pregnancies, and almost all the mothers, 98.8% (166), attended antenatal care during their last pregnancy. Further, the data shows that all the mothers, 100% (169) delivered from the health facility, and 23.7% (40) had a chronic illness.

Table 4b: Neonatal clinical characteristics (n=169)

Variable	Category	Frequency (n)	Percent (%)
HIV exposure	Exposed	39	23.1
	Unexposed	128	75.8
	No information	02	1.2
Weight at birth	Less than 2.5kg	39	23.1
	Greater than 2.5kg	130	76.9
Gestation at birth	Less than 37 weeks	74	43.8
	Greater than 37 weeks	95	56.2
Resuscitated at birth	Yes	61	36.1
	No	108	63.9
Length of hospital stay	Less than 7 days	128	75.7
	Greater than or equal to 7 days	41	24.3
Temperature on admission	35 and below	137	81.1
	35 – 36	11	6.5
	36 – 37.2	11	6.5
	37.2 – 38	10	5.9

Table 4b shows that most of the neonates, 75.8% (128) were not exposed to HIV, and the birth weight of most neonates, 76.9% (130) was above 2.5kg. More than half, 63.9% (108) of the neonates did not require resuscitation at birth, while 36.1% (61) were resuscitated. Further, the data shows that 75.7% (128) of the neonates stayed in the hospital for less than 7 days, while 24.3% (41) were admitted for more than 7 days. Additionally, the body temperature of most neonates, 81.1% (137) was below 35^0C on admission.

4.3. Prevalence of neonatal mortality

This section presents findings on prevalence of neonatal mortality.

Table 5 Prevalence of Neonatal Mortality (n = 169)

Variable	Category	Frequency (n)	Percentage (%)
Neonatal mortality	Survived	154	91.1
	Died	15	8.9
Documented Cause of mortality	Prematurity	3	1.8
	Very low birth weight	1	0.6
	Low birth weight	2	1.2
	Sepsis	4	2.4
	Birth asphyxia	3	1.8
	Respiratory distress syndrome	2	1.2

Table 5 shows that the estimated prevalence of neonatal mortality at NTH is around 8.9% (15), with a majority of neonates, 91.1% (154) showing survival. Most neonates, 91.12% (154) at Ndola Teaching Hospital (NHT), die from other known diseases.

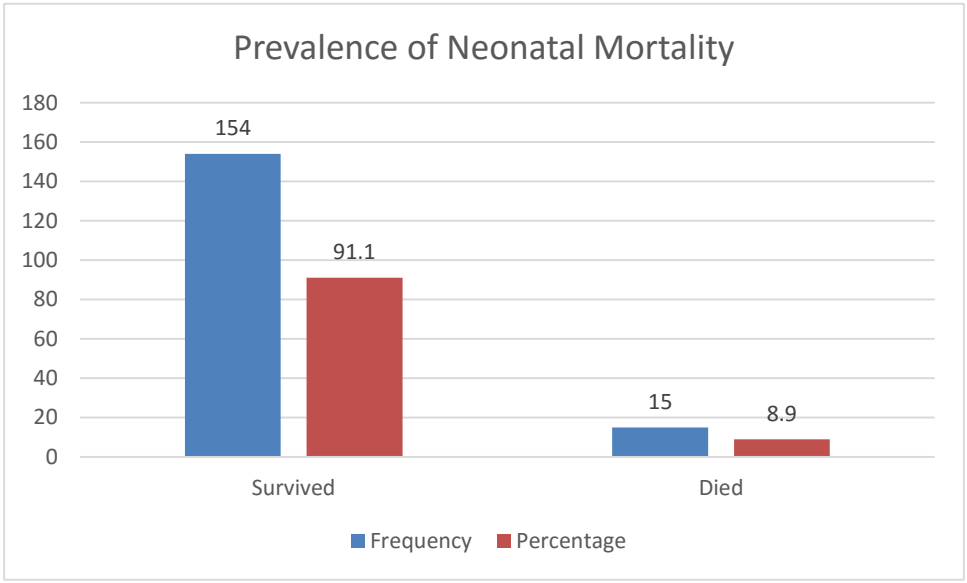

Figure 2: Prevalence of neonatal mortality (n=169)

As shown in Figure 2, 8.9% (15) neonates died whereas 91.1% (154) survived.

4.4. Factors associated with neonatal mortality

This section presents results from analysis of associations between the study's dependent variable and independent variables. Tests of association between neonatal mortality and maternal and neonatal characteristics were also conducted.

Table 6a: Association between neonatal mortality and maternal and neonatal characteristics

Variable	Category	Neonatal mortality		P-value
		Survived, N=154 n (%)	Died, N=15 n(%)	
Maternal age	14 – 19	21 (95.5)	1 (4.5)	**0.033**[FE]
	20 – 24	49 (96.1)	2 (3.9)	
	25 – 29	32 (80,0)	8 (20.0)	
	30 – 34	25 (97.2)	1 (2.8)	
	35 and above	17 (85.0)	3(15.0)	
Age of neonate	Median (IQR)	1 (1, 1)	3 (2, 3)	**<0.0001**
Sex of neonate	Female	48 (92.3)	4 (7.7)	0.486[FE]
	Male	106 (90.6)	11 (9.4)	
HIV exposure	Exposed	37 (94.9)	02 (5.1)	**0.007**[FE]
	Unexposed	117 (91.4)	11 (8.6)	
	No information	00 (0.0)	2 (100.0)	
Residence	Rural	22 (91.7)	2 (8.3)	0.639[FE]
	Urban	132 (91.0)	13 (9.0)	

Gestation at birth	< 37 weeks	60 (81.1)	14 (18.9)	**<0.0001[CH]**
	≥ 37 weeks	94 (98.9)	1 (1.1)	
Maturity of the neonate at birth	Very preterm	17 (89.5)	2 (10.5)	**<0.0001[FE]**
	Late preterm	42 (77.8)	12 (22.2)	
	Term	95 (99.0)	1 (1.0)	
Temperature on admission	≥ 35	2 (13.3)	13 (86.7)	**<0.0001[FE]**
	35 – 36	9 (81.8)	2 (18.2)	
	36 – 37.2	133 (100.0)	0 (0.0)	
	37.2 – 38	10 (100.0)	0 (0.0)	
Number of pregnancies	1 – 2	86 (89.6)	10 (10.4)	0.616[FE]
	3 – 4	51 (94. 4)	3 (5.6)	
	5 – 6	17 (89.5)	2 (10.5)	

FE*=Fisher's Exact Test,* ***CH****=Chi-Squared Test*

Table 6a shows that neonatal mortality was significantly associated with gestation age. 60 (81.1%) neonates were born less than 37 weeks gestation whereas 14 (18.9%) premature babies died. 15 neonates had temperature of less than 35 degrees celsius on admission, 13 (86.7%) died and only 2 (13.3%) survived.

Table 6b: Association between neonatal mortality and maternal and neonatal characteristics

Variable	Category	Neonatal mortality		P-value	
		Survived, N=154 n (%)	**Died, N=15 n (%)**		
Resuscitation at birth	Yes		50 (182.0)	11 (18.0)	**0.002**[CH]
	No		104 (96.3)	4 (3.7)	
Antenatal attendance	Yes		152 (91.0)	15 (9.0)	0.830[FE]
	No		2 (100.0)	0 (0.0)	
Multiple pregnancies	Yes		3 (100%)	0 (0.0)	0.755[FE]
	No		151 (91.0)	15 (9.0)	
Mode of delivery	Spontaneous		41 (93.2)	3 (6.8)	0.912[FE]
	Assisted		15 (93.8)	1 (6.3)	
	Caesarean		98 (89.9)	11(10.1)	
Presence of Chronic Illness	Yes		35 (87.5)	5 (12.5)	0.263[FE]
	No		119 (92.3)	10 (7.8)	
Weight at birth	< 2.5kg		33 (84.6)	6 (15.4)	0.099[FE]
	≥ 2.5kg	121 (93.1)	9 (6.9)		
Length of hospital stay	< 7 days	115 (89.8)	13 (10.2)	0.244[FE]	
	≥ 7 days	39 (95.1)	2 (4.9)		

***FE**=Fisher's Exact Test, **CH**=Chi-Squared Test*

Table 6b shows that resuscitation at birth (p=0.002) was significantly associated with neonatal mortality. However, the birth weight (p=0.099), ANC attendance (p=0.830), mode of delivery (0.912), multiple pregnancies (p=0.755), maternal history of chronic illness (p=0.263), and the length of hospital stay (p=0.244) were not associated with neonatal mortality.

4.5. Univariable and multivariable logistic regression analysis

This section presents results from univariable and multivariable logistic regression analysis results on factors associated with neonatal mortality.

Table 7: Univariable and multivariable logistic regression analysis results on factors associated with neonatal mortality at Ndola Teaching Hospital

Variables	Univariable analysis			Multivariable analysis		
	cOR	CI (95%)	p-value	aOR	CI (95%)	p-value
Age in days	4.58	2.25, 9.32	**< 0.0001**	12.33	2.75,55.19	0.001
Gestation age						
Less than 37 weeks	**Ref**			**Ref**		
Greater than 37 weeks	0.05	0.01, 0.36	0.003	0.02	0.00, 0.42	0.013
Resuscitation						
Yes	**Ref**			**Ref**		
No	0.17	0.01, 0.05	0.004	0.10	0.02, 0.70	0.020
Hospital of stay						
< 7 days	**Ref**			**Ref**		
≥ 7 days	0.45	0.31, 0.98	0.312	0.00003	1.09,0.08	0.010

***cOR**= Crude Odds Ratio, **aOR**= adjusted Odds Ratio, **CI**= Confidence Interval*

Results in Table 7 show that at both univariable and multivariable analysis, the age of babies in days, gestation, and resuscitation are significantly associated with neonatal mortality at Ndola Teaching Hospital. Adjusting for other variables, a day increase in the age of the neonate increased the odds of mortality by a factor of 12.3 (aOR=12.3, 95% CI=2.75, 55.19, P-value =0.001), and neonates who did not require any resuscitation had reduced odds of mortality (aOR=0.10, 95% CI=0.02, 0.70, p-value =0.020). Furthermore, having a gestation age of at least 37 weeks, reduced the odds of dying by a factor of 0.02 (aOR=0.02, 95% CI, 0.00, 0.42, p-value =0.013) compared to having a gestation less than 37 weeks, keeping other variables constant.

CHAPTER FIVE: DISCUSSION OF FINDINGS AND IMPLICATIONS ON THE HEALTH CARE SYSTEM

5.0 Introduction

The discussion of findings in this chapter is based on the results from the analysis of findings in a study which aimed to determine the prevalence and factors that are associated with neonatal mortality at Ndola Teaching Hospital of Copper-belt Province of Zambia in relation to other studies. The outline of the discussion consists of the characteristics of the sample and discussion of each variable. Finally, the implications of the findings on the health care system, conclusion, recommendations, strength and limitations of the study, utilization and dissemination of findings.

5.1 Characteristics of respondents

The main characteristics were maternal age group, maternal residence, age of neonate and sex of neonate. Table 4.1 shows that most of the mothers who participated in this study were in the 20 – 24 age groups who resided in urban areas. All the neonates were less than 7 days old, and were male. This is not a surprising finding as this age group is the child bearing age (Nyenga et al., 2021). This is similar to a study that was conducted by Hadgu et al (2020) titled Prevalence ans Factors associated with Neonatal Mortality at Ayder Comphrehensive Specialized Hospital, Northern Ethiopia-A cross Sectional Study revealed that most of the neonates that died were born from primi para mothers, 89.8 (1,603). This could be due to that first time mothers have inadequate knowledge and skills on how to care for the newborn babies (Hadgu et al., 2020). For instance, many of these mothers may not have enough knowledge on breast attachment and breast feeding among others. In addition primipara mothers might not have awareness about the importance of antenatal care follow up and postnatal period. Therefore, all mothers should have regular ANC follow-up and should get awareness about the importance of giving birth at the health facilities.

Miyoshi et al (2019) in a study titled Baby survival in Zambia: stillbirth and neonatal death in a local hospital setting reports nurses and midwives need to assess patient risk and conduct timely referral. Furthermore, nurses and midwives at hospitals need to accurately assess patient condition,

contact the obstetrician in a timely manner, and manage problems before obstetrician arrival in order to prevent these deaths.

The current study shows that most of the mothers had singleton pregnancies and majority of the mothers attended antenatal care during their last pregnancy. Further, the data shows that all the mothers, delivered from the health facility (Table 6a). In the present study, neonates born to para 2–4 were 36% at less odds of dying when compared to neonates born from primipara mothers (Table 4.2). The fact that all the mothers delivered from a health facility could be attributed to the policies by the Zambian Government as outlined in the 2018 maternal and neonatal guidelines (CSO, 2018) encourages that women should deliver from the health facility. The WHO (2022) also recommends women to deliver from the health facility for close monitoring by skilled health workers and subsequently curb maternal and neonatal mortality.

This study revealed that neonates who stayed less than seven days at NICU were 75.7% less likely to die compared to neonates who stayed for more than seven days (Table 4.3). This finding is in line with a study titled Predictors of Neonatal Mortality in a NICU referral Hospital in Southern Ethiopia: a retrospective cohort study that reported that neonates born with a temperature of 35.5 degrees celsius had 1.6 times higher risk of dying than those with temperature 35.5 to 37.5 degrees celsius (Orsido et al, 2019). In the same study, neonatal mortality was high in the first week of life. This can be explained because most neonatal deaths happen in the early neonatal periods (0–6 days of life) than in the late neonatal period of life of 7–28 days (WHO, 2022). Consequently, it was found that neonatal mortality was related to the hospital length of stay. Thus, health workers should pay due attention to neonates in the early neonatal period to reduce neonatal mortality in the health facilities. In this case neonates who are in a hypothermic state may be more prone to different infections compared to neonates with normal body temperature.

In this study neonates who were delivered by cesarean section had a higher chance of survival than neonates born spontaneously by vaginal route (Table 4.5b). This finding is in contrast with a study conducted at Pakistan, where delivery using C-section had increased risk of neonatal mortality (Hadgu et al, 2020).Therefore, neonates born through C-section had a high probability of survival than neonates delivered through the natural birth canal. Further, this result is in agreement with a study conducted in southern Ethiopia referral hospital NICU, where neonates delivered using C-

section had 66% less chance of risk of death compared to SVD (Orsido et al, 2019). This could be attributed to timely decision making rather than simply waiting for vaginal delivery, which may save the life of the neonate and the mother. Thus, delivering through C-section can reduce the risk of death by early identification and intervention of birth related complications such as prolonged labor. In Zambia, Mukosha et al (2021) reported that neonates who were born by caesarean section had high chances of survival compared to those born by the vaginal delivery who had increased hazards for mortality.

5.2 Prevalence of neonatal mortality

In this study, the prevalence of neonatal mortality was 8.9% (Table 4.4). However, the result of this study is higher than the prevalence of neonatal mortality reported in the Somali region, Ethiopia (5.7%) (Tadesse et al, 2021), a study done in Jimma zone, Southwest Ethiopia (3.2%) (Ezenwa et al, 2021), a study done in North Gondar, Northwest Ethiopia (4.4%) (Tadesse et al, 2021), and a study done in Ayder referral hospital, Mekelle (6.6%) (Hadgu et al, 2020). The prevalence of neonatal mortality in this study is lower than the findings in similar studies conducted in Gondar university teaching hospital, Northwest Ethiopia (14.3%) and Felege Hiwot referral hospital, Bahir Dar (13.3%). On the other hand, the prevalence of neonatal mortality in this study is lower compared to a study conducted in Gondar university teaching hospital (23.1%) (Hadgu et al, 2020). The differences could be explained by the existence of sociocultural and socio-economic differences across Ethiopian regions regarding health service utilization, differences in hospital set-ups (equipment available and skilled persons). Besides, there will be differences in awareness of the community upon utilization of available health services like delivery at health facilities, and visiting health facilities for sick neonates and children.

A study conducted in the Democratic Republic of Congo by Nyenga et al, 2021 titled Predictors of Mortality in neonatal sepsis in a resource limited setting revealed that the neonatal mortality was at 21%. This could be attributed to neonatal infections, intrapartum complications, premature delivery and asphyxia neonatorum among others. In Zambia Miyoshi et al (2019) reports that the second most frequent maternal condition associated with acute intrapartum events was complication of the placenta, cord, or membrane ($n = 8$, 38.1%). Of these, 6 cases (75.0%) had prolapsed cords, and 2 cases (25.0%) had nuchal cords.

5.3 Factors associated with neonatal mortality

In this study, the factors that were associated with neonatal mortality were maternal and neonatal respectively (Table 4.5a). The results further show that the mother's age (P=0.033) was significantly associated with neonatal mortality. The current study has revealed that most (72%) of the neonates were sero-negative for HIV and AIDs (Table 4.5a). This suggests that a significant portion of the neonates were not at risk of vertical transmission of the virus from their mothers. This may imply that efforts to prevent mother-to-child HIV transmission are relatively effective in the study area, which is important for neonatal health. A study conducted in Nigeria titled Trends and predictors of in-hospital mortality among babies with hypoxic ischaemic encephalopathy at a Tertiary hospital in Nigeria: A retrospective cohort study revealed that place of birth, level of prenatal care, the cause of asphyxia, gestational age, maternal age, maternal illness, socioeconomic status, availability of resources for neonatal care among others contributed to neonatal mortality (Ezenwa et al, 2021). Therefore, maternal illnesses could be significant contributors to neonatal mortality. In Zambia, Kamanga et al (2022) observed that improving maternal health would subsequently improve neonatal health and reduce mortality.

Majority of the mothers delivered preterm infants (Table 4.5b). Preterm birth is a significant risk factor for neonatal mortality, as premature infants often have underdeveloped organs and are more susceptible to various health complications. The findings are in agreement with the findings from a study that was conducted in Jordan by Sheyab et al, 2020 that neonatal mortality was associated with low birth weight and prematurity. This finding implies a need for further investigation into the causes of preterm births and measures to improve the care of preterm neonates. The finding of a significant association between the gestation age of the neonate and the cause of neonatal mortality suggests that the gestational age at which a baby is born is a critical factor influencing neonatal mortality. This indicates that preterm neonates (born before 37 weeks of gestation) may be at a higher risk of neonatal mortality, likely due to their underdeveloped organs and physiological systems. The study finding is similar to a study conducted in Kenya, by Olack et al., (2021) which revealed that neonatal mortality occurred due to prematurity among neonatal sepsis, hypothermia and asphyxia neonatorum. The study concluded that prematurity and low birth weight contributed greatly to neonatal mortality. Additionally, Muhe et al., (2019) reported similar

findings that prematurity was a leading cause of neonatal mortality and that 47% of all deaths occurred in children under five years globally.

About 56% of neonates were categorized as preterm is consistent with the high prevalence of preterm deliveries among the mothers. Preterm neonates are at increased risk of neonatal mortality due to their developmental immaturity (Table 4.5b). Research should focus on the specific causes of preterm births and the strategies in place to manage and support preterm infants. In this study, 33 (84.6%) of neonates had a birth weight of less than 2.5 kilograms. Birth weight is a critical indicator of a neonate's health and potential for survival. Adequate birth weight is associated with a lower risk of neonatal mortality. The study has shown positive association between a neonate's birth weight and the cause of neonatal mortality. Low birth weight neonates were at higher risk for a range of health complications, which lead to mortality. This finding suggests that low birth weight is a crucial determinant of neonatal health and survival.

The finding revealed that most (81.8%) of neonates had hypothermia on admission is of concern. Hypothermia can be a life-threatening condition for neonates. This implies that measures to maintain adequate temperature and warmth for neonates on admission may need improvement. There was an association between the neonate's temperature on admission and the cause of neonatal mortality suggests that hypothermia or extremely low body temperature in neonates upon admission is a significant risk factor for neonatal mortality. It highlights the critical importance of maintaining a stable body temperature in neonates, as hypothermia can lead to serious health complications.

A significant finding in this study was that most of the neonates required resuscitation ($p=0.002$) at birth. (Table 4.5b). Understanding the reasons for neonatal resuscitation and the effectiveness of the resuscitation efforts is crucial for improving neonatal outcomes. There was an association between resuscitation at birth and the cause of neonatal mortality indicates that neonates who require resuscitation are at a significantly higher risk of mortality. This implies that effective and timely resuscitation is critical in preventing neonatal deaths, highlighting the importance of skilled healthcare providers and proper equipment for neonatal care during and immediately after birth. Most (75.7%) neonates stayed less than 7 days before their demise suggests that a substantial proportion of neonates did not survive beyond the first week of life. Research should explore the specific causes of mortality during this critical period.

The findings revealed that 56.8% of the mothers had a gravidity between 1-2 implies that a significant portion of the mothers in this study were relatively new to the experience of childbirth. This may suggest that first-time or second-time mothers could benefit from additional support, education, and guidance during pregnancy and childbirth .It is gratifying to note that a large percentage (98.8%) of the mothers attended antenatal clinics during their pregnancies. Regular antenatal care is crucial for ensuring the health and well-being of both mothers and their neonates. The WHO has put antenatal care attendance as one of the strategies to reduce neonatal mortality (WHO, 2022). Masaba et al (2020) in a study titled Neonatal survival in subsahara: A Review of Kenya and South Africa reported that antenatal attendance of pregnant women is crucial to the identification of maternal complications that can impact on neonatal health. In this study, the high antenatal clinic attendance rate implies that access to antenatal care services is relatively good in the study area. Further, majority of mothers (98.2%) had single-tone pregnancies and this implies that most pregnancies were not complicated by the presence of multiple fetuses (Table 4.2). Single-tone pregnancies are generally considered lower-risk than multiple pregnancies. About 64% of mothers delivered through caesarean section. This highlights that a significant proportion of deliveries were complicated. This could indicate that a substantial number of mothers had high risk childbirth experiences.

The finding show that all (100%) the mothers delivered in an urban health facility. This finding is in contrast with the study that was conducted by Kibria el at, 2018 where most neonatal deaths occurred in rural areas. Delivering in a healthcare facility with skilled healthcare providers and proper medical equipment can significantly reduce the risk of neonatal mortality. The findings revealed that 76.3% of mothers did not suffer from any chronic illness suggests that most mothers were in good health. Chronic illnesses can complicate pregnancy and childbirth, so this is a positive finding that implies a relatively low prevalence of chronic health conditions among the study population.

5.4 Univariable and multivariable logistic regression analysis

Results in Table 4.6 show that at both univariable and multivariable analysis, the age of babies in days, gestation, and resuscitation are significantly associated with neonatal mortality at Ndola Teaching Hospital. Adjusting for other variables, a day increase in the age of the neonate increased

the odds of mortality by a factor of 12.3 (aOR=12.3, 95% CI=2.75, 55.19, P-value =0.001), and neonates who did not require any resuscitation had reduced odds of mortality (aOR=0.10, 95% CI=0.02, 0.70, p-value =0.020). Furthermore, having a gestation age of at least 37 weeks, reduced the odds of dying by a factor of 0.02 (aOR=0.02, 95% CI, 0.00, 0.42, p-value =0.013) compared to having a gestation less than 37 weeks, keeping other variables constant.

5.5 Causes of neonatal mortality

The finding revealed that 2.4% of neonates died due to sepsis (Table 4.4). This a significant and concerning revelation in the context of neonatal mortality. These findings are similar to the study by Kawakami et al., (2021) who reported that decreasing neonatal mortality in middle-income countries continued to be a challenge and that neonatal sepsis was a significant contributor to these deaths. In a study conducted by Milton et al (2022) in study titled Neonatal sepsis and mortality in low income and middle income countries from a facility based birth cohort -an International multiste prospective observational study reported that neonates who were born by caesarean section had an increased risk of neonatal sepsis due to long stay in hospital after birth. The finding raises questions about the quality of delivery and obstetric care provided at the hospital. In Zambia, guidelines for maternal and neonatal care are available that health workers are expected to refer to when managing neonates (ZDHS, 2018). Proper monitoring and timely interventions during childbirth are essential to prevent and manage neonatal sepsis. This finding suggest a need for improvements in obstetric and neonatal care practices.

In this study, Birth asphyxia (1.8%), prematurity (1.8%), neonatal sepsis (2.4%), low birth weight (1.2%) and respiratory distress syndrome (1.2%) were the major causes of neonatal mortality. This finding is similar to a study conducted in Mizan Tepi university teaching hospital that revealed prematurity (31%), neonatal sepsis (29.7%), low birth weight (15.3%) and birth asphyxia (7.7%) as the leading causes of death (Tadesse et al, 2021). Majority of neonatal deaths in developing countries are due to conditions of labor, intrapartum and the immediate newborn care practices. From this finding, it can be deduced that neonatal survival interventions are not targeting the intrapartum as well as immediate and early neonatal periods, and as a direct result, neonatal mortality has not declined in the needed manner.

This study revealed that neonates who were admitted because of birth asphyxia had a higher chance of death compared to those who were not asphyxiated at all. This finding is consistent with a study conducted in southern Ethiopia referral hospitals (Orsido et al, 2019), which found that neonates with birth asphyxia had 2 times higher risk of death than their counterparts. This may be due to the fact that besides commencement of adequate efforts after admission, neonates with respiratory problems like birth asphyxia had a greater risk for a poor prognosis and death compared to neonates admitted with other medical problems. Therefore, neonates with a respiratory distress have higher chance of death when compared to those who do not experience any respiratory distress.

Masaba et al (2020) further reports that systemic infections of the newborn such as septicaemia accounts for one-third of neonatal deaths worldwide. These infections include septicaemia, meningitis, pneumonia, arthritis, osteomyelitis and urinary tract infections among others. In the same study, sepsis was attributed to cause approximately 400,000 neonatal deaths in 2015 globally, half of which occurred in sub-Saharan Africa where 34.6% to 66.0% of neonatal deaths reportedly occur within the first 24 hours of life (Masaba et al, 2020).

In another study conducted by Santiago et al (2019) titled Analysis of neonatal risk factors in Brazil: a systematic review and meta-analysis of observational studies revealed the significant factors that contributed to neonatal mortality as absence of partner, maternal age ≥35 years, male gender, multiple gestation, inadequate and absent prenatal care, presence of complications during pregnancy, congenital malformation in the assessed pregnancy, Apgar score < 7 at the fifth minute, low and very low birth weight, gestational age ≤ 37 weeks, and caesarean delivery (Santiago et al, 2019). These findings are in agreement with the study that was conducted in Zambia which revealed that most of the neonates died due to acute intrapartum events (n = 21; 84.0%) or malformations, deformations, or chromosomal abnormalities (n = 4; 16.0%). Neonatal deaths were related primarily to complications from intrapartum events (n = 19; 44.2%); low birth weight or prematurity (n = 16; 37.2%); or infection (n = 3; 7.0%) and fetal unspecified causes (Miyoshi et al, 2019).

5.6 Association between variables

The independent variables for this study included age of the neonate, gestation age, temperature on admission, prematurity, Birth Asphyxia, Low birth weight, Very low birth weight, sepsis, hypoxic ischaemic encephalopathy and congenital anomalies. Maternal variables included maternal age, maternal residence, parity, number of pregnancies, antenatal attendance, mode of delivery, place of delivery and presence of chronic illness whereas the dependent variable was neonatal mortality. As indicated in Table 4.5a the findings revealed a significant association between age of the neonate, gestation at birth and temperature of the neonate on admission with the cause of neonatal mortality. Neonates who were born preterm or very preterm were more likely associated with one of the causes of neonatal mortality. Table 4.5a shows that neonatal mortality was significantly associated with the age of the neonate ($p<0.0001$), term of the baby, ($p<0.0001$), gestation ($p < 0.0001$), the temperature of the baby ($p <0.0001$) and HIV status ($P =0.0007$). The table further shows that the mother's age ($P=0.033$) was significantly associated with neonatal mortality.

5.7 Application of conceptual framework to research findings

This study was based on the premise that factors can influence one another. The conceptual framework that guided this study was Mosley and Chen 1984 who studied how factors influence one another. In tandem with this conceptual framework, neonatal mortality was affected by multiple factors such as: Maternal, Antenatal, Intra-partum, Household and socioeconomic. The infant's characteristics that included sex, weight, age at admission, and resuscitation at birth, temperature and duration of stay in NICU influenced neonatal mortality at Ndola Teaching Hospital. In this study, neonatal mortality was influenced by multiple factors such as maternal, neonatal and socio-economic.

According to World Health Organization (WHO), 2022 it was recommended that Low birth weight and preterm babies required increased attention to keep warm, assistance with initiation of breastfeeding and extra attention to identify danger signs; Sick newborns: Identify danger signs as soon as possible and give appropriate health care service. If the baby was sick at home, the family needed help to transport the baby to the hospital or health facility for care; Newborns of Human

Immune Deficiency Virus (HIV) infected mothers: preventive antiretroviral treatment (ART) for the mother and newborn, counseling and support to mothers for infant feeding among others.

5.8 Implications of findings on the health care system

5.8.1 Nursing and Midwifery Education

The results of this study indicate that Neonatal mortality at Ndola Teaching Hospital (NTH) was 8.9%. There was a significant association between temperature of the neonate on admission and neonatal resuscitation at birth and neonatal mortality. Given the significant association between the need for neonatal resuscitation at birth and neonatal mortality, nursing and midwifery education programs should strengthen comprehensive neonatal resuscitation in the nursing and midwifery curricula. This includes not only the technical skills but also the ability to recognize signs of neonatal distress such as the inability of the neonate to initiate and sustain respirations at birth. The resuscitation that was done at birth could have been done wrongly or late for neonates to die.

5.8.2 Nursing and Midwifery Practice

This study has revealed that Neonatal mortality is high at Ndola Teaching Hospital. Therefore Nurses should be vigilant in assessing neonates' gestational age, birth weight, and vital signs to identify those at risk. Regular monitoring during and after birth is crucial to detect any early signs of distress. Appropriate documentation of the neonates' condition at birth should also be emphasized. In addition, Nurses on the front lines of care must be skilled in neonatal resuscitation techniques and should be prepared to provide immediate intervention when necessary. This is particularly important for preterm neonates. Further, ensuring warmth for the neonate at birth could predict neonate outcome. Ensuring proper thermoregulation, including skin-to-skin contact with the mother, is part of nursing practice that is critical to prevent hypothermia and maintain a stable body temperature in neonates.

5.8.3 Nursing and Midwifery Administration

The findings revealed that some neonates died after being resuscitated. This could be as a result of inadequate skills by the service providers as well as poor monitoring after resuscitation. Nursing administration should allocate resources for ongoing training, education, and staffing to ensure that healthcare facilities are well-equipped to provide high-quality neonatal care. This includes having the necessary equipment for resuscitation and thermoregulation. In addition, infrastructure development is also key to improve neonatal service provision. This implies that neonatal units need to be spacious owing to the high number of neonatal admissions, Kangaroo mother care rooms need adequate linen, beds and privacy among others. +Nursing administration can lead quality improvement initiatives to monitor and enhance the quality of care provided to neonates. Regular audits, feedback mechanisms, and adherence to standardized protocols are essential. Adequate staffing levels should be maintained to ensure that nurses have the time and resources needed to provide Ongoing mentoring of newly and already employed staff should be emphasized and strengthened at facility level.

5.8.4 Nursing and Midwifery Research

Fewer studies have been conducted on the subject area .More research should be conducted in order to reduce neonatal morbidity and mortality and to enable evidence based practice provision to neonates. Further research into neonatal resuscitation protocols, their effectiveness, and factors influencing successful resuscitation is necessary. This can lead to improvements in guidelines and training. In addition, research on best practices for thermoregulation, including the use of warmers, clothing, and skin-to-skin contact, can inform evidence-based care for neonates. In this study, it was established that neonatal management protocols are available. However, it is unclear whether health workers are utilizing them effectively owing to the high number of neonatal mortalities. Therefore, there is greater need to establish factors contributing to inability of health workers to effectively utilize these protocols.

5.9 Conclusion

The general objective of the study was to determine the prevalence and factors associated with neonatal mortality at Ndola Teaching Hospital. The literature that was reviewed showed that Neonatal Mortality remains a huge burden worldwide. Therefore, this study recommends that health workers are continuously trained and mentored in neonatal care that could subsequently reduce neonatal morbidity and mortality.

This study shows a high rate of neonatal mortality (8.9%) at Ndola Teaching Hospital during the study period. Neonatal mortality was highly associated with neonatal and maternal factors. It is expected that all responsible stakeholders should work hard to improve care for all neonates with special attention to the care of high-risk neonates. For instance, the Neonatal Intensive Care Unit (NICU) should work on improving the facility by providing skilled manpower such as paediatric nurses, paediatricians and critical care nurses to provide specialized care and early referral of neonates. The neonatal intensive care unit should work on early diagnosis, proper documentation of the condition of the neonate at admission and there should be good continuous monitoring of the neonates condition following admission to NICU.

5.10 Recommendations

5.10.1 Ministry of Health

The researcher recommends that the MoH should spearhead the implementation and review of protocols for neonatal and maternal care that will guide nurses, midwives and Doctors in the management of mothers and neonates.

5.10.2. Nursing and Midwifery Practice

Nurses, Midwives and Doctors need constant supervision in order to provide quality nursing care and subsequently improve survival of the neonates based on the finding that most of the neonates that died were resuscitated and some of them had low temperature on admission to NICU. More Nurses and Doctors need to be trained in neonatal care for them to provide specialized neonatal

care. Ongoing mentorship for the new and already employed nurses working in NICU need to be emphasized for them to grasp the principles of neonatal care.

5.10.3 Nursing and Midwifery Research

There is need to conduct research in neonatal care as this will help determine the gaps and limitations in neonatal care. Protocols of neonatal care and other relevant documents once revised, supervisors must ensure that implementation is done as soon as possible for effective and quality neonatal care. In addition, strengthening antenatal care at primary level is also crucial to the survival of the neonates. The researcher also recommends strengthening of maternal, perinatal, death surveillance (MPDSR) committee that will be able to identify, discuss and offer recommendations whenever necessary.

5.11 Strength and Limitations of the study

The study has provided evidence on the prevalence and factors associated with neonatal mortality at Ndola teaching hospital NICU. The study findings have also been documented for future reference. The study only involved review of case notes by the researcher, clerks and nurse in charge of NICU at Ndola Teaching Hospital. Therefore, generalization of the findings should be done with caution as these findings may not be a true reflection of what is prevailing at Ndola Teaching Hospital. In addition, this study did not collect information on the neonatal mortalities that occurred in the community rather in the hospital setting. Therefore, the neonatal mortality in this study may not reflect the mortality in the community for families that live far from the point of seeking health care and those that have financial constraints. Further research need to be conducted to establish the causes of neonatal mortalities in the community settings.

5.12 Utilization and Dissemination of findings

Bound hard copies of the dissertation will be submitted to UNZA, School of Nursing Sciences. The findings and recommendations will be presented at Ndola and Kitwe Teaching Hospital s respectively. The findings of the study will be presented at local, national and international conferences, symposiums and meetings. A manuscript will be submitted to a peer review journal for publication.

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APPENDICES

Appendix I: Questionnaire

UNIVERSITY OF ZAMBIA

SCHOOL OF NURSING SCIENCES

TOPIC: PREVALENCE AND FACTORS ASSOCIATED WITH NEONATAL MORTALITYAT NDOLA TEACHING HOSPITAL IN NDOLA DISTRICT, ZAMBIA

DATE : .....

SERIAL NUMBER : .....…….....

INSTRUCTIONS

Do not write the name of the patient on the questionnaire

Fill in the spaces provided in the questionnaire

Write the answers clearly and correctly by ticking at the beginning of your response

Only serial numbers must appear on the questionnaire

SECTION A: DEMOGRAPHIC DATA

1. What was the sex of the neonate?

a) Female
b) Male

2. What was the age of the neonate at admission?

a) Less than 7 days old
b) More than 7 days old

3. What was the mothers/parents residence?

a) Rural
b) Urban

4. What was the age of the mother?

a) 15-19 years ( )
b) 20-24 years ( )
c) 25-29 years ( )
d) 30-34 years ( )
e) 35 and above ( ) specify age.....

SECTION B-MATERNAL HEALTH RELATED CONDITIONS

5. How many pregnancies did the mother have?

a) 1-2 ( )
b) 3-4 ( )
c) 5-6 ( )
d) 7-8 ( )
e) 9-10 ( )
f) Others specify.....

6. Did the mother attend antenatal clinic?

a) Yes ( )
b) No ( )
c) Number of times, specify.....

7. Did the mother have a multiple pregnancy?

a) Yes ( )
b) No ( )
c) If yes, specify.....

8. What was the mode of delivery?

a) Spontaneous vaginal delivery (SVD)
b) Assisted vaginal delivery
c) Caesarean section

9. Where was the delivery conducted from?

a) Home ( )
b) Health facility ( )

10. Did the mother suffer from any chronic illness?

a) Yes ( )
b) No ( )
c) If yes, specify.....

SECTION C-FETAL HEALTH CONDITIONS

11. Was the fetus exposed to Human Immunodeficiency Virus (HIV)

a) Exposed ( )
b) Not exposed ( )
c) No information available ( )

12. At what gestation was the fetus born?

a) Less than 37 weeks ( )
b) Greater than 37 weeks ( )

13. What was the weight of the baby at birth?

a) Less than 2.5 kg ( )
b) Greater than 2.5 kg ( )

14. What was the temperature of the baby on admission?

a) Less than 36.5 degrees celsius ( )
b) Greater than 37.2 degrees celsius ( )

15. Was the child resuscitated at birth?

a) Yes ( )
b) No ( )
c) If yes provide details.....

16. What was the length of stay in hospital?

a) Less than 5 days ( )
b) Greater than or equal to 5 days ( )

SECTION D-CAUSES OF NEONATAL MORTALITY

a) 17. What was the cause of the mortality?
b) Prematurity ( )
c) Very low birth weight ( )
d) Low birth weight ( )
e) Early onset of sepsis ( )
f) Birth Asphyxia ( )
g) Respiratory distress syndrome ( )
h) Hypoglycaemia ( )
i) Neonatal jaundice ( )
j) Severe birth trauma ( )

k) HIV exposed ( )

l) Congenital malformations ( )

m) Others, specify.....

Appendix II: Approval letter

University of Zambia
School of Nursing Sciences
Department of Midwifery, Women and Child Health
P.O. Box 50110,
LUSAKA.

The Chairperson,
University of Zambia
School of Medicine Research Ethics Committee,
Ridgeway Campus,
Box 50110
LUSAKA.

Dear Sir/Madam,

RE: APPLICATION FOR ETHICAL APPROVAL TO CONDUCT A RESEARCH STUDY

I am a postgraduate student pursuing the Master of Science in Midwifery and Women's Health at the University of Zambia, School of Nursing Sciences, Department of Midwifery, Women and Child Health. The research project is in partial fulfillment of the requirements for the award of a Master of Science in Midwifery and Women's Health.

I am here by applying for ethical clearance to conduct a study under the title "Prevalence and factors associated with Neonatal Mortality at Ndola Teaching Hospital in Ndola District, Zambia. This research proposal has been developed in cognizant of the ethical issues surrounding research. Find attached a copy of the full research proposal for your reference and review.

Your favorable consideration will be highly appreciated.

Yours faithfully,

Mwanza Regina

Appendix III: Letter of Approval from UNZABREC

UNIVERSITY OF ZAMBIA
BIOMEDICAL RESEARCH ETHICS COMMITTEE

Telephone: +260 977925304
Telegrams: UNZA, LUSAKA
Telex: UNZALU ZA 44370
Fax: + 260-1-250753
Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia
E-mail: unzarec@unza.zm

Federal Assurance No. FWA00000338 **IRB00001131 of IORG0000774** **NHRAR-REC No 2021-05-0002**

30th April, 2023

Your REF. No. 3785-2023

Ms. Regina Mwanza,
University of Zambia,
School of Nursing Sciences,
Lusaka.

Dear Ms. Mwanza,

RE: PREVALENCE AND FACTORS ASSOCIATED WITH NEONATAL MORTALITY AT NDOLA TEACHING HOSPITAL, NDOLA ZAMBIA (REF. NO. 3785-2023)

The above-mentioned research proposal was presented to the Biomedical Research Ethics Committee on 26th April, 2023. The proposal is **approved**. The approval is based on the following documents that were submitted for review:

a) **Study proposal**
b) **Questionnaires**
c) **Participant Consent Form**

APPROVAL NUMBER : REF. 3785-2023

This number should be used on all correspondence, consent forms and documents as appropriate.

- **APPROVAL DATE : 28th April 2023**
- **TYPE OF APPROVAL : Standard**
- **EXPIRATION DATE OF APPROVAL : 27th April 2024**
  After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the UNZABREC Offices should be submitted one month before the expiration date for continuing review.
- **SERIOUS ADVERSE EVENT REPORTING**: All SAEs and any other serious challenges/problems having to do with participant welfare, participant safety and study integrity must be reported to UNZABREC within 3 working days using standard forms obtainable from UNZABREC.
- **MODIFICATIONS**: Prior UNZABREC approval using standard forms obtainable from the UNZABREC Offices is required before implementing any changes in the Protocol (including changes in the consent documents).
- **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the UNZABREC using standard forms obtainable from the UNZABREC Offices.

Completion of Online Research Ethics Review Submission

You have successfully submitted your application for ethics review for a study entitled "Prevalence and factors associated with neonatal mortality "
Certificate awarded to: Mwanza, Regina
Reference number: UNZA-3785/2023
Date and Time: 2023-03-06 17:55:15

Appendix IV: Letter of Approval from NHRA

NATIONAL HEALTH RESEARCH AUTHORITY

The Health Research Act

(Act No. 2 of 2013)

MINISTRY OF HEALTH

CERTIFICATE OF REGISTRATION

THIS IS TO CERTIFY THAT

Mwanza Regina

has been registered as a Health Researcher

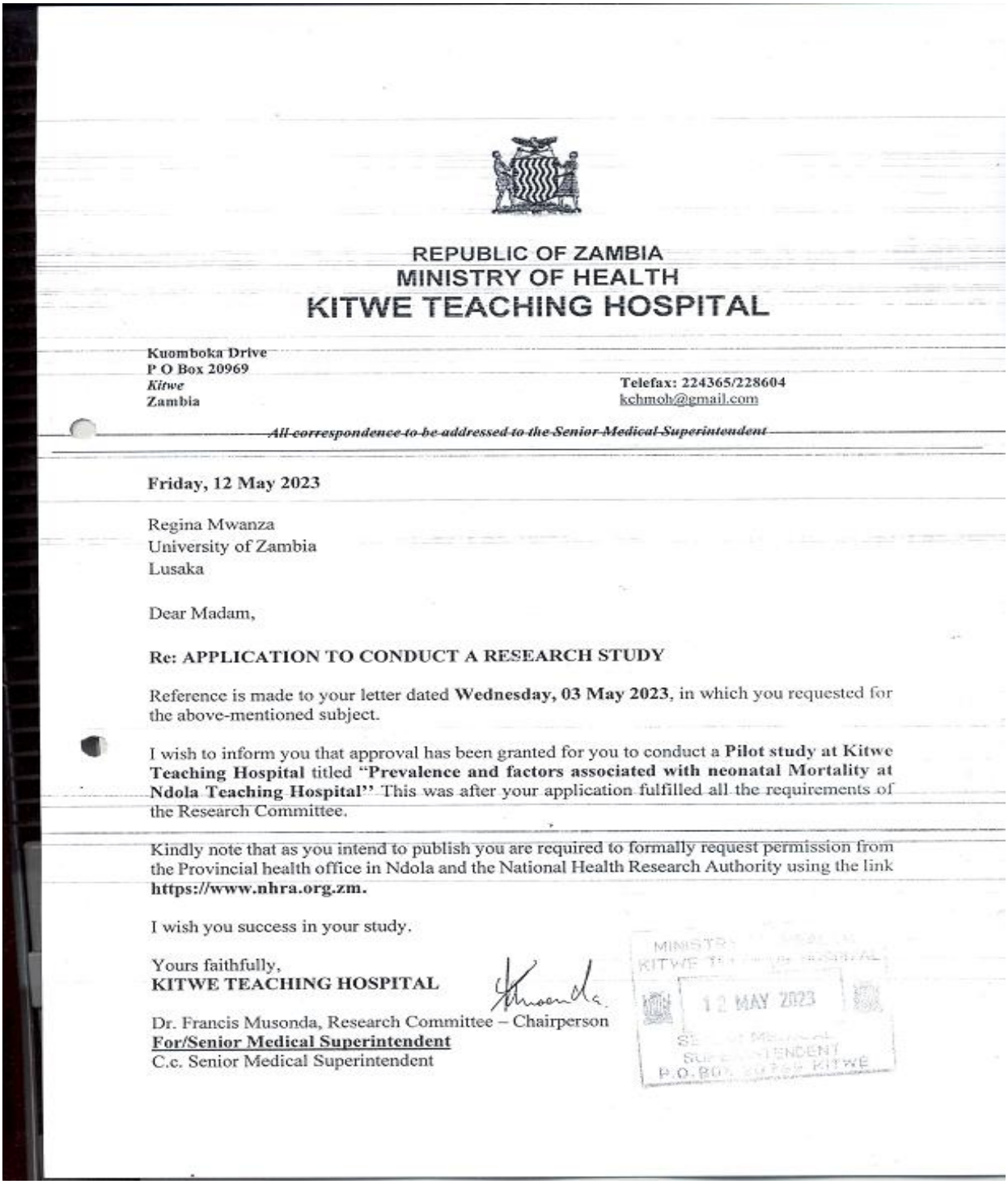
Dated this 7th February 2023

Registration NHRAR-R-116/07/02/2023

DIRECTOR

PROF. GODFREY BIEMBA

Appendix V: Permission to Carry out Pilot Study



REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
KITWE TEACHING HOSPITAL

Kuomboka Drive
P O Box 20969
Kitwe
Zambia

Telefax: 224365/228604
kchmoh@gmail.com

~~*All correspondence to be addressed to the Senior Medical Superintendent*~~

Friday, 12 May 2023

Regina Mwanza
University of Zambia
Lusaka

Dear Madam,

Re: APPLICATION TO CONDUCT A RESEARCH STUDY

Reference is made to your letter dated **Wednesday, 03 May 2023**, in which you requested for the above-mentioned subject.

I wish to inform you that approval has been granted for you to conduct a **Pilot study at Kitwe Teaching Hospital** titled **"Prevalence and factors associated with neonatal Mortality at Ndola Teaching Hospital"** This was after your application fulfilled all the requirements of the Research Committee.

Kindly note that as you intend to publish you are required to formally request permission from the Provincial health office in Ndola and the National Health Research Authority using the link **https://www.nhra.org.zm.**

I wish you success in your study.

Yours faithfully,
KITWE TEACHING HOSPITAL

Dr. Francis Musonda, Research Committee – Chairperson
For/Senior Medical Superintendent
C.c. Senior Medical Superintendent

MINISTRY OF HEALTH
KITWE TEACHING HOSPITAL
12 MAY 2023
SENIOR MEDICAL SUPERINTENDENT
P.O. BOX 20969, KITWE

All correspondence should be addressed to the
Senior Medical Superintendent
Ndola Teaching Hospital
Postal Agency, **Ndola**
Telephone: 611585-9
Fax: 612204
E-mail: ndolateachinghospital@gmail.com

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
NDOLA TEACHING HOSPITAL

12th May, 2023.

Dean
The University of Zambia
School of nursing sciences
Lusaka

Dear Sir/Madam,
Re: Acceptance to Conduct Research Project at Ndola Teaching Hospital

I wish to inform you that we have granted **Regina Mwanza; Student No.200000397** permission to conduct a research project at Ndola Teaching Hospital. On the topic: **"prevalence and factors associated with neonatal mortality at Ndola teaching hospital".**

Ndola Teaching Hospital embraces research activities from students and members of staff. Research enhances informed decision making at any organization. Hence, management demands that the findings of any research conducted at the hospital is shared. The student is mandated to submit the research proposal and the final report to Ndola Teaching Hospital Research Committee through the Planning department.

The student is hereby advised to uphold confidentiality in the chosen topic of study.

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
12 MAY 2023
HEAD CLINICAL CARE
NDOLA TEACHING HOSPITAL
POSTAL AGENCY, NDOLA

Dr. Misa Funjika
Head Clinical Care
NDOLA TEACHING HOSPITAL

Appendix VI: Work Plan

Activity	Time Frame		Responsible Person
	Dates	**Duration**	
Development of Research Proposal	5/04/22-5 /8/22	4 months	Researchers(1) Supervisors (2)
Data collection tool preparation	5/08/22-12/08/22	7 days	Researchers(1) Supervisors (2)
Finalize Research Proposal	12/08/22- /20/12/22	3 months 8days	Researchers(1) Supervisors (2)
Pilot study	12/05/23- 15/05/23	3 days	Researcher (1) Research assistants (2)
Clearance From Authority	01/02/23- 30/05/23	4 months	Researcher(1) Supervisor (2)
Collection Tool Amendments	30/05/23-02/06/23	2 days	Researchers(1) Supervisor (2)
Training Research Assistants	04/06/23-05/06/23	1 day	Researchers(1)
Data Collection	06/06/23-26/09/23	3months 20 days	Researchers(1) Research assistants (3)
Data Analysis	01/10/23-22/10/23	3 weeks	Researchers(1) Supervisor (2)

Report Writing	22/10/23-06/11/23	2 weeks	Researchers(1) Supervisor (2)
Finalize Report	07/11/23-21/11/23	14 days	Researchers(1) Supervisor (2)
Dissemination of results	28/11/23-04/12/23	7 days	Researchers(1)

Appendix VII: Gantt chart

ACTIVITY	**YEAR: 2022 - 2023**					
	DEC	**JAN**	**FEB**	**MAR**	**APR**	**MAY**
Finalising research proposal						
Clearance from research ethics committee						
Pilot study						
Data collection						
Data analysis						
Report writing						
Submission of Draft report						
Submission of final report						
Dissemination of findings						

Appendix VIII: Study Budget

BUDGET CATEGORY	UNIT COST (ZMK)	QUANTITY	TOTAL
1. STATIONERY			
a) External hard drive	900.00	x 1	900.00
b) Pens	3.00	x10	30.00
c) Pencils	2.00	x 5	10.00
d) Rubbers	5.00	x 2	10.00
e) Note book	20.00	x2	40.00
f) Stapler	200.00	x1	200.00
g) Staples	20.00	x1 box	20.00
h) Rim of paper (Rotatrim)	125.00	x 1	125.00
SUBTOTAL			**1335.00**
2. TRANSPORT/LUNCH			
a) Principal researcher	150	X3 days	450.00
b) Research assistants x2(lunch)	100	X3 days	600.00
SUBTOTAL			**1,050.00**
3. SERVICES			

a) Ethics committee (UNZABREC) b) NHRA fees c) Printing and photocopying proposal	1, 000.00 1,020.00 200	x 1 x 3	1,000.00 1,020.00 600.00
d) Photocopying checklist e) Binding	K2x5pages 150.00	x 200 copies x 4 copies	2,000.00 600.00
			5,220.00
4. DISSEMINATION OF FINDINGS			
a) Transport b) Internet bundles c) Publication cost	120.00 160 3500	X2 X1 X1	240 160 3500
SUBTOTAL			**3,900**
TOTAL			**11,505**
CONTIGENCY FUND10%			**1,150.5**
GRAND TOTAL			**K 12,655.5**