PERINATAL DEATHS ACCORDING TO THE INTERNATIONAL CLASSIFICATION OF DISEASES FOR PERINATAL MORTALITY (ICD-PM) AT MUHIMBILI NATIONAL HOSPITAL.

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CLASSIFICATION OF PERINATAL DEATHS ACCORDING TO INTERNATIONAL CLASSIFICATION OF DISEASES FOR PERINATAL MORTALITY (ICD-PM) AT MUHIMBILI NATIONAL HOSPITAL

By

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A Dissertation Submitted in (Partial) Fulfilment of the Requirements for the Degree of Master Medicine in Obstetrics and Gynaecology at

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CERTIFICATION

The undersigned certifies that she/he has read and at this moment recommends for examination the dissertation entitled ***"Classification of Perinatal Deaths according to the International Classification of Diseases for perinatal mortality (ICD-PM) at Muhimbili National Hospital"*** in partial fulfillment of the requirements for the degree of master of medicine in Obstetrics and Gynecology of Muhimbili University of Health and Allied Sciences.

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DECLARATION AND COPYRIGHT

I, **Gabriel Michael Luvanga**, declare that this **dissertation** is my original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award**.**

Signature……. Date…….

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DEDICATION

I want to dedicate this dissertation to my Parents Mr. and Mrs. Luvanga and my sons Jackson Gabriel Luvanga and Kendrick Gabriel Luvanga for their endless love, support, and encouragement. Without whom this would not have been possible.

ABSTRACT

Background: The International Classification of Diseases for Perinatal Mortality (ICD-PM) classifies perinatal deaths according to the timing, underlying cause, and contributing maternal conditions. This allows quantification, proper assignment of causes, and monitoring of perinatal deaths within and between facilities, as well as monitoring the quality of pregnancy and intrapartum care.

Objective: To classify perinatal deaths according to ICD-PM and factors associated with the timing of perinatal deaths at Muhimbili National Hospital (MNH).

Materials and Methods: Cross-sectional study conducted at MNH. All perinatal deaths that occurred between October 2023 and January 2024 were identified. A structured questionnaire was used to extract data. Two independent teams with knowledge of perinatal death audits reviewed the abstracted information. Data was entered and analyzed by using SPSS version 24.

Results: Neonatal deaths were the most prevalent timing of perinatal deaths (62%), mostly due to prematurity and low birth weight, and mostly occurred in mothers without underlying medical conditions. Antepartum deaths were the second most prevalent timing (29.4%), mostly due to antepartum hypoxia, from mothers with hypertensive disorders of pregnancy (HDP), Intrapartum deaths were the least prevalent timing (8.6%) mainly due to acute intrapartum events from mothers with HDP. Hypertensive disorders of pregnancy (aOR=5.03, 95% CI 2.60 – 10.01), Multiple pregnancy (aOR=0.33, 95% CI 0.12-0.82), gestational age at delivery (aOR=5.97, 95% CI 2.14 -17.7) and mode of delivery (aOR=0.41, 95% CI 0.20 -0.81 were significantly associated with the timing of perinatal deaths.

Conclusion: Six out of ten perinatal deaths occurred during the early neonatal period. Targeted interventions to screen, detect, and provide early management of maternal medical conditions, mainly HDP, and preterm birth, as well as to improve antepartum,intrapartum, and neonatal care, have the potential to reduce the burden of perinatal deaths.

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LIST OF ABBREVIATIONS

ANC……Antenatal Care

EVLBW……. Extremely Very Low Birth Weight

GA……...Gestational Age

HDP……. Hypertensive Disorders of Pregnancy

HIV……. Human Immunodeficiency Virus

ICD…… International Classification of Diseases

ICD-PM……...International Classification of Diseases for Perinatal Mortality

IRB……. Institutional Review Board

IUFD……Intrauterine Fetal Death

MCCD……. Medical Certification of Cause of Death

MNH……Muhimbili National Hospital

MRN……Medical Record Number

MUHAS……...Muhimbili University of Health and Allied Sciences

MPDSR……Maternal and Perinatal Death Surveillance and Response

NBW……Normal Birth Weight

NICU……..…...Neonatal Intensive Care Unit

NIHR……National Institute for Health and Care Research

WHO…… World Health Organization

LBW……Low Birth Weight

LI……. Lead Investigator

PMTCT……..…. …. Prevention of Mother-to-Child Transmission

REDCap…….. Research Electronic Data Capture system

SBF…….……. Stillbirth Fresh

SBM…… Stillbirth Macerated

SD……..... Standard Deviation

SPSS…… Statistical Package for Social Sciences

UNICEF……..... United Nations International Children's Emergency Fund

VDRL……...Venereal Disease Research Laboratory

VLBW……. Very Low Birth Weight

OPERATIONAL DEFINITIONS

Term	Definition
Perinatal death	Fetal death at or after 28 weeks of gestational age or weighing 1000g or more and death of the baby within 7 days of life (early neonatal death).
Stillbirth	Birth of a fetus at or after 28 weeks of gestational age or weighing 1000g or more with no sign of life at birth.
Antepartum stillbirth	Death of the fetus before the onset of labor and delivery.
Intrapartum stillbirth	Fetal death occurs after the onset of labor and before delivery. In this study will also be recognized as fresh stillbirth (SBF).
Early neonatal death	death of the baby within 7 days of life
Underlying cause of death	Disease or condition that initiated the chain of morbid events leading directly to perinatal death. Was identified by using WHO medical certification of cause of death (MCCD).
Maternal conditions contributing to perinatal deaths	Medical conditions of the mother at the time of the death that is closely linked with perinatal death.

1.0 INTRODUCTION

1.1 Background

The World Health Organization (WHO) defines Perinatal mortality as the death of the fetus at or after 28 weeks of gestational age or weighing 1000g or more or with a body length of 35cm or more and death of the baby within the first seven days of the neonatal life (1).

Globally, there are 5.1 million perinatal deaths annually, with a disproportionately high burden in low- and middle-income countries (2). Seventy-five percent of the global burden of stillbirths occurs in sub-Saharan Africa and South Asia (3).Most of the perinatal deaths result from preventable causes(3).

According to the Demographic and Health Survey (DHS) data of 12 East African countries, prevalence of stillbirth was 0.86% with the highest deaths reported in Burundi and the lowest in Kenya (4).

Tanzania still has the burden of stillbirths, the stillbirth rate is 18.8 per 1000 births, and the target is to reduce the stillbirth rate to less than 12 per 1000 births by 2030 (5). Majority of stillbirths in Tanzania are due to preventable causes (6).

International Classification of Diseases for Perinatal Mortality (ICD-PM) is the classification of perinatal deaths in terms of the timing and groups of timing, underlying cause of death, and maternal conditions contributing to perinatal deaths(1).

The introduction of ICD-PM in 2016 by the World Health Organization (WHO) was a response to the presence of more than eighty-one classification systems across the world to harmonize the classification system and to make perinatal mortality data comparable throughout the world(7).

The tenth revision of the International Statistical Classification of Diseases and Related Health Conditions (ICD-10) is the basis of the ICD-PM(1). Essential features of ICD-PM include the following, timing of perinatal death is identified as antepartum (deaths that occur before the onset of labor), Intrapartum (deaths that occur during labor but before

delivery) and neonatal (deaths that occur up to the 7th day after birth), underlying cause of death and contributing maternal conditions (1).

World Health Organization (WHO) introduced the technical working group to create ICD-PM to capture perinatal information (8). After the creation of ICD-PM the pilot study of the tool was done in the United Kingdom and South Africa and the results were found to be comparable(1) .

After the pilot study, ICD-PM currently is used in many countries in the world including sub-Saharan countries like Kenya, Malawi, and Sierra Leone(9). It is recommended by WHO those statisticians and academicians to collect data according to it for the data to be comparable worldwide(1).

A stepwise process is used to classify perinatal deaths using ICD-PM. First is a grouping of perinatal deaths according to timing, whether occurred in the antepartum, intrapartum, or early neonatal period. Secondly, the underlying cause of perinatal death is assigned and grouped with timing according to ICD-PM, antepartum deaths have six groups (A1-A6), Intrapartum deaths have seven groups (I1-I7) and neonatal deaths have eleven groups (N1-N11). lastly, the main maternal conditions contributing to perinatal deaths are assigned and grouped into five groups (M1-M5). After these steps, is the tabulation of the groups of the underlying causes of the perinatal deaths and contributing maternal conditions separated by timing of death (1).

No study classifies perinatal deaths according to ICD-PM at Muhimbili National Hospital (MNH). Classification of perinatal deaths according to ICD-PM will enable the understanding of the timing, underlying cause of deaths, and contributing maternal medical conditions. This will enable specific interventions to be put to reduce the burden of perinatal deaths and to monitor the quality of health care services.

1.2 Problem statement

Despite several efforts to reduce preventable perinatal deaths by doing a perinatal deaths review, Tanzania still has a burden of perinatal mortality. The first step in addressing the high burden of perinatal deaths is to document the right cause of death and to harmonize the classification of causes of perinatal deaths using the ICD-PM. This will enable mapping of the burden and understanding of causes of perinatal deaths from different layers.

In reducing the burden of perinatal death at MNH, it is essential to ascertain the timing, underlying causes of death, contributing maternal medical conditions using the ICD-PM component, and factors associated with the timing of perinatal deaths at Muhimbili National Hospital.

1.3 Conceptual Framework

Perinatal death causes can be grouped into distal and proximate determinants. Distal determinants are community-level factors, obstetric risk factors, and fetal risk factors. Community-level factors include place of residence, accessibility of ANC services, and socio-economic and demographic factors.

Obstetric risk factors include the mother's age, multiple pregnancies, maternal medical and surgical conditions, and antenatal care. Fetal factors include the sex of the baby, gestational age at delivery, birth weight, and APGAR score.

Proximate determinants include Obstetrics complications, delivery factors, and post-natal care. Obstetric complications include antepartum hemorrhage (abruptio placenta and placenta previa), hypertensive disorders of pregnancy, and obstructed labor. delivery factors include place, mode of delivery, and assistance during delivery.

Causes of death leading to perinatal death include underlying causes and immediate causes. Underlying causes include prematurity, growth restriction, intrauterine hypoxia, and congenital anomalies. Immediate causes include perinatal asphyxia, trauma, and infection or sepsis as shown in the figure 1 below.

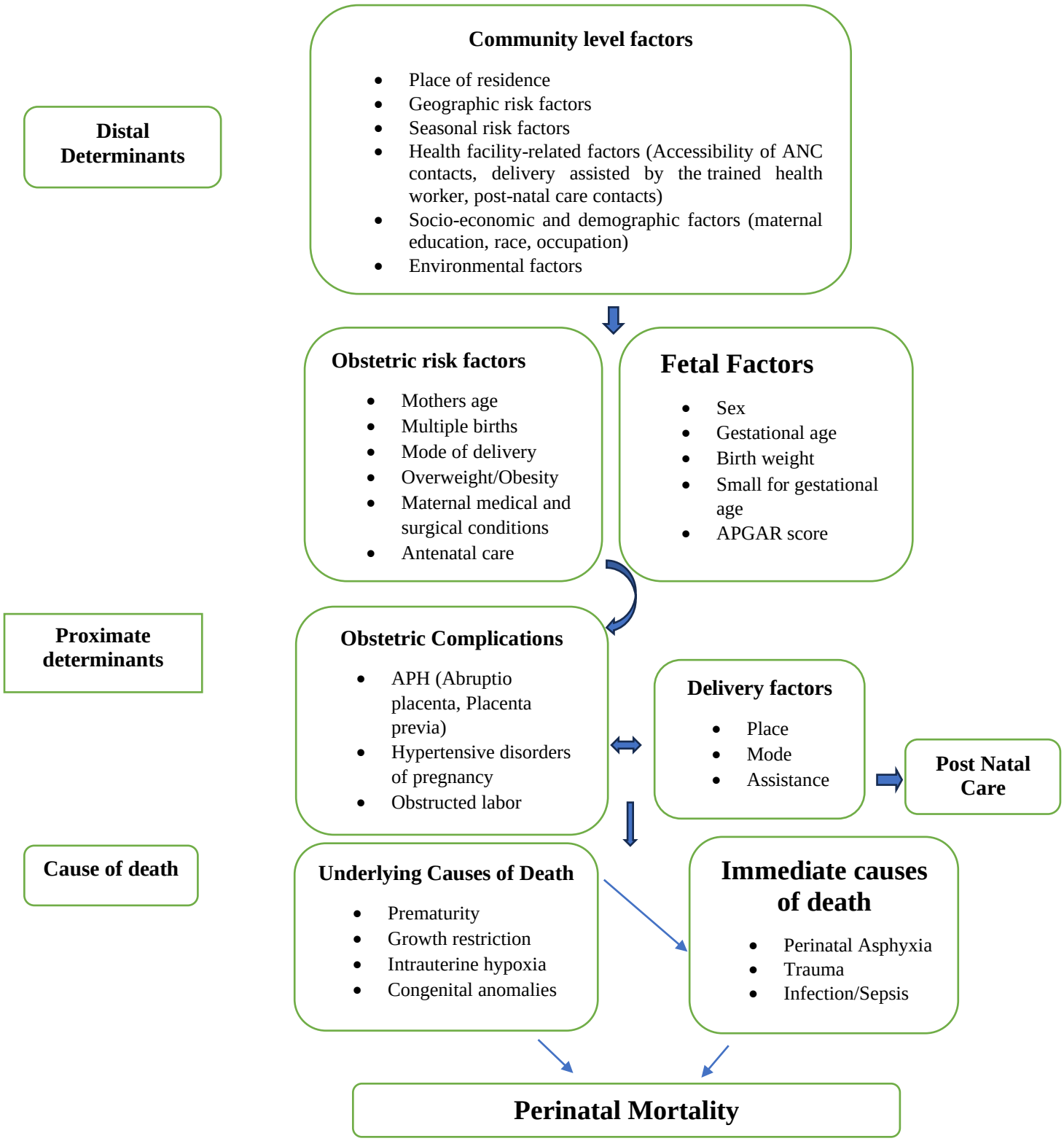


Figure 1: Conceptual framework on the factors and causes of perinatal deaths adapted from Mosley and Chen et al,1984.

1.4 Rationale of the Study

This study will enable an understanding of the timing, underlying cause of death, contributing maternal medical conditions using the ICD-PM component, and factors associated with the timing of perinatal deaths so that specific interventions to be put to reduce preventable perinatal deaths and to improve and monitor the quality of healthcare services at MNH.

1.5 Research Questions

1.5.1 Overall Research Question

What is the timing, underlying cause of death, and maternal conditions contributing to perinatal deaths as assigned by ICD-PM at MNH from September to December 2023?

1.5.2 Specific Research Questions

1. What are socio-demographic and clinical characteristics associated with timing perinatal deaths?
2. What are the timings of perinatal deaths according to ICD-PM at MNH?
3. What are the underlying causes of deaths as per ICD-PM at MNH?
4. What are the maternal conditions that contributed to perinatal deaths as per ICD - PM at MNH?

1.6 Objectives

1.6.1 Broad Objective

To classify perinatal deaths and to ascertain their association factors that occur at MNH using ICD-PM components from October 2023 to January 2024.

1.6.2 Specific Objectives

1. To determine socio-demographic and clinical characteristics associated with the timing of perinatal deaths.
2. To determine the Timing of perinatal death according to ICD-PM.
3. To determine the underlying causes of death as per ICD-PM.
4. To determine maternal conditions leading to perinatal deaths as per ICD-PM.

2.0 LITERATURE REVIEW

2.1 Application of ICD-PM

Since 2008, eighty-one different systems have been used globally for classifying perinatal deaths. In 2008 WHO first conceptualized ICD-PM to facilitate consistent collection, analysis, and interpretation of information on causes of perinatal deaths. The first step in targeting programs that aim to address perinatal mortality is the capture and accurate classification of the causes of all perinatal deaths using a globally applicable and comparable system.(7).

The technical working group was established by WHO for perinatal death classification, including different expertise from high-income, middle-income, and low-income countries to prepare the International Classification of Diseases for Perinatal Mortality (ICD-PM). Three main principles were used to prepare the ICD-PM, firstly globally acceptable system, secondly complying with the rules of ICD-10, and thirdly consistent with the upcoming ICD-11(8).

In the application of ICD-PM, the underlying cause of death is assigned in a stepwise process, which depicts the capacity for investigations and results in the reduction of proportions of perinatal deaths due to unknown causes. Finally links perinatal deaths with contributing maternal conditions(1).

In settings with poor resources where the burden for perinatal mortality is higher, only the timing of perinatal death is the information obtained for international comparison when classifying a perinatal death(10). In settings where investigations are limited, ICD-PM enables the underlying cause of death to be determined based on the local priorities (11).

Application of ICD-PM in the health facilities of low-income countries where perinatal mortality is higher about three to ten times compared to high-income countries, it has been found that the quality of medical care and documentation of perinatal mortality information are poor and need to be improved(11).

A similar study was done at Mnazi Mmoja Hospital in Zanzibar and found that poor documentation of clinical information, un-audited perinatal deaths, and lack of adequate investigations are the main culprits of classification of perinatal deaths and recommended improvement in the history taking, physical examination, and documentation of the clinical information including fetal heart rate (12).

One of the challenges of using ICD-PM is the inability to assign the cause of death when the timing of perinatal death cannot be determined, this could be due to missing or poorly documented clinical information. It is recommended to develop a new category in the ICD-PM of perinatal death of unknown timing (11,13).

There are high proportions of perinatal deaths that occur during the Antepartum period in which the underlying cause of death is unspecified and of which the contributing maternal conditions are not identified. To reduce this, it has been recommended to improve in taking clinical history to the patients, doing a thorough physical examination, appropriate investigations, including postmortem examinations and proper documentation to ascertain the medical causes of stillbirth (13).

2.2 Timing of Perinatal death with underlying cause of death and maternal conditions leading to perinatal deaths as assigned by ICP-PM.

According to the systematic review, proportions of the timing of perinatal deaths vary in different settings and depend on the country's level of industrialization (12). Antepartum stillbirths, mainly of unspecified cause are the most prevalent timing of perinatal deaths across all settings(12) .

The proportion of intrapartum stillbirths is highest in low-income settings and mainly due to acute intrapartum events and lowest in high-income settings(12). Proportions of neonatal deaths are higher in the high- and middle-income settings mainly due to low birth weight and prematurity and lowest in the low-income settings mainly due to complications of intrapartum events (12).

a) Antepartum Perinatal Mortality, the underlying cause of death, and contributing maternal conditions

Different studies report different trends in the timing of perinatal deaths but the majority of the studies show that most perinatal deaths are antepartum in timing followed by intrapartum and neonatal deaths(11,14). Majority of the antepartum fetal deaths are due to unspecified causes and from mothers with medical and surgical conditions mostly due to hypertensive disorders of pregnancy, complications of the placenta, umbilical cord, and amniotic fluid membranes such as abruption of the placenta and placenta previa (9,12,14).

b) Intrapartum perinatal mortality, underlying cause of death, and contributing maternal conditions

Most Intrapartum perinatal deaths follow acute intrapartum events often associated with maternal conditions, complications of the placenta, cord, and membranes mainly placental abruption and cord prolapse, and maternal medical and surgical conditions mainly hypertensive disorders of pregnancy(11–15).

c) Neonatal-Perinatal Mortality, the underlying cause of death, and contributing maternal conditions

Complications of intrapartum events such as birth asphyxia and intrauterine hypoxia, cardiovascular and respiratory disorders are the most common perinatal cause of neonatal death (12–14).Perinatal mortality is significantly associated with preterm delivery, congenital malformations, short birth interval, low birth weight, and previous history of early neonatal death.

Partography use was significantly associated with a decreased risk of perinatal mortality (16). The etiology of early neonatal deaths is closely related to the level of country industrialization, in high-income countries prematurity and congenital anomalies are the leading causes of early neonatal deaths(3).

In low-income countries of Africa and Southeast Asia, birth asphyxia and infections are the leading causes of early neonatal deaths(3). Many of the deaths in low-income countries are

preventable with relatively easy and cost-effective measures such as contraception, vaccinations, hygienic deliveries at health facilities, early initiation of breastfeeding, kangaroo mother care, and training health care workers in resuscitation practices and early detection of perinatal infections (3).

In Tanzania majority of neonatal deaths occur among early newborns, trend over time shows a slow improvement. Most neonatal deaths are preventable, the leading cause is birth asphyxia, neonatal respiratory distress syndrome, prematurity, and neonatal sepsis hence there are opportunities to reduce mortality rates with improvement in service delivery during the first seven days of life(17).

No, study describes perinatal death classification using WHO ICD-PM in Tanzania mainland including the Muhimbili National Hospital. This makes the perinatal mortality data at MNH and Tanzania to be not comparable worldwide. Initiatives should be made to ensure that ICD-PM is applied in health facilities in Tanzania as per WHO recommendations.

3.0 MATERIALS AND METHODS

3.1 Study Design

Cross-sectional study.

3.2 Study Area

This study was conducted at Muhimbili National Hospital (MNH). The setting was considered because it is a tertiary health facility and teaching hospital in Tanzania offering advanced services including antenatal care (ANC) and comprehensive emergency obstetric and Newborn care (CEmoNC), with specialists, consultants' obstetricians, experienced midwife nurses, and neonatologists.

There are two neonatal wards and one Neonatal Intensive Care Unit (NICU) at Muhimbili National Hospital (MNH) neonatal unit. When perinatal death occurs at the labor ward information on the weight of the baby, sex, and condition of the baby whether fresh stillbirth (SBF) or macerated stillbirth (SBM) are filled in the partograph and uploaded to the Research Electronic Data Capture system (REDCap).

Burial permits are filled by the doctor to indicate immediate conditions and other conditions directly resulting in perinatal deaths and information is filled in the nurse report book and mortuary book before sending the body to the mortuary.

At the obstetric theatre information on perinatal deaths is documented in the Obstetric operation book, and nursing report book, and also information is uploaded in the REDCap system as well.

In the neonatal ward neonatal deaths are documented in the nursing report book, burial permits, and mortuary book. The underlying cause of death is documented in the clinical case notes of the baby's file by the registrar, resident, or pediatrician at the time of certification of death. There are weekly neonatal death review meetings to discuss neonatal deaths that occurred in the past 7 days with the members that do not constitute the perinatal death committee as per MPDSR guidelines. Causes of death are determined by using Medical Certification of Cause of Death (MCCD).

There is no counselor at the maternity building which also includes the neonatal ward, when the counselor is needed consultation with the department of psychiatry is done for the patient to be counseled by the counselor.

From January 2022 to December 2022 total of 4805 deliveries were conducted at MNH. Of 4805 deliveries stillbirths were 226 (4.7%), in which antepartum stillbirths were 135 (59.7%) and intrapartum stillbirths were 91 (40.3%). The stillbirth rate at MNH from January to December 2022 was 47 per 1000 deliveries which is 4 times higher compared to the WHO target of a stillbirth rate of less than 12 per 1000 deliveries.

3.3 Study Population

Stillbirths, early neonatal deaths, mothers who had stillbirths, and those with babies who died within 7 days of life at Muhimbili National Hospital.

3.4 Study sample size

The study sample size was calculated from the following formula

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

Where by

Z =1.96 for 95% confidence level

p = expected proportion, (P=19.4%, from a similar study done in Zanzibar by Houssein et al 2021, the proportion of intrapartum and antepartum deaths was 19%)

ε = margin of error (Margin of error of 5% will be used in this study)

$$n = \frac{1.96^2\ 19(100-19)}{5^2}$$

n= 236

A minimum Sample size of 236 was needed. In this study, a sample size of 255 was used which included stillbirths and early neonatal deaths.

3.5 Sampling and Recruitment

Two hundred and fifty-five perinatal deaths that occurred at MNH during the four-month study period from October 2023 to January 2024 were recruited in the study prospectively. Two perinatal deaths were excluded from the study due to missing files.

In multiple pregnancies with unknown gestational age, when one fetus weighed 1000g and above all the fetuses were included in the study. Gestational age was determined by using Naegele's rule, calculated from the Last Normal Menstrual period (LNMP) or extrapolated from the early ultrasound gestational age when mothers were not sure of their dates.

When mothers were not sure of their dates and there was no early ultrasound gestational age, symphysial pubic fundal height at or after 20 weeks documented on the ANC card was used to extrapolate the gestational age.

Perinatal deaths were identified from the nursing report book, burial permits, and mortuary registers at the labor ward and through the REDCap system, in the neonatal wards through burial permits, mortuary book, and nursing report book, In the obstetric operating theatre through obstetrics operation register, theatre report book and through the REDCap system. Patient files were collected from the respective wards after the occurrence of perinatal deaths.

3.5 Inclusion and Exclusion Criteria

3.5.1 Inclusion Criteria

Perinatal deaths (Stillbirths and early neonatal deaths) that occurred at MNH during the study period were included in the study.

3.5.2 Exclusion Criteria

Perinatal deaths with missing files were excluded from the study since it was difficult to ascertain timing, underlying cause of death, and maternal conditions contributing to perinatal deaths.

3.6 Selection and Training of Research Assistants

Four research assistants were selected which formed two review panels (two research assistants per panel) one Nurse officer working at the MNH labor ward, two obstetrics and gynecology senior residents working in the maternity wards, and one senior resident in the department of pediatrics and child health working at the neonatal ward.

These research assistants conducted perinatal death review discussions in the review panels to ascertain timing, groups of timing, underlying causes of death, and maternal conditions that contributed to perinatal deaths.

Research assistants and lead Investigator (LI) were trained for two days by the obstetrician majoring in Maternal and Perinatal Deaths Surveillance and Response (MPDSR). They were trained to have a general understanding of the application of ICD-PM, study objectives, inclusions and exclusion criteria, how to conduct perinatal death review discussions, determination of the cause of death using the Medical Certification of Cause of Death (MCCD) and to ascertain underlying cause of death and maternal conditions contributed to perinatal deaths.

3.7 Variables

Timings of perinatal deaths are antepartum, intrapartum, and neonatal deaths. Antepartum stillbirths are deaths that occur before the labor onset and delivery of the macerated stillbirth. Intrapartum stillbirths are deaths that occurred after the labor onset and delivery of the fresh stillbirth and Neonatal deaths are deaths that occurred within the first seven days of the neonatal life.

Underlying causes of death are grouped according to the timing of perinatal deaths. Antepartum deaths have six groups (A1-A6) which include A1-abnormalities of the chromosomes and congenital anomalies, A2- congenital infections like congenital malaria, syphilis and Rubella, A3-intrauterine hypoxia, A4-other specified antepartum disorders like vasa previa, twin-twin transfusion syndrome, A5- fetal growth-related disorders like macrosomia and intrauterine growth restriction and A6- unspecified causes of antepartum deaths.

Intrapartum deaths have seven groups (I1-I7), I1- abnormalities of chromosomes and congenital anomalies, I2-trauma that occurs during delivery, I3-acute intrapartum events like intrapartum hypoxia, I4- congenital infection like congenital malaria, syphilis and Rubella, I5-other unspecified intrapartum disorder like vasa previa, twin-twin transfusion syndrome, I6- fetal growth-related disorders like macrosomia and intrauterine growth restrictions, I7-unspecified causes of intrapartum deaths.

Neonatal deaths have eleven groups (N1-N11), N1- congenital malformations and chromosomal abnormalities, N2- disorders related to growth like macrosomia and small for gestational age, N3-birth trauma, N4-complications of an intrapartum event like intrapartum hypoxia and birth asphyxia, N5-convulsions and disorders of the cerebral status, N6-infection, N7-respiratory, and cardiovascular disorders, N8-other neonatal conditions like vasa previa, twin -twin transfusion syndrome and Rhesus isoimmunization, N9-low birth weight and prematurity, N10- causes which are miscellaneous in which several other codes are to be used, N11- unspecified causes of neonatal deaths.po

Maternal conditions are grouped into five groups (M1-M5), M1- Placenta, membranes, and umbilical cord complications such as umbilical cord prolapse, chorioamnionitis and placental abruption, M2-Complications like pre labor rupture of membranes, multiple gestation, ectopic pregnancy and polyhydramnios, M3- Other labor and delivery complications, M4-Medical maternal conditions like disorders of hypertension during pregnancy, maternal substance use etc. and M5- No identified maternal conditions.

3.8 Data Collection Procedure

Daily surveillance was conducted by the Lead Investigator (LI) for the perinatal deaths that occurred for the past 24 hours from 9:00 AM to 11:00 PM for the whole four month' study period. Stillbirths were identified in the labor ward by reviewing the delivery register, nurse report book, burial permits, mortuary book, and Redcap system.

In the obstetric operating theatre, perinatal deaths were identified by reviewing the nurse report book, obstetric operation registers book, and Redcap system. Early neonatal deaths were identified in the three neonatal wards through the nurse report book, burial permit, and mortuary register book.

When perinatal death was identified, LI assigned serial numbers to the deaths which meet inclusion criteria. Two perinatal deaths were excluded from the study due to missing files. Medical Record Numbers (MRN) of the mothers for stillbirth were recorded against the serial numbers in the surveillance form.

For early neonatal deaths, MRN numbers of the baby and mother were recorded. Filled surveillance forms were kept confidential by the LI for retrieving patients' files and for easy reference between the serial numbers and the patient files.

Lead Investigator (LI) recorded in the questionnaire serial numbers and baseline characteristics of the perinatal deaths such as social demographic information (age of the mother, education level, occupation, marital status, parity and referral status), ANC, labor and delivery information (number of ANC contacts, type of pregnancy, maternal HIV status, gestational age at delivery, mode of delivery, delivery facility, sex of the baby and birth weight).

Mothers were interviewed after the informed consent was done, and social demographic characteristics and antenatal care information obtained from the ANC card were documented in the questionnaire.

Mothers' and baby's files were collected from the respective wards after the occurrence of perinatal death for panel review to ascertain, timing and groups of timing, the underlying cause of death, and maternal conditions that contributed to perinatal deaths by using the WHO ICD-PM.

Manual review of the patient's clinical case notes files was done by the two-review panels, which reviewed perinatal deaths two times a week (Wednesdays and Fridays) for the whole four months' study period, sixteen perinatal deaths were reviewed per week and 255 perinatal deaths were reviewed to reach consensus on the timing, groups of timing, underlying cause of death and contributing maternal conditions resulting to perinatal deaths.

There was improper documentation of the patient clinical information like social demographic characteristics, gestational age, fetal heart rate, and laboratory and radiological investigations, which resulted in challenges in identifying the cause of death and maternal conditions that contributed to perinatal deaths in the review panels.

To mitigate these challenges, laboratory and radiological investigations were retrieved from the Jeeva system, gestational age was recalculated, and social demographic characteristics were obtained from mothers' interviews and documented in the questionnaire.

Quality control of the reviewing panel was done every two weeks of data collection (eight times for the whole study period) to ensure that the two review panels were reviewing Perinatal deaths, in the same manner, to have consistency of the data by giving the same perinatal death for the panels to review if they reached the same consensus on the timing, groups of timing, underlying cause of death and maternal conditions contributing to perinatal deaths. If there were discrepancies, perinatal deaths were reviewed together by the members of the two review panels and the LI to have a common understanding.

Perinatal deaths were reviewed in the order of occurrence, those that occurred first were reviewed until when the required sample size was reached. Timing of perinatal deaths for antepartum and intrapartum stillbirths was identified by triangulation of documented information of fetal heartbeats in the clinical case notes and partograph before the onset of labor and or during labor checked by either Pinard fetoscope, hand-held Doppler fetoscope (MOYO) or confirmed by ultrasound scanning and after delivery there was documentation of APGAR score of zero in the 1^{st} and 5^{th} minutes and the delivery of fresh or macerated baby.

Early neonatal deaths are death that occurs in the neonatal wards within the seven days of life which was identified by checking information on the date and time of delivery and date and time of death, if it was within first seven days of the neonatal life it was regarded as early neonatal death.

Groups of timing was ascertained after knowing the underlying cause of death per timing of perinatal deaths as per ICD-PM, which was determined by using Medical Certification of Cause of Death (MCCD) and the condition that initiated the chain of morbid conditions leading directly to perinatal death was regarded as the underlying cause of death.

Panels reviewed each death by going through the information in the case note file of the mother and baby (for neonatal deaths). Once consensus was reached information was recorded in the data collection tool. When there was disagreement between the two reviewers, the 3rd reviewer who is the Obstetrician majoring in MPDSR was consulted in order to help in determining the timing, groups of timing, underlying cause of death and maternal conditions contributed to perinatal deaths.

3.9 Data management

Information obtained from the mothers, patient case notes files and in the panel discussion which were recorded in the data collection tool was kept confidential. Patient files with names was used during the panel discussion and the agreed information on the underlying cause of death and maternal condition contributed to the perinatal deaths was recorded in the data collection tools.

Information of the women and baby discussed in the review panel was also kept confidential by the assessors. Principle of anonymity was observed in which serial numbers was used in the data collection tools instead of patient names. Separate sheets of paper with serial numbers and medical record numbers (MRN) of the mother's and baby files was kept confidential by the LI for essay reference during panel discussion and data analysis.

3.10 Data Analysis

Data cleaning was done and analysed by using Statistical Package for the social sciences (SPSS) version 24.0. Chi square was used. P value of < 0.05 was considered as statistically significant. Ordinal logistic regression analysis for the likely hood of perinatal deaths to belong to the high order of antepartum stillbirth was used to determine factors associated with timing of perinatal deaths.

3.11 Ethical consideration

Ethical approval to conduct this study was obtained from the MUHAS Institutional Review Board (IRB). The permission to conduct the study at MNH was obtained from the Director of Muhimbili National Hospital.

Informed consent was obtained from the mothers before interview. Identity of the study participants was kept anonymous in all the data collection tools, where no name was mentioned instead serial numbers was used. Highest level of confidentiality and privacy was ensured, all filled data collection tools were submitted to the LI and locked, only the LI had access to it.

During review of the patient clinical case notes, when medical malpractice was identified, the feedback to the health care workers involved was given by the review panel with no name, no blame and no shame approach so as to learn and improve in the management of the patients.

During the interview when the bereaving mother started to cry, interview was stopped, counsellor was consulted in order to counsel the mother. After counselling interview continued after an informed consent is obtained from the mother.

4.0 RESULTS

4.1 Baseline characteristics of the study participants

Total deliveries at Muhimbili National Hospital (MNH) during the four months study period from October 2023 to January 2024 were 1558 deliveries, stillbirths were 97, Stillbirth rate was 62 per 1000 deliveries. Early neonatal deaths were 69 which constituted an early neonatal death rate of 47 per 1000 live births.

Ninety-one early neonatal deaths were from neonates who were referred from other health facilities due to sickness. This makes a total of 257 perinatal deaths and 255 perinatal deaths were included in the study.

Two perinatal deaths were excluded from the study because mothers and baby's files were not found. Among all perinatal deaths that were recruited in the study 166 perinatal deaths were MNH deliveries which constitute 65% of the total perinatal deaths. Thirty-five percent were deaths among the neonates who were referred from other health facilities due to sickness.

Table 1 : Social-demographic and clinical characteristics of the study participants

Variable	Category	Frequency (n)	Percent (%)
Age of the mother(years)	<20	23	9
	20-34	191	75
	≥35	41	16
	Mean age =29 ±5.6 years SD		
Marital status	Married/Cohabiting	216	85
	Single/divorced/separated/widow	39	15
Level of education	No formal education	4	1.6
	Low-level education (primary and secondary education)	215	84.3
	High level education	36	14.1
Occupation	Unemployed	98	38
	Employed/self employed	157	62
Referral status of the mother	Referred from other facilities	230	90
	Direct Admission	25	10
Parity	1	82	32.2
	2-4	152	59.6
	≥5	21	8.2
	Mean parity 2 ±1SD		
Number of ANC contacts	0	4	1.6
	1-4	124	48.6
	≥4	127	49.8
	Mean number of ANC contacts =2±1SD		
HIV status of the mother	Positive	18	7
	Negative	237	93
ANC Blood pressure status	Hypertensive	78	30.6
	Normotensive	177	69.4
Gestational age at delivery	28 -33	147	57.6
	34 -36	56	22
	≥37	52	20.4
	Mean gestational age=33±4week SD		
Type of pregnancy	Singleton pregnancy	204	80
	Twin pregnancy	45	17.6
	Higher order multiples	6	2.4
Mode of delivery	Normal vaginal delivery	164	64.3
	Assisted breech delivery	13	5.1
	Operative vaginal delivery	4	1.6
	Abdominal delivery	74	29
Sex of the baby	Male	135	53
	Female	115	45
	Unknown	5	2
Birth weight of the baby	<1000 (EVLBW)	59	23.1
	1000-1499 (VLBW)	67	26.3
	1500-2499 (LBW)	73	28.6
	2500-4000 (NBW)	54	21.2
	≥4000 (Macrosomia)	2	0.8
	Mean birth weight =1738 ±842grams SD		

The majority of the mothers had the age group between 20-34 years with a mean age of 29 ±5.6 years SD. Most of the mothers were married/cohabiting, had a low level of education (primary and secondary school), and were self-employed. Most of the mothers were referred from other health facilities and had a parity between 2 and 4 with a mean parity of 2 ±1 SD.

Half of the mothers had ANC contacts of more than four and nearly half had ANC contacts of less than four with the mean number of ANC contact 2±1 SD. Four mothers had no ANC contact. The majority of the mothers (93%) were HIV negative and 7% were HIV positive. Thirty percent of the mothers had hypertensive disorders of pregnancy (HDP).

Eighty percent of the fetuses/babies who had perinatal deaths were delivered preterm (<37weeks). Early preterm (28 -34 weeks) constituted 57.7% of the total perinatal deaths. The mean gestational age was 33 ±4 weeks SD, and the majority (80%) were singleton pregnancies.

The predominant mode of delivery was normal vaginal delivery which constituted 64.3%. Most of the babies born were male (53%). The majority of the babies born (78%) had birth weight below 2500g with a mean birth weight of 1738 ±842 grams SD.

4.2 Timing of perinatal deaths for MNH deliveries

Deliveries that occurred during the four-month study period were 1558, perinatal deaths constituted 10.7% of the total deliveries. Antepartum stillbirths constituted 45%, intrapartum stillbirths constituted 13% and early neonatal deaths constituted 42% of the total MNH deliveries as shown in figure 1 below.

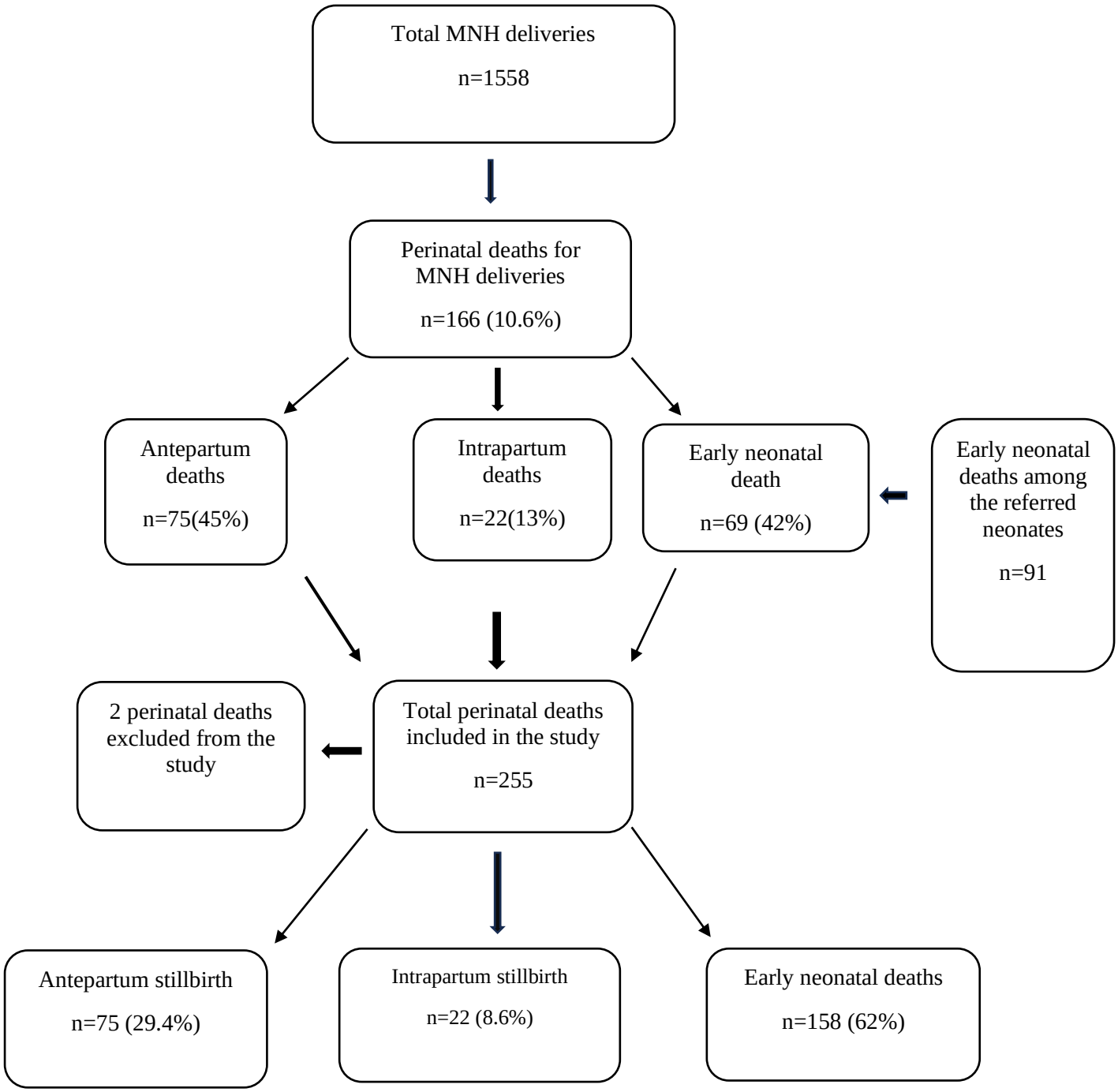


Figure 2**: Deliveries and timing of perinatal death that occurred at MNH from October 2023 to January 2024.**

4.3 Timing of the total perinatal deaths

Ninety-one early neonatal deaths were among the neonates who were referred from other health facilities due to sickness, which constituted 35% of the total perinatal deaths. This makes a total of 257 perinatal deaths. Two perinatal deaths were excluded from the study due to missing files.

Of the total perinatal deaths that were included in the study antepartum stillbirths constituted 29.4%, intrapartum stillbirths constituted 8.6% and early neonatal deaths constituted 62% of the total perinatal deaths that occurred at MNH as shown in the figure 1 above.

4.4 Social-demographic and clinical characteristics associated with the timing of perinatal deaths

Antepartum and intrapartum stillbirths were almost equally more prevalent among mothers in the age group between 20-34 and ≥ 35 years compared with other age groups. Neonatal deaths were more prevalent among mothers with age below 20 years compared with other age groups. However, the observed differences were not statistically significant. The P-value was >0.05 as shown in table 2 below.

Table 2: Socio-demographic and clinical characteristics of the study participants associated with timing of perinatal deaths

Variable	Category	Timing of perinatal death				
		Antepartum n=75 (%)	**Intrapartum n=22 (%)**	**Neonatal n=158(%)**	**Total n=255**	**P-value**
Age of the mother (years)	<20	3 (13)	0 (0)	20 (87%)	23	
	20-34	58 (30.4)	18 (9.4)	115 (60.2)	191	
	≥35	14 (34.1)	4(9.8)	23 (56.1)	41	0.12
Marital status of the mother	Married/Cohabiting	69 (32)	18 (8.3)	129 (59.7)	216	
	Single/divorced/separated/widow	6 (15.4)	4 (10.3)	29 (74.3)	39	0.113
Level of education of the mother	**No formal education**	**2 (50)**	**1(25)**	**1(25)**	4	
	Low level (Primary and secondary)	62 (28.8)	20 (9.3)	133 (61.9)	215	
	High level	11 (30.6)	1 (2.8)	24 (66.6)	36	0.353
Occupation of the mother	Unemployed	29 (29.6)	7 (7.1)	62 (63.3)	98	
	Employed/self-employed	46 (29.3)	15 (9.6)	96 (61.1)	157	0.798
Referral status of the mother	Referred	64 (27.8)	22 (9.6)	144 (62.6)	230	
	Direct Admission	11 (44)	0 (0)	14 (56)	25	0.102
ANC characteristics of the study participants and timing of perinatal deaths						
Parity of the mother	1	16 (19.5)	5 (6.1)	61 (74.4)	82	
	2 -4	52 (34.2)	17 (11.2)	83 (54.6)	152	
	≥5	7 (33.3)	0 (0)	14 (6.7)	21	**0.026**
Number of ANC contacts of the mother	0	1(25)	1(25)	2 (50)	4	
	1-3	31 (25)	14 (11.3)	79 (63.7)	124	
	≥4	43 (33.9)	7 (5.5)	77 (60.6)	127	0.233
HIV status of the mother	Positive	2 (11.1)	2 (11.1)	14 (77.8)	18	
	Negative	73 (30.8)	20 (8.4)	144 (60.8)	237	0.210
ANC blood pressure status of the mother	Hypertensive	41 (52.6)	8 (10.3)	29 (37.1)	78	
	Normotensive	34 (19.7)	14 (8.1)	129 (74.6)	173	<0.001
Labor and delivery characteristics of the study participants						
Gestational age at delivery	28-33	38(25.9)	14(9.5)	95 (64.6)	147	
	34-36	31 (55.4)	4 (7.1)	21 (37.5)	56	
	≥37	6(11.5)	4 (7.7)	42 (80.8)	52	**<0.001**
Type of pregnancy	Singleton pregnancy	68 (33.3)	22 (10.8)	114 (55.9)	204	
	Twin pregnancy	7 (15.6)	0 (0)	38 (84.4)	45	
	Higher order multiples	0 (0)	0 (0)	6 (100)	6	**0.002**
Mode of delivery	Normal vaginal delivery	49 (29.9)	8 (4.9)	107 (65.2)	164	
	Assisted breech delivery	3 (23)	5 (38.5)	5 (38.5)	13	
	Operative vaginal delivery	3 (75)	0 (0)	1 (25)	4	
	Abdominal delivery	20 (27)	9 (12.2)	45 (60.8)	74	**0.001**
Sex of the baby	Male	38 (28.1)	10 (7.5)	87 (64.4)	135	
	Female	36 (31.3)	12 (10.4)	67 (58.3)	115	
	Unknown	1 (20)	0 (0)	4 (80)	5	0.715
Birth weight of the baby	<1000 (EVLBW)	9 (15.3)	3 (5)	47 (79.7)	59	
	1000-1499 (VLBW)	25 (37.3)	8 (12)	34 (50.7)	67	
	1500-2499 (LBW)	28 (38.4)	10 (13.7)	35 (47.9)	73	
	≥2500	13(23.2)	1(1.8)	42 (75)	56	**0.001**

Antepartum and early neonatal deaths were more prevalent among mothers who were married/cohabiting compared to mothers who were single/divorced/separated/widowed. Intrapartum deaths were more prevalent among mothers who were single/divorced/separated/widowed compared to others, however, the observed differences were not statistically significant, P-value was >0.05.

Stillbirths (antepartum and intrapartum deaths) were more prevalent among mothers with no formal education compared to others. Early neonatal deaths were more prevalent among mothers with high levels of education however the observed differences were not statistically significant, p-value was >0.05.

Antepartum and early neonatal deaths were equally prevalent among mothers who were unemployed and employed/self-employed. Intrapartum deaths were more prevalent among mothers who were employed/self-employed, however, the observed differences were not statistically significant, P-value was >0.05.

Antepartum stillbirths were more prevalent among mothers who had direct admission to MNH compared to those who were referred from other health facilities. Intrapartum and early neonatal deaths were more prevalent among mothers and neonates who were referred from other health facilities compared to those who had direct admission to MNH, however, the observed differences were not statistically significant, P-value was >0.05.

Antepartum stillbirths were almost equally more prevalent among mothers who had a parity of 2-4 and those who had a parity of ≥5 compared with primipara women. Early neonatal deaths were more prevalent among primipara women compared to others; The observed differences were statistically significant P-value was <0.05.

Antepartum stillbirths were more prevalent among mothers who had ANC contacts of ≥4 compared to others. Intrapartum stillbirths were more prevalent among mothers who had no ANC contacts compared to others. Early neonatal deaths were more prevalent among mothers who had ANC contacts of less than four compared to others, however, the observed differences were not statistically significant, P-value was > 0.05.

Antepartum stillbirths were more prevalent among mothers who were HIV-negative compared to HIV-positive mothers. Intrapartum and early neonatal deaths were more prevalent among mothers who were HIV positive compared to HIV negative, however, the observed differences were not statistically significant, P-value was > 0.05.

Stillbirths (antepartum and intrapartum deaths) were more prevalent among mothers with hypertensive disorders of pregnancy (HDP) compared to normotensive mothers. Early neonatal deaths were more prevalent among mothers who were normal tensive compared to those with HDP. The observed differences had strong statistical significance P-value was <0.001.

Antepartum stillbirths were more prevalent among stillborn babies who were born in late preterm (34-36 weeks) compared to others. Intrapartum stillbirths were more prevalent among stillborn babies who were born in early preterm (28-33 weeks) compared to others. Early neonatal deaths were more prevalent among babies who had early neonatal deaths and were delivered at or after term (≥37 weeks). The P-value was <0.001 which showed that there was a strong statistical significance.

Stillbirths (antepartum and intrapartum deaths) were more prevalent among stillborn babies from single-tone pregnancies compared to multiple pregnancies. Early neonatal deaths were more prevalent among those babies who had early neonatal deaths from mothers who had multiple pregnancies. The observed differences were statistically significant, P-value was less than 0.05.

Antepartum deaths were more prevalent among stillborn babies who were delivered by operative vaginal delivery compared to others. Intrapartum stillbirths were more prevalent among stillborn babies who were delivered by assisted breech delivery compared to others. Early neonatal deaths were more prevalent among babies who died during the early neonatal period and who were delivered by normal vaginal delivery. The P-value was <0.001 which showed that there was a strong statistical significance.

Antepartum and intrapartum stillbirths were more prevalent among stillborn female babies compared to others. Early neonatal deaths were more prevalent among babies who died during the early neonatal period with unknown sex compared to others, however, the observed differences were not statistically significant, p-value was <0.05.

Antepartum and intrapartum stillbirths were more prevalent among stillborn babies with low birth weight (1500-1499g) compared to others. Early neonatal deaths were more prevalent among babies who had early neonatal deaths who were born with extremely very low birth weight (<1000g) compared to others. The observed differences were statistically significant, P-value was less than 0.05.

4.5 Underlying cause of death and maternal medical conditions contributed to perinatal death

Table 3: ICD-PM summary of the timing, underlying cause of deaths, and maternal conditions contributed to perinatal deaths.

Maternal conditions	M1: complications of placenta, cord, and membranes	M2: Maternal complications of pregnancy	M3: Other complications of labor and delivery	M4: Maternal medical and surgical conditions	M5: No maternal condition identified	Other	Total (%)
Perinatal cause of death							
Antepartum death (A)							
A1: Congenital malformations, deformations and chromosomal abnormalities	0	0	0	0	4	0	4 (5.3)
A2: Infection	0	0	0	0	0	0	0 (0)
A3: Antepartum hypoxia	23	6	0	37	4	0	70(93.3)
A4: Other specified antepartum disorder	0	0	0	0	0	0	0 (0)
A5: Disorders related to fetal growth	0	0	0	0	0	0	0 (0)
A6: Fetal death of unspecified cause	0	1	0	0	0	0	1 (1.4)
Total (%)	23(30.7)	7(9.3)	0(0)	37(49.3)	8(10.7)	0(0)	75 (100)

Intrapartum death (I)							
I1: Congenital malformations, deformations and chromosomal abnormalities	0	0	0	1	0	0	1(4.5)
I2: Birth trauma	0	0	0	0	0	0	0 (0)
I3: Acute intrapartum event	7	6	1	6	0	0	20(91)
I4: Infection	0	0	0	0	0		0 (0)
I5: Other specified intrapartum disorder	0	0	0	0	0	0	0 (0)
I6: Disorder related to fetal growth	0	0	0	0	0	0	0 (0)
I7: Intrapartum death of unspecified cause	0	0	0	1	0	0	1 (4.5)
Total (%)	7(31.8)	6(27.3)	1(4.5)	8(36.4)	0(0)	0(0)	22(100)
Neonatal death (%)							
N1: Congenital malformations, deformations and chromosomal abnormalities	0	6	0	2	13	0	21 (13.3)
N2: Disorders related to fetal growth	0	0	0	0	0	0	0 (0)
N3: Birth trauma	0	0	0	0	0	0	0 (0)
N4: complication of intrapartum event	3	3	1	7	12	0	26(16.5)
N5: Convulsion and disorder of the cerebral status	0	0	0	0	0	0	0 (0)
N6: Infection	0	8	0	5	16	0	29 (18.4)
N7: Respiratory and cardiovascular disorders	0	0	0	0	6	0	6 (3.8)
N8: Other neonatal conditions	0	0	0	0	0	0	0 (0)
N9: Low birth weight and prematurity	3	38	0	16	18	0	75(47.4)
N10: Miscellaneous	0	0	0	0	0	0	0 (0)
N11: Neonatal death of unspecified cause	0	0	0	0	1	0	1 (0.6)
Total (%)	6 (3.8)	55 (34.8)	1(0.6)	30 (19)	66(41.8)	0(0)	158 (100)

4.6 Antepartum Deaths

Antepartum deaths constituted 29.4% of the total perinatal deaths. The most prevalent underlying cause of the antepartum deaths was antepartum hypoxia (A3) which constituted 93.3 % of the antepartum deaths.

The majority of the antepartum deaths (49.3%) occurred in mothers with maternal medical and surgical conditions (M4) mainly due to hypertensive disorders of pregnancy (Pre-eclampsia and eclampsia) followed by complications of placenta cord and membranes (M1) which constituted 30.7%, mostly due to abruptio placenta. Thirty-eight percent of the mothers who had abruptio placenta have had hypertensive disorders of pregnancy (HDP) as well.

4.7 Intrapartum Deaths

Intrapartum deaths constituted 8.6% of the total perinatal deaths. The most prevalent underlying cause of intrapartum deaths was acute intrapartum event (I3), which constituted 91% of the intrapartum deaths.

The main maternal condition that contributed to intrapartum deaths were maternal medical and surgical conditions (M4) mainly due to hypertensive disorders of pregnancy (HDP), followed by maternal complications of pregnancy (M2).

4.9 Neonatal Deaths

Early neonatal deaths were the most prevalent timing of perinatal death, which constituted 62 % of the total perinatal deaths. Low birth weight and prematurity (N9) was the most prevalent group of the underlying cause of neonatal death which constituted 47.4% of the neonatal deaths followed by infection (N6) which constituted 18.4 %.

The majority of these perinatal deaths 41.8% were from mothers without identified medical conditions (M5), followed by maternal complications of pregnancy (M2) which constituted 34.8% of the early neonatal deaths. Most maternal complications of pregnancy were due to multiple pregnancies (20.3%) followed by preterm premature rupture of membranes (12%).

The majority of the early neonatal deaths (85%) occurred more than 24 hours after delivery and (15%) occurred within 24 hours after delivery.

4.10 Neonatal deaths of the neonates who were delivered at MNH

The majority of the early neonatal deaths among the neonates who were delivered at MNH were due to low birth weight and prematurity which constituted 52% followed by congenital anomalies which constituted 23.2% and birth asphyxia which constituted 15% as shown in figure 3 below.

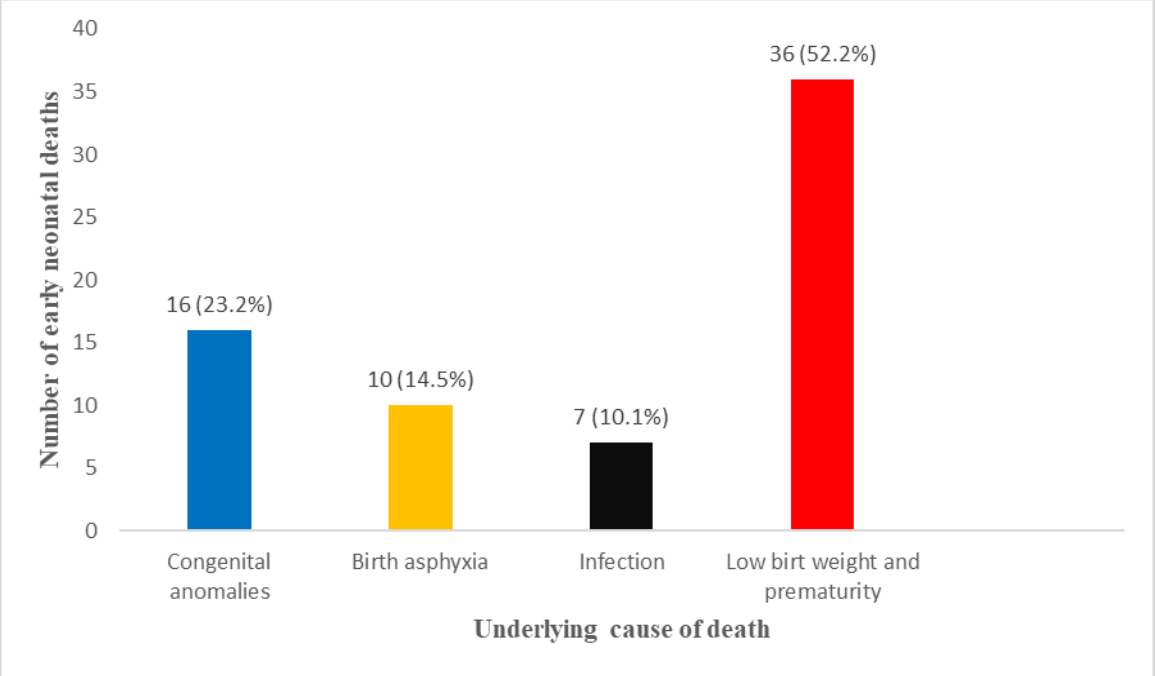


Figure 3: Underlying cause of death of the early neonatal deaths among the neonates who were delivered at MNH

4.11 Neonatal deaths of the neonates who were referred from other health facilities due to sickness.

Low birth weight and prematurity were also the most prevalent underlying causes of death among the neonates who were referred from other health facilities which constituted 43.7%, followed by infection 24.7% and birth asphyxia which constituted 18% as shown in Figure 4 below.

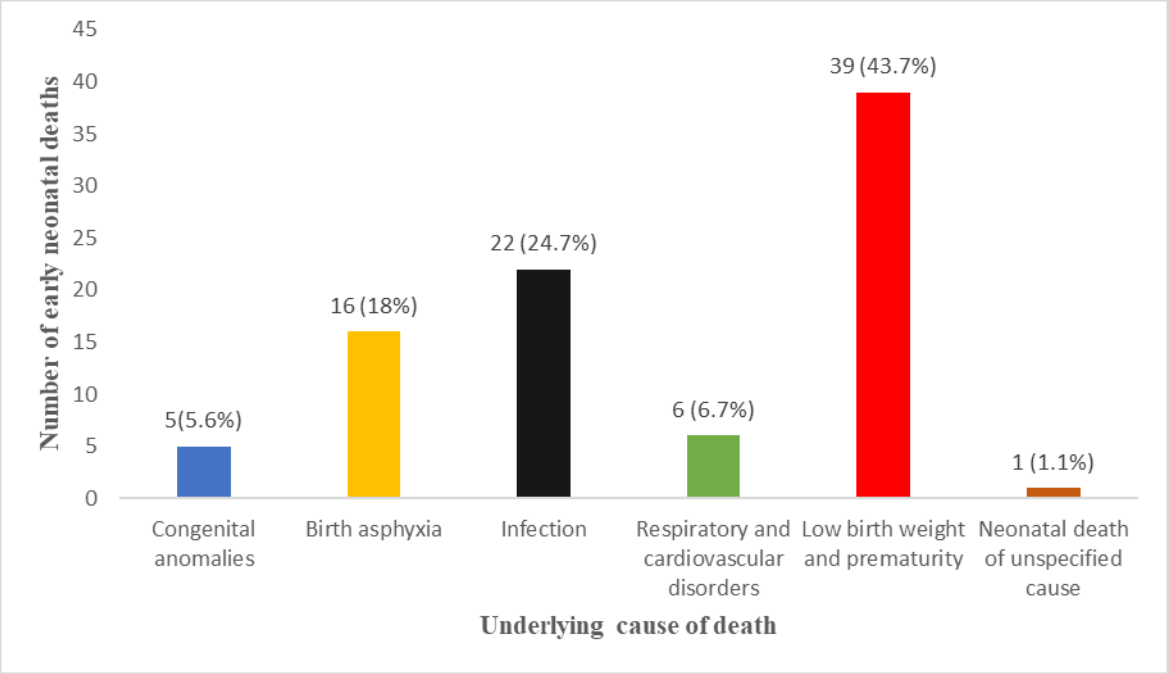


Figure 4: Underlying cause of death of the early neonatal deaths among the referred neonates

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4.12 Factors associated with the timing of perinatal deaths

In the univariable ordinal logistic regression analysis fetuses/neonates of hypertensive mothers who had perinatal deaths were significantly 4.6 times more likely to have antepartum perinatal deaths compared with fetuses/neonates of normotensive mothers (cOR=4.6, 95% CI 2.68 – 7.97).

The results persisted in the multivariable logistic regression analysis in which fetuses/neonates of hypertensive women were significantly 5.03 times more likely to have antepartum perinatal death compared to normotensive women (aOR 5.03 95% CI= 2.60 – 10.01).

Fetuses/neonates of the mothers with multiple pregnancies were significantly 0.22 times more likely to have antepartum perinatal deaths compared with fetuses/neonates of the mothers with singleton pregnancy in univariable logistic regression analysis (cOR= 0.22, 95% C0.08 – 0.47).

Results also persisted in the multivariable logistic regression analysis in which fetuses/neonates of mothers with multiple pregnancies were significantly 0.33 times more likely to have antepartum perinatal death compared with those from the singleton pregnancy (aOR=0.33, 95% CI=0.12 -0.82).

Table 4: Ordinal Univariable and multivariable logistic regression analysis of the factors associated with the timing of perinatal deaths

		Univariable analysis			Multivariable analysis		
Variable	**Category**	**cOR**	**95% CI**	**p-value**	**aOR**	**95% CI**	**p-value**
Maternal age (years)	<20	0.24	0.05 – 0.73	**0.025**	0.42	0.08 -1.76	0.266
	≥35	1.19	0.60 – 2.29	0.616	0.89	0.35 -1.89	0.640
	20-34	Ref					
Marital status	Single/divorced/separated	0.48	0.22- 1.00	0.06	1.02	0.38 -2.60	0.975
	Married/cohabiting	Ref					
Education level	No formal education	3.51	0.51 – 29.69				
	Low-level education	1.13	0.55 – 2.44	0.201			
	High-level education	Ref	0.83 – 6.22	0.750			
Occupation	Unemployed	0.95	0.56 – 1.57	0.829			
	Employed/self-employed	Ref					
Referral status	Referred	1.58	0.67 – 3.64	0.283			
	Direct Admission	Ref					
Parity	1	0.43	0.24 – 0.76	**0.004**	0.48	0.22 – 1.02	0.059
	≥5	0.70	0.25 -1.79	0.470	0.67	0.18 -2.22	0.525
	2-4	Ref					
Number of ANC contacts	No ANC contact	1.13	0.145-7.11	0.894			
	1-3	0.80	0.48 -1.32	0.375			
	≥4	Ref					
HIV status of the mother	Positive	0.41	0.12– 1.17	0.124	0.57	0.14 -1.94	0.402
	Negative	Ref					
ANC blood pressure status	Hypertensive	4.59	2.68– 7.97	**<0.001**	5.03	2.60 -10.01	**<0.001**
	normotensive	Ref					
Type of pregnancy	Multiple pregnancies	0.22	0.08 – 0.47	**<0.001**	0.33	0.12 -0.82	**0.022**
	Singleton	Ref					
Gestational age at delivery	28-33	2.34	1.13 – 5.47	**0.028**	3.55	1.08 -12.21	**0.040**
	34-36	7.75	3.38 – 19.10	**<0.001**	5.97	2.14 -17.7	**<0.001**
	≥37	Ref					
Mode of delivery	Assisted breech delivery	1.69	0.61 -4.55	0.295	1.98	0.60 -6.40	0.254
	Operative vaginal delivery	7.23	0.90-148.60	0.091	4.27	0.31 -129.64	0.327
	Abdominal delivery	1.09	0.62 – 1.89	0.756	0.41	0.20 -0.81	**0.011**
	Normal vaginal delivery	Ref					
Sex of the baby	male	0.80	0.48 – 1.32	0.378			
	Unknown	0.38	0.01 – 2.70	0.398			
	Female	Ref					
Birth weight of the baby	<1000	0.72	0.30 – 1.73	0.464	0.50	0.12 -2.01	0.328
	1000-1499	2.63	1.25 – 5.75	**0.013**	2.01	0.60 -6.94	0.263
	1500-2449	2.85	1.38 –6.15	**0.006**	2.04	0.75 -5.68	0.164
	≥2500	Ref					

Key: cOR: crude odds ratio, aOR: adjusted Odd Ratio, Ref: Reference Category

Fetuses/neonates who had perinatal deaths and who were delivered at a gestational age between 28-33weeks were significantly 2.34 times more likely to have antepartum perinatal deaths compared to others in the univariable ordinal logistic regression analysis

(cOR=2.34, 95% CI 1.13 – 5.47). Results persisted in the multivariable ordinal logistic regression analysis in which they were significantly 3.55 times more likely to have antepartum perinatal deaths (aOR=3.55, 95% CI 1.08 -12.21).

Fetuses/neonates who were delivered at a gestational age between 34-36 weeks were significantly 7.75 times more likely to have antepartum perinatal deaths compared to others in the univariable ordinal logistic regression analysis (cOR=7.75, 95% CI 3.38 – 19.11).

These results persisted in the multivariable ordinal logistic regression analysis in which they were significantly 5.97 more likely to have antepartum perinatal deaths (aOR=5.97, 95% CI 2.14 -17.7).

In the univariable logistic regression analysis fetuses/neonates who were delivered by operative vaginal delivery were 7.23 times more likely to have antepartum perinatal deaths (cOR=7.23, 95% CI 0.90 – 148.60), after controlling for confounders in the multivariable ordinal logistic regression analysis it was still not statistically significant (aOR=4.27, 95% CI 0.31 – 129.64).

Fetuses/neonates who were delivered abdominally were 1.09 more likely to have antepartum perinatal deaths compared to others (cOR=1.09, 95% CI 0.62 -1.89) after controlling for confounders in the multivariable ordinal logistic regression analysis it was 0.41 more likely to have antepartum perinatal deaths and it was statistically significant (aOR=0.41, 95% CI 0.20 – 0.81).

Fetuses/neonates who were born with birth weight between 1000-1499g were 2.63 times more likely to have antepartum perinatal deaths compared to other weight (cOR=2.63, 95% CI 1.25 -5.75). After controlling for confounders in the multivariable ordinal logistic regression analysis it was not statistically significant (aOR=2.04,95% CI 0.60 – 6.94).

Fetuses/neonates with birth weight of 1500 - 2449 were 2.85 more likely to have antepartum perinatal death compared to others in the univariable ordinal logistic regression analysis (cOR=2.85, 95% CI 1.38 – 6.15), after controlling for confounders in the multivariable ordinal logistic regression analysis it was 2.04 times more likely to have antepartum perinatal deaths compared to others and it was not statistically significant (aOR=2.04, 95% CI 0.75-5.68).

5.0 DISCUSSION

The burden of perinatal deaths is still high at MNH, with a stillbirth rate of 62 per 1000 live births, which is five times higher compared to WHO recommendations of a stillbirth rate of less than 12 per 1000 live births. Also, the early neonatal death rate is high, 69 per 1000 live births of the total MNH deliveries.

The majority of the perinatal deaths at MNH were early neonatal deaths (62%), largely contributed by neonates who were referred from other health facilities due to sickness (56%), mainly due to prematurity and low birth weight and the majority are from the mothers with no identified medical condition.

This high proportion of early neonatal deaths is consistence with a similar study done in Zanzibar(13), although they excluded the referred neonates in their study, but early neonatal deaths were the major contributor to the perinatal deaths.

This finding differs from a similar study done in South Africa (14) in which antepartum deaths were the major contributor to the burden of the perinatal deaths. Proportions of the timing of perinatal deaths differ in different studies and depend on the level of industrialization of the country and the quality of the health care services.

According to the systematic review of the global use of the ICD-PM (14), perinatal deaths are higher in the middle-income and low-income settings compared to high-income settings. In this systematic review, antepartum deaths had higher proportions in the high-income and middle-income settings followed by neonatal deaths. Intrapartum deaths are higher in low-income settings followed by antepartum deaths.

The underlying cause of early neonatal deaths was mainly due to low birth weight and prematurity which is contrary to a similar study done in Zanzibar(13) and South Africa(14) in which complication of the intrapartum events (birth asphyxia) was the most prevalent followed by respiratory and cardiovascular disorders and low birth weight and prematurity.

This could be due to suboptimal quality of care of the premature and low birth weight babies at MNH. Also, could be accounted by the delayed referral and improper transportation of the neonates from the referring health facilities to MNH for them to be received in good conditions. Further studies are needed in order to ascertain more on the causes of perinatal deaths due to prematurity and low birth weight.

A low number of babies born with birth asphyxia at MNH shows that there is good monitoring of pregnant women during labor and delivery.

For the referred neonates from other health facilities, it was difficult to ascertain maternal conditions that contributed to perinatal deaths, as the referral letters had minimal information. This was mitigated by communicating with the referring physician in order to find maternal information to ascertain maternal medical conditions contributed to the perinatal deaths.

Antepartum deaths were the second most prevalent timing of perinatal deaths mainly due to antepartum hypoxia followed by congenital malformations, deformations, and chromosomal abnormalities.

Antepartum deaths due to antepartum hypoxia were mainly from mothers with hypertensive disorders of pregnancy (pre-eclampsia and eclampsia) and abruptio placenta in which placental insufficiency was evidenced by abnormal umbilical artery doppler ultrasound findings and presence of retroplacental clots on placental examination after delivery.

This finding was contrary to a similar study done in Zanzibar (13) in which antepartum hypoxia and antepartum deaths of unspecified causes were almost equally prevalent, constituting 46.1% and 50% of the total antepartum deaths respectively.

This finding was contrary to a similar study done in South Africa (14) as well in which the majority of the antepartum deaths were due to antepartum death of unspecified cause (67%) and there was no antepartum death caused by antepartum hypoxia.

According to the systematic review of the global use of the ICD-PM (12), a high proportion of antepartum deaths of unspecified causes might be due to missing data, improper documentation of patient information in the clinical case notes, and lack of diagnostic assessment of both mother and fetus by doing maternal blood investigations, imaging and postmortem examination of the fetus and placenta.

World Health Organization (WHO) should clearly define the hypoxia category in the groups of timing of perinatal deaths as there are wide variations in the use of antepartum hypoxia and intrapartum hypoxia in different studies which results in lack of comparability of data between different settings.

The main maternal condition that contributed to antepartum deaths was maternal medical and surgical conditions mainly due to hypertensive disorders of pregnancy (pre-eclampsia and eclampsia). This was contrary to studies (12–14) in which the majority of the antepartum deaths were from mothers with unidentified conditions.

This difference in findings could be due to the proper diagnosis of mothers with medical and surgical conditions mainly pre-eclampsia and eclampsia and proper documentation of the maternal conditions at MNH.

Early prevention of hypertensive disorders of pregnancy (HDP) by using aspirin and calcium supplementation and management of pregnant women with HDP is crucial in the prevention of perinatal deaths attributable by HDP.

Intrapartum deaths were the least prevalent timing compared to other timings of perinatal deaths. Intrapartum deaths at MNH were mainly due to acute intrapartum events from mothers with abruptio placenta and hypertensive disorders of pregnancy (HDP).

This finding is inconsistency with a similar study done in South Africa (middle-income setting) in which intrapartum deaths were least prevalent (14).

This finding is contrary to the study done at Mnazi Mmoja Hospital in Zanzibar (a low-income setting) (13) in which antepartum and intrapartum deaths were equally prevalent.

According to the systematic review of the global use of the ICD-PM (12), intrapartum deaths were more prevalent in low-income settings. This shows that there is a good quality of care for pregnant women who are in labor at MNH.

Quality of care of pregnant women in labor with hypertensive disorders of pregnancy should be improved with use of continuous electronic fetal monitoring (CTG) during labor in order to detect earlier fetuses with uteroplacental insufficiency that could not sustain labor, for early interventions in order to reduce intrapartum deaths attributable to placental insufficiency like women with hypertensive disorders of pregnancy.

Maternal conditions associated with intrapartum deaths were mainly due to maternal medical and surgical conditions mostly due to pre-eclampsia and eclampsia. This finding was contrary to the study done in Zanzibar (13) in which "no maternal condition identified" was most prevalent.

This finding was also contrary to the study done in South Africa (14) in which complications of the placenta, cord, and membranes were most prevalent. This shows that there is a need to improve the quality of the care of pregnant mothers during antenatal care and during labor and delivery in order to reduce preventable causes of intrapartum deaths.

Hypertensive disorders of pregnancy (HDP) were significantly associated with the timing of perinatal deaths. Antepartum stillbirths were more prevalent among women with hypertensive disorders of pregnancy (HDP). This finding is consistence with studies(18,19) in which hypertensive disorders of pregnancy were significantly associated with perinatal deaths.

Early prevention of women at risk of HDP with aspirin and calcium supplementation and early detection and management of HDP will results into reduction of perinatal deaths attributable to this condition.

The type of pregnancy was significantly associated with the timing of perinatal deaths. Multiple pregnancies were significantly associated with early neonatal deaths. This could be due to the majority of multiple pregnancies resulting into premature labor and delivery

of premature babies which later will result to early neonatal deaths due to complications of low birth weight and prematurity.

This finding is consistent with the studies (20,21) in which multiple pregnancy was significantly associated with perinatal deaths. This is because multiple pregnancies result in preterm labor and delivery of premature babies who die due to complications of prematurity.

Birth weight was significantly associated with the timing of perinatal deaths. Low birth weight was significantly associated with early neonatal deaths due to complications of prematurity. This finding was consistent with studies(22,23) in which low birth weight was significantly associated with early neonatal deaths.

Mode of delivery was significantly associated with perinatal deaths. Assisted breech deliveries were significantly associated with intrapartum perinatal deaths. This finding is inconsistence with the study done in Bangladesh (24) in which assisted breech vaginal deliveries were significantly associated with intrapartum perinatal deaths.

This could be due to a lack of skills in the proper delivery of breech babies. On-job training on how to conduct breech deliveries should be done to the health care workers working at MNH labor ward to improve the outcome of the babies following assisted breech delivery.

6.0 STUDY LIMITATIONS CONCLUSION AND RECOMMENDATION

6.1 Study Limitations

For the neonates who were referred from other health facilities, it was difficult to determine maternal conditions contributed to perinatal deaths in the review panels, since the referral letters had limited information on the maternal conditions.

A sample size of this study was small to power the study to determine factors associated with the timing of perinatal deaths using logistic regression analysis. Larger similar studies should be conducted at MNH in order to ascertain factors associated with the timing of perinatal deaths.

6.2 Conclusion

Six out of ten perinatal deaths occurred during the early neonatal period, mainly due to complications of low birth weight and prematurity, and mostly occurred in mothers with no identified medical conditions, followed by mothers with multiple pregnancy and HDP.

Antepartum deaths were mainly due to antepartum hypoxia, mostly from the mothers with medical and surgical conditions, mainly HDP were the second most prevalent timing of the perinatal death. Intrapartum deaths were the least timing of perinatal deaths mostly due to acute intrapartum events mostly from mothers with HDP.

Hypertensive disorders of pregnancy (pre-eclampsia and eclampsia), Multiple pregnancies, gestational age at delivery, and mode of delivery were significantly associated with the timing of perinatal deaths.

6.3 Recommendations

Targeted intervention to screen, detect, and provide early management of maternal conditions, mainly HDP and preterm birth, as well as improve antepartum care, have the potential to reduce the large burden of perinatal deaths.

The hypoxic category in the groups of the timing of perinatal deaths should be clearly defined by (WHO) as there are wide variations in the use of antepartum hypoxia and intrapartum hypoxia in different studies which results in lack of comparability of data between different settings.

In the daily clinical practice when perinatal death occurs, perinatal death review should be conducted as per ICD-PM and documentation of the timing, groups of the timing underlying cause of death and contributing maternal medical conditions should be done and analyzed so as to improve on the provision of health care services and to monitor quality of care.

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APPENDICES

Appendix A: English version of the questionnaire

Date…….

Serial no……

I am Dr Gabriel Michael Luvanga a postgraduate student at Muhimbili University of Health and Allied Sciences, I would like to thank you for your approval and acceptance to be among the interviewees in this research**.** The interview will be held for 20 minutes. In case you are not comfortable responding to a certain question please feel free to do so. However, your cooperation is highly appreciated.

The purpose of the study: To classify perinatal deaths according to the International Classification of Diseases for Perinatal Mortality (ICD-PM) at Muhimbili National Hospital**.**

Is there any question or an area for clarification from what I have explained to you?

SECTION A: SOCIAL DEMOGRAPHIC DATA

1. Age of the mother ……years.

2. Marital status of the mother
    a) Single
    b) Married
    c) Cohabited
    d) Divorced
    e) Separated
    f) Widow

3. Level of education of the mother
    a) Never attended school
    b) Primary school
    c) Secondary school
    d) College /university

4. Occupation of the mother
    a) Peasant
    b) Self-employed
    c) Employed
    d) Unemployed
5. What is the referral status?
    a) Referred from other health facility
    b) Direct admission

SECTION B: ANTENATAL, LABOR &DELIVERY AND NEONATAL PERIOD

6. Parity …….
7. Mother attended ANC?
    a) Yes
    b) No, go to question 10
    c) Unknown

8. Where was ANC done?
    a) Dispensary
    b) Health Centre
    c) Hospital
    d) Other (specify)……

9. Number of ANC contacts…….

10. Basic package of services provided on ANC (circle which applies)
    a) Syphilis screening
    b) Hemoglobin
    c) Blood group
    d) HIV status
    e) BP measurements
    f) Urinalysis
    g) Iron/folic acid supplementation
    h) TT immunization
    i) SP
    j) Mebendazole

11. Relevant antenatal problems detected during ANC (Circle what applies)
    a) Diabetes Mellitus
    b) Antepartum hemorrhage
    c) Malaria
    d) Anemia
    e) Polyhydramnios
    f) Heart disease
    g) Untreated syphilis

h) Hypertensive disorders
i) HIV and AIDS
j) Others specify…….
k) None
l) Unknown
m) Not applicable (did not attend ANC)

12. If HIV positive, was the mother on ART?
a) Yes
b) No
c) Unknown

13. What is the recent viral load of the mother?.....
a) <1000
b) >1000
c) unknown

14. Gestational age at delivery……. Weeks

15. Type of pregnancy
a) Singleton
b) Twin
c) Higher older multiple pregnancies

16. Place of delivery
a) National hospital
b) Other hospital
c) Dispensary
d) Health Centre
e) Home
f) On the way to the facility
g) Other, specify……

17. Mode of delivery
a) Normal Vaginal delivery
b) Vacuum delivery
c) Emergency C/S
d) Elective C/S
e) Breech delivery
f) Laparotomy
g) Hysterotomy
h) Other…….

18. Delivery attendant
    a) Nurse/midwife
    b) Medical Officer
    c) Obstetrician
    d) AMO
    e) Clinical officer/ Assistant Clinical officer
    f) Medical Attendant
    g) Traditional birth attendant
    h) Family member
    i) Unassisted

19. What was the duration of the first stage of labor……? HRS

20. What was the duration of the second stage of labor……? Minutes

21. In the case of cesarean section/laparotomy/ hysterotomy, what was the indication of surgery

    ……
    ……..
22. What was the time from decision to performing surgery……hours…….. Minutes?

23. What was the duration of surgery?
    a) One hour or less
    b) More than one hour

24. What was the type of anesthesia?
    a) General
    b) Spinal
    c) Not recorded
25. If delivered at MNH was the FHR detected on admission
    a) Yes
    b) No

26. Was the FHR detected during the onset of labor?
    a) Yes
    b) No

27. Condition at delivery
    a) Alive
    b) Fresh Stillbirth
    c) Macerated Stillbirth
28. Birth weight of the baby……g
29. Sex of the baby
    a) Male
    b) Female
    c) Unknown
30. APGAR score at 5^{th} minute
    a) Above 7
    b) Below 7
31. Duration of life after birth (hours/days)?.....
    a) Within 24 hours
    b) More than 24 hours but within 7 days
32. Was a post mortem done?
    a) Yes
    b) No
33. If yes what was the diagnosis……
34. Is there a previous history of stillbirth or early neonatal death?.....
    a) Yes
    b) No
35. Is the mother alive?
    a) Yes
    b) No
    c) No

SECTION C: PANEL DISCUSSION ON THE CAUSE OF PERINATAL DEATH

36. What is the agreed timing of perinatal death?
    a) Antepartum
    b) Intrapartum
    c) Neonatal
    d) Unable to classify

37. What is the agreed underlying cause of death and maternal conditions contributing to perinatal death after discussion?

    a) Medical certification of cause of death

MEDICAL CERTIFICATION OF CAUSE OF DEATH (MCCD)	
(a)	
(b)	Due to;
(c)	Due to;
(d)	Due to;

b) ICD-PM summary for underlying cause of death and contributing maternal conditions

CAUSES OF DEATH		CLINICAL DETAILS	ICD-10 CODES
(a)	The main disease or condition in the fetus or infant		
(b)	Other diseases or conditions in fetus or infant		
(c)	Main maternal disease or condition affecting fetus or infant		
(d)	Other maternal diseases or conditions affecting the fetus or infant		
FINAL ICD-PM CATEGORY:			

Appendix B: Swahili version of the questionnaire

Tarehe…….

Nambari ya mshiriki …….

Utangulizi

Naitwa Dkt Gabriel Michael Luvanga ni mwanafunzi wa shahada ya uzamili ya sayansi katika fani ya magonjwa ya Uzazi na wanawake katika chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS). Napenda kukushukuru kwa kujitolea kwako katika kushiriki mahojiano ya utafiti huu. Mahojiano haya yatafanyika kwa muda wa dakika 20. Uko huru kueleza kama hutajisikia kujibu swali lolote, japo tunathamini ushiriki wako.

Lengo la utafiti

Kuainisha vifo vya Watoto wachanga kwa kutumia njia ya kimataifa ya uainishaji inayopendekezwa na shirika la afya duniani (WHO) katika hospitali ya taifa Muhimbili.

Kutotakana na nilichokueleza una swali lolote au kuna sehemu unahitaji maelezo ya ziada?

SEHEMU A: TAARIFA BINAFSI

1. Umri wa mama ni miaka miaka?.....
2. Hali ya ndoa ya mama
    a) Hajaolewa
    b) Ameolewa
    c) Anaishi kinyumba
    d) Ameachika
    e) Ametengana
    f) Mjane

3. Kiwango cha elimu cha mama
    a) Hajawahi kwenda shule
    b) Elimu ya msingi
    c) Elimu ya sekondari
    d) Elimu ya chuo
4. Kazi ya mama ni?
    a) Mkulima wa kujikimu
    b) Amejiajiri
    c) Ameajiriwa
    d) Hajaajiriwa
5. Hali ya rufaa ni ipi?
    a) Nilipewa rufaa kutoka kituo kingine cha kutolea huduma za afya
    b) Nimelazwa moja kwa moja bila rufaa

SEHEMU B: UTUNZAJI WA UJAUZITO, UCHUNGU &KUJIFUNGUA NA KIPINDI CHA MTOTO MCHANGA.

6. Idadi ya uzao …….
7. Mama amewahi kuhudhuria ANC kliniki ?
    a) Ndo
    b) Hapana
8. Kliniki ya ANC alikuwa anafanyia wap?
    a) Zahanati
    b) Kituo cha Afya
    c) Hospitali
    d) Sehemu nyingineyo (taja)……
9. Umewahi kuhudhuria kliniki ya wajawazito mara ngapi kabla ya kujifungua?.....
10. Huduma alizozipata wakati wa ANC kliniki (zungushia inapohusika)
    a) Upimaji wa kaswende
    b) Upimaji wa uwingi wa damu (HB)
    c) Upimaji wa kundi la damu
    d) Upimaji wa VVU

e) Upimaji wa shinikizo la damu
f) Upimaji wa mkojo
g) Madini ya chuma na folic acid
h) Chanjo ya TT
i) SP
j) Mebendazole

11. Matatizo yaliyogundulika wakati wa kliniki ya ANC
    a) Kisukari
    b) Kutokwa na damu kabla ya uchungu (APH)
    c) Malaria
    d) Upungufu wa damu
    e) Maji mengi katika chupa ya uzazi
    f) Magonjwa ya moyo
    g) Kaswende isiyotibiwa
    h) Shinikizo kubwa la damu
    i) VVU na UKIMWI
    j) Mengineyo ,taja……..
    k) Hakuna tatizo
    l) Haijulikani
    m) Haihusiki (hakuhudhulia kliniki ya ANC)
12. Kama ni chanya, unatumia dawa za kufubaza VVU?
    d) Ndio
    e) Hapana
13. Kiwango chako cha VVU katika damu ni kipi?
    d) <1000
    e) >1000
    f) Hakijulikani
14. Umri wa mimba kwa wiki wakati wa kujifungua ni ……
15. ulikuwa na ujauzito wa aina gani?
    a) Mtoto mmoja
    b) Mapacha
    c) Watoto zaidi ya wawili

16. . Ulijifungulia wap?

a) Hospitali ya taifa (MNH)
b) Hospitali nyingine
c) Zahanati
d) Kituo cha Afya
e) Nyumbani
f) Barabarani kuelekea kituo cha kutolea huduma za afya
g) Sehemu nyingineyo, taja……

17. Ulijifungua kwa njia gani?

a) Kawaida kupitie uke
b) Vacuum
c) Upasuaji wa kumtoa mtoto kwenye kizazi wa dharura
d) Upasuaji wa kumtoa mtoto kwenye kizazi kwa kupanga
e) Kupitia uke kwa mtoto alyetanguliza makalio (breech)
f) Upasuaji kupitia tumboni kwa mimba iliyotungwa nje ya kizazi (laparotomy)
g) Operesheni ya kumtoa mtoto katika kizazi kabla ya wiki 34 (hystorotomy)
h) Nyinginezo taja…….

18. Alizalishwa na nani?

a) Muuguzi mkunga
b) Daktari
c) Daktari bingwa
d) Daktari msaidizi
e) Tabibu/Tabibu msaidizi
f) Mhudumu wa afya
g) Mkunga wa jadi
h) Mwanafamilia
i) Hakuhudumiwa na mtu

19. Hatua ya kwanza ya uchungu ilichukua muda gani? Masaa…….

20. Hatua ya pili ya uchungu ilichukua muda gani? Dakika……...

21. Kama mama alijifungua kwa upasuaji, sababu yake ilikuwa ni nini?

    ……

22. Ulipita muda gani kutoka oparesheni ilipo amuliwa hadi kuanza kufanyika?

    masaa……...na dakika…….

23. Upasuaji ulichukua muda gani?

    a) Saa moja au chini ya saa moja
    b) Zaidi ya saa moja

24. Aina ya ganzi iliyotumika ni ipi?

    a) Anesthesia ya jumla
    b) Anesthesia ya mgongo
    c) Haijarekodiwa

25. Mapigo ya moyo ya Mtoto yalisikika wakati mama analazwa?

    a) Ndio
    b) Hapana

26. Mapigo ya moyo ya Mtoto yalisikika wakati uchungu umeanza?

    c) Ndio
    d) Hapana

27. Hali ya mtoto baada ya kujifungua?

    a) Hai
    b) Amefariki, Ngozi haijachunika (SBF)
    c) Amefariki, Ngozi imechunika (SBM)

28. uzito wa mtoto baada ya kujifungua ni……g

29. Jinsia ya mtoto ni ipi

    a) Kiume
    b) Kike
    c) Haijulikani

30. APGAR score katika dakika ya 5 ni?

    a) 7 na zaidi
    b) Chini ya 7

31. Mtoto aliishi masaa mangapi /siku ngapi baada ya kujifungua kabla ya kufariki?.....
    a) Ndani ya masaa 24
    b) Zaidi ya masaa 24 lakini ndani ya siku 7
32. Uchunguzi baada ya kifo ulifanyika?
    a) Ndio
    b) Hapana
33. Kama ulifanyika, ugonjwa uliogundulika ni…….
34. Mama anahistoria ya mtoto kufia tumboni au kifo cha mtoto mchanga siku 7 baada ya kujifungua……
    a) Ndio
    b) Hapana
35. Mama wa mtoto yupo hai?
    a) Ndio
    b) Hapana

SEHEMU C: MAJADILIANO KUHUSU SABABU ZA KIFO CHA MTOTO MCHANGA

36. Wakati uliokubaliwa wa kifo cha mtoto mchanga baada ya kujadili ni upi?
    a) Kabla ya uchungu kuanza
    b) Kipindi cha uchungu
    c) Kipindi cha uchanga baada ya kujifungua
    d) Imeshindikana kuainisha
37. Ni nini msingi wa sababu za kifo cha mtoto mchanga na hali au magonjwa ya mama yaliyochangia kifo cha mtoto mchanga zilizokubaliwa baada ya majadiliano?
    c) Kutoa cheti cha sababu za kifo cha mtoto mchanga

CHETI CHA SABABU ZA KIFO CHA MTOTO MCHANGA	
(a)	
(b)	Kutokana na;
(c)	Kutokana na
(d)	Kutokana na;

d) Taarifa fupi ya msingi wa sababu za kifo cha mtoto mchanga na hali au magonjwa ya mama yaliyochangia kifo kulinganga na ICD-PM.

SABABU ZA KIFO		**MAELEZO**	**KANUNI YA ICD-PM**
(a)	Msingi wa sababu za kifo		
(b)	Magonjwa au hali zinginezo zilizopelekea kifo cha mtoto mchanga.		
(c)	Hali au ugonjwa wa mama uliochangia kifo cha mtoto mchanga.		
(d)	Hali au ugonjwa wa mama mengineyo yaliyo changia kifo cha mtoto mchanga.		
HITIMISHO LA KUNDI LA ICD-PM:			

Appendix C: Ethical Clearances

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR OF RESEARCH AND PUBLICATIONS

P.O. Box 65001
DAR ES SALAAM
TANZANIA
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Direct Line: +255-22-2152489
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Ref. No.DA.282/298/01.C/ Date: 28/08/2023

MUHAS-REC-08-2023-1881
Gabriel Michael Luvanga
School of Medicine
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: Classification of perinatal deaths according to International Classification of Diseases for Perinatal Mortality (ICD-PM) at Muhimbili National Hospital.

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 28/08/2023
EXPIRATION DATE OF APPROVAL: 28/08/2024

STUDY DESCRIPTION:
Purpose:
The purpose of this cross-sectional study is to classify perinatal deaths according to International Classification of Diseases for Perinatal Mortality (ICD-PM) at Muhimbili National Hospital from September to December 2023 and to ascertain dermographic and clinical characteristics associated with perinatal deaths

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided:
https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014961.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain data transfer agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain material transfer agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country,
8. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
9. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
10. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz



Dr. Nahya Salim Mbaruk

Chairperson, MUHAS Research and Ethics Committee

Appendix D: Introduction Letter to MNH

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote;
Ref. No. HD/MUH/T.126/2021

18th September, 2023

The Executive Director,
Muhimbili National Hospital,
P.O. Box 65000,
DAR ES SALAAM

Re: INTRODUCTION LETTER

We would like to inform you that the bearer of this letter is Gabriel Michael Luvanga with Reg. No. HD/MUH/T.126/2021 is a student at Muhimbili University of Health and Allied Sciences (MUHAS) "pursuing MMed. Obstetrics/Gynaecology.

As part of his studies, he will be doing an elective research titled: **"Classification of Perinatal Deaths According to Internationa Classification of Diseases for Perinatal Mortality (ICD-PM) at Muhimbili National Hospital."** he is being supervised by Dr. Hellen Mrina from MNH and Dr. Fadhlum M. Alwy Al-Beity from MUHAS.

The research has been approved by the Chairman of University Senate.

Kindly provide him the necessary assistance to facilitate the conduct of his research.

We thank you for your cooperation.

Victoria Mwanilwa
For: DIRECTOR, POSTGRADUATE STUDIES

c.c Gabriel Michael Luvanga

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix E: Permission to collect at MNH

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH

MUHIMBILI NATIONAL HOSPITAL

In reply please quote;

Ref. No.: MNH/CRTCU/Perm/2023/509 Date: 26th September, 2023

Head Department,
- Obstetrics and Gynaecology
- Paediatrics and Child Health

Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of Student	**Gabriel Michael Luvanga**
Title	**"Classification of Perinatal Deaths According to international Classification of Diseases for Perinatal Mortality (ICD-PM) at MNH".**
Institution	Muhimbili University of Health and Allied Sciences
Supervisor	Dr. Fadhlum M. Always Al-Beity (MUHAS)
Co - Supervisor	Dr. Hellen Mrina (MNH)
Period	26th September, 2023 to 30th January, 2024

Approval has been granted to the above mentioned student to collect data at MNH. **A final study report should be lodged with Clinical Research, Training and Consultancy Unit.** Dissemination of study findings to MNH stakeholders shall be overseen by **Dr.** Hellen Mrina (MNH) Co – supervisor.

Kindly ensure that the student abide to the ethical principles and other conditions of the research approval.

Yours Sincerely,

Dr. Deus Buma

For: Head of Clinical Research, Training and Consultancy Unit

c.c DSS
c.c Dr. Hellen Mrina
c.c **Gabriel Michael Luvanga**

Upanga West, Kalenga Street, Plot No. 10480/3, P.O. BOX 65000, Dar es Salaam, Tanzania.
Telephone: +255-22-2151367-9, Telephone: +255-22-2151351-2
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Appendix F: Turnitin Receipt

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Digital Receipt

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Submission title:	Perinatal Deaths According to The International Classificatio...
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File size:	1.23M
Page count:	61
Word count:	12,271
Character count:	69,181
Submission date:	24-Jun-2024 09:32AM (UTC+0300)
Submission ID:	2407722202



PERINATAL DEATHS ACCORDING TO THE INTERNATIONAL CLASSIFICATION OF DISEASES FOR PERINATAL MORTALITY (ICD-PM) AT MUHIMBILI NATIONAL HOSPITAL.

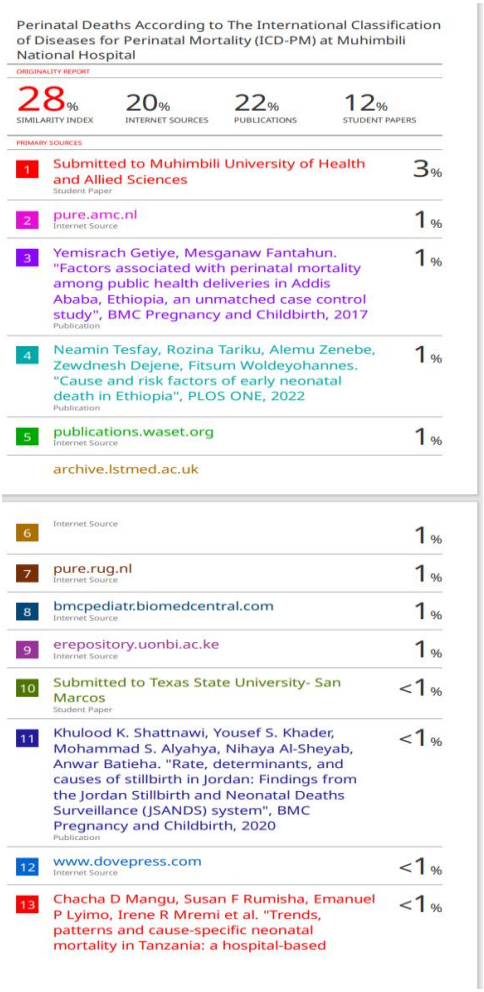
Gabriel Michael Luvanga, MD

MMed (Obstetrics and Gynaecology) Dissertation
Muhimbili University of Health and Allied Sciences
June 2024

i

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Appendix G: Plagiarism Report



Perinatal Deaths According to The International Classification of Diseases for Perinatal Mortality (ICD-PM) at Muhimbili National Hospital

ORIGINALITY REPORT

28%	20%	22%	12%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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4	Neamin Tesfay, Rozina Tariku, Alemu Zenebe, Zewdnesh Dejene, Fitsum Woldeyohannes. "Cause and risk factors of early neonatal death in Ethiopia", PLOS ONE, 2022 Publication	1%
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