ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENTAL STUDY

CENTER FOR POPULATION STUDIES

Prevalence And Factors Associated With Neonatal Mortality Among Neonates Admitted To Neonatal Intensive Care Unit Of Addis Ababa's St. Peter's Specialized Hospital.

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Acronyms and Abbreviations

AGA	Appropriate for Gestational Age
ALERT	All Africa Leprosy, Tuberculosis and Rehabilitation Training Center
ANC	Anti Natal Care
APGAR	Appearance Pulse Grimace, Activity and Respiration
CI	Confidence Interval
CSA	Central Statistical Agency
EDHS	Ethiopian Demographic Health Survey
FMOH	Federal Ministry of Health
HBW	High Birth Weight
LBW	Low Birth Weight
LGA	Large for Gestational Age
LMICs	Low and Middle Income Countries
MDG	Millennium Development Goal
NBW	Normal Birth Weight
NICU	Neonatal intensive care unit
NMR	Neonatal Mortality Rate
PNC	Post Natal Care
RDS	Respiratory Distress Syndrome
SGA	Small for Gestational Age
SPSS	Statistical Package for Social Science
SVD	Spontaneous Vaginal Delivery
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
VLBW	Very Low Birth Weight
WHO	World Health Organization

1. INTRODUCTION

1.1. BACKGROUND

The first 28 days after birth are known as the neonatal period, which can be divided into three categories: very early birth to 24 hours, early birth to 7 days, and late neonatal periods (7 days to 28 days) (Hadgu et al., 2020). The most crucial time for an infant to survive during childhood is the first 28 days of life (Kayode et al., 2014). About 3.3 million of the 8.2 million fatalities of children under the age of five that take place every year happen in the first four weeks of life, or the neonatal period.In this period, the risk of dying of a child is almost 15 times greater than at any other time during the first year of life.(Millennium Development goal (MDG); 2011).

According to the Convention on the Rights of the Child newborns have a basic right to enjoy the highest attainable standard of health. Yet a recent review of child mortality has revealed that the proportion of under-five child deaths occurring in the first month of life has been increasing (Yared Mekonnen et al.,2013)

Neonatal mortality is one of the leading public health problems accounting for about 44% of deaths among children <5 years worldwide and over the last decade, neonatal deaths have gained importance on the world policy agenda because the Millennium Development Goal (MDG) for child survival cannot be met without substantial reductions in neonatal mortality (Weddih et al., 2019).

The targets set by the Lancet Commission on Investing in Health and the Sustainable Development Goals (SDGs) for decreasing neonatal deaths is defined as 12 neonatal deaths per 1,000 livebirths by 2030 to meet this target, systematic practical interventions need to be implemented that are effective and efficient (Abdelghader et al., 2019).

In comparison to children born in high-income nations, infants born in sub-Saharan Africa had a 10-fold higher risk of dying in the first month, while infants born in South Asia had a nine-fold higher risk. These two regions had the highest rates of neonatal mortality, with rates estimated at 27 and 24 deaths per 1,000 live births, respectively, in the UNICEF 2020 report.

In 2017, the neonatal mortality rate was 28.9 deaths per 1,000 live births in Ethiopia (Basha GW et al., 2020). From 2000 to 2019, the neonatal mortality rate in Ethiopia fell gradually from 48.2 to 27.6 deaths per 1,000 live births (World Data Atlas 2019*).* Neonatal morbidity and mortality rates reflect a nation's socioeconomic status and the effectiveness of its healthcare system. Planning to improve healthcare services can benefit from these crucial indicators (Hadgu FB 2020).

As defined by World Health Organization (WHO), essential neonatal care is a comprehensive strategy developed to advance the newborn health through evidence-based interventions prior to conception, during the time of pregnancy, during delivery and soon after birth and during the postnatal period. World Health Organization (WHO) recommended essential neonatal cares are the crucial interventions to save the life of newborn. This neonatal care package includes birth preparedness and complication readiness (BPCR), four or more antenatal care (ANC) visit, skilled care at birth, social support during delivery, immediate thermal care, timely initiation of breast feeding, cord care and check-up during postpartum period (Sanjel, K et al., 2019).

Although there are studies done on neonatal mortality in different regions of Ethiopia, there are no current studies on Addis Ababa and the study hospital. Therefore, this study was conducted with the objective of identifying the prevalence as well as factors associated with neonatal mortality of St. Peter’s Specialized Hospital, Addis Ababa, Ethiopia.

1.2. STATEMENT OF THE PROBLEM

With an average global rate of 17 deaths per 1,000 live births in 2020 and an estimated 6,500 neonatal deaths every day, children have the highest risk of dying during their first month of life. Nearly three-quarters of all neonatal deaths occur within the first week of life (UNICEF 2021).In the recent decades, there has been a dramatic decline in infant and young child mortality.But in neonates, it was not significant with 7000 newborns dying daily. The difficulty of treating newborn illnesses with a single medication or treatment is a contributing factor (Mitiku, et al., 2021).

With 28 deaths per 1000 live births, sub-Saharan Africa had the highest newborn mortality rate in 2018.With 38% of all newborn mortality occurring in this region, it is one of the least developed. The average neonatal mortality rate in sub-Saharan Africa decreased by 18.3% annually between 1990 and 2018, yet due to an increase in birth rates, the annual number of neonatal fatalities still hovers around 1 million (Eyeberu and colleagues 2020).

Ethiopia currently has one of the highest rates of neonatal mortality in the world which accounts for, 40% of under-five mortality in the nation. According to the Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF, 2021, the mortality rate rose from 29 deaths per 1,000 live births in 2016 to 33 deaths per 1,000 live births in 2019. Numerous factors, including biological factors, socioeconomic factors, demographic factors, health care systems, cultural practices, and technologies, interact to determine neonatal mortality. These factors are important drivers of neonatal death (de Souza S 2019). Compared to those born to wealthy households; newborns from the poorest families have a greater than 1.4 times higher risk of dying within the first 28 days.

Reports from previous studies have identified sepsis, asphyxia, birth injury, tetanus, preterm birth,low birth weight, congenital malformations, and "unknown causes" as major causes of neonatal mortality. Most deaths are avoidable, and by providing essential newborn care at birth and during the neonatal period, up to two-thirds of these deaths might be avoided (Demisse et al., 2017).

Neonatal morbidity and mortality rates reflect a nation's socioeconomic status and the effectiveness of its healthcare system. Planning meant to improve healthcare services might be aided by these significant indicators. With the primary health care approach and health extension package put in place since the 1990s, the Federal Ministry of Health devised a national strategy for addressing mother and newborn health (FMOH Ethiopia, Addis Ababa 2015). Additionally, throughout the last 10 years, neonatal health has been ranked as one of Ethiopia's top goals as a measure of the nation's development index (Berhan Y, Berhan A 2014).

Ethiopia has also developed and adopted regional, national, and international child health intervention strategies, such as a national newborn and child survival strategy (2015–2020) to lower the NMR from 28 to 10/1000 by that year. Additionally, Ethiopia has worked to fulfill the Sustainable Development Goals (SDGs), with the target of reducing newborn mortality to 12 per 1000 live births by 2030. Neonatal mortality has been unacceptably high and rising since 2014 despite numerous efforts by the government of Ethiopia and international partners to minimize it (Eyeberu et al., 2020).

Neonatal mortality in Ethiopia was found to be 23.3 percent in Addis Ababa and 14.3 percent in Gondar, according to facility-based studies (Demisse et al., 2017). As the results indicate, the neonatal mortality rate in facility delivery is high; therefore, one way to reduce neonatal mortality is to improve the quality of neonatal care delivered at the facility level. Quality improvement of neonatal care services can be achieved by improving the skills and knowledge of health care providers in addition to providing them with the equipment and resources necessary for quality care (Tekleab et al., 2016).

A crucial first step is to determine the causes of neonatal morbidity and mortality at the facility level. Enhancing the standard of current procedures is crucial to directing the creation of targeted, evidence-based health interventions to lower neonatal mortality. Therefore this study was aimed at estimating the prevalence and factors associated with neonatal mortality among neonates admitted in a neonatal intensive care unit (NICU) to St. Peter’s Specialized Hospital so as to provide a baseline data for further studies and interventions in St. Peter Specialized Hospital and beyond.

1.3. OBJECTIVES

1.3.1 General objective

This study is aimed estimating the prevalence as well as the factors associated with neonatal mortality in St. Peter's Specialized Hospital, Addis Ababa, Ethiopia.

1.3.2 Specific objectives

- To estimate the prevalence of neonatal mortality in St. Peter specialized hospital
- To assess factors associated with neonatal mortality.

1.4. SIGNIFICANCE OF THE STUDY

The findings would be of major importance in assessing factors affecting neonatal mortality and the research will contribute to a better understanding of the problem that could guide interventions to reduce neonatal mortality through planning and policy making in Addis Ababa, Ethiopia.

1.5. SCOPE OF THE STUDY

This study assessed factors associated with neonatal mortality in the health facility (St. Peter hospital) Addis Ababa, and it only focuses on neonates admitted to the Neonatal Intensive Care Unit (NICU).

1.6.1. DEFINITION OF TERMS

Neonate: - Is a child under 28 days of age(UNICEF data).

Neonatal period: The first 4 weeks of a child's life (UNICEF data).

Mortality: - The state of being subject to death (UNICEF data).

Morbidity: -The condition of suffering from a disease or medical condition (UNICEF data).

Neonatal mortality: -Refers to death in the 1st 28 days of life (UNICEF data).

Sepsis: -A serious condition results from the presence of harmful microorganisms in the blood or other tissues and the body's response to their presence, potentially leading to the malfunctioning of various organs, shock, and death (Oxford medical dictionary).

Respiratory distress syndrome: -Condition in which fluid collects in the air sacs of the lungs, depriving organs of oxygen (Oxford medical dictionary).

Preterm birth: -A birth that occurs before the 37^{th} week of pregnancy (Oxford medical dictionary).

APGAR score: -**APGAR** is a quick test performed on a baby at 1 and 5 minutes after birth (Oxford medical dictionary).

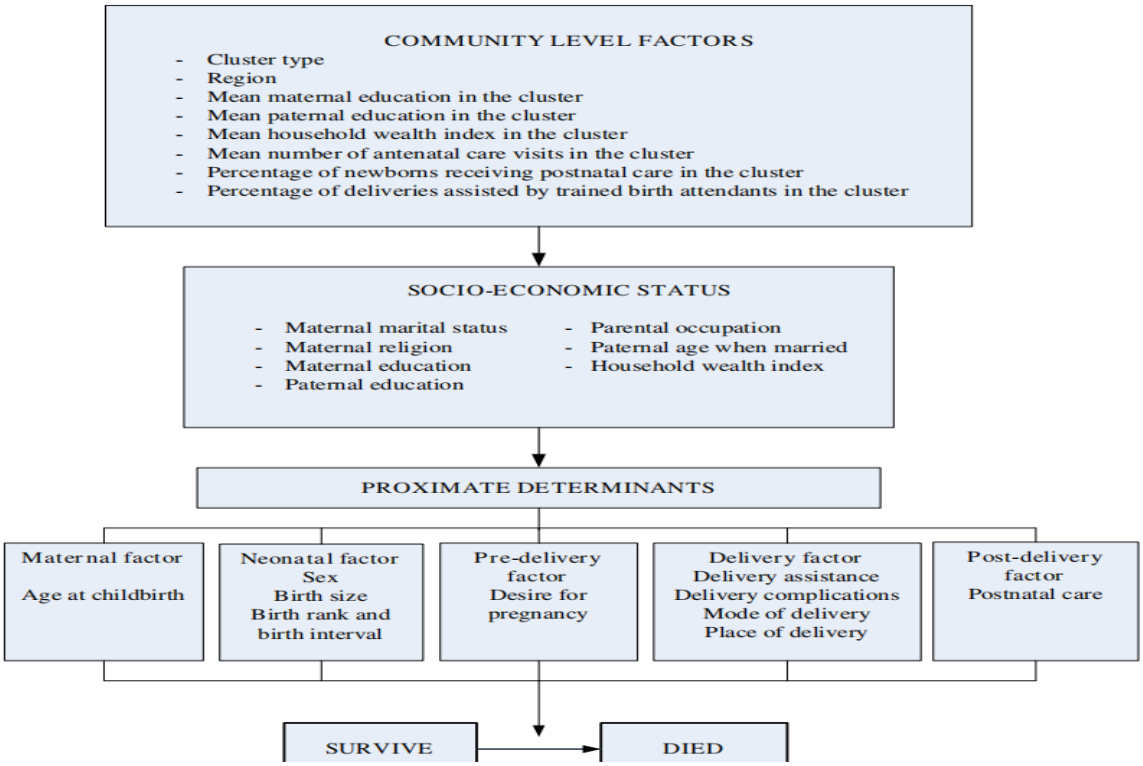
2. LITERATURE REVIEW

2.1. Theoretical Literature

W.Henry Mosely , Lincoln C. Chen model on child survival in developing countries

The model or the framework incorporates both social and biological variables and also based on the premise that all social and economic determinants of child mortality necessarily operate through common set of biological mechanisms, or proximate determinants. Traditionally, social science research on child mortality has focused on the association between socioeconomic status and levels and patterns of mortality in population. Correlations between mortality and socioeconomic characteristics are used to generate causal inferences about the mortality determinants and studies of cause of death attribute mortality to specific disease process using information obtained from death reports or clinical case records.

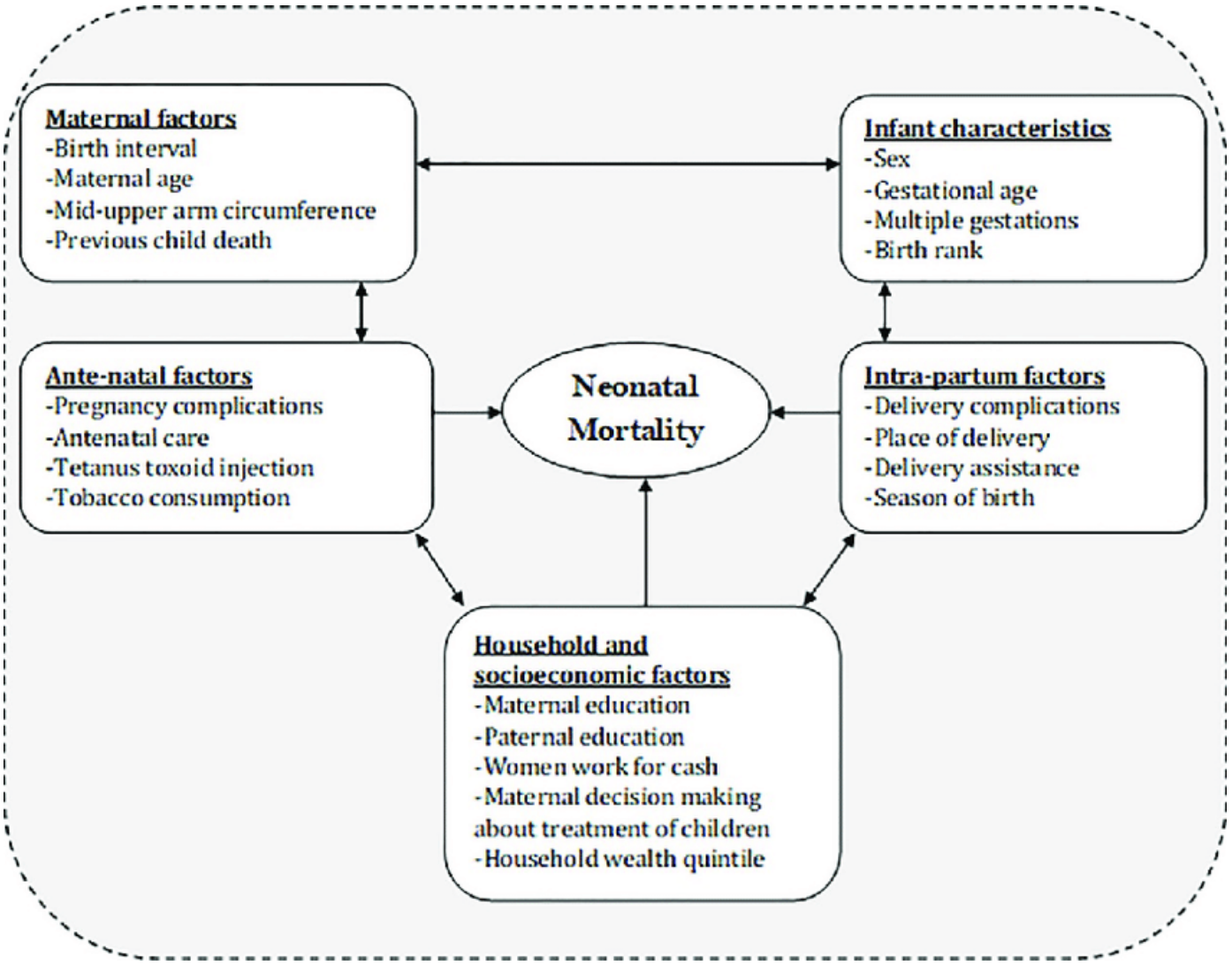
Fig.1 W.Henry Mosely, Llincoln C.Chen framework on factors influencing neonatal mortality.



Theoretical framework by Paudel et al.,

According to the framework, neonatal mortality is affected by the simultaneous presence of multiple factors like; maternal factors, infant characteristics, anti-natal, household and socioeconomic factors. Potential risk factors for neonatal mortality were grouped and this framework guides our research.

Fig. 2 framework of Paudel et al on neonatal mortality



2.2. Empirical Literature

In 2016, the mortality rate in Ethiopian was 29 deaths per 1,000 live births this means1 in every 35 children dies within the first month and in 2019 the mortality rate has increased to 33 deaths per 1,000 births (Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF. 2021). According to results of a retrospective cross-sectional study done on all newborns admitted to the University of Gondar referral hospital's NICU from December 1, 2015, to August 31, 2016, the overall neonatal mortality rate was14.3% (Demesse et al.,2017).

Factors associated with neonatal mortality

Socioeconomic factors

Some scholars have related maternal and child health status and socio-economic development as vital in the quest for infant survival (Azuh et al., 2017; Egharevba et al., 2016). Lower household wealth, an uneducated mother and birth in a rural area have lower newborn chances of survival within the first 28 days of life (UNICEF, 2014). Fausta 2015 noticed that mothers who had no education experienced neonatal deaths than mothers who had secondary education. Lower household wealth, an uneducated mother and birth in a rural area lower a newborn's chances of survival within the first 28 days of life (The Partnership for Maternal, Newborn & Child Health, 2011). 2019, mini DHS study shows the prevalence of neonatal mortality of place of residence is; urban 21% rural 37% neonatal mortality rate. Wealth index, low (34%), high (24%) of prevalence of neonatal mortality rate

Delivery factors

In a 2012 study by Ajaari et al., it was discovered that mothers who gave birth outside of a medical facility had a higher rate of neonatal fatalities than mothers who gave birth inside of a medical facility. Poor maternal health seeking behavior was shown to be more prevalent among

women with low educational backgrounds. Delivery assistance, by health professional (15.4%), other (16.4%), place of delivery, home delivery (15.4%), health facility (16.2%), mode of delivery, caesarean section (16%) non-caesarean (19.6%) of prevalence of neonatal mortality.

Demographic factors

Study shows that in Ethiopia, boys are more likely to die in childhood than girls, when male children are nearly twice as likely as female children to die 49 deaths compared with 26 deaths, per 1,000 live births, respectively (CSA 2016). 2019, mini DHS study shows, the prevalence of neonatal mortality of males was high (37%) than females (28%) and the prevalence mother's age at birth (<20) of age had 55% prevalence of mortality rate, (20-29) of age, 26 %, (30-39) 42%, (40-49)36% of neonatal mortality rates respectively. Birth interval (<2) years of interval, the neonatal mortality rate was 56 %,(2 years) 28%, (3years) 19%, (4 +years) 18% neonatal mortality rates respectively. (Ethiopian Public Health Institute (EPHI) Ethiopia and ICF 2021)

Newborn factors

A facility-based cross-sectional study conducted on neonates admitted to the neonatal intensive care unit of Ayder Comprehensive Specialized Hospital from June 1, 2018 to May 30, 2019 it studied total of 1785 neonates admitted to NICU. The study was done retrospectively and semi-structured data collection format was used to collect the data and the overall neonatal mortality in the study was 16.7% in which most deaths occurred during the 7 days of age by the cause of prematurity and low birth weight (Hadgu FB 2020).

From 2019 mini EDHS the prevalence of neonatal mortality of neonates birth weight, 2500 grams was (72.4%) prevalence of neonatal mortality, 2500-3500 grams (8.4%), >3500 grams (6.3%) neonatal mortality rate respectively and most common causes of neonatal mortality are ; Birth defect, Infection and Prematurity. Through ANC, postnatal care (PNC), prenatal and postpartum immunization, and skilled delivery attendance, Ethiopia has adopted ways to reduce the burden of newborn mortality. Even though neonatal mortality has decreased, neonatal and infant interventions still require a lot of attention. Therefore, the aim of this study was to identify factors affecting neonatal mortality in St Peter Specialized hospital, Addis Ababa, Ethiopia.

2.3 Synthesis of The Literature

The model of W.Henry Mosely , Lincoln C. Chen which is based on the concept that all social and economic factors that affect child's survival must share a common set of biological mechanisms, sometimes known as proximal factors it also states that social science studies on child mortality have historically concentrated on the relationship between socioeconomic status and the rates and patterns of mortality in the population. Another model which guided our research was Paudel et al's model which showed grouped Potential risk factors for neonatal mortality .

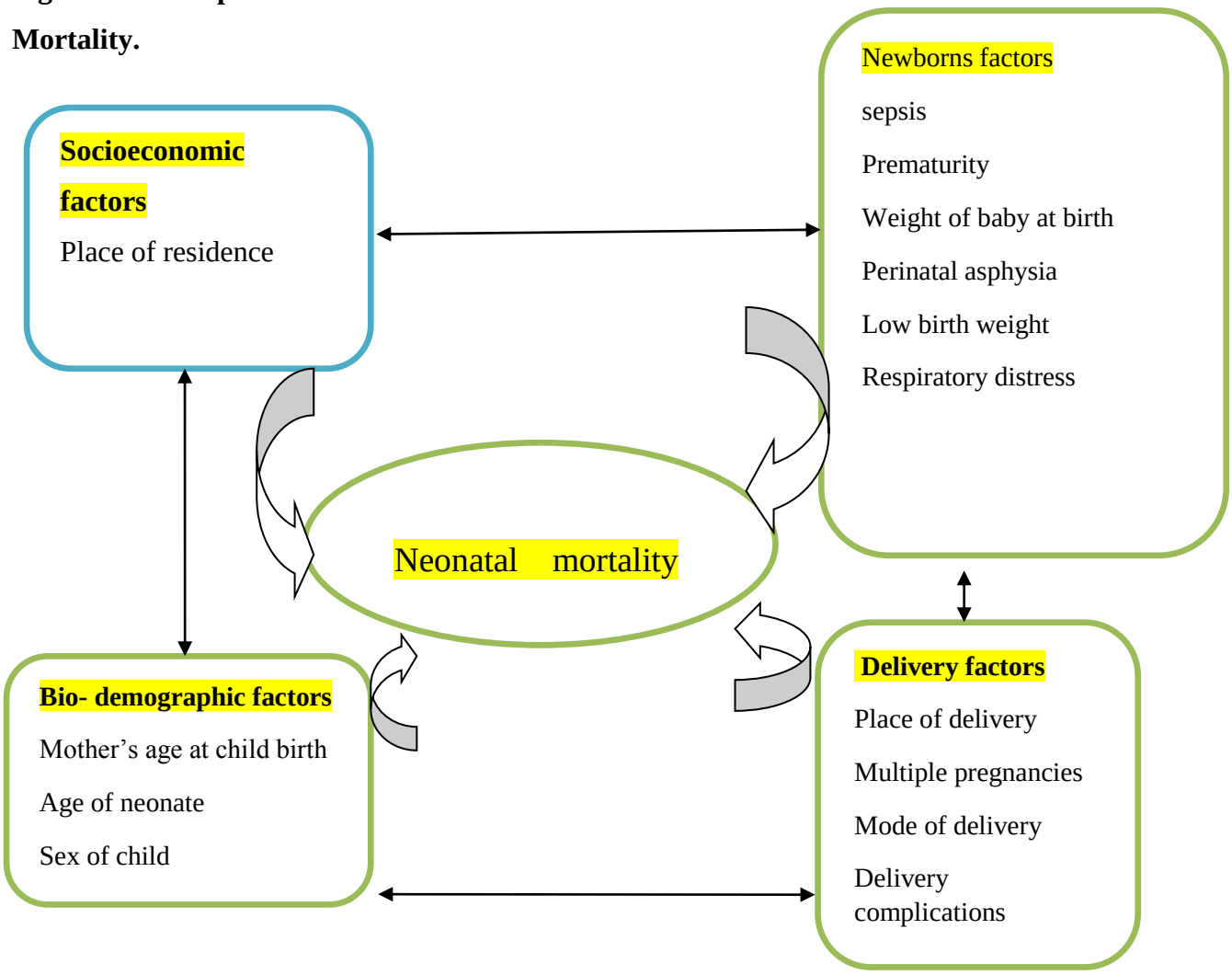
Many studies done on mortality showed as neonatal mortality remains a public health concern especially in developing countries like Ethiopia. Research in different regions of Ethiopia with different methodological approach on determinants of neonatal mortality was done like the study done on retrospective cross-sectional study done on all newborns admitted to the University of Gondar referral hospital's NICU from December 1, 2015, to August 31, 2016, the overall neonatal mortality rate was14.3% and facility-based cross-sectional study on neonates admitted to the neonatal intensive care unit of Ayder Comprehensive Specialized Hospital from June 1, 2018 to May 30, 2019 it studied total of 1785 neonates admitted to NICU.

Socioeconomic factors like, education, lower household wealth have been noted by researchers that it has effect on child survival and also determinant factors like, demography which is sex of the child, mothers age at birth, birth interval has its own visible impact on mortality.and another determinant like newborn factor which includes birth weight, prematurity, infection and the like is stated that requires a lot of attention and intervention to reduce the mortality.

2.4. CONCEPTUAL FRAMEWORK

The conceptual framework is developed from the theoretical mainly from paudel et al and empirical literature which includes socioeconomic factors, newborn factors, bio-demographic factors and delivery factors of neonatal mortality.

Figure 3 Conceptual Framework of the Prevalence and Associated Factors of Neonatal Mortality.



Each arrows indicate that the association or linkage between independent factors, intermediate factors or associated factors and the outcome factor.

3. METHODOLOGY

This research was carried out at Addis Ababa. According to the 2021 study, Addis Ababa, the capital and most populous city in Ethiopia, has a total population of 5 million people. Addis Ababa is a chartered city and as such, is considered both a city and a state. It is the largest city in the world located in a land locked country. This capital city holds 527 square kilometers of area in Ethiopia. The population density is estimated to be near 5,165 individuals per square kilometer available. The city is divided into 11 sub-cities which are, Addis Ketema, Akaky Kaliiti, Arada, Bole, Gullele, Kirkos, Kolfe Keranio, Lideta,Nifas Silk-Lafto, Yeka, Lemi Kura sub-city. The study will take place in Gullele sub-city which has a total population of 267,624 from which 129,396 are males and 138,228 are females. The sub-city has 10 woredas. In this sub-city there are two specialized government hospitals (St. Peter's Hospital in woreda 01 and Poulos hospital in woreda 09) and one general private hospital, (cure hospital found in woreda 02), 3 health centers and 37 clinics are found. The specialized hospitals of the Gulele sub-city serve not only to Gulele sub-city but also for the country as a whole. The study hospital (St.Peter Hospital) is one of the greatest tuberculosis hospitals in Africa. The hospital has 400 beds and a wide range of acute care services, including an Accident & Emergency department and is expected to serve 1,000,000 populations.From 400 beds 18 beds are found in neonatology department with 2 incubator and 2 phototherapy machines. (Gulele Sub-City Administration).

The reason for selection of St. Peter's Hospital is;

- ✓ It is selected by lottery method from government hospitals found in Addis Ababa.

3.2. RESEARCH APPROACH AND DESIGN

Quantitative research approach was applied for numerical measurement and analysis of factors affecting neonatal mortality and extent of the problem and to see the relationship between the dependent and independent variables.

To learn more about neonatal mortality and related factors among newborns admitted to St. Peter's Specialized Hospital, a facility-based cross-sectional study was conducted. The prevalence of neonatal mortality is estimated by this design, which is why it was chosen.

3.3. SOURCE OF DATA

The data were be obtained from birth and death records of all neonates admitted to neonatal intensive care unit (NICU) in St. Peter's Specialized Hospital from October 1,2019 to July 30, 2021.

3.4 SOURCE POPULATION, INCLUSION AND EXCLUSION CRITERIA

Any possible home deaths, very late neonatal deaths (>28 days postnatal age), and babies dying after discharge from the hospital and neonates with incomplete charts were not be included in the study. However, all neonates admitted to NICU which born with congenital anomalies, very low APGAR scores, extremely premature (24–28 weeks' gestation), and extremely low birth weight (500–1000 g at birth) in St. Peter's Specialized Hospital were included in the neonatal mortality data.

3.5. SAMPLE SIZE DETERMINATION

The minimum required sample size of this study was determined by using single population proportion formula (Pourhoseingholi et al., 2013). To calculate total sample of 422, 52% prevalence of mortality rate among neonates admitted to NICU (Worku.et al,, 2012) was used adding 10% for non-response rate.

$$\mathrm{n} = \frac{Z_{a/2}{}^{2}\,\mathrm{p\,q}}{d^2}$$

Where:

n = sample size

P = percentage

q = 1-p

d = desired degree of precision

Z= is the standard normal value at the level of confidence desired, usually at 95% confidence level

Z (α2)2 = at 95% confidence interval Z value (α = 0.05) = 1.96

p = Proportion of occurrence of the event to be studied

d= Margin of error at (5%) (0.05)

$$n = \frac{(1.96)^2 \times p(1-p)}{d^2}$$

$$n = \frac{(1.96)^2 \times 0.52(1-.0.52)}{(0.05)^2}$$

$$n = \frac{3.8416 \times 0.2496}{0.0025} = 383$$

Assuming a10% none response rate

383×10% =38.3

383+38.3=421.3 ~ 422

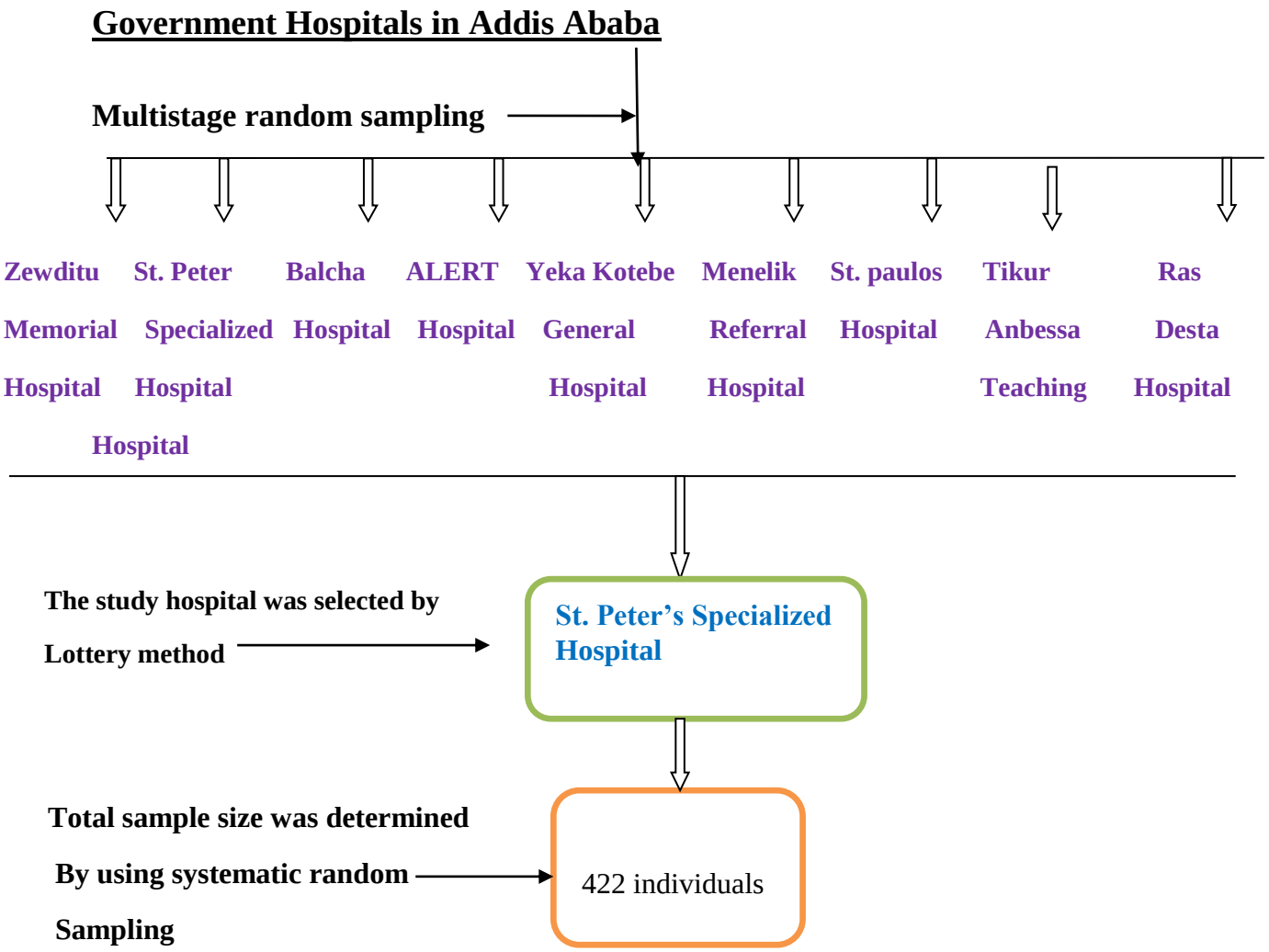
Therefore sample size of 422 neonates was selected.

3.6. SAMPLING TECHNIQUES

All government hospitals in Addis Ababa were listed using a multistage random sample technique, and one hospital was chosen using a lottery system. The four sources of information used to compile a facility-based chart review of neonates admitted to NICU from October 1, 2019, to July 30, 2021 were the patient's card, discharge form, and death registrations. Information on primary admission diagnosis (Sepsis, RDS, Prenatal asphyxia,jaundice,low birth weight, prematurity, meconium aspiration syndrome), gestational age (preterm, term, postterm), mode of delivery (spontaneous vaginal delivery (SVD)/cesarean section/instrumental), place of delivery, referral from other facility/same facility), diagnosis to admission time(</> = 24 hr,<7 days, 7-28 days), birth weight in gram, congenital anomality (yes/no), APGAR scores, maternal age (years), obstetric complications (eclampsia/pre-eclampsia, other complications), antenatal care visits, gravidity, parity and neonatal death (yes/no) was collected.

3.6.1 SCHEMATIC PRESENTATION OF THE SAMPLING PROCEDURE

Figure 4: Schematic diagram of sampling technique based on government hospitals



3.7. STUDY VARIABLES

3.7.1 Dependent variable of this study

- Neonatal Mortality

Neonatal mortality: Neonatal death is defined as the death of a baby within 28 days of life (days 0–27). In this study it was dichotomised as Dead (coded as 1) if the baby died within 28 days or Alive (coded as Not dead = 2)

3.7.2 The independent variables

- Include demographic and socioeconomic variables
  - **Age:** The length of time that a person has lived or a thing has existed. age of neonate categorized in to hours and days
  - **Place of residence:** The place of residence refers to the civil subdivision of a country (district, county, municipality, province, department, state) in which the individual resides. residence of the mother.
  - maternal health characteristics:
  - **Maternal age:** Mother's age at delivery.
  - **Multiple pregnancy:** Multiple births refer to a mother who delivered more than one baby at the end of a single pregnancy. It was dichotomised into singletons and multiple, for twins or more. If a multiple birth was recorded as more than four babies, it was judged to have been an error and treated as a missing value.
  - **Sex of the child:** Male or female.
  - **Place of delivery:** Refers to the setting where the baby was reported to have been delivered, categorised as hospital, clinic or home births. Hospitals were formal facilities with a midwife or nurse and a doctor. Clinics were formal facilities with either a midwife or nurse, but no doctor. It included health centres, community-based health planning services (CHPS) and maternity homes. Home births included babies delivered in either the traditional birth attendant's (TBA) home or the mother's home, with no formally trained midwife or doctor.

- **Mode of delivery**: Defined as choosing either the vaginal or caesarean section (C-section) delivery.
- **ANC visits:** ANC attendance was classified as Yes or No, depending on whether a mother received at least one episode of ANC during pregnancy.
- Newborn health characteristics ;-prematurity, birth defect, sepsis, perinatal asphysia, low birth weight

  Note: The above data will be collected from the hospital records by using structured data checklist.

3.8 DATA COLLECTION

Maternal and neonatal medical records were reviewed and audited using structured data extraction checklist. Data was collected by trained nursuses of St.Peter's Specialized Hospital NICU staffs (after receiving ethical clearance from, Addis Ababa University development studies (CoDs), center for population studies). The medical records were selected by systematic random sampling technique. Before the actual data collection; training was given to staff nurses on the data collection techniques. Socio-economic and demographic character of the neonates and mothers, gestational age, birth weight, mode and place of delivery, diagnosis and outcome (death and survived) was included from patient charts.

3.9 DATA ANALYSIS TECHNIQUES

Data were entered, edited, cleaned, and analyzed by SPSS version 26.0.Descriptive analysis was performed using frequency distribution and tables. Multicollinearity between independent variables was be checked. The data investigated by using the variance inflation factor in SPSS to produce co-linearity statistics. To compute a variance inflation factor for an independent variable to test for multicollinearity, a multiple regression was performed and there were multicolliniarity issue with two variables that are >5 variance inflation factor test and the variables were removed. Binary logistic regression analysis was done to identify the association between dependent and independent factors. Adjusted odds ratio (AOR) was computed at 95% CI (Confidence Interval).A p - value of < 0.05 was considered as significant.

3.10. ETHICAL CONSIDERATIONS

The general ethical issues that arise at each stages of a research process and the researcher gave due attention because of the nature of the study area. A letter of support obtained from Addis Ababa University Development Studies (CoDs), Center for Population studies based on which permission was obtained to undertake the study in St.Peter's Specialized Hospital. The entire neonatology department was informed about the objective and importance of the study. Privacy and confidentiality of information was guaranteed throughout the entire study period and information was provided for any misconception at the end of the data collection as deemed necessary.

4. RESULTS

Table 1 displays the back ground characteristics of study participants. A total of 422 neonates admitted in NICU are included in this study and descriptive analysis is done from the findings. Births from mothers aged 23 years have highest percentage (9.0%) and most of mothers (55.2%) were from Addis Ababa. Neonates aged <24 hour admitted to NICU were higher with (74.4%) percent. (61.6%) were male and (38.4%) were female neonates. Government hospital deliveries was (100%) and were delivered by skilled birth attendant (94.8%).

Table 1**: Socio-economic and demographic characteristic of neonate and mother, Addis Ababa, St.Peter's Specialized Hospital (n=422)**

Variables	**Category**	**Frequency**	**Percent**
Maternal age	18-24	151	35.8
	25-34	184	43.6
	35-44	36	8.5
	44-49	0	0
Residence	Addis Ababa	233	55.2
	out of Addis Ababa	189	44.8
Age of neonate	<24 hour	314	74.4
	<7days	89	21.1
	7-28 days	19	4.5
Sex of neonate	Male	260	61.6
	female	162	38.4
	Governmental hospital	422	100
Birth attendant	Skilled health professional	400	94.8

	Untrained birth attendant	1	.2
	unknown	21	5.0

Table 2 presents the clinical characteristics of neonate. Term deliveries were higher with (43.8%) and preterm deliveries with (27.7%) follows .most neonates were weighted 2600-3500 gram (33.2%). (96.9%) of neonates were diagnosed with medical problem and respiratory distress (21.3%) and sepsis (19.7%) were most common diagnosis. From total neonates admitted (26.3%) or from 422 neonates 111 of them have died and 311 were alive.

Table 2: **Clinical characteristics of neonates, Addis Ababa, St.Peter's Specialized Hospital (n=422)**

variable	Category	Frequency	Percent
Gestational age	preterm	117	27.7
	term	185	43.8
	postterm	46	10.9
	unknown	74	17.5
Birth weight	< or = 1500	87	20.6
	1501-1599	28	6.6
	1600-2500	73	17.3
	2501-2599	21	5.0
	2600-3500	140	33.2
	3501-3599	18	4.3
	3600-4500	35	8.3
	4501-4599	8	1.9
Medical problem of	Respiratory distress	90	21.3

neonate	Jaundice	36	8.5
	Perinatal Asphyxia	31	7.3
	Hypothermia	4	.9
	Sepsis	83	19.7
	Meconium aspiration syndrome	28	6.6
	prematurity	64	15.2
	low birth weight	74	17.5
Neonatal outcome	death	111	26.3
	alive	311	73.7

Table 3 presents characteristics of mothers. Most of mothers were gavida 1 (39.1%) and para 1 (42.7%) and most of them had ANC follow of 4 times visit of ANC (94.8%).

Table 3**: Characteristics of the mother, Addis Ababa,St.Peter's Specialized Hospital (n=422)**

variable	Category	Frequency	Percent
Gravida	1	165	39.1
	2	162	38.4
	3	66	15.6
	4	23	5.5
	5	5	1.2
	7	1	.2
	2	162	38.4
Number of Parity	0	42	10.0
	1	180	42.7
	2	132	31.3
	3	53	12.6

	4	14	3.3
	7	1	.2
Number of ANC follow ups	1	4	.9
	2	3	.7
	3	9	2.1
	4	400	94.8
Multiple pregnancy	yes	31	7.3
	no	391	92.7

Table 4 presents clinical characteristics of mother. (50.0%) of mothers had A blood type (23.7%) B (5.2%) AB and (21.1%) O respectively. (95.5%) of them were RH positive. Caesarean section deliveries were higher (50.2%) than among other mode of delivery.

Table 4: **Clinical characteristics of mother,Addis Ababa,St.Peter's Specialized Hospital (n=422)**

variables	Category	Frequency	Percent
Blood group of mother	A	211	50.0
	B	100	23.7
	AB	22	5.2
	O	89	21.1
Mothers RH	positive	403	95.5
	negative	19	4.5
Have diagnosed with obstetric Complications	yes	16	3.8
	no	406	96.2
Type of complications of the mother diagnosed with	Pre-eclampsia	7	1.7
	Eclampsia	2	.5
	Placenta previa	4	.9
Mode of delivery for current	Spontaneous vaginal delivery	198	46.9

pregnancy	cesarean section	212	50.2
	Instrumental	12	2.8
	Spontaneous vaginal delivery	198	46.9

4.1 Factors associated with neonatal mortality

On multiple logistic regression analysis variables like parity, multiple pregnancy, birth weight, gestational age, medical diagnosis which are, respiratory distress,sepsis, prematurity, low birth weight are found significant. Birth weight < or =1,500 g and 2600-3500 g were significantly associated with neonatal mortality with p-value of 0.001 and (AOR: 0.113;95 % CI:.030-.421), (AOR: 13.50;95 % CI:.3.02-60.24) and neonates weighting 1501-1599 had (AOR:0.20;95 % CI:.0.04-0.85) respectively and medical problems like; respiratory distress and low birth weight had p-value of 0.00 and (AOR:12.212;95%CI:5.721-26.068), (AOR:22.63;95 % CI:4.979-102.859) prematurity (AOR:7.289;95% CI:3.541-15.007) and sepsis (AOR:2.385;95% CI:1.202-4.735). Preterm deliveries had (AOR:0.192;95% CI:0.102-0.363) and term delivers had (AOR:2.881;95% CI:1.409-5.891). Maternal characteristics like; multiple pregnancy had odds of (AOR:0.347;95% CI:0.165-0.728). primipara mothers (AOR:0.091;95% CI:1.985-4.236), para1 (AOR:0.059;95% CI:1.869-2.231) and para 2 mothers had (AOR:0.012;95% CI:0.001-0.246) respectively were significantly associated with neonatal mortality. Other variables which were not significantly associated were not included in this discussion.

5. DISCUSSION

The purpose of the study was to identify the prevalence and factors affecting neonatal mortality at St. Peter Specialized Hospital in Addis Abeba. Neonatal mortality is extremely high, according to the study's findings. The prevalence of neonatal mortality in the current study is 26.3 percent, which is higher than the prevalence of studies carried out in Felege Hiwot referral hospital in Bahir Dar (13.3 percent), Somali region Ethiopia (5.7 percent), Jimma zone in Southwest Ethiopia (3.2 percent), North Gondar in Northwest Ethiopia (4.4 percent), Ayder referral hospital in Mekelle (6.6 percent), Mizan Tepi university teaching hospital (22.8 percent). This variation might also be due to the variation in sample sizes and this study used data of those critically sick babies that were admitted to the neonatal intensive care unit.

The main contributing factors to neonatal death in this study were low birth weight with p-value of <0.05 (0.00) and highest risk of dying than normal weighted neonates (AOR:22.63;95 percent CI:4.979-102.859). According to one explanation, immune systems and other body defense mechanisms that regulate a newborn's susceptibility to disease were immature in low birth weight babies. Then the neonates may develop health problems including RDS, bleeding from the brain, and finally, neonatal death may follow. Premature neonates were 7 times more likely to die than mature neonates (AOR:7.289;95% CI:3.541-15.007) in fact, prematurely delivered baby faced different complications as a result of difficulty in adapting to extra-uterine environment and consequently are at risk of different complications compared to mature babies therefore, they need more special attention to reduce neonatal mortality.

Neonates who developed sepsis had 2 times risk of dying than healthy neonates (AOR:2.385;95% CI:1.202-4.735) and respiratory distress (AOR:12.212;95% CI:5.721-26.068) had higher risk of dying than a healthy baby. Similar study conducted in Mizan Tepi university teaching hospital revealed respiratory distress (AOR:,12.56; 95% CI: 6.40–24.66) neonatal sepsis (AOR: 8.9; 95% CI: 4.14–19.21) and in Hiwot Fana Hospital, Harer the odds of death which had neonatal sepsis been 4.59 times that of neonates who did not have the conditions.

This is consistent with studies conducted in Ghana, Gondar, and Mekele, Ethiopia The possible justification is that sepsis results in abscess formation, venous thrombosis, neurologic damage, and multi-organ dysfunction. Finally, neonatal mortality may follow. This could be explained by the fact that the bulk of neonatal mortality in underdeveloped nations are linked to intra-partum, labor, and infant care procedures and also indicates that neonatal survival efforts are not focusing on the intra-partum and early neonatal periods, and as a result, neonatal death has not decreased as required.

The death of neonates due to neonatal sepsis can be minimized by the provision of proper postnatal care and proper health service at NICU and by strengthening the care provided at the post-natal period and NICU is very important in reducing neonatal mortality. In comparison to neonates with normal or higher birth weights, those weighing less than 1,500 g had odds of (AOR:0.113;95 percent CI:0.030-0.421) which is less than studies conducted in Gandhi Memorial Hospital in Addis Abeba (AOR:3.23;95 percent CI:1.17-8.91), Hiwot Fana Hospital in Harer with low birth weight the odds of death among newborns who had low birth weight were 4 times that of neonates who did not have the conditions (AOR:4.005;95% CI:1.301-12.326), and (AOR:2.39;95 percent CI:1.04-5.49) in an Eastern Ethiopian public hospital all consistently reported similar results. Low birth weight increases a child's susceptibility to infection and reduces their immune systems and other body defense mechanisms, which regulate newborn disease exposure, according to one theory. Neonatal survival suffers as a result. Low birth weight babies are also more susceptible to infections, immune system dysfunction, and hypothermia, which raises the risk of neonatal mortality.

Neonatal mortality due to preterm deliveries (<37weeks) in this study had odds of (AOR:0.192;95% CI:0.102-0.363) which has lower odds than study conducted in Wollega university referral hospital (AOR:4.152;95%CI:1.67-10.33), Gonder University hospital(AOR:3.45;95% CI:2.16-5.52), Eastern Ethiopia public hospital (AOR:2.78;95% CI:1.17-6.56) and Jimma University Medical Center, Jimma, South West Ethiopia (AOR:3.06;95%CI:1.79-5.26).

Neonates born from mothers with multiple pregnancy had odds of (AOR:0.347;95% CI:0.165-0.728) in this study and 2.87 times higher odds of neonatal mortality than those of singleton pregnancy in Hiwot Fana Hospital in Harer and in referal hospital in southern Ethiopia, the odds of mortality was 1.8 times (AOR:1.8;95% CI:1.10-2.94). The possible justification is that multiple pregnancy causes preterm delivery, congenital malformation, and LBW. These complications lead to neonatal death.

When compared to neonates born to 2-7 moms in the current study, neonates born to para 0-1 mothers had a (5.1) percent odds of dying. study conducted in Ayder comprehensive specialized hospital, northern Ethiopia with neonates born to para 2–4 were 36% at less odds of dying when compared to neonates born from primipara mothers and in Eastern Ethiopia public hospital (AOR:1.94;95% CI:0.93-4.05). This can be because primipara women might have poor knowledge in newborn care. For instance, many of them could lack sufficient knowledge of proper placement and attachment when it comes to breastfeeding.

Table 5: Results of multiple logistic regression of neonatal mortality from October 1, 2019 to July 30, 2021 (N=422).

Variables	Categories	Neonatal outcome		P-value	AOR	95 % CI for AOR	
		Died	Survived			Lower	Upper
Age of neonate	<24 hour	90	224	.216	0.449	0.126	1.597
	<7days	82	231	.589	0.689	0.179	2.659
Gestational age	Preterm	68	44	.000	0.192	0.102	0.363
	Term	17	165	.004	2.881	1.409	5.891
	Postterm	7	38	.327	1.612	0.620	4.188
	Unknown	19	64	.293	1.641	0.651	4.133
Birth weight	< or = 1500	71	16	.001	0.113	0.030	0.421
	1501-1599	20	8	.030	0.200	0.047	0.856
	1600-2500	5	68	.013	6.800	1.510	30.631
	2501-2599	2	19	.106	4.750	0.719	31.370
	2600-3500	5	135	.001	13.500	3.025	60.247
	3501-3599	1	17	.074	8.500	0.813	88.852
	3600-4500	1	34	.017	17.000	1.666	173.456
	4501-4599	2	6	.691	1.500	0.203	11.088
Multiple pregnancy	Yes	15	16	0.005	0.347	0.165	0.728
	No	96	295				
Medical diagnosis of	Respiratory distress	13	77	0.000	12.212	5.721	26.068

neonate	Perinatal Asphyxia	5	26	0.652	9.052	3.112	26.33
	Sepsis	16	67	0.013	2.385	1.202	4.735
	Prematurity	27	37	0.002	7.289	3.541	15.007
	Low birth weight	47	27	0.000	22.63	4.979	102.859
No of Parity	0	38	4	0.000	0.091	1.985	4.236
	1	39	141	0.000	0.059	1.869	2.231
	2	21	111	0.004	0.012	0.001	0.246
	3	8	45	0.422	0.362	0.03	4.334
Which among the following the mother had been diagnosed	Preeclampsia	4	3	0.317	0.25	0.017	3.77
What was the mode of delivery for this pregnancy	Spontanous vaginal delivery	63	135	0.884	1.097	0.318	3.780
	Cesarean section	44	168	0.330	1.856	0.535	6.441

LIMITATIONS OF THE STUDY

Due to the fact that this study was conducted in a single facility, the prevalence may not accurately reflect the community's total prevalence. Incompleteness of medical records neonates and mothers.The study does not demonstrate cause and effect correlations because it is a cross-sectional study. In multi-variate logistic regression, certain variables have large confidence intervals.

6. CONCLUSION AND RECOMMENDATION

When compared to national data, neonatal mortality rates are still high with prevalence of 26.3% in this study. Compared to other studies conducted in facilities, low birth weight deliveries in this study were higher with 47%. Preterm deliveries (<37weeks) with 14.2% prevalence, neonatal sepsis (16%), respiratory distress (13%) and low birth weight were most common causes of neonatal mortality in this study. This neonatal deaths could be avoided by promoting anti natal care services, early detection and treatment, and referral of high risk pregnancies and babies. Neonatal patients, especially those at high risk, should get special attention and care from all accountable hospital administration personnel. Neonatal mortality was influenced by low birth weight, premature birth, respiratory distress, and sepsis. High-quality services should be provided at the labor and delivery ward and neonatal critical care unit, and the federal ministry of health bureau should give capacity building training to health care providers, especially for those who are working in maternal and child health care providers in the health facilities, in order to achieve the Sustainable Development Goals (SDGs), with the target of reducing newborn mortality to 12 per 1000 live births by 2030.

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Annex 1: Data collection check list English version

Code----------

This checklist is prepared to assess the Magnitude and Predictors of Neonatal Mortality among neonates admitted from 2019-2021 in St. Peter Specialized hospital Addis Ababa Ethiopia, 2022

S.N	**Section 1.socioeconomic and demographic factors ofneonate and mother**	Possible choices	
101	Maternal age in years	<18 18-24 25-29 30-35 36-40 <40	1 2 3 4 5 6
102	Age of neonate	<24 hour <7days 7-28 days	1 2 3
103	Sex of neonate	Male Female	1 2
104	Place of delivery	Governmentalhospital	1
105	Birth attendant	Skilled healthprofessional Health extensionworker Untrained birthattendant Other	1 2 3 4
Section 2. neonatal factors			
201	Gestational age	preterm term postterm	1 2 3

202	Birth weight	< or = 2,500grams 4,000 grams >4,000grams	1 2 3
203	Was APGAR score done	Yes No	1 2
204	If yes for question no 203 what was 1st minute and 5th minute APGAR score	1st minute…….. 5th minute……	1 2
205	Was the current pregnancy multiple (twin?)	Yes No	1 2
206	Does the newborn had birth defect or any Congenital anomalies?	Yes No	1 2
207	If yes for question no 206 which birth defect or Congenital anomalies does the child had	Neural tubedefect Congenital heartdisease Omphalocele TEF Gastroschiasis Downsyndrome Other specify	1 2 3 4 5 6 7
208	Was the neonate been diagnosed withany medical problem	Yes No	1 2
209	If yes to question no 208, what was the medical	Respiratorydistress Jaundice PerinatalAsphyxia Hypoglycemia Hypothermia	1 2 3 4 5 6

	Diagnosis?	Sepsis Meconium aspiration syndrome Others	1 2 3
210	Was the neonate been on oxygen treatment?	Yes No	1 2
211	Neonatal status/outcome	Death Alive Left against medical advice	1 2 3
Section 3. Maternal factors			
301	No of Gravidity	----------	
302	No of Parity	----------	
303	Does the mother have ANC follow up?	Yes No	1 2
304	If yes for Q-303 how many times?	……	
305	What was mothers blood group ?	A B AB O Unknown	1 2 3 4 5
306	What was mothers RH?	positive negative	1 2
307	Does mother had been diagnosed with obstetric Complications?	Yes No	1 2

308	If yes, for Q- 309 Which among the following the mother had diagnosed?	Abruptioplacenta Severpreeclampsia Eclampsia Placentaprevia Amniotic fluid relatedproblem Other….	1 2 3 4 5 6
309	What was Time of ROM?	PPROM PROM Intrapartal	1 2 3
310	What was her mode of delivery for this pregnancy?	spontanous vaginal delivery cesarean section Instrumental	1 2 3