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COLLEGE OF HEALTH SCIENCES

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MAGNITUDE AND PREDICTORS OF MORTALITY AMONG PRETERM NEONATES ADMITTED IN NICU AT DEBRE MARKOS AND FELEGEHIWOT SPECIALIZED HOSPITALS, AMHARA REGION, ETHIOPIA, 2020.

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Magnitude and predictors of mortality among preterm neonates admitted in NICU at Debre markos and Felegehiwot specialized hospitals in east and west Gojjam zones, Amhara reginal state, Ethiopia, 2020; a retrospective cohort study.

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ACRONYMS AND ABBREVIATION

ANC	Ante Natal Care
AOR	Adjusted Odds Ratio
APH	Anti Partum Hemorrhage
APGAR	Appearance, Pulse, Grimily, Activity and Respiration
CHD	Congenital Heart Diseases
DM	Diabetic Miletus
EDHS	Ethiopian Demographic and Health Survey
EVLW	Extremely Low Birth Weight
EVPTB	Extremely Very Premature Birth
GA	Gestational Age
HR	Hazard Ratio
LBW	Low Birth Weight
MDG -	Millennium Development Goals
MTLPTB	Moderate To Late Preterm Birth
NICU	Neonatal Intensive Care Unit
NMR	Neonatal Mortality Rate
OR	Odds Ratio
PIH-	Pregnancy Induced Hypertension
PNA	Prenatal Asphyxia
PROM	Premature Rupture Of Membrane
PTB	Pre-Term Birth

PTN	Premature Neonate
RDS	Respiratory Distress Syndrome
UTI	Urinary Tract Infection
VLB	Very Low Birth Weight
VPTB-	Very Preterm Birth
VPTB	Very Premature Neonate

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ABSTRUCT

Backgrounds: Premature neonatal death is a global burden both in developed and developing countries. Despite, different strategies and interventions were implemented to reduce premature neonatal complications including death, the rate of neonatal mortality in Ethiopia are too far from the targets.

The objective: the aim of this study is to determine magnitude and predictors of mortality among preterm neonates admitted to neonatal intensive care unit from 2016-2019 in NICU of Debre markos and Felegehiwot specialized hospitals in Amhara region, Ethiopia.

Method: an institution based retrospective cohort study in two specialized hospitals of Debre markos and Felegehiwot in East and West Gojjam zones, Amhara regional state, among all 432 preterm neonates admitted and enrolled in NICU treatment from 1st of January, 2016 to the 1st of February, 2019 after getting ethical clearance from Institutional Review board of Addis Ababa University, College of Health sciences, school of Nursing and Midwifery and department of nursing using a structured checklist to gather information. The data abstraction tool was developed from related literatures with some modification and the neonatal national guideline which are currently used in NICU in hospitals. Data was entered into and cleared using epidata software version 3.1 and then has been exported to SPSS version 24 for further statistical analysis. Data was analyzed using SPSS version 24 for windows. The level of significance was set at $P<0.05$ with the corresponding confidence intervals at 95%. A logistic regression model was used for analysis and to control for confounders.

Result: The magnitude of mortality among preterm neonates admitted to neonatal intensive care unit of public hospitals was 160(37%) with (95%CI; 58.8%%,-67.6%). Variables of premature rupture of membrane{AOR: 2.14(95%CI=1.098, 4.20)}, neonatal sepsis{AOR: 2.80, (95%CI=1.46, 5.40)}, respiratory distress {AOR: 2.28, (95%CI=1.32, 3.95)}, Perinatal asphyxia{AOR: 2.85, (95%CI: 1.34, 6.10)}, Gestational age of the preterm neonates (28-31 weeks){AOR: 2.55, (95%CI=1.356, 4.80)}, low birth weight of 1000-1499 and less than 1000 grams{AOR:3.274, (95%CI=1.54, 6.97)} and {AOR: 10.34(95%CI=1.6, 7,20)} respectively) and length of hospital stay less than or equal to one and 2-7days {AOR: 9.63, (95%CI=3.35,

7.70)} and {AOR; 5.45, (95%CI: 2.37, 12.52})respectively were significantly associated Predictors of preterm neonatal mortality.

Conclusion: In the current study, a total of 160(37.0%) neonates were died during the follow up period. Magnitude of death was found to be high particularly in early neonatal period and multivariate analysis showed that the major predictors of death of preterm neonates admitted to NICU were found to be premature rupture of membrane, neonatal sepsis, respiratory distress syndrome, gestational age less than 32 weeks, weight of the preterm neonates less than 1500grams and length of hospital stay less than 2 days were found to be significantly associated predictors of preterm neonatal death.

The keywords: Magnitude of mortality, predictors, gestational age, Preterm neonate, occurrence of death.

1. INTRODUCTION

1.1. Background

Preterm birth is defined by world health organization(WHO) as all births before 37 completed weeks of gestation (fewer than 259 days)(1–3) and it is sub-classified based on weeks of gestational age as: Moderate to late preterm (MTLPTB)(32 to <37 weeks),Very preterm (VPTB)(28 to <32 weeks), and Extremely preterm(EPTB) (<28 weeks)(1). Most preterm births happen spontaneously because of common causes including; multiple pregnancies, obstetric conditions such as; preeclampsia, premature rupture of membrane, placenta Previa, abruption placenta, antepartum hemorrhage, poor antenatal care (ANC) follow up, and chronic illnesses such as; diabetes and hypertension, and infections such as human immune virus(HIV), malaria and sexual track infections (ST)(1,4)

Causes of preterm birth (PTB) are not so clear, but many factors play significant role in increasing the risks of PTB which includes; hypertension during pregnancy, gestational diabetes mellitus, cesarean births, antepartum hemorrhage, Interpregnancy interval less than two years, malnourished women and postpartum hemorrhage, are among important risk factors for PTB, and significant impacts on PTB delivery rates and on the other hand, mothers using multivitamins and folic acid during pregnancy had less chances of delivering PTB(4,5). In addition, mothers with previous history of PTB, maternal educational status, mothers living in low socioeconomic conditions, infections during pregnancy(3), and violence whether physical, emotional or sexual during pregnancy increase the risks of PTB(4). These preterm neonates are at increased risk of morbidity and mortality since they are highly vulnerable to jaundice, sepsis, respiratory distress syndrome, perinatal asphyxia, necrotizing enterocolitis, hypoglycemia, congenital anomalies and meconium aspiration syndrome and these are also risk factors of neonatal mortality(5,6).

Preterm birth may result in morbidity, short and long-term complications which arise from immature organ systems that are not yet prepared to support life in the extra uterine environment. These short and long-term complications in survivors range from some school

learning disability through to severe cerebral palsy. Impairment outcomes have a heavy toll on families and on the health system, with the frequency and severity of adverse outcomes rising with decreasing gestational age and decreasing quality of care such as; growth retardation, cerebral palsy, learning problems, central nervous system complications, neurodevelopmental delay, respiratory complications, such as bronchopulmonary dysplasia, blindness, deafness and other short term complications(2).

Ensuring antenatal care for all pregnant women, including screening, diagnosis and treatment of infections such as HIV and STIs, nutritional support and counseling, screening and management of pregnant women at higher risk of preterm birth; e.g., multiple pregnancies, diabetes, high blood pressure, or with a history of previous preterm birth, reducing non-medically indicated inductions of labor and cesarean births especially before 39 completed weeks of gestation can help to reduce preterm birth rates(2). Additionally, strategic investments in innovation and research are also important to accelerate progress in preterm birth reduction(2). Governments, together with civil society, must review and update existing policies and programs to integrate high-impact care for premature babies within existing programs for maternal, newborn and child health, together with an urgent increase in health system capacity to take care of newborns particularly in the field of human resources, such as training nurses and midwives for newborn and premature baby care, and ensuring reliable supplies of commodities and equipment(1).

The burden of preterm birth and death is substantial for many developing countries, and scale up of some low tech, cost-effective interventions can help to reduce newborn deaths from prematurity and has two main elements: prevention and care. Prevention Interventions that are proven necessary to help prevent preterm birth are clustered in the preconception, between pregnancy, and pregnancy periods, as well as during preterm labor and the following interventions contribute to prevention of preterm birth: The preconception care package, with family planning (e.g., birth spacing and adolescent friendly services); education and nutrition, especially for girls; and sexually-transmitted infection (STI) prevention, antenatal care packages for all women, including screening for and management of STIs, high blood pressure, and presumptive treatment of malaria in endemic areas; behavior change for lifestyle risks; and targeted care of women at increased risk of preterm birth, provider education to

discourage inappropriate induction and cesarean, policy support, including smoking cessation and employment safeguards for pregnant women(7).

Care for babies born prematurely should include: essential and extra newborn care, especially feeding support, neonatal resuscitation, kangaroo Mother Care, Chlorhexidine for umbilical cord care, management of premature babies with complications, especially respiratory distress syndrome and infection, comprehensive neonatal intensive care, where capacity allows(7). The government has tried to improve the survival of neonate mainly preterm births through the inclusion of high impact life-saving neonatal interventions in its Health Sector Transformation Plan and Newborn and Child Survival Strategy. Despite these efforts, death and cause of preterm births still not decreased as targeted, therefore, this study aimed to address the study on root predictors and magnitude of premature neonate admitted at NICU of Felegehiot and Debre markos referral hospitals.

1.2. Statement of the problem

In spite of premature death seriously affects low-income countries, it is also a major public health challenge throughout the world. Globally, the majority of child and young adolescent deaths occur at the youngest ages. Eighty five percent (85%)(5.4 million) of the 6.3 million deaths in 2017 occurred in the first five years of life and about half (47%) of the under-five deaths in 2017 occurred in the neonatal period of life. The global report showed that the neonatal mortality rate fell from 36 deaths per 1,000 live births in 1990 to 19 per 1000 in 2015, and the number of neonatal deaths declined from 5.1 million to 2.7 million. However, the decline in neonatal mortality from 1990 to 2015 has been slower than that of post-neonatal under-five mortality: 47% compared with 58% globally(8). Worldwide, about 1.1 million babies die from preterm neonatal birth complications and the study across 184 countries showed that the range of preterm birth rates of the world was 5-18% and more than 80% of preterm births occur between 32-37 weeks' gestation and most of these babies can survive with essential newborn care(9). Currently preterm birth number is rising and complications related to this preterm birth are the leading cause of death among children under 5 years of age, responsible for approximately more than 1 million deaths in 2015 and in this, more than 1 in 10 babies are born preterm, affecting families all around the world(10).

Many survivors of preterm birth face a lifelong of disability, including learning disabilities and visual and hearing problems and the preterm birth rates are increasing in almost all countries with reliable data; prematurity is the leading cause of newborn deaths (babies in the first 4 weeks of life) and now the second leading cause of death after pneumonia in children under the age of 5; global progress for child survival and health to 2015 and beyond cannot be achieved without addressing preterm birth and investment in women's and maternal health(2,11).

Preterm neonatal mortality contributes significantly to the high number of death among children under five years of age(12) and these newborn deaths occur during the first week of life (75%), and about 25% to 40% of deaths occur within the first 24 hours(13). in India most of neonatal deaths are related to preterm complications showing that, Nearly a quarter (20-40%) of preterm neonates with less than 33 weeks' gestation admitted to Indian NICUs died

of sepsis(14).The most common cause of neonatal death is prematurity which accounted about (37%)(13). That is Seventy-five percent (75%) of neonatal mortality occurs in infants born preterm with the common long-term complications including: Central nervous system complications, such as cerebral palsy, neurodevelopment delay, respiratory complications; such as bronchopulmonary dysplasia blindness and deafness. These complications have also their highest incidence in births occurring at less than 30 weeks gestation(15).

South Asia and sub-Saharan Africa account for almost two-thirds of the world's preterm babies and over three-quarters of the world's newborn deaths due to preterm birth complications and in Sub-Saharan Africa where about a third of under-five deaths occurred during the neonatal period; has the highest neonatal mortality rate (32 deaths per 1,000 live births in 2012) and accounts for 38 percent of global neonatal deaths(16). The variation in the rate of preterm birth among regions and survival of premature neonates has improved significantly with the improvements of highly specialized intensive care, but still they are the main reason of neonatal admission and death worldwide and carries lifelong risks to health and survival of the neonate(17).In South East Nigeria, a preterm birth rate was 16.9% (169 preterm births per 1,000 live births)(18) .

According to the Ethiopian Demographic Health Survey (EDHS) 2016, the under-5, infant and neonatal mortality rate were 67, 48 and 29 deaths per 1,000 live births respectively((19) and the Ethiopian Mini Demographic and Health Survey showed that the overall under-5, infant and neonatal mortality rates were 55, 43 and 30 deaths per 1,000 live births, respectively(20). Trends showed that a continuous decline in under-5 and post neonatal childhood mortality rates over time. However, the trend of neonatal mortality rate remained relatively stagnant(20). in other words, in Ethiopia 1 in every 35 children dies within the first month (within neonatal period), 1 in every 21 children dies before celebrating the first birthday, and 1 of every 15 children dies before reaching the fifth birthday in which premature neonatal death shared a larger part((19). In developing nations, like Ethiopia, PTB and death are under reported and underestimated. However, it is the leading cause of neonatal and under-five mortality(21).

In general, as different studies have demonstrated that the birth of a preterm neonates has a greater risk of developmental disabilities, health, and growth problems than neonates born at full term neonates, so, with well-development in obstetric and neonatal care including well standardized intensive NICU service, it is expected that premature and low birth weight including more VPN and EVLBW neonates will be survived. In spite of this, different kinds of studies explored that premature neonatal mortality rate is still high and contribute to more NMR and infant and under-five mortality rate. The occurrence of death and survival rate of preterm neonates is also not consistent across the world including Ethiopia, demanding further exploration into the reasons for difference. In addition, even though several studies were made in different countries to assess magnitude and predictor of mortality among premature neonate admitted to NICU, studies related to this area is little in Ethiopia. Besides, limited and non-comparative research studies to date have been conducted in the country to address the prevalence of PTB and predictors of mortality among these preterm neonates. Therefore, this study aimed to determine the magnitude and predictor of mortality among premature neonate admitted to NICU at DM and Felegehiwot specialized hospitals, in East and West Gojjam zones, Amhara region, Ethiopia(22).

1.3. Significance of the study

A better understanding of the magnitude of preterm neonate's mortality and associated predictors could be helpful for designing relevant intervention strategies. However, previous research is very scarce on the magnitude of these neonates' mortality rates and its predictors in the respected health institutions such NICU of hospitals in our county. Furthermore, no published research is found on similar topic in Amhara region. Therefore the study will fill these gaps.

The rational of studying magnitude and factors affecting mortality of preterm neonates who are managed in hospital will have also practical vital value for patients, health care providers, researchers and policy-makers in the Ministry of Health. This study will help both the individuals and community at large on the effect of early detection, diagnosis, management and follow-up care.

The study may be an input to policy makers, program managers and administrators to design an interventional project and guidelines towards improving reduction in preterm neonatal mortality and management, to forward prioritized planning, to develop ongoing education and training program and to provide needed facilities for institution who are giving the service. This study will also increase the exciting health professionals' body of knowledge about factors affecting preterm neonatal mortality and helps to promote health research, education and even the practical aspect of the profession so as to provide evidence-based quality care. Moreover, this paper may also be a base line for future researchers of other studies.

2. LITERATURE REVIEW

2.1. Introduction

The aim of this literature review is to summarize what has already been available knowledge about magnitude of mortality of preterm neonates both in developing and developed countries, to discuss the impact of previous research findings and to identify gaps of premature neonatal clinical practice in Ethiopia. As a baseline, literatures have been reviewed and collected on socio-demographic, obstetric, neonatal medical factors, maternal factors and other related factors which have an impact on the magnitude of preterm neonatal mortality.

2.2. The magnitude of mortality among preterm neonates admitted to NICU

In spite of preterm neonatal death seriously affects low-income countries, it is also a major public health challenge throughout the world. Globally, the majority of child and young adolescent deaths occur at the youngest ages. Eighty five percent [85 %(5.4 million)] of the 6.3 million deaths in 2017 occurred in the first five years of life and about half (47%) of the under-five deaths in 2017 occurred in the neonatal period of life. The global report showed that the neonatal mortality rate fell from 36 deaths per 1,000 live births in 1990 to 19 per 1000 in 2015, and the number of neonatal deaths declined from 5.1 million to 2.7 million. However, the decline in neonatal mortality from 1990 to 2015 has been slower than that of post-neonatal under-five mortality: 47% compared with 58% globally(8).

A worldwide study using systematic review to estimate the magnitude of preterm neonatal birth showed that in 2005, there were 12.9 million births worldwide(23). Approximately 11 million (85%) of these preterm births were concentrated in Africa and Asia, while about 0.5 million occurred in each of Europe and North America and 0.9 million in Latin America and the Caribbean. The highest level of preterm birth were in Africa and North America (11.9% and 10.6% of all births, respectively), and the lowest were in Europe (6.2%)(23) and in relation with this, preterm birth was the leading direct cause of neonatal death (27%); more than one million preterm newborns die annually and it is also the dominant risk factor for neonatal mortality, particularly for deaths due to infections associated with an increasing issue of long term impairment (24).

As different studies explored, preterm neonatal mortality is still slow in reduction. A hospital based study in Iran indicated that, the overall mortality was 9.1%(25). The other study in Iran, also demonstrated that the magnitude of preterm neonatal death was 27.4% (134 of 489 preterm neonates), which was significantly higher in gestational age subgroup of less than 28 weeks compared with other gestational age subgroups ($P < 0.001$)(26) and a case study in Trinidad and Tobago identified that magnitude of preterm neonatal mortality was 12%(12).Another prospective studies in Indiaand Australia identified that the magnitude of mortality was 33.5%(14) and 7.7% deaths(27) respectively. A study in Nigeria identified that, there were 311 neonatal deaths with a magnitude of 19.7% mortality of which the preterm neonatal deaths formed 45.6% (142/311) of the total neonatal deaths (28).Another study done in a tertiary hospital in southwest Nigeria and in Kenya at Kenyatta national hospital indicated the overall mortality of preterm neonates were 21.9% and 18.3% respectively(28,29).

According to the Ethiopian Demographic Health Survey (EDHS) in 2016, the under-5, infant and neonatal mortality rate were 67, 48 and 29 deaths per 1,000 live births respectively(41) and the Ethiopian Mini Demographic and Health Survey showed that the overall under-5, infant and neonatal mortality rates were also 55, 43 and 30 deaths per 1,000 live births, respectively (20).The study in Northwest Ethiopia in Gondar comprehensive specialized hospital showed that 28.8% preterm neonates died. Seventeen {17 (11.4%)} of them were died within the first 24 h of life and 127 (85.23%) died in the first 7 days of life (early neonatal death)(17). Another study conducted in Jimma University Specialized Hospital also revealed that 171 (34.9%) premature neonates were died, Out of which 45.3% were female having death proportion of 15.5% lower than males (19.4%)(30).

2.3. Predictors of mortality in preterm neonate

2.3.1. Scio demographic predictors

Findings explored in different studies demonstrated that residence of mother, place of delivery, gender of the neonates, age of the women and newborns' birth weight were among the sociodemographic predictors of preterm neonatal mortality(16,24).

The result of different studies also identified that maternal and neonatal age were the factors of preterm neonatal death(31). Studies identified that the likelihood of PTB among women in the age group <18 years of age and >40 years were three times higher compared to women greater or equal to 35 years of age with (AOR = 3.47)(16).

In a study in Northeastern Nigeria also identified that gender, age of mothers, birth weight of the preterm neonates and place of delivery were predictors for preterm neonatal birth and death showing that, out of 3435 study participants during the study period, 1129/3435 (32.86%) were preterm babies giving a prevalence of 32.9% preterm birth. In this, neonates with birth weight of 1000-1499 grams were nearly four times more likely to die than those with birth weight of greater than 1500 grams(AOR: 4.370), neonates with GA of 28-32 weeks nearly three times (AOR: 2.99) and those with GA of less than 28 are nearly five times (AOR: 5.455) more likely at increased risk to die than those greater than 33 weeks of GA, male preterm babies were 372 (52.1%), while female preterm babies were 342 (47.9%); which indicates a high proportion of males with the male to female ratio of 1:1.08(32). The study in Mt. Hope Women's Hospital in Trinidad and Tobago identified that preterm neonate with birth weight of less or equal to 1000 grams were fifteen times more likely at risk to die than neonates whose birth weight were greater than 1000 grams (AOR: 15.41, (95%CI: 2.00, 120.34))(12).

Likewise, a case control study in the central zone of Tigray, Ethiopia; identified that the age of mothers was a significant predictor of preterm neonatal death showing that among preterm neonates born from mothers who gave birth before the age of 18 were 4.6 times more likely vulnerable than those who were 18 years or older(AOR: 4.56)(33). Another study conducted in Jimma University Specialized Hospital also revealed that 171 (34.9%) premature neonates were died, Out of which 45.3% were female having death proportion of 15.5% lower than males (19.4%)(30).

2.3.2. Maternal obstetric predictors

As different studies inquired that preterm birth and mortality have also obstetric and gynecologic factors. Different prospective and retrospective studies demonstrated that anti natal care, preeclampsia, number of parity and gravidity, gestational age of the neonates,

gestational diabetes mellitus, hypertension, and cesarean section were the predictors of preterm neonatal death and indicated that preterm neonatal death prevalence was extremely high among women who did not use antenatal care services (13.8%), hypertension (12.6%), preeclampsia (24.7%) and gestational diabetes (25.7%)(30–35).

A retrospective hospital based study in Iran showed that the smallest surviving neonate was a 750 gr female with GA of 30 weeks and the youngest neonate was a 970 gr female with GA of 25 weeks plus 2 days(25). Another study conducted in Malaysia and analyzed using multiple logistic regressions, indicated that multiple pregnancy increases the risk of preterm neonatal death by more than twice compared to singleton(34). Likewise, a study conducted in Northeastern Nigeria showed that number of parity was among the predictors of preterm neonatal death indicating that neonates born from mothers with a parity of 4 or more were nearly 5 times more likely to die than those born from who deliver less than 4(AOR: 4.709) and A preterm neonatal death was 4.7 times more likely among preterm neonates born from mothers who were pregnant for the first time with (AOR :4.66) than among those born from mothers who had been pregnant before(36).

Another study conducted in Kenya and others identified that about 35% of mothers who delivered before term had a history of previous preterm delivery, compared to 16% of those who delivered at term and this was significant ($p = 0.010$)(16,33,37). Caesarean section, multiple pregnancies, PROM, APH, PIH prolonged PROM and labor and UTI were among predictors of preterm death identified in this study(29). Preterm neonates delivered from mothers who delivered through Caesarean section were nearly two times (OR: 1.832) more likely to die than those who delivered vaginally)(16,36,38). Twin pregnancy conferred nearly a 4-fold increase in the risk of preterm mortality (OR 3.753)(16,39). A study in California indicated that, preterm neonates delivered from mothers with APH had 3-fold increase in risk of mortality (2.790)(40). Likewise, another study done in Kenya at Kenyatta national hospital indicated that, the risk of preterm death increased 5- fold if the neonate delivered from mother who had prolonged PROM (AOR: 5.319) and 4-fold with APH (AOR: 4.264) after controlling for confounders(29).

As a case-control study at public hospitals in the Amhara region, in Ethiopia explored that women who had not had antenatal care visits for this index pregnancy had five-folds higher odds of death compared to those who had antenatal care visits [AOR = 5.18]((29)).

2.3.3. Premature neonatal predictor

Studies in different areas have presented that, preterm neonatal death was associated with different risk factors and more than a third of newborn deaths are the result of complications associated with preterm births. These complications are also exacerbated by different predictors as identified through different studies and the study conducted in Jimma University Specialized Hospital identified that: preterm neonates with PNA nearly two times(AOR=2.479, (95%CI;1.239,4.9585)), RDS three times(AOR=3.287, (2.033,5.3148)), Jaundice nearly three times(AOR: 2.737 (95%CI: 1.7182,4.361)), sepsis two times(AOR: 2.072, (95%CI: 1.2415,3.4587)),hyaline membrane diseases nearly three times(AOR: 2.636,(95%CI: 1.5971,4.3517)) more likely to die than those without those diseases(30)and others such as; anemia, congenital anomalies, hypothermia, hypoglycemia and APGAR score levels were among the commonest predictors which were identified through a study(36). The study done in Northwestern Iran, revealed that from overall, of 179 neonates, 101 (56.4%) cases died because of some of common predictors of death Very early preterm birth (GA<30w) nearly eleven times more likely at risk to die than other GA groups(10.7 (8.6-13.7)) and congenital anomaly which is nearly five times (5.20 (3.27-8.26))(25). Another study done in India indicated that perinatal asphyxia, sepsis and malformations were predictors of preterm deaths which were the cause of about half (51%) of all deaths and in this, sepsis was the second most common predictor, accounting for a quarter of the deaths (207/ 828; 25%). Perinatal asphyxia and congenital malformations accounted for 9 and 3% of deaths respectively in these neonates(14). Congenital malformations are also associated with preterm neonatal mortality with (AOR: 4, (95% CI: 2.55, 2.68))which significantly associated(39).

The study in University of Gondar comprehensive specialized hospita identified that, preterm neonates with neonatal respiratory distress(RDS)was two times [AOR=1.93, 95% CI (1.13, 3.31)], preterm neonates with perinatal asphyxia nearly three times(2.65 (1.76, 4.01)), APGAR score at birth <7 nearly two times([AOR=2.39, 95% CI (1.34, 4.27)], HMD five

times[AOR=5.15, 95% CI (2.83, 9.36)], jaundice nearly three times [AOR=(3.39, 95% CI (1.90, 6.05)], hypoglycemia nearly four times [AOR=3.86, 95% CI (2.12, 7.06)] more likely at increased risk to die than those without the diseases and neonates with gestational age of less than 30 weeks of GA were nearly two times more likely to die than those with greater than 30 weeks of GA [AOR=2.42, 95% CI (1.33, 4.38)] and were significantly associated predictors of preterm neonatal death(17).

2.3.4. Maternal medical predictors

As different studies explored that maternal hypertension, maternal DM, maternal infection during pregnancy, maternal anemia and HIV infection were medical predictors which increase preterm neonatal deaths. A prospective study done in Jordan revealed that the rate of preterm birth from mothers with hypertension was (12.6%), gestational diabetes (10.3%), pre-gestational diabetes (25.7%)(41). Another study done in Hasan Sadikin General Hospital also showed the preterm neonates born from mothers with factors such as; anemia with (AOR = 1.307) and hypertension which increases the likelihood of death nearly four times than those preterm neonates born from mothers without hypertension (AOR=3.969)(40).

The study conducted in Northwest Ethiopia revealed that preterm neonatal death for each maternal clinical factor 40(8.2%), IDM 8 (1.6%)(38). The study done in Shire Suhul General Hospital, in Tigray, Northern Ethiopia also identified that among the study participants, 16 (4.9%) were reactive in HIV/AIDS(37). Moreover, women who had experienced medical problems (UTI, DM and renal diseases) during pregnancy had nearly 14-folds higher odds of PTB and mortality compared to those who were not exposed to any medical problems during this index pregnancy [AOR = 13.94] (37).

As it is evidenced in the literature which has been discussed above, different studies have identified that the prevalence of preterm neonates mortality related to preterm birth complications with respect to the associated predictors that have direct and indirect role for this events to occur. These common predictors which have been identified in the literatures discussed include: sociodemographic predictors such as; age of the mother, age of the neonate, residence of the mother, occupation of the mother, family income and gestational age of the neonate. Maternal obstetric predictors such as; PROM, placenta Previa, abruption

placenta, poor ANC follow up, cesarean delivery, and others, Neonatal medical predictors such as; PRN, RDS, HMD, sepsis, CHD, meningitis, congenital anomalies and anemia. But, there is little research that have been conducted in Ethiopia on the magnitude and predictors of mortality, and even there is no any research done on this title in East and West Gojjam zone Amhara regional state, Ethiopia. That is why this is important to undergo a study on magnitude and predictors of mortality among preterm neonates admitted to NICU at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara regional state, Ethiopia.

2.4. Conceptual framework

Below is the framework of the study which shows the interaction of different independent variables with outcome variables that contains maternal sociodemographic factors, maternal medical and obstetrics factors and neonatal sociodemographic and medical factors which were adapted from different researches and slightly modified in accordance of this context.

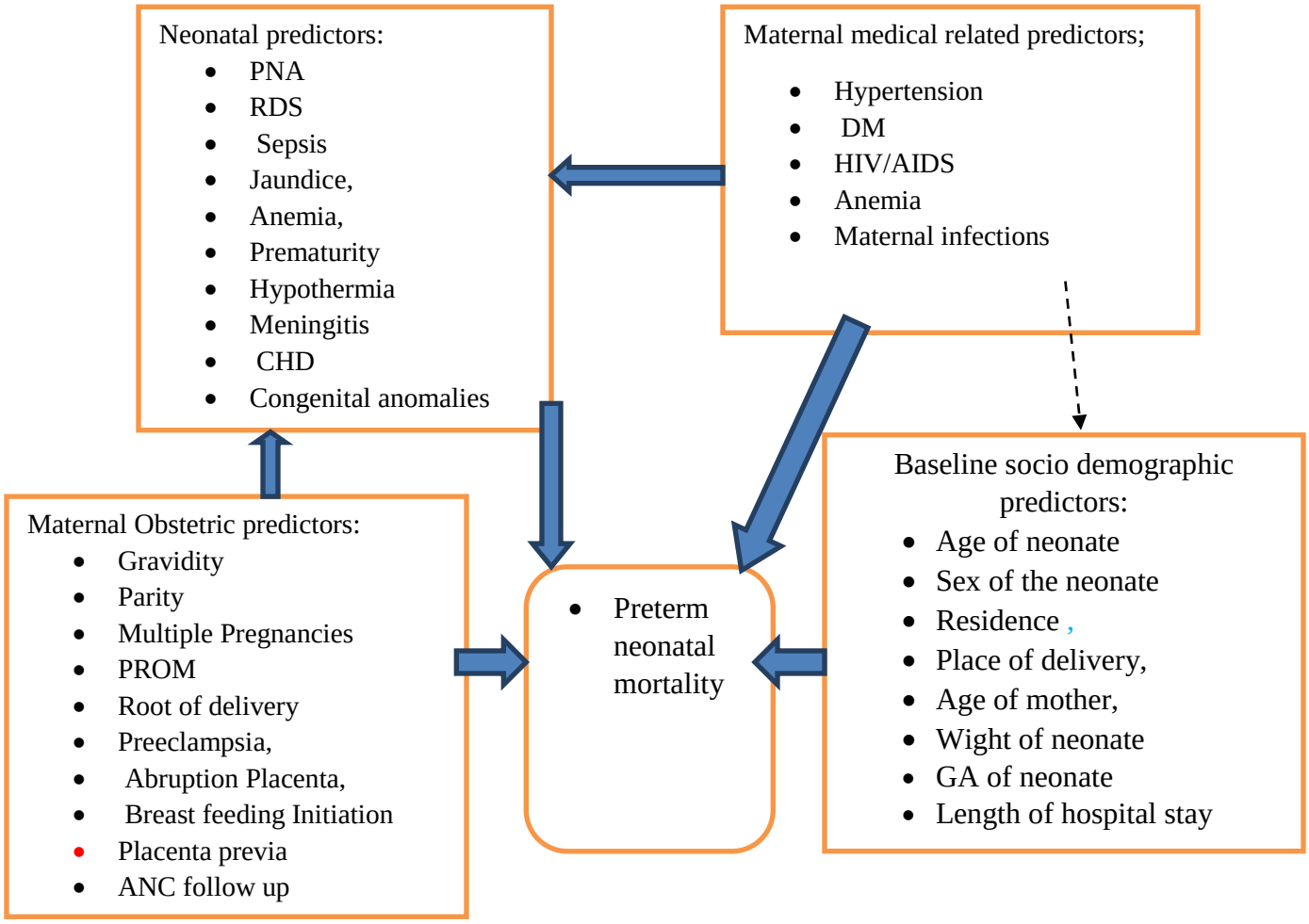


Figure 1; Conceptual framework of the study adapted from different literatures 2020 (30, 38, 39, 40, 41).

3. OBJECTIVES

3.1. General objective

To determine the magnitude and predictor of mortality among preterm neonates admitted to NICU at Debre markos and Felegehiwot specialized Hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

3.2. Specific objectives

To determine the magnitude of mortality among preterm neonates admitted to NICU at Debre markos and Felegehiwot specialized Hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

To identify predictors of mortality among premature neonates admitted to NICU at Debre markos and Felegehiwot specialized Hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

4. METHODS AND MATERIALS

4.1. Study Area and period

The study was conducted in the two specialized hospitals (Debre Markos and Felegehiwot specialized hospitals which were randomly selected among the eight referral hospitals found in Amhara region) of East and West Gojjam zones found in Amhara Regional state which is among the 9 regions in Ethiopia and found in Northwest part of Ethiopia. Debre Markos specialized hospital is the only specialized hospital in East Gojjam zone and found in Debre Markos, the town of East Gojjam Administrative Zone located 256 Kilometer from Bihar Dar, (capital city of Amhara Region) and about 300-km away from Addis Ababa, (the capital city of Ethiopia). According to the information obtained from administrative office of the hospital, Debre markos specialized hospital serves for more than 5 million populations in its catchment area. Apart from other services, It provides neonatal intensive care services and has 50 beds in NICU with total admission of 15440 neonates from which preterm comprises 1900 starting from(2016-2019).

Whereas, Felegehiot comprehensive specialized hospital is also the only specialized hospital in West Gojjam zone and found in Bahir Dar which is the capital city of Amhara regional state and it is 256 and 565 kilometer far from Debre markos and Addis Ababa respectively and this specialized hospital serves for more than 10 million populations in their catchment area. Apart from other services, this referral hospital also provides neonatal intensive care services with total bed number within NICU of 75 and admission of 16860 neonates from 2016-2019, from these; preterm admission comprises 2500 within the same year. But other general and primary hospitals found within these Zones have not enough equipment and facilities to serve all complex cases like NICU. In this, most of the time they refer their patients who had been seriously ill to these referral hospitals which influence to conducted the study in these hospitals. The study was conducted from March 1-30, 2020.

4.2. Study design

An institutional based retrospective cohort study was conducted among preterm neonates admitted at NICU from the 1st of January 2016 to the 30thof February 2019 at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zone, Amhara state, Ethiopia, 2020.

4.3. Populations

4.3.1 Source of Population

All preterm neonates admitted to NICU at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones.

4.3.2. Study population

All preterm birth neonates that fulfill the inclusion criteria at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zone, who have been admitted starting (2016-2019) to NICU.

4.3.3. Sampled Population

The 432 preterm neonates that fulfill the inclusion criteria at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, who have been admitted starting (2016-2019) to NICU.

4.3.4. Study unit

Each selected preterm neonates' chart from the hospital's NICU registration book.

4.4. Eligibility criteria

4.4.1. Inclusion criteria

All live-born preterm babies delivered during the study period [01/01/2016-31/12/2019] and admitted to NICU at Debre markos and Felegehiwot Specialized Hospitals in East and West Gojjam zones.

4.4.2. Exclusion criteria

Preterm neonates with incomplete records (at least sociodemographic data and baseline predictors has to be recorded) and preterm neonates whose card are not available in card room at the time of data collection

4.5. Sample size determination and sampling procedure

4.5.1. Sample size determination

For the first objective (outcome), a single population proportion formula was used to calculate the sample size by considering the following statistical assumptions: P = proportion of mortality among preterm neonates admitted in NICU, 34.9%,(Z α/2 = Z score of 95% CI, d= Margin of error (5%)(30).

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

n= $(1.96)^2$ *0.349*0.651/ $(0.05)^2$ = 349. Then after adding 10 % contingency rate for an incomplete chart, the final sample size is 384.

For the second objective (predictors), the sample size was determined using double population proportion formula; by considering sepsis, hyaline membrane diseases, prenatal asphyxia, respiratory distress syndrome and home delivery as the major predictor variables. Moreover, perinatal asphyxia was considered as the independent predictor since it gives the maximum sample size. The sample size was calculated by using Epi info version 7 statistical packages with the equation below.

$$n_1 = \frac{\left[Z_{\alpha/2}\sqrt{\left(1+\frac{1}{r}\right)P(1-P)} + Z_{\beta}\sqrt{\frac{P_1(1-P_1)+P_2(1-P_2)}{r}}\right]^2}{(P_1-P_2)^2}$$

Table1: sample size calculation to assess the magnitude and predictor of mortality among preterm neonates admitted to NICU from 2016-2019 at Debre markos and Felegehiwot specialized Hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

Variables	**Assumptions**	**Total sample size**	**After adding 10%**
Home delivery	P1=16% P2= 45.2%	273	303 (17)
PNA	**P1=41%** **P2=18.6%**	**389**	**432** (17)
Sepsis	P1=56.6% P2=21.2%	184	204 (17)
HMD	P1=16.5% P2= 45.3%	316	351 (35)
RDS	P1=22.3% P2=55.7%	227	252 (35)

Where:

P1: is proportion of exposed with the outcome

P2: is proportion of non-exposed with the outcome;

Z α/2: is taking CI 95%

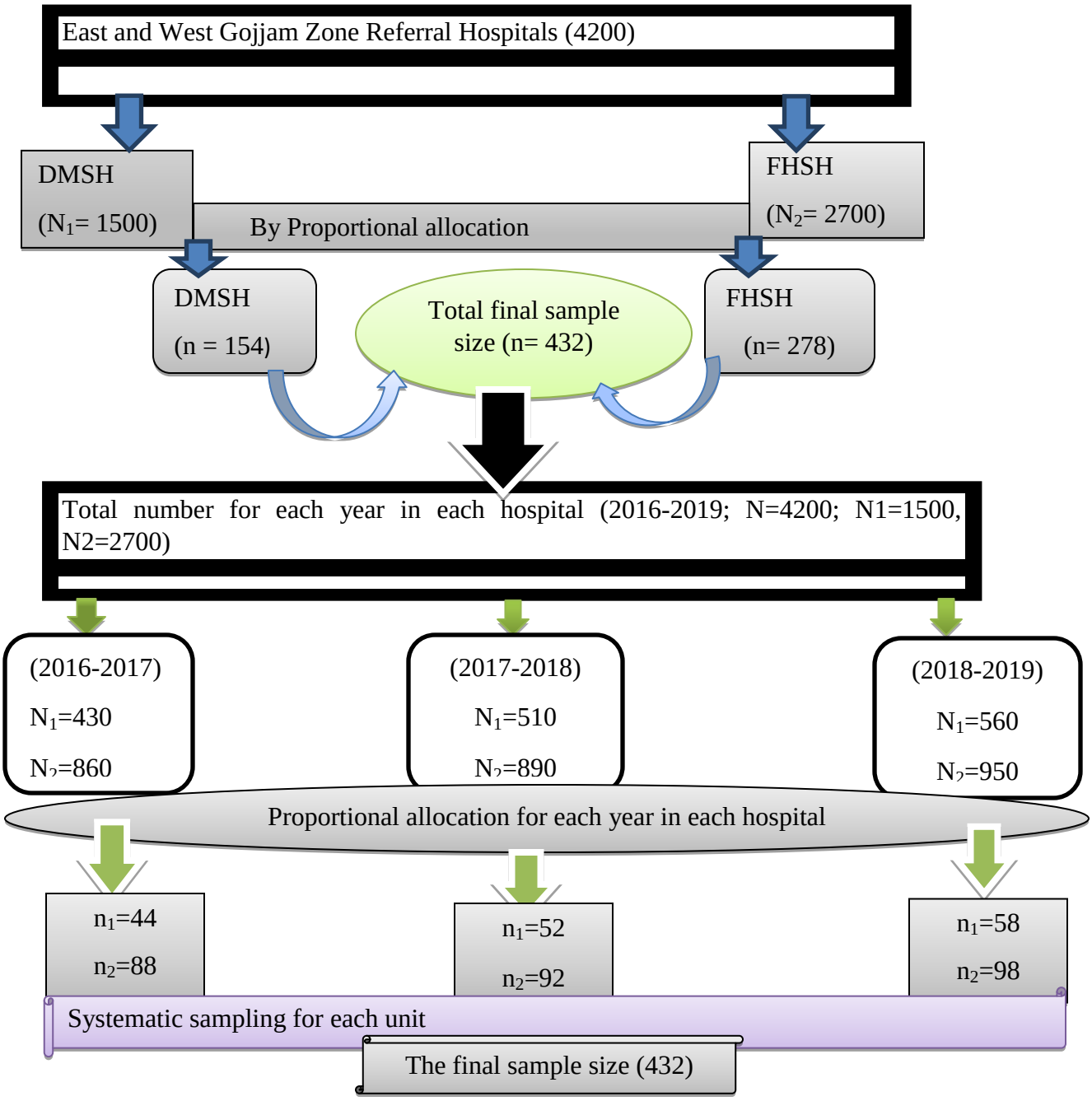
Zβ: 80% power and, r is the ratio of exposed to non-exposed 1:1.

While using the double population proportion formula, it resulted in a high sample size with the independent variable of perinatal asphyxia which has strong association(17) with exposed outcome than sample size which resulted while using single population formula. Therefore; the largest sample size (N= 432) had been selected as the final sample size for the study.

4.5.2. Sampling technique and procedure

First, hospitals found in East and West Gojjam zones of Amhara region which have been delivering neonatal intensive care (NICU) service were selected purposively. Then, two hospitals (Debre Markos and Felegehiwot specialized hospitals) were selected. The number of total admissions in Debre Markos specialized hospital was 1500 and in Felegehiwot specialized hospital was 2700. After identifying the total number of admissions in each hospital, the sample was allocated proportionally to select the study participants from each hospital. After that, medical records of preterm neonates who had been admitted and enrolled in NICU between january1st, 2016 to December 30th, 2019 had been recruited. From the recruited cards in each hospital the study participants of each year had been selected with systematic sampling as follows.

First, numbering the units of each year on the frame from 1 to N (N=total admission of each year), then the sampling interval (K) was determined by dividing the number of units in the population by the desired sample size of each year (n=sample size of each year) which gives ten. Then number between 1 and 10 at random was selected (2 was selected). This number is called the random start and the first number included in the sample. Then later Selection had been conducted every 10th unit after that first number. Finally, the selected medical charts had been followed for four years (based available and complete data registry) (Figure 2).



Key: DMSH = Debre markos specialized hospital, FHSH = Felegehiwot specialized hospital, $N_{1=}$ Total number of patients in Debre markos specialized hospital, $N_{2=}$ Total number of patients in Felegehiwot specialized hospital, $n_{1=}$ sample of patients in Debre markos specialized hospital and $n_{2=}$ sample of patients in Felegehiwot specialized hospital.

Figure2; Schematic presentation of sampling procedure to assess the magnitude and predictors of mortality among premature neonates admitted to NICU from (2016-2019) at Debre markos

and Felegehiwot specialized Hospitals in East and West Gojjam Zones, Amhara regional state, Ethiopia, 2020

4.6. Variables of the study

4.6.1. Dependent variable

Mortality of the preterm neonates

4.6.2. Independent variables

- ❖ Sociodemographic factors
    - Neonatal characteristics: Age of preterm neonate, gestational age of preterm neonate, sex, and weight of preterm neonate.
    - Maternal characteristics: Age, residency, place of delivery.
- ❖ Maternal obstetric related factors: like having PROM, preeclampsia, abruption placenta, breast feeding initiation, ANC follow up, gravidity, Parity, mode of delivery and multiple pregnancies.
- ❖ Medical disorders in mother: like DM, HIV/AIDS, Hypertension, maternal infections, anemia.
- ❖ Neonatal medical diagnosis: like RDS, sepsis, jaundice, hypothermia, Apgar score, PNA, hypoglycemia, CHD and Congenital anomalies.

4.7. Operational definition

The following operational definitions pertain to the study:

- **Preterm neonatal mortality:** the death of preterm neonates with GA of less than 38 week and within 28 days.
- **Premature birth**: A neonate born between 25 and 37 weeks of gestation.
- **Multigravidas**: Recorded gravida of >2.
- **Multiparty**: Recorded parity of >2.
- **Magnitude**; Total number of preterm neonatal death within the study period (high level of mortality if magnitude is more than 25%, medium level if mortality is 5-24% and low level of mortality if less than 5% of the sampled participants.
- **Full-term birth:** A neonate born between 37 and 42 weeks of gestation.

- **Post-term birth:** A neonate born after 42 full weeks of gestation.
- **Infection during pregnancy:** Any infection of the reproductive system experienced during pregnancy, including urinary tract infections.
- **Having ANC follow up**-If the mother has a follow up of at least 4 times at her pregnancy period.
- **Medical disorders in the neonate**: Any recorded medical diagnosis for the premature neonates on their medical records such as; RDS, PNA, Jaundice, sepsis, Hypoglycemia, HMD, CHD, Hypothermia.
- **Low APGAR SCORE**: A neonate with an Apgar score of < 7.

4.8. Data collection procedures

4.8.1. Data collection tools and procedures

A data extraction tool has been developed from different related literatures and modified in accordance of this study context. The checklist was prepared in English and has subparts such as; part- I sociodemographic factors of the mother and preterm neonates, Part-II maternal obstetric factors, Part IV medical factors of the preterm neonate , Part V outcome of the preterm Neonates .

Four data collectors were participated during data extraction. Two BSc nurses and two diploma nurses, and one day training was given to data collectors about how to extract data prior to real data collection. Data collectors used the check list for data collection from neonate's charts in NICU. The available information was checked and then, the appropriate data was extracted based on the check list format from the medical record of neonates that fulfill the inclusion criteria was reviewed retrospectively by the data collectors from the first of January 2016 to December 31^{rst}, 2019 .

4.8.2. Data quality control

The data was collected by four-nurses with the background of BSc in nursing (two from each Hospitals) who had been working in NICU and involved in the patient care in that unit. Pretest was done in finoteselam general hospital found in West Gojjam zone on 5% of charts and modification of checklist has been made. That is based the pretest, there was modification

of checklist (three variables had not been recorded on the charts of the patient. Such variables were: educational status, occupation and numbers of ANC follow up had not been recorded so that these variables had been left).One supervisor in each hospital had closely supervised the entire data collection process. Data quality was assured by designing proper data abstraction tool and through continuous supervision. Codes had been given to the questionnaires. All collected data was checked for completeness by data collector and supervisor every day to ensure the quality of the data. Consistency had been examined through random selection of cards by the principal investigator and cross check for their similarity. Problems encountered during the study period were discussed with principal investigator and had been solved.

4.9. Data processing and analysis

First the data was checked for its completeness and consistency. Then it was coded and entered using Epi-Data version 3.1.After that, data was exported to SPSS (statistical package for social science) version 24 for analysis. Descriptive analysis using frequencies, proportions, graphs was performed to describe number and percentage of socio-demographic characteristics of the sample and other variables. Binary logistic regression analyses model was used to identify predictors of mortality. This was done by odds ratio and p value. Explanatory variables with p-value less than or equal 0.25 in the bivariate logistic regression was entered into multivariate logistic regression analysis to control possible confounding and for further analysis and variables having p - value of less than 0.05 was considered as significantly associated with the dependent variable, mortality. Finally the results were presented in text, tables and graphs based on the types of data.

4.10. Ethical considerations

Ethical clearance was obtained from Institutional Review board of Addis Ababa University, College of Health sciences, school of Nursing and Midwifery, and department of Nursing and a formal letter was submitted to Debre Markos and Felegehiwot Specialized Hospitals' administrative offices and permission was assured. To keep the confidentiality, all collected data was coded and locked in a separate room before entered in to the computer. After entered to the computer the data was locked by password, names and unique NICU Patient's numbers was not included in data collection format and the data was not disclosed to any person other

than principal investigator. All information collected from patient's cards were kept strictly confidential and names of Patients was not included in the checklist.

4.11. Dissemination plan

The final thesis will be presented and submitted to Addis Ababa University College of health sciences, school of nursing and midwifery and department of nursing as a partial fulfillment of masters of Science in pediatric and child health nursing. The study result will also be submitted to hospitals where research is conducted such as Debre markos and Felegehiwot specialized hospitals and in addition, the finding will be presented in locally or internationally held seminars, workshops, conferences and meetings including in Ethiopian nursing and midwifery associations and it will be published in internationally or nationally recognized journals.

5. RESULT

5.1. Socio-demographic characteristics of the study participants

In this study the data were collected from 432 preterm neonates through chart review. Among these about 227(52.54%) were males. From those 79(34.8%) were died. Preterm neonates with age of 24hrs or less comprised 316(73.1%) which contributed to 119(74.4%) of the deaths. The mean age of mothers was found to be 27.44± 5.52 SD years old and majority of them 345(80.0%) were belonged to the age group of 20-34 years. The mean age and gestational age of the preterm neonates were 2.4 ± 3.48 SD days and 32.85 ± 2.68 SD weeks respectively and most neonates' gestational age 304(70.4%) belonged to the age group of 32 - 37 leading to a proportion of preterm neonatal death of 82(51.25%) and mean weight of the participants was also found to be 1665 ± 406.8957SD grams (Table 2).

Table 2: Baseline socio-demographic characteristics of preterm neonates and mothers at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

Variables	Category	Frequency	Totals% N=432	Status	
				Alive	Death
Sex of the neonate	Male	227	(52.5%)	148(65.2%)	79(34.8%)
	female	205	(47.5%)	124(60.5%)	81(39.5%)
	≤19	20	(4.6%)	12(60%)	8(40%)
	20-34	345	(80.0)	222(64.3%)	123(35.7%)
	≥35	67	(15.4%)	38(56.7%)	29(43.3%)
Age of the neonate in days	≤1	316	(73.1%)	197(62.3%)	119(37.7%)
	2-7	80	(18.5%)	52(65%)	28(35%)
	≥8	36	(8.4%)	23(63.9%)	13(36.1%)
Residence	Urban	170	(39.4%)	113(66.5%)	57(33.5%)
	Rural	262	(60.6%)	159(60.7%)	103(39.3%)
Place of delivery	At health	376	(87%)	239(63.6%)	137(36.4%)

	institution				
	At home	56	(13%)	33(58.9%)	23(41.1%)
Gestational age of the neonate in weeks	32-37	304	(70.4%)	222(73%)	82(27%)
	28-31	120	(28%)	48(40%)	72(60%)
	≤27	16	(5%)	8(25%)	6(75%)
Weight of the neonate	2000-2500	123	(28.5%)	92(74.8%)	31(25.2%)
	1500-1999	182	(42%)	128(70.3%)	54(29.7%)
	1000-1499	114	(26.5%)	50(43.9%)	64(56.1%)
	≤999	18	(15.4%)	8(3%)	11(84.6%)
Length of hospital stay in days	≤1	52	(12%)	20(38.5%)	32(61.5%)
	2-7	182	(42%)	100(54.9%)	82(45.1%)
	8-15	133	(31%)	102(76.7%)	31(23.3%)
	≥16	64	(15%)	50(78.1%)	14(21.9%)

5.2. Medical and obstetric characteristics of the mother

Among the total participants enrolled into the study, 307(71.06%) had given a birth through spontaneous vaginal delivery, 75(17.36%) through a cesarean section and 50(11.60%) through instrumental delivery. Most of the preterm neonatal deaths {116(72.5%)} were contributed from preterm neonates delivered through a spontaneous root. The result of this study also indicated that majority {371(86.8%)} of the neonate's mothers had ANC follow up and from these 133(83.12%) preterm neonates had died. Regarding obstetric and a medical diagnose of maternal diseases, premature rupture of membrane {78(18.05%)}, preeclampsia 59(13.66%), number of gravidity equal or greater than 3 205(47.45%), HIV/ADIS 40(9.5%), DM 34(8.7%), hypertension 41(9.50%) and anemia 33(7.6%) were identified. Of the 160 preterm neonates who died, the highest number 85(53.12%) and 82(51.25%) of preterm neonates who had been delivered from mothers whose parity and gravidity of greater or equal to 3 were died (Table 3).

Table 3: Maternal medical and obstetric characteristics of the study participants that were admitted to NICU from (2016-2019) at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

Variables	Category	frequency	Totals (%) (N=432)	Status	
				Alive	Death
Mode of delivery of the mother	Spontaneous	307	(71.06%)	191(62.2%)	116(37.8%)
	Cesarean section	75	(17.36)	51(68%)	24(32%)
	Instrumental	50	(11.6%)	30(60%)	20(40%)
Premature rupture of membrane	NO	354	(82.4%)	235(66.4%)	119(33.6%)
	YES	78	(18.05%)	37(47.4%)	41(52.6%)
Preeclampsia	NO	373	(86.34%)	235(63%)	138(37%)
	YES	59	(13.66%)	37(62.7%)	22(37.3%)
Abruption placenta	NO	407	(94.21%)	261(64.1%)	146(35.9%)
	YES	25	(6.70%)	11(44%)	14(56%)
Antepartum hemorrhage	NO	398	(92.12%)	255(64.1%)	143(35.9%)
	YES	34	(7.87%)	17(50%)	17(50%)
Others (oligo.hydr, Rh, polyhydramnious)	NO	395	(91.43%)	251(63.5%)	144(36.5%)
	YES	37	(8.56%)	21(56.8%)	16(43.2%)
Antenatal follow up	NO	61	(14.12%)	34(55.7%)	27(44.3%)
	YES	371	(86.8%)	238(64.2%)	133(35.8%)
Number of gravidity	≤2	227	(52.5%)	149(65.6%)	78(34.4%)
	≥3	205	(47.45%)	123(60%)	82(40%)

Number of parity	≤2	247	(57.2%)	162(65.6%)	85(34.4%)
	≥3	185	(43.2%)	110(59.5%)	75(40.5%)
Multiple pregnancy	NO	294	(68%)	185(62.9%)	109(37.1%)
	YES	138	(32.14%)	87(63%)	51(37%)
HIV/AIDS	N0	392	(90.74%)	248(63.3%)	144(36.7%)
	YES	40	(9.25%)	24(60%)	16(40%)
Hypertension	NO	391	(90.50%)	244(62.4%)	147(37.6%)
	YES	41	(9.50%)	28(68.3%)	13(31.7%)
Diabetes malites	NO	398	(92.12%)	252(63.3%)	146(36.7%)
	YES	34	(8.7%)	20(58.8%)	14(41.2%)
Anemia	NO	399	(92.36%)	248(62.2%)	151(37.8%)
	YES	33	(7.63%)	24(72.7%)	9(27.3%)
Maternal infections(UTI, Malaria, pyelonephritis)	NO	391	(90.5%)	243(62.1%)	148(37.9%)
	YES	41	(9.5%)	29(70.7%)	12(29.3%)

5.3. Common medical diagnosis of preterm neonates admitted to NICU

The common medical problems identified among admitted preterm neonates during the study period were: low first minute APGAR score less or equal to7 345(80.0%) with mean of 6.36±1.23SD in which most preterm neonatal death was concentrated 133(83.0%), Respiratory distress syndrome 205(47.5%), Sepsis 322(74.53%), Hypothermia 237(55.1%), Perinatal asphyxia 79(18.3%), Hypoglycemia 74(17.12%), neonates with no immediate breast feeding 260(60.2%). From which 133(83.0%), 111(69.4%), 133(83.12), 99(61.87), 50(31, 25), 39(24.4), 115(72.0%) were died during the follow up period respectively. The other

common causes of admission to NICU were, Prematurity 38(8.8%), Jaundice 50(11.6%), CHD 17(4.0%), Congenital anomalies, Hyaline membrane diseases 16(4.0%) and meningitis 6(2.0%) (Table4).

Table 4: Common medical and other diagnosis of preterm neonates admitted to NICU from 2016-2019 at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

Variables	Category	Frequency	Totals% (N=432)	Status	
				Alive	Death
Respiratory distress syndrome	NO	227	(52.54%)	178(78.4%)	49(21.6%)
	YES	205	(47.5%)	94(45.9%)	111(54.1%)
Jaundice	NO	382	(88.4%)	241(63.1%)	141(36.9%)
	YES	50	(11.6%)	31(62%)	19(38%)
Perinatal asphyxia	NO	353	(81.7%)	243(68.8%)	110(31.2%)
	YES	79	(18.3%)	29(36.7%)	50(63.3%)
Hypothermia	NO	195	(45.13%)	134(68.7%)	61(31.3%)
	YES	237	(55.1%)	138(58.2%)	99(41.8%)
Hypoglycemia	NO	358	(82.87%)	237(66.2%)	121(33.8%)
	YES	74	(17.12%)	35(47.3%)	39(52.7%)
Sepsis	NO	110	(25.46%)	83(75.5%)	27(24.5%)
	YES	322	(74.53%)	189(58.7%)	133(41.3%)
Congenital heart diseases	NO	415	(96.0%)	267(64.3%)	148(35.7%)
	YES	17	(4%)	5(29.4%)	12(7.570.6%)

Meningitis	NO	426	(98%)	266(62.4%)	160(37.6%)
	YES	6	(2%)	6(100%)	
Hyaline membrane disease	NO	416	(96%)	267(64.2%)	149(35.8%)
	YES	16	(4%)	5(31.3%)	11(68.7%)
Anemia	NO	427	(99%)	269(63%)	158(37%)
	YES	5	(1%)	3(60%)	2(40%)
Congenital	NO	424	(98.0)	269(63.4%)	155(36.6%)
Anomalies	YES	8	(2%)	3(37.5%)	5(62.5%)
First minute APGAR score	≤7	345	(80%)	212(61.4%)	133(38.6%)
	≥8	87	(20%)	60(69%)	27(31%)
Fivith minute APGAR Score	≤7	202	(46.75%)	119(58.9%)	83(41.1%)
	≥8	230	(53.24%)	153(66.5%)	77(33.5%)
Immediate breast feeding	NO	260	(60.2%)	145(55.8%)	115(444.2%)
	YES	172	(39.8%)	127(73.8%)	45(26.2%)
Prematurity	NO	394	(91.2%)	254(64.5%)	140(35.5%)
	YES	38	(8.8%)	18(47.4%)	20(52.6%)
Others(AGA, MAS, esophageal atresia, enterocolitis)	NO	363	(85.4%)	230(63.4%)	133(36.6%)
	YES	69	(14.6%)	42(60.9%)	27(39.1%)

5.4. Magnitude and predictors of preterm neonates admitted to NICU

From the total study participants of 432 preterm neonates' charts reviewed during the study period, about 160(37.0%) preterm neonates had died. A higher number of deaths 119(74.4%) were recorded during the first day of neonatal age. Likewise, a higher proportion of neonatal death was also recorded among mothers aged 20-34yrs {123(77.0%)}, neonates with gestational group of 32-37{82(51.25%)}, in preterm neonates whose sex was female

{81(50.6%)} and in preterm neonates with the weight of 1000-1499 grams {64(40.0%)} (figure 3).

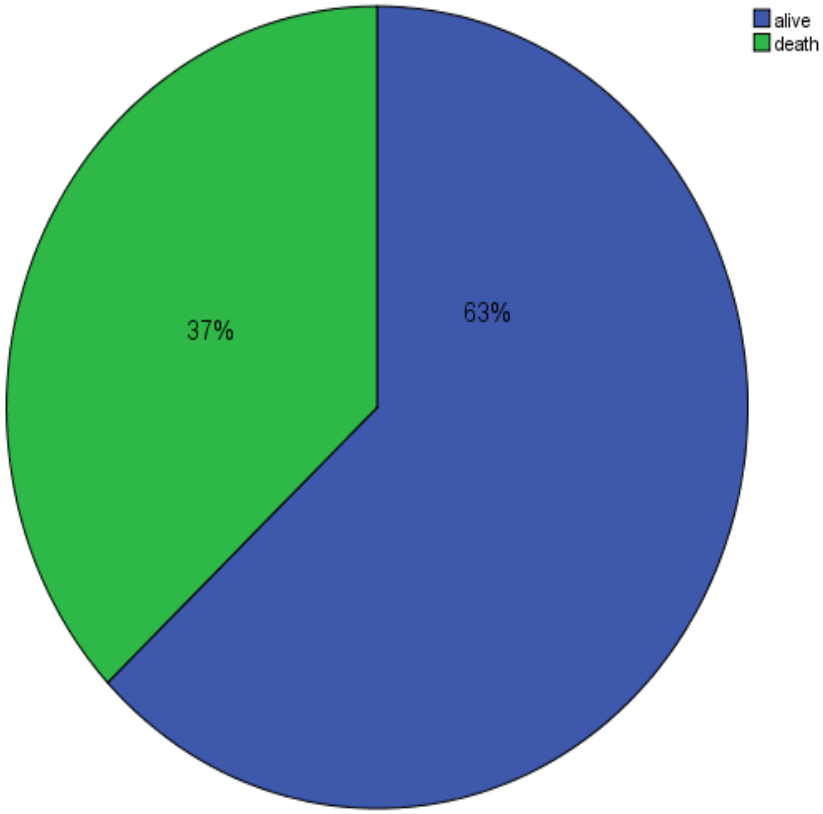


Figure 3: Magnitude of mortality of preterm neonates admitted to NICU at Debre markos and Felegehiot referral hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

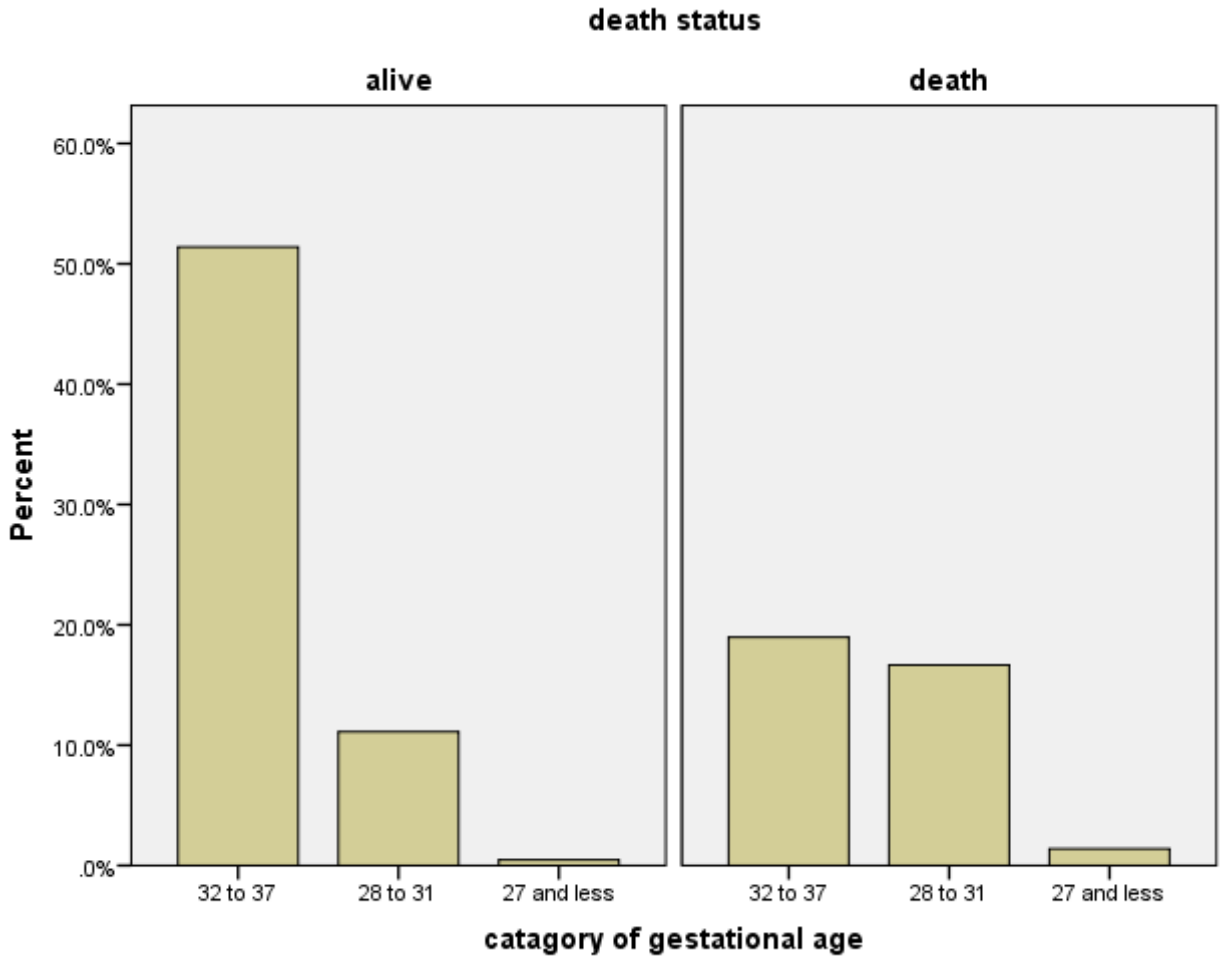


Figure 4: diagrammatic representation of category of gestational age of preterm neonates admitted to NICU at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

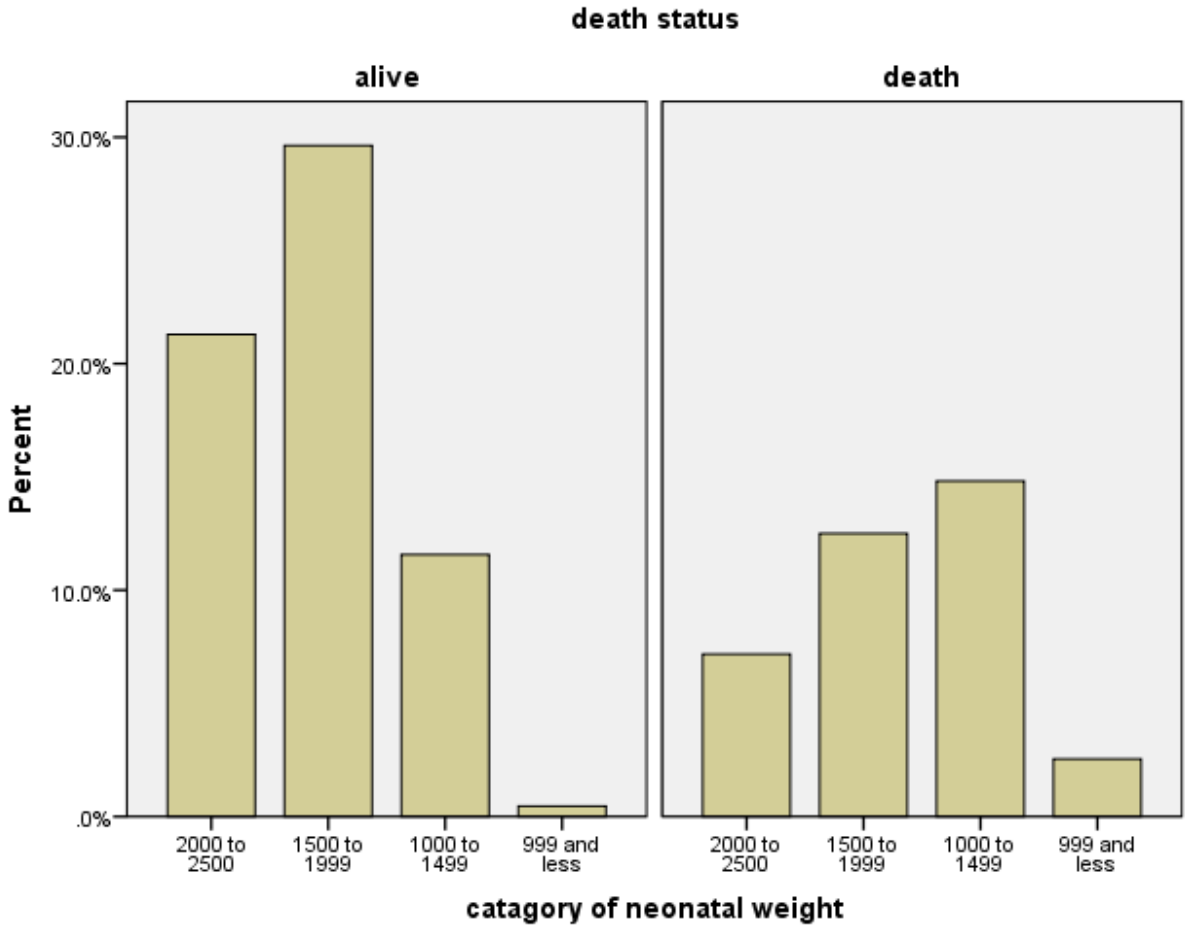


Figure 5: diagrammatic representation of category of birth weight of preterm neonates admitted to NICU at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

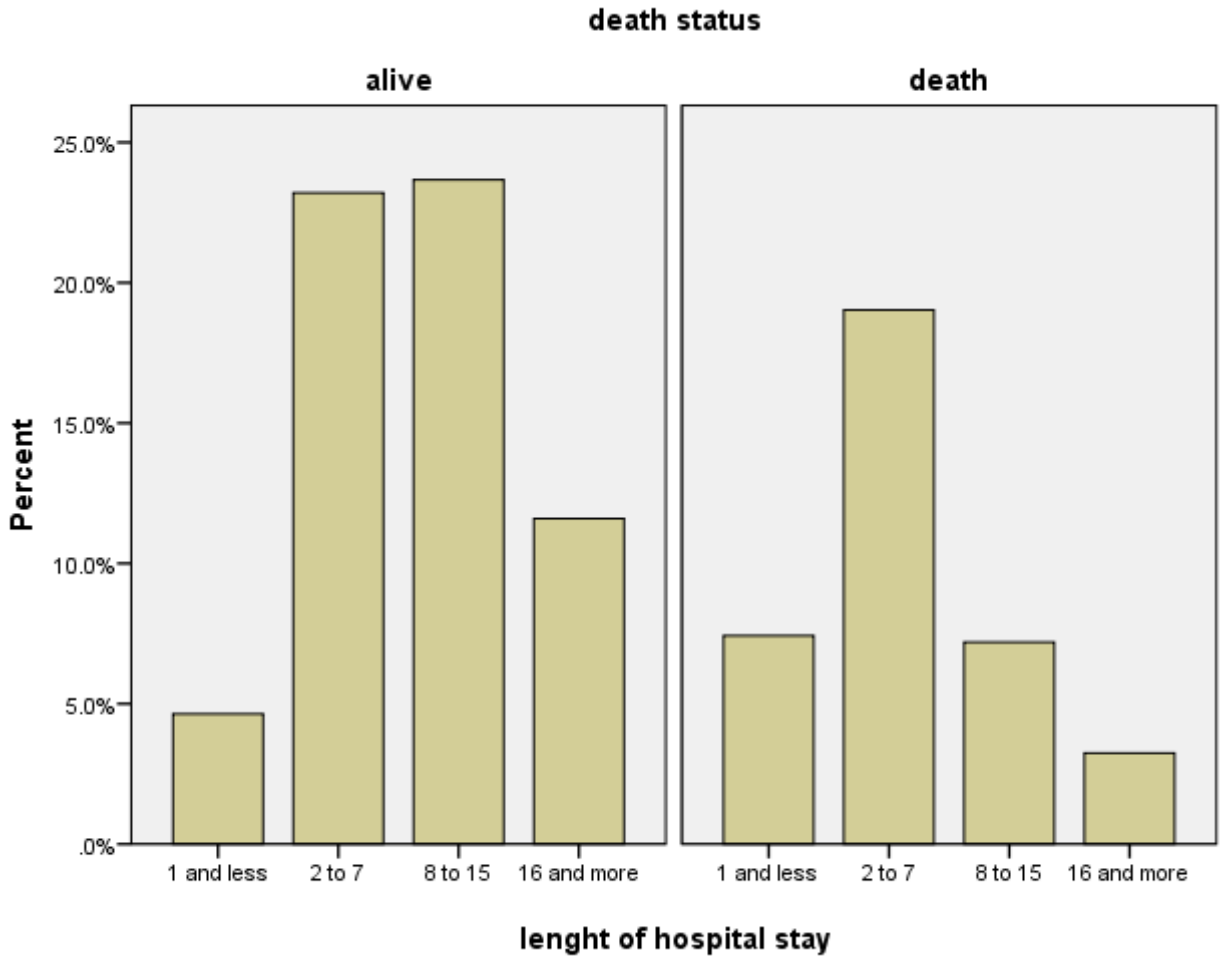


Figure 6: diagrammatic representation of category of length of hospital stay of preterm neonates admitted to NICU at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara Regional State, Ethiopia, 2020.

5.5. Predictors significantly associated with magnitude of mortality among preterm neonates admitted to NICU

Those variables with a P-value of ≤ 0.25 in the binary logistic analysis were entered to multiple logistic analysis using enter method to identify the independent predictors associated with preterm neonatal mortality admitted to NICU. In bivariate analysis the covariates such as: maternal factors like age 20-34, resided in rural areas, having not ANC follow up, abruption placenta, antepartum hemorrhage, number gravidity and parity, PROM, anemia, and neonatal predictors like gestational age, weight, sepsis, RDS, hypoglycemia, hypothermia, perinatal asphyxia, CHD, congenital anomalies, hyaline membrane disease, prematurity, first and fifth minute APGAR score and breast feed initiating were statistically significant (p-value < 0.25) predictors of preterm neonatal mortality with 95% confidence interval.

The result of multivariate analysis of logistic regression also showed that preterm neonates whose gestational age was 28-31 were approximately three times more likely to die as compared to those of 32-37 gestational age groups{(AOR: 2.5, (95%CI: 1.356, 4.802)}. The preterm neonates admitted to NICU who were born from mothers with PROM were two times more likely to die as compared to those neonates born from mothers who hadn't PROM(AOR:2.143, (95%CI: 1.098, 4.180)). Preterm neonates with RDS are also nearly two times more likely to die as compared to those neonates without RDS {(AOR: 2.28, (95%CI: 1.316, 3.952)}.

Preterm neonates that had sepsis at the time of admission were also nearly three times more likely to die than those neonates without sepsis (AOR; 2.802, (95%CI: 1.457, 5.387)) and preterm neonates with perinatal asphyxia were nearly three times more likely to die as compared to those of without the perinatal asphyxia (AOR: 2.85(95%CI: 1.338, 6.071)). Likewise; preterm neonates whose birth weight were 1000-1499 and ≤999 were approximately three times (AOR: 3.3, (95%CI: 1.539, 6.968)) and approximately ten times (AOR: 10.338, (95%CI: 1.591, 6. 20)) more likely to die than the other preterm neonates with birth weight greater than 1500 grams.

Another significant predictor associated with preterm neonatal mortality was length of hospital stay. That is neonates stayed less or equal to one day were nearly ten times {(AOR:

9.63, (95%CI: 3.4, 7.70)} and neonates stayed 2-7 days similarly were nearly five times{(AOR: 5.45, (95%CI: 2.4, 12.52)} more at increased risk to die than those stayed greater than those of 8-15 and more than 15 days in NICU(Table 5).

Table 5: Binary and multivariable Logistic regression analysis of magnitude and predictors of mortality among preterm neonates admitted to NICU from 2016-2019 at Debre markos and Felegehiwot specialized hospitals in East and West Gojjam zones, Amhara Regional state, Ethiopia, 2020.

Variables	Category	Status of the neonate		COR(95%CI)	AOR (95% CI	P-value
		Alive	Death			
	Urban	113	57	1.00	1.00	
Residence	Rural	159	103	1.28(0.858, 1.923)	1.24(0.73,2.106	0.421
ANC follow up	NO	34	27	1.421(0.82, 2.46)	1.26(0.58, 2.44)	0.642
	YES	238	133	1.00	1.00	
Premature rupture of membrane	NO	235	119	1.00	1.00	
	YES	37	41	2.188(1.33, 3.59)	**2.14(1.1, 4.18)**	**0.025***
Abruption Placenta	NO	261	146	1.00	1.00	
	YES	11	14	2.275(1.007, 5.14)	2.46(0.76, 7.99)	0.133
Antepartum Hemorrhage	NO	255	143	1.00	1.00	
	YES	17	17	1.783(0.88, 3.60)	1.27(0.45, 3.60)	0.652
Mother give breast feeding	NO	145	115	1.00	1.00	
	YES	127	45	2.238(1.472, 3.40)	1.33(0.76, 2.33)	0.320
Anemia	NO	248	151	1.00	1.00	
	YES	24	9	0.616(0.279, 1.36)	0.66(0.244, 1.8)	0.415
Respiratory	NO	178	49	1.00	1.00	

Distress Syndrome	YES	94	111	4.290(2.82, 6.52)	**2.31(1.32, 3.95)**	**0.003***
Perinatal Asphyxia	NO	243	110	1.00	1.00	
	YES	29	50	3.809(2.287, 6.342)	**2.85(1.34, 6.07)**	**0.007***
Hypothermia	NO	134	61	1.00	1.00	
	YES	138	99	1.576(1.06, 2.346)	1.30(0.76, 2.20)	0.342
Hypoglycemia	NO	237	121	1.00	1.00	
	YES	35	39	2.18(1.316, 3.62)	1.34(0.63, 2.85)	0.449
Sepsis	NO	83	27	1.00	1.00	
	YES	189	133	2.163(1.33, 3.52)	**2.80(1.457, 5.4)**	**0.002***
Congenital heart disease	NO	267	148	1.00	1.00	
	YES	5	12	4.330(1.50, 12.53)	2.74(0.70, 10.8)	0.151
Hyaline membrane diseases	NO	267	149	1.00	1.00	
	YES	5	11	3.942(1.34, 11.56)	1.90(0.46, 7.71)	0.378
Congenital Anomalies	NO	269	155	1.00	1.00	
	YES	3	5	2.892(0.68, 12.27)	3.54(0.38, 33.3)	0.268
Prematurity	NO	254	140	1.00	1.00	
	YES	18	20	2.016(1.032, 3.94)	0.905(0.4, 2.3)	0.835
Age of the mother in years	≤19	222	123	0.726(0.43, 1.235)	0.60(0.3, 1.30)	0.185
	20-34	12	8	0.874(0.316, 2.42)	0.21(0.04, 1.05)	0.058
	≥35	38	29	1.00	1.00	
Number of Gravidity	≤2	149	78	1.00	1.00	
	≥3	123	82	1.274(0.861, 1.88)	0.43(0.15, 1.24)	0.116
Number of	≤2	162	85	1.00	1.00	

parity	≥3	110	75	1.299(0.88, 1.927)	2.23(0.77, 6.44)	0.137
Gestational age in weeks	32-37	222	82	1.00	1.00	
	28-31	48	72	4.061(2.60, 6.334)	**2.55(1.356, 4.8)**	**0.004***
	≤27	8	9	8.122(1.61, 41.1)	3.64(0.50, 26.6)	0.203
Weight of the neonate in grams	2000-2500	92	31	1.00	1.00	
	1500-1999	128	54	1.252(0.75, 2.1)	1.379(0.7, 2.70)	0.349
	1000-1499	50	64	3.799(2.22, 6.60)	**3.34(1.54, 6.97)**	**0.002***
	≤999	8	10	16.323(3,43,77.73)	**10.34(1.6, 6.2)**	**0.014***
First minute Apgar score	≤7	212	133	0.717(0.43, 1.20)	0.68(0.34. 1.36)	0.276
	≥8	60	27	1.00	1.00	
Fivith minute Apgar score	≤7	119	83	1.386(0.94, 2.051)	0.70(0.39, 1.24)	0.218
	≥8	153	77	1.00	1.00	
Length of hosp. stay in days	≤1	20	32	5.714(2.53, 12.90)	**9.63(3.4, 7.70)**	**0.00****
	2-7	100	82	2.929(1.513, 5.67)	**5.45(2.4, 12.52)**	**0.00****
	8-15	102	31	1.085(0.53, 2.22)	1.370(0.57, 3.3)	0.480
	≥16	50	14	1.00	1.00	

NB: * Significant (P-value < 0.05*) and significant (p-value<0.001**)

6. DISSCUSSION

6.1. Magnitude of mortality in preterm neonates admitted to NICU

The magnitude of preterm neonatal mortality in this study was 160(37%) within (95%CI: 58.8%-67.6%). This finding was relatively higher than the studies reported from Iran, another areas of Iran, South India, Nigeria, Australia, southwest Nigeria and Kenya at Kenyatta national hospital and Northwest Ethiopia in Gondar comprehensive specialized hospital {(9.1%), (27.4%),(7.5 %),(19.7%) ,7.7%,21.9% and 18.3%}respectively(14,25–29,42). This might be due to different possible reasons. One possible source of variation in mortality might be difference in sample size and methodology. Further, possible reason might be the difference in study period as there were changes in treatment modality. This gap might be also due to facilities in the hospital, NICU setup and manpower.

However, the overall magnitude of mortality of this study was relatively comparable with studies reported from India and Jimma specialized hospital, Ethiopia (33.5%) and (34.9%) respectively(14,25). This may due to similarity in NICU setup, study methodology, similarity in policy accomplishment and setup, study period, treatment modality, manpower resources and facility distribution.

6.2. Predictors associated with mortality among preterm neonates admitted to NICU

This study also identified the predictors of mortality in preterm neonates that were admitted to NICU. PROM, sepsis, RDS, PNA, GA, birth weight and length of hospital stay were identified as statistically significant predictors of preterm neonatal mortality. Consequently, it was identified that preterm neonates born from mothers with PROM were nearly two times more likely to die than neonates born from mothers without PROM which was in consistent with the study in Kenya revealed that it was 5- fold(29). The possible reason might be due to premature labor may be more common in PROM women, so that they might give immature neonates for their gestational age which increased risk of premature complications.

Presence of RDS at the time of admission was found to be another important statically significant predictor of preterm neonatal mortality evidenced that preterm neonates who had

RDS at the time of admission were nearly two times more likely to die as compared to those who did not have RDS. This result was similar with other studies conducted in Jimma University Specialized Hospital which was nearly three times and in University of Gondar comprehensive specialized hospital which showed it was nearly two times(17,30). This may be due to lung immaturity (lack of adequate surfactant substance which prevents collapse of alveoli at the end of expiration) and might be due to maternal factor like having DM, PROM which may increase alveolar surface tension. Additionally, premature neonates may use up their pulmonary reserve and may eventually develop respiratory failure.

Having neonatal sepsis at the time of admission was also statistically significant predictor increasing the risk of mortality among preterm neonates that was admitted to NICU. Those who had neonatal sepsis were nearly three times more likely to die compared to those who were not having sepsis. This finding is similar with the study conducted in Jimma University Specialized Hospital which showed that it was two times more likely to die than those without sepsis(30). The possible reason might be that most of premature neonates were born with possible immature immunity, different procedures and the mode of delivery might have its own contribution. Likewise, this study revealed that preterm neonates with perinatal asphyxia were nearly three times more susceptible for death as compared with those without perinatal asphyxia. This is consistent with the studies conducted in University of Gondar comprehensive specialized hospital which showed that it was nearly three times more likely to die than without perinatal asphyxia and in Jimma University Specialized Hospital which identified that it was nearly two times more likely to die those with perinatal asphyxia than without perinatal asphyxia(17,33). This may be also due to lung immaturity (lack of adequate surfactant substance which prevents collapse of alveoli at the end of expiration and inadequate perfusion of the different part of the neonates' body.

In this study, GA was identified as statically associated independent predictor of premature neonatal death, that is the likelihood of death of premature neonates who were 28-31 week of GA at time of admission were nearly three times more likely to die than those who were between 32-37 week of GA. This is comparable with the study done in Northwestern Iran which was nearly eleven times more likely to die than those less than 30 weeks of GA, in Northeastern Nigeria which showed that neonates with GA of 28-32 weeks were nearly three

times and those with GA of less than 28 were nearly five times more likely to die than those greater than 33 weeks of GA(32) and in University of Gondar comprehensive specialized hospita which indicated that neonates with gestational age of less than 30 weeks were nearly two times more likely to die than those with greater than 30 weeks of GA(17,25,32). This may be due immature immunity and high body mass index which exposes the neonate to hypothermic as well as hypoglycemic which are the major causes of comorbidity and mortality among preterm neonates.

Another result of multivariate analysis revealed that preterm neonates with birth weight of less than or equal to 1500 grams were nearly three times and birth weight of the preterm neonates whose birth weight were less than 1000 grams ten times more likely at increased susceptibility of death than the neonates with birth weight greater than 1500 grams which was similar with result of the study in Mt. Hope Women's Hospital in Trinidad and Tobago which identified that preterm neonates with birth weight of less or equal to 1000 grams were fifteen times more likely at risk to die than neonates whose birth weight were greater than 1000 grams and in Northeastern Nigeria which showed that neonates with birth weight of 1000-1499 grams were nearly four times more likely to die than those with birth weight of greater than 1500 grams(12,32). This may be due immature immunity and high body mass index which exposes the neonate to hypothermic as well as hypoglycemic which are the major causes of comorbidity and mortality of the preterm neonates.

Another statistically significant predictor associated with preterm neonatal mortality was length of hospital stay which had not been identified in other studies explored before. That is neonates stayed less or equal to one day were nearly ten times and neonates stayed 2-7 days similarly were nearly five times respectively more at increased risk to die than those stayed greater than those of 8-15 and more 15 days in NICU. This might due to the reason that these neonates were severely ill before they reached to the facility, it might due to distance which was far from the health facility, this also may due to low treatment modality found in the NICU, it might low awareness of the mothers to take to health facility immediately after the neonate has been sick, and it might be also due to low manpower resources available in the facility to give quick treatment management.

7. LIMITATIONS AND STRENGTHS

Strength

The study was conducted considering consisting of different years of admission with equal proportional allocation; this may upgrade number of events and reduces variability. Data were also collected by Nurses who were trained on neonatal care at NICU which has an important role in the quality of the data. It increases an insight for researchers especially for prospective study. Because, the result was death, it was easy to establish temporal relationship with dependent variables which were registered during the time of admission.

Limitation

Since the data was collected from secondary source; some important predictors such as socioeconomic factors like level of income, educational status, occupation of the mother and birth spacing might be missed which will have a significant prediction with preterm neonatal death. The study area covers only Debre markos and Felegehiwot specialized hospitals in East and West Gojjam Zones, Amhara Regional state. Its generalizability to all hospitals of the city and Ethiopia may not be possible. Selection bias is possibly introduced during secondary data collection because patients with incomplete records were excluded. So, the magnitude of death may be under or over estimated.

8. CONCULUSION

In the current study, magnitude of preterm neonatal death was found to be high particularly in early neonatal period and multivariate analysis showed that the major predictors of death of preterm neonates admitted to NICU were found to be PROM, neonatal sepsis, RD, GA less than 32 weeks, weight of the preterm neonates less than 1500grams and length of hospital stay less than 2 days were found to be significantly associated predictors of preterm neonatal death.

9. RECOMMENDATION AND CONCULSIO

The recommendation was made based on our study finding

The federal minster of health works to reduce the neonatal mortality rate by including in the second MDG IV, though the magnitude of death of preterm neonates in the study area is still high, so that the government should able to strengthen services related with reducing preterm neonatal deathlike strengthen HSDG. The medical managements of the hospital should facilitate more research to find out more precise diagnosis of predictors of preterm neonatal death and maternal adverse outcome with better computerized recording system.

Ethiopian federal ministry of health must focus on making the policy in order to reduce neonatal mortality throughout the country. Debre markos and Felegehiwot specialized hospitals should able to strengthen careful, follow up and regular monitoring of patients with sepsis, PNA and RDS and other significant predictors in order to reduce the magnitude of preterm neonatal death.

T**o health care provider of Debre markos and Felegehiot referral hospitals**

A special emphasis and close follow up should be given to patients in early neonatal period, since this is the time of a great number of mortality in the current study. The health care provider should able to closely screen and give follow- up for preterm neonates particularly those identified with predictor of death in this study. It would be better to give special attention for patients with sepsis, low GA, low birth weight, RDS, extremely very premature. It would be better to strengthen care of women with the risk of PROM during pregnancy and give priorities for preterm neonates born from PROM mothers.

To upcoming researchers

A longitudinal prospective cohort study is strongly recommended to follow preterm neonates because it would be highly beneficial to identify the long-term outcomes of preterm births and the health needs of babies who are preterm neonates and to identify other predictors including socioeconomic, educational, occupational, genetic and environmental and other factors as well as reason specific predictors. Further community based study should be conducted on magnitude of preterm neonatal death and its predictors.

10. REFERENCES

1. Global T, Report A. Born Too Soon, 2012.
2. Leung C. Born too soon. Neuroendocrinol Lett. 2004;25(SUPPL. 1):133–6.
3. Care I, House N, Manual S. Very Low and Extremely Low Birthweight Infants. 2004;65–8.
4. Murad M, Arbab M, Khan MB. Study of Factors Affecting and Causing Preterm Birth Study of factors affecting and causing preterm birth. 2018;(March 2017).
5. Kinney M V., Lawn JE, Howson CP, Belizan J. 15 million preterm births annually: What has changed this year? Reprod Health. 2012;9(1):2–5.
6. Paudel L, Kalakheti B, Sharma K. Prevalence and Outcome of Preterm Neonates Admitted to Neonatal Unit of a Tertiary Care Center in Western Nepal. 2018;6(2):0–4.
7. Of A. C AUSES OF N EWBORN D EATH : P RETERM B IRTH *.
8. You D, Hug L, Ejdemyr S, Beise J, Idele P, Gerland P, et al. Child Mortality 2015. 2015;
9. THE STATE OF THE WORLD ' S CHILDREN 2009 Maternal and. 2009.
10. Liu L, Oza S, Hogan D, Chu Y, Perin J, Zhu J, et al. Global, regional, and national causes of under-5 mortality in 2000–15: an updated systematic analysis with implications for the Sustainable Development Goals. Lancet [Internet]. 2016;388(10063):3027–35. Available from: http://dx.doi.org/10.1016/S0140-6736(16)31593-8
11. Leigh J, Us S, Carlo G, Renzo D. FIGO / March of Dimes Working Group for Preterm Birth Prevention.
12. Cupen K, Barran A, Singh V, Dialsingh I. Risk Factors Associated with Preterm Neonatal Mortality : A Case Study Using Data from Mt . Hope Women ' s Hospital in Trinidad and Tobago. 2017;
13. Directoratefederal CH. National Strategy for Newborn and Child Survival in Ethiopia National Strategy for Newborn and Child Survival in Ethiopia. 2019;(June 2015).

14. Jain K, Sankar MJ, Nangia S, Bhat V, Venkataseshan B. Causes of death in preterm neonates (< 33 weeks) born in tertiary care hospitals in India : analysis of three large prospective multicentric cohorts. J Perinatol [Internet]. 2019;13–9. Available from: http://dx.doi.org/10.1038/s41372-019-0471-1

15. Estimating. G. Neonatal and Perinatal Mortality, 2014(234-245), 65-465.

16. Bay G, Miller T, Faijer DJ. Mortality. 2013;

17. Yismaw AE, Tarekegn AA. Proportion and factors of death among preterm neonates admitted in University of Gondar comprehensive specialized hospital neonatal intensive care unit, Northwest Ethiopia. BMC Res Notes [Internet]. 2018;11(1):1–7. Available from: https://doi.org/10.1186/s13104-018-3970-9

18. Iyoke CA, Lawani OL, Ezugwu EC, Ilechukwu G, Nkwo PO, Mba SG, et al. Prevalence and perinatal mortality associated with preterm births in a tertiary medical center in South East Nigeria. Int J Womens Health. 2014;6:881–8.

19. Survey H. Ethiopia. 2016.

20. Demographic M, Survey H, Indicators K. No Title. 2019.

21. Woday A, Dessalegn M, Id M, Sherif S. Determinants of preterm birth among mothers who gave birth at public hospitals in the Amhara region , Ethiopia : A case-control study. 2019;1–12.

22. Mekonnen Y, Tensou B, Telake DS, Degefie T, Bekele A. Neonatal mortality in Ethiopia : trends and determinants. 2013;

23. Beck S, Wojdyla D, Say L, Betran P, Merialdi M, Requejo H, et al. The worldwide incidence of preterm birth : a systematic review of maternal mortality and morbidity. 2010;(September 2009):31–8.

24. Rubens CE, Gravett MG, Victora CG, Nunes TM, Group R. Global report on preterm birth and stillbirth (7 of 7): mobilizing resources to accelerate innovative solutions (Global Action Agenda). 2010;10(Suppl 1):1–17.

25. Haghighi L, Nojomi M, Mohabbatian B, Najmi Z. Survival predictors of preterm neonates: Hospital based study in Iran (2010-2011). Iran J Reprod Med.

2013;11(12):957–95764.

26. Basiri B, Ashari FE, Shokouhi M, Sabzehei MK. Neonatal Mortality and its Main Determinants in Premature Infants Hospitalized in Neonatal Intensive Care Unit in Fatemieh Hospital ,. 2015;6(3).

27. Schindler T, Koller-smith L, Lui K, Bajuk B, Bolisetty S. Causes of death in very preterm infants cared for in neonatal intensive care units : a population-based retrospective cohort study. 2017;1–9.

28. Ogunlesi TA, Ayeni VA. Mortality among Preterm Babies in a Resource-poor Setting : What Time is Crucial ? 2018;26(2):1–7.

29. Wagura P, Wasunna A, Laving A, Wamalwa D, Ng'ang'a P. Prevalence and factors associated with preterm birth at kenyatta national hospital. BMC Pregnancy Childbirth. 2018;18(1):2–9.

30. Wesenu M, Kulkarni S, Tilahun T. Modeling Determinants of Time-To-Death in Premature Infants Admitted to Neonatal Intensive Care Unit in Jimma University Specialized Hospital. Ann Data Sci. 2017;4(3):361–81.

31. Lee HC, Gould JB. Survival rates and mode of delivery for vertex preterm neonates according to small- or appropriate-for-gestational-age status. Pediatrics. 2006;118(6).

32. Bello M, Pius S, Ibrahim BA. Characteristics and Predictors of Outcome of Care of Preterm Newborns in Resource Constraints Setting, Maiduguri, Northeastern Nigeria. 2019;39–46.

33. Yismaw AE, Gelagay AA, Sisay MM. Survival and predictors among preterm neonates admitted at University of Gondar comprehensive specialized hospital neonatal intensive care unit, Northwest Ethiopia. Ital J Pediatr. 2019;45(1).

34. Sutan R, Mohamed NE, Mahdy ZA, Ishak S, Shamsuddin K, Idris IB, et al. A 5 year trend and predictors of preterm births in single referral centre of the Greater Kuala Lumpur , Malaysia. 2018;(January 2019).

35. Yismaw AE, Gelagay AA, Sisay MM. Survival and predictors among preterm neonates admitted at University of Gondar comprehensive specialized hospital neonatal intensive care unit , Northwest. 2019;3:1–11.

36. Wudie FT, Tesfamicheal FA, Fisseha HZ, Weldehawaria NB, Misgena KH, Alema HB, et al. Determinants of preterm delivery in the central zone of tigray, Northern Ethiopia: a case-control study. SAJCH South African J Child Heal. 2019;13(3):108–14.

37. Kelkay B, Omer A, Teferi Y, Moges Y. Factors Associated with Singleton Preterm Birth in Shire Suhul General Hospital , Northern Ethiopia , 2018. 2019;2019.

38. Ayalew S YS. Survival Analysis of Premature Infants Admitted to Neonatal Int ensive Care Unit (NICU) in Northwest Ethiopia using Semi-Parametric Fr ailty Model. J Biom Biostat. 2015;06(01):1–12.

39. Health P, Seid SS, Ibro SA, Ahmed AA, Akuma AO, Reta EY, et al. Causes and factors associated with neonatal mortality in Neonatal Intensive Care Unit (NICU) of Jimma University Medical Center , Jimma , South. 2019;

40. Hidayat ZZ, Ajiz EA, Krisnadi SR. Risk Factors Associated with Preterm Birth at Hasan Sadikin General Hospital in 2015. 2016;798–806.

41. Razeq NMA, Khader YS, Batieha AM. The incidence , risk factors , and mortality of preterm neonates : A prospective study from Jordan (2012-2013). 2017;28–36.

42. Margaret B. Mortality and Morbidity Among Preterm Neonates in Neonatal Intensive Care Unit . 2018;17(3):2–5.

11. APENDIX

Appendix1: Information sheet

Title of the Research Project: Magnitude and predictor of mortality among premature neonate admitted to NICU from [2015-2019] at Debre Markos and Felegehiot referral hospitals, Amhara region, Ethiopia, 2020.

Name of Investigator: kassakindie (BSc in Nursing)

Name of the Organization: Addis Ababa University, College of health science, school of nursing and midwifery and department of nursing.

Name of the Sponsor: Addis Ababa University.

Introduction: This information sheet is prepared for East and West Gojjam zone referral hospitals administration and NICU coordinating offices. The aim of the form is to make the above-concerned offices clear about the purpose of research, data collection procedures and get permission to conduct the research.

Purpose of the Research Project: To determine magnitude and predictor of mortality among premature neonate admitted to NICU from 2015-2019 at Debre Markos and Felegehiot referral hospitals, Amhara region, Ethiopia, 2020.

Procedure: In order to achieve the above objective, information which is necessary for the study which will be taken from premature neonatal medical record form?

Risk and /or Discomfort: Since the study will be conducted by taking appropriate information from medical chart, it will not inflict any harm on the patients. The name or any other identifying information will not be recorded on the questionnaire and all information is taken from the chart will keep strictly confidential and in a safe place. The information retrieved will be only used for the study purpose.

Benefits: The research have no direct benefit for one whose document/ record is included in this research and already died. But the indirect benefit of the research for the participant and other clients in the program is clear. This is because if program planners are preparing predicted plan there is a benefit for clients in the program of getting appropriate care and

treatment services for those survived and other newly born ones. In all, the research work has a paramount direct benefit for health care planners and managers.

Confidentiality: To reassure confidentiality the data on the chart will be collected without the name of the clients and the information collected from this research project will be kept confidential and stored in a file cabinet. In addition, it will not be revealed to anyone except the investigator and it will be kept in a key and locked system with computer pass ward. **Person to contact:** This research project will be reviewed and approved by the institutional review board of College of Health Science, school of nursing and midwifery and department of nursing, Addis Ababa University. If you have any question you can contact any of the following individuals (Investigator and Advisors) and you may ask at any the time you want.

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Appendix 2: Data collection tool (Checklist)

This checklist is prepared for the collection of socio-demographic, maternal medical and obstetrics and gynecology, premature neonatal medical and other major predictors and outcomes related information that are important for the assessment of magnitude of premature neonatal mortality and its predictors among premature neonates at Debre markos and Felegehiot referral hospitals of NICU. All this information will be retrieved from the client's registration book and from an individual patient card without mentioning the name of the clients from [2015-2019G.C]. This information will be collected by health care providers possibly working in the NICU of the hospitals.

Table 6: Checklist to determine magnitude and predictor of mortality among preterm/premature neonates admitted to NICU from 2015-2019 Debre markos and Felegehiot referral hospitals, Amhara region, Ethiopia, 2020

Question Number	Questions	Possible answers	
Questions for the mother			
a. Socio-demographic characteristics of the mother			
1. Age		1. <=18 2. 20-34 3. >34	
2. Family income		1. <1500 2. 1500-2499 3. 25000-3499 4. >=3500 (ETB	
3. Mothers occupation		1. Employed 2. Self employed 3. Housewife	
4. Place of delivery		1. Home delivery	

		2. Delivery at health institution	
5. Place of residence		1. Ruler 2. Urban	
b. Obstetric and medical related factors of the mother			
1.	Number of Gravidity	1. <2 2. >=2	
2.	Number of Parity	1. <2 2. >=2	
3.	Does the mother have ANC follow up (visit)?	1. Yes…… 2. No…	
4.	If yes, how many times	1. >=4 Times 2. 3 Times 3. 2 Times 4. <2times	
5.	Was the current baby multiple (twin?)	1. Yes…… 2. No…	
6.	Reasons for premature labor	1. PROM 2. Preeclampsia 3. abruption placenta 4. Other….	
7.	Mode of delivery	1. spontaneous vaginal delivery 2. cesarean section	

		3. Instrumental a. Vacuum b. forceps	
8.	Does the neonates breastfeed? Mother gave breast feed	1. yes 2. No	
9.	If yes, when was the breast feed initiated?	1. <1 Hr. 2. [1, 2] Hr. 3. >2 Hr.	
C. Mothers medical problem			
1.	Mother had medical problem during pregnancy	1. Yes 2. No	
2.	If yes, mention the Diagnosis	1. HIV 2. Hypertension 3. Anemia 4. Maternal infection 5. Others……	
II. Questions for the premature neonate			
a. Socio demographic / Identifications of the neonate			
1.	Age of neonate on admission	1. <24Hr 2. 1-7days 3. >=7days	
2.	Sex of the neonate	1. Male 2. Female	
3.	Gestational age at birth in weeks	1. 26-28 weeks 2. 28-32 weeks 3. 32-37weeks	

4.	Weight of preterm neonate in grams	1. <1000g 2. 1000-1500g 3. 1500-2500g 4. >2500g	
	b. Diagnosed medical problems of the preterm neonate		
5.	Had the preterm neonate diagnosed with any medical problem	1. Yes 2. No	
6.	If yes, mention the Diagnosis	a. Respiratory distress b. Jaundice c. Perinatal Asphyxia d. Hypothermia e. Sepsis f. CHD g. Meningitis h. Anemia i. Prematurity j. Others….	
7.	APGAR score of preterm neonate	1. 1st min Apgar <7 >7 2. 5th min Apgar <7 >7 3. 10th min Apgar <7 >7	

8.	Length of hospital stay		
9.	Date of discharge		
10.	Day of neonatal death		
11.	Patient status	a. Death b. Alive c. Referred d. Other…	