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SURVIVAL STATUS AND PREDICTOR OF MORTALITY AMONG PREMATURE NEONATE ADMITTED TO NEONATAL INTENSIVE CARE UNIT FROM 2013-2017 IN TIKUR ANBESA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA, 2018.

By: Yared Asmare (BSN)

Advisor: DR. Hussein MEKONEN (Ph.D.)

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THESIS EXAMINER:

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FULL NAME RANK SIGNATURE DATE

RESEARCH ADVISOR

D.R. HUSSEIN MEKONEN ---------- ---------- ----------

FULL NAME RANK SIGNATURE DATE

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Acronyms and abbreviation

AIDS -Acquired Immune Deficiency Syndrome

ANC-Ant natal care

APGAR-Appearance, pulse, grimily, activity and respiration

DM-Diabetic Miletus

EDHS- Ethiopian Demographic and Health Survey

EVLW- Extremely low birth weight

EVPTB-Extremely very premature birth

GA- gestational age

HIV -Human Immunodeficiency Virus

HR= Hazard Ratio

HSTP-Health Sector Transformation Plan

LBW-Low birth weight

MDGs - Millennium Development Goals

NICU-neonatal intensive care unit

NMR- Neonatal mortality rate

OR-odds ratio

PNA-prenatal asphyxia

PTN- premature neonate

RD-respiratory distress

TASH-Tikur Anbesa Specialized Hospital

UNICEF - United Nations International Children Emergency Fund

VLB-Very low birth weight

VPTB-very premature neonate

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Backgrounds: Premature neonatal death is a global burden both in developed and developing countries. Despite, different strategies and interventions were implemented to reduced premature neonatal complications including death, the rate of neonatal mortality in Ethiopia are too far the targets. Even though published research in developing countries are increasing, scarcity of data regarding to the survival status and predictor of it is still seen. Therefore, estimating time to death and its predictors will provide an input for planners and decision makers for neonatal care.

Objectives: To determine survival status and predictor of mortality among premature neonate admitted to neonatal intensive care unit from 2013-2017 at Tikur Anbesa specialized hospital, Addis Ababa, Ethiopia, 2018.

Methods: An institution based retrospective follow up study was conducted among 604 premature neonates that were admitted from [2013 -2017] at TASH, Addis Ababa, Ethiopia. Data were collected from patient charts using systematic sampling with pretested data extraction tool and entered using Epi-data 3.1 and analyzed using STATA 14. A Kaplan Meier curve and long rank test were used to estimate the survival time and compare survival curves between variables. Cox proportional hazard model were fitted to identify predictors.

Results: In this study, out of 571 participants, 299(52.36%) were female. A total of 170(29.7%) neonates were died during the follow up period with incidence rate of 39.1 (95%CI:33.59,45.38) per 1000-person day with overall median survival time of 21 days. rural (AHR:0.699(95%CI:0.49,0.98), maternal diabetic mellitus (AHR:2.29(95%CI:1.43,3.65), neonatal sepsis(AHR:1.62(95%CI:1.11,2.37), respiratory distress (AHR: 1.54(95%CI=1.03,2.31), extremely prematurity(AHR:2.87(95%CI:1.61,5.11), low first and fifth minute APGAR score with (AHR:3.11(95%CI:1.79,5.05) and (AHR:0.51 (95%CI:0.32,0.78) respectively and breast feed initiating (AHR:2.87 (95%CI:0.29, 0.58) Predictors of .

Conclusion: The incidence of death was found to be high and being male, living in rural, maternal diabetic mellitus, sepsis, respiratory distress, being extremely premature, low APGAR score and breast feed initiating were found to be a predictor for time to death of neonates. Hence, it should be better to give special attention for patients with identified predictors.

Keywords: censored, incidence, predictors, Preterm neonate, Time to death, occurrence of death, survival status.

1.Introduction

1.1. Background

A premature neonate is a baby born alive before 37 completed weeks of pregnancy from the first day of last menstrual period [1, 2] and sub-divided as extremely preterm (EPTN),very preterm (VPTN) and preterm neonate(PTN) (born in 26-28, 28-32 and 32-37 week of gestational age (GA)respectively and by birth weight: low(LBW), very low(VLBW), and extremely low birth weight(ELBW) (<2500 g ,1500-2500 g ,<1000g)[3, 4].Regardless of GA, the neonatal period begins at birth and includes the first month of life and subdivided in to very early (birth < 24 hours), early (birth<7days), and late (7 to< 28 days) [4, 5].

During this period, marked physiologic transitions occur in all organ systems, and they learn to respond to many forms of external stimuli, which implies that this period is a highly exposed time for preterm as they are completing many of the adjustments required for extra-uterine survival. A developing baby moreover goes through important growth throughout pregnancy; including the final weeks and months in which vital organs developed**.** But preterm neonate is born prior to this vital event are well established. Therefore, they faced a variety of physiologic handicaps which predispose to; feeding difficulty, altered body temperature, apnea and bradycardia, complicated nutritional, fluid and electrolyte management, sepsis and hypoglycemia [4, 6]. This shows that preterm birth is a pervasive disorder that impacts all the functioning of the neonate on short- and long-term basis like neurodevelopment, education, psychosocial, growth, and health outcome for those even survived. mortality is also inversely related to GA and so far, preterm birth is still continuing to be the leading cause of peri and postnatal mortality mainly in undeveloped states where health services are not only limited but also not well functioning [3].Neonatal mortality is a death of newborn from the time of birth to the first 28th days of life irrespective of the GA and preterm neonatal death within birth to 28thday of life who is < 37 week of GA [4, 6, 7].

The rate of premature birth and death varies all over the globe. In 2016, >15 million babies are born <37 weeks of GA and of which, > 80% of births were between 32-37 weeks and from this, 60%-85% found in Africa and South Asia and of these births, more than 1.1 million deaths occur due to prematurity[8] . As a result, premature birth is public health problem in the globe but , is serious in developing countries [9-15] and the most cause of neonatal death(4 out of 5)

worldwide, followed by congenital anomalies even if there are different patterns in survival rates [16]. In developed countries, 50% and 90% of premature neonate born at 24 and 28 weeks-GA survived to discharge from the hospital, yet <10% of this baby survive in low-income one. But >75% can be prevented without intensive care[17].

Of all deaths occurring in the first year of life in the United States, two-thirds are in the neonatal period and the major cause were premature and congenital anomalies[4]. It also associated with intrauterine growth restriction; conditions that lead to asphyxia, like early-onset sepsis and the medical and gynecological problem of the mother like multiple pregnancies, hypertension, human immune virus/HIV/Acquired immune deficiency syndrome /AIDS. Consequently, neonates in need of critical medical attention are admitted to the NICU. These infants tend to be preterm, low birth weight, or have serious medical conditions[4, 8].

Globally, there are different policies, strategies, and programs which work on prevention and care of preterm birth like Sustainable Development Goals (SDGs) and Every Women and Every Child initiative [18, 19]. Despite of this, it is the first leading cause of NMR and the second most cause of under-five mortality in the world[12, 20-23].

In Ethiopia, a report of United Nations international child education and fund(UNICEF) and Ethiopian Demographic and Health Survey (EDHS), one of the main causes of neonatal death (23% and 29 per 1000 live births respectively) is preterm birth and one in thirty five and one in eight babies born did not survive to celebrate its first and fifth birthday in that order ,is due to preterm death[7, 24]. According to FMOH report, prematurity is first cause of neonatal mortality and the fourth cause of under-five mortality in Ethiopia [12, 20-23, 25]. The government showed its effort 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 this efforts, death and cause of preterm births still not reduced as expected, Therefore, this study aimed to assess the root predictors and survival status of premature neonate admitted AT NICU of TASH.

1.2. Statement of the Problem

Survival of premature babies has improved significantly with the arrival 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 [7, 26, 27].

Globally, For many neonates mainly premature, their day of birth is also their day of death in which close to 1 and 2 million deaths occur on the day of birth, and in the first week of life in that order [28] and in their first month of life(19 deaths /1,000 live birth)[24].Moreover, the NMR at NICUs greatly varied between developed (4 to 46%) and developing (0.2 to 64.4%) countries but remain high in both[29].

Variance in neonatal survival has also occurred through regions and nations: in sub-Saharan Africa (1 in 36) and developed (1 in 333) child die in the neonatal period [8, 24]. Eighty present of the world neonatal death likewise are found in sub-Saharan Africa(41 %) and Southern Asia (39%) in which the number of neonatal deaths remained almost the same from 1990 to 2016 due to an increased premature births and its complication[24]. Half of all global deaths are found in India (24%), Pakistan (10 %), Nigeria (9%), Congo (4 %) and Ethiopia (3 %)[8, 24] .Moreover ,fifty percent of deaths in sub -Saharan countries occurs in Nigeria (22.1%), Congo (11.23%), Ethiopia (10.3%), Tanzania (3.9% and Uganda (3. 84%) in which most of the death is attributed by premature birth[30].Almost 70 % of deaths of children under 5 occur in the first year of life, and 60 % of those in neonatal life [31] and Premature birth complications accounts 35% of it [24].

In Ethiopia, despite different strategies, health policies (like HSDP IV 2010-2015) and interventions were implemented to prevent and care premature births and death, the rate of neonatal and infant mortality are too far the targets. About 89,000 death /year occurred in neonatal period which accounts 44% of all under-five death and premature birth shared the major cause of it [7]. This implies that even if Ethiopia is well achieved its target for MDG 4, reducing child mortality by two-thirds, three years prior to the target year 2015, still its achievement in reducing infant and neonatal mortality particularly premature one is not yet reached (48 and 29 per 1000 live births respectively) [7, 32]and , is still holding the 5th and 3rd rank of global and sub-Saharan neonatal mortality which indicates that new born particularly premature death is a major problem which needs farther extracting the root underline predictors [30] .

In summary, with advanced in obstetric and neonatal care including 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 literature showed that premature neonatal mortality rate is still high and contribute to NMR and infant and under-five mortality. The occurrence of death and survival rate of premature is also not consistent across the world including Ethiopia, which demanding further exploration into the reasons for difference. So that this study is novel because of the following reason; First, maternal related factors which contribute for premature neonatal death were included just as comparing with previous studies that we discussed. Second, different studies in Ethiopia, determines the prevalence and determinant factor of premature neonatal death, however limited studies on survival status. So that, survival analysis was employed that consider censored time. Third, as far as my knowledge there is no any research conducted on premature neonate survival status and its predictor following neonatal care in the study area since this time. So that, a facility-based follow up studies using survival analysis is required, and, for this, patient registers offer a chance to conduct such studies effectively. fourth, improving maternal and neonatal health is one of priority issue in Ethiopian health policy.

Even though several studies were made in different countries to assess survival status and predictor of mortality among premature neonate admitted to NICU, studies related to this area are little is known in Ethiopia. Therefore, this study aims to determine survival status and predictor of mortality among premature neonate admitted to NICU at TASH, Ethiopia.

2. Literature review

2.1. The magnitude of mortality among premature neonate admitted to NICU

Even through premature death seriously affected low-income country, it is a major public health problem throughout the world. Globally, the Neonatal mortality rate(NMR) were declined from 4.7 million to 2.8 million and 49 % to 19% in 1990 and 2016[7] and from 2.7 million[28] to 2.6 million[8, 24]. however, this rate especially premature was slower than under five mortality rates in which under five dropped by 62% from 1990 to 2016 and of all this death were due to neonatal death(41%) [28].

Different studies have been conducted in developed as well as in developing countries to determine the survival among premature neonate that admit to NICU. In developed countries, a different cohort study conducted in USA, Iran showed that the mortality rate of premature infant was 26.48% [33],27.4% [34] , 28.7%(with n=338) [35] with higher incidence in < 28 weeks of age[34] and at the second (4.7%) and third (5.9%) days of admission [35]. A study in Jordan university showed that the incidence of premature death were 123/1000 live births among preterm babies(early neonatal death with 99 per 1000 live births, and late neonatal death with 24 per 1000 live births) [36]and another study in china also reviled that the incidence of death were 2.75 premature deaths per 1,000 live births [37]. Another study also reviled that the overall hospital mortality rate was 20.6%[38] and 9.1% with a Survival rate of 11.11% for extremely LBW and 45.12% for very early PTBs. of which 39% and 63.7% died in the first 24 and 48 hours, respectively and 84.3% in early, 12.24% in the late neonatal period. Survival rate at first 24, 48 hours, 1, 2 and 4 weeks were 95%, 93%, 87%, 83%, and 79% respectively with smallest surviving neonate of 750 gr female with GA of 30 weeks. Survival was higher in late PTBs comparing early and very early PTBS (p=0.0001)[39]. A prospective institution based cohort study in Cameroon with a sample size of 332 also reviled that neonatal mortality is 15.7%[40]

Farther more, different institution and community-based retrospective and prospective cohort studies have been conducted in developing countries to determine the occurrence of mortality among premature neonate. From which, an institution based retrospective study done at Nigeria with the mean length of stay at NICU of 1.9 $\pm$ 8.4 days showed that 72.31% of the followed

premature was survived[41] and 26.5% of neonate were survived from a sample of 382 in Johannesburg.[42].

In Ethiopia neonatal mortality rate were fallen from 49 to 29 deaths /1,000 births in 2000 to 2016, a drop of 41% over the past 16 years [7] and studies found that the incidence of premature birth ranges from 4.4 to 26% which is higher than 2016 WHO estimate (10% to 15%) and Ethiopia is ranked 11th among the premature high burden countries in the world [10, 11, 20, 43]. A prospective cohort study conducted in Northern Ethiopia revealed, of the 63 deaths per 1000 live births, more than one-third (34%) of deaths were attributable to premature and deaths in the early neonatal period (37%) occur due to prematurity(35%) [23, 25].A retrospective cohort study also reviled that the overall mortality of premature was 25.2% with a mean and median survival of 20.38 and 28 days, respectively[44] and 34.9% with a mean and median survival of 21.23 and 27[45] and a study in Tigray region indicated that from 68 neonatal deaths yielding a neonatal mortality rate of 62.5 per 1000 live birth, 42 (62 %) were premature with RR of 7.06 [46].The cumulative survival probability was also found to be 93.4%),73.25%,63.33%, 30.62% and at the first ,10th and 19-25th day of hospital stay[44].

2.2. Predictors of mortality in premature neonate

2...2.1. Scio demographic predictors

In different studies, the age of the mother, gestational age, sex and Wight, residency, parity is the most common sociodemographic significant predictor associated with early premature neonatal mortality after birth[35, 44, 47]. A finding in Florida showed that males have at higher risk of death and maternal age < 18 with HR of 1.13 and greater than 35 with HR of 0.99 were higher risks than 18-35[33].However, a study in Iran and Canada could not find a significant difference of sex for mortality rate **[47].**But there is a gender difference in the time of death, survival for females in the 600–699 g group was 7 % higher.For all age and birth weight groups the first few days of life was highest risk of death with relatively few deaths occurring after day 7[48].A cohort meta-analysis also indicated that women who were both nulliparous and age <18 were increased risk of premature mortality (OR: 2.07) [49].

Regarding residency , the death of premature was higher in rural areas,49.95% [37] and with HR of 1.31[50].

A study in a middle-income country also indicated that birth weight was most predictors with a majority of deaths in VLBW neonates (30.1%) and the birth weight of survived was greater than those who died (2260 versus 1495g) ;($p < 0.001$). Survivors stayed in a hospital for a longer period of time than those who died (14.8 days vs. 7.1 days, $p < 0.001$) and those survived were born at a more mature gestational age than those who died (34.8 weeks) vs. 30.5 weeks ($p < 0.001$g) [51]. A population-based retrospective cohort study with a sample size of 4454 premature neonate in Australian indicted that extreme prematurity was strongly associated with mortality as compared with other age group with AOR of 3.46 [52] and mortality was also inversely proportional to birth weight ,89% with death of in < 1 kg[53].

A finding in Johannesburg showed that most of the female (30.6%) were survived and from those (60%) died with in <72 hours and 79% at the end of the first week with a median age at death of 3 days [43] and a study in Uganda showed that males are at greater risk of mortality rate(HR = 1.8) [54].Results from Nigeria also suggested that most of the early premature deaths were attributable to young (<20 years) maternal age (AHR= 2.83) and male sex with a hazard of AH 1.44 [50].

Similarly, a follow-up cohort study in Ethiopia indicated that male accounts most of the premature death (15.1%) with mean and median length of stay 20 and 28 days [44].and 19.4% [45]and < 28 weeks of age with mean and median length of stay 3.686 and 2.00 days respectively and 1600g account the majority of death [44] and the leading cause of death were (34 %)premature and low birth weight[46].Extremely low birth weight (OR=7.467), and very low birth weight preterm (OR=3.04) and with low APGAR score (OR=5.215), more likely die before discharge [55]and A finding of EDHS also showed that males are nearly twice as likely to died and mothers >40 and <20 years old at time of birth associated with high mortality (56%and 47% respectively)[7]. A study in Jemma university also reviled that premature from Rural has high 27.1% than Urban 7.8%[45]

2.2.2. Obstetrics and gynecology predictor

As presented by different studies causes of premature mortality and survival vary in different nations and obstetrics and gynecology predictor was among the major predictor that contribute premature death. Mothers that gives birth via caesarian section has a high incidence of premature mortality with HR 1.53[33] and parity > 3 and age > 35 had a 66% increase risk of death[49] and premature born from Multiple pregnancies has also higher mortality rate (OR=1.53) [47].A

retrospective cohort study in Bangladesh and south Africa showed that having no ANC visits were associated with increased premature mortality [42, 56].A study in Nigeria and South Africa also showed that premature neonate born with Caesarian section has a higher risk of death [42, 50]. A hospital-based follow-up study showed that preeclampsia (21%), premature rupture of membranes (20.3%) and abruption of the placenta (10%), were the major obstetrical predictor for premature death [39]

According to EDHS finding birth interval <2 years is high risky for neonatal mortality (54%) [7] and A study in Gondar university hospital reviled that haven't ANC follow up(HR of 4.7), Gravidity (6-10) (HR of 2.0717) , Parity, Multiple Pregnancy are statistically significant and Premature had breast feed initiated <1,[1,2] and >2 hours were 89.1%, 83.9% and 61.2% less likely to die than to those infants who hadn't initiated at all, in that order [44] and other study also showed that preterm death strongly associated with having no ANC follow up [45].premature neonates that were born from mothers without multiple pregnancy [21.63 days,95% CI:20.070, 23.188]has longer survival time than those born from mothers with multiple pregnancy[18.03 days,95%CI:16.220, 19.838][45].

2.2.3 Premature medical neonatal predictor

A different studies showed that complication of extreme prematurity (OR= 1.109) were the major predictors of death in premature neonate [9,38,39,45,46,50,56,57]. Similarly, perinatal asphyxia was strongly associated with premature death in different prospective and retrospective follow up studies [11,39,50,51,56,57,58]. Neonatal sepsis was also found to be other major predictor for time to death of premature neonate in developed and developing countries [9,38,39,44,56,57]. Different study in developed and developing countries also shown that premature neonates born with congenital problem were likewise have higher incidence of death [9,1146,50]. Having RD also found to be major predictors of death [9,38,43,44,53,58,59]. Several studies further more explored that hypothermia [34,41] and fifth minute Apgar score (P<0.05) [34,39] were significantly predicted with premature survival and death. Those who had APGAR <7 at 5 minutewere identified as a strong predictor for the time to death of premature neonate [46,51,56]. A study in South Africa shows that the most significant predictors of survival on univariate analysis was found to be neonatal jaundice (p=0.001) [42].

A population-based retrospective cohort study in new south wales and Australian indicted that pulmonary hypertension, intraventricular hemorrhage and necrotized enter colitis [38,51] were major neonatal factors associated with increased premature mortality and A study on Perinatal complications associated with premature deliveries indicated that patent ductus arteriosus (21.47%), retinopathy (3.57%), were major determinant of preterm death [39].

A study in our country showed that Survival of premature neonate was significantly associated with having prenatal Asphyxia, sepsis, hyaline membrane diseases, jaundice, prenatal asphyxia and anemia with HR of 1.64, 1.78, 1.88, 2.39, 7.77, 2.12 respectively [44]and hypothermia with HR of 0.8553 [45] .The highest mean length of hospital stay was 25.09(23.572, 26.608) days for neonate of gestational age (32, 34] and the smallest mean and median length of hospital stay was 3.686 and 2.00 days for infants of Gestational Age ≤ 28 respectively [44]. The mean survival time of preterm neonate with sepsis [16 days,95% CI:13.49,20.34] is shorter than those without sepsis [22 days, CI: 95% CI:19.79,24.53] A study was done in Tigray also indicated that neonatal complications like meconium aspiration, prematurity, low birth weight and prolonged labor, which lead to Apgar score less than 7 and birth asphyxia were major death predictors [46].

2.2.4 Maternal medical condition predictor

Different studies reviled that premature neonates born to mothers with the medical problem were low survival rate. premature death and low birth weight were each significantly associated with >6-fold increased neonatal mortality in mother born with HIV/AIDS[57].A population-based retrospective cohort study with a sample size of 4454 infants in Australian indicted that premature neonate born from mother with no hypertensive were found to be preventive of death with AOR of 0.93 and antepartum hemorrhage with of AOR 1.23 [52].Women with severe anemia were associated with increased risks of giving low birthweight with AOR of 6.19 and small for gestational age babies AOR of 8.72 and preterm and neonatal death AOR OF 16.42[58]. Similarly, a Study in Gondar university hospital reviled that premature infants born from those mothers with HIV were 80.33% more likely to die. An initiation based cross-sectional study also showed that premature neonate of HIV mother more likely dies before discharge than that of HIV negative mothers with OR of 4.200 before discharge [44, 55] and another study also reviled that 0.36 times higher risk to die [54]. Having diabetic also associated with premature neonatal death with p value of 0. 003 (43).

2.3. Conceptual frameworks

Below are the abstract frameworks of the study which shows the interaction of different variables with outcome variables that contains Sociodemographic factors, maternal medical, obstetrics and gynecological, neonatal factors which is adapted in different researches and slightly modified.

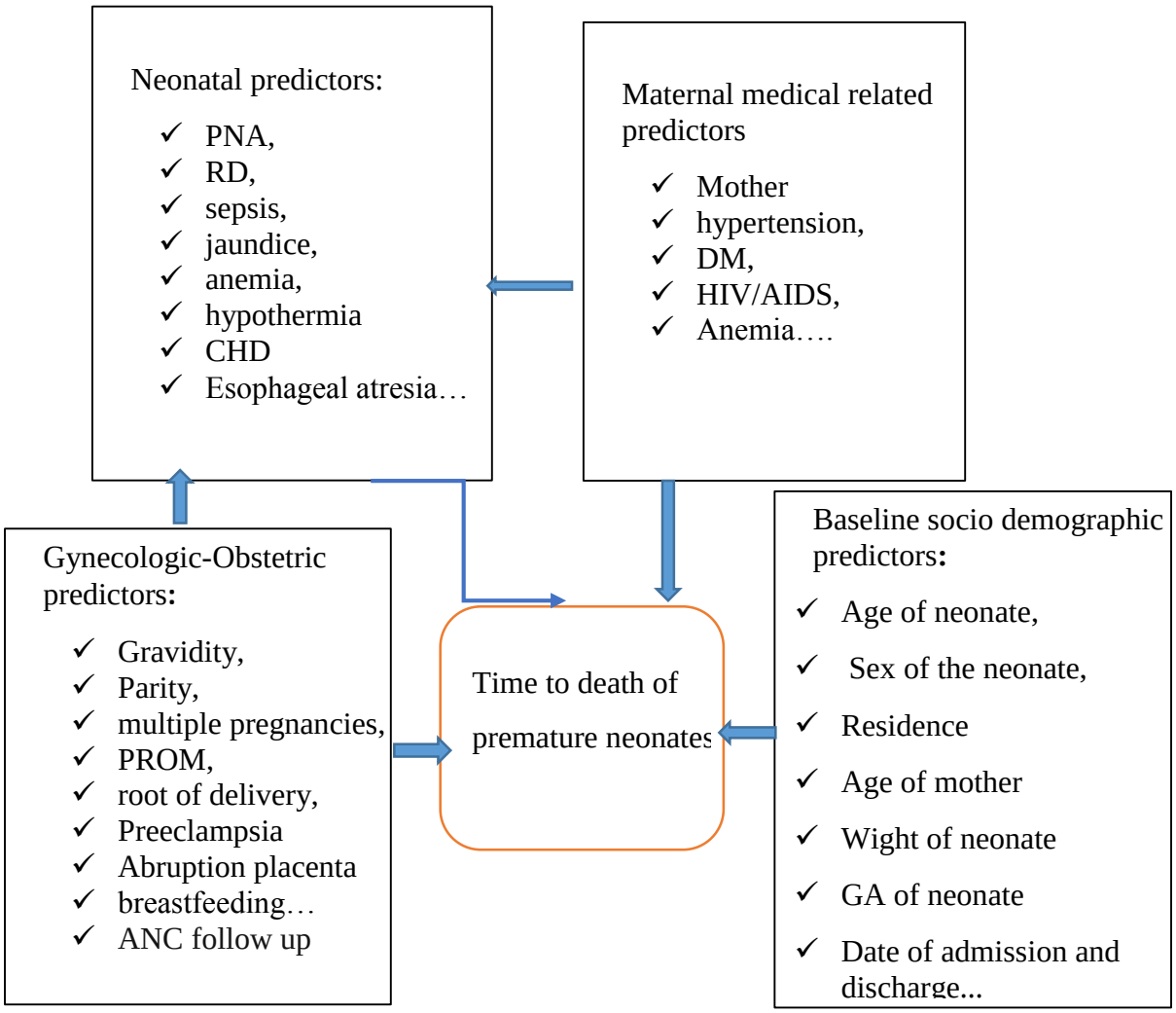

Figure 1: Conceptual framework of assesses Survival status and predictor of mortality among premature neonate admitted to NICU from 2013-2017 at TASH hospital Addis Ababa, Ethiopia, 2017/18[38,42, 43,50,51,54,56,51,58,59].

3. Significance of the study

It is currently known that the study of survival and predictor for neonatal mortality is very important, as particularly in premature neonate, it can be considered one of the best quality indicators for health care, as well as for population social and economic welfare [59, 60].The issue of addressing the incidence of preterm mortality is also vital for continual enhancement in survival of neonates which may lead to in future to a growing number of children and adults with long-term[26].

Known the fact that the death rate of premature and low birth weight neonates contributes significantly to NMR and ultimately to the under-five and infant mortality rate, so that this study will contribute to provision of data that is essential in forwarding planning, especially by prioritizing budgeting and facilities, staffing and training with the aim of improving outcome of preterm and low birth weight neonates in the public healthcare setting and reducing the neonatal mortality rate.

Evidence on which factor that predicts the premature neonate death in the area will also provide an input to decision makers, program implementers, for monitoring and evaluation activities, to develop maternal and newborn care and providing timely registering, awareness of risks and early seeking to care and birth preparedness and for healthcare professionals in early identification of high risk neonates to give maximum efforts for their survival. This study will also increase the nursing body of knowledge and helps to promote nursing research, nursing education and even the practical aspect of the profession. Moreover, the result of this study will also act an input for future researchers of other studies which will be conducted on the related subject matter.

4. Objectives

4.1. General objective

To determine survival status and predictor of mortality among premature neonate admitted to NICU from 2013-2017 at TASH, Addis Ababa, Ethiopia, 2018.

*4.*2. Specific objectives:

To assess survival status among preterm neonates that were admitted to NICU from 2013-2017 at TASH, Addis Ababa, Ethiopia, 2018.

To determine time to death of premature neonate that were admitted to NICU from 2013-2017 at TASH, Addis Ababa, Ethiopia, 2018.

To identify predictors of mortality among premature neonates that were admitted to NICU from 2013-2017 at TASH, Addis Ababa, Ethiopia, 2018.

5. Methodology

5.1. Study Area and period

The study was conducted in Addis Ababa, a capital city of Ethiopia at TASH. Addis Ababa has ten sub-cities in which the City lies at an altitude of 7,546 feet (2,300metres). It has twelve governmental and nine nongovernmental hospitals. TASH is one of amongst the governmental hospital which has 600 beds in medical, gynecological and obstetrics, surgical, pediatrics, emergency and outpatient department (OPD). It has also 7 x-rays, 9 surgical and 3 laboratory diagnostic rooms. It offers diagnostic and treatment for approximately 370,000 to 400,000 patients per year and there are around 715 nurses and 237 physicians.

The NICU of TASH ward is able to accommodate a maximum of 60 patients with average of 20-40 patient's daily admission. There are on average 5000-6000 annual admissions of neonates and 75% of admissions are from referral of different birth centers. Many referrals are premature and low birthweight neonates. Average of 1000 premature neonate was admitted to NICU per year over the past five years. From a total of 25,000/5 year NICU admissions, premature neonate accounts 20% (5000) of the neonatal admission per five years[61]. The study was conducted from March to April 1, 2018.

5.2. Study Design

An institution based retrospective follow up study was conducted among premature neonates admitted at NICU from the 1st of January 2013 to the 30h of December 2017 at TASH, Addis Ababa, Ethiopi**a.**

5.3. Populations

5.3.1. Source of Population

All premature births neonates admitted to NICU at TASH.

5.3.2. Study population

All premature births neonates that were admitted at NICU from the first of [2013-2017] at TASH.

5.3.2. Sampled Population: All premature births neonates that fulfill the inclusion criteria at TASH, in [2013-2017] who have been admitted to NICU.

5.3.3. Study unit: Each selected premature birth neonate chart from the hospital's NICU registry log book.

5.4. Eligibility criteria

5.4.1. Inclusion criteria

All live-born premature babies delivered during the study period [01/01/2013-30/12/2017] and admitted to NICU of TASH.

5.4.2. Exclusion criteria

premature neonates with incomplete records and records which are not available at the time of data collection.

5.5. Sample size determination and sampling procedure

5.5.1. Sample size determination

For the first objective (outcome), a single population proportion formula is used to calculate the sample size by considering the following statistical assumptions: P = proportion of mortality rate among premature neonate admitted in NICU, 34.9% [45],(Z α/2 = Z score of 95% CI, d= Margin of error[4] (5%).

$n = \frac{(Z_{\frac{\alpha}{2}})^2 \times p(1-p)}{(d)^2}$, 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, jaundice, prenatal asphyxia, ANC, gestational age, weight of neonate and multiple pregnancies as the major predictor variables. Moreover, gestational age was considered as the independent predictor since it gives the maximum sample size (to reduce

the role of chance) (Table1). The sample size is calculated by using Epi info version 7 statistical package[62].

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

Table1:sample size calculation to assess Survival status and predictor of mortality among preterm neonate admitted to NICU from [2013-2017] in TASH, Addis Ababa, Ethiopia, 2018.

Variables	Assumptions	Total sample size	After adding 10%
Sepsis	P1=0.472	308	339[45]
	P2=0.313		
Jaundice	P1=0.76	86	94.6[45]
	P2=0.217		
Prenatal asphyxia	P1=0.642	86	94.6[45]
	P2=0.32		
gestational Age	P1= 0.14	522	604[45]
	P2=0.24		
Weight of Infants	P1=0.50	70	
(very low weight)	P2=0.16		77 [44]
ANC Visit	P1=0.45	140	154 [44]
	P2=0.214		

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%;

Z_{β}: 80% power and, r is the ratio of exposed to non-exposed 1:1.

5.5.2. Sampling technique and procedure

Premature neonatal chart number were taken from the HMIS- data base. The total patient admitted to NICU from January 2013-December 2017 were 5000. We have found the number of admission for each year. The sample were proportionally allocated for each year, and with systematics sampling; the study participants of each year were selected as follows. First, numbering the units of each year on the frame from 1 to N (N=total admission of each year), then we determine the sampling interval(K) 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 8. Then number between one and 8 at random was selected (2 were selected). This number is called the random start and the first number included in the sample. Then later Selection was conducted every 8th unit after that first number.

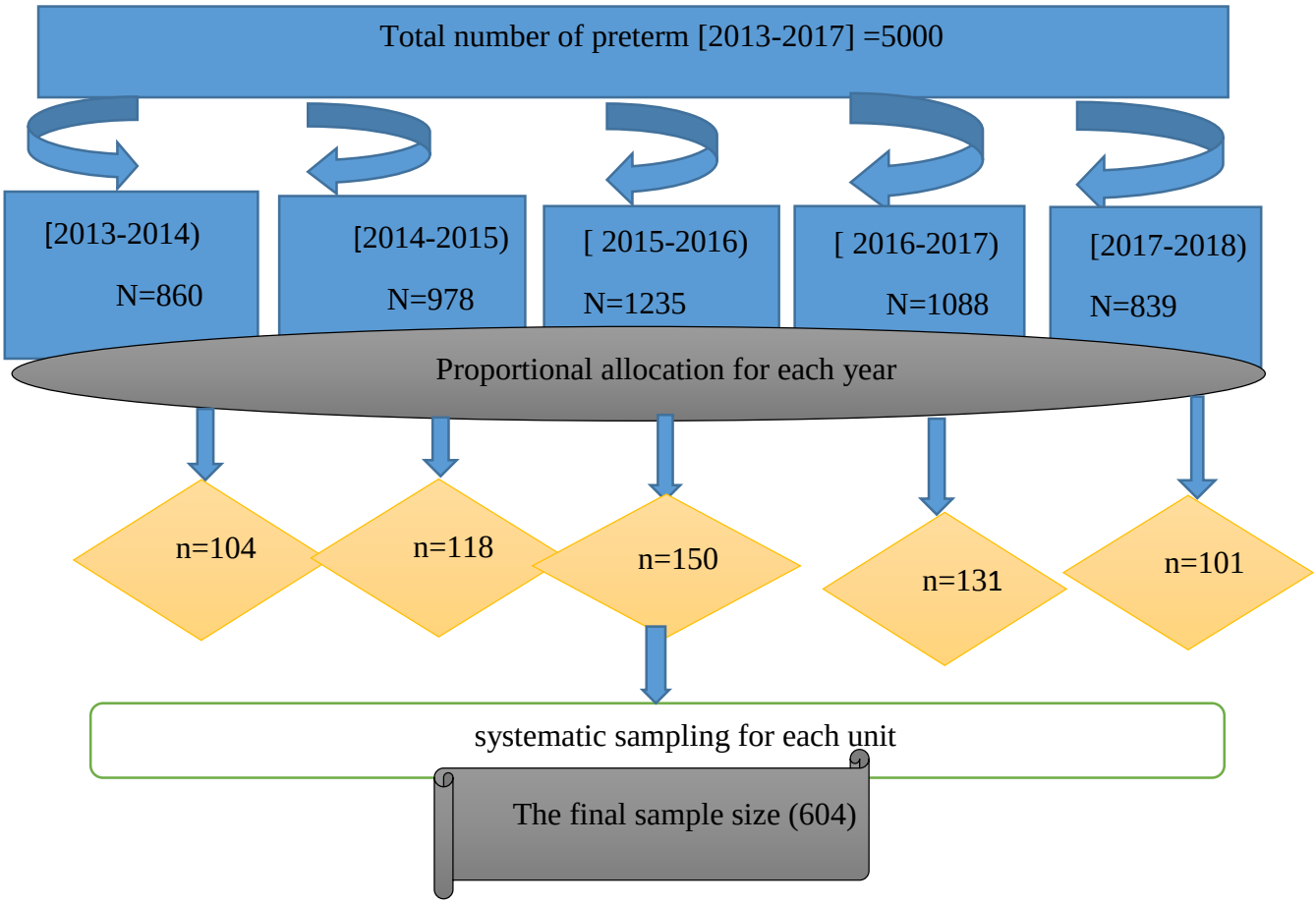

Figure 2: schematic presentation of sampling procedure to assess Survival status and predictor of mortality among premature neonate admitted to NICU from [2013-2017] in TASH, Addis Ababa, Ethiopia, 2018.

5.6. Variables of the study

5.6.1. Dependent variable

Time to death

4.6.2. Independent variables

Sociodemographic factor

- Neonatal: Age at admission, gestational age, sex, weight of neonate, Date of NICU admission and discharge.
- Maternal: Age, residency

Gynecologic-obstetric related factors: like having ANC follow up, gravidity, Parity, mode of delivery, multiple pregnancies, PROM, preeclampsia, abruption placenta, breast feeding initiation

Medical disorders in mother: like Hypertension, DM, HIV/AIDS, anemia

Neonatal outcome condition: like APGAR score, RD, sepsis, jaundice, hypothermia, PNA, hypoglycemia, mengitis, esophageal atresia, CHD...

5.7. Operational and variable definition

5.7.1. Operational definition

Censored: Premature neonate at NICU with predictors but still will be alive at the end of the study or lost to follow up including discharged to home, discharged against medical advice or transfer out to other health institutions without knowing the outcome.

Follow up time-From the time of admission until either an event or censorship occurs**.**

Having ANC follow up-If the mother has a follow up of >4 times at her pregnancy period.

Medical disorders in mother: Any history of medical diagnosis in the mother as it has been registered on the neonate's medical record.

Medical disorders in the neonate: Any recorded medical diagnosis for the premature neonates on their medical records.

Low APGAR SCORE: A neonate with an Apgar score of > 7**.**

Survival status: Is the final outcome of premature neonate; either death or censored.

Survival time: Measures the follow-up of time from a defined starting point/from admission in NICU up to the occurrence of the outcome/last neonatal period.

Time origin: Admission of premature neonate at NICU.

Time scale: Days from admission of premature neonate.

5.7.2. Definition of Variables

Multigravidas: Recorded gravida of >2.

Multiparty: Recorded parity of >2.

Preterm birth: any infant born before 37 weeks of gestational age.

5.8. Data collection tools and procedures

The available information on the patient chart was first observed and appropriate data extraction check list was prepared in English. The check list was also adopted and modified from different related studies [43,44,54]. The checklist also comprises sociodemographic characteristics of both for premature neonate and the mother, maternal medical disorders, gynecologic and obstetric factors, common medical disorders in the neonate, and date of admission and discharge and outcome of the premature birth. The starting point for retrospective follow-up was the time from first admission date and the endpoint was date of death and censored (date of discharge, or alive at the end of the study) until the last neonatal period. All charts of premature neonates, diagnosed in between January 1st 2013 to December31st 2017 at TASH was reviewed from neonatal registries. The record of all study participants were select according to the eligibility criteria. The survival status of patients was obtained from the medical record. Survival time was calculated as the time between the date of admission to the date of death, censored or the end of study. Before collecting the data, the records were reviewed (both baseline and follow up records).

Then all medical records of a premature neonate that fulfills the inclusion criteria who were admitted to NICU at TASH from the first of January, 2013 to December 28th, 2017 was retrospectively reviewed by health professionals. Death was confirmed by reviewing medical death certificate in the hospital

5.9. Data quality control

Data quality was assured by designing a proper data abstraction tools. The adopted and developed checklist was evaluated by experienced researchers. Pretest were employed on 5%(30 premature baby's card) of the sample size with a structured checklist at Gandhi hospital two weeks prior to the actual study to check usually recorded variables on the patient's medical record. Consequently, some unrecorded variables were reduced from the checklist and others arranged as per usual records of those variables.

The data collector and supervisor was experienced MSc nurses who were trained in NICU care and who currently working in this unite and training was given for them effectively. a one-day training was given concerning the data abstraction tool and data collection process for both data collectors and supervisors. During the data collection time, close supervision and monitoring was carried out by supervisors and investigator to ensure the quality of the data. Daily evaluation of the data for completeness and encountered difficulties on the time of data collection was attended accordingly. Double date entry were done using Epidata 3.1 software. Finally, all the collected data were checked by supervisor and investigator for its completeness and consistency during the data management, storage, and analysis. Consistency was examined through random selection of cards by the principal investigator.

5.10. Data processing and analysis

Before analysis, data was cleaned, edited and coded. Any errors identified at this time was corrected after review of the original data using the code numbers. After this data was entered using Epi-Data version 3.1[63] and analyzed using STATA 14 statistical software[64]. Premature neonates' cohort characteristics of continuous data, depending on the distribution, was described either in mean and standard deviation or median. Frequency distribution was used for categorical data. Finally, the outcome of each participant was dichotomized into censored or death. Incidence density rate (IDR) was calculated for the entire study period. Subsequently, the number of mortality within the follow up was divided by the total person time at risk on follow up and reported per 100PD. Kaplan Meir was used to estimate mean survival time and cumulative probability of survival and log-rank tests was used to compare survival curves after admission to NICU. Before running the Cox PH regression model multi-collinearity was checked. Residuals were checked using goodness-of-fit

test by Cox Snell residuals, which is, satisfied the model test. The Cox-proportional hazard regression model assumption was also checked using Schoenfeld residual test and variables having P-value >0.05 were considered as fulfilling the assumption. Bivariate Cox-proportional hazards regression model was fitted for each explanatory variable. Accordingly, those variables having p-value ≤ 0.005 in the bivariate analysis was fitted to the multivariable cox-proportional hazards regression model with 95% confidence interval and P-value < 0.05 was considered as statistically significant. Hazard ratio with 95% confidence interval and p-values were used to measure the strength of association and to identify statistical significant results.

5.11. Ethical considerations

Ethical clearance was obtained from AAU, college health science research committee. Then Letters of cooperation was written to TASH and concerned bodies. Permission was obtained from clinical director and subsequent department and unit heads of the hospital. Following these, searching and obtaining of the selected samples' medical record was processed with the assigned person. Finally, Care have been taken from disclosing patients records. Since, the study was done through reviewing of medical records, the individual patients may not be subjected to harm as much as the confidentiality is kept. To keep the confidentiality all collected data was coded and locked in a separate room before entered into the computer and names were not included in the data collection format. After entered to the computer the data was locked by password, and the data not have been disclosed to any person other than principal investigator.

5.12. Dissemination of the result

The result of the study will be submitted and presented to Addis Ababa University, School of Allied Health Sciences, Department of Nursing and Midwifery as a partial fulfillment of masters in pediatric and child health nursing. The study result will also be submitted to TASH and the finding will also be presented in locally or internationally held seminars, workshops, conferences and meetings including in Ethiopian nursing association and it will be published in internationally or nationally recognized journals.

6. Results

6.1. socio-demographic characteristics of the study participants

Among 604 premature neonate charts reviewed, 571 (94.54%) records were met enrollment criteria in the final analysis; 33 charts were excluded (20 incomplete data and 13 of the chart is not available at the time of data collection). Of which, about 299 (52.36 %) of the study participants were males and majority of them 382 (66.90 %) were came from urban area. Neonates in early neonatal period accounts 275(48.2%) of the study participant, which contributed 81(47.05%) of the death. The mean age of mothers was found to be 28±5.42SD years old. Majority of them 426 (74.61%) are belonging to the age group of 20-35 and most of 107(62.9%) premature neonatal death was concentrated in this age groups of mother. The mean age of the cohort at the time of admission to NICU was 3 ± 3.72 SD days. The mean weight was also found to be 1837.01 ±518.947 SD gms, while 500gms was the minimum weight who survives till the end of the study and the maximum to be 4200gms.

Table 2: Baseline socio-demographic characteristics of premature neonate and their mother in TASH, Addis Ababa, Ethiopia, January 1st, 2013 – December 30th, 2018.

Covariates	Category	Total(%)	Status	
			Death(%)	Censored (%)
Sex	female	272(47.6)	60(35.3)	212(52.9)
	male	299(52.4)	110(64.7)	189 (47.1)
Neonatal age	<24 hrs.	275(48.2)	81(47.6)	194(48.4)
	1-7 day	262(45.9)	80(47)	182(45.4)
	≥7 day	34(5.95%)	9(5.4)	25(6.2%)
Mater age	<20	61(10.9)	22(12.9)	39(9.7)
	20-34	426 (74.6)	107(62.9)	319 (79.6)
	≥34	84 (14.7)	41(24.1)	43(10.7)
Residency	Ruler	188(32.9)	92(54.1)	111(27.7)
	Urban	383(67.1)	78(45.9)	291(72.3)
GA	26-28	31(5.4)	23(13.5)	8
	28-32	208(36.4)	86(50.6)	122(30.4)
	32-37	332(58.1)	61(35.9)	271(67.6)
weight of new born	<1000	33 (5.8)	11	22 (12.9)
	1000-1500	155 (27.1)	99(24.7)	56(32.9)
	15000-2500	341 (59.7)	257(64.1)	84(49.4)
	≥2500	42(7.4)	34(8.5)	8

6.2. Maternal and pregnancy characteristics

Among the total mothers enrolled into the study 310(54.29%) of the mothers had given a birth through spontaneous vaginal delivery and 249(43.61%)%) of them with caesarian section and half of neonate that was delivered via CS was dead during the follow up period. Regarding obstetric, gynecological and medical diagnose of maternal diseases, preeclampsia,75(30.65%), PROM 165(28.9%), HIV/ADIS 76(13.3%) and DM 56(9.8%) were identified. The results of this study also indicated that majority of 410(84.5%) neonates of their mother had ANC follow up. Of the 170 who died, the highest number 125 (73.5%)and 101(59.4%)premature neonates were died from mother's parity and gravidity of less than 2(see Table 3).

Table 3: maternal and pregnancy characteristics of the study participant that was admitted to NICU of TASH, Addis Ababa, Ethiopia, January 1st, 2013 – December 30th, 2017.

Covariates	Category	Total(%)	Status	
			Death(%)	Censored (%)
Mode of delive	Caesarian section	249(43.6)	87(51.2)	162(40.4)
	Spontaneous vagina	310(54.3)	79(46.8)	231(57.6)
	Instrumental	12	4	8
Preeclampsia	Yes	175(30.6)	72(42.3)	103(25.7)
	No	396(69.3)	98(57.7)	298(74.3)
PROM	Yes	165(28.9)	58(34.1)	107(26.7)
	No	406(71.1)	112(65.9)	294(73.3)
Abruption	Yes	18(3.15)	7	11
placenta	No	553(96.8)	163(95.9)	390(97.3)
ANC follow up	Yes	481 (84.2)	118(69.4)	363 (90.5)
	No	90(15.8)	52(30.6)	38(9.5)
number	<2	439(76.9)	125(73.5)	314(78.3)
parity	≥2	132(23.1)	45(26.5)	87(21.7)
number of	<2	375(65)	101(59.4)	274(68.3)
gravidities	≥2	196(34.3)	69(40.6)	127(31.7)
multiple	Yes	220(38.5)	82(48.2)	138(34.4)
pregnancy	No	351(61.5)	88(51.8%)	263(65.6)
HIV/ADIS	Yes	76(13.3)	35(20.6)	41(10.2)
	No	495(86.7)	135(79.4)	360 (89.8)
DM	Yes	56(9.8)	34(20)	22(5.5)
	No	515(90.2)	136(80)	379 (94.5)
Anemia	Yes	45 (7.9)	23(13.5)	22(5.5)
	No	526(92.1)	147(86.5)	379(94.5)

6.3 Common medical and other diagnosis of premature neonates admitted to NICU

The common medical problems identified among admitted premature neonate during the study period were low APGAR score (1st minute APGAR score <7 ,437 (76.53%)which was found to range 1 to 9 with mean of 6.33 and SD± 1.38), hypothermia 391 (68.5%), RD 352 (61.65%) and neonatal Sepsis 323 (56. 57%).From which 154(90.6%),139(81.8%),134(78.8%) and 126(74.1%) of them were died during the follow up period respectively. The other common causes of admissions were jaundice, hypoglycemia, PNA, anemia esophageal atresia (See Table4).

Table 4: Common medical diagnosis of premature neonate that was admitted to NICU of TASH, Addis Ababa, Ethiopia, January 1st, 2013 – December 30th, 2017.

Covariant	Category	Total (%)	Status	
			Censored(%)	Death (%)
RD	No	219 (38.3)	183(45.6)	36(21.2)
	Yes	352(61.6)	218(54.4)	134(78)
Jaundice	no	369(64.6)	277(69.1)	92(54.1)
	Yes	202 (35.4)	124 (30.9)	78(45.9)
1st minute |APGAR	<7	437 (76.5)	283 (70.5)	154(90.6)
	>7	134 (23.5)	118 (29.5)	16
5th minute APGAR	<7	259(45.4)	131(32.7)	128 |(75.2)
	>7	312 (54.6)	270(67.3)	42(24.8)
Hypothermia	No	180(31.5)	149(37.2)	31(18.2)
	Yes	391 (68.5)	252(62.8)	139(81.8)
Sepsis	No	247 (43.3)	203(50.6)	44(25.9)
	Yes	323 (56.6)	198(49.4)	126(74.1)
Hypoglycemia	No	465(81.4)	344(85.8)	121(71.2)
	Yes	106 (18.6)	57(14.2)	49(28.8)
CHD	No	506 (88.62)	360(89.8)	146(85.9)
	Yes	65(11.4)	41(10.2)	24(14.1)
Mengitis	No	519(90.9)	372(92.8)	147(86.5)
	Yes	52(9.1)	29(7.2)	23(13.5)
Anemia	No	491 (86)	351(87.5)	140(82.4)

6.4. Survival status of premature neonate

A total of 571 premature neonates that were admitted to NICU have been followed from 0 to 28 days. The overall mean and median hospital stay was 17.27(95%CI:16.13,18.41) and 21(95%CI:15,.) days respectively with a minimum and the maximum follow up time of 1 and 27 days. In this study ,170 (29.77%) (95%CI:23-33) of the study participant were died during the follow up period and from this male accounts the higher value 110(64. 7%). From neonates included in the analysis, 401 (70.23) were censored (from which, 311(76.98%) were discharge to home ,48 (11.88%) referred and 45 (11.14%)) of them discharged against medical advice) at the end of the follow up. The total extent of follow-up was 4354 person-day, with an incidence rate of 39.1 deaths per 1000 person-day observation (95%CI:33.59, 45.38).

This study also showed that male premature neonates are nearly twice as likely as female to die (48.9 deaths compared with 28.5 deaths per 1,000 live births). Incidence of premature neonatal death was also higher in neonates born <28 week of GA with incidence rate of 16/1000 (CI=0.11, 0.23). In the current study 58.3 % and 60.80% died in the first 24 and 48 hours, respectively and 60.80% in early, 54.3% in the late neonatal period with incidence rate of 40.1 /1000 (95%CI:0 .03, 0.049) and 39.13/1000 (95%CI:0.031, 0.04). `

6.4.1. Overall Survival Function (survivorship function)

The overall Kaplan- Meier estimate showed that the probability of survival of premature neonates are high in the first day of admission, which relatively falls as follow up time increases (see figure 1). During the first day of hospital stay, a maximum (95.4%) probability of survival was observed with a standard error of 0.01(95%CI:0.93,0.97). The overall mean and median survival time of premature neonate admitted to NICU in the study was found to be almost 17 and 21 days. At the 10^{th} days of hospital stay the probability of survival of premature neonate was also found to be 65.2% with a standard error of 0.025 (95%CI:0.60,0.70), from 19 to 25 days of hospital stay the probability of survival of premature neonates was 40.1 % with a standard error of 0.052 (95%CI:0.298, 0.501) and at the 27 days of hospital stay ,the over all probability of survival of premature neonate was 26.73% with a standard error of 0.11 (95%CI:0.08,0.49) for the follow up period of time(see figure 3).

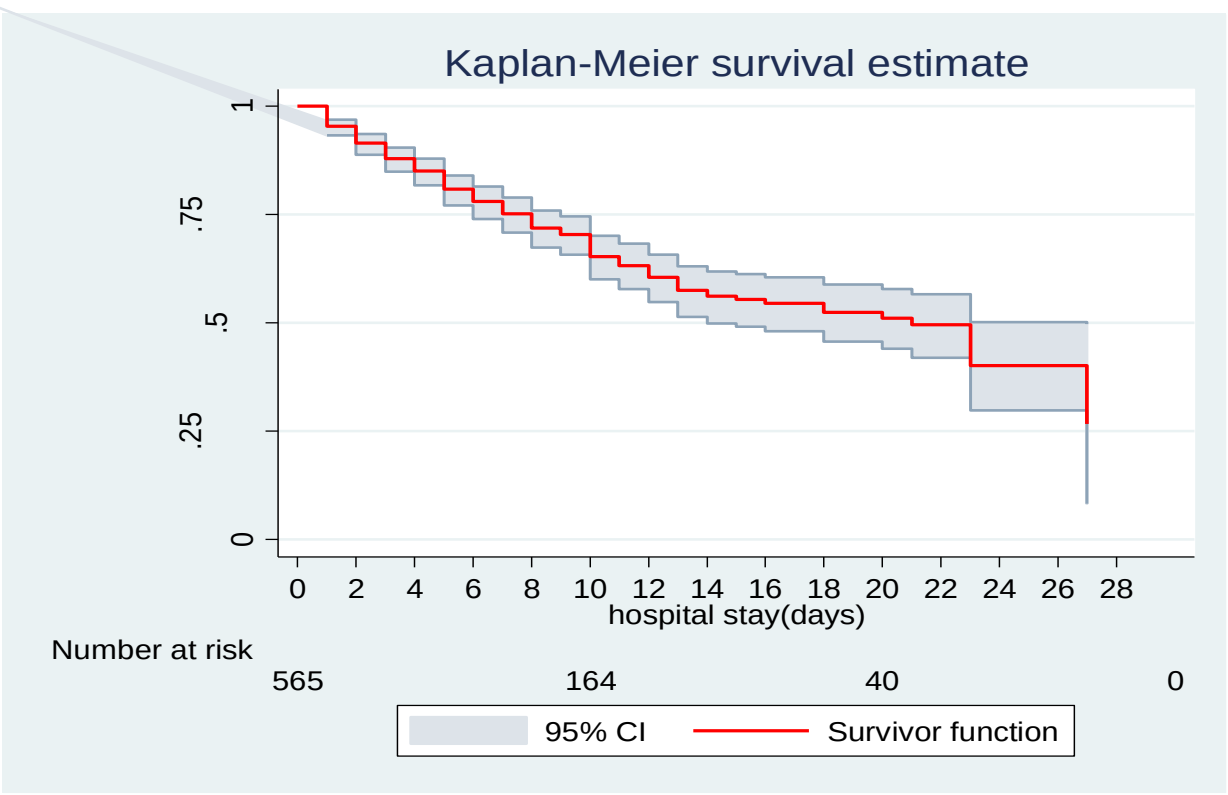

Figure 3:Overall Kaplan-Meier survival estimate of premature neonate admitted to NICU of TASH, Addis Ababa, Ethiopia , January 1st, 2013 – December 30th, 2017.

6.4.2. Survival function and Comparison of Survivorship Functions for different categorical variables

The Kaplan-Meier estimator survival curve gives the estimate of survivor function among different groups of a covariates to make comparisons. Separate graphs of the estimates of the Kaplan-Meier survivor functions were constructed for different categorical covariates as described below. In general, the pattern that one survivorship function lying above another means the group defined by the upper curve has a better survival than the group defined by the lower curve or had a more favorable survival experience than the group defined by the lower curve. But, the statistical question is whether the observed difference seen on the plot is significant or not. This can be showed by loge rank test. To test equality of survival curves of different categorical explanatory variables Cochran-Mantel Haenszel Log rank test was performed (table 5). The test statistics which is obtained from log rank test (table 5) showed that there is a significant difference in survival function (curve) for different categorical variables as shown in the table 5. From the graph below, there is very clear differences among the various groups survival ship.

In this study, male premature neonate has lower survival time (with median age 13 days) with 95% CI:11,21) as compared to those females). At the 27 days of hospital stay, the overall survival of male and females are found to be 52% and 30 % respectively (figure 4). This difference was statistically significant with p value = 0.0000 (see Fig.10).

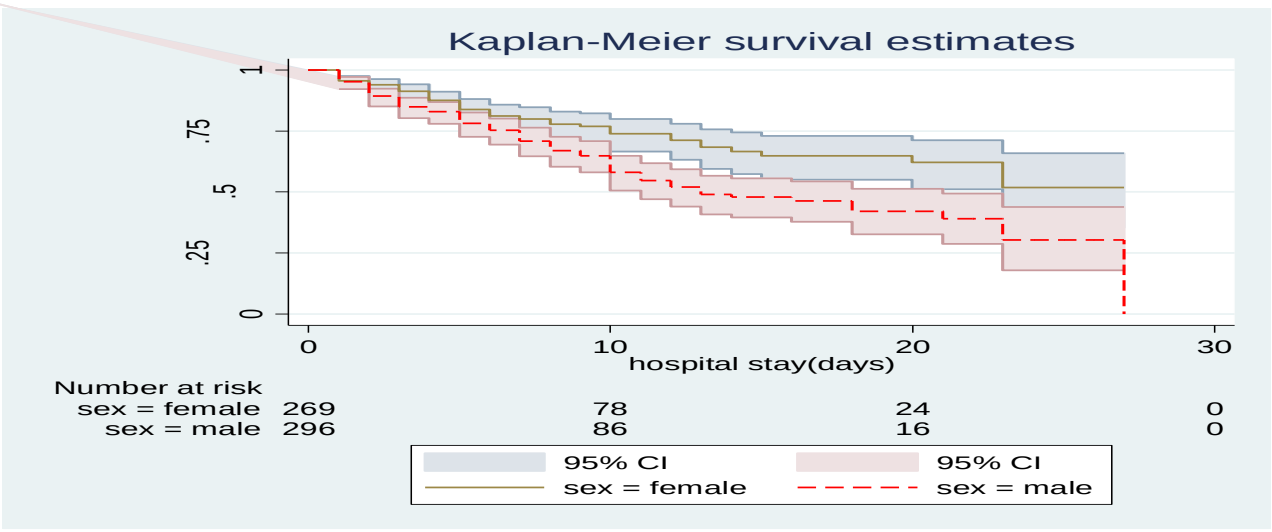

Figure 4: The Kaplan-Meier survival curves compare survival time of premature neonate with categories of sex at NICU, TASH, Addis Ababa, Ethiopia from January 1st- February 30th, 2017.

Similarly, the median survival time for those neonates whose mother have live in urban residence had a longer survival time (with median of 23 days, 95% CI: 20-.) than who had live in rural residence (12days,95% CI:9,18) with overall survival of 53% and 22.5% at the end of the follow up period. This difference was statistically significant with p-value = 0.000(see Figure 5)

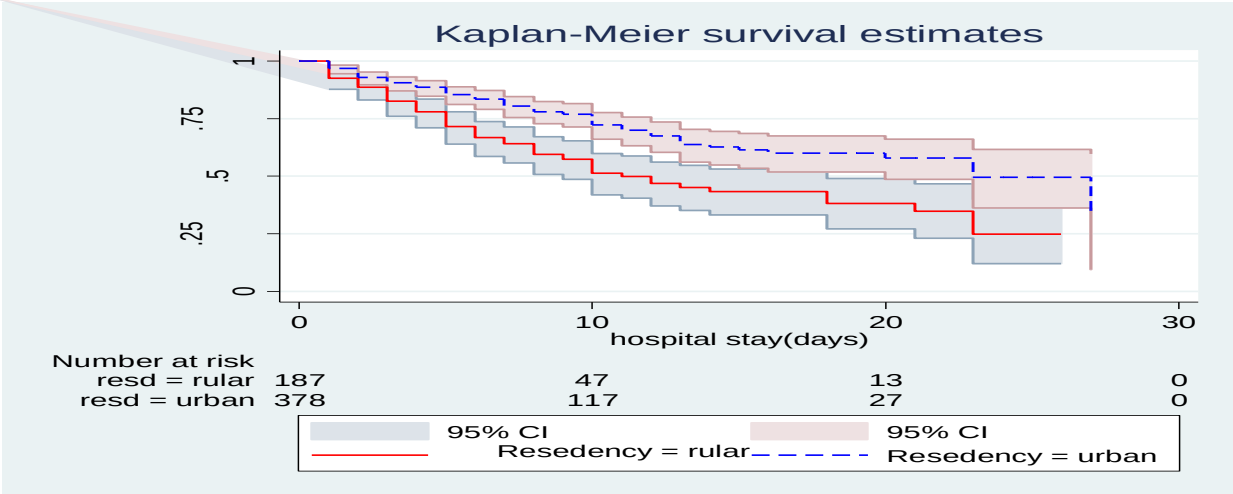

Figure 5:The Kaplan-Meier survival curves compare survival time of premature neonate with categories of residency at NICU, TASH, Addis Ababa, Ethiopia from January 1st February 28th, 2017.

This study also reviled that, neonates born from those mothers who hadn't DM at baseline of admission had a longer survival time than those with DM (with median of 23 days 95% CI :18,.) and (8days,95%CI:5,11). This difference was statistically significant with p-value < 0.000 (Figure 6).95% of neonate born from mothers without DM and 92% of neonates born from mothers with DM have at list a one day of survival probability. Similarly, those neonates born from with no DM have longer (31% of them survived 27 days) overall survival probability than born from mother with DM (12% of them survived 25 days) (see fig:6).

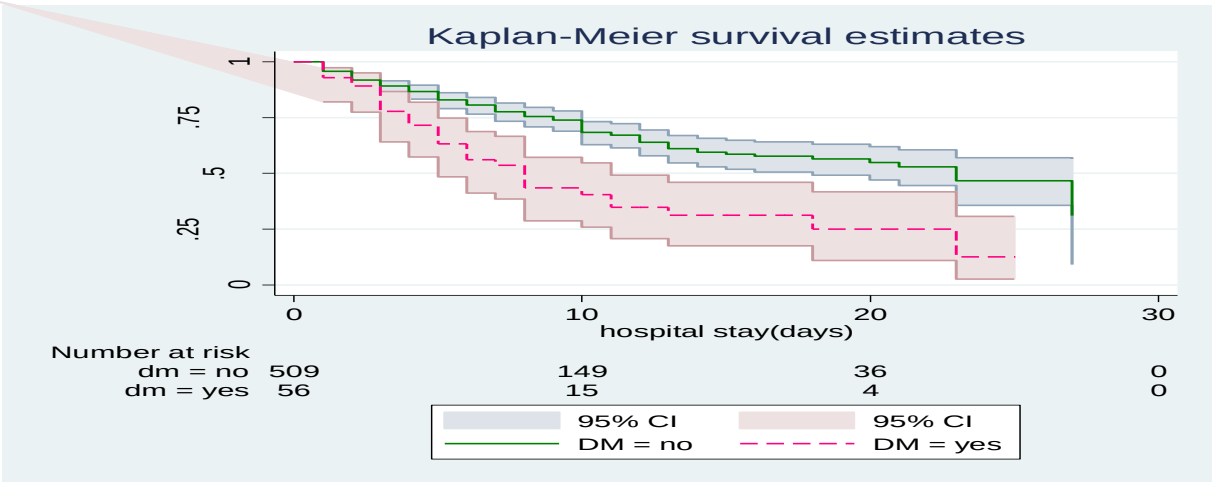

Figure 6:The Kaplan-Meier survival curves compare survival time of premature neonate with categories of DM at NICU, TASH, Addis Ababa, Ethiopia from January 1st- February 30th, 2017.

The median survival time for premature neonates who developed RD and sepsis was 13 days, but it was longer (95%: 22,. and 23,.) days for patients who does not develop RD and the difference was significant (p-value<0.001) (see figure7 and 8)

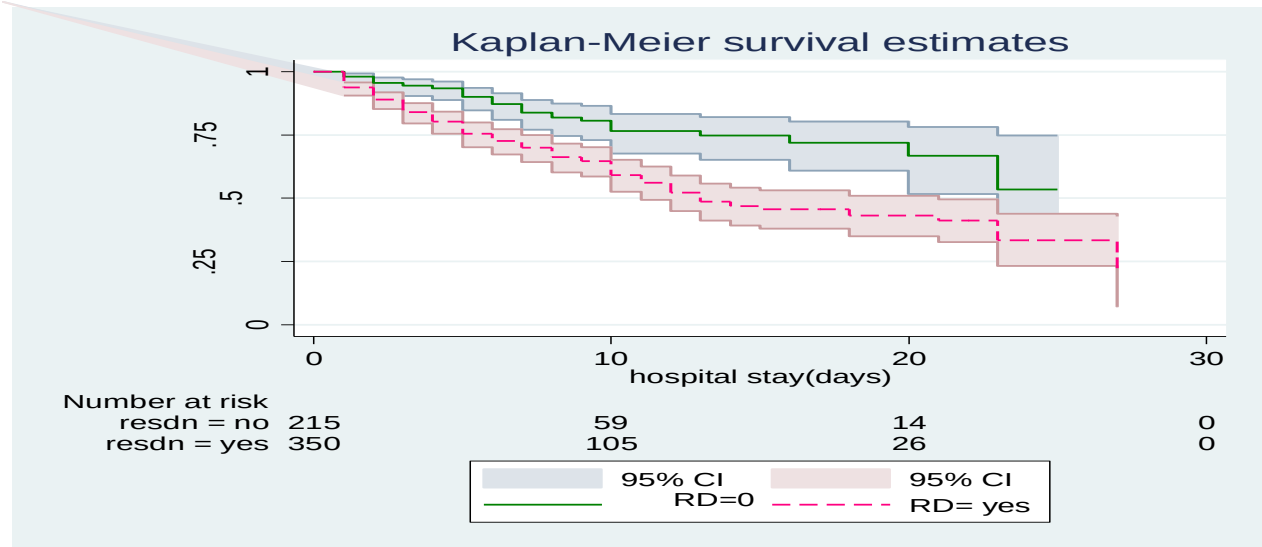

Figure 7: The Kaplan-Meier survival curves compare survival time of premature neonate with categories of RD at NICU, TASH, Addis Ababa, Ethiopia from January 1st- February 28th, 2017.

In this study, neonates without sepsis have favorable survival probability than neonates with sepsis, in which 96 and 95 % of premature neonate with sepsis and without sepsis have at list a one day a survival probability. In the same way, the overall survival of premature neonate with and without sepsis at 27 days of neonatal admission were found to be 61 and 15% respectively.

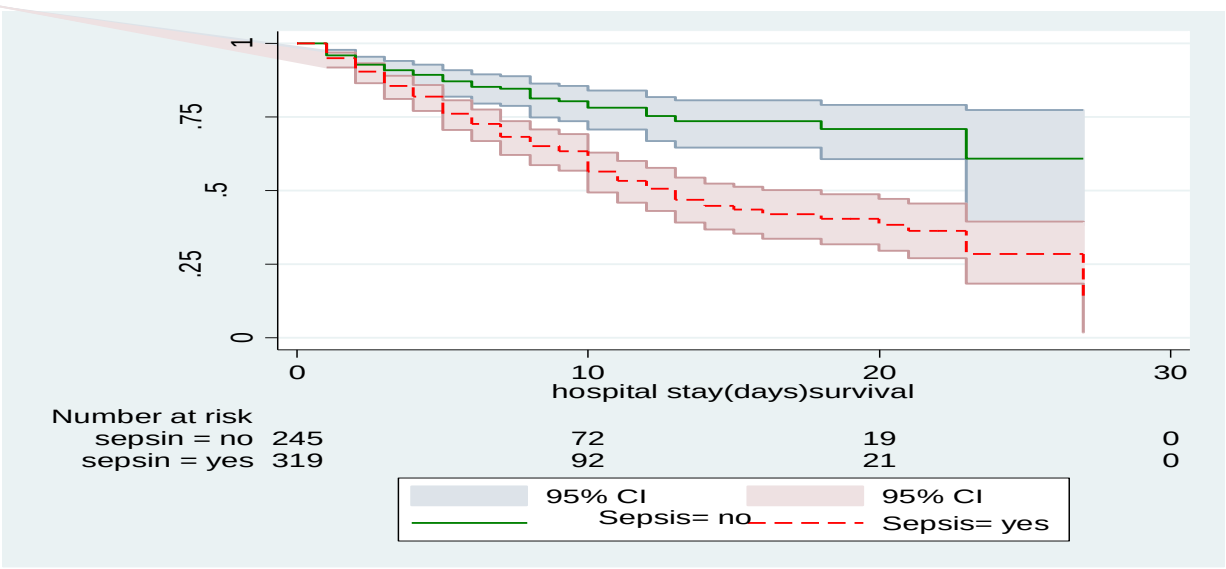

Figure 8: Kaplan-Meier survival curves compare survival time of premature neonate with categories of sepsis at NICU, TASH, Addis Ababa, Ethiopia from January 1st- February 28th, 2018.

The median survival time of premature neonates who had 5th minute APGAR score<7 at the time of admission was 10 days but it was 22 days for neonate who had 5th minute APGAR score≥7 at the time of admission and the difference was significant (p-value<0.000) (see fig 9).

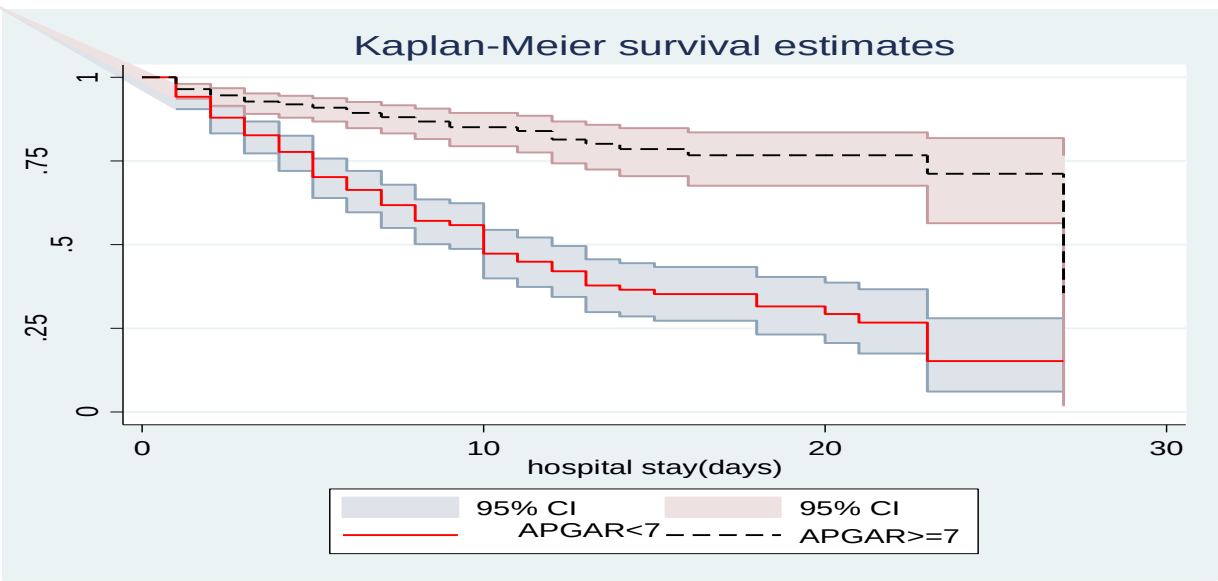

Figure 9: The Kaplan-Meier survival curves compare survival time of premature neonate with categories of 5th minute APGAR score at NICU, TASH, Addis Ababa, Ethiopia from January 1st- February 30th, 2017.

The median survival time for those neonate born from mothers with no multiple pregnancy at a time of admission had a longer survival time (22 days with 95% CI:20,.) than born with multiple pregnancy with median age of 13 days with 95%CI:10,23). At the end of this study, the overall hazard of those neonates was also found to be 77% and 65.1% for with and without maternal DM respectively. This difference was statistically significant with p-value = 0.000(see Fig10).

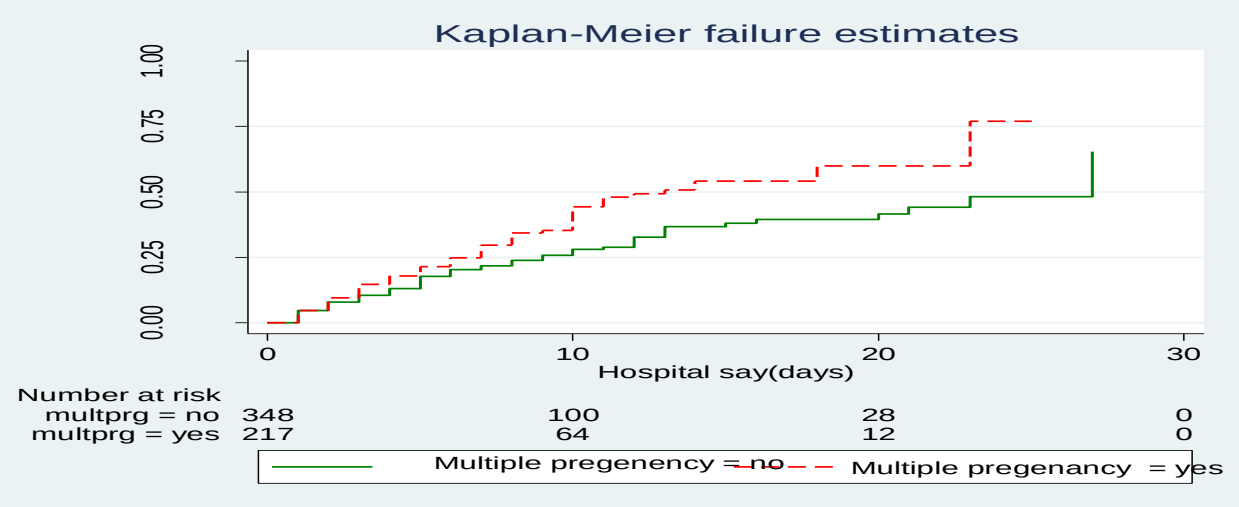

Figure 10: The Kaplan-Meier hazard curves compare hazard time of premature neonate with categories of types of pregnancy at NICU, TASH, Addis Ababa, Ethiopia from January 1st-February 30th, 2017.

The median survival time for those neonate that was born as premature (22days with 95%: 23,.) and very premature at admission (13 days with 95%:10,21) was found to be longer survival time as compared with those extremely premature neonates (see table). This difference was statistically significant with p-value < 0.000 (see Figure 11).

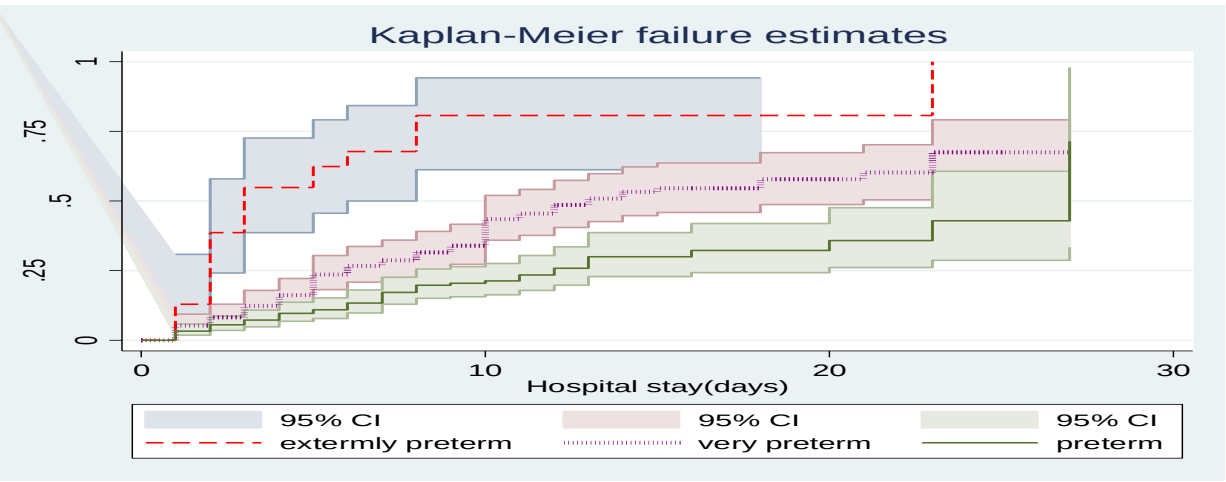

Figure 11:: The Kaplan-Meier hazard curves compare hazard time of premature neonate with categories of types of GA at NICU, TASH, Addis Ababa, Ethiopia from January 1st- February 28th, 2017.

Finally, the log-rank test was conducted (table 4) to check for the existence of any significant differences in survival among various levels of the categorical predictors considered in the study. Accordingly, the Kaplan-Meier analysis indicated significant evidence of differences in survival times in the categories.

The table below describe how to evaluate whether or not overall Kaplan Meier curves for two or more categories of covariates are statistically equivalent using the log-rank test. Therefore, based on this statistical test procedure all covariant listed in the table below except mode of delivery of the neonate are statistically significant (P-Value<0.05). This means that, we have enough evidence to say that the premature neonate admitted to NICU survival curves are diff erent or the Kaplan Meier curves are statistically diff erent with respect to categories of significant covariates.

In the table below, we observed that, the highest median length of hospital stay was 27 days for those neonate that was born between GA of 32-37(premature) and initiate breast feeding and the smallest median (95%\CI) length of hospital stay was 5 days ((95%CI:3,13) for extremely very low weight neonate s< 1000.

Table 5: Mean and median survival time and log-rank test for equality of survivor functions among preterm neonate admitted to NICU, in TASH, from January 1st- February 28th, 2017.

Variables	Category	Survival		Log-rank test (x^2)
		Median(95%CI)	**Mean (95% CI)**	
Mother age	<20	16(7,.)	14(11.3 ,16.8)	10.3***
	20-34	23(20,.)	18.5(11.3 ,16.8)	
	>34	11(9,23)	14.0(11.6, 16.5)	
Sex	Male	13(11,21)	15.5(13.9, 17.0)	11.64***
	Female	.(23,.)	19.5(17.8 , 21.1)	
Residency	Urban	23(20,)	18.9(17.51, 20.3)	19.99***
	Rural	12(9,18)	13.9(12.2,15.7)	
Delivery	Cesarean	14 (12,.)	16.2(14.5, 17.9)	4.33
	Spontaneous	23(20,.)	18.4(16.8, 19.9)	
	Instrumental	10(1,.)	11.1(5.6, 16.6)	
PROM	Yes	14(10, 23)	14.7(16.8, 19.5)	6.25**
	No	23(16,.)	18.1(16.8, 19.5)	
Preeclampsia	Yes	13(10,23)	15.0(13.1, 16.9)	9.86**
	No	23 (18,.)	18.3(16.9, 19.8)	
HIV	Yes	10(7,23)	12.7(10.1, 15.4)	12.18***
	No	23(18,.)	17.9(16.7, 19.14)	
Maternal anemia	Yes	7(5, 23)	12.1(8.8, 15.4)	11.45***
	No	23 (16,.)	17.7(16.5, 18.9)	
DM	Yes	8(5,11)	11.1(8.5, 13.6)	22.49***
	No	23(18,..)	18.2(16.9, 19.4)	
Maternal CHF	Yes	10(6,.)	11.0(7.9,14.2)	4.12**
	No	23 (16,.)	17.5(16.3,18.7)	
Poly/oligohydramnios	Yes	10(5,.)	11.8(8.1, 15.5)	4.60*
	No	23(16,.)	17.5(16.3, 18.7)	
RD	Yes	13(11,21)	15.5(14.11, 16.9)	20.87 ***
	No	(23,.)	19.6(18.0, 21.2)	
Jaundice	Yes	13(10,23)	15.4(13.6,17.2)	5.83**

	No	23(21,.)	18.5(17.1,19.9)	
Sepsis	Yes	13(11,18)	14.9(13.54,16.41)	22.84***
	No	(21,.)	20.8(19.2,22.6)	
Hypoglycemia	Yes	12(10,23)	13.7(11.7, 15.8)	9.17***
	No	21(20,.)	18.2(16.9,19.6)	
Mengitis	Yes	21(6,23)	14.4(11.5, 17.5)	3.99**
	No	23(15,.)	17.7(16.5, 18.9)	
GA	<28	3(2,6)	7.3(4.1,10.6)	71.08***
	28-32	13(10,21)	15.4(13.78, 17.09)	
	32-37	27(23, .)	20.2(18.7,21.8)	
Hypothermia	Yes/<35.5	14(12,21)	15.8(14.5,17.2)	17.35***
	No>=35.5	(23,.)	20.9(19.0,22.9)	
Wight	<1000	5(3, 13)	9.92 (6.5,13.3)	
	1000-1500	23(12,.)	17.1(15.1,19)	
	1500-2500	23(16,.)	17.1(15.1,18.4)	24.34*
	>2500	20(10,.)	18.6(13.8,23.5)	
ANC follow up	Yes	23(21,.)	18.8(17.6, 20.0)	36.8**
	No	10(6,10)	10.4(8.5, 12.3)	
Multiple pregnancy	Yes	13(10,23)	14.5(12.9, 16.1)	8.84***
	No	27(20,.)	18.8(17.4, 20.3)	
Breast feed	Yes	27	20.5(19.2, 21.8)	80.18***
	No	8 (7 ,10)	10.7(9.2, 12.2)	
1st minute APGAR	<7	15(12,23)	15.8(14.5 ,17.1)	22.9***
	>7	.(23,.)	22.8(20.8 ,24.7)	
5th minute APGAR	<7	10 (9 ,12)	12.8(11.3,14.2)	68.6***
	>7	27(27, .)	22.3(16.1, 18.4)	

NB: * Significant (P-value < 0.05), significant (p-value<0.01) **, *** significant (p<0.001)

6.5. Fitted cox proportional hazard model of premature neonate's predictors

The relationship between the baseline variables and the risk of mortality was analyzed using Cox proportional hazard regression model. The Cox proportional hazard model in Table 6 shows that maternal factors like age >34,come from rural, having ANC follow up, multiple pregnancy, PROM, preeclampsia, HIV/ADIS, anemia, CHF, oligohydramnios /polyhydramnios and neonatal factor like being male, gestational age, weight, sepsis, RD, hypoglycemia, jaundice, hypothermia, first and fifth minute APGAR score and breast feed initiating were statistically significant (p-value < 0.05) predictors of premature neonatal mortality in bivariate analysis. Moreover, to identify independent predictors of mortality and survival, multivariate cox regression was performed for all predictors found to be significantly predicted with survival in the bivariate analysis. however, only residency, DM, sex of neonate, GA, first and fifth minute APGAR score, RD, sepsis, breast feeding initiating were found to be strong predictors of mortality in the multivariate analysis.

The result of multivariate analysis shown that premature neonates whose mother comes from urban were almost 70% times less likely to die as compared to those who came from rural area (AHR: 0.699(95%CI:0.49,0.98). The hazard ratio for premature neonate admitted to NICU who were born from those mothers had DM were 2.29 times more likely as compared to those neonates born from mothers hadn't DM (AHR:2.29(95%CI:1.434,3.650). Premature neonate with RD at base line are also 1.54 times more likely to die as compared to those neonates without RD (AHR: 1.54(95%CI:1.03, 2.31)). Those premature neonates whose first minute APGAR score less than seven were 3.11 times more likely to die as compared to those neonates whose first minute APGAR score greater than seven (AHR: 3.11(95%CI:1.79,5.05). Premature neonate who had Sepsis at the time of admission were also 1.62 times more likely to die than those neonates without sepsis (AHR:1.62(95%CI:1.11,2.37). The HR for death was 1.51 times (AHR:1.51, 95%CI:1.16, 2.13) higher in patients who is male compared to being female and premature neonate who were less than 28 week of GA at time of admission increased the risk of death by 87% times when compared to those who were between 32-37 week of GA (AHR:2.87(CI:95%1.61,5.11). in this study, premature neonate whose mother initiated breast feeding were found to be 59% less likely to die than those neonates that never initiated (AHR:2.87 (95%CI:0.29,0.58).

Table 6: Results of the bivariate and multivariate Cox regression analysis of preterm neonate that were admitted to NICU, TASH, Addis Ababa, Ethiopia from January 1st- February 28th, 2017.

Predictor	Category	CHR (95% CI	AHR (95% CI
Mothers age	<20	1.55(0.97, 2.44)	1.13(0.67,1.89)
	20-34	1	
	>=34	1.69(1.18 ,2.42)*	0.88(0.58,1.33)
Sex	Female	1	
	Male	1.70(1.24 , 2.33)**	1.51(1.06,2.13)*
Residency	Rural	1	
	Urban	0.52(1.43,2.61)***	0.69(0.59, 0.98)*
ANC follow up	Yes	0.38(0.28,0.53)***	0.81(0.54, 1.19)
	No	1	
Multiple	Yes	1.56(1.15 ,2.11)**	1.14(0.88,1.61)
pregnancy	No	1	
PROM	Yes	1.48(1.08, 2.04)*	1.07(0.76,1.52)
	No	1	
Preeclampsia	Yes	1.61(1.18, 2.18)**	0.88(0.61,1.25)
	No	1	
HIV/ADIS	Yes	1.89(1.30,2.75)**	1.55(0.96, 2.50)
	No	1	
Maternal anemia	Yes	2.07(1.33,3.21)**	0.92(0.51, 1.62)
	No	1	
DM	Yes	2.38(1.63,3.46)***	2.29(1.43 ,3.65)***
	No	1	
RD	Yes	2.27(1.56 ,3.28)***	1.54(1.03, 2.31)**
	No	1	
Jaundice	Yes	1.44(1.12,1.94)*	1.00(0.70 ,1.42)
	No	1	
Sepsis	Yes	2.21(1.57,3.12)***	1.62(1.10, 2.37)**
	No		
Hypoglycemia	Yes	1.63(1.16,2.27)**	0.71(0.46,1.08)
	No	1	
GA	26-28	6.31(3.89 ,10.24)***	2.87(1.61, 5.11)***

	28-32	1.96(1.41,2.72)***	0.95(0.64,1.41)
	32-37	1	
Neonatal Wight	<1000	3.847(1.97, 7.49)**	1.963(0.89,4.3)
	1000-1500	1.33 (0.75, 2.38)	0.80(0.41, 1.57)
	1500-2500	1.1 (0.65, 1.88)	0.76(0.42, 1.39)
	>2500	1	
First minute	<7	3.22(1.92,5.39)*	3.11 (1.79,5.05)*
APGAR	>=7	1	
Score			
Fifth minute	<7	3.83(2.70, 5.44)***	1.81 (1.32,4.78)***
APGAR score	>=7	1	
Breast feeding	Yes	0.28(0.21,0.38)***	0.41(0.29, 0.58)**

*NB: *** Significant (P-value < 0.05), ** significant (p-value<0.01), *** significant (p<0.001)**; Crude HRs reflect bivariate modeling results, whereas adjusted HRs are taken from a multivariate model containing all variables in the table and categories labeled as 1 are considered as reference categories.*

6.6. Test of proportional hazard assumption

Testing the proportional hazard assumption is vital for interpretation and use of fitted proportional hazard models. Therefore, in this study goodness-of-fit (GOF) particularly the Schoenfeld residuals proportional hazard assumption test for the individual covariates and global tests was used. If P-Value < 0.05, then the proportional hazard assumption is rejected. From Table 7, we observe that each covariate (P-Value > 0.05) and all of covariates simultaneously (Global for Cox proportional hazard P-Value=0.7277> 0.05) met the proportional hazard assumption.

Table 7: Schoenfeld Residuals test for proportionality assumption of each covariate and overall model of the stratified Cox Proportional Hazard.

Covariant	Rho	X^2	P –value
Sex	0.04756	0.43	0.5102
Residency	0.04216	0.32	0.5735
Mode of delivery	0.06192	0.78	0.3768
PPROM	0.02012	0.07	0.7859
Preeclampsia	0.09674	1.93	0.1643
Maternal Anemia	0.07112	1.02	0.3125
HIV/ADIS	0.01574	0.05	0.8319
DM	0.06436	0.91	0.3411
abruption placenta	0.03046	0.19	0.6598
RD	0.00043	0.00	0.9953
Sepsis	0.015375	0.048	0.811
Hypoglycemia	0.00065	0.00	0.9933
PNA	0.07301	0.99	0.3189
Mengitits	0.01690	0.05	0.8248
GA	0.08413	1.75	0.1854
Temperature	0.01161	0.02	0.8796
Wight	0.03310	0.19	0.6656
ANC	0.01667	0.023	0.8961
Parity	0.07669	1.05	0.3046
Gravidity	0.03207	0.18	0.6680
Multiple pregnancy	0.04791	0.46	0.4986
Breast feeding	0.04144	0.36	0.5472
global test	21.27	26	0.7277

NB: Rho is the correlation coefficient between the residuals and time

7. Discussion

In this retrospective follow up study, we aimed to determine the survival status and predictor of mortality among premature neonate admitted to NICU at TASH. This study shows that the overall mortality of premature neonates admitted to NICU in TASH during the study period was 170 (29.77%). This finding is slightly higher than the study done in Ethiopia, UOGH (25.2%)[44] and lower than a study conducted in Jimma university hospital (34.9%) [45]. Similarly, the finding is higher than a study conducted in Cameroon which is 15.7% [40]. However, the overall mortality rate of this study was consistent with other previous studies which have been conducted in other African developing countries like Nigeria (27.69%) [41] and Johannesburg 26.5%[42] .Similarly, the mortality rate for this study is in line with a study conducted in developed countries like USA, Iran which was 26.48% [33],27.4% [34] , 28.7% [35].This gap might be due to different reasons. One possible source of variation in mortality rate might be difference in sample size for example the study in Cameroon (N= 332). Further, possible reason might be the difference in methodology. Other, possible justification might be the difference in the study period as there were changes in treatment modality.

At the end of follow up, the overall incidence of mortality was found to be 39.1deaths per 1000 person-day observation. This finding is higher than a report by UNICEF and EDHS(23% and 29 per 1000 live births respectively) [7, 24] and china [37]. But lower than a study in Jordan[36]. Similarly, the current finding is higher than a study conducted in Ethiopia, Tigray region [46]. This marked difference might be attributed to a number of factors such as care difference, in which developed countries might be well equipped with skilled professionals with organized personnel and equipment to perform neonatal resuscitation, evaluate and provide postnatal care of newborn and even they begin NICU earlier than our countries. Difference in Sample size, study period and area might be the other possible explanation. The other possible justification might be the characteristics of the study participants. for example, a study in Tigray region includes both premature and matured neonates in the study.

The highest hazard probabilities(60.80%) were observed during early neonatal period with incidence rate of 40.1/1000 which is similar with a study in Jordan[36]. The possible explanation might be because of complication occurring during pregnancy and birth delay in identification and

poor management of complications during pregnancy and birth by health workers might be the possible reasons.

This study also showed that male neonates are nearly twice as likely as female to die (48.9 vs 28.5 deaths per 1,000 live births). This result is in line with a study done by EDHS 2016[3]. The reason for this could be hormonal environment differences. Male neonates have been reported to have a higher level of circulating testosterone than female. This difference might be associated with differences in pulmonary biomechanics and vascular development that lead to increased respiratory and neurological morbidity among premature male neonates. Currently and in this study even, pulmonary disease and its complications remain predominant predictor of neonatal death[65].

The overall mean and median survival time of premature neonate admitted to NICU in the study was found to be almost 17 and 21 days which is consistence with a study in Ethiopia (UOGH 20.38 and 28 day) and Jimma university hospital (21.23 and 27) days [43,44].

In this study the overall cumulative survival probability was found to be 27.73% at the 27th day of hospital stay. The survival probability was also found to be 95.4%,65.2% and 40.1% at the first ,10th and 19-25th day of hospital stay, which is in line with a study done in UOGH in which 93.4%,73.25%,63.33%, and 30.62% of the study participant have overall survival probabilities at 1st ,10th 19-25th and 30th day of their hospital stay[44].

The survival curves in our study were significantly different between neonates with sepsis and without sepsis patients with mean survival time of 15 and 21 days respectively which is in line with a study in Jimma university hospital [45]. Similarly, premature neonates born from mothers with multiple pregnancy has higher hazard probability (with median 13 day) than those neonates born from without multiple pregnancy (with median of 27 days). The current findings consistent with a study done in UOGH [44]. The mechanism probably due to multiple births might be a significant stressor to the fetuses , which will subsequently lead to premature death[65].

After adjusted by multivariate cox proportional regression model, the independent significant predictor of reduced surviving in premature neonate that were admitted to NICU was being male, living in rural, having maternal DM, neonatal sepsis, RD, GA ,1st and 5th minute APGAR score and breast feeding initiation.

In our study, being male was found to be an important predictor of survival status premature neonate in which being male was found to be increase hazard of death almost two times than female, in agreement with another study conducted in the world [32,40,41]. It might probably because of delay of lung maturation among male premature neonates may serve as an important factor to the sex difference in neonatal mortality. The other reason for male sex to be the predictor of mortality in our study might be due to the fact that more than half of our study participants was males.

Breast feeding initiation was also found to have a protective effect for premature neonatal mortality (AHR, 0.59). This result is in line with a study in UOGH [44]. This could be due to breast feed initiating might provide protection against various diseases because breast milk consists immunologic and antibacterial factors such as Secretory IgA, complements, bactericidal enzymes, macrophages[4].

Having neonatal sepsis at the time of admission was significantly increased the hazard of mortality among premature neonate that was admitted to NICU. Those who had neonatal sepsis were nearly two times increase the hazard of mortality at any time as compared to those who were not have sepsis. This finding is supported by a result in developed and developing country [9,38,39,44,56,57]. The possible reason might be most of premature neonate were born with possible explanation might be immature immunity, different procedures and the mode of delivery might have its own contribution.

Presence of RD at the time of admission was found to be another important predictor of mortality. Therefore, premature neonate who had RD at the time of admission were one and half times more likely to die as compared to those who did not have RD at the time of NICU admission. Consistent results have been recorded in our countries and other studies [9,38,43,44,53,58,59]. 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 be use up their pulmonary reserve and may eventually develop respiratory failure [4].

This study also revealed that, premature neonate that were born from mothers who came from rural area were found to be statistically significant predictor for time to death of premature neonate admitted to NICU. This finding is in line with the following study [48,49]. This difference could

have been due to that rural residents are still relatively disadvantaged in terms of infrastructures compared with their counterpart. The other possible reason might be knowledge and awareness difference and distance from the site will have its own contribution. Additionally, this may be due to Socioeconomic difference is likely the main underlying cause of the disparity.

In the current study, premature neonate those were born from mothers with DM were 2.3 times more likely to die than those neonates born from mothers hadn't DM. This finding is comparable with a study done at UOGH [44].This might be due to premature labour may be more common in DM women, so that they might give immature for their gestational age which increased risk of premature complications . The other scientific justification might be premature neonate born from DM women may have abundant glucose stores in the form of glycogen and fat but develops hypoglycemia because of hyperinsulinemia induced by maternal and fetal hyperglycemia [4].

In the present study, GA were recognized as a strong (leading) independent predictor of premature neonatal hazard, that is the risk of death for premature neonate, who were less than 28 week of GA at time of admission was 87% higher than those who were between 32-37 week of GA [9,38,39,45,46,50,56,57].

The final significant covariant that predicted time to death of premature neonate in our study was found to be APGAR scoring in which, those neonates who had 1^{st} and 5^{th} minute APGAR <7 were almost two and three times more likely to die than neonates with APGAR $\geq$7 (1^{st} and 5^{th} minute) respectively. This study is supported with a study done in Ethiopia [43,44] and another literature put it as one of the major reasons for mortality of premature neonate [11,39,50,51,56,58]. This might be because of delay in identification of newborn complications and its management and miss diagnosis.

8. Limitation and strength of the study

Strength

The study has the following strengths:

The study was conducted for comprises different years of admission/observations with equal proportional allocation; this may increase number of events and decrease 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 gives an insight for researchers especially for prospective study. Retrospective follow up study with survival analysis which consider time and censoring are used. Since the outcome was death, it was easy to establish temporal relationship with predictor variables which were documented at the time of admission.

Limitations

Despite the above strength this study has the following weakness:

Since the data were collected from secondary source; some important predictors such as socioeconomic factors like nutritional status of mother, educational level, birth interval might be missed which will have a significant prediction with premature death. The study area covers only TASH; 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 that, the incidence of death may be under or over estimated.

9. Conclusion

In the current study, a total of 170(29.77%) neonates were died during the follow up period. Hence, the overall incidence rate was 39.1 per 1000-person day with overall mean and median survival time of 17 and 21 days respectively. Incidence of death was found to be high particularly in early neonatal period and Cox proportional hazard analysis showed that the major predictor of time to death of premature neonate admitted to NICU were found to be male sex, living in rural, having maternal DM, neonatal sepsis, RD, GA less than 28 weeks, low 1^{st} and 5^{th} minute APGAR score.in contrast breast feeding initiation was found to be protective effective on premature death of neonate.

10. Recommendations

The recommendation below was made based on our study finding:

For federal minster of health and TASH

The federal minster of health works to reduce the neonatal mortality rate by including in the second MDG IV, though the incidence of death of premature neonate in the study area is still high, so that the government should able to strengthen services related with reducing premature neonatal deathlike strengthen HSDG.

The medical managements of the hospital should facilitate more research to find out more precise diagnosis of predictors of premature neonatal death and maternal adverse outcome with better computerized recording system.

There exists residency difference in premature neonatal mortality of survival time. This is an indication that the neonatal survival varies from rural to urban. Thus, Ethiopian federal ministry of health must focus on making the policy for the residency separately in order to reduce neonatal mortality throughout the country and /or should give emphasis to those came from rural area.

TASH should able to strengthen careful, follow up and regular monitoring of patients with sepsis and RD and other significant predictors in order to reduce the rate premature neonatal death.

FMOH and TASH should able to strength and scale up conception DM screening.

To health care providers of TASH

A special emphasis and close follow up should be given to patients in early neonatal period, since this is the time of high incidence of mortality in the current study.

The health care provider should able to closely screen and give follow- up for premature neonates particularly those identified with predictor of death in this study.

It would be better to give special attention for patients who is males, comes from rural area, have low APGAR score sepsis, RD, extremely very premature.

It would be better to strengthen screening of DM during pregnancy and give priorities for premature neonate born from DM mothers.

The health care professionals should abele to strengthen breast feeding initiation because it was found to be a protective factor for time to death of premature neonate admitted to NICU.

To upcoming researchers

A longitudinal prospective cohort study is strongly recommended to follow premature neonates because it would be highly beneficial to identify the long-term outcomes of premature births, and the health needs of babies who survive as prematurity and to identify other predictors including socioeconomic genetic and environmental and other factors as well as reason specific predictors.

Further community based study should be conducted on survival status of premature neonate after censored which may avoid the estimation effect.

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12.ANNEX

12.1. extraction checklist

12.1.1. information sheet

Title of the Research Project: To determine Survival status and predictor of mortality among premature neonate admitted to NICU from [2013-2017] at TASH, Addis Ababa, Ethiopia, 2018.

Name of Investigator: Yared Asmare (BSc in Nursing)

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

Name of the Sponsor: Addis Ababa University.

Introduction: This information sheet is prepared for TASH administration and NICU coordinating office. The aim of the form is to make the above-concerned office clear about the purpose of research, data collection procedures and get permission to conduct the research.

Purpose of the Research Project: To determine Survival status and predictor of mortality among premature neonate admitted to NICU from 2013-2017 at TASH, Addis Ababa, Ethiopia, 2018.

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

Risk and /or Discomfort: Since the study was conducted by taking appropriate information from medical chart, it will not inflict any harm on the patients. The name or any other identifying information was not recorded on the questionnaire and all information is taken from the chart was kept strictly confidential and in a safe place. The information retrieved was 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 was collected without the name of the clients and the information collected from this research project was kept confidential and stored in a file cabinet. In addition, it was not revealed to anyone except the investigator and it have been kept in a key and locked system with computer pass ward.

Person to contact: This research project was reviewed and approved by the institutional review board of College of Health Science, school of nursing and midwifery, 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.

Yared Asmare, Addis Ababa University, College of Health Science, Department of Nursing and midwifery: principal investigator

Cell phone: +251- 09 18512280, E-mail: yaredasmare123@gmail.com

Dr. Hussein Mekonen(Ph.D.Ass.prof,) Addis Ababa University, College of Health Science, school of aliened health, Department of nursing and midwifery: main Advisor.

12.1.2-Data collection tools

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 survival status of premature neonatal mortality and its predictors among premature neonates at TASH of NICU. All this information was retrieved from the client's registration book and from an individual patient card without mentioning the name of the clients from [2013-2017G.C]. This information was collected by health care providers possibly working in the NICU of the hospitals.

Table: 8 an abstract checklist to determine Survival status and predictor of mortality among preterm/premature neonate admitted to NICU from 2013-2017 TASH, Addis Ababa, Ethiopia, 2018.

Question Number	Questions	Possible answers	
Questions for the mother			
Socio-demographic characteristics			
101.	Age		
102.	Place of residence	1. ruler 2.urban	
b. Obstetric and medical related factors			
1.	Number of Gravidity		
2.	Number of Parity		
3	Does the mother have ANC follow up?	1. Yes…… 2. No……	
4	Was the current pregnancy multiple(twin?)	1.yes 2.no	
5	Which among the following do you have diagnosed?	1.PROM 2.preclampsia 3abraptio placenta 4.other…..	
5	What was her Current mode of delivery?	1.spontanousvagina delivery 2.cesarean section 3. Instrumental	
6	Does the neonates breastfeed?	1. yes 2.no	

7	If yes, when was the breast feed initiated	1. <1 Hr 2. [1, 2] Hr 3. >2 Hr	
	c. Mothers medical problem		
8	Has she been diagnosed with any medical problems'	1. Yes 2. No.	To NO 2010
9	If yes for question no 207, what was the diagnosis	1. HIV 2. Hypertension 3. anemia 4.other……	
	II. Questions for the premature neonate		
	a. Socio demographic / Identifications		
1.	ID no-		
2	date of admission		
3	Age in day		
4.	Sex	1. Male 2. Female	
5	Gestational age at birth in weeks		
6.	Weight in grams		
7.	APGAR score of	1.1stminute… 2.5th minute… 3.10thminute…	
	b. Diagnosed comorbidities (medical problems)		
9	Had the neonate been diagnosed with any medic disorders?	a. Yes , b. No	To NO30

10	If yes to question no 309, what was the diagnosis?	a. Respirato distress b. Jaundice c. Perinat Asphyxia d. Hypothermia E. Sepsis F. Other(specify)	
11	Length of hospital stay		
12	Date of discharge		
13	Time of neonatal death		
14	Patient status	a. death b. alive c. referred d. other…	

Annex2: