ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

Research thesis

Title: POST DISCHARGE MORTALITY AMONG PRETERM NEWBORNS ADMITTED TO SELECTED PUBLIC HOSPITAL NICU, ADDIS ABABA, ETHIOPIA: A CROSS SECTIONAL STUDY

A research thesis submitted to department of Pediatrics and Child health, College of Medicine and Health Science, Addis Ababa University for the partial fulfillment of the requirements for the specialty certificate in Pediatrics and Child Health

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Advisor: Professor Amha Mekasha MD, MSC

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ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

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Total cost of the project	29,679.1 ETB.
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Declaration

Title: Post discharge mortality among preterm newborns admitted to selected public hospitals NICU Addis Ababa Ethiopia: cross sectional study

Name of principal investigator: AbebeTadesse MD, Pediatrics and Child Health Resident

A. Declaration by the Student

I do hereby declare that this thesis submitted in partial fulfillment of the requirements for the specialty certificate of Pediatrics and Child Health is my original work and has not previously been submitted elsewhere.

Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited.

Date and Signature of the Student

November 14, 2021

B. Authority to submit the thesis

Name advisor: Professor Amha Mekasha MD, MSC

In my capacity as an advisor, I do hereby authorize the student to submit his/her thesis.

Date and Signature of the Supervisor

November 14, 2021

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ABBREVIATIONS AND ACRONYMS

AGA	Appropriate For Gestational Age
AHR	Adjusted Hazard Ratio
AOR	Adjusted Odd Ratio
APGAR	Appearance, Pulse, Grimace, Activity, Respiration
CI	Confidence Interval
CPAP	Continuous Positive Airway Pressure
DM	Diabetes Mellitus
EDHS	Ethiopian Demographic Health Survey
HAI	Hospital Acquired Infection
HIV	Human Immune Virus
KMC	Kangaroo Mother Care
NEC	Necrotizing Enterocolitis
NICU	Neonatal Intensive Care Unit
OR	Odd Ratio
PNA	Perinatal Asphyxia
PROM	Premature Rupture Of Membrane
RR	Relative Risk
SGA	Small For Gestational Age
WHO	World Health Organization

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Abstract

Introduction: Worldwide, 15 million babies are born prematurely each year. Prematurity has become the leading cause of newborn deaths worldwide, resulting in more than 1 million deaths each year .Preterm birth rates around the globe are increasing and are now responsible for 35% of the world's neonatal deaths; the condition is the second-leading cause of death among children under five. Ethiopia is among the top 15 countries that contribute to two-thirds of the world's preterm babies with an estimated preterm birth rate of 14.1%. In Ethiopia, of the estimated 91,700 neonatal deaths in 2010, more than one-third were estimated to be due to complications of preterm birth.

Objective: The objective of this study is to assess post NICU discharge mortality rate among preterm infants discharged from selected public Hospital NICU in Addis Ababa.

Methods: The study design was institutional based cross-sectional descriptive study conducted in selected public hospital NICUs in Addis Ababa. The study subjects were preterm neonates who were discharged from NICU. The sampling methods were simple random sampling method. Chart review and phone call was used to collect data. Data was analyzed using descriptive statistics by software called SPSS version 25.

Result: out of 406 preterm discharges 395(97.3%) survived to 28 days and 11(2.7%) died making post discharge mortality rate of preterm neonates is 2.7 %.There were no statistically significant association between post discharge mortality among preterm neonates and neonatal, maternal and sociodemographic characteristics.

Recommendation :post discharge preterm mortality is low in this research , which is encouraging but critical attention should be paid on improving in hospital survival especially for extremely low and very low birth weight neonate because the vast majority did not survive to discharge. They account a significant minority in this study.

1. INTRODUCTION

1.1. Background

The WHO defines preterm birth as any birth before 37 completed weeks of gestation, or fewer than 259 days since the first day of the women's last menstrual period (LMP) and this can be further subdivided on the basis of gestational age: extremely preterm (<28 wks), very preterm (28–<32wks) and moderate (32wk-< 34wk) and late preterm (34–<37completed weeks of gestation). These subdivisions are important since decreasing gestational age is associated with increasing mortality, disability, intensity of neonatal care required, and hence increasing costs.(1)

Low birth weight (LBW) and prematurity are major contributors to infant mortality (2, 3). Overall, more than two-thirds of infant deaths occur during the neonatal period. The risk of dying within this neonatal period increases with decreasing GA. In addition, lower BW due to fetal growth restriction (FGR) increase mortality at a given GA in preterm infants born at or below 31 weeks gestation (4).Mortality rates amongst preterm infants correlate with BW and GA, with decreases in both associated with poorer survival (2,5). Thus, infants born with the lowest GA and BW have the largest impact on infant mortality because they have the greatest risk of death.

Worldwide, 15 million babies are born prematurely each year of which more than 1 million died as a result of their prematurity. Preterm birth rates around the globe are increasing and are now responsible for 35% of the world's neonatal deaths(6). Preterm birth is the leading cause of childhood mortality. Approximately 1 million babies die every year due to complications of preterm birth (7). The issue of preterm birth is of paramount significance for achieving United Nations Sustainable Development Goal 3 target #3.2, which aims to end all preventable deaths of newborns and children aged less than 5 years by 2030(8). Of the 15 million preterm births every year, over 84% occur at 32–36 weeks of gestation. Only about 5% fall into the extremely preterm (<28 weeks) category and the other 10% are born at 28–32 weeks of gestation. Six countries—India, China, Nigeria, Pakistan, Indonesia, and the United States—account for 50% (~7.4 million) of the total preterm births in the world (9). Of the 15 million babies born preterm every year worldwide, more than 1 million die before the age of 5 years

due to preterm birth and its complications(6). As a result, complications related to preterm births are now the leading cause of death among children, accounting for 18% of all deaths in children aged less than 5 years.

The mortality risk from prematurity is greater in low- and moderate-income countries. In a systematic review, pooled data from studies conducted in Latin America, Africa, and Asia report that preterm infants had a 6.8-fold increase in neonatal death compared with term infants (10). In this review, the proportion of infants born before 32 weeks was low, but these infants had a substantially higher mortality rate compared with term infants.

Ethiopia is among the top 15 countries that contribute to two-thirds of the world's preterm babies with an estimated preterm birth rate of 14.1% (11). In Ethiopia, of the estimated 91,700 neonatal deaths in 2010, more than one-third were estimated to be due to complications of preterm birth (12). A higher proportion (44%) of under-five deaths in Ethiopia occurs within the first 28 days of life due to the high rate of death of neonates. The majority of newborn deaths occur during the first week of life (75%), and about 25% to 40% of deaths occur within the first 24 hours. The most common causes of death are prematurity (37%), infection (28%), and asphyxia (24%) (13). Following discharge from the NICU, preterm infants continues to be at risk for early death (14). In Ethiopia little is known about the epidemiology of deaths that occur after NICU discharge.

1.2. Statement of the problem

Newborns are perhaps the most vulnerable population the world over. Preterm or babies born too early are particularly at risk. Approximately 15 million babies are born preterm annually worldwide, indicating a global preterm birth rate of about 11% with 1 million children dying due to preterm birth before the age of 5 years (6). Preterm birth is the leading cause of death among children, accounting for 18% of all deaths among children aged under 5 years and as much as 35% of all deaths among newborns (aged <28 days)(7). The burden of preterm birth is particularly high in low- and middle-income countries, especially those in Southeast Asia and sub-Saharan Africa (13). The issue of preterm birth is of paramount significance for achieving United Nations Sustainable Development Goal 3 target #3.2, which aims to end all preventable deaths of newborns and children aged less than 5 years by 2030(8).

In Ethiopia there are neonatal survival rate studies, but there is a lack of information regarding mortality among infants discharged from neonatal intensive care units (NICUs). Assessing post NICU discharge mortality helps to anticipate and prevent neonatal morbidity and mortality. Thus, my purpose in this descriptive cross-sectional study was to assess post NICU discharge mortality at three selected hospitals in Addis Ababa, TikurAnbessa Specialized Hospital, Yekatit 12 hospitals, and GMH.

1.3. Significance of the study

The neonatal period carries the highest risk of mortality than any other period during the entire childhood. Most of the neonatal deaths occur in low and middle income countries. Prematurity is major contributors to infant mortality. Preterm birth (PTB) is a public health issue worldwide. It is the leading cause of neonatal and under-five mortality in Ethiopia as well.

According to SDG -3 which stated “Ensure healthy lives and promote wellbeing for all at all ages”, the goal by 2030 is to reduce neonatal mortality to at least as low as 12 per 1000 live births.Studies shows that infants cared for in NICUs and subsequently discharged are at increased risk for early death when compared with the general population.

Multiple studies have examined the predictors of early death and survival to NICU discharge, however, information on risk factors for post-NICU discharge mortality is scarce. Factors that may affect post-NICU discharge mortality may be very different from factors that are known to affect risk of in-hospital mortality. Thus, to improve the quality of care, and it is desirable to assess post NICU discharge mortality which will have a significant contribution in reducing under five mortality.

The results of this study can be used as an input for the policy makers/FMOH to increase early identification gaps and to address factors for better out comes timely. Also, the findings of the study will help as baseline data for further researches in the future.

2. Literature review

In 2015, among the 5·941 million children who did not live to age 5 years globally, 2·681 million (45·1%) died in the neonatal period. The leading causes of deaths in children under 5 were preterm birth complications (1·055million), 17·8%, pneumonia (0·921 million, 15·5% and intrapartum related events (0·691 million, 11·6 %.Among neonates, the leading causes were preterm birth complications (0·944 million, 15·9%), intrapartum related events (0·637 million , 10·7%), and sepsis or meningitis (0·401 million , 6·8%). Sub-Saharan Africa and southern Asia remained the MDG regions with the highest numbers of under-5 deaths in 2015 (2·947 million and 1·891 million, respectively). In sub-Saharan Africa, the leading causes of under-5 deaths were pneumonia (0·490 million, 16·6%), preterm birth complications (0·356 million, 12·1%), and intrapartum-related events (0·338 million, 11·5%) (13).

A retrospective cohort analysis of prospectively collected data from the NICHD NRN Generic Database Registry USA. To evaluate maternal and neonatal risk factors associated with post-neonatal intensive care unit (NICU) discharge mortality among ELBW infants. In this study 5,364 infants survived to NICU discharge. 107 infants died following NICU discharge. Post-NICU discharge mortality rate was 22.3 per 1000 ELBW infants. African-American race, unknown maternal health insurance, and hospital stay ≥120 days significantly increased risk, and maternal exposure to intrapartum antibiotics was associated with decreased risk of post-NICU discharge mortality. Post-NICU discharge mortality occurred at a median age (mean ± SD) of 228 (290 ± 176) days and at a median (mean ± SD) of 100 (151 ± 158) days from NICU discharge (14).

Infants in the post-NICU discharge mortality group had higher prevalence of BPD, ROP (≥ Stage 3) and home oxygen use; had longer duration of mechanical ventilation and hospital days and had more individuals living with them in the household compared with those infants who were alive at follow-up ($P < .05$). maternal factors such as age <24 years, Medicaid insurance, African-American race, single marital status and less than high school education showed significantly increased odds of having an infant with post NICU discharge mortality ($P < 0.05$). Infant predictors that showed increased odds of post-NICU discharge mortality were presence of BPD, ROP, home oxygen use, duration

of ventilator use (per week), hospitalization ≥120 days and living with ≥4 individuals in the household (P< .05).(14)

In a prospective cohort study of Mortality among very low birth weight infants after hospital discharge in a low resource setting which was conducted Among 190 VLBW infants discharged from Mulago Special Care Baby, National Referral Hospital for Uganda and teaching hospital for Makerere University. Of the infants who were, enrolled and completed the study, the median gestational age was 32 weeks and the mean discharge weight was 1119 g (range 760-1470 g). This study shows a mortality rate of 19.5% among VLBW infants discharged. The average duration of hospital stay among study participants was 12.2 days (range 4-42 days). All infants were discharged on multivitamin drops, iron supplementation and oral aminophylline. A majority of study infants were discharged on breast feeding with topping off through nasogastric tube, 11 were fully breast feeding and 23 fully tube feeding. During follow up 32 infants died, sixteen of study participants died from presumed sepsis based on mother's description of signs suggesting baby was unwell. Ten of these infants were re-hospitalized but died in hospital, 2 died on the way to hospital and 4 had signs of being unwell but parents did not know what to do so infants died at home. Nine infants who died from presumed sepsis died within 1 month of discharge. With regards to eight infants who died from suspected cot death, the mothers described baby being completely well but found dead in the bed; all infants who died from suspected cot death had discharge weight < 1200 g, with four of them at < 1000 g. Four of these infants died at corrected gestational age of < 35 weeks. Eight infants who died from suspected cot death died within 1 month of discharge. Discharge weight of < 1000 g, postmenstrual age < 35 weeks and not being small for gestational age was associated with mortality p 0.008, p 0.012 and p 0.001 respectively. (15)

In a prospective, multi-center, observational clinical study conducted in 5 tertiary hospitals in Ethiopia to determine the risk factors for death among preterm neonates admitted into neonatal intensive care unit. Out of the 3773 preterm births included in the analysis, 2036 (54%) were early preterm (<34weeks) and 1737 (46%) were late preterm (34–36weeks). The average weight at birth was 1712 (SD±462)g. There were 2667

(70.69%) survivors and 1106 (29.31%) deaths of the neonates. The average length of stay in a hospital for those who were discharged alive was 12 days, while the average length of stay among those who died was 6 days. The significant risk factors for preterm deaths were low gestational age, low birth weight, being female, feeding problem of the neonate, and not ANC received (16). In another prospective cross-sectional observational study aimed to establish the major causes of preterm mortality in preterm infants in the first 28 days of life in Ethiopia, Of the 4919 preterm births, 1117 (22·7%) died. Of the 3852 infants admitted to the NICU, 1109 (28·8%) died. Of the 1067 infants not admitted to the NICU, eight (0·7%) were reported dead at 28 days. The main primary causes of death in the 1109 infants were established as respiratory distress syndrome (502 [45%]); sepsis, pneumonia and meningitis (combined as neonatal infections; 331 [30%]), and asphyxia (151 [14%]). Hypothermia was the most common contributory cause of preterm mortality (770 [69%]). The highest mortality occurred in infants younger than 28 weeks of gestation (89 [86%] of 104), followed by infants aged 28–31 weeks (512 [54%] of 952), 32–34 weeks (349 [18%] of 1975), and 35–36 weeks (159 [8%] of 1888). (17)

Mortality in Hargeisa, Somaliland: an observational, hospital based study of the 164 patients admitted to the neonatal unit 16% were born premature half of the patients admitted to the neonatal ward with GA<37 weeks died (18).

A retrospective cross-sectional study done in FelegeHiwot specialized hospital, Bahir Dar, Ethiopia, the survival rate of EVLBW, VLBW, LBW and NBW was 0%, 19.9%, 66.1% and 87.5%, respectively. The survival rate was 0%, 19.4%, 40%, 46.7% and 75% for GA < 28 weeks, 28–31 + 6 weeks, 32–33 + 6 weeks and 34–36 + 6 weeks, respectively. Neonates with GA < 28 weeks, weight <1000 g and acute bilirubin encephalopathy had no chance of survival. The overall survival rate of preterm neonates was 49.1% and the overall mortality rate was 36.1% which signifies very low survival and high mortality rate compared to other hospitals with similar setups in Ethiopia. Hypothermia, sepsis, RDS, NEC, hyperbilirubinemia and HAI were among the leading causes of morbidity. RDS, sepsis and NEC were the leading cause of death. A higher number of neonatal death occurred after 24hrs of life (19).

In study which was conducted on newborns delivered from January 1 to June 30, 2017 before gestational age of 37 completed weeks at the three teaching hospitals in Addis Ababa, among 9927 neonates delivered during the study period, 415 (4.2%) were preterm. Among 407 preterm newborns 304 (74.7%) newborns were survived to 28th day while 103 (25.3%) neonates died. The cumulative survival rate for preterm babies at the three teaching hospitals is 74.4%. The survival rate of preterm neonates is zero %, 9.1%, 31.8%, 55.2%, 57.6%, 77.4%, 90.4%, 98.6% and 98.8% for GA of 28, 29, 30, 31, 32, 33, 34, 35, and 36 weeks respectively. Majority of neonatal deaths occurs within the first 2 days (52.5%) and two third (67.1%) of the deaths occurs within the first 3 days. Birth weight of 1500 grams or above (AOR 3.5, 95% CI 1.5-8.1, P <0.01), GA increment by one week (AOR 2.4, 95% CI 1.9-3.2, P<0.001) and married mother (AOR 3.9, 95% CI 1.2- 12 P< 0.05) are associated with a better chance of neonatal survival in this study. Neonates who required resuscitation after delivery have lower probability of survival (AOR 0.3, 95% CI 0.12-0.64, P< 0.01). Preterm neonates delivered prior to 31 weeks of GA have very low survival rate. (20).

2.2. Conceptual Frameworks

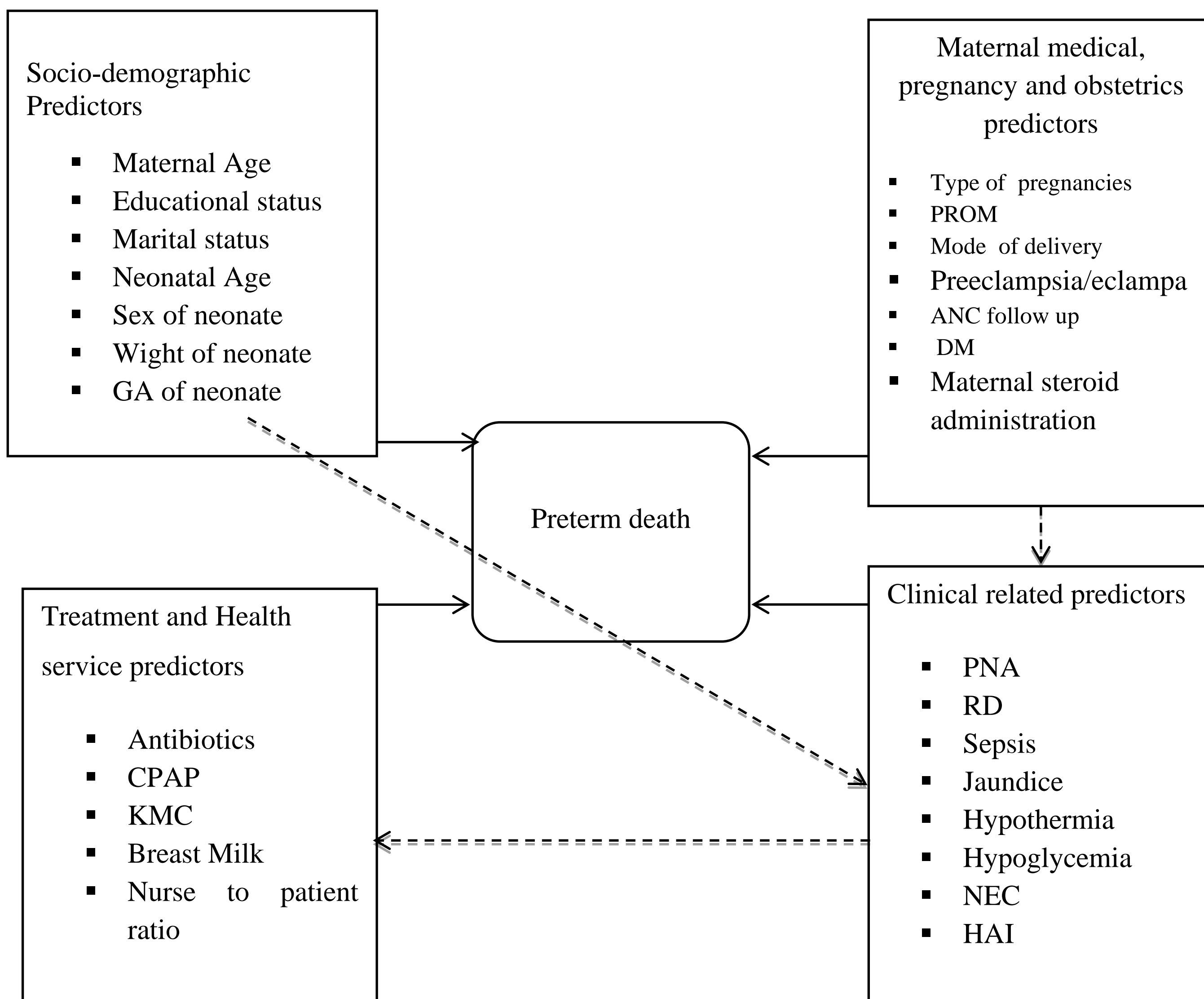

Figure 1: Conceptual frame work

3. OBJECTIVES

3.1. General objective

The objective of this study is to assess post NICU discharge mortality rate among preterm neonates who were admitted to selected public hospitals in Addis Ababa.

3.2. Specific objectives

1. To determine post discharge mortality rate among preterm neonates
2. To identify socio demographic factors associated with post discharge mortality
3. To identify neonatal clinical condition associated with post discharge mortality

4. METHODOLOGY

4.1. Study Area: This study was conducted in three selected public hospitals in Addis Ababa, includes TASH, GMH and Y12HMC.

Addis Ababa is the capital and largest city of Ethiopia. The city has twelve public Hospitals, among these six hospitals(Gandhi memorial hospital , Yekatit 12 hospital medical college , Zewditu memorial hospital , Ras-DestaDamtew memorial hospital, Menillik II referral hospital, Tirunesh Beijing general hospital) are governed by Addis Ababa health bureau and the rest five(St' peter Specialized hospital, St' Paul's Hospital millennium medical college, Amanuel hospital, Alert hospital and YekaKotebe hospital are governed by Federal Ministry of Health and one university hospital (TikurAnbessa Specialized Hospital).

Most of these hospitals except Amanuel hospital have their own neonatal intensive care unit. So the study was conducted in three randomly selected public hospitals of Addis Ababa, These are TikurAnbessa Specialized Hospital, Gandhi memorial Hospital and Yekatit 12 hospital medical college.

4.2. Source Population: all neonates discharged from selected public hospitals NICU of Addis Ababa during the study period.

4.3. Study Population: all preterm neonates who were discharged from selected public hospitals NICU of Addis Ababa during the study period.

4.6. Eligibility Criteria

4.6.1. Inclusion Criteria

All preterm neonates discharged from selected public hospitals NICU of Addis Ababa during the study period were included.

4.6.2. Exclusion Criteria

Preterm neonates whose discharge was not completely documented Preterm neonates whose chart is lost, phone is not working, and whose parents refused to give information and whose data becomes difficult to access by any means were excluded.

4.5. Study Design

Institutional based cross-sectional descriptive study was conducted to assess post NICU discharge mortality rate among preterm infants discharged from selected public hospitals NICU of Addis Ababa, Ethiopia.

4.6. Sample Size Determination and Sampling Procedure

4.6.1. Sample size calculation

Sample size is determined by using a single population formula

$$n = \frac{(z\alpha/2)^2 pq}{d^2}$$

n = the desired sample size

z = the standard normal deviation at the required confidence interval

(1.96)

P = 50%

q = 1-p

d = the level of statistical significance

$$n = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2}$$

n = 384

The sample size for this study was 384. Considering 10% non-response rate, sample size for the study was calculated to be 422.

4.6.2 Sampling Procedure

Three month average base line preterm discharge data was taken from HMIS. Based on the data there was an average of 25 preterm discharges per month making estimated total population of 600. The total populations are less than twice of the sample size, and the value of k is 1.43. Therefore, all preterm that full fill the inclusion criteria were selected randomly until the required sample size achieved.

4.7. Data Collection tool

Standardized checklist was prepared after extensive literature review on the topics and was revised to fit in to the setup. Data was collected from neonate's medical records and phone call. Principal investigator and two trained heath care professionals using standardized checklist collected the data, the principal investigator and supervisor were following data collectors.

4.7.1 Parts of the checklist

The check list had about 5 components including basic information about the interview, maternal socio demographic characteristics, maternal medical, pregnancy and obstetric characteristics, preterm demographic ,medical problem ,treatment related, condition at discharge and home,.

4.8. Data quality assurance

The completeness of the checklist was checked every day by investigator before actual data analysis and interpretation.

4.9. Data Analysis

Post discharge outcome of the neonate to 28 days of life, i.e. preterm death was the event of interest so coded as "1"and "0" for outcome was alive at 28 days. Information about study subjects was collected from patient medical record, HMIS log book, and phone calling using structured data collection tool. Data was cleaned and entered in to a computer. All analysis was conducted using SPSS for windows version 25.

Descriptive statics was used to describe the frequencies, percentage and rate to calculate the median and standard deviation.

Bivariate and multivariate logistic regression was performed to explore association between independent variables and post discharge mortality. Characteristics with $P \leq 0.25$ level of significance were included in the multivariable analysis. Multivariable logistic regression analyses were used to the following confounding variables: maternal occupation, history of still birth, use of intrapartum antibiotics , preeclampsia, IUGR, sex of the neonate, first minute APGAR score , PNA, apnea , time of initiation of feeding , length of hospital stay before discharge, postnatal age at discharge, KMC practice. Characteristics with p value < 0.05 were reported as predictors of mortality.

4.10. Study variables

4.10.1. Dependent variable

Post discharge Preterm mortality

4.10.2. Independent variables

Sex, gestational age, mode of delivery ,birth weight, discharge weight, parental occupation, educational status, residence, ANC follow-up, Parity ,Gravidity ,History of abortion, history of still birth , type of pregnancy , age at death, Apgar scores, Hypothermia, sepsis, RDS, NEC, age at discharge ,duration of hospital stay, discharge weight , KMC practice, feeding type .

4.11. Operational Definitions/ Definition of Terms

Preterm: neonates whose gestational age is less than 37 weeks calculated either from last normal menstruation period, by Ballard score or using early ultrasound.

Post discharge mortality: Preterm neonates who survived to NICU discharge and died following NICU discharge in the first 28 days of life.

4.12. Ethical Approval

Ethical approval was obtained with written permission from the Department Research and Publication Committee, at Addis Ababa University College of Medicine and health science, so that the department of pediatrics and child health to carry out the study. Permission was also sought from each hospital. Informed consent process was done over the telephone since the research cannot reasonably be conducted in person. The study participants were asked for their willingness to participate in the study after explaining the purpose of the study by giving adequate information, providing opportunity for the subject to consider all options by responding to the subject's questions, by ensuring that the subject has understood the information and by obtaining the subject's voluntary agreement after explaining that the study doesn’t have untoward effect on the participants as well as any benefit for the participants but it will provide valuable information for the care and management of the subsequent generation.The privacy and confidentiality of information maintained by not writing the name of study participants on data collection tool.

4.13. Dissemination of Result

The findings of the study will be shared with the staff, authorities and officials in the department of Pediatrics and Child Health at TASH in order to enhance appropriate interventions.

It will be presented on the annual research conference of the department. Finally, the result of the study will be attempted to be published in medical journals.

5. RESULT

5.1. Socio-demographic characteristics of preterm and their mothers

There were a total of 653 preterm admissions of which 446 survived to discharge from which 406 were included in the analysis with response rate of 96 percent. The mean age of the mother was 27±4.59 SD years. The range of maternal age was 18 – 43yrs and 86.9 % of the mothers were in the age range of 20 – 35yrs. In this study 11(2.7%) mothers had no formal education, 106(26.1%) primary education, 155 (38.2%) secondary education, 39 (9.6%) technical/vocational and 95 (23.4%) higher educational level. Most 379(93.3%) mothers are living in urban and 128 (31.5%) mothers are government employees.

In this study 213(52%) of the preterm neonates were male and 193(48%) were female. Majority of preterm neonates 387(95.3%) were admitted at less than 24 hrs of age. Mean gestational age at admission was 34^{+3} ±1.66 SD weeks with a range of 28- 36^{+6} wks. Majority, 291 (71.7%) were between 34 and 36^{+6} wks of gestation. The rest, 83(20.4 %) were between 32 and 33^{+6} wks and 32(7.9%) were between 28-31^{+6} weeks of gestation. The mean birth weight was 1964gm with a range of 1000 and 3500 gm. Majority of preterm neonates 332(81.8%) were between 1500 and 2499 gm. (Table: 1)

Table 1: Socio Demographic Characteristics of the preterm and their Mothers

Characteristics	Frequency	Percent
Maternal age in years		
<20	31	7.6
20-35	353	86.9
≥35	22	5.4
Marital status of mother		
Single	19	4.7
Married	374	92.1
Divorced	11	2.7
Widowed	2	.5
Educational status		
no formal learning	11	2.7
primary	106	26.1
secondary	155	38.2
technical/vocational	39	9.6
higher	95	23.4

Occupation of Mother		
governmental employee	128	31.5
private	93	22.9
merchant	110	27.1
farmer	2	.5
house wife	73	18
Residency		
urban	379	93.3
rural	27	6.7
Sex of the baby		
Male	213	52.5
Female	193	47.5
Age at Admission of Preterm		
<1day	387	95.3
1-3days	7	1.7
>3days	12	3.0
Gestational age		
$28\text{-}31^{+6}$	32	7.9
$32\text{-}33^{+6}$	83	20.4
$34\text{-}36^{+6}$	291	71.7

Weight at Admission		
≤1000	1	.2
1001-1499	39	9.6
1500-2499	332	81.8
2500	34	8.4
Weight for gestational age		
AGA	379	93.3
LGA	7	1.7
SGA	20	4.9

5.2. Maternal medical, pregnancy and obstetrics related characteristics

Almost all 400 (98.5%) mothers of this study had ANC follow up, of whom 328 (80.8%) of them had four or more antenatal visit, whereas only 72(17.7%) of the mothers have less than four antenatal visits. The majority of the mothers 319(78.6%) had single pregnancy the rest 87 (21.4%) of the mothers had multiple pregnancy. In 396 (97.5%) of the mother delivery was in health institution and only 9(2.2%) gave birth at home. More than half of the neonates 236(58.1%) were born via SVD, 164(40.4%) of them were via C/S and 6(1.5%) were born instrumentally. Significant majority 292(71.9%) of the mothers had risk for preterm delivery. Around one-third 123(30.3%) of the mothers had PROM, 97(23.9%) preeclampsia and /or eclamptic and only 14(3.4%) of the mothers had oligo/polyhydramnious. Twenty (4.9 %) of the mothers had chronic illness of which 5(1.2%), 6(1.5%) and 6(1.5%), were diagnosed with HIV/AIDS, Hypertension and diabetes respectively (table 2).

Table: 2 Maternal medical, pregnancy and obstetrics related characteristics

Characteristics	Frequency	Percent
No of ANC Follow up		
0	6	1.5
1- 4	72	17.7
≥ 4	328	80.8
Parity		
1	199	49.0
2-4	195	48.0
≥5	12	3.0
History of Abortion		
Yes	81	20.0
No	325	80.0
History of Still Birth		
Yes	9	2.2
No	397	97.8

Type of pregnancy		
Singleton	319	78.6
Multiple	87	21.4
Steroid Administration for the Mother		
Yes	148	36.5
No	258	63.5
Intrapartum Antibiotics		
Given	118	29.1
Not given	288	70.9
Mode of Delivery		
SVD	236	58.1
Instrumental delivery	6	1.5
CS	164	40.4
Place of Delivery		
Institutional	396	97.5
Home	9	2.2
On the way to facility	1	.2

Risk of Preterm Birth		
Known	292	71.9
Unknown	114	28.1
Risk of Preterm Birth		
PPROM		
Yes	123	30.3
No	169	41.6
APH		
Yes	46	11.3
No	246	60.6
Preeclampsia/Eclampsia		
Yes	97	23.9
No	195	48.0
Oligo/Polyhydraminous		
Yes	14	3.4
No	278	68.5
Chorioaminities/Clinical		
Yes	6	1.5
No	286	70.4

Multiple Pregnancy		
Yes	53	13.1
No	239	58.9
IUGR		
Yes	13	3.2
No	279	68.7
Mother Dx with Chronic disease		
Yes	20	4.9
No	386	95.1
HIV/AIDS		
Yes	5	1.2
No	15	3.7
Diabetes		
Yes	6	1.5
No	14	3.4
Hypertension		
Yes	6	1.5
No	14	3.4
Anemia		
Yes	1	.2
No	19	4.7
Tuberculosis		
Yes	2	.5
No	18	4.4

5.3. Preterm Medical Problem and Treatment characteristics

Majority of the neonates 379(93.3%) were appropriate for gestational age, only 20(4.9%) and 7(1.7%) of preterm neonates were SGA and LGA respectively. EONS was found in 343(84.5%) of the neonates followed by RD 312 (76.8%). At admission 336(82.8%) of the neonates were hypothermic. Majority 233(57.4%) of the neonate's had developed new medical problem during their initial hospital stay. Of those new medical problems observed during their hospital stay, most 164(40.4%) of the neonates developed hyperbilirubnimia, 92(22.7%) developed thrombocytopenia. Antibiotic treatment was instituted in 378(93.1%) of the neonate during hospital treatment stay. Others modes of treatment included 235 (57.9), 98(24.1%), 152(37.4%) required CPAP, blood product transfusion and phototherapy respectively. A third of 134(33%) of the neonate stayed less than 7 days in the hospital before discharge, the rest 125(30.8%) stayed 7-14 days, 82(20.2%) stayed 15- 21 days before discharge. (Table 3)

Table: 3 Preterm Medical Problem and Treatment characteristics

Characteristics	Frequency	Percent
APGAR score 1st minutes		
<5	17	4.2
5-6	86	21.2
>7	298	73.4
APGAR score at 5th Minutes		
<5	2	.5
5-6	25	6.2
>7	374	92.1

Resuscitated		
Yes	30	7.4
No	376	92.6
Diagnosis at Admission		
Hypothermia		
Yes	336	82.8
No	70	17.2
RD		
Yes	312	76.8
No	94	23.2
EONS		
Yes	343	84.5
No	63	15.5
PNA		
Yes	31	7.6
No	375	92.4
NHB(Jaundice)		
Yes	10	2.5
No	396	97.5
Meningitis		
Yes	2	.5
No	404	99.5
IUGR		
Yes	2	.5
No	404	99.5

New medical problem during hospital stay		
Yes	233	57.4
No	173	42.6
HAI		
Yes	70	17.2
No	163	40.1
NEC		
Yes	49	12.1
No	184	45.3
NHB(Jaundice)		
Yes	164	40.4
No	69	17.0
Apnea		
Yes	34	8.4
No	199	49.0
Hypoglycemia		
Yes	69	17.0
No	164	40.4
Thrombocytopenia		
Yes	92	22.7
No	141	34.7
Anemia		
Yes	29	7.1
No	204	50.2

Initial feeding at the age of		
<1	128	31.5
1-3	253	62.3
>3	25	6.2
Treatment During Hospital Stay		
Antibiotics		
Yes	378	93.1
No	21	5.2
CPAP		
Yes	235	57.9
No	164	40.4
Blood Products		
Yes	98	24.1
No	301	74.1
Phototherapy		
Yes	152	37.4
No	247	60.8
Maintenance fluid		
Yes	319	78.6
No	79	19.5
Length of Stay		
<7days	134	33.0
7-14	125	30.8
15-21	82	20.2
>21	65	16.09

5.4. Discharge and After Discharge Characteristics

The mean age of preterm infants at discharge was 12 days (SD +/- 22 days).Nearly a third of the neonates 131(32.3%) were discharged at 7 – 14 days of post natal age, 128(31.5%) at less than one week of age, 83(20.4%) at 15- 21 days of age and 64(15.8%) at more than 21 days of age. The mean discharge weight was 1990gm with a range of discharge weight of 1140 - 3470 gm. The majority of the neonate 356(87.7%) discharge weight was between 1500 and 2499 gm. Most 220(54.2%) practiced home KMC, significant majority of the neonates 289(71.2%) were on exclusive breast feeding, 81(20%) of the neonates were on mixed feeding and 36(8.9%) were on formula milk.

Out of 406 study participants 395 (97.3 %) of the neonates survived to 28 days of life and 11 (2.7%) were died, from which 8(72.7%) of the death occurred after 3 weeks of life. Nine of the 11 deaths (81.81%) of them died in the health facility 2 (18.18%) of them died suddenly, one (9.09%) at home and one (9.09%) died on the way to hospital. (Table 4)

Table: 4 Discharge and After Discharge Characteristics preterm neonates

Characteristics	Frequency	Percent
Post Natal Age at Discharge		
<7days	128	31.5
7-14	131	32.3
15-21	83	20.4
>21	64	15.8
Weight at Discharge		
<1000	0	0
1000-1499	22	5.4
1500-2499	356	87.7
≥2500	28	6.9
KMC practice at home		
Yes	220	54.2
No	186	45.8
Feeding Type		
Exclusive breast milk	289	71.2
Formula milk	36	8.9
Mixed	81	20.0
Outcome of the neonate at up to 28 days of age		
Alive	395	97.3
Death	11	2.7

Age of the neonate at death		
<7days	0	0
7-14	1	.2
15-21	2	.5
>21	8	2.0
Did the baby die suddenly		
Yes	2	.5
No	9	2.2
Place of Death		
Home	1	.2
Health facility	9	2.2
On the way to health facility	1	.2

From the total deaths Most of the deaths 8 (72.7%) occurred at ≥21 days of life the rest 2(18.2%) and 1 (9%) occurred at 14-21 days and 7- 14 days of life respectively. Majority 9(81.8%) of the deaths were babies of mothers with 20- 35yrs of age and 2(18.2%) were babies of mothers ≥35yrs of age. Most of the deaths 8(72.7%) of the preterm neonates were male.

Bivariate logistic regression (Table: 5) was performed to all variables to explore association between independent variables and post discharge mortality. Occupation of Mother, History of Still birth, Intrapartum antibiotics, Preeclampsia/Eclampsia, IUGR, Sex of the baby, APGAR score at 1st minute, PNA, Apnea, time of feeding initiation, length of hospital stay before discharge , post natal age at discharge, KMC practice are significant with the $p<0.25$.

Table 5: Bivariate logistic regression Analysis of predictors of post discharge Preterm mortality

Category	Sig.	Exp(B)	95% C.I.for EXP(B)	
			Lower	**upper**
Occupation of Mother				
Governmental	.043	.107	.012	.935
employee	.156	.299	.056	1.587
Private	.197	.381	.088	1.647
Merchant	.999	.000	.000	.
Farmer	.256	Ref.		
House wife				
History of stillbirth				
Yes	.155	4.837	.551	42.435
No		Ref.		
Intrapartum antibiotic				
Yes	.173	.238	.030	1.877
No		Ref.		
Preeclampsia				
Yes	.191	2.753	.604	12.552
No		Ref.		
IUGR				
Yes	.234	3.792	.422	34.033
No		Ref.		
Sex of the baby				
Male	.234	3.792	.422	34.033
Female		Ref.		
APGAR score at 1st minute	.999	.000	.000	
<5	.006	5.847	1.673	20.434
5-6	.022	Ref.		
>7				
PNA				
Yes	.200	2.805	.579	13.591
No		Ref.		
Apnea				
Yes	.121	3.113	.740	13.097
No		Ref.		
Time of feeding initiation				
<24hr	.044	.151	.024	.948
24-72hr	.389	.483	.092	2.537
>72hr	.102	Ref.		
Length of stay				
<7Days	.096	.231	.041	1.296
7-14days	.113	.248	.044	1.392
14-21days	.485	.579	.125	2.685
>21days	.261	Ref.		

Post natal age at discharge				
<7Days	.103	.238	.042	1.336
7-14days	.097	.233	.041	1.305
14-21days	.462	.562	.121	2.608
>/21days	.253	Ref.		
KMC practice at Home				
Yes	.223	2.302	.602	8.805
No		Ref.		

In multivariate analysis (Table:6) there is no statistically significant increased odd of post discharge preterm mortality in association to Occupation of Mother, History of Still birth, Intrapartum antibiotics, Preeclampsia/Eclampsia, IUGR, Sex of the baby, APGAR score at 1st minute, PNA, Apnea, time of feeding initiation, length of hospital stay before discharge , post natal age at discharge, KMC practice.

Table 6: Multivariable Logistic Analysis: Risk Factors for Post discharge Mortality among Preterm neonates

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Occupation of Mother			2.117	4	.714			
Occupation of Mother(1)	-.147	2.431	.004	1	.952	.863	.007	101.320
Occupation of Mother(2)	-32.501	4521.023	.000	1	.994	.000	.000	.
Occupation of Mother(3)	2.691	2.795	.927	1	.336	14.740	.062	3530.070
Occupation of Mother(4)	-13.970	40192.970	.000	1	1.000	.000	.000	.
History of Still	2.458	2.244	1.200	1	.273	11.683	.144	949.898

birth(1)								
Intrapartum antibiotics	-36.037	3565.668	.000	1	.992	.000	.000	.
Preeclampsia/Eclampsia	19.071	1824.446	.000	1	.992	191686306.721	.000	.
IUGR(1)	-18.799	16950.830	.000	1	.999	.000	.000	.
Sex of the baby(1)	1.541	2.074	.552	1	.457	4.670	.080	272.184
APGAR1G			1.244	2	.537			
APGAR1G(1)	35.778	17571.270	.000	1	.998	3452107861884651.500	.000	.
APGAR1G(2)	1.874	1.680	1.244	1	.265	6.514	.242	175.496
PNA(1)	-36.508	6639.675	.000	1	.996	.000	.000	.
Apnea(1)	1.634	2.112	.598	1	.439	5.125	.082	321.939
FeedingintiationG			.025	2	.988			
FeedingintiationG(1)	-20.713	1824.450	.000	1	.991	.000	.000	.
FeedingintiationG(2)	-21.139	1824.448	.000	1	.991	.000	.000	.
LengthofsatyG			1.338	3	.720			
lengthofsatyG(1)	51.131	41068.931	.000	1	.999	1607218382815210000000000.000	.000	.

lengthofsatyG(2)	.137	2.696	.003	1	.959	1.147	.006	225.957
lengthofsatyG(3)	-1.810	1.712	1.118	1	.290	.164	.006	4.689
postnatalageatdischargeG			.000	1	.999			
postnatalageatdischargeG(1)	-48.943	41068.931	.000	1	.999	.000	.000	.
KMC practice at home(1)	-.130	1.919	.005	1	.946	.878	.020	37.778

6. DISCUSSION

In this study the rate of post discharge preterm mortality is 2.7% of infants discharged from the hospital. The finding is lower than a prospective cohort which was conducted in Uganda to assess Survival time and its predictors among pre terms in the neonatal period post-discharge, overall post discharge mortality was 8%. In same study Preterm infants who were not on KMC, preterm infants born to mothers with primary or no education, preterm infants born to HIV positive mothers, Preterm infants who were not exclusively breastfed had higher risk of mortality in the post discharge period. (21) But in this study none of the variables have statically significant correlation with post discharge mortality. The possible reason for this could be, the mean postnatal age of preterm infants at discharge is only 4 days in their study but 12 days in this cross-sectional study that will predispose neonates to acquire in hospital infection this will increase in hospital mortality rather than post discharge mortality. The other explanation can be the caregivers, 5.5% (7/128) were positive for HIV which had significant association with mortality but in this study only 1.2 % of the mother reported to have HIV. Another possible reason Mean Gestational age is 34^{+3} ±1.66 SD weeks and significant majority 71.7% were between 34 and 36^{+6} wks of gestation this group of neonates less vulnerable to hypothermia, apnea and sepsis and they also have a relatively good suck and swallowing reflex, this all can be the reason for the low mortality in this study.

In another prospective cohort study of mortality among very low birth weight infants after hospital discharge in a low resource setting, mortality rate was 19.5% among VLBW infants discharged, which is higher than this research post discharge mortality. This can be due to the study was aimed to determine post discharge mortality among very low birth weight infants, which account only 9.6 % (39/406) study participants in this study. Majority of preterm neonate survived to discharge were low birth wt. and above (> 81.8%) which have relatively lower risk of mortality as compared to VLBW neonates discharged. (15)

In the study evaluating maternal and neonatal risk factors associated with post-neonatal Intensive care unit (NICU) discharge mortality among ELBW infants, reported that post-NICU discharge mortality occurred at a rate of 22.3 per 1000 ELBW infants discharged from the hospital .They reported on smaller infants (<1000 g) Probably because of advances in perinatal care such as antenatal exogenous surfactant therapy have resulted in improved survival of extremely low birth weight infants <1000 grams (ELBW) to NICU discharge. But in this study only 1(0.2%) ELBW neonate survived to NICU discharge. Most of the neonates survived to discharge had birth weight above 1500gm which have relatively lower risk of mortality compared to ELBW infants.

In a prospective multi-center observational clinical study conducted in 5 tertiary hospitals in Ethiopia, demonstrated that there were 70.69% survivors and high 29.31% deaths of the neonates. (16) The average length of stay in a hospital for those who were discharged alive was 12 days, almost comparable to this research finding. They also reported that among preterm neonates admitted to a NICU, 11.4% died in the first 24 hours and 85.27% died in the first 7 days. 42.78% of early preterm, 13.53% of Late preterm were not survived to discharge. In addition 82.93% of ELBW, 50.05 % of VLBW were not survived to discharge. The significant risk factors for preterm deaths were low gestational age and low birth weight.(16) From this we can understand that majority of low birth weight and low gestational age neonates did not survive to discharge that will be the possible explanation for the low post discharge mortality rate in this study. In another prospective, cross-sectional, observational study aimed to establish the major causes of preterm mortality in preterm infants in the first 28 days of life in Ethiopia. The

highest mortality occurred in infants younger than 28 weeks of gestation (89 [86%] of 104), followed by infants aged 28–31 weeks (512 [54%] of 952), 32–34 weeks (349 [18%] of 1975), and 35–36 weeks (159 [8%] of 1888).This finding can also support the markedly lower post discharge mortality in this research science significant majority of the neonate survived to discharge were above 32- 34 wks of gestation which have a relatively lower risk of mortality compared to extreme and very preterm neonates .

In study which was conducted on newborns delivered before gestational age of 37 completed weeks at the three teaching hospitals in Addis Ababa among 407 preterm newborns 304 (74.7%) newborns survived to 28th day while 103 (25.3%) neonates died.(20) which shows higher mortality than this study. This is because the study was conducted in all preterm from births to 28 days of life and didn't separately study the post NICU discharge mortality status.

In summary this study shows lower post discharge preterm mortality, 2.7%. Both preterm and maternal sociodemographic factor didn't show significant risk of mortality. This is probably due to the low rate of mortality which might not result in significant association with the study variables. The other main explanation for the lower mortality rate finding in this study is the majority of discharges have higher birth weight and gestational age which relatively has low risk of mortality. Majority of neonatal deaths occurs at ≥ 21 days of life.

In conclusion this research showed low post discharge preterm mortality which is encouraging but critical attention should be given on improving in hospital survival especially for extremely low and very low birth weight neonate because the vast majorities were not survived to discharge.

6. Strength and limitation of the study

6.1. Strength of the study

This study provides information about preterm after discharge from a health facility and the finding is encouraging.

Previous studies in our setting on preterm neonates shows mortality, morbidity, risk factors and predictors of mortality while they were in the health facility but this is a new experience to study post discharge mortality.

It provides baseline information about post discharge status of preterm neonates. This will be a foundation to further study chronic complication of prematurity and other associated factors.

6.2. Limitation of the study

In this study secondary data were used to get neonatal medical and demographic characteristics.

Phone calling was also used to get final outcome of the neonate which will result in recall bias and uncertainties to talk about the deceased.

Neonatal survival status was assessed to 28 days of life which might be short so if infants followed for 1yr or more the finding might also be different.

7. Recommendation

Critical attention should be paid on improving in hospital survival especially for extremely low and very low birth weight neonate because the vast majorities were not survived to discharge.

Further multicenter study should be done using primary data to determine the survival time to mortality and its predictors post-discharge from hospital.

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APPENDIX I: DATA ABSRACTION SHEET

Hospital Name ____

Subject's Code No._______________

Part I: Maternal Socio demographic related characteristics

No	Maternal socio demographic Characteristics	Response	Skip to
101	Age of the mothers	____________Year	
102	Marital status **(Phone calling)**	1. Single 2. Married 3. Divorced 4. Widowed	
103	Educational status **(Phone Calling)**	1. No formal learning 2. Primary 3. Secondary 4. Technical/vocational 5. Higher	
104	Occupation **(phone calling)**	1. Governmental employee 2. Private 3. Merchant 4. Farmer 5. House wife 6. Other (specify)……	
105	Residency	1. Urban 2. Rural	

Part II: Maternal medical, pregnancy and obstetrics related characteristics

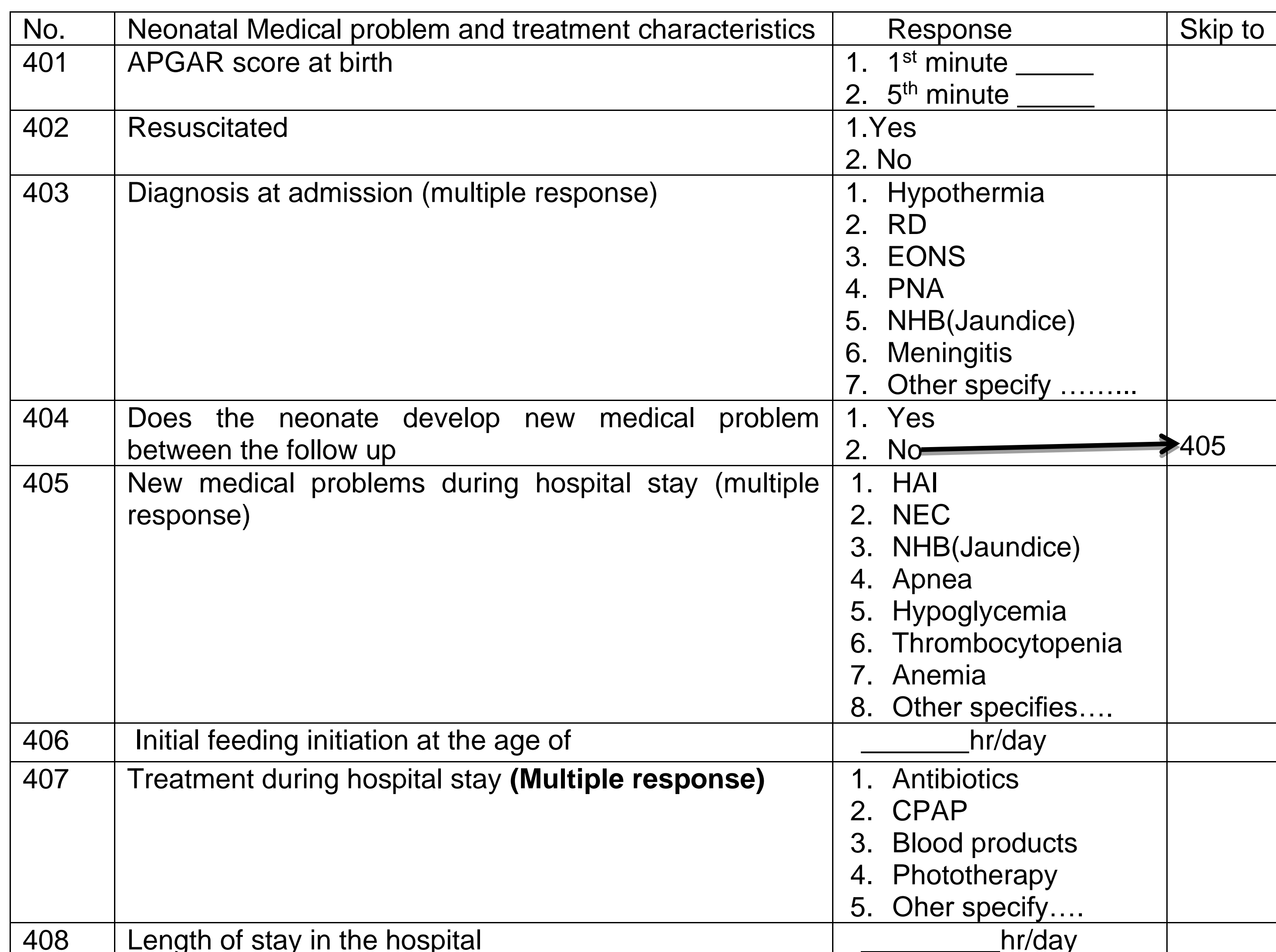
No	**Maternal medical and obstetrics characteristics**	**Response**	**Skip to**
201	ANC follow Up	1. No 2. ≥4x 3. <4X	
202	If yes, how many times?		
204	Parity		
205	Gravida		
206	History of Abortion	1.Yes 2. No	
207	History of still birth	1. Yes 2. No	
208	Type of pregnancy	1. Singleton → 2. Multiple	**210**

209	If the pregnancy is multiple	1. First baby 2. Second baby 3. Third baby 4. Fourth and above	
210	Steroid administration	1. Yes 2. No	
211	Intrapartum antibiotics	1. Given 2. Not given	
212	If yes how many times	_______________dose	
213	Mode of Delivery/delivery method/	1. SVD 2. Instrumental delivery 3. C/S	
214	Place of delivery	1. Institutional 2. Home 3. On the way to facility	
215	Risk of preterm birth	1. Known 2. Unknown →	217
216	If yes, risk of preterm birth (multiple response)	1.PPROM 2.APH 3.Preeclampsia/Eclamps i 4.Oligo/polyhydraminous 5.Chorioaminities/clinica 6.Other specify…..	
217	Does the mother diagnose with chronic disease	1. Yes 2. No →	301
218	If yes which one of the medical problems (multiple response)	1. HIV/AIDS 2. Diabetes 3. Hypertension 4. Anemia 5. Tuberculosis 6. Others specify ……..	

Part III: Preterm demographic related characteristics

	Preterm demographic characteristics	Response	Skip to
301	Sex	1. Male 2. Female	
302	Age at admission	___________hr/day	
303	Gestational age	____________Week	
304	Weight	____________ gram.	
305	Weight for gestational age	1. AGA 2. LGA 3. SGA	

Part IV: preterm medical problem and treatment related characteristics



No.	Neonatal Medical problem and treatment characteristics	Response	Skip to
401	APGAR score at birth	1. 1st minute _____ 2. 5th minute _____	
402	Resuscitated	1.Yes 2. No	
403	Diagnosis at admission (multiple response)	1. Hypothermia 2. RD 3. EONS 4. PNA 5. NHB(Jaundice) 6. Meningitis 7. Other specify ……..	
404	Does the neonate develop new medical problem between the follow up	1. Yes 2. No →	405
405	New medical problems during hospital stay (multiple response)	1. HAI 2. NEC 3. NHB(Jaundice) 4. Apnea 5. Hypoglycemia 6. Thrombocytopenia 7. Anemia 8. Other specifies….	
406	Initial feeding initiation at the age of	_______hr/day	
407	Treatment during hospital stay **(Multiple response)**	1. Antibiotics 2. CPAP 3. Blood products 4. Phototherapy 5. Oher specify….	
408	Length of stay in the hospital	_________hr/day	

Part V: preterm condition at discharge and Home

No.	**Discharge and after discharge characteristics**	Response	Skip to
501	Gestational Age		
502	Post-natal Age		
503	Weight		
504	KMC practice at home **(Phone calling)**	1. Yes 2. No	
505	Feeding type **(Phone calling)**	1. Exclusive breast milk 2. Formula Milk 3. Mixed	
506	Any traditional substance given to the neonates		

507	Duration of illness before death (**Phone calling)**		
508	Outcome of the neonate at up to 28 days of age	1. Alive → 2. Death	END!
509	If the neonate's outcome is died, died at the age of **(Calling)**		
510	Did the baby die suddenly **(Phone calling)**		
511	Place of death (**Phone calling)**	1. Home 2. Health Facility 3. On the way to health facility	