



INSTITUTE OF HEALTH
DEPARTMENT OF BIOMEDICAL SCIENCES, ANATOMY COURSE UNIT

**PREDICTORS OF ADMISSION TO NEONATAL INTENSIVE CARE UNITS AND
NEONATAL SURVIVAL IN HAWASSA, SOUTHERN ETHIOPIA: HOSPITAL-BASED
PROSPECTIVE COHORT STUDY.**

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JIMMA, ETHIOPIA

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ABSTRACT

Background: The neonatal period, the first 28 days of life, it is the most crucial time for Childs survival in which changes are very rapid and many critical events can occur. It the most vulnerable period; newborns face the highest risk of dying.

Objectives:The aim of this study was to assess the admission rate, to find out predictors to neonatal intensive care unit admission and neonatal survival.

Subjects and Methods: Hospital -based prospective cohort study was conducted from August 30 to October 30 2020 at HUCSH and AGH, Hawassa, southern Ethiopia, The samples were obtained by consiquetive sampling technique. The obtained datawere analyzed by using SPSS version 23, bivariate and multivariate analyses weredone to identify associations between dependent and independent variables. Kaplan Meier survival curve with log-rank test was fitted to test the survival time of the neonates. Cox regression analysis was used to identify potential predictors of neonatal survival.

Results - Response were obtained from 252 neonate’s mothers who deliver in the study hospitals. From the neonates under follow up 31 were admitted to neonatal intensive care units of the hospitals, this give admission rate to neonatal intensive care unit, among inborn neonates 12.3%. The cumulative survival rate of neonates was, 92.5%. Maternal chronic illness, ANC follow up, pregnancy related complications were identified as predictors for NICU admission .5th minute APGAR, duration of labour and pregnancy related complications were among predictors significantly associated with neonatal survival.

Conclusion: The admission rate to NICU was 12.3 %, cumulative survival rate was 92.5%. Maternal chronic illness, ANC follow up, pregnancy related complications were identified as predictors for NICU admission .5th minute APGAR, duration of labour and pregnancy related complications were among predictors significantly associated with neonatal survival.

Key words: “Neonates”, “Neonatal period”, “Neonatal intensive care” “Neonatal Mortality” &“Survival”.

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ACRONYMS

| | |
|--------|---|
| AGH | Adare General Hospital |
| ANC | Antenatal care |
| APH | Ante partum hemorrhage |
| CHD | Congenital heart disease |
| CS | Caesarian section |
| EDHS | Ethiopian demographic health survey |
| ECG | Electro cardiograph |
| ELBW | Extremely low birth weight |
| ENMR | Early neonatal mortality rate |
| HUCSH | Hawassa University Comprehensive Specialized hospital |
| ETB | Ethiopian Birr |
| HMD | Hyaline Membrane Disease |
| LBW | Low birth weight |
| LUCS | Lower Uterine Caesarian Section |
| NICU | Neonatal intensive care unit |
| NMR | Neonatal mortality rate |
| RVI | Retro viral infection |
| RDS | Respiratory Distress Syndrome |
| SPSS | Statically package for social science |
| SVD | Spontaneous vaginal delivery |
| PROM | Pre mature rupture of membrane |
| UNICEF | United nation children fund |
| WHO | World Health Organization |

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CHAPTER1. INTRODUCTION

1.1 Background

The neonatal period, the first 28 days of life, it is further divided in to early neonatal and late neonatal period, which is up to 7th day and 7th - 28thday respectively. Neonatal period is the most crucial time for Childs survival (*Ravi et al., 2012*).It is the first four weeks of a child's life in which changes are very rapid and many critical events can occur (*Nelson, 2016*).It is the most vulnerable period; neonates face the highest risk of dying in their first day.In 2018, average global neonatal mortality rate was 18 deaths per 1000 live birth(*UNICEF, 2019*). The health of future societies depends on the health of the children of today and their mothers (*Save the children, 2012*). Childbirth is an occasion for joy and celebration. However, there is a threat of serious illness or death of a newborn and it places serious responsibilities on health care providers to respond appropriately and with effective therapy (*Lawn JE & Zupan J, 2005*). Globally over, millions newborn babies die in the first month of life, 99% of those deaths found in low and middle-income countries every year (*Lawn et al., 2016*). Neonatal mortality is the death of neonates that happens within the first 28th day of life. It is also divided into early neonatal mortality which is before the seventh day of life and late neonatal mortality which is occurring then(*Ravi , Yadav K, & Yadav, 2012*).

Most of the neonates died in their early neonatal period, this periodis highly vulnerable time for the neonate who is completing many of the physiological adjustments required for extra uterine existence.Almost two-third of infant deaths occur in the first month of life, among these, more than two- thirds die in their first week and of those also, two- thirds die in their first 24 hours(*Onasoga, Oluwastosin, & Ojo, 2012*).Two - thirds of the neonatal mortality occurs in ten countries of the world, most of which are from Asia and Africa, Children are still dying of diseases which could have been prevented and/or treated easily with low- cost and effective interventions (*UNICEF, 2015*).

Newborn babies who need intensive medical care often put in special care in hospital called neonatal intensive care unit (NICU), NICU has advanced technology and trained health care professionals. NICU provides the Intensive Care, Incubation, Resuscitation, and Ventilation; exchange Transfusion, Phototherapy, Ultrasonography, ECG, Echo, and Diagnostic Laboratory service (*National perinatal information center, 2017*). Neonatal Intensive Care Units (NICU) has a role in especially in developing countries although it is among the more expensive services that any health care facility can't afford and provide (*Black man, 2001*). Establishment of neonatal intensive care unit can result in reduction of morbidity and mortality of new borns especially those delivered in the health facility (*Prinja et al., 2013*).

1.2 Statement of the problem

Although neonatal death is a global burden, it is the highest in Sub Sahara African countries such as Ethiopia (*WHO, 2016*). The first 4 weeks of life after birth (neonatal period) carries one of the highest risks of death in human lifespan. The majority of problems during the early neonatal period are causally related with the fetal life or the birth process; while most problems during late neonatal life are acquired (*Sajjad, 2012*). There has been a global decline in under-five and infant mortality rates recently; however, the neonatal mortality rate remained relatively unchanged (*Alkema & New, 2013*). Neonatal morbidity and mortality is a reflection of socioeconomic status of a society. Improved neonatal survival requires not only care before, during and after pregnancy; but also wider issues of socioeconomic development including reduction in poverty and increased maternal education (*Lawn JE & Zupan J, 2005*). Neonatal mortality is a reflection of countries state of health, especially obstetric care. In countries with poor obstetric care, inadequate or unsupervised deliveries, neonatal mortality will remain high (*Ugwu et al., 2016*). Africa accounts for 11 percent of the world's population but more than 25 percent of the world's newborn deaths recorded in this continent. Of the 20 countries in the world with the highest risk of neonatal death, 15 (75 %) are in found Africa (*Joy, Pyandes & Simon, 2010*). Neonates in Sub-Saharan Africa have the highest risk of death in the first month of life and Sub-Saharan Africa is among regions showing the least progress in reduction of neonatal death. Ethiopia continues to have one of the highest rates of neonatal deaths in Africa (*Nelson, 2016*). Ethiopia is one of the top five countries contributing more than half of

the neonatal deaths globally (*UNICEF, 2017*).According to EDHS Report 2019, the overall neonatal death in Ethiopia was 29.1/1000 live births(*EDHS, 2019*).

1.3. Significance of the study

Evaluating the causes of neonatal morbidity and mortality at facility level is an essential step toward improving the quality of existing health care practices, because nowadays most of deliveries are attended in health facilities. Generally, newborns are highly fragile, whose life and death can be determined by embryonic, intra partum and post-partum factors, so identifying the causes is the first step to be taken in order to decrease the death of neonates, the present study aim was in finding neonatal, maternal and obstetric factors that predict Admission to NICU and affecting the neonates survival and to predict the prognosis of neonates admitted to NICU. This study aimed to describe the characteristics of the neonates delivered, the magnitude of neonatal survival status and to assess predictors of admission and neonatal survival at Hawassa University comprehensive specialized hospital and Adare general hospital. Generally this study associate survival of neonates in NICU with indication for admission, route of delivery, maternal and gestational age and other maternal and neonatal factors in order to add effort on decreasing neonatal mortality. Conducting this study on the study area will help anyone who is working with neonate to

- Associate the neonatal, maternal and obstetric factors with NICU admission and survival of neonates.
- Predict the prognosis of neonates who are going to be admitted in NICU
- Identify warning signs that leads neonates to death.
- It would also serve as a stepping stone on which further studies could be planned.

This would have an important input in identifying cause of admission, and, identifying risk factor for death and overall outcomes of neonatal admissions. It may help in planning to improve neonatal care and services.

CHAPTER 2 .LITERATURE REVIEW

2.1. Neonatal survival status and causes of neonatal death

A retrospective descriptive study was done in a Tertiary Care Hospital of Coastal South India, two year data of all neonatal admissions (between 1st January 2015 and 31st December 2016) from NICU of a university teaching hospital were included, Overall survival rate of neonates who are admitted to NICU of Tertiary Care Hospital was 94.1% (*Knnan et al.,2016*). On another study conducted in Neonatal Intensive Care Unit (NICU) of a Tertiary Care Hospital in Dhaka, Bangladesh between January 2017 to December 2018, analysis of outcome showed that out of 262 neonates, 206 cases (78.6%) were improved and discharged to home (survived). The leading cause of death were prematurity (60%), followed by birth asphyxia (30%) and sepsis (10%)(*GTajkia et al.,2018*). Similar study was performed at NICU of Cairo University Children's Hospital during the period from April 2003 to October 2004, the overall mortality rate was 29.1% (240 deaths), having survival rate 71.9 % (Iman et al., 2004). On study done in a Tertiary Center, Lagos, Nigeria, over a period of one year from May 2016 to June 2017, neonatal mortality was 12.5%, meaning the survival rate of neonates who are admitted to NICU were 87.5% (*Akintan et al., 2019*). A finding from Sheik Hassan Yabare Referral Hospital, Jijjiga East Ethiopia, from August 1 to August 30, 2019, reveals that, overall survival rate of neonates admitted to the NICU was 79.5 %.(*Mohamed et al., 2019*). On prospective cohort study conducted in Survival and predictors of early neonatal death in neonatal intensive care unit of Mekelle general and Ayder comprehensive specialized hospitals, Northern Ethiopia in 2018, the cumulative survival rate of neonates at the end of the follow up was 86.96 % (95%CI: 0.8197, 0.9065).(*Abraham, Haftom, & Letekirstos, 2018*).

Institution-based retrospective cohort study was also conducted to assess the survival status and predictors of Neonatal mortality among Neonates who admitted in Neonatal Intensive care unit in Arba Minch General Hospital, the study revealed that 232(69.88%) of neonates were alive or Discharged with recovery, 67 (20.18%) died.(*Dessu, Gebremeskel, , & Seman, 2018*).

2.2 Predictors of admission and neonatal Survival

2.2.1 Socio demographic factors

On a retrospective study conducted at the Department of Pediatrics and Adolescent Medicine, BPKIHS Dharan, Nepal in 2014, there were 67.29% males and 32.8% were females. Number of babies admitted on the first day of life was 561 (55.5%) (Kanodia, Yadav, & Singh, 2015). On a study conducted in Egypt to assess the Predictors of Neonatal Mortality in Intensive Care Unit in Children's Hospital, Cairo University out of 826 neonates, 324 were females (39.2%) and 502 were males (60.8%). Sex was not a significant predictor of neonatal deaths on multivariate analysis (p value = 0.568) (Iman et al., 2004). On a study conducted to assess Predictive factors of neonatal mortality in intensive neonatal care unit at Goma Eastern Democratic Republic of Congo during the study period, among 923 newborns admitted in the neonatology unit; 183 newborns died; 107 (58.5%) of them were females and 76 (41.5%) males (Mashako, Ngbonda, & Alworong, 2013).

On a study conducted in Jimma University Specialized Hospital Pediatrics Neonatal Ward: Neonates Admitted in A One Year from Jan 2012 to Dec 2012, Background characteristics of the neonates, 135 (60%) were males with a male to female ratio 1.6:1 (Habtamu, Netsanet, & Eshetu, 2012). On a prospective study conducted to assess the reasons for admission and neonatal outcome in the neonatal care unit of a tertiary care hospital in Addis Ababa: 132 (61.1%) were male and the rest 38.9% were female. One hundred fourteen (52.8%) were admitted within the first hour of age. (Atnafu, Gesit, & Yemisirach, 2015).

2.2.2 Neonatal factors

On a study conducted in Neonatal Intensive Care Unit (NICU) of a Tertiary Care Hospital in Dhaka, Bangladesh, among the neonates under follow up more than half, 52.7% were preterm. Regarding the birth weight of these babies, 56.2% babies were low birth weight (<2500 gm.) (GTajkia et al., 2018). Similar study was also conducted at the Department of Pediatrics and Adolescent Medicine, BPKIHS Dharan, Nepal in 2014, Majority of the babies ($n=715$; 70.8%) were term, 294 (29.1%) were preterm (Kanodia, Yadav, Bhatta, & Singh, 2015). In Tertiary Care Hospital of Coastal South India study was conducted from January 2015 to December

2016, showed that Admission rates among inborn neonates were 2.9%, regarding birth weight 1596 (44.1%) neonates weighed 2500 g or above, 44% were low birth weight, (Knnan et al., 2016). In this similar study on comparing survival among different birth weight groups it was seen that there was statistically significant difference between VLBW and normal birth weight group ($P \leq 0.05$), and between ELBW and normal birth weight group ($P \leq 0.05$) (Sridhar, Thammanna, & Sandeep, 2015). On study conducted in Egypt Cairo of the followed neonates 262 (32%) were preterm, the mean age of the studied neonates was 7.05 ± 7.91 days. Weight ranged between 630 and 5000 g with a mean \pm SD of 2480 ± 800 g. Overall, the most prevalent indications of admission to NICU were neonatal jaundice ($n=296$ [35.8%]), infection ($n=186$ [22.5%]), prematurity ($n=162$ [19.6%]) (Iman et al., 2004).

Similarly the finding from Asmera showed that there was a significant association between low gestational age (<37 weeks), LBW (<2500 g) and mortality ($P < 0.001$). A significant inverse association was detected between Apgar score and neonatal mortality ($P < 0.001$) (Amanuel et al., 2016). On study done in 2019 to assess Prevalence and Causes of Neonatal Mortality among Neonates Admitted in Neonatal Intensive Care Unit at Sultan Hassan Yabare Referral Hospital, East Ethiopia, Around one third 124 (32.2%) of the neonate's birth weight were less than 2500g and 131 (34.0%) were preterm neonates and among all neonate's 64 (16.6%) of them were Twins (Mohamed et al., 2019). On prospective cohort study conducted in Survival and predictors of early neonatal death in neonatal intensive care unit of Mekelle general and Ayder comprehensive specialized hospitals, Northern Ethiopia in 2018, the study's multivariable analysis revealed that a neonate born with very low birth weight (1000–1499g) had 3 times higher hazard of neonatal death compare to neonates born with normal birth weight (2500–3500 g.) (AHR: 3.02, 95% CI: 1.11, 8.25). (Abraham, Haftom, & Letekirstos, 2018).

On a study done in neonatal care unit of a tertiary care hospital in Addis Ababa, One hundred nine (50.5%) weighed 2,500 g. Only five (2.3%) neonates weighed 1,000 g during admission. Thirty-six (72%) of the 50 neonates, who died had admission weight, 2,500 g. First-minute and fifth-minute Apgar scores were ,7 for 79.5% and 56.8% of the deaths, respectively, first-minute Apgar score ,7 ($P=0.000$), fifth minute Apgar score ,7 ($P=0.000$) (Atnafu, Gesit, & Yemisirach, 2015). On study conducted in Neonatal Intensive Care Unit at Arba Minch General Hospital, Southern Ethiopia to assess Survival Status and Predictors of Neonatal Mortality among

Neonates Who were admitted, regarding neonatal factors from the total client charts reviewed, 281 (84.6%) of neonates the 5th minute APGAR score were measured and also the score ranges from 3-10 with a mean score of 6.8+1.3. The birth weight at admission was ranged from 785-5200 g with a mean weight of 2634+874 g(*Dessu et al., 2018*).

2.2.3 Obstetric factors

There were study on Neonatal Intensive Care Unit (NICU) of a Tertiary Care Hospital in Dhaka, Bangladesh the mode of delivery was mostly lower uterine caesarean section (LUCS) 206 (78.6%), normal vaginal delivery (SVD) was 52(20%) and instrumental delivery 4(1.4%) (*GTajkia et al , 2018*).On study conducted aim to assess neonatal mortality and associated factors in the specialized neonatal care unit Asmara, Eritrea 96 % of mothers of neonates had visited antenatal care during their pregnancy (*Amanuel et al 2016*).

In One study done in 2019 to assess Prevalence and Causes of neonatal mortality among neonates Admitted in Neonatal Intensive Care Unit at Sultan Hassan Yabare Referral Hospital, East Ethiopia About Mode of delivery 306 (79.5%) delivered vaginally followed by 73 (19%) delivered by cesarean section (*Mohamed et al., 2019*).On a prospective study conducted to assess the reasons for admission and neonatal outcome in the neonatal care unit of a tertiary care hospital in Addis Ababa regarding modes of delivery were spontaneous vaginal delivery (55.6%), cesarean section (38.4%), and operative vaginal delivery (6%) (*Atnafu, Gesit, & Yemisirach, 2015*).

The main complications observed were preeclampsia (25%) and chorioamnionitis (30.4%).The mothers of 92.0% of the neonates who died received ANC, and the number of ANC visit was,4 for 80.4% of the deaths Bivariate analysis showed that absence of ANC has significant association with neonatal survival (P=0.026)(*Atnafu, Gesit, & Yemisirach, 2015*).On study in Neonatal Intensive Care Unit at Arba Minch General Hospitalregarding Maternal and obstetric related factors, three hundred Eight (92.8%) of the mothers had ANC follow up. One hundred Eighty-one (54.5%) have the previous history of pregnancy (*Dessu et al., 2018*). From the total delivery 284 (85.5%) have spontaneous labor, Among them, the maximum duration of labor was 50 hours and the minimum duration was 1 hour with a mean of 12.3+7.5 hours.

2.2.4 Maternal factors

A data from a study aim to assess Predictive factors of neonatal mortality in intensive neonatal care unit at Goma Eastern Democratic Republic of Congo Maternal age, less than 18 and more than 35 years OR=9.65 (5.34-17.04), and number of prenatal consultation<4 OR=9.59 (6.38-14.42), marital status not married OR=3.38 [2.13-5.37] are real determinants of neonatal deaths (*Mashako, Ngbonda, & Alworong, 2013*).According to a study in Libya, at MisurataTeaching Hospital regarding the presence of maternal risk factors associated with neonatal death, there are higher neonatal deaths among neonates born to mothers with ante partum hemorrhage and diabetic mothers (10% and 8%) respectively (*Alburke, Ashur, & Assadi , 2015*).On a prospective study conducted to assess the reasons for admission and neonatal outcome in the neonatal care unit of a tertiary care hospital in AddisAbaba on maternal conditions, one hundred nine (50.5%) mothers were younger than 25 years. Antenatal human immunodeficiency virus (HIV) testing was done in 107 (49.5%) mothers, five (4.7%) of them were positive for HIV antibodies (*Atnafu, Gesit, & Yemisirach, 2015*).

2.3 Conceptual Framework

After reviewing a number of literature evidences, [(Dessu et al., 2018), (Abraham, Haftom, & Letekirstos, 2018), (Iman et al., 2004), BPKIHS Dharan, Nepal in 2014,]the factors contributing to NICU admission and neonatal survival and their inter-relations were conceptualized as shown in Figure 1 below

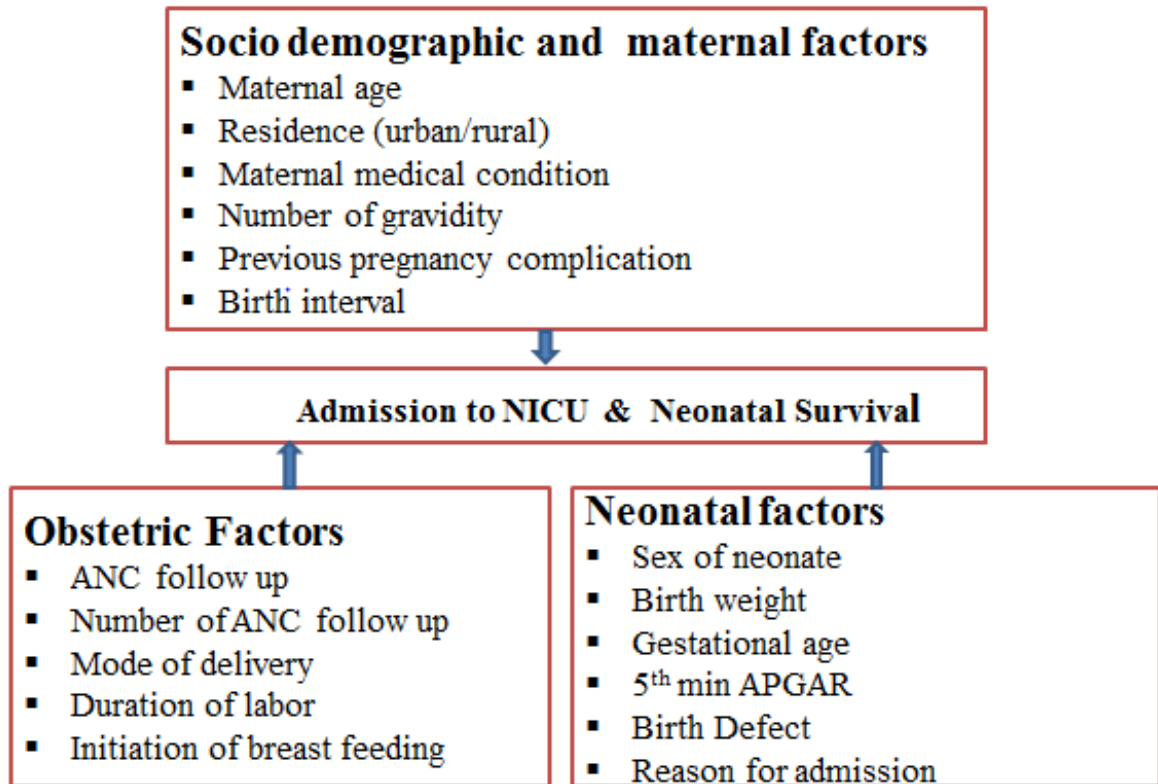


Figure 1- Conceptual Framework showing potential factors contributing for admission to NICU and neonatal survival

CHAPTER 3 . OBJECTIVES

3.1.General objective

- To assess the predictors of admission to neonatal intensive care units and survival of neonates in Hawassa University comprehensive Specialized hospital and Adare general Hospital, Hawassa, Ethiopia, 2020

3.2. Specific objectives

- To evaluate admission rate (proportion of newborn infants admitted) among inborn neonates to neonatal intensive care units (NICUs)
- To identify predictors of admission to Neonatal intensive care unit
- To assess survival status of neonates at the study hospitals
- To identify predictors of neonatal survival at the study hospitals

CHAPTER –4 . METHODS

4.1. Study area and period

The study was conducted at Hawassa University Comprehensive Specialized hospital and Adare General Hospital at Hawassa. Hawassa town is the capital of the southern nation nationalities and peoples region (SNNPR), located 273 km south of Addis Ababa. Hawassa University Comprehensive Specialized hospital (HUCSH) is one of referral hospitals in the region serving as teaching, training and healthcare facility since its establishment in 2004. According to 2017 report of the town health office, the hospital serves about 18 million populations in SNNPR and referral patients from neighboring regions. According to the data obtained from obstetric department, HUCSH provides obstetrics service by 9 gynecologist and obstetrician, 54 midwives, 6 pediatric nurses in Gyn/Obs ward.

The neonatal intensive care unit has four separate rooms including kangaroo mother care giving room, a total of 20 beds found in the unit. Resuscitation, Phototherapy (for neonatal jaundice) Ultrasonography ,ECG and Diagnostic Laboratory service are among services given by neonatal intensive care unit and Adare general hospital (AGH) is the second study area. According to 2017, report of the Hawassa town health office, AGH serves 350,000 population. The data obtained from the obstetrics department showed that, AGH provides the service by 15 midwives 3 nurses, 2 public health officers and 2 obstetrician and gynecologists. In Gyn/Obs ward, the neonatal intensive care unit give the service with 3 rooms including kangaroo mother care room, the NICU has 10 beds, serving at the time of data collection. Data was collected from August 30 to October 30, 2020.

4.2. Study design

An institution based prospective cohort study was conducted from August 30 to October 30, 2020 at HUCSH and AGH.

4.3. Population

4.3.1. Source Population

All live births at the two study hospitals were the source population.

4.3.2. Study population

All live births delivered in Hawassa University Comprehensive Specialized and Adare general hospitals from August 30 to October 30, 2020.

4.3.3. Study subjects

Neonate who is delivered in the study area, during the study period, who fulfill the inclusion criteria

4.4. Participants' Eligibility

4.4.1 Inclusion criteria

- All live births in the study period whose mother signed informed consent.
- All neonates with known gestational age

4.4.2 Exclusion criteria

- Stillbirths
- Neonates, whose parents become against medical advice and leave hospitals
- Neonates for whom gestational age is unavailable
- Unaccompanied neonates (mother not available(died))

4.5. Sample size determination and Sampling technique

4.5.1. Sample size determination

The maximum sample size was calculated using double population proportion formula taking in to account the following assumptions:

- 2-sided confidence level at 95%
- Standard margin of error (power of 80%)
- Gestational age as a parameter and 10% for non- respondent
- Using version 7 Epi-info Stat Calc data for cohort study. (www.openEpi.com updated accessed @ 2020/07/18).

- The proportions of unexposed (term neonates) & exposed to death (pre-term neonates) are taken as 0.5968 & 0.4032 respectively (Abraham, Haftom, & Letekirstos, 2018), which give maximum sample size. Accordingly, a total of 256 neonates were included in the study and followed until the intended outcome was seen.

4.5.2 Sampling technique

Consecutive sampling technique were employed in which, neonates that are delivered in the study area during the study period and fulfill the inclusion criteria were included until the required sample size is obtained. Hawassa University Comprehensive Specialized hospital (HUCSH) and Adare General Hospital (AGH) was selected purposively because these two hospitals are the only public hospitals in the town that provide comprehensive essential obstetric care that have neonatal intensive care unit. The samples were taken from the two hospitals by proportional allocation, according to average number of deliveries in the study area in the previous three months before data collection, 210 and 140 deliveries were the average delivery within one month in HUCSH and AGH respectively. Based to this, 60% of the sample was taken from HUCSH and the rest 40% was from AGH, accordingly 153 and 103 neonates who fulfill the inclusion criteria and whose mothers signed the informed consent was taken from HUCSH and AGH, respectively and the neonates was followed until outcome is seen/discharged.

4.6. Data collection procedures and Tools

Data was collected using semi structured checklist which was prepared by the investigator depending on the literature reviewed and adapted to this study. Six data collectors (3 in each hospital, 1 for each shift) and two supervisors (1 for each hospital) were trained for one day on objectives of the study, selection of study participants, how to keep confidentiality of information, the contents of the questionnaire, how to fill the data collection format and data quality management by the principal investigator. Pre-test was performed on 5% (13 neonates) of the sample population in similar setting, at Yirgalem General Hospital, situated in Yirgalem town which is located at 317 km south of Addis Ababa and 47 km from Hawassa. Additional variables were considered and added to the questioner after performing the pre-test.

Data collection instruments included information sheet [Annex-1], consent form [Annex-2] and checklists [Annex-3] prepared specifically for this study by the principal investigator after reviewing similar study reports in literature. All instruments were prepared in English and then translated to a local language, Amharic.

4.7. Study Variables

4.7.1. Dependent variables

- Admission to Neonatal intensive care unit
- Neonatal Survival

4.7.2. Independent variables

Socio demographic and other maternal factors

- Maternal age
- Residence (urban/rural)
- Educational level
- Maternal medical condition
- Maternal Gravidity
- Previous pregnancy related complication

Obstetric Factors

- ANC follow up status
- Number of ANC follow up
- Current Pregnancy complication
- Mode of delivery
- Duration of labor
- Initiation of breast feeding
- Type of pregnancy (single tone/ multiple pregnancy)

Neonatal factors

- Sex of neonate
- Birth weight
- Gestational age
- 5th min APGAR

- Birth Defect
- Indication for admission (if admitted)

4.8. Definition of terms and Operational Definitions

- Gestational age is determined by calculating from the last normal menses to the day of delivery in weeks or clinically estimated.
- Term: newborn is delivered at 37+ completed weeks.
- Preterm: new born is delivered in < 37 weeks.
- Post term: new born is delivered in > 40 weeks.
- Low birthweight: birth weight is 1500- 2500 g
- Very low birth weight : new born is delivered 1000- 1500 g
- Extremely low birth weight: new born is delivered .< 1000g
- Normal birth weight : new born is delivered in 2500-4000g
- Macrosomia: if new born is delivered in >4000 g.
- Survived neonate is a neonate discharged from the hospital alive.
- Prolonged labor.- A labor lasts more than 12 hour, after rupture of membrane.

4.9. Data processing and analysis

The questioners obtained from two study areas were coded as ‘‘AGH 1’’ to ‘‘AGH 103’’ for data obtained from neonates from Adare general hospital and ‘‘HUCSH 104’’ to ‘‘HUCSH 256’’ were for neonatal information from HUCSH and entered separately on Epi info version 7. Data analysis was done using SPSS version 23 statistical software packages by merging data from the two study areas. Then exploratory data analysis was carried out to check the levels of missing values, Categorical and discrete variables were described as frequency and percentage (%). Continuous variables were described as Means, \pm Standard deviation (SD). Differences was considered to be of statistical significance at an error probability of less than 0.05 ($P < 0.05$) with a confidence interval of 95 %. Bivariate and multivariate analysis were done to identify associations between dependent and independent variables. Crude odds ratio and adjusted odds ratio, 95% CI and p-value were used to assess the strength of association and statistical significance. Kaplan Meier survival curve together with log-rank test was fitted to

test the survival time of the neonates. Cox regression analysis was used to identify potential predictors of admission to neonatal intensive care unit and survival. Crude hazard ratio and adjusted hazard ratio, 95% CI and p-value were used to assess the strength of association and statistical significance. Kaplan Meier survival curve was used to estimate survival time of the neonates and for comparison of survival among two groups.

4.10. Data quality management

The data collection was done by the principal investigator and trained health professionals in delivery ward and NICU, filled questioners were checked every day by the principal investigator for its completeness. Problems facing was discussed over night with data collectors. Data was checked again for its completeness before running and entered using Epi info version 7 then exported to SPSS version 23 for analysis.

4.11. Ethical consideration

The research was conducted in accordance with institutional review board of Research and Post graduate Coordination office of Health Institute Jimma University, Jimma, Ethiopia ethical clearance letter [Annex-6]. Official letter was written to the Hawassa University comprehensive Specialized and Adare general Hospital from Biomedical department [Annex5A-D]. Informed consent was obtained from the participants before running the questionnaire [Annex 2]. All the principles of ethics such as informed consent, confidentiality, and privacy was kept. The obtained data was used only for the purpose of this research and all study participants read and sign on the informed consent. For Illiterate study participants, the data collector read and takes the sign or thump impression when they agree to participate in the study. Possible COVID 19 prevention was considered during data collection: the data collectors and participants wear face mask during data collection, physical distancing was kept between participants and data collectors during interviewing.

4.12. Dissemination plan

The finding of the study will be presented in the form of Thesis to Jimma University, Institute of Health, College of Medical Sciences, and Department of Biomedical Sciences as partial fulfillment of the requirements for MSc in clinical anatomy. Findings will also be disseminated to HawassaUniversity Comprehensive and Specialized hospital and Adare General Hospital and Jimma University health library in both electronic and hard cover print copies. Publishing of the study findings in peer reviewed journals and presentation at scientific meetings is also planned.

CHAPTER 5 . RESULTS

The data was collected from August 30 to October 30, 2020. Four hundred sixteen deliveries were registered from both hospitals in the study period. For this study responses were obtained from 252 neonate's mothers deliver in the study hospitals, 152 were from Hawassa University comprehensive and specialized hospital and 100 were from Adare general hospitals, and was followed up to the time of discharge or death, mothers of 2 neonates were against medical advice and 2 neonates withdrew from the follow up which gives the response rate for this study 98.1%.

5.1. Sociodemographic characteristics

Of those deliveries in this study, 249 (98.8 %) were single tone delivery while the rest 3 (1.2 %) were twin delivery. From the neonates included in this study, 130 (51.6%) were female and 122 (48.4%) were male, with male to female ratio 1:1.06. Regarding the residence of mothers 226 (89.7%) were urban while the remaining 26 (10.3%) were rural. Two hundred thirty nine (95.6%) of mothers reported they are married, while 11 (4.3%) and 2 (0.79%) were single and widowed respectively. About one -third (32.5%) of the studied mothers reported that they had attended up to secondary school, 76 (30.2%) of mothers reported that they had completed primary school and another 66 (26.2%) of mothers educational status were diploma and above, the remaining 11.1% reported not attend formal education any more.

5.2. Maternal and Obstetric factors

Regarding maternal age 17 and 40 years were the minimum and the maximum age, respectively. Two hundred thirty nine (94.8%) mothers were less than 35 years, while Thirteen (5.2%) were 35 years and above. while mean age was 26.05 ± 5.5 years. The Age distribution of the mothers under the study will be summarized the figure below (Figure 2).

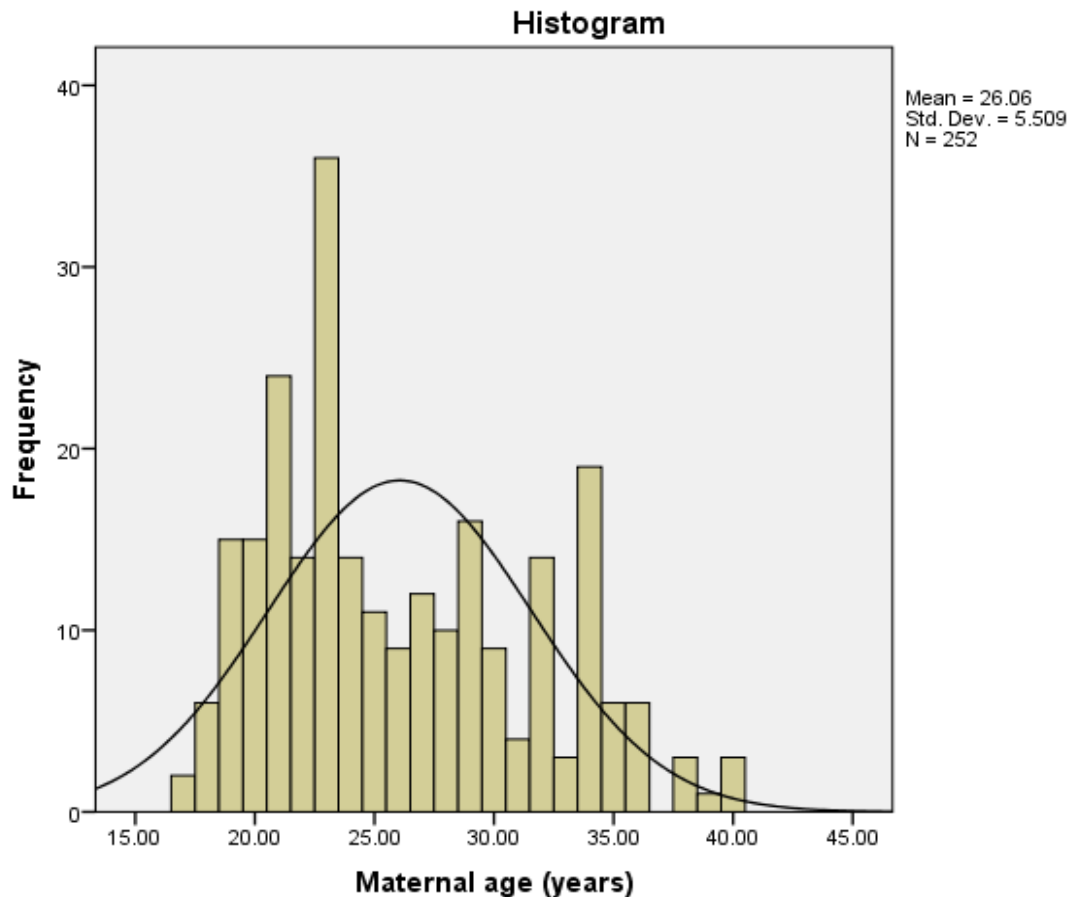


Figure 2-Age Distribution of neonates' mothers in HUCSH and AGH , Hawassa,Ethiopia 2020

Regarding the gravidity of the mothers the majority of mothers 169 (67.1%) were multigravidae, while, 83 (32.9%) were primigravida, the median gravidity were 2. With the maximum and minimum gravidity 7 and 1, respectively. From multigravida mother 20(11.9 %) had diagnosed complication in their previous pregnancy, of those complications APH and Abortion rank the first (50%) and second (30%). From the participant mothers 17 (6.7%) had known (diagnosed) chronic illness of those 8 had diabetes mellitus , 7 hypertension and the remaining 2 had RVI as shown in the following table, which include the distribution of maternal and obstetric factors among neonates under follow up (Table-1).

Table 1- Maternal and obstetric factors distribution among neonates in HUCSH and AGH, Hawassa, Ethiopia, 2020

| Variables(n=252) | Categories | Frequency | Percentage (%) |
|--|--------------------------------|------------------|-----------------------|
| Maternal age | <35years years | 239 | 94.8 |
| | 35 and > 35 years | 13 | 5.2 |
| Maternal chronic illness | Yes | 17 | 6.7 |
| | No | 235 | 93.3 |
| Type of chronic illness (n= 17) | Hypertension | 8 | 47.05 |
| | DM | 7 | 41.17 |
| | RVI | 2 | 11.76 |
| ANC follow up status | Yes | 230 | 91.3 |
| | No | 22 | 8.7 |
| Number of ANC follow up (N =230) | Once | 12 | 5.3 |
| | Twice | 48 | 21.5 |
| | Three times | 65 | 28.9 |
| | Four times and above | 105 | 44.3 |
| Diagnosed complication (N =230) | yes | 18 | 7.7 |
| | No | 212 | 92.18 |
| Type of complication (N= 18) | APH | 6 | 33.33 |
| | PROM | 7 | 38.88 |
| | preeclampsia | 3 | 16.66 |
| | Eclampsia | 1 | 5.5 |
| Route of delivery | SVD | 173 | 68.7 |
| | CS | 64 | 25.4 |
| | Instrumental assisted delivery | 15 | 6.0 |
| Initiation of breast feeding | yes | 237 | 94.0 |
| | No | 15 | 6.0 |
| Time of breast feeding initiation (n=237) | Within 1 hour | 199 | 84.0 |
| | After 1 hour | 38 | 16.0 |
| Duration of labor | < 12 hour | 231 | 91.7 |
| | 12 hour and above | 21 | 8.3 |

Legend: SVD- spontaneous vaginal delivery CS- caesarian section ANC- antenatal care, DM Diabetes mellitus, RVI- Retro viral infection, APH-Antepartal hemorrhage, PROM- premature rupture of membrane

From the total participants, 230 (91.3%) had ANC follow up on the current pregnancy, while 22 (8.7%) had no ANC follow up anymore. Of those ANC attendants, the majority 101(44.3%) had ANC follow up for four times or above, and 12 (4.8%) had ANC follow up once, From participants, who had ANC follow up 18 (7.7%) had diagnosed pregnancy related complication on theirlast pregnancy, Of those PROM and APH were the leading complications, 7 (36.8%) and 6 (31.6%), respectively.Regarding the duration of labour on the current delivery, minimum duration was 2 hours while 24 hours were the maximum, 7.61 \pm 3.59 hour was the mean duration of labour. From the participant mothers 231 (91.3%) had labour duration less than 12 hours, while 21 (8.7%) had prolonged labour (> 12 hours), it is summarized in the above table (Table 1) .The majority of mothers 173 (68.1%) deliver their baby through spontaneous vaginal delivery, followed by caesarian section and instrumental (vacuum) delivery, 64 (25.4%) and 15 (6.0%), respectively. Regarding breast feeding initiation 237 (94.0%) initiated breast feeding, of them 199 (84.0%) initiated breast feeding with 1 hour.

5.3. Neonatal characteristics

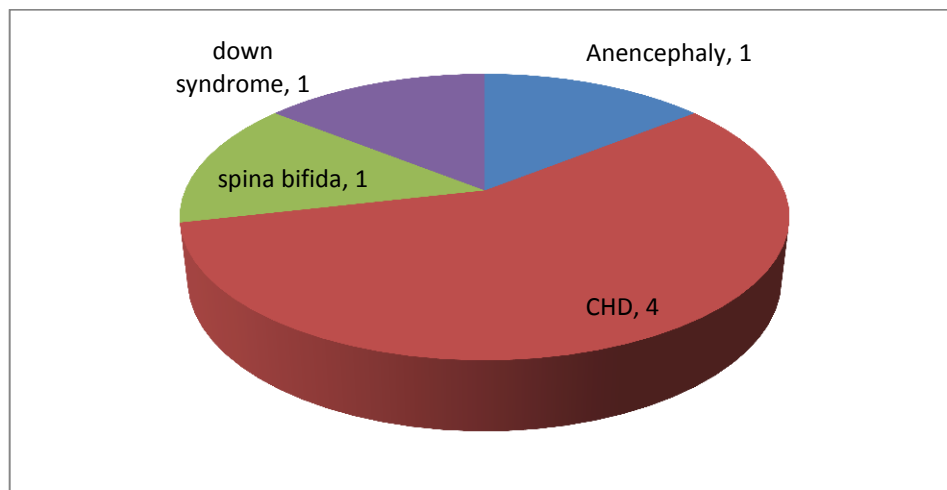
Regarding the Birth weight of the neonates under follow up the minimum weight was 990g and 4300g was the maximum, 3144 \pm 500g were the mean birth weight, 212 (84.1%) of neonates under follow up had normal birth weight (2500-4000), 22 (8.7%) had low birth weight (1500 – 2500g) , followed by macrosomia (>4000g), very low birth weight(1000-1500g) and extremely low birth weight(<1000g),15 (6.0%), 2 (0.8%) and 1(0.4%), respectively. The minimum gestational age of neonates under follow up was 30 weeks, while 42 week was the maximum. The mean and median gestational ages were 37.32 \pm 1.81 and 37.0 weeks respectively. 198 (78.6%) of neonates included in this study were term neonates, succeeded by preterm 49 (19.4%) and post term 5 (2.0%). Regarding 5th minute APGAR scores of neonates delivered in the study period 216 (85.7%) had greater than five, while the rest 36 (14.3%) had Apgarscore less than five; the main characteristics of neonates under follow-up were shown and summarized in table 2.

Table 2- Distribution of neonatal factors among neonates under follow -up in HUCSH and AGH, Hawassa, Ethiopia, 2020

| Variables(n=252) | Categories | Frequency(n) | Percent (%) |
|------------------------------------|---------------------|--------------|-------------|
| Sex of neonate | Male | 122 | 48.4 |
| | Female | 130 | 51.6 |
| Birth weight | ELBW (<1Kg) | 1 | 0.4 |
| | VLBW (1kg-1.5 kg) | 2 | 0.8 |
| | LBW (1.5 – 2.5) | 22 | 8.7 |
| | NBW (2.5 – 4 kg) | 212 | 84.1 |
| | Macrosomia (> 4 kg) | 15 | 6.0 |
| Gestational age | Pre term | 49 | 19.4 |
| | Term | 198 | 78.6 |
| | Post term | 5 | 2.0 |
| 5 th minute APGAR score | Less than 5 | 39 | 15.5 |
| | Greater than 5 | 213 | 84.5 |
| Congenital defect | Yes | 7 | 2.8 |
| | No | 245 | 97.2 |

Legend: NBW- Normal birth weight, LBW – Low birth weight, VLBW – Very low birth weight, ELBW- Extremely low birth weight

From neonates followed in this study 245 (97.2 %) neonates had no congenital anomaly, while, 7 (2.8%) had congenital anomalies, of those Congenital heart disease (CHD) accounts 4 more than half (57.1%).



Legend:CHD - congenital heart disease

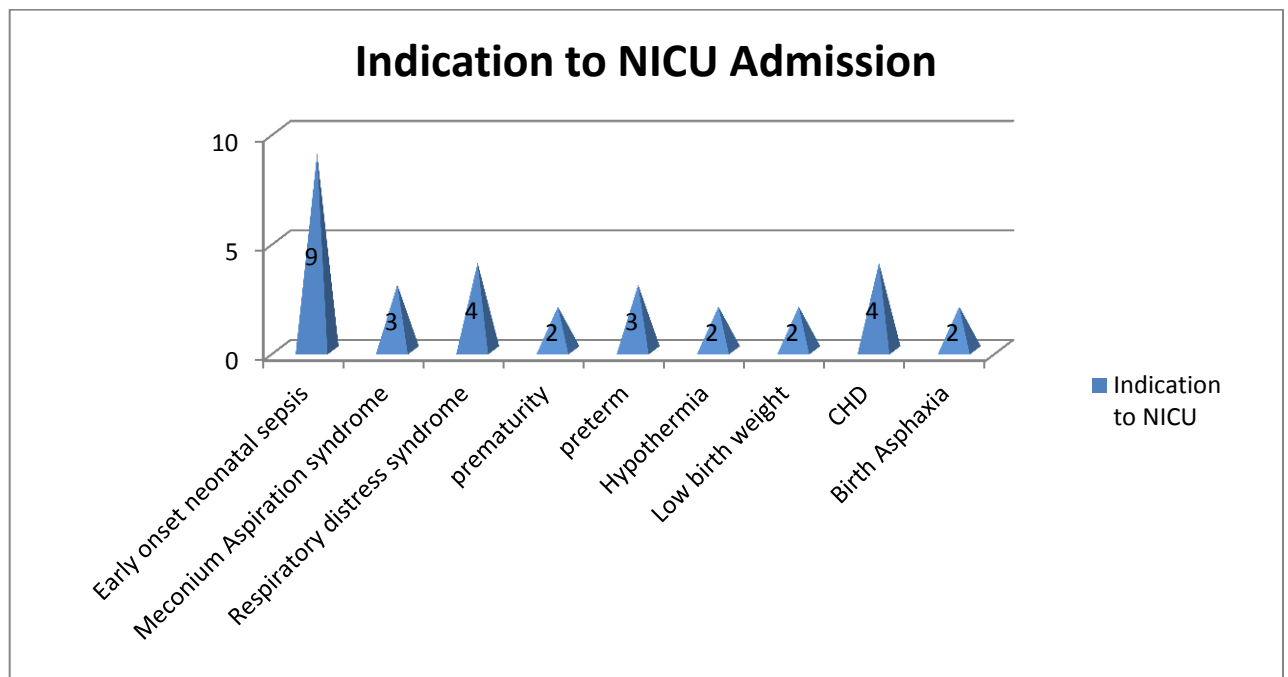
Figure 3- Types of congenital defect present among neonates under follow-up in HUCSH and AGH, Hawassa,Ethiopia,2020

5.4. Follow up duration

The majority neonates 184 (73.0%) were followed for 24 hours (1 day), 49 (19.4%) were followed for 3 days. The maximum duration of follow up was 18 days, 96.82% of the neonates under follow up followed for < 7days, while 3.17% followed for 7 days or more, the mean duration of follow up was 1.83 ± 2.12 days.

5.5. Neonatal Intensive Care Unit Admission

From the neonates delivered in the study period, 31 were admitted to neonatal intensive care unit, this give admission rate of inborn neonates to neonatal intensive care unit 12.3%. More than half (61.29%) of neonates admitted to NICU were male, while the rest (38.71%) were female. The overall prevalent indication for admission to NICU, were early onset neonatal sepsis 9(29.03%), Respiratory distress syndrome (12.90%), and Meconium aspiration syndrome (MAS) 3(9.6%), the reasons to NICU admission were summarized under the following figure (Figure 3).



Legend: CHD - congenital heart disease, NICU – neonatal intensive care unit

Figure 4- Indications for neonatal intensive care unit admission, among neonates under follow-up in HUCSH and AGH, Hawassa, Ethiopia, 2020

5.6. Neonatal characteristic in NICU

Eighteen (58.06 %), of the neonates in NICU were with 5thAPGAR score less than five, while the remaining 13 (41.93%) were greater than five. Concerning gestational age, 17 (54.83%) of neonates in NICU were preterm, while the rest 12 (38.7%) and 2 (6.45%) were term and post term respectively. Regarding birth weight of the neonates under follow up 14(45.16%) had normal birth weight, 10 (32.25%) had low birth weight, 4 (12.9), 2(6.66%) and 1 (3.22%) had macrosomia, very low birth weight and extremely low birth weight .respectively. Twenty four (77.4%) of neonates who were admitted to NICU had no congenital defect, while 7 (22.5%) had congenital defect.

5.6. Predictors of Admission to NICU

Bivariate and multivariate analysis was done to identify associations between dependent and independent variables. To identify the predictors to neonatal intensive care unit admission .Crude odds ratio and adjusted odds ratio, 95% CI and p-value were used to assess the strength of association and statistical significance.

5.6.1 Binary and Multinomial logistic regression analysis

The data was analyzed for association with sex of neonates, maternal age, residence of the mother, maternal gravidity and other maternal, obstetric and neonatal factors with admission to NICU, with binary logistic regression, those predictors have p value < 0.05 considered as having statically significant association, then it was analyzed by multinomial logistic regression. The bivariate analysis showed that, even though 61.29% of the neonates admitted to NICU were male, sex of neonates has no significant association with NICU admission (p=0.129,CI =0.255,1.190).

Neonates born from mothers who had pregnancy related complications in their previous pregnancy, had 7 times a risk of admission to NICU than neonates whose mother had no history of previous pregnancy related complication (p =0.008, CI= 0.084, 0.688) .The bivariate logistic regression analysis result showed that neonates born from mothers who had diagnosed chronic illness had 4.5 times probability of being admitted to NICU (p=0.006,CI=0.921,2.311). Binary logistic regression analysis, ANC follow up has significant association with NICU admission (p= 0.001), while number of ANC follow up has no significant association with NICU admission (p=0.108, CI= 0.921, 2.311).The

analysis showed that mothers, who had current diagnosed pregnancy related complication on ANC follow up, their newborns had 12 times risk of being admitted to NICU than those neonate born from mother with no current pregnancy related complication ($p=0.000$, $CI =4.331 ,35.721$).

Caesarian section (CS) delivery has significant association with NICU admission ($p=0.001$), it increase the risk of NICU admission by 1.5 times. Mothers who labored for more than 12 hours has 9 times a probability of admitting their new born to NICU than mothers who labored 12 hours and less ($p=0.000,CI =3.457,23.903$).Neonates whose 5th minute APGAR score less than five, 2.7 times had a risk of NICU admission, than neonates who had APGAR score greater than 5($p=0.000,CI = 0.027,0.15$).Concerning gestational age ,it was showed that preterm neonates had 10 times risk of admission to NICU than term neonates,($p= 0.015$, $CI= 1.574,67.856$).Neonates born with congenital anomalies had 9.2 times probability of being admitted to NICU, than neonates without congenital defect. The Multivariate analysis revealed that the following predictors has statically significant association with NICU admission,mothers who labored for more than 12 hours has 6.1 times probability of admitting their new born to neonatal intensive care unit ($p= 0.009$, $OR= 6.1$ $CI = 1.8-23.922$). As shown in the multinomial logistic regression analysis pre term neonates has 1.5 times risk of being admitted to NICU than term neonates, ($p= 0.019$, $CI = 0.18-0.239$).Mothers who had diagnose pregnancy related complication during ANC follow up has 2.5 times risk of admitting their neonate to NICU, ($p= 0.002$, $CI= 0.726, 0.53$).Neonates whose 5th minute APGAR score has also significant association with NICU admission, neonates with APGAR score less than 5 has 2.5 times risk of NICU admission, ($p= 0.000$, $CI = 0.18,0.239$).Predictors that has statically significant association both by bivariate and multivariate analysis are shown in the table below (Table- 3).

Table 3- Bivariate and Multivariate Analysis showing the association between predictors of NICU admission and Admission in HUCSH and AGH, Hawassa, Ethiopia, 2020

| Predictors | Bivariate analysis | | | | Multivariate analysis | | |
|------------------------------------|--------------------|------|---------|--------------|-----------------------|---------|--------------|
| | Category | COR | P value | CI | AOR | P value | CI |
| 5 th minute APGAR score | Less than five | | | | 2.5 | 0.000 | 0.18,0.239 |
| | Greater than five | 2.7 | 0.000 | 0.255,1.190 | | | |
| Maternal age | Less than 35 | | | | | | |
| | 35 and above | 7.33 | 0.001 | 2.285,23.557 | | | |
| Maternal chronic illness | Yes | 4.5 | 0.006 | 0.921,2.311 | | | |
| | No | | | | | | |
| ANC follow up status | Yes | 5.1 | 0.01 | 1.950,13.561 | | | |
| | No | | | | | | |
| Pregnancy complications | Yes | 7.0 | 0.02 | 0.084,0.688 | 2.5 | 0.002 | 0.726,0.53 |
| | No | | | | | | |
| Duration of labor | < 12 hour | | | | | | |
| | ≥12 | 9.09 | 0.000 | 3.457,23.903 | 6.1 | 0.000 | 3.457,23.903 |
| Congenital defect | Yes | 9.2 | 0.000 | 0.000, | | | |
| | No | | | | | | |

5.7. Survival analysis

Among the neonates delivered in the study period and included in the follow up , 233 discharged from the hospital alive, which gives the cumulative survival rate, 92.5% ,while the remaining 19 (7.5%) died , which gives neonatal mortality rate 75 / 1000 live births. From those recorded deaths 17 (84.2%) were early neonatal death (< 7 days), while the remaining 2 (15.7 %) late neonatal death (≥ 7 days).From early neonatal deaths, more than half (68.42%) of deaths occurs in the first 48 hours (2 days) and of those deaths occurs in 48 hours,66.6 % of death occurs in the first 24 hours (1day), 3.0 ± 2.84 and 2.0 are mean and median age of neonates at death, respectively, according to the result obtained from Kaplan Meir survival analysis, the cumulative proportion of surviving at the end of the 1st day was 96.8%, on 2nd day 94.0%,on 3rd day , 91.0%,7th 59.1% & and after 10 days 39.4% .As it will be seen with the next graph, during the first two days a higher proportion of neonates were dying and there was a lower probability of survival. While on the next 6days (Day 3 - 9), the proportion of neonates survived has slightly increased and the graph fell down slowly and finally, after day 9, the graph is straight line indicates that there was no neonatal death after 9th day as indicated in Figure below (Figure 6).

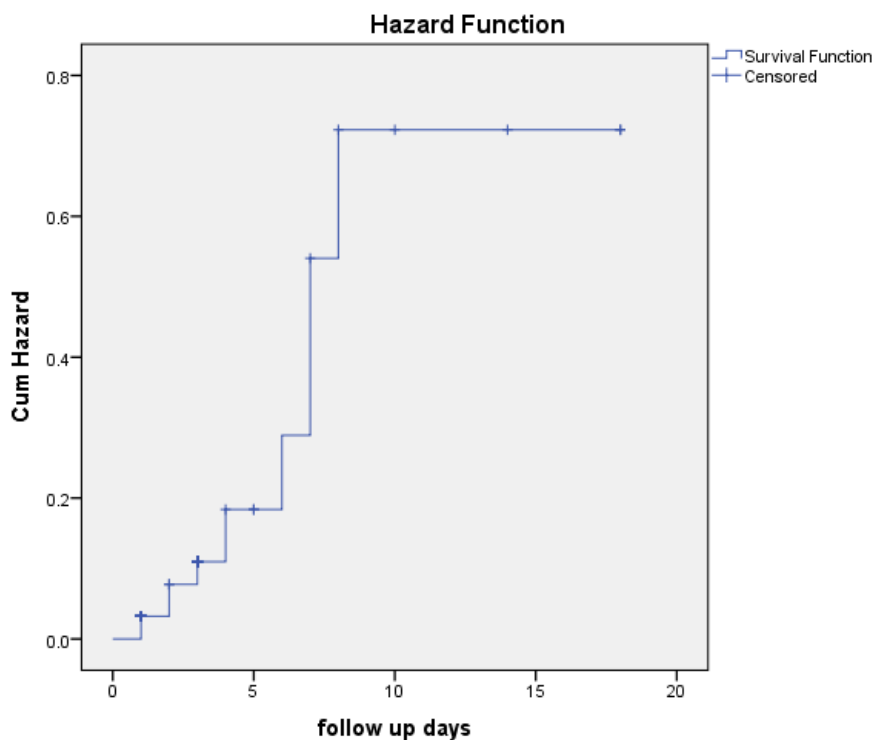
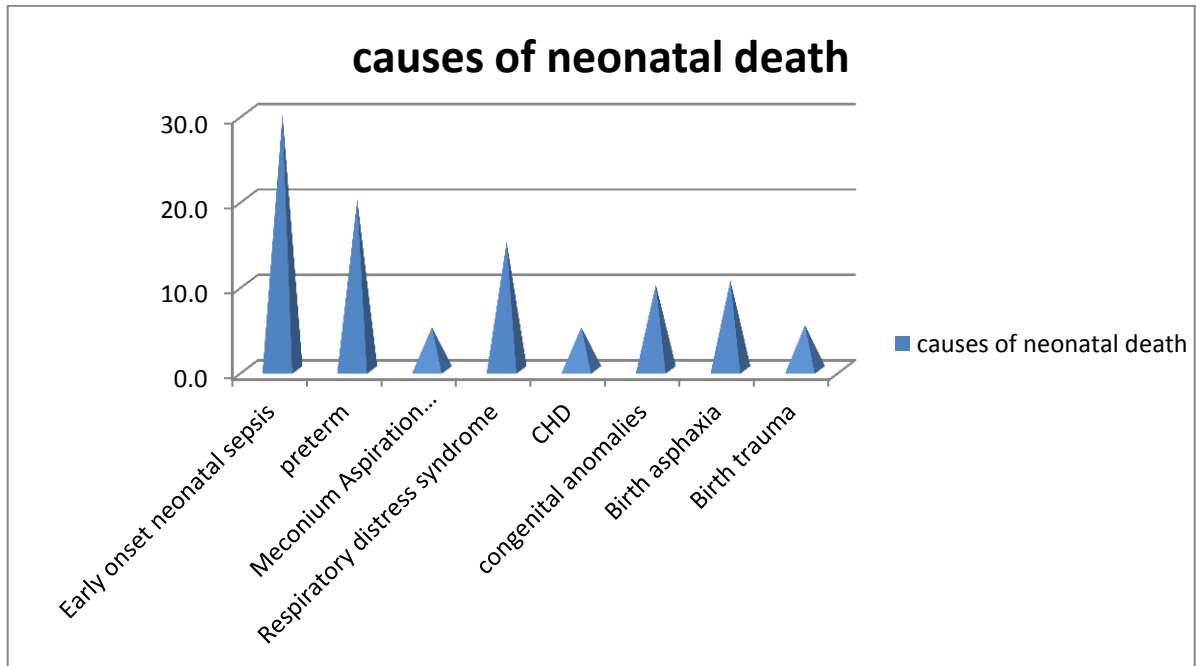


Figure 5- Kaplan Meir curve showing the survival of neonates in HUCSH and AGH, Hawassa, Ethiopia, 2020.

Table 4- Summary of cumulative proportion at a time death occur among neonates in HUCSH and AGH, Hawassa, Ethiopia.2020.

| Time | Number of death recorded | Cumulative proportion of survival at the time | |
|----------------|--------------------------|---|----------------|
| | | Estimate | Standard error |
| Day 1 | 8 died | 0.968 | 0.11 |
| Day 2 | 3 died | 0.926 | 0.026 |
| Day 3 | 2 died | 0.896 | 0.033 |
| Day 4 | 1 died | 0.832 | 0.069 |
| Day 6 | 1 died | 0.747 | 0.100 |
| Day 7 | 2 died | 0.583 | 0.130 |
| Day 8 | 2 died | 0.485 | 0.140 |
| Standard error | | Confidence interval | |
| 1.614 | | (8.476,14.804) | |

Among those 19 deaths 15 (78.9%) were from NICU. 61.29 % and 38.71 % were male and female, respectively. Regarding the causes of death, Early onset neonatal sepsis, 5 (26.3 %), preterm delivery 4 (21.1%) and respiratory distress syndrome 3 (15.8%) were among the commonest causes of neonatal death. The following figure will illustrate the causes of neonatal death in the study area (figure 7).



Legend: CHD- congenital heart disease

Figure 6- The causes of neonatal death, among neonates under follow up in HUCSH and AGH, Hawassa, Ethiopia, 2020.

Among neonates who died 12 (63.1%) were preterm neonate, concerning birth weight , 52.6 % of the neonates had birth weight less than 2500 g, and 57.8 % of the neonates mother had labor last greater than 12 hours. The following figure show the difference in the outcome of neonates in groups having different gestational age (Figure 7).

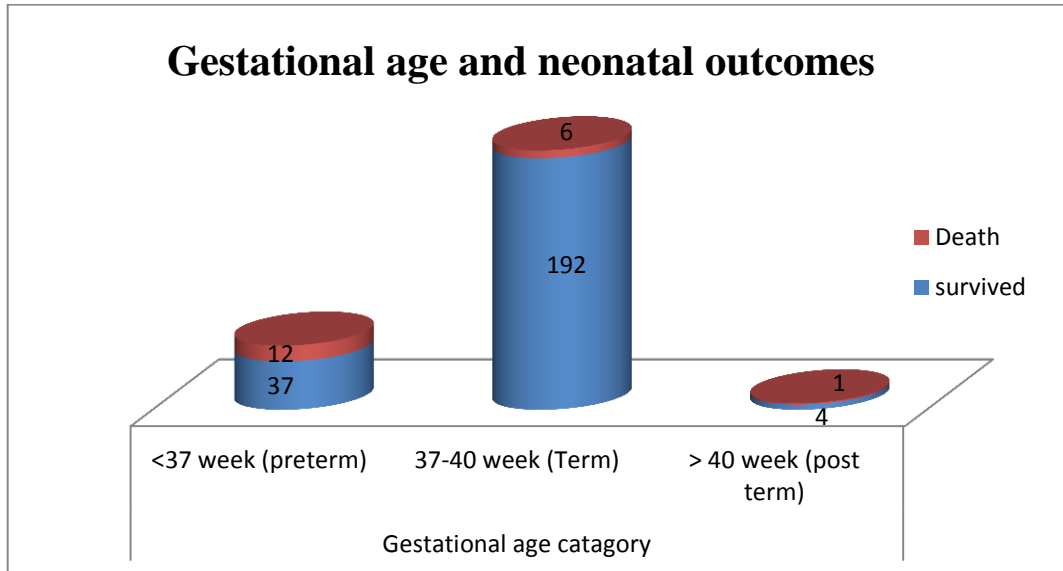


Figure 7- Gestational age and outcome of neonates among a neonates under follow-up in HUCSH and AGH, Hawassa, Ethiopia,2020 .

Among neonates admitted to neonatal intensive care unit 15 (48.3%) died, while 16 (51.7%) discharged from hospitals alive (survived).Of neonates with congenital defect 5 (71.42%) died, and 2 (28.5%) were discharged from hospital alive (survived).

Table 5- Neonatal outcomes among different maternal, neonatal and obstetric predictors in HUCSH and AGH , Hawassa, Ethiopia,2020.

| Predictors | Category | Survived | Died | Total |
|---------------------------------|----------------|----------|------|-------|
| Maternal age | Less than 35 | 225 | 14 | 239 |
| | 35 and above | 8 | 5 | 13 |
| Maternal chronic illness | Yes | 11 | 7 | 18 |
| | No | 222 | 12 | 234 |
| ANC follow up | Yes | 219 | 11 | 230 |
| | No | 14 | 8 | 22 |
| Previous pregnancy complication | Yes | 16 | 4 | 20 |
| | No | 139 | 9 | 148 |
| 5 th minute APGAR | Less than 5 | 28 | 11 | 39 |
| | Greater than 5 | 205 | 8 | 213 |
| Gestational Age | Pre term | 37 | 12 | 49 |
| | Term | 192 | 6 | 198 |
| | Post term | 4 | 1 | 5 |
| Birth weight | ELBW | 0 | 1 | 1 |
| | VLBW | 0 | 2 | 2 |
| | LBW | 15 | 7 | 22 |
| | NBW | 205 | 7 | 212 |
| | Macrosomia | 13 | 2 | 15 |
| Duration of Labor | <12 hours | 222 | 9 | 231 |
| | ≥12 hours | 11 | 10 | 21 |
| Congenital defect | Yes | 2 | 5 | 7 |
| | No | 232 | 13 | 245 |

Predictors of neonatal survival

The log-rank test result showed that, survival pattern or time to neonatal mortality has significantly varied among the covariates of maternal chronic illness (X2 for log-rank test=5.39, p=0.002), ANC follow up (X2 for log-rank test=5.39, p=0.000), pregnancy related complication, (X2 for log-rank test=10.147, p=0.001, CI=2.666, 9.340), duration of labor (X2 for log-rank test=14.265.6, p=0.000), 5th minute APGAR (X2 for log-rank test=4.356, p=0.037), Birth weight (X2 for log-rank test=45.8, p=0.000), Gestational age (X2 for log-rank test=15.055, p=0.001), maternal age (X2 for log-rank test=5.469, p=0.019).

Differences in survival of neonates, with Apgar score less than five and greater than five among neonates under follow up is analyzed by Kaplan Meir curve summarized under figure 8.

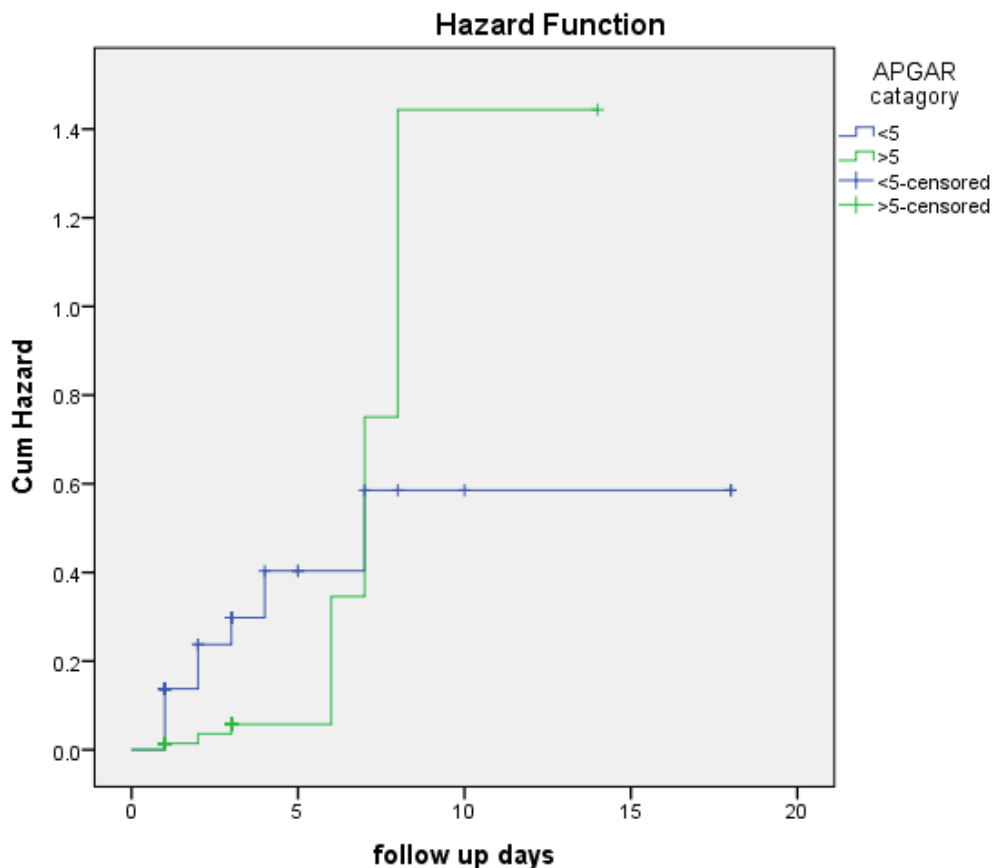


Figure 8- Difference in survivor function of neonates, with 5th minute Apgar score less than 5 and greater than 5 among neonates under follow-up in HUCSH and AGH, Hawassa, Ethiopia, 2020

The mean and the median survival time were also significantly different for predictor variables. The difference in hazard of death among variables during the follow-up period was estimated from Kaplan Meier survival curves with log-rank test and a significant difference was observed. The mean survival time for term neonates, were 12.196 days and 6.006 days for preterm neonates, 8.62 and 17 days were the mean age of survival for neonates born from mothers with pregnancy related complication and without pregnancy related complication, respectively. The final cox regression analysis model for predictor of survival, showed that neonates delivered from mother who had labored for greater than 12 hour has 5.489 times higher hazard of death, as compared to neonates whose mothers labored for less than 12 hours, (AHR= 5.489, p = 0.001, CI = 2.040, 14.818). Neonates with APGAR score less than five has 2.8 times higher hazard of death than neonates, with APGAR score greater than five. The analysis revealed that neonates born from mothers aged 35 and above has 3.25 higher hazard of death than neonates born from mother aged <35 years .

CHAPTER 6 – DISCUSSION

The aim of conducting this study was to assess neonatal admission rate to neonatal intensive care unit, survival rate and predictors to NICU admission and survival. Admission rate among inborn neonates to neonatal intensive care unit was 12.3%. In Tertiary Care Hospital of Coastal South India study was conducted from January 2015 to December 2016, showed that Admission rates among inborn neonates were 2.9 %, this variation the difference in antenatal care and obstetric service difference between Ethiopia and India.

The overall prevalent indication for admission to NICU, were early onset neonatal sepsis 9(29.03%), respiratory distress syndrome 4 (12.90%), and meconium aspiration syndrome (MAS) 3(9.6 %). In a study conducted in Bangladesh (Tajkial , et al., 2018), early onset neonatal sepsis accounts one third of admission to NICU, similar finding was obtained from a study conducted in Mandya, Libya (Thammanna, & Sandeep, 2015), early onset neonatal sepsis (28.8%) and respiratory distress syndrome (28.5%) accounts the first and the second commonest indications to NICU admission, again similarly the finding obtained from study done in Mekelle Ayder hospital (Abraham, & Haftom, 2018), 29.2% of the neonates indication for NICU admission was early onset neonatal sepsis.

In this study the survival rate was 92.5%, this makes the neonatal mortality rate 7.5% (75 death per 1000 live birth), it is higher than the national average 2019 , EDHS report ,30

death per 1000 live birth, [EDHS ,2019].This variation could be explained due to the fact that HUCSH is referral hospital for SNNPR and nearby towns out of the region, due to this fact ,mothers with high risk pregnancy are more involved and those neonates who are admitted to NICU are high risk neonates even contribute to majority of death recorded, but the national data, includes both high risk and low risk pregnancy, and low risk pregnancies outnumber the high risk, Similar study was performed Cairo University Children's Hospital during the period from April 2003 to October 2004, the overall mortality rate was 29.1% (240 deaths), having survival rate 71.9 % (Iman et al., 2004).This variation could be explained with study period,since it has 6 years difference improvement in the service is expected.while NMR (7.5%)recorded in this study ,is nearly similar with a study a study conducted in Mandya, Libya(Sridhar & Sandeep, 2015),the neonatal death observed was 7.1% (71 death per 1000 live birth). The finding of the current study is low when compared with a study conducted in Somali region, Ethiopia,(Elmi farah, , & Tahir, 2018),the finding revealed that NMR as 20.5% (205 death per 1000 live birth), this variation is from difference in methodology and the study done only in NICU, meaning only high risk neonates are included in the study. This finding is low when compared with study conducted in Mekelle Ayder hospital (Abraham, & Haftom, 2018), which is 126.5 deaths per 1000 live birth.

Regarding age of neonate at death on the current study, 84% of neonatal deaths were early neonatal death (death occur with 7 day of delivery), while 15.7 % were late neonatal death (death occur after 7 days of delivery).Similarly early neonatal death outnumbered late neonatal death in study conducted in Arbaminch general hospital, (Dessu & Seman, 2018),91% of neonatal death occurs within 7 days of delivery, another study done in Ethiopia Somali region (Mohamed, Abdilkani, 2019)also strengthen this finding ,96% of neonatal death were early neonatal deaths.

Kaplan Meir survival analysis show that the cumulative proportion of surviving at the end of 1st and 7thday was 96.8 % and 59.1% respectively, Cumulative proportion of surviving was also calculated on study done in at Arbaminch general hospital,(Dessu & Gebremeskel,2018)at 1st and 7th days was 96.1 and 69.9% days respectively ,even though it has number variation, in both case the cumulative proportion of surviving decrease significantly from day 1 to day 7 ,this indicates majority of neonatal death occurs on the first 7 days. More than half (68.42%) of deaths occurs in the first 48 hours (2 days) and of those deaths occurs in 48 hours, 66.6 % occurs in the first 24 hours.Another study done in

Arbaminch general hospital ,(Dessu & , Gebremeskel,2018),study revealed that 19.4% of neonates died within the first 24 hours(1day), 58.2% in the first 3 days, there was no death after 16 days .Similarly a study conducted in Mekelle Ayder hospital,(Abraham, & Haftom, 2018)has similar finding,15.62% of death occurs within the first 24 hours,21.88 % in the next day of birth and 55.26% of deaths occur within 72 hours.

This is due to antenatal and perinatal factors start affecting the survival of neonate immediately ,after joining the extra uterine environment, and early neonatal mortality (ENMR) is a key outcome indicator for new born care and directly reflect prenatal, intra partum and neonatal care, early neonatal death are more closely associated with pregnancy related factors, maternal health, whereas ,late neonatal death are associated more with factors in newborn environment, since all neonates are followed starting from delivery and they are on similar environment early neonatal deaths recorded are a direct reflection of antenatal and intrapartal conditions.

From the analysis obtained on this study early onset neonatal sepsis (26.3%),preterm delivery (21.1 %) and respiratory distress syndrome are the commonest cause of neonatal death, On another study conducted in Neonatal Intensive Care Unit (NICU) of a Tertiary Care Hospital in Dhaka, Bangladesh between January 2017 to December 2018, the leading cause of death were prematurity (60%), followed by birth asphyxia (30%) and sepsis (10%) (GTajkia et al.,2018). The current finding also goes in line with most study findings, on a study conducted in Libya (Mandya),(Sridhar & Thammanna, 2015),respiratory distress syndrome (43.3%) and early onset neonatal sepsis (EONS)(8.25 %) are the commonest causes of neonatal death, in study conducted the same finding was conducted in Ethiopia, Somali region(Mohamed, Abdilkani, 2019),early neonatal sepsis (29.5%) was the commonest cause of death.

The bivariate analysis showed that, even though 61.29% of the neonates admitted to NICU were male, sex of neonates has no significant association with NICU admission ($p=0.129$,CI =0.255,1.190) , this finding supported by the finding from Egypt (Iman et al., 2004), Sex was not a significant predictor of neonatal admission and deaths on multivariate analysis (p value = 0.568)26.1% of neonatal death was from neonates whose mother had pregnancy related complication, of which, APH,(10.5 %), PROM (10.5%) and preeclampsia (5.2%),From the data obtained in the current study, neonates delivered from mothers who had diagnosed pregnancy related complication, has 10 times higher hazard of neonatal

death, (X² for log-rank test=10.147, p=0.001 CI=2.666-9.340). Similarly there was a study conducted in Libya (**Alburke & Assadi , 2015**), 10% of neonatal death was from neonates whose mothers had APH, similar study was conducted in Arbaminch revealed that neonates delivered from mothers who had diagnosed APH has 2.6 times hazard of neonatal death.

In the current study, 63.1% of neonatal death was recorded from preterm neonates, as shown in Kaplan Meir survival analysis the mean age of neonatal survival, delivered < 37 weeks was 6.0 days, 12.1 days and 2.6 days was for term and post term neonates respectively. (x² =17.390, p = 0.000), in contrary to this finding on study conducted in India (**Knnan,& Rekha,2016**). conclude that, gestational age has no statically significant association with neonatal survival. Similar to the current study finding, study conducted in Mekelle revealed(**Abraham, & Haftom, 2018**), preterm neonates (born <37weeks) has 3.7 times greater hazard of death than term neonate.

This study revealed that neonates with 5th minute APGAR score less than five has 2.8 times higher hazard of neonatal death than neonates with greater than five APGAR score, this finding was also supported by the finding from Egypt(**Iman, Rasha, 2004**), and Arbaminch, (**Dessu & Seman, 2018**), 1.3 and 3.9 higher hazard of neonatal death, respectively, as compared to neonates >5 Apgar score. Similarly, a significant inverse association was detected between Apgar score and neonatal mortality (P<0.001) (**Amanuel et al., 2016**), on study done in 2019 to assess Prevalence and Causes of Neonatal Mortality among Neonates Admitted in neonatal intensive care unit at Sultan Hassan Yabare Referral Hospital, East Ethiopia.

6.1. Strength of the study

The study was prospective cohort, data was obtained from primary source, each maternal and obstetrics details were reliable and follow up was obtained from delivery ward as soon as the neonate delivered.

6.2. Limitation of the study

The limitation of this study was, since it is hospital based study, there is no information about the neonates, after the end of follow up, if there is any change in the outcome after leaving the hospital

CHAPTER – 7. CONCLUSION AND RECOMMENDATION

7.1. Conclusion

The admission rate to neonatal intensive care unit at the study hospitals was 12.3 %.The commonest reasons for admission to NICU were early onset neonatal sepsis, respiratory distress syndrome and meconium aspiration syndrome (MAS).The cumulative survival rate, 92.5%,which gives neonatal mortality rate 75 / 1000 live births. 84.2%recorded deaths were early neonatal death.68.42% of deaths occur in the first 48 hours (2 days).Maternal chronic illness, ANC follow up, pregnancy related complication, duration of labor, 5th minute APGAR, Birth weight, Gestational age, and maternal age are predictors to neonatal survival.The majority of causes of NICU admission and causes of the mortalities can be prevented by improving antenatal care, maternal health, timely intervention, referring at appropriate time to tertiary care centers for high risk cases.

7.2. Recommendation

Health institution level

Improved and special obstetric care should be given for neonates who delivered from mother who had pregnancy related complication on current pregnancy, chronic illness, and neonates whose 5th minute Apgar score less than five and neonates who had congenital defect. Radiologic identification of congenital defect should be given on ANC follow up and early referral of mothers whose fetus is suspected for congenital defect to high set up hospital since this finding revealed poor outcome (survival) for neonates with congenital defect.

Community level -Awareness should be created on the importance of ANC follow up as indicator for survival of the neonates, and mothers should also be aware that the number of visits is also very important to determine neonatal outcome.

Researchers – Further investigations should be needed especially community based researches are needed to get the final neonatal outcome.

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ANNEXES

Annex 1: Information sheet

Good morning/ afternoon?

My name is Bezawit Worku Lemma Currently I am MSC student at Jimma university institute of health biomedical science department, Anatomy course unit

I am conducting a research entitled ‘‘PREDICTORS OF ADMISSION TO NEONATAL INTENSIVE CARE UNITS AND NEONATAL SURVIVAL IN HAWASSA, SOUTHERN ETHIOPIA: HOSPITAL-BASED PROSPECTIVE COHORT STUDY.’’

To assess survival status and outcome predictors among neonates who are admitted to neonatal intensive care unit at Hawassa University comprehensive specialized and Adare general hospital.

This study is important input in identifying cause of admission, duration of hospital stay, identifying risk factor for death and overall survival of neonatal admissions. It may help in planning to improve neonatal care and services. To attain this purpose your honest and genuine participation is very important and highly appreciable. I, therefore, kindly request you to participate in the research.

Please be assured that all the information gathered will be kept strictly confidential and your name shouldn't be written on any of the questionnaire page. Only the researcher has the access of the information and used it for the study purpose only. You have a full right and decision to not respond at all or you can stop any time.

Thank you.

Have a nice time

Data Collector: Name SignatureDate

Supervisor: Name SignatureDate

Annex 2: Consent form

Each information about the study has been explained to me by the data collector. I understood the objective of this study. I also understood the risk and benefit of participation in this study. I agree to participate in the study and I here approve my agreement with my signature.

Participants: SignatureDate

Data Collector: Name SignatureDate

Investigator: Bezawit Worku

Annex 3 - Data collection Format



Data collected from mothers of neonates and medical card of neonates in Hawassa University comprehensive specialized and Adare general hospital, from August 30, to October 30, 2020 accordingly.

Code of neonate: _____/_____

| Code | Questions | Response | Remark |
|--|--|---|---|
| Part 1- socio demographic factors | | | |
| Date and time of admission _____ | | | |
| 01 | Age of neonate at admission | _____days | |
| 02 | Time of admission of neonate | Date _____; Time: hour&min)_____ | |
| 04 | Residence of the mother | A. Urban B. Rural | |
| 05 | Maternal educational status | A. Not attended formal education B. Attended primary school (grade 1-8) C. Attended secondary school(grade 9-12) D. Attended higher education (diploma and above) | |
| 06 | Marital status | A. Married B. Single C. Divorced D. Widowed | |
| Part 2- Maternal factors | | | |
| 06. | How old is the mother? | _____year | |
| 07. | How many gravidity the mother had? | _____ | |
| 08 | If the mother is multigravida, was there any pregnancy complication in her previous pregnancy? | A. Yes B. No | If, the mother is primi gravida skip to question number 11. |
| 09 | If the answer for question number 8 was yes, what was the complication? | _____ | If the answer was no skip to question |

| | | | |
|-----|---|-----------------|-------------------------------------|
| | | | number 10 |
| 10 | What is the birth interval from the previous birth | _____yr/yrs. | |
| 11. | Does the mother have any diagnosed chronic medical illness? | A. Yes B. No | |
| 12 | If your answer for question number 11 was yes ,please specify the illness | | if the answer was no skip to part 3 |

| Part 2 Obstetric factors | | | |
|--|---|---|--|
| Code | Questions | Response | Remark |
| 13 | Did the mother have ANC follow up? | A. Yes B. No | |
| 14 | If your answer for question number 13 was yes how many visit she had? | _____ | If your answer was no skip to question number 17 |
| 15 | Was there any diagnosed complication during the pregnancy on ANC follow up? | A. Yes B. No | |
| 16 | If your answer for question number 15 was yes, what was the complication, | _____ | if your answer was no, skip to question number 17. |
| 17. | Type of pregnancy | A. Single tone B. Multiple (twin) | |
| 18 | What was the mode of delivery | A. Spontaneous vaginal delivery B. Caesarian section C. Instrumental delivery | |
| 18 | How long did the labor stay? | _____hr | |
| 19 | Was breast feeding initiated | A. Yes B. No | |
| 20 | If your answer for number 21, when was breast feeding initiated? | A. Within one hour after birth B. After one hour of birth | if your answer was no skip to part 4 |
| Part -4 Neonatal factor (from medical card) | | | |
| 21 | Sex of neonate | A. Male B. Female C. Undifferentiated genitalia | |
| 22 | What was the birth weight of the neonate? | _____g. | |
| 23 | What was the gestational age of neonate at birth? | _____wks | |
| 24 | What was the 5 th minute APGAR score? | _____ | |
| 24 | Does the neonate has diagnosed birth defect? | A. YES B. NO | |

| | | | |
|---|---|---------------------------------------|--|
| 25 | If the answer for question number 24 was yes, specify the defect _____ | _____ | If the answer was NO skip to part question no 25 |
| 26 | What was the diagnosis in NICU? (reason for admission | _____ | Only for neonates admitted in NICU |
| PART 5 – Neonatal Outcome (To be filled at discharge) | | | |
| 27 | What is the outcome of the neonate? | A. Survived B. Died C. Referred | |
| 28 | Time of discharge /death of neonate | Date_____ Time _____ | |
| 29 | If your answer for question number 27 was died, at what age the neonate died? | _____day/s. | If survived / referred you have finished |

Thank you for your participation.

ANNEX 4- Data collection Checklist Amharic version

የተሳትፎ ፍቃድና መተማመን ጥያቄ

የተሳትፎ ፍቃድ

ሰላም ጤና ይስጥልኝ ቤዛዊት ወርቁ እባላለሁ። በጅምቶ ለሰጠህ ጥራት ከፍተኛ የሆኑ ሰላተኛዎች ጋር ለመሥራታችሁ እጠይቃለሁ። PREDICTORS OF ADMISSION TO NEONATAL INTENSIVE CARE UNITS AND ITS MANAGEMENT OUTCOMES OF NEONATES IN SOUTHERN ETHIOPIA: HOSPITAL-BASED PROSPECTIVE COHORT STUDY ማድረግ ለመቻላችሁ እጠይቃለሁ።

እርስዎ በዚህ ጥናት ላይ የሚኖርዎት ትሳትፎ ሙሉ በሙሉ በግልፈቃደኝነት ላይ የተመሰረተ ሲሆን ለመሳተፍ አልያም ላለመሳተፍ ቢወስኑ እንኳ በዚህ ጤና ተቋም ውስጥ የሚያገኙት ማንኛውም አገልግሎት አይቋረጥም። በዚህ ጥናት ለመሳተፍ ፍቃደኛ ከሆኑ አንዳንድ ቃለመጠይቆችን ለመመለስ መስማማት ይጠበቅብዎታል።

የእርስዎ ትሳትፎ ህጻናት በጨቅላ ህጻናት ጽኑ ህመማት ማከሚያ ክፍል ውስጥ ስለሚኖራቸው ቆይታና የሚደርግላቸው ህክምና ከጤንነታቸው ጋር ያለውን ተያያዥነት እና ስጋት በማወቅ በተሻለ አማራጭ ህክምና እንዲያገኙ ያግዛል።

በዚህ ጥናት መሳተፍ የሚያስከትለው ምንም አይነት ጉዳት የሌለው ሲሆን ከእርስዎ የሚወሰደው መረጃ ጥቅም ላይ የሚውለው ለጥናቱ አላማ ብቻ ነው። ቀጥሎም የተሰበሰበው መረጃ ለስራው አግባብነት ላላቸው ጥቂት ሰዎች ብቻ የሚደርስ ሲሆን የራስን ማንነት የሚገልጡ መረጃዎች ማለትም ስም፣ አድራሻ፣ የስልክ ቁጥር እና የመሳሰሉትን ግን አያካትትም።

መተማመኛ ቅጽ

ከላይ የተጻፈውን ሀሳብ የጥናቱን ዓላማ፣ በጥናቱ ውስጥ በመሳተፍ የሚገኘውን ጥቅምና ጉዳት በግልጽ ተረድቻለሁ።

ስለዚህ በዚህ ጥናት ውስጥ ለመሳተፍ ፍቃደኛ ነኝ።

አዎ:

የህጻኑ እናት ፊርማ:

የአጥኚው ፊርማ:

ስለ ፍቃደኝነትዎ አመሰግናለሁ!!!

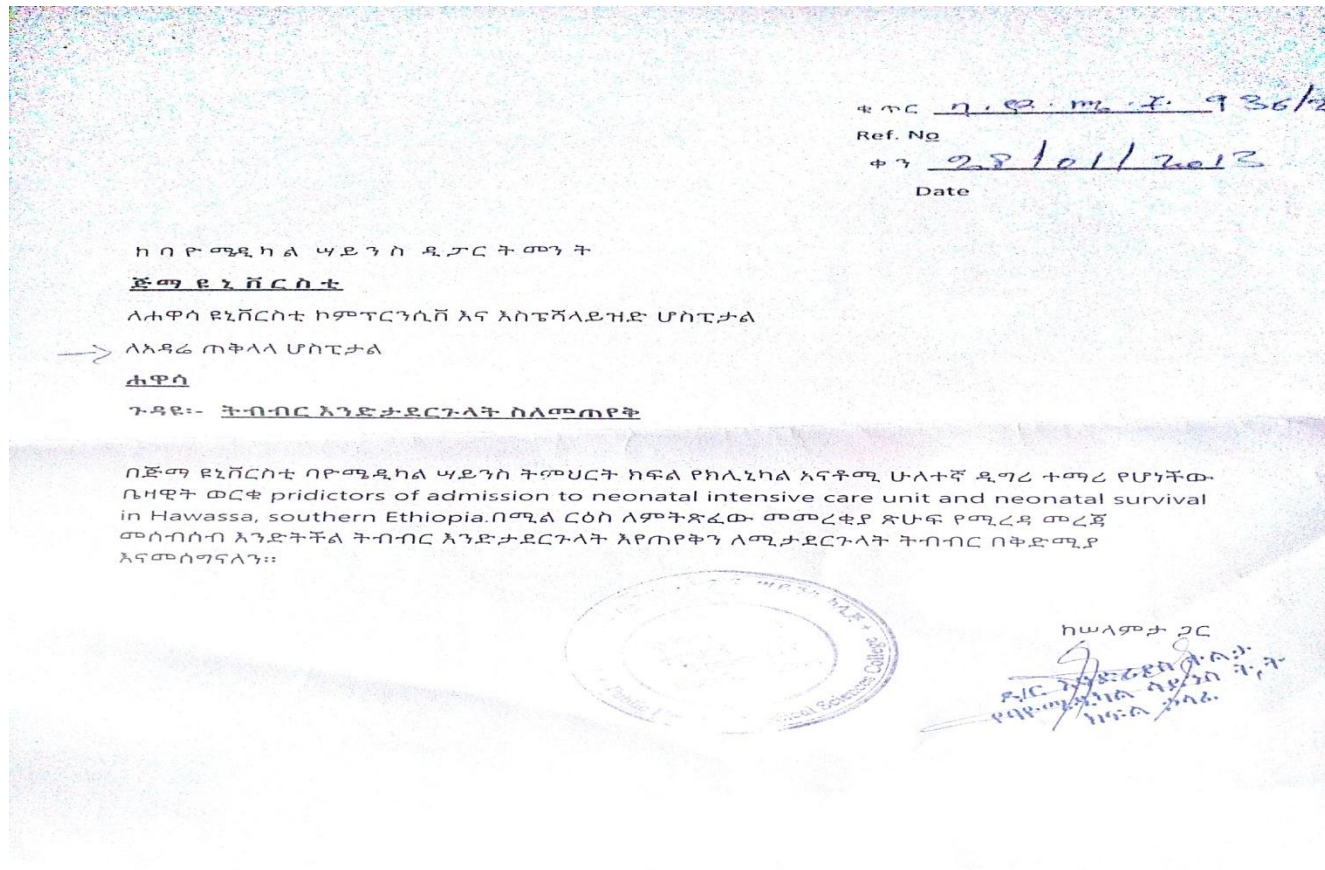
የጥናቱ ሆስፒታል: HUCSH AGH የጨቅላ ህጻኑ መለያ ቁጥር: _____/_____

| መለያቁጥር | መጠይቅ | ምላሽ | ምርመራ |
|--|---|---|--|
| ክፍልአንድ፡ የማህበረሰብናሰነ-ህዝብባህርያትበተመለከተ | | | |
| 01 | ህጻኑወደጽኑህመጣጠንማከሚያከፍልየገባውመቼነው?..... | (ቀን፣ሰአት) | አስተኝቶማከሚያከፍልለ ገቡበቻ |
| 02 | የጨቅላህጻኑጾታ 1.ወንድ 2.ሴት 3.ጾታውያልተለየ | | |
| 04 | የጨቅላህጻኑእናትየውየመኖርያአካባቢ፡ | 1. ገጠር 2.ከተማ | |
| 05 | የጨቅላህጻኑእናትየትምህርትደረጃ፡ | 1.ዘመናዊትምህርትያልተማረች 2.የመጀመሪያደረጃትምህርትየተማረች 3.የሁለተኛደረጃትምህርትየተማረች 4.ዲፒሎማናከዛበላይየተማረች | |
| ክፍልሁለት፡ ከእናትየውጋርየተያያዙጉዳዮች | | | |
| 06. | የእናትየውዕድሜሰንትነው? |(በአመት) | |
| 07. | እናትየውሰንትልጆችአሏት? | | |
| 08 | እናትየውከአንድልጅበላይያላትከሆነከዚህእርግዝና በፊትየተወሳሰበየጤናችግርገጥሟትነበር? | 1. አው 2. አይደለም | እናትየውየወለደችውለመ ጀመሪያጊዜከሆነወደጥያቄ ቁጥር 11ይሸጋገሩ |
| 09 | የጥያቄቁጥር8 መልስአውከሆነያጋጠማትየተወሳሰበየጤናችግርገጥም? | _____ | የጥያቄቁጥር8መልስአይደለም ከሆነወደጥያቄቁጥር 9 |

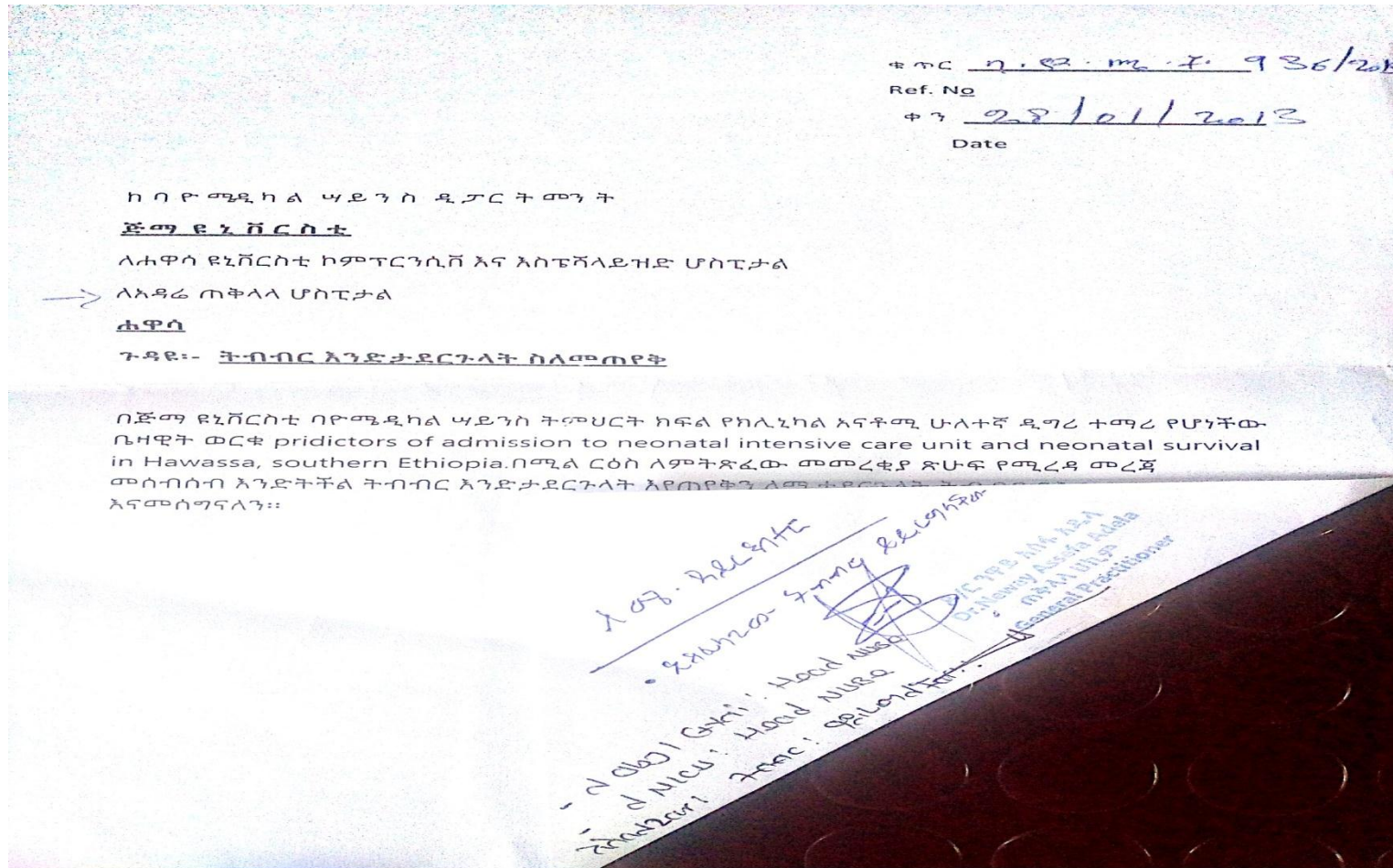
| | | | |
|-----|--|----------------|-------------------------------------|
| | ነበር?. | | ይሸጋገሩ |
| 10 | በአሁኑናከዚህበፊትበነበረውልጅ-መካከልያለውየጊዜልዩነትምንያህልነው? | | |
| 11. | እናትየውየታወቀናአብሯትየቆየየጤናችግርአለባት? | 1. አው 2. አይደለም | |
| 12 | የጥያቄቁጥር 11 መልስአውከሆነእናትየውያለባትየጤናችግርምንድን ነው? | | የጥያቄቁጥር 11 መልስአይደለምከሆነውደክፍል 3 ይሸጋገሩ |

| ክፍል ስም: ከእናት የውእረ ግዝናና ወሊድ ጋር የተያያዙ ጉዳዮች | | | |
|--|---|--|--|
| መለያ ቁጥር | መጠይቅ | ምላሽ | ምርመራ |
| 13 | እናት የውቅድ መወሊድ ክትትል ነበራት? | 1. አዎ 2. አይደለም | |
| 14 | የጥያቄ ቁጥር 10 መልስ ለዎከሆነ እናት የውስንት ጊዜ የቅድመ ወሊድ ክትትል አድርጋለች? | _____ | የጥያቄ ቁጥር 13 መልስ አይደለም ከሆነ ወደ ጥያቄ ቁጥር 17 ይሸጋገሩ |
| 15 | እናት የውቅድ መወሊድ ክትትል ወቅት የታወቀ የተወሳሰበ የጤና ችግር ነበራት? | 1. አዎ 2. አይደለም | |
| 16 | የጥያቄ ቁጥር 12 መልስ አዎ ከሆነ እናት የውቅድ መወሊድ ክትትል ወቅት አጋጥሟት የነበረው የተወሳሰበ የጤና ችግር ምን ነበር? | _____ | የጥያቄ ቁጥር 15 መልስ አይደለም ከሆነ ወደ ጥያቄ ቁጥር 17 ይሸጋገሩ |
| 17 | እናት የውይይት ልጅ ገደብ ለደገው በምን ድንገት? | 1. በምጥ 2. በቀድሞ ገና 3. በመሳሪያ በመታገዝ | |
| 18 | 1. ምጡ ለምን ያህል ጊዜ ቆየባት? | (በሰአት) | |
| 19 | ልጅ ገደብ ለደገው በኋላ ጡት አጥብታለች? | 1. አዎ 2. አይደለም | |
| 20 | የጥያቄ ቁጥር 18 መልስ አዎ ከሆነ በምን ያህል ጊዜ ውስጥ ነው ጡት ያጠባቸው? | | |
| 21 | ህጻኑ ሲወለድ ክብደቱ ምን ያህል ነበር? | (በግራም) | |
| 22 | ህጻኑ የተወለደው በስንተኛው የእርግዝና ወቅት ነው? | (በሳምንት) | |
| 23 | የአምስተኛው ደቂቃ APGAR ውጤት ስንት ነበር? | | |
| 24 | ህጻኑ ሲወለድ ጀምሮ አብሮት የነበረ የጤና እክል/ጉድለት ነበር? | 1. አዎ | |


ANNEXE-5(C); Official letter written from Jimma University Bio-medical department to AGH



ANNEXE-5 (D)- Official letter written from Jimma University Bio-medical department to AGH then to delivery ward and NICU



ANNEX 6– Ethical clearance obtained from institutional review board of Jimma University

 **Jimma University Institute of Health**
Institutional Review Board


Ref.No: JHRPE/1837/20
Date: 5/10/2020

To: Bezawit Worktu:
Subject: Ethical Approval of Research Protocol

The IRB of Institute of Health has reviewed your research project "**Predictors of Admission To Neonatal Intensive Care Units and Neonatal Survival in Hawassa, Southern Ethiopia: Hospital-Based Prospective Cohort Study.**"

Thus, this is to notify that this research protocol has presented to the IRB meets the ethical and scientific standards outlined in national and international guidelines. Hence, we are pleased to inform you that your research protocol is ethically cleared.

We strongly recommend that any significant deviation from the methodological details indicated in the approved protocol must be communicated to the IRB before it has been implemented.

With Regards!

Milton Tesfaye, PhD
IRB chairperson
Tel: +251917063744
E-mail: mtesfaye1@gmail.com

Tel: +251-47 11 114 57 Fax: +2514711114 50 P.O.Box. 378 e-mail: ero@ju.edu.et
PBX: +251471111455-60 +251471112040 JIMMA, ETHIOPIA website: <http://www.ju.edu.et>

DECLARATION

This is to certify that the thesis prepared by **Bezawit Worku** entitled “Predictors of admission to neonatal intensive care units and neonatal survival in Hawassa, southern Ethiopia: hospital-based prospective cohort study. And submitted in the partial fulfillment of the requirements for Degree of Master science in Clinical Anatomy complies with regulation of Jimma University and I undersigned agrees to accept responsibility for the scientific ethical, originality, quality and technical conduct of this research provision of required progress reports.

Name of the student: Bezawit Worku

Date _____ Signature _____

Examiners

_____ Signature _____ Date _____

_____ Signature _____ Date _____

Approval of Advisor(s)

1. Tilahun Alemayehu (Assistant Professor of Human Anatomy)

Signature _____ Date _____

2. Mengistu Ayele (MSc in Human Anatomy)

Signature _____ Date _____

Approval of examiner(s)

Name of examiner: _____

Date _____ Signature _____

Approval of school/department head Name of school/department head: _____

Date _____ Signature _____