



**St. Paul's Hospital
Millennium Medical College**
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**DISEASE PATTERN AND OUTCOME OF NEONATES
ADMITTED TO NEONATAL INTENSIVE CARE UNIT IN SAINT
PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE**

**St. Paul Hospital Millennium Medical College
Graduate Study Program**

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Addis Ababa, Ethiopia

March, 2024



St. Paul Hospital Millennium Medical College Graduate Study Program

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MILLENNIUM MEDICAL COLLEGE**

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**A THESIS TO BE SUBMITTED TO DEPARTMENT OF PEDIATRICS
AND CHILD HEALTH, SAINT PAUL'S HOSPITAL MILLENNIUM
MEDICAL COLLEGE FOR THE PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE CERTIFICATE IN PEDIATRICS AND
CHILD HEALTH**

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Abstract

Background:

Neonatal morbidity along with the mortality is a major health issues in the developing countries accounting majority of under 5 year mortality(1,10). Majority of which are preventable. Regular assessment of the illness patterns in hospital NICU settings is an indicator to show the availability, utilization and effectiveness of mother and child health services(15).

Objective: The aim of this study was to assess the disease pattern and outcome of neonates who were admitted to NICU at SPHMMC.

Methods and Subjects

An institutional based cross sectional retrospective study was conducted on 226 neonates who were admitted to the neonatal care unit of St Paul's Hospital Millennium Medical College from May to July 2020, were included in this study. Data collected from patient's chart by pre-structured and pre tested check lists. The independent variables were demographic, obstetric, and clinical characteristics, while the dependent variable was neonatal mortality. Data were analyzed using simple frequencies, odds ratio, and finally binary logistic regression analysis for mortality outcome. Odds Ratio with 95% Confidence Interval (CI) was used to determine the effect of the independent variables on the outcome variable. P-value less than 0.05 is considered statistically significant.

Result: Out of 226 study population male to female ratio was 1.23:1. The mean age at admission was 13.79 hours. The most common reason for admission to NICU RDS 45(19.9%), followed by TTN 26(11.5%), MAS 24(10.6%) ,Neonatal hyperbilirubinemia 20(8.8%) and early onset neonatal sepsis 18(8%). 74.3% of the patients discharged from NICU, while 8(3.5%) of the patients were referred to other health facility and 49(21.7%) were died in the Hospital. From total neonates died RDS account 31(63.2%) followed by EONS 8(16.3%) and PNA4(8.1%). The rest gastroschisis and TEF 2(4%) each. Lastly MAS resulted in death in 1(2%). Most of the deaths occurred 24 to 72 hours 16(32.7%),while 14 (28.5%) and 13(26.5%) of the patients died 3 to 7 days and within the first day of admission

respectively. Gestational age, admission oxygen saturation and 1st minute APGAR score were significantly associated with the outcome of neonates.

Conclusion: Prematurity with RDS followed by early onset neonatal sepsis, MAS and Neonatal hyperbilirubinemia are common reasons for admission. Of total 226 admissions 49(21.7%) neonates died. Most common cause of death are prematurity with RDS followed by EONS and PNA. Gestational age, low admission oxygen saturation and 1st minute APGAR score were significantly associated with increased neonatal death.

Key words: Neonatal admission, Neonatal mortality, neonate, NICU, outcome

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Acronyms

ANC.....	Antenatal care
ANO.....	Adverse neonatal outcome
APH.....	Antepartum hemorrhage
BW.....	Birth weight
CI.....	Confidence Interval
ETB.....	Ethiopian Birr
ELBW.....	Extremely low birth weight
EDHS.....	Ethiopian Demographic and Health Survey
EONS.....	Early onset neonatal sepsis
G. C.....	Gregorian Calendar
HMIS.....	Health management information system
LBW.....	Low birth weight
LONS.....	Late onset neonatal sepsis
MAS.....	Meconium aspiration syndrome
MMC.....	Myelomeningocele
NICU.....	Neonatal intensive care unit
PI.....	Principal Investigator
PNA.....	Perinatal asphyxia
PPV.....	Positive pressure ventilation
PROM.....	Premature rupture of membrane
RDS.....	Respiratory distress syndrome
SPHMMC.....	St. Paul hospital millennium medical college
SPSS.....	Statistical Package for Social Sciences

TASH.....Tikur Anbessa specialized hospital
TEF.....Tracheo-esophageal fistula
TTN.....Transient tachypnea of newborn
VLBW.....Very low birth weight
WHO.....World health organization

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1. Introduction

1.1 Background

Neonatal period is a susceptible time in which the newborn has to adapt to a new environment and is vulnerable to antenatal and postnatal complication (19). Neonatal morbidity along with the mortality being the major health issues in the developing countries accounting majority of under 5 yrs. mortality majority of which are preventable (17,24). The most common causes of neonatal deaths are preterm birth, birth asphyxia and infection (21, 23).

According to WHO report of 2022, with 2.4 million newborns dying in 2020. In the same year, the newborn period accounted for 47% of all under-five mortality, an increase from 1990 (40%), because newborn mortality is dropping more slowly globally than the rate of under-5 mortality. and more than one quarter of deaths occur in the first 24 hours (1,10).

Regionally, South Asia and SubSaharan Africa had the highest overall rates of neonatal mortality, with estimates of 27 and 23 deaths per 1,000 live births, respectively, in 2021. Compared to children born in high-income nations, children born in sub-Saharan Africa had a first-month mortality rate that was over ten times higher, while children born in South Asia had a nine fold higher mortality rate. Between nations, the probability of passing away in the first month of birth was around 53 times higher in the nation with the highest mortality rate than the nation with the lowest mortality rate.(2)

Ethiopia stood 4th on the rank in the world in neonatal mortality. The primary causes of most neonatal deaths include preterm birth, birth asphyxia, infections, and birth anomalies .(2)

Children who die early during the first 28 days of birth suffer from ailments and disorders linked to a lack of high-quality treatment during pregnancy, labor , delivery, and the first few weeks of life (2,12).

The Every Newborn Action Plan (ENAP), one of the approaches used to prevent newborn deaths based on evidence-based solutions, is one of the numerous global programs created to minimize neonatal mortality. To reinforce this effort, a new global ambition was adopted under the sustainable development goal (SDG), which has a goal of lowering neonatal mortality to only 12 deaths per 1000 live births by 2030 (1,10,23).

Trends in mortality worldwide show that perinatal and neonatal mortality are declining less rapidly compared to infant and under-5 mortality (1,15). The slow decline in neonatal mortality as compared to post-neonatal mortality calls for attention and efforts to reverse this trend. Regular assessment of the illness patterns in hospital NICU settings is an indicator to show the availability, utilization and effectiveness of mother and child health services (16). Therefore, the aim of this study is to assess the pattern of admission and outcome of neonates that were admitted to NICU.

2. Statement of the problem

Early newborn mortality is typically influenced by three key factors: maternal issue, neonate factor, and the preparedness of the health facility .The total neonatal mortality rate will be significantly lower as a result of interventions targeted at preventing early premature deaths of infants. According to the EDHS, the newborn mortality rate decreased from 49 deaths per a thousand live births in 2000 to 33 deaths per thousand live deliveries in 2019 (10).

Although the nation has made strides over the past twenty years, progress in lowering neonatal mortality has been much slower than that of fewer than 5 years (2, 15). Preterm delivery, birth asphyxia, and infections are widely recognized preventable causes (20).

Planning, putting into practice, and assessing newborn health measures would be greatly aided by continuous surveillance on the cases, epidemiology, and characteristics of neonatal admission (17). Therefore, newborns hospitalized to NICUs need to have their outcome and associated factors evaluated regularly.

3. Significance of the study

Neonatal care starts in the delivery room followed by proper transport and safe NICU environment for those neonates who are sick. Trained health workers both in the delivery room and NICU is mandatory to treat and improve outcome of sick neonates .NICU requires level specific equipment to take care of sick neonates (22).

This study has assessed the outcome of neonates admitted to NICU after the unit has moved to new MCH building which has better space, equipment for level 2 NICU and trained neonatologists as well as ALS nurses in labor ward. The study data has helped as an input to identify gaps and challenges to further improve quality of care and to compare outcome from previous similar study conducted in 2015. The study can also be used as an input to identify gaps and challenges to further improvement of quality of care, to help policy makers and implementers to better utilize services, allocate resources more wisely, and address problems that cause adverse neonatal outcomes. Additionally, it can be beneficial for strengthening NICU admission and treatment protocols. Last but not least, the results of this study can be operated as a foundation for future research.

4. Literature review

The neonatal period, the first 28 days of life, are the most precarious for a child's survival. At an average global rate of 18 deaths per 1,000 live births in 2021, down 51% from 37 deaths per 1,000 live births in 1990, children have the highest risk of dying in their first month of life. In contrast, the likelihood of passing away after the first month and before turning one was predicted to be 11 deaths per 1,000, and the likelihood of passing away after turning one and before turning five was predicted to be 10 deaths per 1,000 in 2021. Around 6,700 neonatal deaths per day, or 2.4 million children worldwide, perished in their first month of life in 2020, this accounted for 47% of death under 5 year (1,2).

Despite a global decline in neonatal mortality, there are still noticeable difference between areas and nations. In terms of regions, Sub-Saharan Africa and South Asia account for the highest mortality, having 27 and 23 deaths per thousand live births in 2021 respectively. Compared to children born in high income countries, children in sub-Saharan Africa had mortality in the first month of life that was ten times higher (1).

In a 5-year retrospective study done at tertiary care hospitals in central India, RDS- 39%, and neonatal sepsis (24%) were common admissions. Only 2.5% of newborns had congenital malformations .Newborn mortality was 11% .54% of the babies were delivered low birth weight The two most frequent causes of neonatal mortality were prematurity with RDS and perinatal asphyxia, with extremely small birth weight neonates having the greatest share (3).This finding is in contrast to a research carried out in Nepal with infections and hyperbilirubinemia as top admission diagnosis(44.96% and 23.15%, respectively), with preterm (9.51%) followed by birth asphyxia (9.13%). From those admitted, 79.83% improved and discharged, 34 newborns were referred, and 36 newborns died. Birth asphyxia (13.89%), sepsis (27.78%), and preterm (44.45%) were the primary causes of neonatal mortality. (4)

A systematic review and meta-analysis done in Sub-Saharan Africa showed neonates born with normal APGAR score at 1st and 5th minute had 3.47(PHR:3.47,95%CI) times higher risk of dying, When compared to neonates delivered from single pregnancies, multiple birth neonates had a four-fold (PHR:3.92.95%CI:2.64,5.37) higher mortality .Similarly, preterm infants had a 3.78 (PHR: 3.78, 95% CI: 2.28, 5.27) times more likelihood of succumbing than neonates born at term (6).

Multiple congenital anomalies (n14180, 25.4%), neonatal jaundice (15.3%), congenital intestinal obstruction (15.3%), and transient newborn tachypnea (9%) were the most typical causes for hospital admission among full-term babies, according to a study on inborn and out-born newborn admissions to the NICU at a tertiary care university hospital in Egypt. Perinatal asphyxia, hypoglycemia, IDM, and meconium aspiration syndrome were all notably more prevalent in inborn full-term newborns than out-born full-term neonates in cases of transitory tachypnea of the newborn (7). Contrarily, there were significantly more out-born full-term neonates than in-born full-term neonates who had congenital intestinal obstruction, neonatal jaundice, sepsis, neonatal convulsions, and thrombocytopenia. Similar multi-center research conducted in Taiwan and Nepal showed, Out born newborns had a higher neonatal mortality rate than inborn newborns (4, 8).

The most frequent diagnoses among the admitted newborns in the NICU at Saad Abu Elella Teaching Hospital Sudan Kartum were sepsis, respiratory distress syndrome, neonatal jaundice, and asphyxia. In line with the causes of mortality documented in a number of poor nations, neonatal sepsis and respiratory distress syndrome were the most often diagnosed causes of death in newborns. About 15% mortality rate documented in this study (9)

A study using data from EPHI, which is collected and compiled from various health facilities across the country on review of perinatal death obtained from all PDSR implementing regions for four consecutive years (2018–2021), revealed that 2190 (57.4%) of the 3814 perinatal fatalities overall were early neonatal deaths. Within the 48 hours following birth, 1147 (52.4%) of the early newborn deaths occur, which accounted for 84% of the reported perinatal mortality from tertiary level healthcare overall, with 100.0%, 90.5%, and 85.4%, respectively, of the recorded perinatal deaths from Gambella, Harari, and Addis Ababa. Additionally, early neonatal deaths accounted for 69.9% of all recorded perinatal fatalities in 2018. (10)

A hospital-based unmatched case-control in 5 randomly selected hospitals of Mekelle city, showed nearly two thirds of ANO had (61.5%) low birth weight, followed by preterm birth (57.7%), and a poor Apgar score (53.9%). In 5.8% to 3.9% of cases, neonatal fatalities and small for gestational were noted. Mothers with low monthly incomes (500 ETB) were 7.7 times more likely than mothers with higher monthly incomes (>1000 ETB) to have

unfavorable newborn outcomes (AOR = 7.647% to 95 % (1.545-37.84)). In addition, those earning 501 to 1000 ETB were 4.4 times more likely than mothers earning more than 1000 ETB to have ANO (AOR = 4.364 to 95% CI (1.050-18.129) Mothers who lived in rural areas were six times more likely than urban residents to experience poor newborn outcomes (AOR = 5.992 to 95% CI (1.011-35.809)). Similar to this, poor newborn outcomes were strongly related to the mode of delivery. In this instance, neonates born by emergency C/S had a 10-fold higher risk of having ANO than neonates delivered via vaginal delivery (AOR = 9.969 to 95% CI (1.023-97.148)) (11).

According to a hospital-based retrospective cohort research conducted in Ethiopia's Somali area, out of 765 patients (between 0 and 7 days) assessed, 99 perished before their time and 666 survived. In comparison to 184/666 (27.6%), a higher percentage of low birth weight (under 2000 g), (41.4%)—died. Similar to this, of the 99 newborns that died prematurely (88.9%) and (72.7%) were hypothermic and not revived, respectively, mortality was higher among newborns with lower first minute APGAR scores of (88.9%) compared to those with higher scores of (11.1%) (12)

A retrospective cross-sectional study was conducted admitted neonates in the NICU of University of Gondar ,from a total of 769 neonates was included in the study common neonatal morbidity were hypothermia 546 (71%), sepsis 522 (67.9%), prematurity 250 (34.9%), polycythemia 242 (31.5%), hypoglycemia 142 (18.5), meconium aspiration syndrome 113 (14.7%), and perinatal asphyxia 96 (12.5%). The overall mortality was 110 (14.3%). Highest mortality seen with perinatal asphyxia (AOR: 5.97; 95% CI: 3.06–11.64), instrumental delivery (AOR: 2.99; 95% CI: 1.08–8.31), and EONS Additionally, rural residency, delivery at a health center, gestational age 34 weeks, LBW, and lack of ANC follow-up were significantly associated with neonatal death. Newborns with morbidity such as moderate hypothermia, EONS, hypoglycemia, and perinatal asphyxia were significantly associated with neonatal death (14).

According to a prospective cohort study of newborns hospitalized to the NICU at SPMMC in 2015, Prematurity with RDS (36.6%), infection (22.7%), and neonatal hypoxic events (16.2%) were the most prevalent primary diagnoses during admission to the neonatal care unit. Of total admissions, 23.2% of the neonates died. Patients with the diagnoses of prematurity with

RDS (40.5%) and asphyxia (40.0%) had a high case fatality rate. Of the 50 neonates who died, 36 (72%) had a birth weight of 2,500 g. 18 (58.1%) of the 31 neonates (weighing between 1,000 g and 1,499 g) and four (80%) of the five neonates (weighing 1,000 g) passed away. Asphyxia was a standalone predictor of mortality (adjusted odds ratio =5.817; 95% confidence interval: 1.611-20.977), although gestational age greater than the norm for the study population (36.6 weeks) was protective against mortality (adjusted odds ratio =0.683; 95% confidence interval: 0.588-0.795). Thirty of the fifty fatal patients or infants (or 60%) were admitted to the newborn ICU within the first hour of life. after the 50 deaths, 12 (24.0%) happened within a day after admission, and 34 (68%) happened within three days. 86.0% of the deaths were inborn neonates. Neonates with a gestational age of 36.6 3.8 weeks (P=0.000), a first-minute Apgar rating of 7, a fifth-minute Apgar rating of 7, the need for ventilator support (P=0.000), a diagnosis of asphyxia (P=0.012), the absence of ANC (P=0.026), and fewer than four ANC visits all had higher mortality rates. For the other obstetric and clinical traits, the probability of death was not noticeably different.(15)

5. Objectives

5.1. General objective

To assess the pattern of admission and outcome of neonate admitted to neonatal intensive care unit at SPMMC

5.2. Specific objectives

1. To assess the characteristics of disease of the neonates admitted
2. To assess the outcome of newborn infants admitted
3. To identify the cause of death of newborn admitted

6. Methods and Materials

6.1 Study Area

The study was conducted in SPHMMC, NICU. St. Paul's millennium medical college is a leading public hospital and medical college in Addis Ababa, Ethiopia. It was inaugurated in July 1947, which was furnished with 250 beds. The hospital was then administered by ministry of Health in 1969 by the late emperor Haile-sillase with 75% of finance cost financed

by the German Evangelical Church. NICU during the study period was on Level II setup and receives an average of 271 neonates monthly as in patient. It has one preterm room, one stable side, one Low dependency unit, 2KMC rooms, and one HDU with 6 beds for critical care equipped with CPAP machine .It is led by two neonatologists with nursing staff , pediatrics residents and medical interns during the study period..

6.2 Study Period

The study was conducted from charts of neonates admitted from May - July , 2020

6.3 Study Design

An institutional based retrospective cross-sectional study was conducted by reviewing patient charts.

6.4 Population

6.4.1 Source Population

All neonates admitted to SPHMMC

6.4.2 Study Unit

All neonates admitted to NICU at SPHMMC during the data collection period and who fulfills the inclusion criteria

6.4.3 Inclusion criteria

All neonates admitted to NICU with full information recorded in the chart and stayed more than 24 hour was included during the study period

6.4.4 Exclusion criteria

Neonate stayed and discharged with in 24 hour, gestational age less than 25+6 weeks, those with incomplete data or discharge situation unknown was excluded.

6.5. Sample size determination

$$n = \frac{(Z \alpha/2)^2 P (1-P)}{d^2}$$

Where n=Sample size

Z=z value corresponding to a 95% level of significance=1.96

p =prevalence of neonatal mortality from previous study done at SPMMC =23.2%=0.232

$q = (1-p) = (1-0.232) = 0.768$

d =absolute precision (5%)

Therefore, based on the above single proportion formula the sample size $n=274$

However, since the total number of neonatal admission at SPMMC per year is 3252 which less than 10, 000, so reduction formula employed as follows;

$nf = n / (1 + n/N)$,

Where nf : final sample size resulted from reduction formula

n : sample size from simple proportion formula: 274

N : total population (total neonatal admission over 3mo): 813

Therefore, nf : 205

With Non response rate of 10%, final sample size was 226.

6.6. Sampling procedure

The study population calculated from average number of neonates who were admitted in a month from monthly report from previous year. To get actual sample, systematic random sampling technique every k value was used as a sampling frame among neonates admitted during the study period $k = N/n = 813/226 = 4$, so the data collection procedure was every 4th chart according to the registration on HMIS.

6.7. Measurements

6.7.1 Dependent variables

Outcome of neonates admitted to SPMMC

6.7.2 Independent variables

➤ Maternal status

✓ Age

✓ Address

✓ Parity

✓ ANC status

✓ Chronic illness

✓ Obstetric complication

➤ **Neonatal status**

- ✓ Postnatal age at admission
- ✓ Gestational age
- ✓ Birth weight
- ✓ Sex
- ✓ Mode of delivery
- ✓ Place of birth
- ✓ APGAR score
- ✓ Clinical diagnosis at admission
- ✓ Length of stay

6.8 Data collection procedure

The data for this study was collected from registration log book and patient chart. The data was collected by structured check list for medical record review developed for this study. The data was collected by residents and general practitioners under supervision of primary investigator. The data collectors were given half day training on the checklist and questionnaire was pretested and necessary modification was made prior to data collection.

6.9 Operational definitions

Outcome refers to the condition of the patient at the end of hospital stay as discharged improved, referred, left against medical advice and died.

The **discharged improved**: includes those discharged with better condition than at admission after completion of treatment.

Neonatal mortality is defined as neonate who was born alive after 28 weeks of gestational age and died within the first 28 days

6.10 Data quality control

Careful modification of the data collection tool (PSS) according to Ethiopian situation

The data collection tool was pre-tested with 5 % of the sample size to assess its clarity, length, completeness, consistency and required time to carry out the chart review.

6.11 Data processing & analysis

The collected data was checked for completeness and consistency. The collected data was cleaned, coded and entered into EPI- Info version 7 and then exported in to SPSS Version 25.0 for analysis. Descriptive and analytical statistics including bivariate and multivariate analysis was computed and Logistic regression model was used to identify the association b/n dependent and independent variables. Data was presented using frequency tables and Chi-square test and odds ratio was determined when appropriate. P-value less than 0.05 was considered statistically significant

6.12 Ethical consideration

The proposal was submitted and clearance was sought from the ethical committee of SPHMMC. All information collected from patient's records was kept strictly confidential and names of patient were not included in the abstract data.

7. Results

7.1. Maternal socio-demographic pregnancy and delivery status

The mean maternal age was 26.12 years ranging from 16 to 42 years of age. 86% of the mothers were 20 to 34 years old, the rest 6.6% were less than 20 and more than 34 years old each.. 95.1% of the mothers were from urban whereas the rest 4.9% were from rural. 42.9% of the mothers were primiparous, while 27.4%,22.6%,6.2% and 9% of the mothers are para 2,3,4 and 5 respectively. Regarding previous abortions 13.3% of the mothers had 1 or more previous abortions. From those 66.7% of the mothers had abortion once while 26.7% and 6.7% of the mothers had 2 and 3 times of previous abortions. None of the mothers had early neonatal death or still birth. Of all 94.7% mother's ANC visit status was not known while 1.3% and 4% had incomplete and complete ANC visit respectively. About 46.5% of the population had obstetric complications. From which hypertensive disorders of pregnancy accounted for 52.4%, while PROM and preterm labor account for 21.9% and 12.4% respectively.

From laboratory findings of the mothers, 1.3% of the mothers are HBsAg and HIV positive status each. None of the mothers have VDRL positive result. The commonest mode of presentation was cephalic (90.3%) followed by breech 7.1 % and brow and face presentation account for 1.3% each. Most of the deliveries are by cesarian section (47.8%), while Spontaneous vaginal and Instrumental deliveries account for 45.6% and 6.6% respectively. Most of the pregnancies were singleton (89.8%) , while 10.2% of the pregnancies were twin. . The most common medications the mother took before birth was dexamethasone with magnesium sulphate (11.5%), Magnesium sulphate with antibiotics (9.3%) and dexamethasone alone account for 3.5%,(Table 1).

Table 1: Maternal socio-demographic and delivery status at SPHMMC, Addis Ababa, Ethiopia from May to July, 2020.

Characteristic		Frequency	Percent
Maternal age	<20	15	6.6
	20-34	196	86
	>34	15	6.6
Residence	Urban	215	95.1
	Rural	11	4.9

Mode of presentation	Cephalic	204	90.3
	Breech	16	7.1
	Face	3	1.3
	Brow	3	1.3
Parity	Primipara	97	42.9
	Multipara	129	57.1
Mode of delivery	Spontaneous vaginal	103	45.6
	Cesarean section	108	47.8
	Instrumental	15	6.6
Obstetric complications	Hypertensive disorders of pregnancy	55	52.4
	Antepartal hemorrhage	5	57.1
	Gestational diabetes mellitus	1	1
	PROM	23	21.9
	Preterm labor	13	12.4
	Uterine rupture	1	1
	Oligohydraminos	5	4.8
	Rh incompatibility	2	1.9
Maternal medications	Dexamethasone	8	3.5
	Magnesium sulphate	21	9.3
	Antibiotics	5	2.2
	Dexamethasone and magnesium sulphate	26	11.5
	Dexamethasone and antibiotics	6	2.7
	Magnesium sulphate and anticonvulsant	2	0.9
	Antibiotics, Magnesium sulphate Antibiotics	2	0.9
	Others	1	0.4
Previous abortion	Yes	30	13.3
	No	196	86.7
Laboratory findings	HIV positive	3	1.3
	HBsAg Positive	3	1.3
	VDRL Positive	0	0
Pregnancy outcome	Singleton	203	89.8
	Twin	23	10.2

7.2. Characteristics of the neonates during admission

Out of 226 neonates 55.3% were male, while 44.7% of the neonates were females making Male to Female ratio of 1.23:1. The mean age at admission was 13.79 hours with 5 minute was the minimal and 12 days being the maximum age. Regarding the birthplace out of 226 neonates 72.6% of the neonates were inborn while 27.4% of the neonates were out-born. From the out-born deliveries 38(16.8%) were at health center, while 15(6.6%) and 9(4%) were hospital and home deliveries respectively. Most of the patients 127(55.7%) were term deliveries, while 46(20.2%), 26(11.4%),17(7.5%) and 4(1.8%) were 34 to 36, 28 to 31, 32 to 33, and more than 42 weeks of gestational age, (Table 2)

The mean birth weight was 2448 grams with minimum birth weight of 700 grams and maximum birth weight of 4400 grams. 52.6% of neonates had normal birth weight , while 24.6%, 13.2% and 4.4% LBW,VLBW and ELBW respectively. The rest 2.2% were macrocosmic . Regarding size at birth based on birth weight percentile 74.1% of the neonates were AGA and 24.8% were SGA, (Table 2)

Table 2: Characteristics of neonates admitted to the NICU of SPHMMC , Addis Ababa, Ethiopia from May to July 2020.

Characteristic		Frequency	Percent
Sex	Male	125	55.3
	Female	101	44.7
Place of delivery	Inborn	164	72.6
	Out-born	62	27.4
Birth weight	500 – 999	10	4.4
	1000-1499	30	13.2
	1500-2499	56	24.6
	2500-3999	120	52.6
	>4000	5	2.2
Gestational age	28 to 31	26	11.4
	32 to 33	17	7.5
	34 to 36	46	20.2
	37 to 41	127	55.7
	>42	4	1.8

Birth size based on weight percentile	AGA	163	74.1
	SGA	56	24.8
	LGA	1	4

Out of 226 patients 211(93.4%) patients have their APGAR score mentioned on the chart, while 15(6.6%) of the patients APGAR score was not known. The 1st minute APGAR score was 0 to 3 in 7%, 4 to 6 in 44% and 7 to 10 in 41.2% of the neonates. The 5th minute APGAR score was found to be 0 to 3 in 1.8%, 4 to 6 in 19.7% and 7 to 10 in 71.1%. The 10th minute APGAR score was 4 to 6 in 43.8%, 7 to 10 in 53.9%, (Figure 2).

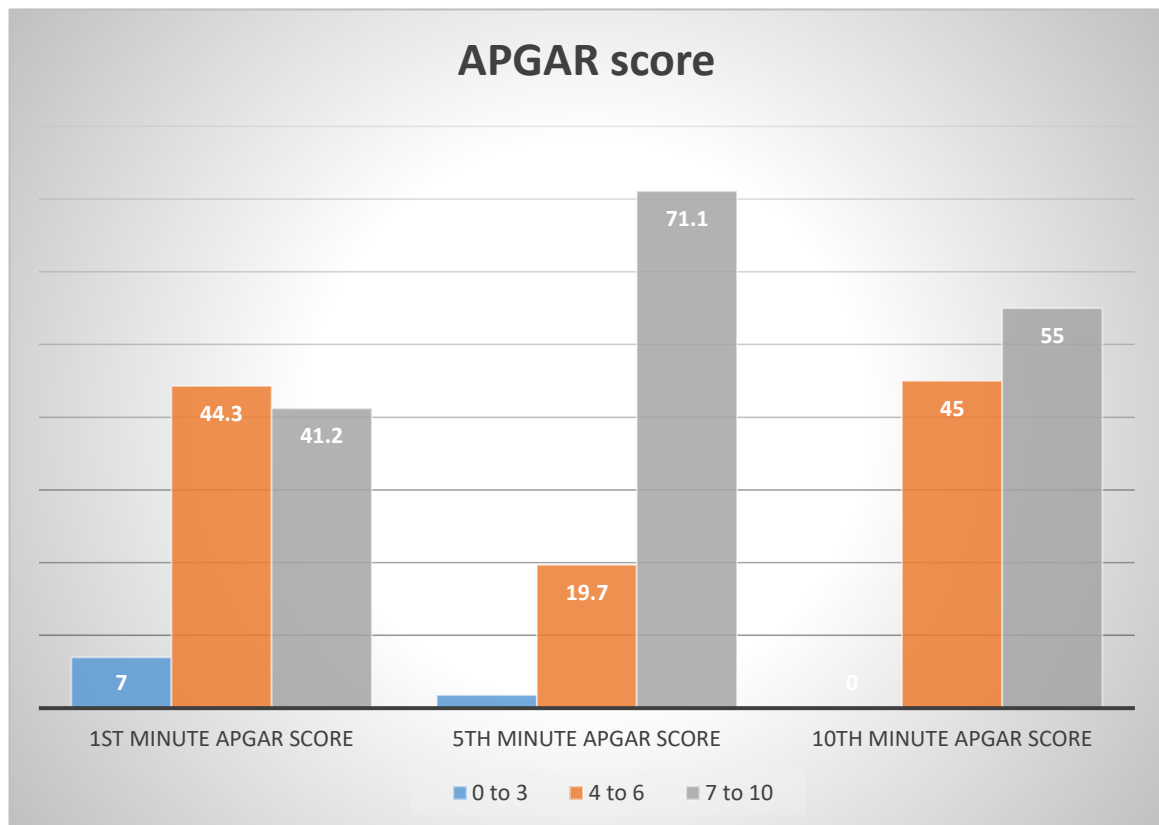


Figure 1: APGAR score of the neonates at SPHMMC , Addis Ababa, Ethiopia from May to July 2020.

Regarding the resuscitation status of the patients, 54 (23.9%) of the patients were resuscitated in the delivery room. 50(22.1%) of the patients were resuscitated with PPV only and

79(3.1%) of the patients were resuscitated with PPV with chest compression. IV fluid needed in 2(0.9%), Adrenaline with IV fluid in(1(0.4) and Adrenaline, atropine and IV fluids in 2(0.9%) of the patients,(Table 3).

Table 3: Resuscitation status and medications used during resuscitation at SPHMMC, Addis Ababa, Ethiopia from May to July 2020

Resuscitation in delivery room	Yes	54	23.9
	No	172	76.1
Type of resuscitation	PPV	50	22.1
	PPV with chest compression	4	1.7
Medications used during resuscitation	Adrenaline	1	0.4
	Atropine	2	0.9
	Aminophylline	3	1.3
	IV fluids	2	0.9

Regarding the admission vital signs the mean heart rate was 146.3, while the mean respiratory rate , Temperature, oxygen saturation and random blood sugar are 54.9, 35.9, 84.6 and 70.1 respectively, (Table 4).

Table 4: : Admission vital signs of the study population at SPHMMC, Addis Ababa, Ethiopia from May to July 2020.

Admission heart rate	<90	4	1.8
	90-160	166	72.8
	160-180	56	24.6
Admission respiratory rate	<20	5	2.2
	20-60	143	62.7
	>60	78	34.2
Admission temperature	32-35.9	65	28.5
	36-36.4	78	34.2
	36.6-37.5	60	26.3
	>37.5	23	10.1
Admission oxygen saturation	<90	102	44.7
	>90	124	54.4

7.3. Pattern of admission and diagnosis of patients at SPHMMC NICU.

The most common reason for admission to NICU RDS 45(19.9%), followed by TTN 26(11.5%), MAS 24(10.6%) ,Neonatal hyperbilirubinemia 20(8.8%) and early onset neonatal sepsis 18(8%), (Table 5).

Table 5: Reason for admission of the study population at SPHMMC, Addis Ababa, Ethiopia from May to July 2020.

Reason for admission		Frequency	Percent
Valid	Early onset neonatal sepsis	25	11
	Late onset neonatal sepsis	1	0.4
	Neonatal hyperbilirubinemia	20	8.8
	Meconium aspiration syndrome	24	10.5
	Respiratory distress syndrome	45	19.7
	Perinatal asphyxia	19	8.3
	Small for gestation age	16	7.07
	Hypoglycemia	5	2.2
	Hypothermia	8	3.5
	Transient tachypnea of newborn	26	11.4
	Baby of a mother with prolonged PROM	7	3.09
	Subgaleal hemorrhage	11	4.8
	Urinary retention	1	0.4
	Myelomeningocele	3	1.3
	Hydrocele	1	0.4
	Neonatal dehydration	3	1.3
	Campomelic dysplasia	1	0.4
	Tracheo-esophageal fistula	2	0.9
	Hirschsprung disease	2	0.9
	Gastroschisis	2	0.9
	Cleft lip and palate	1	0.4
	Circumcision site bleeding	1	0.4
	Hydrops fetalis	1	0.4
	Down syndrome	1	0.4

The most common treatment the newborn received was antibiotics 134(59.3%) followed by phototherapy 65(28.8), aminophylline 19(8.4%), and anticonvulsants 10(4.4%). Over all 21(9.3%) of the patients were transfused 1 or more blood components. From those Platelet and FFP transfusion account 7 (3.1%) each, While 1(0.4%) patient had exchange transfusion , 3(1.3%) underwent direct blood transfusion, and 3 (1.3%) underwent combined blood product transfusion. Regarding the respiratory support the newborn received 72(31.9%) were oxygen via nasal cannula while 85 (37.6%) were CPAP, (Table 6).

Table 6: Treatments the study population received at SPHMMC NICU Addis Ababa, Ethiopia from May to July, 2020

Treatment given		Frequency	Percent
Antibiotics		134	59.3
Phototherapy		65	28.8
Aminophylline		19	8.4
Anticonvulsant		10	4.4
IV fluids		48	21.24
Blood product the patient transfused	Exchange transfusion	1	0.4
	Direct blood transfusion	3	1.3
	Platelet	7	3.1
	FFP	7	3.1
	Combined	3	1.3
Respiratory support the newborn received	Oxygen via nasal cannula	72	31.9
	CPAP	85	37.6

7.4. Neonatal outcome

Out of 226 patients 168 (74.3%) of the patients discharged from NICU, while 8(3.5%) of the patients were referred to other health facility and 49(21.7%) were died in the Hospital. One patient left against medical advice, (Figure 3).

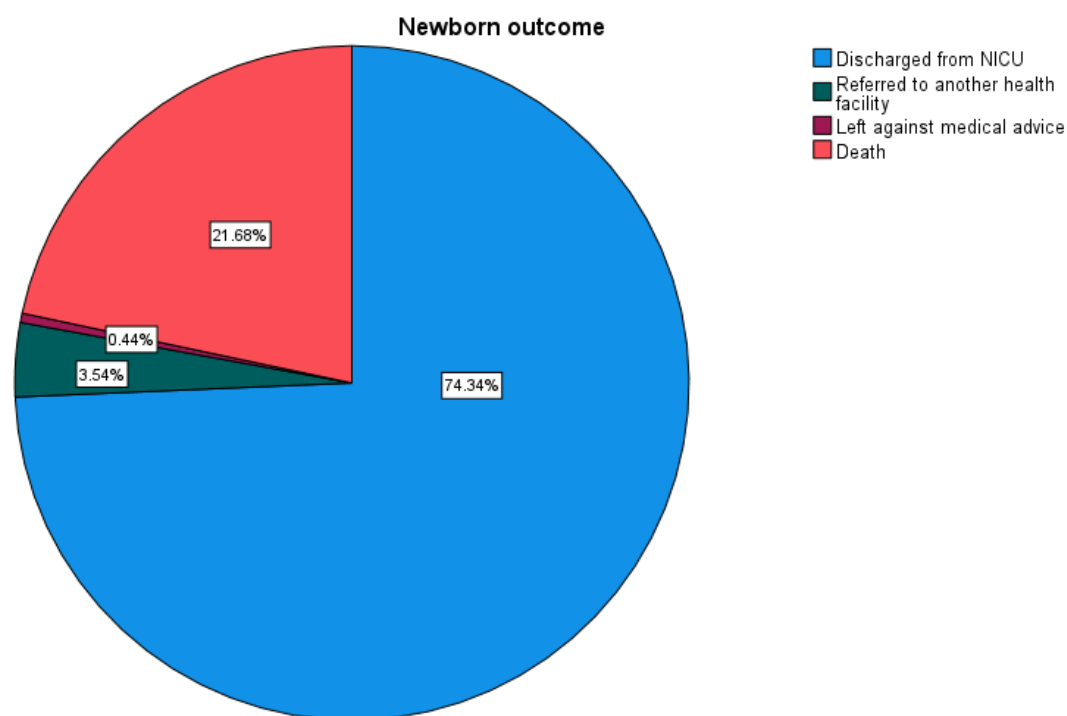


Figure 2: Newborn outcome at SPHMMC, Addis Ababa, Ethiopia from May to July 2020.

7.5. Discharge

Regarding the length of stay of discharged patients most patients stayed up to 24 hours 68(30.1%), while 63(27.9%) and 56(24.8%) of patients stayed for 1 to 3 and 4 to 7 days respectively. Most of the patients have discharge diagnosis the same as admission diagnosis 128(56.6%), (Table 7).

Table 7: Length of stay and condition at discharge of the study population at SPHMMC, Addis Ababa, Ethiopia from May to July 2020.

Condition at discharge	The same	6	2.7
	Improved	172	76.1
Length of stay in days	Up to 1day	68	30.1
	1 to 3 days	63	27.9
	4 to 7 days	56	24.8
	More than 7 days	39	17.3
Final diagnosis at discharge	The same as admission diagnosis	128	56.6
	EONS	12	5.3

	Neonatal hyperbilirubinemia	21	9.3
	MAS	1	0.4
	PNA	2	0.9
	TTN	9	4
	Others	7	3.1

7.6. Neonatal mortality

From total neonates died RDS account 31(63.2%) followed by EONS 8(16.3%) and PNA4(8.1%). The rest gastroschisis and TEF 2(4%) each. Lastly MAS resulted in death in 1 patient from total of 24 admission accounting 2 %, (Table 8).

Table 8: Proportion of mortality from admission diagnosis at SPHMMC, Addis Ababa, Ethiopia from May to July 2020

Primary diagnosis	Number of admission	Number of deaths	Percent
RDS	45	31	68.9
EONS	25	8	32
PNA	19	4	21.1
Gastroschisis	2	2	100
TEF	2	2	100
MAS	24	1	4.2
MMC	3	1	33.3

Regarding the mortality most of the deaths occurred 24 to 72 hours 16(32.7%),while 14 (28.5%) and 13(26.5%) of the patients died 3 to 7 days and within the first day of admission respectively, (Figure 4).

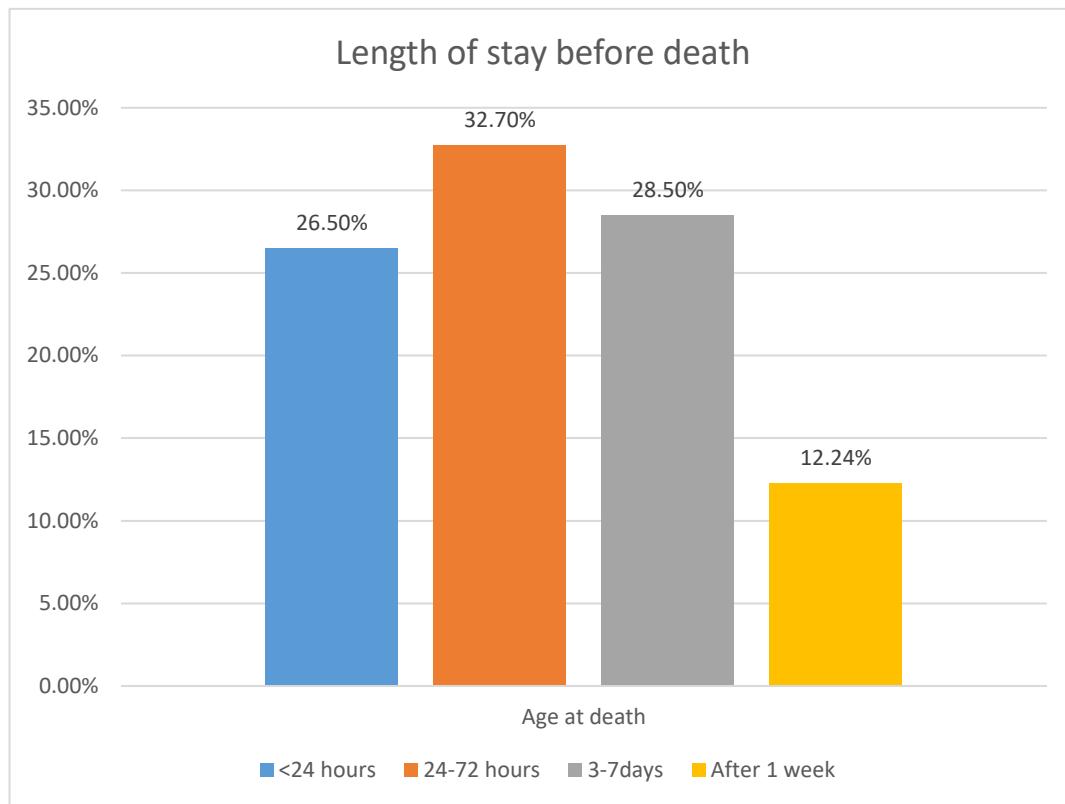


Figure 3: : Length of stay before death of the study population at SPHMMC, Addis Ababa, Ethiopia from May to July 2020.

7.7. Factors Associated with the Outcome of Neonates

Multiple logistic regression analysis was done using forward stepwise selection method using independent variables identified by binary logistic regression analysis. The assumption of no multi-col linearity was met and there were no outliers. The model was statistically significant $p < 0.05$ suggesting it could distinguish factors contributing to neonatal outcome. Gestational age, admission oxygen saturation and 1st minute APGAR score were significantly associated with the outcome of neonates. The model explained between 39.2% (Cox & Snell square) and 59.1% (Nagelkerke R square) of the variance in the dependent variable and correctly classified 90% of the cases.

Those neonates whose gestational age ranging from 28 to 31 weeks ($P = 0.03$, AOR 1.68, 95% CI (1.192-3.532)) were 1.68 times more likely to die than other gestational age categories.

Similarly, those neonates with admission oxygen saturation less than 90% ($P = 0.027$, AOR = 2.65, 95% CI: (0.997-7.088)) were 2.65 times more likely to die than those with admission oxygen saturation above 90%. Moreover, those neonates with 1st minute APGAR score of 0

to 3 (P=0.014, AOR=7.09, 95% CI: [0.87- 71.98]) were 7.09 times more likely to die than those with 1st minute APGAR score of more than 3. (Table)

Table 9: Bivariate and multivariate analysis of factors associated with neonatal outcome of the study population at SPHMMC, Addis Ababa, Ethiopia from May to July 2020.

Predictor variable	Outcomes	P value	COR	AOR
Gestational age	28-31 - 25(11.8%) 32-33- 17(8.1%) 34-36- 44(20.9%) 37-41- 121(57.3%) >42- 4(1.9%)	0.03	4.27	1.68
Admission oxygen saturation	<90%- 96(45.5%) >90%- 115(54.5%)	0.027	3.11	2.65
1 st minute APGAR score	0 to 3- 4(1.9%) 4 to 6- 101(47.9%) 7 to 10- 94(44.6%)	0.014	1.81	7.09
Birth weight	500-999- 7(7%) 1000 -1499- 25 (25%) 1500- 2499- 32(32%) 2500-3999- 34(34%) >4000-2(2%)	0.35	1.39	
Fifth minute APGAR score	0 to3- 6(6%) 4 to 6- 57(57%) 7 to 10- 37 (37%)	0.63	1.17	0.12
RDS	Yes - 32(32%) No- 68(68%)	0.19	2.85	0.53

8. Discussion

This study aimed to assess disease pattern and outcome of neonates admitted to the NICU. Out of 226 neonates included in this study 55.3% were male, while 44.7% of the neonates were females which was similar with a study done at Adama hospital in which 62.2% were males and 37.8% were females.

Our finding showed, 52.6% of neonates had normal birth weight, while 24.6%, 13.2% and 4.4% LBW, VLBW and ELBW respectively. The rest 2.2% were macrosomic. Regarding size at birth based on birth weight percentile 74.1% of the neonates were AGA and 24.8% were SGA. This result is in line with the study result from Dilchora hospital in which minority of neonates were below <1500 g with a frequency of 20(5.2%) and majority 283(72.9%) of the neonates were having appropriate weight for gestational age.

This study revealed prematurity with RDS 45(19.9%), followed by TTN 26(11.5%), early onset neonatal sepsis 25(11%), MAS 24(10.6%) and Neonatal hyperbilirubinemia 20(8.8%) as common reason for admission to NICU. In previous similar study done at SPHMMC the common primary diagnoses during admission to the neonatal care unit were prematurity with respiratory problem (36.6%), neonatal sepsis (22.7%), and asphyxia (16.2%). BUT Study done in Dilchora referral hospital showed early onset neonatal sepsis (EONS) as the major diagnosis in 157(40.5%) of neonates, while prenatal asphyxia observed in 8(2.1%) of neonates. Similar study done in TASH also showed EONS(50%), hyperbilirubinemia(16%) and MAS(12.8%) as major cause of admission. Another study done in Sudan Khartoum tertiary hospital revealed common diagnosis at admission being neonatal sepsis (28.6%), followed by respiratory distress syndrome (23.3%) and then neonatal jaundice which represents 13.6%.

Regarding the length of stay of the patients most patients up to 24 hours 68(30.1%), while 63(27.9%) and 56(24.8%) of patients stayed for 1 to 3 and 4 to 7 days respectively. In contrast in TASH majority 138(45.4%) of the neonates stayed for 4 -7 days followed by 90(29.6%), 1 - 3 days & 60(19.7%), >7days respectively and the rest 16(5.3%) of the neonate stayed for only < 24 hours.

In this study neonatal mortality accounts 49(21.7%)of total admission. There is a small decline in neonatal mortality from prior study done in SPHMMC in which 50 (23.1%) neonates died in the neonatal unit. This can be due to better care being given both in delivery room by trained ALS nurses as well as in NICU since the innovation of NICU with better staff number and quality with neonatologists .But study in Jimma tertiary hospital showed lower death among neonates admitted to NICU with overall neonatal mortality rate obtained at 18.48% which is in line with the study in TASH where neonatal death accounted 38(12.5%) from total admission and in study done in tertiary hospital in Sudan Khartoum in which 15% neonates died. This difference may be explained by high prevalence of prematurity with RDS which accounts 64.5% of death in our study.

In our study, most of the deaths occurred within 24 to 72 hours 16(32.7%),while 14 (28.5%) and 13(26.5%) of the patients died 3 to 7 days and within the first day of admission respectively. Similarly majority of death (34 (68%)) has occurred within the 3day of admission in prior by Tekleab et al. which is in line as reported by Bayana E et al. where out of 63 deaths, 35 (55.56%) of them occurred at ages of 24h to 7 days.

With respect to the outcomes, the present study found that 68.9% died of prematurity with RDS followed by EONS 32% and PNA 21.1% almost similar with prior study reported by Tekleab et al. in which Prematurity with respiratory problem and asphyxia were the major causes of deaths (64% and 28% of the deaths). Similarly as per Desalew et al. most common causes of neonatal mortality were complications of preterm 28 (28.58%), followed by birth asphyxia 22 (22.45%) and neonatal infection 18 (18.36%) which is in hand to hand with studies done in India and Nepal witnessed same result as prematurity with RDS as major morbidity and mortality . EONS was a leading cause of death (40.5%)followed by preterm (21.9%) and MAS (20.4%) in Dilchora tertiary hospital. But the three leading cause of death from the admission diagnosis were early onset of neonatal sepsis (n= 38), 14(36.8%), prenatal asphyxia (PNA) 8(21%) and Meconium aspiration syndrome 6(16%) in TASH.

Our finding has showed gestational age, admission oxygen saturation and 1st minute APGAR score were significantly associated with the outcome of neonates. Those neonates whose gestational age ranging from 28 to 31 weeks ($P=0.03$, AOR 1.68 , 95% CI (1.192-3.532)) were 1.68 times more likely to die than other gestational age categories in line with

study in Sudan showed that gestational age group of (30-36 week) (odds ratio [OR]=10.88; 95% CI: 1.171–101.253). Prior study in SPMMC showed that the odds of death was higher in neonates who had gestational age (36.6 ± 3.8 weeks) ($P=0.000$), . Study in TASH showed those who are preterm or delivered at gestational age of 30-33wks died more than those who were delivered at term OR.299(.101-.885) AOR.142(.039.513).

Similarly, those neonates with admission oxygen saturation less than 90% ($P=0.027$, AOR= 2.65 , 95% CI: (0.997-7.088)) were 2.65 times more likely to die than those with admission oxygen saturation above 90%. similarly oxygen saturation < 90% at admission was found as a significant predictor of neonatal death among referred neonates who were admitted at NICU in Amhara public hospitals .

Moreover in this study, those neonates with 1st minute APGAR score of 0 to 3 ($P=0.014$, AOR=7.09, 95% CI: [0.87- 71.98]) were 7.09 times more likely to die than those with 1st minute APGAR score of more than 3. Tekleab et al showed that the odds of death was higher in neonates who had fifth minute Apgar score ,7 ($P=0.000$), need of ventilator support ($P=0.000$), similarly in Dil Chora referral hospital there was a strong ($p=0.001$) association between APGAR Score and final admission out-come (those neonate with APGAR Score of 8-10 recovered more than those whose APGAR Score was below.

9. Recommendation

Having studied limited factors highlight the need for further prospective studies to identify the maternal and institutional factors that can affect the neonatal health outcome. Even though with these limitations, our study demonstrated an important fact that most of the causes of neonatal morbidity and mortality were preventable diseases, hence, emphasizing the importance of adopting interventions that were proven to improve maternal and neonatal intensive care services.

Hence, the fact that prematurity, sepsis, and asphyxia were common causes of death in our center could imply the need to take appropriate measures to reduce these factors of which most of them were preventable. Neonatal sepsis can be prevented by appropriate treatment of maternal infection and by proper infection prevention strategies during labor and delivery or after delivery. Asphyxia can also be prevented by proper training of the health care providers on how to detect fetal jeopardy during labor and delivery and also on how to identify risk factors. Providing training on neonatal resuscitation to health care providers who attend labor and delivery. Addressing some of the factors, which can lead to premature labor, could help to arrest preterm delivery.

10. Strength and limitation

This study contributes to the growing body of knowledge on factors influencing neonatal outcome. The insights gained from this research have the potential to drive improvements in prenatal care, early detection and management of neonatal diseases and ultimately improves neonatal outcome.

The main limitation of this study, was that being a retrospective some important data were missed and cannot be analyzed, and also it was a single center study, so the findings cannot be generalized outside the study area.

11. Conclusion

This study revealed prematurity with RDS followed by early onset neonatal sepsis, MAS and Neonatal hyperbilirubinemia as common reason for admission. Of total 226 admissions 49(21.7%) neonates died. 68.9% died of prematurity with RDS followed by EONS 32% and PNA 21.1%. Gestational age, low admission oxygen saturation and 1st minute APGAR score were significantly associated with increased neonatal death.

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13. Annexes

Annex III - Data collection sheet

PATIENT DATA

Date

Study number

Age

Sex 1) Female... 2) Male...

I. Maternal History

1. Age

A.<20 B.20-34 C.>34

2. Parity

A. Para I B.II- IV C.V and above

4.Residency

A. Urban, B. rural

3. RVI status

A. Positive B. negative C. unknown

5. ANC visits

A. yes, B .no

If yes specify number of visits.....

6. Obstetric complications

A.no B. Yes

If yes specify -----

7. Pregnancy outcome

A. Singleton B. Multiple

II. PATTERN of ADMISSION

1. Gestation age in weeks at birth

A. 29 to 31 B. 32-33 C. 34-36 D. >36

2. Weight at birth (g)

A. 500 – 999 B. 1000 – 1499 C. 1500 – 2499 D. >2500

3. Size at birth

A. Adequate for gestation age (AGA)

B. Small for gestation age (SGA)

C. Large for Gestation age (LGA)

4. Mode of delivery

A. Spontaneous vaginal delivery

B. caesarian section

C. Instrumental delivery

6. APGAR score at birth (minutes)

A. 1st

B. 5th.....

C. 10th

7. Resuscitation done at birth

A. Yes.....

B. No.....

8. hypothermia at admission

A. Yes

B. No

8. Place of delivery

A. Home delivery

B. Hospital delivery

C. Health Center

9. Admitted to NICU from

A. Maternity ward

B. Referred from other hospital

C. Came from home

10. Reasons for admission to NICU

1.

2.

3.

11. Admission diagnosis

1.

2.

3.

Part III . NEONATAL OUTCOME

1. Newborn outcome

1.1 . Discharged from NICU

1.1.1. Length of stay

A. 24 hr – 3 days

B. 4 days – 7 days

C. >7 days

1.1.2. Condition at discharge if different from one at admission

A.....

B.....

C.....

1.2. Referred to another health facility.....

1.3. Left against medical advice

1.4. Death.....

1.4.1. Death occurred after admission

A. <24 hours

B. 24 –72 hours.....

C. Within first week of life

D. > first week of life

1.4.2 Cause of death.....

13. Declaration

I hereby declare that; this thesis report is my original work and has not presented for a degree by another person in this or any other university and all source material used for this thesis have been acknowledged.

Name: _____

Signature_____

Date_____

Name of Advisor:_____

Signature_____

Date_____