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POSTGRADUATE PROGRAM

TREATMENT OUTCOME OF NEONATAL SEPSIS AND ASSOCIATED FACTORS AMONG NEONATES ADMITTED TO NEONATAL INTENSIVE CARE UNIT IN PUBLIC HOSPITALS, ADDIS ABABA, ETHIOPIA, 2021.

BY: **ASALF ENDAZANAW (BSc)**

A RESEARCH THESIS SUBMITTED TO DEPARTMENT OF NURSING, SCHOOL OF NURSING AND MIDWIFERY COLLEGE OF HEALTH SCIENCE, ADDIS ABABA UNIVERSITY, FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF MASTERS OF SCIENCE IN NEONATAL NURSING.

JUNE, 2021

ADDIS ABABA, ETHIOPIA

ADDIS ABABA UNIVERSITY

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THIS THESIS BYASALF ENDAZENAW WOLDATSDIK (BSC NURSE) IS ACCEPTED IN ITS PRESENT FORM BY BOARD OF EXAMINERS AS SATISFYING THESIS REQUIREMENT FOR THE DEGREE OF MASTERS IN NEONATAL NURSING.

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DECLARATION

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every effort has been made to avoid plagiarism in the preparation of this thesis.

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ABBREVIATIONS/ ACRONYMS

APGAR	Appearance, Pulse, Grimace, Activity and respiration
BVH	Bahawal Victoria Hospital
EONS	Early Onset Neonatal Sepsis
DOR	Discharged on request
GA	Gestational age
GMH	Gandhi memorial hospital
LAMA	Leave against Medical Advice
LONS	Late Onset Neonatal Sepsis,
MDG	Millennium development goal;
MEDHS	Mini Ethiopian Demographic health survey
MSAF	Meconium stained amniotic fluid;
NICU	Neonatal Intensive Care Unit
NMR	Neonatal mortality rate;
PROM	Premature rapture of membrane;
SDG	Sustainable development goal
SPSH	St Peter specialized hospital
TASH	Tikur Anbessa Specialized Hospital
UTIs:	Urinary Tract Infections,
WHO	World Health Organization
Y12HMC	Yekatit 12 hospital medical college

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Background: Neonatal sepsis is the major cause of neonatal mortality and morbidity globally, particularly in developing countries. Despite studies revealed the extent of neonatal sepsis in developing countries, the findings were inconclusive. Identification of the determinants for neonatal sepsis and treatment outcome of newborns with sepsis is not adequate in Ethiopia.

Objective: the aim of this study was to assess the treatment outcome of neonatal sepsis and its identifying factors among neonates admitted to neonatal Intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

Methods- Institution based cross sectional study was conducted among 308 neonates admitted with neonatal intensive care unit of selected public hospitals in Addis Ababa, Ethiopia. After coding, and entering the data to the software descriptive statistics such as proportion, frequencies, cross-tabulation, and measure of central tendency were calculated. Hospitals and study participants were selected by lottery method and systematic random sampling techniques respectively. Data were collected using structured pretested questionnaire through face to face interview and by reviewing both maternal and newborns profile card. The collected data was entered by using Epi-data version 4.6 and exported to SPSS version 26 for analysis. Variables that have p-value ≤ 0.25 were taken into the multivariable model to control for confounder. Statistical significance was declared at p-value ≤ 0.05. Odds ratio with 95% CI is used to determine the direction and strength of association between dependent and independent variable.

Results: Among the total study 308 neonates, 75(24.4%) were died. Regarding the treatment outcome of neonatal sepsis neonates <37 weeks of gestational age (AOR=4.87, 95% CI: 1.23-19.22), Grunting (AOR 6.94: 1.48-32.54), Meconium amniotic stained (AOR=3.03, 95% CI: 1.02-9.01), Duration of rupture of membrane (PROM) >18hours (AOR=3.66, 95% CI: (1.20-11.15), Hypertensive PIH/ Eclampsia (AOR=3.54, 95% CI: 1.24-10.09), Meropenum (AOR=4.16, 95% CI: 1.22-14.21) and CRP positive result (AOR=5.87, 95% CI: 1.53-22.56) were significantly associated with poor treatment outcome of neonatal sepsis.

Conclusion and recommendation: The treatment outcomes of neonates 75.6% were recovered and 24.4% were died. Empirical treatment was the pillar for management of neonatal sepsis in this setup**.** There is a need health policy maker to focus on the prevention of risk factors rather than treating the underline disease.

Keywords: Addis Ababa, neonatal sepsis, treatment outcome, 2021

1. INTRODUCTION

1.1. Background

Neonatal sepsis, a common critical illness in the neonatal intensive care unit (NICU), is outlined as a clinical condition characterized by a syndrome of infection with the presence of clinically suspected or culture confirmed infection in the first 28 days after birth(1). Neonatal sepsis is a systemic infection occurring for neonates up to 28 days of life and it's a major cause of morbidity and mortality in newborns(2).

Worldwide, neonatal sepsis accounts for an estimated 26% of under-five deaths, with sub-Saharan Africa (SSA) having the highest mortality rates. Sub-Saharan Africa has an uneven burden of neonatal mortality, leading to an estimated 49.6% of all under-five deaths in 2013(3).Furthermore, neonatal sepsis is accountable for 15% of global neonatal deaths and 30-50% of neonatal deaths in developing countries. In sub-Saharan Africa, 17% of neonatal deaths are due to neonatal sepsis. Around 37% of Ethiopian neonates also died due to neonatal sepsis, which accounts for more than one third of neonatal deaths(4).

Classification of neonatal sepsis is two main categories based on the time of onset, early onset neonatal sepsis (EONS) and late onset neonatal sepsis (LONS). Early-onset neonatal sepsis appears within the first seven days of life, and most cases happen within 24 hour of birth. Whereas late onset neonatal sepsis happens after 8 days of neonatal life and is mostly developed after delivery(5).

Bacterial sepsis is considered to be an important cause of neonatal mortality (deaths) in the first month of life(6). The world health organization estimated that there are approximately five million neonatal deaths per year of which 98% occur in developing countries(7). The number of children dying from sepsis in the world has almost doubled in the past 20 years(8).

Although the gold standard for the diagnosis of neonatal sepsis is identification of the pathogen in blood culture, it takes a minimum of one week to report and has low sensitivity. Thus, neonatal sepsis will not be excluded despite blood culture is negative(9). Auxiliary laboratory tests have limited value and are difficult to interpret due to low sensitivity and changing normal

ranges in neonatal age group(10). As a result, identification of the risk factors for risk based diagnosis and treatment of neonatal sepsis may contribute in better interventions and studies that help to reduce the burden of neonatal mortality resulting from these risks**.**

In developing countries, bacterial pathogens are the most common cause of neonatal sepsis,7 causing a wide variety of infections including meningitis, pneumonia, urinary tract infection and sepsis(11). These infections can run a rapid course with death occurring in less than 24 hours, if prompt effective empirical treatment is not instituted.(12). The development of effective empirical antibiotic protocols depends on the knowledge of the prevailing bacterial pathogens in that locality. In the neonatal period, it has been documented that the commonest blood-culture isolates in many low income countries were Staphylococcus aureus, Streptococcus pyogenes, and Escherichia coli(13).

In east Africa neonatal sepsis is one of the major common causes of neonatal death; it is the cause for more than one-third of neonatal deaths in Ethiopia. Particularly Identification of risk factors and timely initiation of treatments can significantly decrease neonatal mortality and morbidity(14). Preterm birth, asphyxia, tetanus and sepsis are reported to be the major causes of neonatal mortality in Ethiopia(4). Neonates diagnosed early and treated aggressively with antibiotics and good supportive care, it may be possible to save most cases of neonatal sepsis(15).

1.2. Statement of the problem

Globally neonatal sepsis is one of the major causes of neonatal morbidity and mortality(16). According to WHO report sepsis caused approximately 12% of the 2.9 million neonatal deaths in 2012(17). Out these deaths 99% happen in developing countries(18).

Early empiric treatment with antibiotics is essential for neonatal bacterial sepsis. Rapid clinical deterioration, however, may still ensue even if antibiotic treatment is started promptly. Possible life-threatening complications include the development of disseminated intra-vascular coagulation, pulmonary hypertension, congestive heart failure and shock (19). Conventionally, an estimated of 5.29–8.73 million disability-adjusted life years are lost annually in Sub-Sahara due to neonatal sepsis(20). Sepsis is a major cause of mortality in the first month of life. Overall sepsis causes for 6.8% under-5 mortality from 2000–2015(21).

In Pakistan a cross-sectional study shows regard to treatment outcomes of neonatal sepsis nearly 50% of neonates were discharged from the wards after successful completion of treatment. Importantly, 23% of neonatal sepsis patients left the Bahawal Victoria Hospital (BVH) against the medical advice. And also 25% of neonatal patients left against the medical advice (22). Most of the bacterial isolates showed high level of resistance against empiric treatment. Preterm less than optimal birth weight and EOS babies were more likely to die from sepsis. The antibacterial spectrum of the tested antibiotics was given, the combination of Piperacillin+ Tazobactam with Amikacin could be recommended as an empiric therapy for neonatal sepsis (22).

According to 2019 Mini Ethiopian Demographic health survey (MEDHS) report, the neonatal mortality rate (NMR) is 30/1000 live births, which has no significant reduction from the 2011 EDHS report which was 37/1000 live births. This significant number of death is greatly attributed to neonatal sepsis (23, 24). To achieve sustainable development goal (SDG) reducing newborn and under five mortality as low as 12/1000 and 25/1000 respectively, is one of the Global strategies of WHO in African countries by 2030. This could be achieved through better prevention and management of preterm births and severe infections as the key(24) . In a number of developing countries, identification of factors for neonatal sepsis and treatment of neonates with sepsis is not satisfactory. Moreover, reports from low income countries revealed inconsistencies in the prevalence, risk factors, and mortality from that of developed countries.

Identification of risk factors and timely initiation of treatments can significantly decrease neonatal mortality and morbidity (25).

Despite the presence of few studies regarding risk factors, predictor and treatment of neonatal sepsis, there are some contradicting or inconsistent findings on some factors for neonatal sepsis, like prematurity, low birth weight and maternal complications. Besides some factors specifically neonatal invasive procedures were not incorporated(26).

The treatment outcomes of neonatal sepsis vary in different hospitals with different setups. Early diagnosis and treatment are necessary to save the life of our upcoming generation. The neonates with "risk factors" for neonatal sepsis are thus treated with broad-spectrum antibiotics and it requires prolonged hospitalization. This may require expertise to identify the common risk factors, the antimicrobial use pattern and the clinical outcome treatment of neonatal sepsis. Therefore the purpose of this study was to assess treatment outcome and associated factors of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia.

2. LITERATURE REVIEW

2.1. Introduction

Neonatal sepsis is a clinical syndrome of systemic illness in infants of 28 days or younger, manifested by systemic sign of infection and/or isolation of bacterial pathogen from blood stream. It may cause just bacteremia or be association with systemic involvement as meningitis, pneumonia or osteomyelitis(27). The most common causes of death in the neonatal period are infections, including septicemia, meningitis, respiratory infections, diarrhea, and neonatal tetanus (32%), followed by birth asphyxia and injuries (29%), and prematurity (24(17).

Literature review searching different search engines such as BMC**,** PubMed, Cochrane library, Google scholar, Hinari, and other journals were used. Literature searches were performed by combining terms that are indicative of illnesses of interest (sepsis, neonatal sepsis, early onset sepsis, late onset sepsis, treatment outcome of neonatal sepsis and bacteremia). Indicators of target age group (neonates and newborn) were used. All used literatures have been cited.

2.2. Overview of neonatal sepsis

A cross-sectional study conducted in Pakistan Bahawal Victoria Hospital shows regard to treatment outcomes among the total neonates 47.8% were discharged (with treatment success), 20.8% leave against medical advice (LAMA), 10.4% were discharged on request (DOR) and 21% were died during treatment(22). According to a study done in Nepal factors affecting the treatment outcome of neonates admitted in the neonatal intensive care unit includes maternal age, gestational age of neonate, birth weight, availability of resources, adequate, and well-trained personnel(28).

A cross sectional study which was conducted in mexico, poor treatment outcome and mortality were mainly dependent on prematurity, low birth weight, perinatal asphyxia, low Apgar score, a requirement of assisted ventilation, and invasive medical procedures(29).

A cross sectional study reveled in Dessie Referral Hospital, Ethiopia, small gestational age, being male, out born, not having breastfeed and lower Apgar score in the first 5 minute were identified as associated factors for the poor treatment outcome of preterm neonates admitted in

NICU(30). According to a study done in nekemte town the outcome of neonates with infections is strongly related to their appropriate diagnosis and management. Diagnosing neonatal infection, however, is a challenge, since 12 (3.92%) died in the hospital (31). Another study done in Ethiopia Debrezeyt town the overall poor outcomes of neonatal sepsis were 26% including deaths (32).

2.3. Factors Associated with Treatment Outcome of neonatal sepsis

Factors which were considered as determinants of neonatal sepsis were reviewed from the findings of literatures. Those factors which were related to neonatal sepsis were structured as socio-demographic, maternal factors, neonatal factors Antimicrobial use, clinical presentation of neonatal sepsis and Diagnostic/laboratory results of neonates related to neonatal sepsis.

2.3.1. Socio-demographic characteristics of the patients

According to a study in Nepal, maternal illiteracy was associated with the likelihood of developing treatment of neonatal sepsis despite do not statistically significant (33). Another study in Tanzania, showed that maternal age was significant factor for neonatal sepsis, neonates delivered from women with age of less than 20 years old, (AOR=6.7;95%CI=2.1-20.1) were 6.7 times more likely to develop sepsis compared to neonates delivered from women >20 years(34).

According to a study done in Nekemte town in western Ethiopia regarding maternal education more than half of the 53.9% attended secondary school followed by 23.5% college or above (31).

2.3.2. Maternal factors related to neonatal sepsis

According to a study in Mexico ; neonates born from women with meconium - stained amniotic fluid (MSAF) to have more sepsis when compared to neonates born from women without MSAF; neonates delivered from women with prolonged rupture membrane (PROM)>18 hours (RR=3.5, 95 % CI =1.8-6.6) were 3.5 times more likely to have sepsis when compared to those delivered from women without prolonged rupture membrane (PROM)(29). Studies done in Ghana resuscitation at birth was ($p<0.004$), APGAR scores at the first and fifth minutes were ($p<0.001$) and Premature rupture of membrane (PROM) were ($p<0.001$) had significant association with the risk of neonatal sepsis(3).

According to a study done in Nekemte town, Western Ethiopia factors such as place of delivery, mode of delivery and mother with UTI during delivery were the most common risk factors for the incidence of neonatal sepsis. In Nekemte town, 31.4% has urinary tract Infection (UTI) and 40.8% have high-grade fever during delivery(31).

Another study done in Central Gondar Zone Primary Hospitals, Northwest Ethiopia neonates who get care by health workers who had no training on NICU/ IPPs were 2 times more likely to develop treatment of neonatal sepsis as compared to neonates who get care by trained health professionals(35).

2.3.3. Neonatal factors related to neonatal sepsis

Very low birth weight (VLBW), Immature, newborns have improved survival but remain in the hospital for a long time in an environment that puts them at continuous risk for acquired infections(36).

According to a study in Nepal, male babies showed odd of 2.91 higher chance of developing sepsis than females was associated with the likelihood of developing neonatal sepsis despite do not statistically significant (33).

According to a study in Indonesia, Apgar score <7 in the first minute were 14.05 (AOR= 14.05, 95% CI= 5.45-35.98) times greatest risk of sepsis compared to ≥7. On gestational age <37 weeks were 13.45 (AOR =13.45, 95% CI =3.91-46.26) times more likely to develop sepsis compared to neonates with gestation age ≥37 weeks. While birth weight <1500 gram were 4.9 (AOR=4.9, 95% CI =1.08-22.25) times greatest risk of sepsis compared to ≥1500 gram(37). In Tanzania studies showed that birth weight and male sex were significant predictors of LONS (P< 0.05)(38).

Based on study done in Shashemene town Neonates who had asphyxiated were 3.54 times developed to have neonatal sepsis compared to those who did not have birth asphyxia (AOR=3.54 95%CI (1.57,7.99). Neonates whose age less than seven days were 3 times more likely to develop neonatal sepsis compared with the age of neonates greater than eight days of age (AOR = 3.01 with 95% CI (1.148,7.89) and neonates who used oxygen via mask were 2.86

times highly at risk to develop neonatal sepsis compared to neonates those who did not used it at birth AOR=2.86 with 95%CI (1.30,6.29)(39).

According to a study conducted in Gondar, Ethiopia: gestational age has significant association which means that neonates born in gestation < 37 weeks had almost nine times more likely to develop sepsis compared to those neonates born in gestation ≥37 weeks. Neonates born with birth weight < 2500 grams had 3 times more likely to develop sepsis than neonates with normal birth weight. Apgar score < 7 pre five minute had 0.5 times more likely to develop sepsis than neonates with Apgar score >7. Neonates delivered through caesarian section had 5 time risk to develop neonatal sepsis than SVD(40). Another study done in Dessie Referral Hospital, North Central Ethiopia neonates who had not breast fed were (AOR=8.09, 95% CI: (3.20-20.43) 8 times more likely to die as compared to those who had breast milk(30).

In a study conducted in Bahir Dar neonates more likely to develop poor neonatal outcome of neonatal sepsis were respiratory distress syndrome 74% (AOR 0.26: 0.07, 0.93) than and meconium aspiration syndrome 80% (AOR 0.19: 0.06, 0.66) than neonates without history of meconium aspiration syndrome(41). Another study done in Nekemte town, regarding the weight of the neonates about 7.5%, neonates had the weight of <2.5kg(31).

2.3.4. Treatment for neonatal sepsis

Antimicrobials used to neonatal treat sepsis are combinations and in most units are penicillin (Benzyl penicillin, Ampicillin or Cloxacillin) together with an aminoglycoside, most commonly Gentamicin is largely preventable by timely appreciation, rational antimicrobial therapy and aggressive supportive care(42, 43). According to a study done in Nekemte town 60.8% of the neonates received the combination of ampicillin and gentamycin for 3-5 days (31).

2.3.5. Clinical presentation of neonates with sepsis

According to a study done in Nigerian tertiary hospital: Clinically, majority of the neonates presented with respiratory distress, jaundice, and fever (44).

According to a study done in Felege Hiwot referral Hospital, Bahir Dar, Amhara Regional State, North West Ethiopia 70.2% neonates had history of fever, 12.9% were history of irregular respiration and 6.7% were tachypnea. 32.9% of neonates had poor feeding and about these

19.1% had cold and clammy skin. Factors such as Respiratory distress syndrome were [AOR = 0.26 (0.07–0.93)] and meconium aspiration syndrome were [AOR = 0.19 (0.06–0.66)] times to determinant factors for poor outcome of neonatal sepsis (41).

2.3.6. Investigation for neonatal sepsis

According to a study done in USA, the CBC in early onset of neonatal sepsis result was Low white blood cell counts, low absolute neutrophil counts, and high immature-to-total neutrophil ratios which is associated with increasing odds of infection (highest odds ratios: 5.38, 6.84, and 7.97, respectively)(45). Another study done in Iran was in one hundred septicemia neonates who had been admitted in the NICU were included in the study (57 male 43 female)(46). According to a study done in Sudan, although a trend toward multiple CBC abnormalities in infected (and especially fatally infected) patients was noted, some infected patients had no abnormalities and some seriously ill non infected patients had multiple CBC abnormalities(47).

According to a study done in Felege Hiwot referral Hospital Bahir Dar town, Amhara Regional State, North West Ethiopia 17.3% neonates were gram negative. While the CSF result showed; white blood cell (WBC) count >5 cells/μL was 6.7% cases, 4.4% were glucose <40 mg/dL, 2.7% were protein >45 mg/dL and WBC count in CBC profile were 63.1% (41). Another study done in Dessie Referral Hospital, North Central Ethiopia The investigation done for the preterm neonates; complete blood count of 8%, blood group and Rh factor did for 33.8% and random blood sugar for 4.1%(30).

2.4. CONCEPTUAL FRAME WORK

The conceptual framework is adapted after reviewing different literatures and modified accordingly our situation (3, 26, 31, 41, 42). This framework conceptualizes the treatment outcome of neonatal sepsis with attending mothers as the result of interaction between various factors which are directly related to neonatal sepsis. In this study this conceptual framework looks at the relationship between dependent and independent variables.

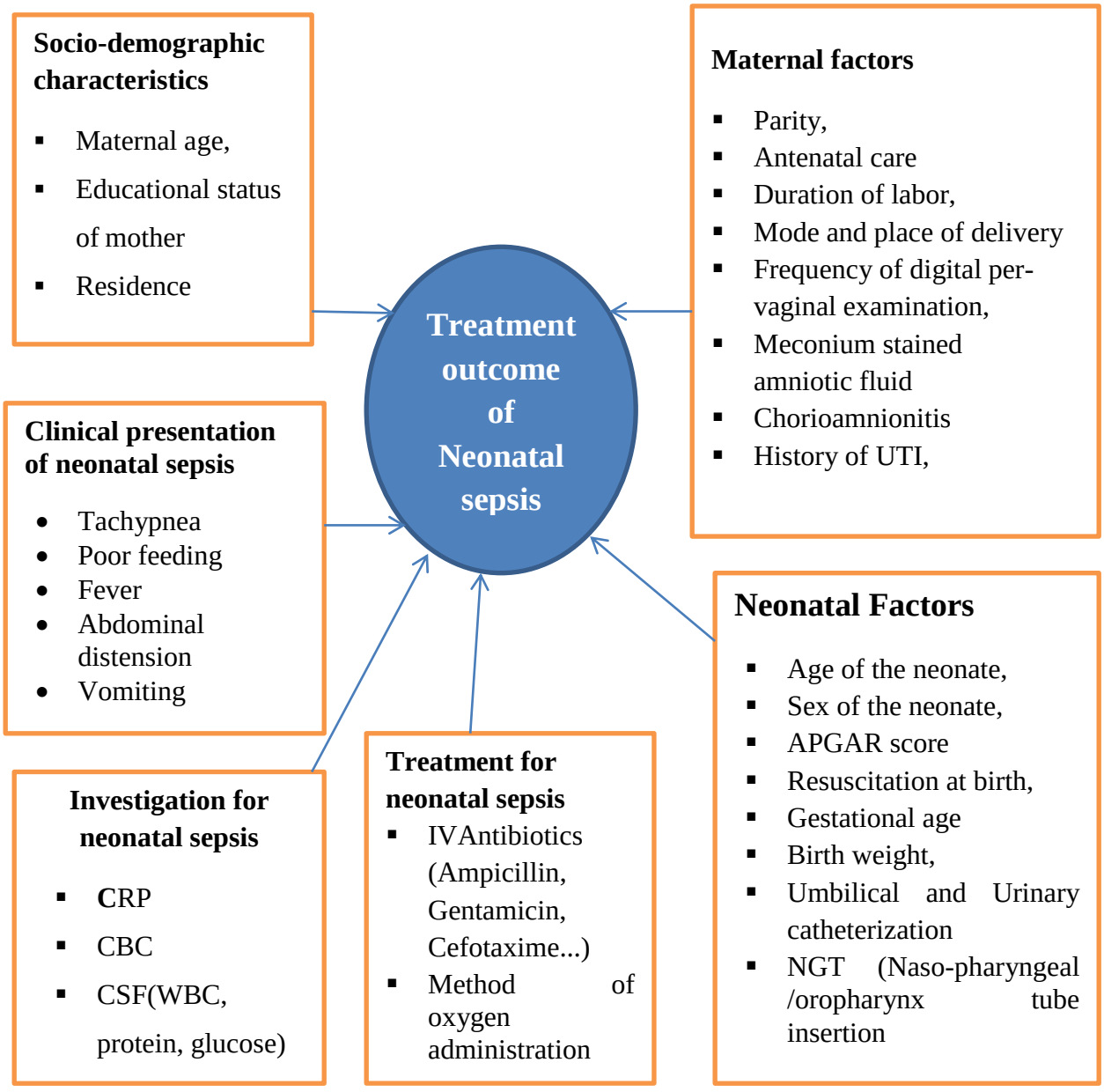


Figure 1: Conceptual framework on treatment outcome and identifying factors of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

2.5. Significant of the study

The main purpose of this study was identifying the treatment of neonatal sepsis that helps to reduce the burden of neonatal mortality by sepsis**.**

It helps health care providers to identify treatment outcome of neonatal sepsis and initiate interventions based on research finding. It also helps to improve health care providers and women as knowledge on neonatal sepsis treatment during NICU. Therefore, the finding of this study was important for policymakers, health proffessionals, health instutition, stalkholders and the result will hopefully give as a base line data for any neonatal and child health intervention will be implemented at Ethiopian health institutions.

Finally, this study used as a reference for scientific community to conduct extensive study in this area. It is believed that this study was given an insight on the treatment of neonatal sepsis and associated factor admitted to neonatal intensive care unit of selected public hospitals of Addis Ababa.

3. OBJECTIVES

3.1. General objective

To assess treatment outcome of neonatal sepsis and associated factors among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

3.2. Specific objectives

To determine treatment outcome of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

To identify factors affecting treatment outcome of neonatal sepsis among neonates admitted to neonatal Intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

4. METHODS AND MATERIALS

4.1. Study area and period

4.1.1. Study area

The study was conducted in Addis Ababa, which is the capital city of Ethiopia and Seat of African Union, and the United Nations World Economic Commission for Africa. It covers an area of 527 square kilometers and has 11 sub cities. According to a population projection value for 2020 the city has an estimated population of 4.8 million(48).

The city has 12 public Hospitals among these 11 hospitals having neonatal intensive care unit. Among these 6 were under Addis Ababa Health Bureau, 5 were under Ministry of Health and 1 was under Addis Ababa University (Tikur Anbessa Specialized Hospital)(49).

The study was conducted in four Addis Ababa public Hospitals selected by lottery method. These selected Hospitals are Gandhi Memorial hospital (GMH), St peter Specialized hospital (SPSH), Tikur Anbessa special hospital (TASH) and Yekatit 12 hospital medical college (Y12HMC).

In Gandhi Memorial Hospital (GMH): In neonatal intensive care unit a total of 2 pediatricians, 5 General practitioners, 2 Health officers, 2 MSc neonatal nurse practitioners and 26 Nurses are working in the unit. The number of admitted neonates varies from time to time; the average annual admission rate was being 3,200. The NICU had a 48-bed capacity. It has radiant warmers to keep the room warm and 12 incubators for premature neonates. In St Peter Specialized hospital (SPSH): In neonatal intensive care unit a total of 2 pediatricians' and 30 nursing staffs are caring for neonates in this unit. The number of admitted neonates varies from time to time; the average annual admission rate was being 2500. The NICU had a 34-bed capacity. In Tikur Anbessa Specialized Hospital (TASH): In neonatal intensive care unit a total of 2 neonatologists, 30 nurses working in the unit. The number of admitted neonates varies from time to time; the average annual admission rate was being 2850. The NICU had a 41-bed capacity (50). In Yekatit 12 Hospital Medical College (Y12HMC): In neonatal intensive care unit a total of 38 nurses, 2 MSc neonatal nurses, 1 neonatologist fellow and 3 pediatricians are working in the unit. The

number of admitted neonates varies from time to time; the average annual admission rate was being 3000. The NICU had a 45-bed capacity (51).

In all selected hospitals the Hospitals NICU receives high risk babies delivered within the institution, referrals from other health facilities, and referrals from home deliveries. In all units did not have a mechanical ventilator but available continuous positive airway pressure (CPAP) machine such as: diamedica and homemade CPAP (locally developed for neonates with respiratory distress syndrome (RDS)), incubators, radiant warmers and Phototherapy machines, additionally in the units babies receive oxygen through nasal prongs or a nasal catheter from oxygen cylinders or oxygen concentrators. Ampicillin and gentamicin are commonly used antibiotics for the treatment of sepsis empirically. Medications are administered via peripheral vein and in few cases intramuscular and umbilical vain is used.

4.1.2. Study period:

The study was conducted from March, 2021 to April, 2021.

4.2. Study design

An institution based crossectional study design was conducted.

4.3. Population:

4.3.1. Source population:

All neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals during the study period.

4.3.2. Study population:

All neonate patients who were admitted to NICU of Addis Ababa selected public hospitals diagnosed for neonatal sepsis during the study period.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion criteria:

The study included neonates with clinical diagnosis of sepsis based on the following **two risk factors and/or clinical features of bacterial infections.**

Risk factors include: Low birth weight (<2500 grams) or prematurity (<37 weeks of gestation age), febrile illness in the mother within 2 weeks prior to delivery, foul smelling discharge and/or meconium stained amniotic liquid, Prolonged rupture of membranes >18 hours, suspected chorioamnionitis, Prolonged labor (> 24 hrs) and Perinatal asphyxia (Apgar score <4 at 1 minute).

Clinical feature of sepsis include: (poor reflexes, lethargy, respiratory distress, bradycardia, apnea, fever, convulsions, abdominal distension, and bleeding.

4.4.2. Exclusion criteria:

Neonates whose mothers were not available for interview to complement the data despite the neonates fulfilling the inclusion criteria were excluded because of possible risk of data incompleteness and inconsistence.

Similarly, critically ill newborns that were not able to undergo the necessary laboratory evaluations were also excluded.

Neonates discharged out of the study period and neonates who died without taking any treatment

4.5. Sample size and sampling procedure

4.5.1. Sample size determination

The sample size (n) was determined by using single population proportion formula, and calculated by taking culture-proven neonatal sepsis approximately 23.9% in the previous study in Ethiopia(52).

$\mathbf{n}=\frac{Z^{\alpha}/_{2}2p(1-p)}{d^{2}}$ was used to:

Where; **Z** = normal standard distribution value at 95% confidence level of $\frac{a}{2}$= 1.96,

n= Sample size,

p= the prevalence of culture-proven neonatal sepsis 23.9 % from the previous study conducted in Ethiopia was

d= Margin of error between the sample and population=5%=0.05

Using the above formula, the sample size calculated as:

z= 1.96 for 95% confidence interval

p= 23.9%=0.239

So, $\mathbf{n} = \frac{z^{\alpha}/_{2}{}^{2}\, p(1-p)}{d^2}$

$$\boldsymbol{n} = \frac{1.96^2 \times 0.239 \times 0.761}{0.05^2} = \underline{\mathbf{280}}$$

N.B: Then, considering 10% of non-respondent rate the final desired sample size was 280+ 10% non-response rate, n=**308**.

- Then, the final sample size was **308**.

4.5.2. Sampling methods (procedures):

The study was conducted in Addis Ababa public hospitals those having neonatal intensive care unit. Out of 12 public hospitals except Amnuel hospital have their own neonatal intensive care units. Four hospitals were selected by lottery method. The reason of selecting only public health facilities was more clients are available at public health facilities than private health facilities, so the major problem at governmental health facilities since the service is given free of charge.

According to data from the four hospitals in two month prior to the study period from October 2020 to December 2020 a total of 343 mothers with neonates admitted to neonatal intensive care unit neonates diagnosed with neonatal sepsis (Gandhi Memorial hospital 105, In St Peter Specialized hospital 69, Tikur Anbessa Specialized Hospital 76 and Yekatit 12 Hospital Medical

College 93). Then allocation of the sample size to each hospital was completed proportionally based on average number neonates admitted to neonatal intensive care unit in each hospital one month proceeding to the survey. Each study participants were selected using consecutive sampling technique was utilized to select individual respondents. Data collection method was face to face interview (**Figure** 2).

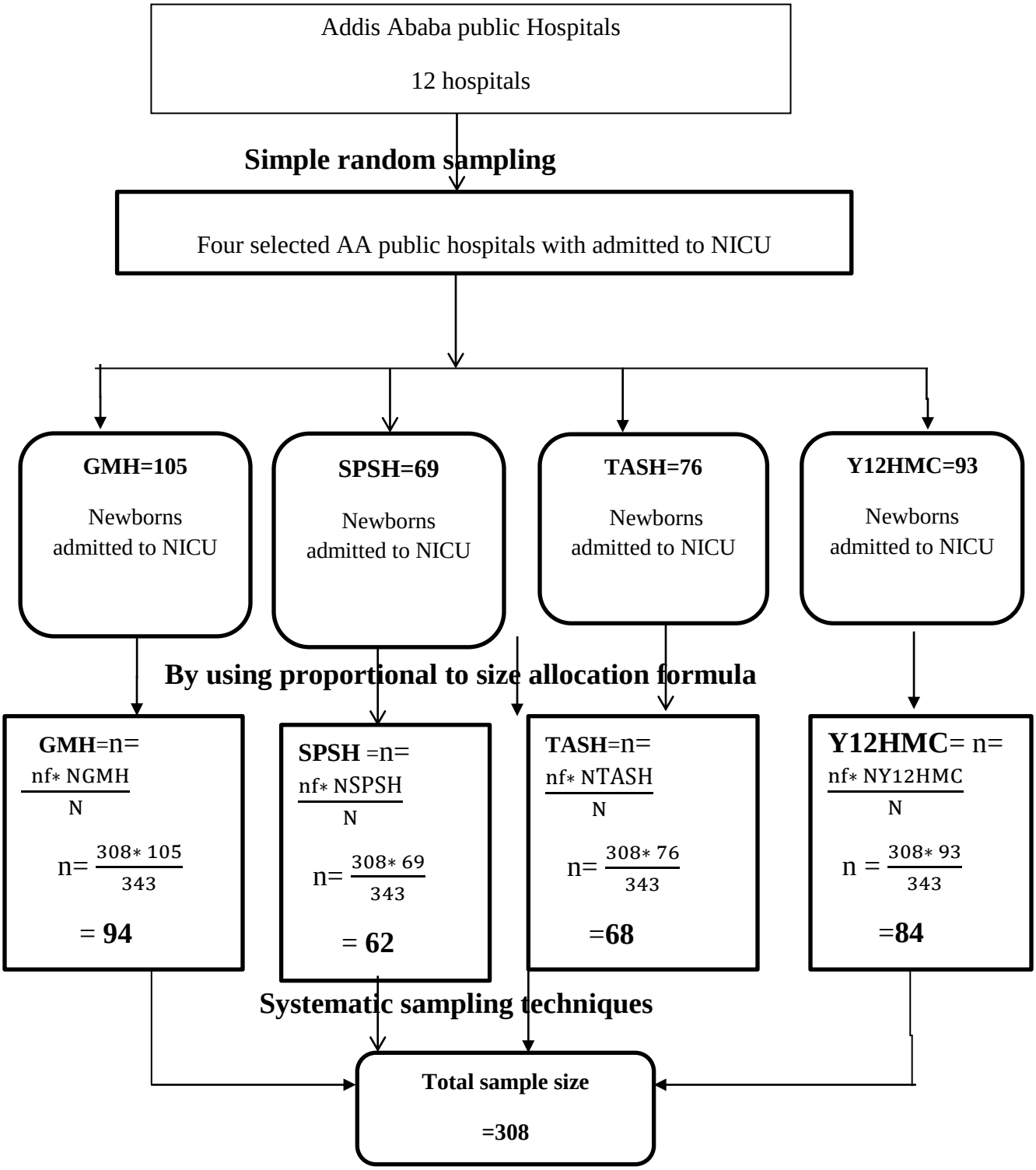


Figure 2: Schematic presentation of sampling procedure of the neonates in the selected public hospitals of Addis Ababa, Ethiopia, 2021.

4.6 Operational definitions of the variables

Neonate: Baby from birth until 28 days old**.**

Neonatal sepsis: neonates with presence of at least **two risk factors and/or clinical features of bacterial infections** plus at least two laboratory results which are suggestive for neonatal sepsis (CRP, WBC, ANC,E SR, Platelet count and Blood glucose) or neonates who are diagnosed as sepsis by attending physician and fulfill sepsis criteria within 0-28 days of life.

Early onset of sepsis: If sepsis is occurred from birth to seven days of age.

Late onset of sepsis: If sepsis is happened between 8 to 28 days of age.

Treatment outcomes: Neonates discharge (with treatment success), leave against medical advice (LAMA), referred and death.

Good outcome: If neonate is improved after completing the treatment of sepsis without any complications such as seizure, meningitis and shock.

Poor outcome: If neonate is not improved after completing the treatment, offered with complications, referred to other health institutions, died and refused against medical treatment.

Prolonged rupture of membrane (PROM): the time from membranes' rupture to delivery more than 18 hours.

Treated or improved- In this research, treated is neonates who become well again (becoming free clinical features of neonatal sepsis, and/or discharged from NICU due to completion of their management or treatment)

Died - are those neonates who passed away and whose death report is recorded on the chart

4.7. Study variables

4.7.1. Dependent variables: treatment outcome of neonatal sepsis

4.7.2. Independent variables: **Socio-demographic characteristics** such as (Maternal age, maternal marital status, Residence, monthly income and Educational status of mother), **Maternal factors like (**Parity, History of UTI, Foul smelling fluid/vaginal discharge**,** Antenatal care**,** Duration of labor**), Neonatal Factors** such as (Age of the neonate, Sex of the neonate, APGAR score, Resuscitation at birth, Gestational age), **Clinical presentation of neonatal sepsis: (**Tachypnea**,** Poor feeding**,** and Fever**), Diagnostic/laboratory results of neonates (**CBC**,** CRP**,**

CSF (WBC, protein, glucose and Blood culture)**, and Antimicrobial use in neonatal sepsis (**IV Antibiotics (Ampicillin, Gentamicin, Cefotaxime...)**.**

4.8. Data collection instrument and procedures

Data was collected by using structured questionnaire with face to face interview. The data collection tools were adapted from different literatures (3, 26, 31, 41, 42) and by reviewing both maternal and newborns profile cards. The questionnaire was first developed in English and converted into Amharic versions and re-translated back into English by language experts to assure its consistency. For data collection procedure, twelve health professionals (eight data collectors and four supervisors) were involved. Data collectors were closely monitored and guided by each hospital senior BSc nurses supervisors. Two-day training was given about data collection procedure for those data collectors and supervisors regarding the study purpose, on how to conduct the interview, how to administer questionnaire, how to take consent, keep confidentiality and respect the right of the participant. The collected data was checked by the supervisor regularly for its completeness and finally the researcher was monitored the overall quality of data collection. The data was collected in the day time shift from 8:30 am – 5:30 pm after obtained consent from each participant prior to data collection in the hospitals after finishing the services and back to their home.

The questionnaire consists of **five** parts.

Part I: **Socio-demographic characteristics** such as (Maternal age, maternal marital status, Residence, monthly income and Educational status of mother**)**

Part II: **Maternal factors: (**Parity, History of UTI, Foul smelling fluid/vaginal discharge**,** Antenatal care**,** Duration of labor, Place of delivery, Mode of delivery**,** Frequency of digital per-vaginal examination, Meconium stained amniotic fluid**,** Person assisting delivery**,** Maternal fever and History of APH)

Part III: **Neonatal Factors**: Age of the neonate, Sex of the neonate, APGAR score, Resuscitation at birth, Gestational age, Birth weight, Immediate cry, Method of oxygen administration, Surgical procedures, Umbilical catheterization, Urinary catheterization, Naso/ oropharynx tube insertion, and Endotracheal tube

Part IV: **Clinical presentation of neonatal sepsis: (**Tachypnea**,** hyperthermia**,** tachycardia**,** Poor feeding**,** and Fever)

Part V: Diagnostic/laboratory results of neonates: (CBC**,** CRP**,** CSF (WBC, protein, glucose and Blood culture)

Part VI: Antimicrobial use in neonatal sepsis: IV Antibiotics (Ampicillin, Gentamicin, Cefotaxime...)**.**

4.9. Data quality control

To ensure quality of the data, supervisor and data collectors were trained on how and what information they should collect from the targeted data sources. Tool was given to expertise to check content validity and accuracy. It was pre-tested on 5% (n=15) of similar mothers in Zewditu Memorial Hospital outside the study area to assess for its completeness, clarity, length, skip patterns and correctness of filled questioners. After the pretest result, based on the response the questionnaire was modified. Data collection was carried out by trained health professionals from other units of the health facilities.

In addition, check for completeness and quality of data collection were made on daily bases by the supervisors and detailed feedback was provided to data collectors.

4.10. Data analysis procedure

Data were entered using EPI Data version 4.6 and analyzed by using SPSS Soft-ware version 26. Mean, Standard deviation, Frequencies, Percentage and odds ratio were calculated. After coding, and entering the data to the software descriptive statistics such as proportion, frequencies, cross tabulation, and measure of central tendency was calculated.

Bi-variable analysis was used to see the association between each independent variable & the outcome variable. Binary logistic regression analysis was carried out to determine the effect of various factors for the predictor variables of treatment outcome of neonatal sepsis. All variables with p-value $\leq$ 0.25 were taken into the multivariable model to control for all possible confounders. Multi-co linearity was also checked to see the linear correlation among the independent variables. The degree of association between dependent and independent variables was assessed by using odds ratio with 95% confidence interval & p-value $\leq$0.05.

4.11. Ethical Consideration

Ethical clearance was obtained from institutional review board of Addis Ababa University, College of Health Sciences, School of Nursing and Midwifery and Department of Nursing. Formal letter were obtained from Addis Ababa public health research and emergency management core process in order to get permission to carry out the study. Informed written consent was obtained from each respondent after illumination the purpose and procedure of the study. No name or other identifying information was included in the instrument. The eligible study participants were enrolled in the study only after they give written informed consent and will not be forced to participate.

Each study participant was effectively informed about purpose, anticipated benefit & risk and method for data collector. The respondent has the right to respond or refuse to the interview. Even they had the right to withdraw the interview at any time or skip any question that they do not want to respond. All the information given by the respondents was used for research purposes only, confidentiality and privacy was maintained by omitting the name of the respondents during data collection procedure and after data collection information from the study put without participants' name and principal investigator put questionnaires locked with a key.

4.12. Dissemination and utilization of the result

The thesis was presented to Addis Ababa University, College of Health Sciences, School of Nursing and Midwifery, and Department of Nursing as partial fulfillment of master's degree in neonatal nursing. The result of the study was disseminated to Federal Minister of Health, Addis Ababa public health research and emergency management core process and Addis Ababa town public hospitals. Hard and soft copy was available in the library of Addis Ababa University for graduate students as well as for other concerned readers. The finding was presented in different seminars and meetings. Finally, it was prepare for manuscript and trying to publish the research in internationally recognized journals, the abstract of this thesis were submitted to national or international peer reviewed publishers.

5. RESULTS

5.1. Socio-demographic characteristics of respondents

All the required 308 study participants were interviewed with the response rate of 100%. From those respondents, 121 (39.3%) of the mothers age were between 25–29 years. The mean ages of the mother were 29.37(±5.16) years. Almost all, 296 (96.2%) of respondents were married. Around 267(63.6%) of mothers had secondary and above their educational status. Among the study participants 136(44.2%) of government employee and 84(27.3%) of the respondents average monthly household income were ≥7501 Ethiopian Birr. The mean and SD of the household income were 5775.83(±3543.15) years respectively (**Table 1**).

Table 1: Socio-demographic characteristics of mothers whose neonates treatment outcome of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021 (n=308).

Variables	Frequency	Percentage (%)
Age_ group of the mother		
≤24	52	16.9
25-29	121	39.3
30-34	81	26.3
≥35	54	17.5
Marital status_ group		
Un married (single, divorced &widowed)	12	3.8
Married	296	96.2
Mothers Educational status		
Can't read and write	15	4.9
Primary education	71	23.1
Secondary education	94	30.5
College and above	128	41.6

Occupation status		
Housewife	100	32.5
Gov't employee	136	44.2
Prv't employee	52	16.9
Daily labor	16	5.2
Student	4	1.3
Residency		
Rural	25	8.1
Urban	283	91.9
Income_ quartile		
≤1800	71	23.1
1801-3800	83	26.9
3801-7500	70	22.7
≥7501	84	27.3

5.2. Obstetric and neonatal health related factors of the study participants for their neonates

Almost all of the respondents, 303(98.4%) of had ANC follow up. Among those respondents who had ANC follow up, 221(71.8%) of them having four and above visit. Majority 247 (80.2%) of mothers' delivered their neonate's at hospital. Half 157(51.0%) of mother's with their neonates were ≥37 weeks of gestational age. Regarding birth weight 163(52.9%) of neonates had ≥2.5kg. Majority 262(85.1%) of neonates were admitted at the age of > 30 minutes (**Table 2**).

Table 2: Obstetric and neonatal related factors of treatment outcome of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021 (n=308).

Variables	Frequency	Percentage (%)
Parity		
Primi	126	40.9
Multi	182	59.1

ANC visit		
Yes	303	98.4
No	5	1.6
Number of ANC visit (n=303)		
1-3	82	26.6
≥4	221	71.8
Place of delivery		
Home	5	1.6
Health center	56	18.2
Hospital	247	80.2
Maternal complications		
Yes	260	84.4
No	48	15.6
PROM (n=260)		
Yes	170	55.2
No	90	29.2
Chorioamnionitis (n=260)		
Yes	42	16.2
No	218	83.8
Hypertensive (PIH, Eclampsia (n=260)		
Yes	75	24.4
No	185	60.1
Gestational Age		
< 37 week	158	51.3
≥37 week	150	48.7
Birth weight		
<2.5kg	145	47.1
≥2.5kg	163	52.9
Sex		
Male	188	61.0
Female	120	39.0

Age of the neonates admitted to NICU		
<30 minutes	46	14.9
≥30 minutes	262	85.1
Meconium stained		
Yes	70	22.7
No	238	77.3
Grunting		
Yes	205	66.6
No	103	33.4
Chest in drawing		
Yes	67	21.8
No	241	78.2
Unable to feed (failure to suck)		
Yes	223	72.4
No	85	27.6
Temperature >37.5 or <35.5oC		
Yes	171	55.5
No	137	45.5

From the total mother 260(84.4%) had risk for infection, 170 (34.21%) have PROM/PPROM (Figure 3).

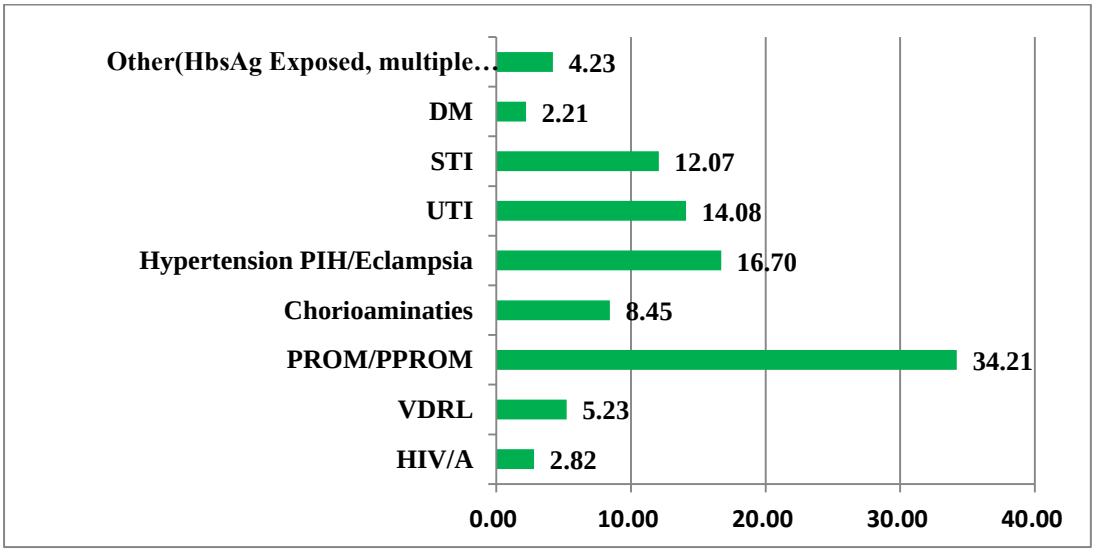


Figure 3: Maternal complications among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021

About 13.0% neonates were Clinical diagnosis to tachypnea or bradypnea (Figure 4).

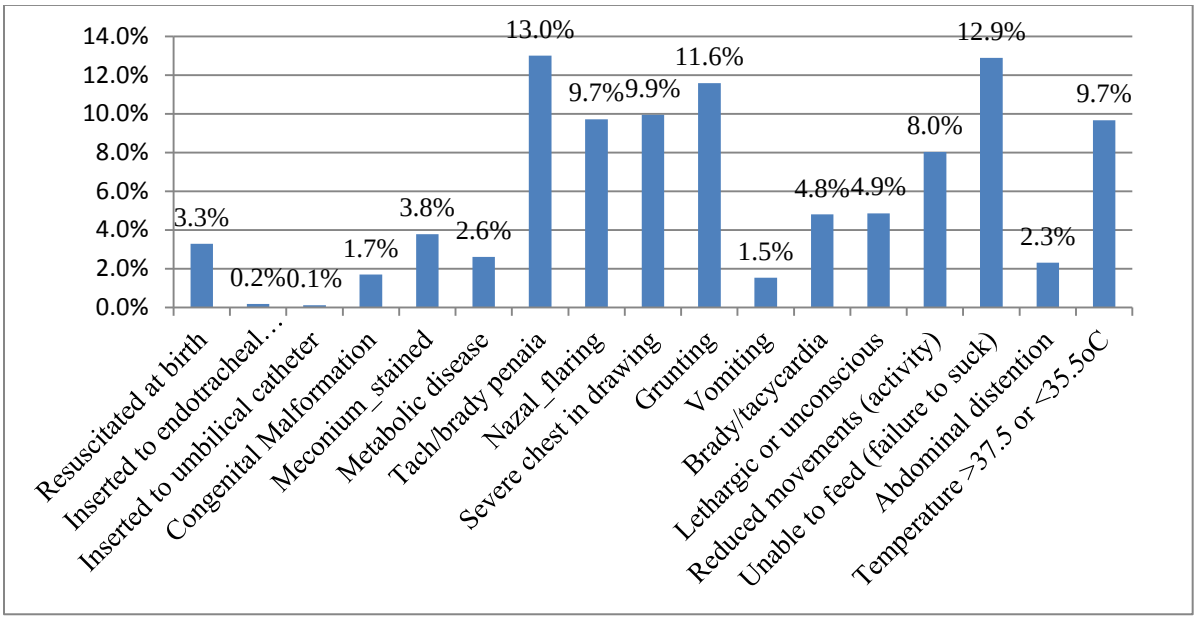


Figure 4: neonatal risk factors among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021

5.3. Treatment and laboratory findings of neonatal sepsis

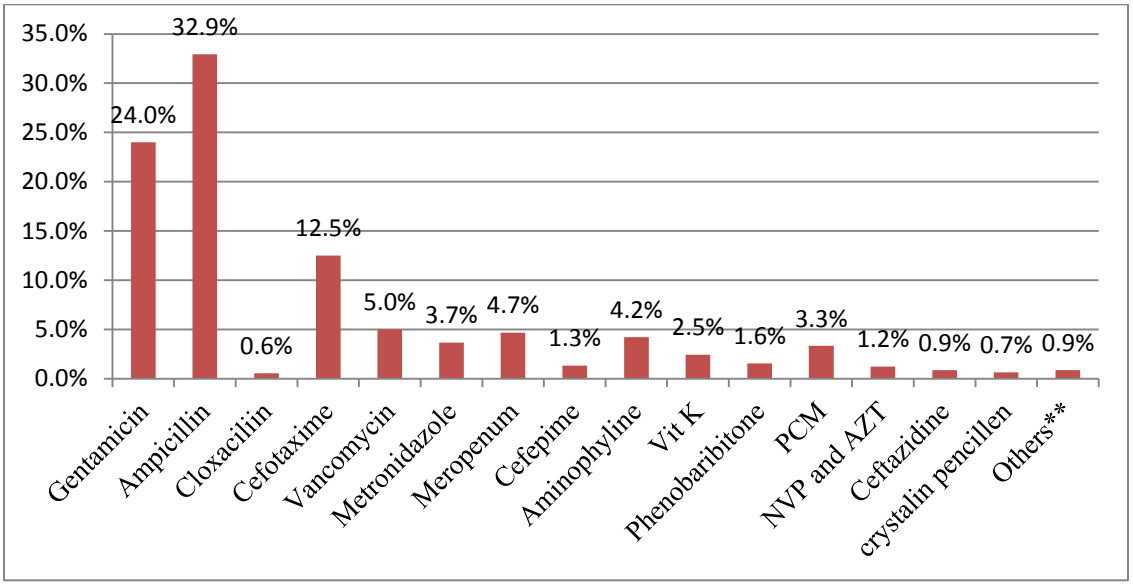
Regarding the treatment outcomes majority of neonates 233 (75.6%) were recovered from their condition with improvement and 75(24.4%) of neonates were died (Table 3).

Table 3: Treatment and laboratory findings of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021 (n=308).

Variables	Frequency	Percentage (%)
Treatment outcome		
Died	75	24.4
Recovered	233	75.6
Did the neonate on oxygen		
Yes	252	81.8
No	56	18.2

Did the neonate had started feeding		
Yes	257	83.4
No	51	16.6
Breast milk		
Yes	255	82.8
No	53	17.2
Formula milk		
Yes	34	11.0
No	274	89.0
NGT feeding		
Yes	157	51.0
No	151	49.0
Onset of sepsis		
Early	291	94.5
Late	17	4.5
CBC result		
Normal	113	36.7
Drop/raise	195	63.3
CRP result		
Non-reactive	70	23.5
Reactive	228	76.5
CSF result		
Normal	27	8.8
Drop/raise	281	91.2
Blood culture		
Normal	52	16.9
Drop/raise	256	83.1
X-ray		
Normal	28	9.1
Abnormal finding	280	90.9

Almost all neonates were administered the combination of ampicillin and gentamicin as a first line. (Figure 5).



Others:** fluconazole, esomeprazole, TTC, phototherapy

Figure 5: Antibiotics administration among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021

In this study 93 (52.2%) of neonates were administered intranasal catheter (Nasal cannula) oxygen. (Figure 6)

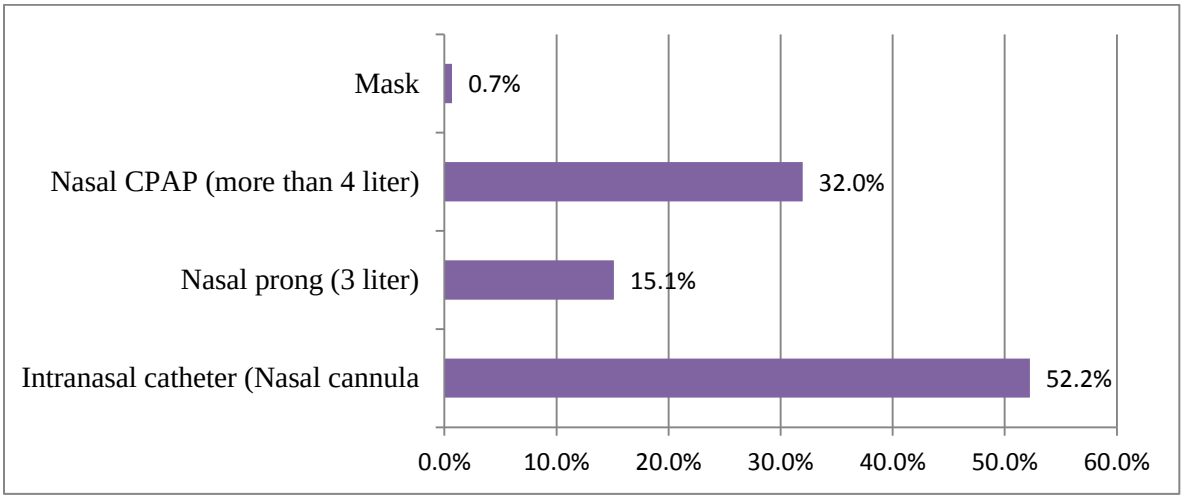


Figure 6: Oxygen administration among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021

In this study the possible causes of neonatal deaths are 35(46.67%), cardio respiratory arrest secondary to respiratory problems and 14(18.67%) sepsis. (Figure 7)

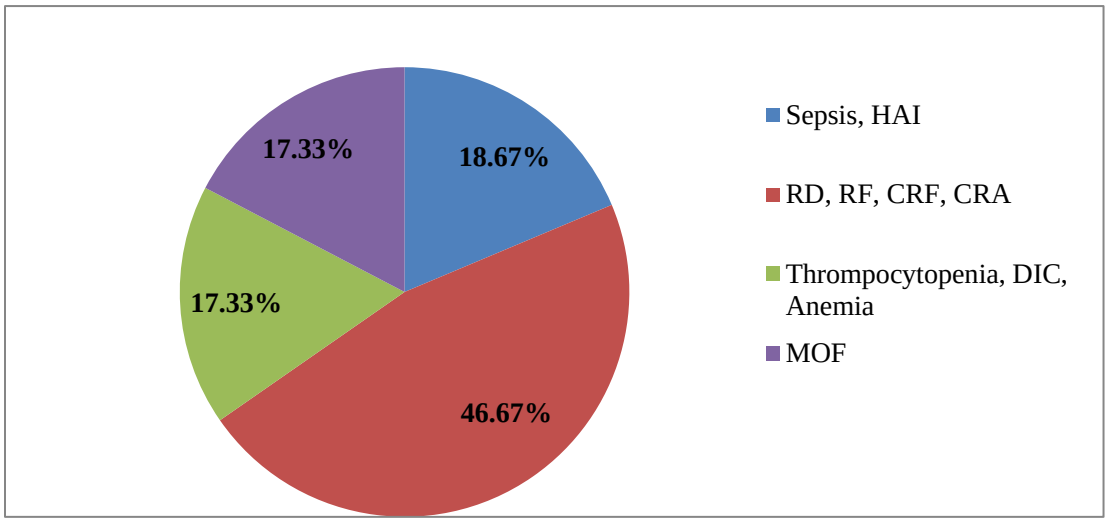


Figure 7: The possible causes of neonatal deaths among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

5.4. Predictor variable of treatment outcome of neonatal sepsis

The association of the independent and dependent variable were first tested by using bi-variable analysis which (P≤0.25) were tested in the final multivariable analysis to see their significant association with their treatment outcome of neonatal sepsis. Accordingly, as shown in Table 4 below those bi-variable regression associated with the crude odds ratios (COR) treatment outcome of neonatal sepsis such as education status of the mothers, place of delivery, gestational age < 37weeks, birth weight of the neonate, age of the neonate admitted to NICU, sever chest in drawing, grunting, un able to feed, temperature, Chorioamnaties, meconium amniotic stained, PROM, Hypertensive PIH/ Eclampsia, meropenum, vancomycin, metronidazole, CBC and CRP result.

In Multivariable analysis results showed that, there was statistically significance association found between) treatment outcome of neonatal sepsis parameters which showed p-value of below 0.05 were Preterm babies admitted to NICU (gestational age), grunting, meconium amniotic stained, duration of rupture of membrane >18hours (PROM), Hypertensive PIH/ Eclampsia, meropenum and CRP result.

The odds of neonates who had less than 37 weeks of gestational age were 4.87 (AOR=4.87, 95% CI: 1.23-19.22) times developed poor treatment outcome compared to those neonates ≥37 weeks of gestational age.

The odds of neonates whose mothers had Hypertensive PIH/ Eclampsia were 3.54 (AOR=3.54, 95% CI: 1.24-10.09) times developed poor treatment outcome of neonatal sepsis than those neonates whose has no develop Hypertensive PIH/ Eclampsia. PROM was statistically significantly associated with poor treatment outcome of sepsis. Mothers who give birth from PROM, their neonates were associated with poor outcome than mothers who give birth had not PROM were 3.66 (AOR=3.66, 95% CI: (1.20-11.15).

In this study Meconium aspiration syndrome was significantly associated with poor outcome of neonatal sepsis. Meconium amniotic stained were 3.03 (AOR=3.03, 95% CI: 1.02-9.01) times developed poor treatment outcome when compared to those neonates without history of Meconium amniotic stained.

A neonate who has at risk of respiratory problem was significantly associated with poor outcome of neonatal sepsis. Those neonates diagnosed with grunting were 6.94 (AOR 6.94: 1.48-32.54) times developed poor treatment outcome than neonates without respiratory distress syndrome (grunting).

C-reactive protein result positive was significantly associated with poor outcome of sepsis. Positive CRP laboratory results of neonates were 5.87 (AOR=5.87, 95% CI: 1.53-22.56) times developed poor treatment outcome when compared to those neonates negative CRP results.

Empirical treatment is the mainstay management of neonatal sepsis in most developing countries including Ethiopia. Neonates after revising Meropenum were 4.16 (AOR=4.16, 95% CI: 1.22-14.21) times developed poor treatment outcome when compared to those neonates without starting meropenum(Table 4).

Table 4: Bi-variable and multivariable logistic regression treatment outcome of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021 (n=308).

Variables	Neonatal sepsis		COR (95% of CI)	AOR (95% OF CI)
	Good	Poor		
Mothers Educ. Status				
Can't read and write	9(60.0%)	6(40.0%)	2.89(0.94-8.89)	1.29(0.16-10.08)
Primary Educ.	46(64.8%)	25(35.2%)	**2.36(1.22-4.55)***	1.34(0.41-4.39)
Secondary Educ.	74(78.7%)	20(21.3%)	1.17(0.60-2.28)	1.86(0.59-5.79)
College and higher	104(81.3%)	24(18.8%)	**1**	1
Place of delivery				
Home	2(40.0%)	3(60.0%)	2.93(0.45-18.91)	0.59(0.02-19.23)
Hospital	190(76.9%)	57(23.1%)	**0.52(0.29-0.97)***	0.36(0.11-1.17)
Health center	41(73.2%)	15(26.8%)	1	1
Age of the newborn at admission NICU				
<30 minutes	28(60.9%)	18(39.1%)	**2.31(1.19-4.48)***	1.29(0.37-4.45)
≥30 minutes	205(78.2%)	57(21.8%)	1	1
Gestational Age				
<37 Wks	102(64.6%)	56(35.4%)	**3.53(1.99-6.27)***	**4.87(1.23-19.22)****
≥37 Wks	131(87.3%)	19(12.7%)	1	1
Birth weight group				
<2.5kg	98(81.6%)	47(18.4%)	**2.31(1.35-3.95)***	0.33(0.08-1.30)
≥2.5kg	135(82.8%)	28(17.2%)	1	1
Hypertension PIH/ Eclampsia				
Yes	163(68.2%)	76(31.8%)	**1.96(1.06-3.64)***	**3.54(1.24-10.09)****
No	143(79.0%)	38(21.0%)	1	1
PROM				
Yes	122(71.8%)	48(28.2%)	**2.78(1.36-5.68)***	**3.66(1.20-11.15)****

No	81(90.0%)	9(10.0%)	1	1
Meconium amniotic stained				
Yes	32(45.7%)	38(54.3%)	**6.45(3.59-11.59)***	**3.03(1.02-9.01)****
No	201(84.5%)	37(15.5%)	1	1
Chorioamnionitis				
Yes	36(85.7%)	6(14.3%)	**0.55(0.22-1.37)***	2.50(0.57-10.99)
No	167(76.6%)	51(23.4%)	1	1
Sever chest in drawing				
Yes	123(69.9%)	53(30.1%)	**2.83(1.57-5.10)***	1.85(0.56-6.09)
No	110(83.3%)	22(16.7%)	1	1
Grunting				
Yes	134(65.4%)	71(34.6%)	**4.80(2.35-9.81)***	**6.94(1.48-32.54)*****
No	99(96.1%)	4(3.9%)	1	1
Un able to feed				
Yes	165(74.0%)	58(26.0%)	**2.16(1.09-4.27)***	1.82(0.54-5.79)
No	68(80.0%)	17(20.0%)	1	**1**
Temperature				
Yes	141(82.5%)	30(17.5%)	**0.44(0.26-0.74)***	0.47(0.19-1.17)
No	92(67.2%)	45(22.8%)	1	1
CBC_ result				
Normal	92(81.4%)	21(18.6%)	**0.59(0.34-1.05)***	0.42(0.15-1.22)
Raise/drop	141(72.3%)	54 (27.7%)	1	1
CRP_ result				
Reactive	176(77.2%)	52(22.8%)	**2.68(1.52-4.69)***	**5.87(1.53-22.56)*****
Non-reactive	51(72.9%)	19(27.1%)	1	1
Metronidazole				
Yes	10(30.3%)	23(69.7%)	**9.86(4.43-21.98)***	3.27(0.86-12.49)
No	223(81.1%)	52(18.9%)	1	1

Meropenum				
Yes	18(42.9%)	24(57.1%)	**5.62(2.84-11.3)***	**4.16(1.22-14.21)****
No	215(80.8%)	51(19.2%)	1	1
Vancomaycine				
Yes	24(53.3%)	21(46.7%)	**3.39(1.75-6.54)***	2.01(0.56-7.19)
No	209(79.5%)	54(20.5%)	1	1

Key 1= Reference

***** Statistically significant by COR at p-value ≤0.25

******Statistically significant by AOR at p-value <0.05

***strongly associated by AOR: p-value<0.01

6. DISCUSSION

This study aimed to assess the magnitude treatment outcome of neonatal sepsis and its associated factors among newborns delivered in public hospitals in Addis Ababa, Ethiopia. In this study, the prevalence of poor treatment outcome of neonatal sepsis among newborns admitted to NICU in public hospitals in Addis Ababa was 24.4% with 95% CI (19.5-29.2). This finding is higher compared to a study conducted in Bahir dar (16%) (41). This deference could be due to in the way neonatal sepsis has used to confirmatory blood culture to assert neonatal sepsis to the study which is done in some facility. Many of the complications of preterm birth that lead to adverse in-hospital outcomes depend on the gestational age, with more premature infants being prone to more complications. This finding is almost similar compared to a study conducted in Debrezeyt town Ethiopia were 26% (32). This finding is lower compared to a study conducted in Nigeria were (34%)(44). This may be due to neonatal sepsis has used to confirmatory blood culture to assert neonatal sepsis to the study which is difficult to apply in this study area due to unavailability of the some facility. Another possible explanation for this variation could be due to the differences in health facility and sample size variation across studies.

The odds of neonates who had less than 37 weeks of gestational age were 5 times developed poor treatment outcome of neonatal sepsis when compared to those neonates' ≥37 weeks of gestational age. This is in agreement with the study done in Gondar(40),Tikur Anbessa Specialized Hospital, Ethiopia(53) and Kenya(54) who reported that preterm neonates were more likely to die compared to term neonates. This finding is similar compared to a study conducted in Australia reveals that one-week gestational age increased the survival rate of neonates greater than 5%(55). Increasing gestational age is associated with better respiratory maturity which enables preterm infants to adapt better to extra-uterine life.

The odds of neonates whose Hypertensive PIH/ Eclampsia were 4 times developed poor treatment outcome of neonatal sepsis than those neonates whose has no develop Hypertensive PIH/ Eclampsia. This finding is in line with other studies that reported chronic hypertension was found to be a risk factor for neonatal sepsis in Ethiopia. This might be maternal hypertensive

problems directly affect the fetal wellbeing in the uterus, which directly contributes to neonatal sepsis at birth.

PROM was statistically significantly associated with poor treatment outcome of sepsis. Mothers who give birth from PROM their neonates were 4 times developed to suffer from sepsis compared with those neonates born from women with that has not develop PROM. This finding is comparable with studies conducted in Nepal (56), Mexico (29) and USA (43).These may be due to birth canal is colonized with aerobic and anaerobic pathogens that might cause in ascending amniotic fluid infection and colonization of the neonate at birth. Mother to fetus transmission of bacterial agents that infect the amniotic fluid and birth canal may occur in uterus more commonly during labor and delivery which results in neonatal sepsis (EONS)(57).

Meconium amniotic stained were 3 times developed poor treatment outcome when compared to those neonates without history of Meconium amniotic stained. Which is similar with a study in Bahir dar (41), Uganda(58), Ghana(3), India(59) and Nepal(56). This is revealed that after meconium aspiration strict follow up is needed for neonates. This may be due to neonates delivered from women with meconium stained amniotic fluid are more liable to aspirate it and fill smaller air ways and alveoli in the lung. And it increases the multiplication of microbes that cause sepsis and predisposes to late onset neonatal sepsis (LONS)(60).

A neonate who has at risk of respiratory problem was significantly associated with poor outcome of neonatal sepsis. Those neonates developed with grunting were 7 times developed poor outcome compared to neonates without respiratory distress syndrome. This is similar with a study in Bahir dar (41). This result comparable with studies done in Uganda(58) and Sudan (47). This may be due to health workers ignorance the syndromes poor early detection of signs and another explanation due to mothers delay to come in health facility or institutions.

C-reactive protein result positive was significantly associated with poor outcome of sepsis. Positive CRP laboratory results of neonates were 6 developed poor treatment outcome when compared to those neonates' negative CRP results. This finding is similar with studies done in Nepal (56). This may be due to CRP is the most sensitive and widely used, however it is necessary to consider a sepsis panel of at least three tests out of which at least two should be positive for one to suspect septicemia with reasonable amount of certainty.

Empirical treatment is the mainstay management of neonatal sepsis in most developing countries including Ethiopia. Neonates after revising Meropenum were 4 times developed poor treatment outcome when compared to those neonates without starting meropenum. The antimicrobial use pattern in our hospital is mainly empirical. This may increase the development of resistant microbial, which in turn affect future drug selection in the management of neonatal sepsis.

7. STRENGTH AND LIMITATIONS OF THE STUDY

7.1. Strength of the study

Data was collected through face to face interview which could be able to reduce information bias.

7.2. Limitation of the study

Since the study participants were selected from institutions, neonates having sign and symptoms of sepsis who didn't come to hospitals for medical care might be missed resulting in reduced external validity.

Besides, the other limitation of this study was, the identification of sepsis cases was not based on culture confirmed sepsis. However, it was based on suggestive clinical presentations and sepsis indicative laboratory findings. This might expose our finding for selection bias because neonates who had sign and symptoms of sepsis could be negative for culture which is the golden standard for diagnosis of sepsis.

We did not do routine blood cultures for all babies admitted with prematurity. This could limit our ability to identify many of the babies with accompanying sepsis as signs and symptoms of sepsis may mimic many of the features of prematurity.

8. CONCLUSION AND RECOMMENDATION

8.1. Conclusion

Empirical treatment was the mainstay for management of neonatal sepsis in this setup. Ampicillin and gentamicin combination was administered for all neonates with neonatal sepsis at NICU for all selected Addis Ababa hospital. The prevalence of poor treatment outcome of neonatal sepsis among newborns admitted to NICU in public hospitals in Addis Ababa was 24.4%. The majority (94.5%) of the neonates had early onset of sepsis. The study found both maternal and neonatal factors as possible independent risk factors to have a strong association with the risk of poor outcome of neonatal sepsis. Preterm babies admitted to NICU, grunting, meconium amniotic stained (MSAF), duration of rupture of membrane >18hours (PROM), Hypertensive PIH/ Eclampsia, meropenum and CRP result were significantly associated with poor treatment outcome of neonatal sepsis.

8.2. Recommendations

According to the findings from this study, the following recommendations have been suggested to different stakeholders;

8.2.1. For health workers

Professionals who are working in labor and delivery ward screened for mothers preeclampsia and duration of rupture of membrane >18hrs /PROM/ treated with antihypertensive drug and antibiotics for the prevention of neonatal sepsis.

8.2.2. For Ministry of health and health service organizations

The antimicrobial use guideline should be developed and updated timely by testing microbial sensitivity. The investigation of coexisting infections by a collection of other clinical samples in addition to blood sample is recommended to reduce the morbidity and mortality of neonates.

8.2.3. For researchers

Researchers who are interested to conduct on neonatal sepsis should have to include neonates in the community which may increase external a validity of the study. It is also better to do meta-analysis since the previous findings about the factors of neonatal sepsis were inconsistent.

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10. APPENDIX

Appendix I: Participant Information Sheet

Good morning/ afternoon?

My name is _____ Currently I am a graduate student at Addis Ababa University, College of Health Sciences, department of Nursing and Midwifery. And now I am conducting a study to assess treatment outcome of neonatal sepsis and identifying factors among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

1. **Title of the research**: Treatment outcome of neonatal sepsis and associated factors among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.
2. **Objective:** this study was aimed to identify treatment outcome of neonatal sepsis. The main aim of this study is to prepare thesis for partial fulfillment of the requirement for masters of Science in neonatal nursing by investigator. In addition, the study finding will be used as baseline data, evidence and input to develop future quality improvement projects so this hospital will have benefited for this study, and also governmental and non-governmental organizations will be used this study finding for designing proper implementation and evaluation on reduction of neonatal morbidity and mortality.
3. **Participants**: Neonates admitted to NICU in the selected public hospitals
4. **Potential Risks and Benefits**: There is no anticipated risk by being involved in this study; but only taking few minutes from the mother's time. No financial benefits are related with this study. But by participating in this study, most importantly, the result of the study will be beneficial to design effective preventive and control measures for neonatal sepsis. Hence, you are indirectly benefiting other patients and the society in this respect. I would like to ask you few questions.
5. **Confidentiality:** The questionnaire will be coded to keep privacy of the participants. The information which you will give us will be kept confidentially. There will be no information that will identify you in particular. The findings of the study will be generalized for the study population and it will not reflect anything specific of individual participants. No reference

will be made in oral or written reports which link participants to the research. Your truthful response to the questions can make the study to attain its objective.

6. **Rights**: Mothers have the right to participate or not in this study, participation for this study is fully voluntary. If the mother agrees to participate, she has the right to withdraw from the study at any time and this will not label her for any loss of benefits which she otherwise is entitled. Mothers do have the right to not respond any question that she doesn't want to answer.
7. **Contact address**: At any time that you have questions, you can contact me by using the following Addresses**:**

Asalf Endazanaw

Phone: +251-921995619**,**

Email: asalfend401@gmail.com

Appendix II: Consent form

In signing this document, I am giving my consent to participate in the study entitled "Treatment outcome and identifying factors of neonatal sepsis among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa". I have been informed that the purpose of this study is to identify Treatment outcome and identifying factors of neonatal sepsis. I have understood that participation in this study is entirely voluntarily. I have been told that my answers to the questions will not be given to anyone else and no reports of this study ever identify me in any way. I have also been informed that my participation or non-participation or my refusal to answer questions will have no effect on me. I understood that participation in this study does not involve risks. I understood that Asalf Endazanaw is the contact person if I have questions about the study or about my rights as a study participant.

Respondent's signature_____

Results of interview questionnaire

1. Completed
2. Refused
3. Partially completed

Appendix III: English version Questionnaire

Addis Ababa University

College of Health Sciences

School of Nursing and Midwifery

A questionnaire to determine treatment outcome of neonatal sepsis and associated factors among neonates admitted to neonatal intensive care unit in public hospitals, Addis Ababa, Ethiopia, 2021.

1. Questionnaire ID number _____
2. Name of health facility_____

Note: Encircle from the given options and write if any other idea or answer is given

PART I: Socio-demographic characteristics of mothers with their index neonates in public hospitals, Addis Ababa, Ethiopia, 2021 (age 0-28 days)

No.	Question	Response	Skip
101	Mother's age	_____(in years)	
102	Marital status	1. Married 2. Single 3. Widowed 4. Divorced	
103	Residence	1. Urban (regional, zonal / district town) 2. Rural	
104	Maternal education	1. Can't read and write 2. Primary 3. Secondary 4. College and higher	
105	Occupation of mother	1. Housewife 2. Government organization 3. Private Organization	

		4. Daily laborer 5. Student	
106	Monthly income of the household	_____ in Ethiopian Birr	

PART II: Maternal health related factors of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021.

No.	Question	Response	Skip
201	Parity	1. Primi 2. Multi →	202
202	If the answer for question 201 is multi, How many times have you given birth?	……..…….……number	
203	Did you visit health facility for ANC during your pregnancy for this neonate?	1. Yes 2. No →	205
204	If yes, how many times did you receive antenatal care during your time of pregnancy for this neonate	_____ times	
205	Place of delivery	1. Home 2. Hospital 3. Health center 4. Other (specify)_____	
206	Mode of delivery	1. Spontaneous Vaginal delivery 2. Instrumental vaginal delivery 3. Caesarean section	
207	Did the mother had any risk for infection?	1. Yes → 2. No	208
208	Maternal risk factors for sepsis/	1. HIV	

	multiple response	2. VDRL 3. PROM/PPROM 4. Chorioamnaties 5. hypertension PIH/ Eclampsia 6. UTI 7. STI 8. Others specify_____	
209	What was the duration of rupture of membrane?	_____ in hours	
210	How many times did the birth attendant performs vaginal examination	_____ times	

PART III: Neonatal health related factors of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021.

No.	Question	Response	Skip
301	Age of the newborn at admission	_____hrs	
302	Sex of the newborn	1. Male 2. Female	
303	Gestational age	_____ in weeks	
304	Birth Weight	_____ in grams	
305	Gestational for birth weight	1. SGA 2. AGA 3. LGA	
306	APGAR score at birth	At 1st minute_____ At 5th minute_____	
307	Did the neonate had risk of infection?	3. Yes ⟶ 4. No	308

308	If yes what type of risk of neonatal infection (multiple response)	1. Resuscitated at birth 2. Inserted to endotracheal intubation 3. Inserted to umbilical catheter 4. Inserted to urinary catheter 5. Prematurity 6. Fetal distress 7. Congenital malformations 8. Necrotizing enter colitis 9. Metabolic disease 10. Other specify _____	

Part IV: Clinical criteria for diagnosis of neonatal sepsis of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021.

No.	Question	Response	Skip
401	Respiratory rate (bradypenia or tachypnea) (Count full minute)	1. Yes _____ 2. No ____	
402	Severe chest in drawing	1. Yes _____ 2. No ____	
403	Nasal flaring	1. Yes _____ 2. No ____	
404	Grunting	1. Yes _____ 2. No ____	
405	Vomiting	1. Yes _____ 2. No ____	
406	Pulse rate (bradycardia or tachycardia) in beat/minute	1. Yes _____ 2. No ____	
407	Lethargic or unconscious	1. Yes _____ 2. No ____	
408	Reduced movements (activity)	1. Yes _____ 2. No ____	

409	Unable to feed (failure to suck)	1. Yes _____ 2. No ____	
410	Abdominal distention	1. Yes _____ 2. No ____	
411	Temperature >37.5 or <35.5oC	1. Yes _____ 2. No ____	

Part V: Treatment factors for neonatal sepsis of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021. [Clients charts]

No.	Question	Response	Skip
501	Antibiotics (Duration of treatment (days) (**Multiple response**)		
	a. Gentamicin	1. Yes 2. No	
		If yes how many days_____	
	b. Ampicillin	1. Yes 2. No	
		If yes how man3y days _____	
	c. Cloxaciliin	1. Yes 2. No	
		If yes how many days _____	
	d. Cefotaxime	1. Yes 2. No	
		If yes how many days _____	
	e. Vancomycin	1. Yes 2. No	
		If yes how many days _____	
	f. Metronidazole	1. Yes	

		2. No	
		If yes how many days _____	
	g. Meropenum	1. Yes 2. No	
		If yes how many days_____	
	h. Cefepime	1. Yes 2. No	
		If yes how many days_____	
	i. Others		
502	Was the neonate on oxygen?	1. Yes → 503 2. No	
503	If yes what was the method of oxygen administration? (multiple response)	1. Intranasal catheter (Nasal cannula) (1liter) 2. Nasal prong (3 liter) 3. Nasal CPAP (more than 4 liter) 4. Mask 5. Others specify_____	
504	Did the neonate had started feeding?	1. Yes 2. No	
505	If yes, what type of feeding (multiple response)	1. Breast milk 2. Formula milk 3. Other specify _____	
506	Did the neonate had NG tube inserted?	1. Yes_____ 2. No_____	
507	Onset of sepsis	1. Early onset 2. Late onset	
508	Treatment outcome	1. Treated → 601 2. Died	
509	If the neonate is died, cause of death	_____	

Part VI: Investigation for neonatal sepsis of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021. [Clients charts]

No.	Question	Response	Skip
601	Blood glucose	**_____mg/dl**	
602	CBC	1. Yes 2. No →	**603**
	If yes, CBC results had drop/ raise (Platelet, Neutrophil, WBC, HCT and Others results)	1. Normal 2. Abnormal finding (raise/drop)	
603	C reactive protein (CRP)	1. Yes 2. No →	**604**
	If yes, test result of C reactive protein (CRP)	1. Reactive 2. Non-reactive Specify _____in number	
604	CSF	1. Yes 2. No →	**605**
	CSF results had drop/ raise (**CSF** Glucose, **CSF** Protein**, CSF** Gram stain, Neutrophil count and Others results)	1. Normal 2. Abnormal (raise/drop)	
605	Blood culture	1. Yes 2. No →	**606**
	If yes, Blood culture result	1. Normal 2. Abnormal (raise/drop)	
606	X-ray	1. Yes 2. No	
	If yes, finding of x-ray	1. Normal 2. Abnormal finding	

Appendix IV: Amharic version የተሳታፊዎች የመረጃ ቅፅ

እንደምን አደሩ/ዋሉ?

ሥሜ_____ እባላለው፤ በአዲስ አበባ ዩኒቨርሲቲ፣ ጤና ሳይንስ ኮሌጅ፣ ነርሲንግና ሚድዋይፍሪ ትምህርት ክፍል በጨቅላ ህጻናት ነርስነት የ2ኛ ዓመት የማስትሬት ድግሪ ተመራቂ ተማሪ ነኝ፡፡ በአሁኑ ሰዓት በአዲስ አበባ ከተማ አስተዳደር ጥናቱ ከሚካሄድባቸው ሆስፒታሎች ውስጥ በጨቅላ ህፃናት ሰውነት ውስጥ በሚከሰተው የሰውነት መመረዝ ለማከም በሚሰጠው መድኃኒት ላይ ያለውን ውጤት እና አጋላጭ ሁኔታዎችን ለመለየት በማጥናት ላይ ነኝ፡፡

1. **የጥናቱ ርዕስ፡ - በጨቅላ ህፃናት የሰውነት መመረዝ ለማከም በሚሰጠው መድኃኒት ውስጥ ያለውን ውጤት እና አጋላጭ ሁኔታዎችን ለመለየት በአዲስ አበባ ከተማ አስተዳደር በሚገኙ ሆስፒታሎች በጨቅላ ህፃናት ክፍል ውስጥ ተኝተው በሚታከሙ ህፃናት ላይ የሚደረግ ጥናት አዲስ አበባ፣ ኢትዮጵያ፣ 2013 ዓ.ም፡፡**
2. **የጥናቱ አላማ፤ በጨቅላ ህፃናት ውስጥ የሰውነት መመረዝ ለማከም በሚሰጠው መድኃኒት ላይ ያለውን ውጤት እና አጋላጭ ሁኔታዎችን ለመለየት፡፡**
3. **ተሳታፊዎች፡- ከ28 ቀናት በታች የሆኑ ከእናታቸው ጋር ሆስፒታል ውስጥ የተኙ ጨቅላ ህፃናት**
4. **የጎንዮሽ ጉዳት፡- በዚህ ጥናት መሳተፍ ምንም አይነት ጉዳት የለውም፡፡**
5. **ጥቅማ ጥቅም፡- በጥናቱ ለሚሳተፉ ፍቃደኛ ተሳታፊዎች ምንም አይነት የገንዘብ ክፍያ የለም፣ ነገር ግን የጥናቱ ውጤት የህጻናት ሰውነት መመረዝን ለመቆጣጠርና ለመከላከል ስለሚጠቅም በተዘዋዋሪ መንገድ ሌላ ህመምተኛ እንዲሁም ህብረተሰቡን የመጥቀም እድል ያገኛሉ፡፡ ስለዚህ የተወሰኑ ጥያቄዎችን ልጠይቅዎት እወዳለሁ፡፡ የእርስዎ በእውነት ላይ የተመሰረተ መልስ ለዚህ ጥናት መሳካት አስተዋፅኦ ያደርጋል፡፡ እርስዎ የሚሰጡት መረጃ ከአጥኚውና ቃለመጠይቅ አድራጊው በስተቀር በማንኛውም መልኩ ለሌላ 3ኛ ወገን ተላልፎ አይሰጥም፡፡**
6. **በጥናቱ የተከበረው መብት፡ ጥናቱ በእናትየው ሙሉ ፈቃደኝነት ላይ የተመሰረተ ነው፡፡ በጥናቱ የመሳተፍም ያለመሳተፍም ሙሉ መብት አላት፡፡የጥናቱ አካል ለመሆን ፈቃደኛ ከሆነች መልስ ለመስጠት ፍቃደኛ ያልሆነችባቸውን ጥያቄ ያለመመለስ እንዲሁም ከጥናቱ**

በማንኛውም ጊዜ የማቋረጥ ሙሉ መብት ሲኖራት በዚህም ምክኒያት የሚደርስባት የተለየጥቅም መጓደል ወይም ጉዳት ፈጽሞ ሊኖር አይችልም፡፡

7. **የጥናቱ አድራሻ፡**

ይህ ጥናት በሚካሄድበት ማንኛውም ጊዜ የጥናቱን አካሄድ በተመለከተ ወይም ሌላ ማንኛውም ጥያቄ ካሎት ከዚህ በታች በተሰጠው አድራሻ ማግኘት ይቻላል፡፡እስከ አሁን በነገርኮት ነገር ላይ ጥያቄ ካሎት እኔን መጠየቅ ይችላሉ፡፡

ስም፡ አሳልፍ እንዳዘናው

ስልክ: + 251-921995619,

ኢሜይል asalfend401@gmail.com

Appendix V: Amharic version የስምምነት መግለጫ ፎርም

አዲስ አበባ ዩኒቨርሲቲ፤ጤና ሳይንስ ኮሌጅ፤ነርሲንግ ትምህርት ክፍል፤ድህረ ምረቃ ፕሮግራም እኔ ለዚህ ጥናት የስምምነት ፊርማዬን ስሰጥ፤የዚህ ጥናት ዓላማ በደንብ የተብራራልኝ ሲሆን የጥናቱንም ዓላማ ተረድቻለሁ፡፡ በዚሁ ጥናት ላይ መሳተፍ በሙሉ ፈቃደኝነት ላይ የተመሰረተ መሆኑን በሚገባ የተረዳሁ ሲሆን በማንኛውም ጊዜ ከጥናቱ ራሴን የማግለል መብት እንዳለኝ አውቄአለሁ፡፡ ስለሆነም የምሰጠው መረጃ እስከተጠበቀ ድረስ በዚህ ጥናት ለመሳተፍ ተስማምቻለሁ፡፡ በጥናቱ ስሳተፍ በህጻኑ/ኗ ወይም በኔ ላይ ምንም አይነት ጉዳት እንደሌለው በግልጽ ተረድቻለሁ፡፡በዚህ ጥናት ለመሳተፍ ስምምነቴን ስገልፅ ለምጠቀው ጥያቄ በእውነት ላይ የመሰረተ መልስ ለመስጠት የተስማማሁ መሆኔን አረጋግጣለሁ፡፡በመብቴ ዙሪያም ሆነ ስለ ጥናቱ ማንኛውንም ያልገባኝን ጥያቄ መጠየቅ እንደምችል ተገልፆልኛል፡፡

የጥናቱ ተሳታፊ ስም _____

ፉርማ ----------

ቀን ----------

Appendix VI: Amharic version መጠይቅ ፎርም

በአዲስ አበባ ዩኒቨርሲቲ፤ ጤና ሳይንስ ኮሌጅ፤ ነርሲንግ ዲፓርትመንት፤ ድህረ ምረቃ ፕሮግራም ይህ መጠይቅ የተዘጋጀው በአዲስ አበባ ከተማ አስተዳደር በተመረጡ የህዝብ ሆስፒታሎች ውስጥ በህፃናት ሰውነት ውስጥ የሰውነት መመረዝን ለማከም በሚሰጠው መድኃኒት ውስጥ ያለውን ውጤት እና ሊያመጡ የሚችሉ አጋላጭ ሁኔታዎችን ለመለየት ነው።።

የመጠይቁ መለያ ቁጥር _____

የተቋሙ ስም _____

ክፍል አንድ፡- የሥነ- ህዝብ፤ማህበራዊ እና ኢኮኖሚያዊ ጉዳዮችን በተመለከተ የተዘጋጁ አጋላጭ ሁኔታዎ አዲስ አበባ፤ ኢትዮጲያ፤ 2013 ዓ.ም.

ተ.ቁ	ጥያቄ	መልስ	ይዝለሉ
101	እድሜዎ ስንት ነው?	_____ (በዓመት)	
102	የጋብቻ ሁኔታ?	1. ያገባች 2. ያላገባች 3. ባሏ የሞተባት 4. ባሏን የፈታች	
103	መኖሪያ ቦታ	1. ከተማ 2. ገጠር	
104	የትምህርት ደረጃዎ ስንት ነው?	1. ማንበብና መፃፍ የማይችል 2. ከ1-8ኛ ክፍል 3. ከ9-12ኛክፍል 4. ኮሌጅ እና ከዚያ በላይ	
105	የርስዎ የስራ ሁኔታ ምንድ ነው?	1. የቤት እመቤት	

		2. የመንግስት ሰራተኛ 3. በግል ተቋም 4. የቀን ሰራተኛ 5. ተማሪ 6. ሌላ ካለ_____	
106	ወራዊ ገቢዎ ምን ያህል ነው?	_____ በኢትዮጵያ ብር	

ክፍል ሁለት፤ ከእናት ጤና ጋር የተያያዙ አጋላጭ ሁኔታዎች አዲስ አበባ፡ ኢትዮጲያ፤ 2013 ዓ.ም.

ተ.ቁ	የእርግዝና እና የወሊድ ሁኔታ	አማራጮች	ወደሚቀጥለ ውሂድ
201	ከዚህ በፊት ወልደሽ ነበር	1, አንድ 2, ሁለት እና ከዛ በላይ →	202
202	ለጥያቄ ቁጥር 201 መልስዎ አዎ ሁለት እና ከዛ በላይ ከሆነ ስንት ልጂ ወልደሻል;	……በቁጥር	
203	የቅድመ ወሊድ ክትትል አግኝተዋል?	1. አዎ 2. አላገኘሁም	አላገኘሁም ካሉ ወደ ጥያቄ 204 ይሂዱ
204	መልስዎ አዎ ከሆነ ስንት ጊዜ?	_____ጊዜ	

205	ህጻኑን የት ነው የወለዱት?	1. ቤት 2. ሆስፒታል 3. ጤና ጣቢያ 4. ሌላ የጥቀሱ_____	
206	በምንምት ነው የወለዱት?	1. በተፈጥሮ/በምጥ 2. በመሳሪያ በመታገዝ 3. በቀዶጥገና	
207	እናትየዋን ለበሽታ የሚያጋልጥ ሁኔታ ነበር።	1. አዎ ⟶ 2. የለም	208
208	ልጁን ከእንትየዋ ጋር ተያይዞ ለኢንፌክሽን የሚያበቃ ችግር ካለ (ከአንድ በላይ ይጥቀሱ)	1. ኤች አይቢ ኤድስ (HIV 2. የአባላዘር በሽታ (VDRL 3. የእንሽርት ውሃ ቀድሞ መፍሰስ 4. ከማህፀን ውስጥ በሚወጣ ሽታ እና ፈሳሽ ካለ 5. ከእርግዝና ጋር ተያይዞ የተከሰተ የደም ግፊት ካለ 6. የሽንት ቧንቧ ኢንፌክሽን (UTI 7. በግብረ ስጋ ግንኙነት የሚመጣ በሽታ (STI 8. ሌላ ካለ _____	
209	የእነረሽርት ውሃ ከፈሰሰ በኋላ ምጡ ምን ያህል ጊዜ ቆየብዎት?	_____ በስዓት	
210	ያዋለደዎት ሰው በእጁ ማህጸንዎን ስንት ጊዜ አየዎት?	_____ ጊዜ	

PART III: Neonatal health related factors of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021.

No.	Question	Response	Skip
301	Age of the newborn at admission	_____hrs	
302	Sex of the newborn	3. Male 4. Female	
303	Gestational age	_____ in weeks	
304	Birth Weight	_____ in grams	
305	Gestational for birth weight	4. SGA 5. AGA 6. LGA	
306	APGAR score at birth	At 1st minute_____ At 5th minute_____	
307	Did the neonate had risk of infection?	5. Yes ⟶ 6. No	308
308	If yes what type of risk of neonatal infection (multiple response)	11. Resuscitated at birth 12. Inserted to endotracheal intubation 13. Inserted to umbilical catheter 14. Inserted to urinary catheter 15. Prematurity 16. Fetal distress 17. Congenital malformations 18. Necrotizing enter colitis 19. Metabolic disease 20. Other specify _____	

Part IV: Clinical criteria for diagnosis of neonatal sepsis of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021.

No.	Question	Response	Skip
401	Respiratory rate (bradypenia or tachypnea) (Count full minute)	3. Yes _____ 4. No ____	
402	Severe chest in drawing	1. Yes _____ 2. No ____	
403	Nasal flaring	3. Yes _____ 4. No ____	
404	Grunting	3. Yes _____ 4. No ____	
405	Vomiting	3. Yes _____ 4. No ____	
406	Pulse rate (bradycardia or tachycardia) in beat/minute	3. Yes _____ 4. No ____	
407	Lethargic or unconscious	3. Yes _____ 4. No ____	
408	Reduced movements (activity)	3. Yes _____ 4. No ____	
409	Unable to feed (failure to suck)	3. Yes _____ 4. No ____	
410	Abdominal distention	3. Yes _____ 4. No ____	
411	Temperature >37.5 or <35.5oC	3. Yes _____ 4. No ____	

Part V: Treatment factors for neonatal sepsis of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021. [Clients charts]

No.	Question	Response	Skip

501	Antibiotics (Duration of treatment (days) (**Multiple response**)		
	j. Gentamicin	3. Yes 4. No	
		If yes how many days_____	
	k. Ampicillin	3. Yes 4. No	
		If yes how man3y days _____	
	l. Cloxaciliin	3. Yes 4. No	
		If yes how many days _____	
	m. Cefotaxime	3. Yes 4. No	
		If yes how many days _____	
	n. Vancomycin	3. Yes 4. No	
		If yes how many days _____	
	o. Metronidazole	3. Yes 4. No	
		If yes how many days _____	
	p. Meropenum	1. Yes 2. No	
		If yes how many days_____	
	q. Cefepime	1. Yes 2. No	
		If yes how many days_____	
	r. Others		

502	Was the neonate on oxygen?	3. Yes → 503 4. No	
503	If yes what was the method of oxygen administration? (multiple response)	6. Intranasal catheter (Nasal cannula) (1liter) 7. Nasal prong (3 liter) 8. Nasal CPAP (more than 4 liter) 9. Mask 10. Others specify_____	
504	Did the neonate had started feeding?	3. Yes 4. No	
505	If yes, what type of feeding (multiple response)	4. Breast milk 5. Formula milk 6. Other specify _____	
506	Did the neonate had NG tube inserted?	3. Yes_____ 4. No_____	
507	Onset of sepsis	1. Early onset 2. Late onset	
508	Treatment outcome	3. Treated → 601 4. Died	
509	If the neonate is died, cause of death	_____	

Part VI: Investigation for neonatal sepsis of the study participants in public hospitals, Addis Ababa, Ethiopia, 2021. [Clients charts]

No.	Question	Response	Skip
601	Blood glucose	**_____mg/dl**	
602	CBC	3. Yes 4. No → **603**	
	If yes, CBC results had drop/ raise (Platelet, Neutrophil, WBC, HCT and Others results)	1. Normal 2. Abnormal (raise/drop)	

603	C reactive protein (CRP)	3. Yes 4. No →	**604**
	If yes, test result of C reactive protein (CRP)	3. Reactive 4. Non-reactive Specify _____in number	
604	CSF	3. Yes 4. No →	**605**
	CSF results had drop/ raise (**CSF** Glucose, **CSF** Protein**, CSF** Gram stain, Neutrophil count and Others results)	1. Normal 2. Abnormal (raise/drop)	
605	Blood culture	3. Yes 4. No →	**606**
	If yes, Blood culture result	1. Normal 2. Abnormal (raise/drop)	
606	X-ray	3. Yes 4. No	
	If yes, finding of x-ray	1. Normal 2. Abnormal finding	