2021-02

Magnitude and Associated factors of Sepsis Among Neonates Admitted in Neonatal Intensive Care Unit of Bahir Dar Town Public Hospitals, Northwest, Ethiopia

Mequanent, Getasew

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF PUBLIC HEATH

MAGNITUDE AND ASSOCIATED FACTORS OF SEPSIS AMONG NEONATES ADMITTED IN NEONATAL INTENSIVE CARE UNIT OF BAHIR DAR TOWN PUBLIC HOSPITALS, NORTHWEST, ETHIOPIA

BY: MEQUANENT GETASEW (BSC)

A THESIS REPORT SUBMITTED TO DEPARTMENT OF REPRODUCTIVE HEALTH AND POPULATION STUDIES, SCHOOL OF PUBLIC HEALTH, COLLEGE OF MEDICINE AND HEALTH SCIENCES, BAHIR DAR UNIVERSTY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN REPRODUCTIVE HEALTH

BAHIR DAR, ETHIOPIA

FEBRUARY, 2021

NAME &ADDRESS OF INVESTIGATOR	MEQUANENT GETASEW KASSIE (BSC) Tel: +251 918 220368 EMAIL: - mequanentgetasew01.mg@gmail.com
NAME & ADDRESS OF ADVISORS	MR.ENDALKACHEW WORKU (MPH/RH, ASSISTANT PROFESSOR) Tel: +251930316799 E-mail: endalkwk@gmail.com MR. YIBELTAL ALEMU (MPH/RH, ASSISTANT PROFESSOR) Tel: +251910012547 E-mail: yibeltalalemu6@gmail.com
FULL TITLE OF RESEARCH PROJECT	PREVALENCE AND ASSOCIATED FACTORS OF NEONATAL SEPSIS AMONG NEONATES ADMITTED IN NEONATAL INTENSIVE CARE UNIT OF BAHIR DAR TOWN PUBLIC HOSPITALS, NORTHWEST ETHIOPIA, 2020: INSTITUTIONAL BASED CROSS-SECTIONAL STUDY
STUDY PERIOD	JUNE 28, 2019 TO JUNE 27, 2020
STUDY AREA	BAHIR-DAR TOWN PUBLIC HOSPITAL, NORTHWEST, ETHIOPIA

Acknowledgment

Firstly, I would like to extend my warmth appreciation and sincere gratitude to my advisors Mr. Endalkachew Worku and Mr. Yibeltal Alemu for wonderful and valuable support throughout this thesis.

Secondly, my gratitude goes to Bahir Dar University college of Medicine and Health Sciences, school of public health that encourage me to participate in actual thesis activity for the fulfillment of Master of public health in Reproductive Health.

Thirdly, I would like to express my highest appreciation, gratitude and love to my friends, hospital administrators, data collectors, and supervisors.

Abstract

Introduction: Globally sepsis remains one of the major causes of morbidity and mortality in neonates, in spite of recent advances in health care units. Neonatal mortality is a major public health issue, 5.3 million neonates died in 2018 worldwide. Of which, sub-Saharan countries alone contributed half of world neonatal death, neonatal sepsis accounts one-fourth (25%). Likewise, Ethiopia is with highest neonatal deaths (30 /1000 live births). Although maternity care utilization and quality of essential newborn care in Ethiopia are improving neonatal sepsis and neonatal mortality remain as problem.

Objective: To assess the prevalence and associated factors of neonatal sepsis among neonates admitted in neonatal intensive care units of Bahir Dar town public hospitals, North West Ethiopia, 2020.

Methods: - Facility based cross-sectional study design was conducted among 338 neonates who were admitted in neonatal intensive care units from June 28, 2019 to June 27, 2020. Data was collected via structured checklist. Patient's chart was selected using simple random sampling technique. Data was cleaned, coded and entered into Epi-data and exported to Statical package for social science version 23 for farther analysis. Bivariable and multivariable analysis was performed. P-value less than 0.05 was used to declare as statically significant and adjusted Odds ratios were used to measure the strength of association.

Results: - The prevalence of neonatal sepsis was 47.63%. Premature rapture of membrane (AOR=2.26; 95% CI: 1.22-4.16), assisted vaginal delivery (AOR=3.53; 95% CI: 1.65-7.58), low birth weight (AOR= 2.10; 95%CI: 1.16-3.78), foul smelling liquor (AOR=5.7; 95%CI: 2.87-11.32), low, APGAR score at (AOR=2.20; 95%CI: 1.60-4.59)), and prematurity (AOR=2.20; 95% CI: 1.23-3.88) were factors that showed significant association with neonatal sepsis.

Conclusion: - Being low birth weight, being low APGAR score, having history of foul-smelling liquor, being premature and assisted vaginal delivery were factors associated with neonatal sepsis.

Key words: Neonate, Sepsis, Ethiopia.

Acronyms and abbreviation

ANC	Antenatal Care
AOR	Adjusted Odd Ratio
APGAR	Appearance, Pulse, Grimace, Activity, Respiration.
BSC	Bachelor of Science
EONS	Early Onset Neonatal Sepsis
LONS	Late Onset Neonatal Sepsis
NICU	Neonatal Intensive Care Unite
PROM	Premature Rupture of Membrane
UNICEF	United Nations International Children's Emergency Fund
UTI	Urinary tract Infection
WHO	World Health Organization

Table of Contents

List of tables

List of figures

List of annexes

1. Introduction

1.1. Background

Neonatal sepsis is defined as a clinical systemic inflammatory response syndrome in the presence or absence or as result of suspected/proven infection with or without accompanying bacteremia, documented by positive blood culture that characterized by sign and symptom of infection with in 28 day of new born life [1,2]

Neonatal sepsis classified into two categories by considering the onset of symptom: Early onset neonatal sepsis (EONS) and late onset neonatal sepsis (LONS). Early onset neonatal sepsis happens within first seven day of new born life and usually less than 72 hours may acquire before, during or after delivery. Whereas late onsets neonatal sepsis also appears after seven day of neonatal period that acquired after delivery in the new born intensive care unit, or community [1, 3-5].

Neonatal sepsis massive public health impact in sub-Saharan Africa significantly associated with economic consequence. Neonatal sepsis is mostly caused by different species of bacteria, viral and candida that may led to short- and long-term neuro developmental morbidity resulting implicating the productivity of childhood to adulthood [6, 7].

There is different risk factor for neonatal sepsis. Premature rupture of membrane (PROM), chorioamnionitis, repeated vaginal examination, prematurity. birth asphyxia, low birth weight, instrumental delivery, obstructed Laboure, and invasive procedure during hospital admitting considered as risk factor for both EONS and LONS [8-10].

Neonates are the most vulnerable and many condition ending by morbidity and mortality, though that can be prevented through providing a combined approach to the mother and the infant [11]. Neonatal sepsis had generous disease burden in sub-Saharan Africa. Among infectious killers of children, neonatal sepsis is one of the most preventable and treatable infection [12].

Federal minatory health of Ethiopia designed different strategies to reduce preventable neonatal mortality and morbidity including neonatal sepsis implemented by continuum of care approach; like focused antenatal care, institutional delivery, early initiation of breast feeding, improving maternal health and nutrition before delivery, immunization, clean delivery practice, provision of antenatal corticosteroid, provision antibiotics, ensuring functional new born corner each health center, thermal care, new born intensive care unit service, continuous capacity building for health care worker and health extension worker, provision of Essential medicines, commodities and logistics, that all delivered through community based intervention, population oriented outreach service and individual oriented clinical service [1].

1.2. Statement of the problem

Globally child survival is increasing, but it is remaining a public health problem. Worldwide 5.3 million (39 per 1,000) children were died before celebrating fifth year birth day in 2018. Of these new born accounts 2.5 million of deaths. Sub-Saharan country accounts around half of neonatal mortality. More than 2.7 million (78 death per 1000 live birth) under- five were died. Among this 36% (28/1000 live birth) of death contributed by neonates, Which was accounted 26% of under-five mortality in 1990 [13].

Ethiopia is one of Sub-Sharan countries with highest neonatal mortality, which is 30 deaths per 1000 live birth. It accounts for 43% of under-five mortality in 2016, Which was 30% in 2000 [14, 15]. Majority of neonatal mortality cause are preventable, of which neonatal sepsis take the lion share, which accounts 25 % of neonatal death in the low and middle income countries [16, 17]. In Ethiopia it accounts about 20% of all cause of neonatal death [18]. The prevalence of neonatal sepsis in the low- and middle-income countries ranges from 4.3%-77.9%, which indicates varied place to place or facility to facility[19, 20].As some studies showed it is associated with Sexual transmitted infection during index child, premature rupture of membrane, low birth weight, birth asphyxia, Maternal age, multiple per vaginal examination, parity, gestational age, low APGAR score, and delay initiation of breast feeding were risk factors for neonatal sepsis[21, 22]. Neonatal sepsis causes disability, morbidity and mortality [23].

Ethiopian Federal Ministry of Health (FMOH) strived to reduce neonatal mortality by adapting of integrated management of childhood illness (IMNCI), increasing of health service accessibility and quality and considering neonatal sepsis as strategy for neonatal survival, yet instead of decreasing neonatal mortality in Ethiopia is increasing[24, 25]. Continues study is necessary since the problem is existing. As far as the investigator's knowledge and searching effort, there is no recent study conducted in the study area about neonatal sepsis. Therefore, this study was conducted to give reliable current data on the prevalence of neonatal sepsis and its associated risk factors among neonates admitted at Bahir Dar town three public hospitals.

1.3. Significance of the study

Knowing the prevalence and identifying factors for neonatal sepsis in the area was had a contribution to program managers for designing, proper implementation and assessing of programs on reduction neonatal mortality and improvement of neonate care to the achievement of sustainable development goal (SDG) 3 calls to end preventable death and reduce neonatal mortality as low as 12 death per 1,000.

Furthermore, the finding helps to suggest interventions to be designed to improve the quality of neonate care for health care providers. It may also be used for planning and intervention purpose for non-governmental organization those who are interested in working on neonates. In addition, Students and researchers will be used as a reference for their work for the future

2. Literature review

2.1. Prevalence of neonatal sepsis

A study conducted at different places out of Africa showed that the prevalence of neonatal sepsis was 4.3% (75.3%EONS and 24.7% LONS), 4.7% and 18.4% in Southern Mexico, Western Mexico and Iran respectively[19, 26, 27].

A study conducted at Africa showed that the prevalence of neonatal sepsis was 15.4%, 8.6%, 18.4%, 40.7% and 31.4% in Northern Tanzania, South Sinai Egypt, Egypt and Temeke and Mwananyamala Hospitals in Dareselam respectively[9, 28-30].

When come to Ethiopia, study conducted at different place of Ethiopia showed that the prevalence neonatal sepsis was 67.5%, 72.2%, (80% EONS and 19% LONS), 34%, 77.9 (64.7% EONS and 35.3%LONS), 78.3% (78.9 EONS, 21.1% LONS), and 33.8 (26.9 EONS and 6.9 LONS) in Gondar hospital, Bishoftu General hospital, Arsi, Shashemene, Arbaminch and Hospital of welayta Sodo respectively [20, 22, 31-34].

2.2. Factor associated with neonatal sepsis

2.2.1. Socio demographic characteristics of the mother and the neonate

A study conducted Mexico showed that, mother's age was on of predictor factored for neonatal sepsis. Neonates born from mother with age <15 years more likely to have Sepsis than their counter parts [26]. A study conducted at Dares Salaam showed that neonates delivered from mother with age less than 20 and above 41 years old were more likely to experience neonatal sepsis than neonates delivered from mother with age group from21-30 [30]. Similarly, a study at Ghana showed that age of mother was one predictor factor for neonatal sepsis. A mother age 21-30 years was less likely neonates with sepsis compared to mothers age less than 20 years. In this study neonates delivered from women's age 31-40 years less likely to have neonatal sepsis compared to neonates born from mother with less than 20 Years. Similarly, women age above 40 years less likely to have neonate with sepsis compared to women with age less than 20 years [35]. A study at Ghana reveled that age of

neonate was one of predictor factor for sepsis [36]. Another study at Ghana revealed that the odds of neonatal sepsis was more likely among male neonates compared to female neonates [35].

A study conducted in Ethiopia showed at Wolayta Sodo town hospitals revealed that, the odds of developing neonatal sepsis was lower among neonates born from mother with age group age 20-24 compared neonates born from mother with age<20 years[22]. A study conducted at Shashemene Town, Oromia Regional State maternal age less than 20 and neonatal age less than 8 days were factors associated with neonatal sepsis[20]. Other study at Welaita Sodo hospitals revealed that the odds of developing neonatal sepsis among neonate age < 8 was higher than their counterparts [22].

As study conducted Mekele Place of delivery was one factor for neonatal sepsis. Neonates delivered at health center more likely to experience sepsis than hospital delivered neonates [37].A study at Bishoftu General Hospital showed place of delivery was one predictor factor for neonatal sepsis. In this study, the odds of developing neonatal sepsis were more among neonates deliver at home compared neonates delivered at facility [32].

2.2.2. Obstetric characters of mother

Premature rupture of membrane (PROM) was one predictor factor for neonatal sepsis. A study at Mexico the odds of neonatal sepsis was higher among neonates born from mother having rupture of membrane more than 18 hours than their counter parts[26]. Correspondingly, a study at Ghana showed that a mother who had premature rupture of membrane were more likely to have neonate with sepsis compared to mother without rupture of membrane [35, 36].A study Egypt revealed that Premature rupture of membrane was one of risk factor for neonatal sepsis [29]. When come to Ethiopia a study conducted at Mekele showed that neonatal sepsis was higher among neonates born from mother with PROM [37]. A study conducted at Arsi showed that the odds of neonatal sepsis was higher among neonates born from mother with PROM than their counter parts [33]. Similarly A study conducted at Debre

Markos referral hospital revealed that the odds of neonatal sepsis was higher among neonates born from mother with PROM than their counter parts [38].

Meconium stained was one of significant factor for neonatal sepsis. A study at Ghana showed that the mother who had meconium stained amniotic fluid more likely to give birth neonate with neonatal sepsis than their counterparts [35]. A mother presented with Foul smelling liquor more likely to have neonates surfed from sepsis than mother without foul smelling liquor [35].

A study at Mexico showed that neonates born from mother with history of fever more likely to have sepsis than neonates born from mother haven't history of fever during current pregnancy [26]. A study at Mekele revealed that neonates delivered from mother with history of Fever or Sexual transmitted diseases(STI) was more likely to develop neonatal sepsis compared to their counterparts [37].

A study at Egypt reveals that neonates delivered through spontaneous vaginal delivery less likely to experience neonatal sepsis [29].Other study at Ghana reveled that neonates delivered through vaginal mode of delivery less likely to have neonatal sepsis [36]. Mode of delivery also other significant factor for neonatal sepsis as a study conducted at Bishofitu hospital showed. Neonates delivered through instrumental mode of delivery more likely to develop neonatal sepsis compared with neonates delivered spontaneous vaginal delivery [32]. A study at Gondar revealed that neonates delivered through cesarean section was more likely to have neonatal sepsis compared to neonates delivered through SVD[31].

Parity was one of risk factor for neonatal sepsis. A study at Ghana showed that multiparous mother less likely to have neonate with sepsis compared to prim-gravidas [35, 36]. Similarly, a study at Egypt revealed that neonates born from multiparous mother was less likely to develop sepsis than neonates born from prim-parous mother[29]. Twin delivery was one of risk factor for neonatal sepsis as a study at Egypt revealed[29]. In this study male neonate more likely to develop neonatal sepsis than female neonate [29].

Duration of labor was one of predictor factor for neonatal sepsis as a study Arbaminch reveal. Neonates born from mother with >=12 hours' duration of labor more to experience neonatal sepsis than neonates born <12 hrs. duration of labor [34].

History Urinary tract infection (UTI) or sexuality transmitted infection (STI) was one predictor factor for neonatal sepsis. A study at Ghana revealed that neonates born from women having history of UTI/STI was more likely to have sepsis than neonate born from mother without history of UTI/STI [35].A study at Bishoftu General Hospital showed neonates delivered from mother was having history of UTI more likely to develop neonatal sepsis than their counter parts [32].

2.2.3. Neonatal related characteristics

As studies revealed birth weight was one of predictor factor for neonatal sepsis. A study at Mexico showed that odds of sepsis was higher among neonates with low birth weight neonates compared with normal birth weight neonates [26]. A study at Ghana showed that low birth weight neonates more likely to suffer from sepsis than normal birth weight neonates [35]. Likewise, a study at Egypt indicated that neonates with low birth weight was one of predictor factor for neonatal sepsis compared with normal birth weight neonate [29]. A study at Gondar showed that neonates with very low birth weight and low birth weight more likely to have neonatal sepsis than neonates with normal birth Wight. A study at Arbaminch revealed that Neonates with low birth weight more to develop sepsis than normal birth weight [34]. Similarly, a study at Arsi also revealed that low birth neonates were had higher risk for neonatal sepsis than normal birth weight neonates [33].

Gestational age was one of risk factor for neonatal sepsis. A study at Mexico showed that preterm neonates was more risk for neonatal sepsis than term neonate [26]. Another study at Ghana showed that preterm neonates more likely to suffer from sepsis than term neonates [35]. Similarly, a study Egypt indicated that the odds of sepsis was higher among preterm neonates than term neonates [29]. A study at Arbaminch general hospital reveal that preterm neonates were more likely to have sepsis than term neonates [34]. Similarly, a study at

Gondar and Debre Markos showed that the odd of neonatal sepsis was higher among preterm neonates compared to term neonate[31, 38]. A study at Arsi showed that premature neonates were more likely to develop neonatal sepsis than their counter parts [33].

APGAR score was one contributing factor for neonatal sepsis. study at Ghana showed that neonates with low APGAR score more likely to develop sepsis than neonates had normal APGAR score[35, 36].Other study at Dareselam showed that neonatal sepsis among neonates with low Apgar score was higher [30]. A study at Shashemene Town showed that odds of developing neonatal sepsis was higher among new born with birth asphyxia than their counterparts [20]. Another study at Arbaminch Revealed that neonate with APGAR score <=7 more to develop neonatal sepsis than neonates have >= 7 APGAR Score [34].A study at Mekele revealed that neonates with low Apgar score fifth minute was more risk for neonatal sepsis compared to neonate have normal score [37]. Similarly, a study at Gondar showed that Apgar score was one of contributing factor neonatal sepsis. The neonates with low APGAR score more likely to develop neonatal sepsis compared to neonates with normal APGAR score [31].The odds of experiencing neonatal sepsis among neonates with low APGAR score was high than their counter parts as a study at Arsi reveals [33].

A study at Ghana showed that neonates who resuscitated at birth was more likely to had sepsis than neonates not resuscitated[35, 36].Similarly, study at Dareselam the odds of sepsis was high among Resuscitated neonates [30]. A study at Shashemne town reveal that neonate who use oxygen via mask more likely to develop neonatal sepsis than those note used at birth[20].

The odds of developing neonatal sepsis was less likely among neonates who crying immediately after birth compared to neonate not crying as a study at Ghana revealed [35]. Similar study at Tigray Mekele and Debre Markos revealed that neonates who cries immediately After birth less likely to develop neonatal infection than their counter parts[37, 38].

3. Conceptual framework

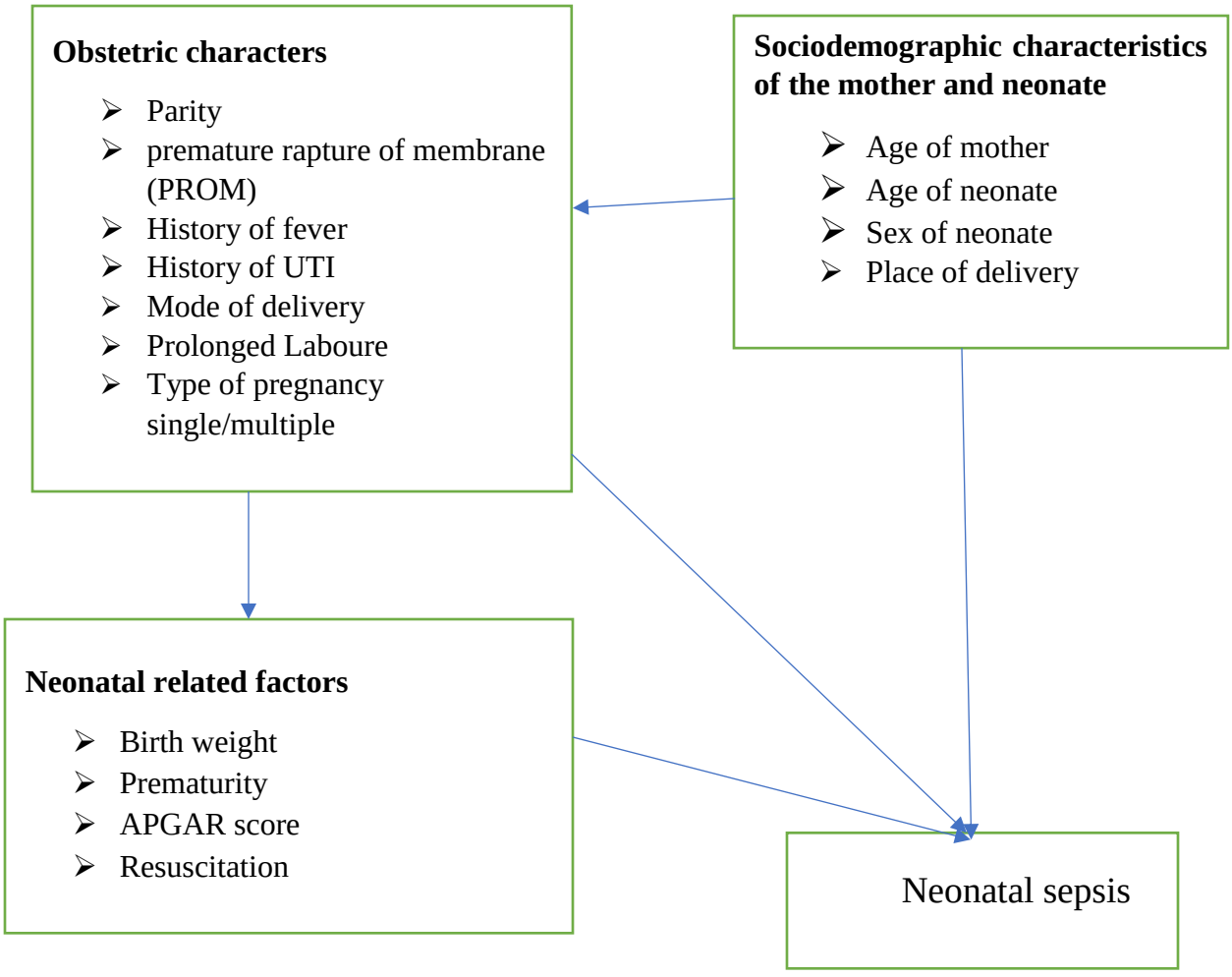

Figure 1: conceptual framework to NICU of Bahir Dar public hospitals, 2020 [26, 27, 31].

4. Objective of the study

4.1. General objective

To assess the prevalence and associated factors of neonatal sepsis among neonates admitted to NICU of Bahir Dar town public hospitals, North West Ethiopia, 2020

4.2. Specific objective

1. To determine the prevalence of neonatal sepsis among neonate admitted to NICU in Bahir Dar town public hospitals
2. To identify factors associated with neonatal sepsis among neonate admitted to NICU in Bahir Dar town public hospitals**.**

5. Method

5.1. Study design and period

Institutional based cross-sectional study was conducted from June 28, 2019- June 27, 2020.

5.2. Study area

The study was conducted in Bahir Dar town public hospitals. Bahir Dar Town, the Capital City of Amhara National Regional State in Ethiopia, which is located on the southern side of Lake Tana (where Blue Nile river starts) with the altitude of town about 1801 meters above mean sea level, 55 minutes air flight distance and 565 kilometer away from Addis Ababa, in northwest Ethiopia [39].

In Bahir Dar town, there are 3 public hospitals that give comprehensive services including maternal and child health services such as ANC follow up, delivery, postnatal care and newborn care. Among this Felege-hiwot Compressive Specialized Referral hospital (FSCRH) is the large hospital which is established in 1963 G.C in collaboration with the German government during emperor H/Selassie. Currently, the hospital named as Felege-hiwot Comprehensive Specialized Referral hospital that gives service for around 5-7 million people, Addis Alem primary hospital is the second governmental hospital in the town and another newly established hospital is Tibebe-Ghion specialized teaching hospital of Bahir-dar university. In addition to these, there are 6 governmental health centers in the town.

The study conducted among Felege-hiwot Comprehensive Specialized referral hospital, Addis Alem primary hospital and Tibebe-Ghion specialized teaching hospital which has NICU and gives service for the surrounding community.

5.3. Population

5.3.1. Source population

All neonates chart who came at NICU of Bahir Dar town Public hospitals from June 28 /2019- June 27/2020

5.3.2. Study population

Medical record cards of those neonates who were admitted at NICU of FCSRH, AA, TGSRH from June 28, 2019- June 27, 2020

5.4. Eligibly criteria

5.4.1. Inclusion criteria

All neonates medical record charts who were admitted to NICU of Bahir Dar town public hospitals from June 28, 2019- June 27, 2020 (referral sheet log books.)

5.5. Variables

5.5.1. Dependent Variable

Neonatal sepsis (Yes=1, No=0)

5.5.2. Independent variables

Sociodemographic and Obstetric Characteristics of mother: - (age, parity, PROM, prolonged Laboure, mode of delivery, place of delivery history of fever, history of STI)

Neonatal related characteristics: - (age, sex, gestational age, birth weight, APGAR score)

5.6. key term definitions

Neonate: birth up to first 28 days of life.

Sepsis: is life-threatening condition that arises when the body`s response to infection injures its own tissues and organs.

Low birth weight: - A neonate measured with <2.5 KG weight at birth [1]

Prematurity: - Neonate considered as premature if delivered <37 completed weeks of gestation [1].

Low APGAR score: - When the neonate fifth minute APGAR score less than 7 consider as low score.

5.7 Sample size and sampling methods

5.7.1 Sample size determination

Sample size determined based on specific objective of the study. It was calculated using single proportion formal for the first objective taking the prevalence of neonatal sepsis 67.5% from previous similar studies[31], 95 confidence level (z α/2=1.96) and margin of error (d=5%).

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

$n = (1.96)^2 0.675 *0.325)/0.05^2 = 338$

Regarding the second objective; the sample size was also calculated by using factors associated with neonatal sepsis among NICU admitted neonates in view of different variables from previous studies by EPI Info version 7 Statcalc cohort or cross-sectional, based on the assumption: power 80%, 95% CL, unexposed: exposed ratio 2, outcome in unexposed group (%), adjusted odds ratio and outcome in exposed group (%) (Table 1).

Table 1: Sample size determination for neonatal sepsis by using associated factors, 2020

Variables	Outcome in unexposed group (%)	AOR (%)	%outcome in exposed group	Sample size
Intrapartum fever [31]	7.3	3.35	21.8	249
Age of neonate [20]	62.4	3.01	73.0	183
PROM [33]	26.1	2.31	35.9	245
APGAR at five score[33]	26.3	2.1	42.9	312
Low birth weight [31]	27.8	2.63	60.7	180

The sample size obtained by using single proportion formula for objective one is greater than the sample size obtained using the associated factor. So, the sample size for this study was 338.

5.7.2. Sampling technique and procedures

Felege-hiwot Compressive Specialized Referral hospital, Addis Alem district hospital, and Tibebe-Ghion specialized teaching hospital are hospitals with NICU. The sample size assigned proportionally to each hospital based on total annual neonatal admission. Study participants was selected through simple random sampling technique.

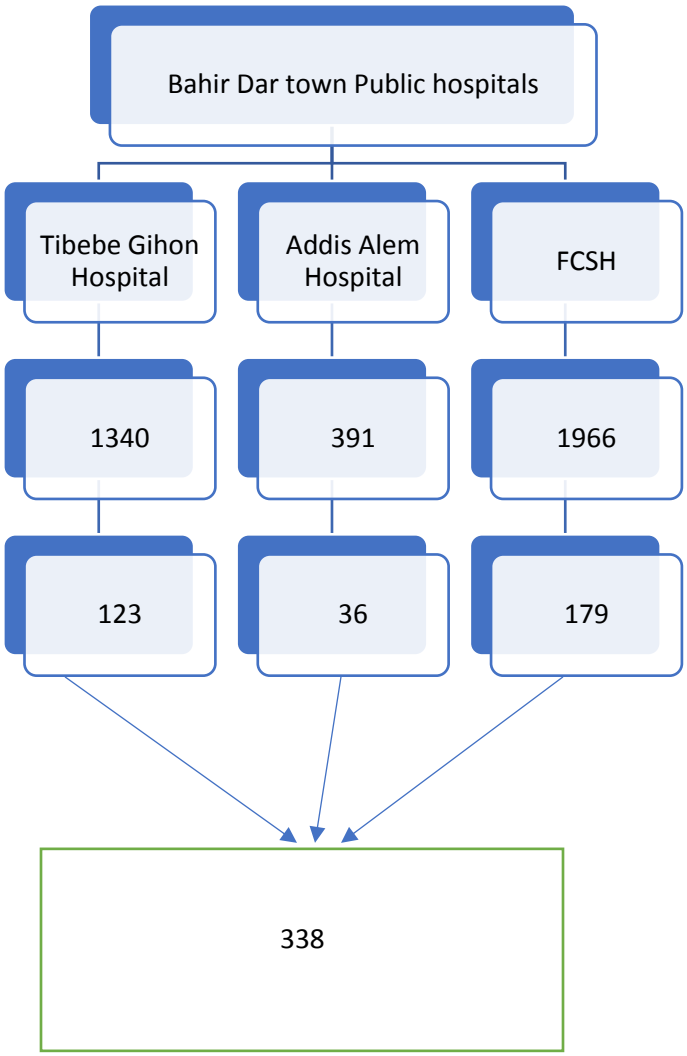

Figure 2: Schematic presentation of the sampling procedure of prevalence of neonatal sepsis and its associated factor among neonates admitted to NICU in Bahir Dar town public hospitals, 2020

5.8. Data Collection tools and procedures

Data was collected through a structured questionnaire developed by reviewing, selecting modifying and adapting different literature in English language [20, 22, 31]. The questionnaire comprised of socio-demographic characteristics, obstetrical-related characteristics and neonatal related characteristics. Data was extracted from Chart of mothers, neonates, Referral sheets, and NICU registers. Record of neonates for the last one year (from June 28, 2019- June 27, 2020) was reviewed. The medical files of neonate was trace by using medical registration number on the log book of NICU. If neonatal information incomplete on neonatal medical card, the maternal card used. Six-degree holder nurses was assigned for data collection and one-degree holder nurse was assigned to supervise all data extraction process.

5.9. Data quality control

One day training was provided for data collectors and supervisor on the objective, relevance of the study and how to extract data. The supervisor was managing the data collection process every day and the principal investigator also checked the accomplished questionnaire for completeness every other day. All completed checklist examined for completeness and consistency during data management, storage, and analysis.

5.10. Data processing and analysis procedure

Data was cleaned, coded, and entered into Epi data version 3.1 and exported to Statical package for social science (SPSS) version 23 for further analysis. Descriptive statistics (Frequency, proportion, and summary statistics) carried out to see the distributions of independent variables. Both bivariable and multivariable logistic regression was employed. On bivariable analysis p-value of less than 0.25 was used to select candidate variables for multivariable analysis. P-value and 95% confidence interval used to measure the level of significance on multivariable analysis and those variables whose P-value less than 0.05 on multivariate analysis was considered as statistically significant and the strength of association measured by adjusted odd ratio (AOR). Multi-collinearity between the independent variables was checked (VIF<10). Hosmer-Lemeshow statistic tests was used to test for model fitness (P=0.22).

5.11. Ethical consideration

Ethical clearance was obtained from institutional review board of College of Medicine and Health Sciences, Bahir Dar University. A support letter was received from Zonal health department and Tibebe Gihon Specialized Teaching Hospital.

Afterward explaining the purpose and the likely benefit of the study, permission to gather the data was gained from the medical directors of the perspective hospital and heads of NICU. After permission gained from the concerning body the checklist given to data collectors to extract data. The confidentiality of the information was assured throughout the study procedure.

6. Dissemination of the finding

The finding of the study was presented and submitted to the School of Public Health College of medicine and health science, Bahir Dar University for Partial Fulfillment of Masters of Public Health in reproductive health.

It also disseminated to Amhara Regional State Health Bureau, Bahir Dar town health office, and the respective health institutions and sectors, as well as, interested and concerned governmental and non-governmental organizations. It will be also placed in the library. An effort also will make for publication and presentation to scientific conferences.

7. Results

7.1. Scio demographic characteristics of Mother and neonate

A total of 338 neonates participated in this study with the response rate of 100%. Two hundred twenty (65.09%) index mother were in the age group between 20-34 years with the mean age and standard deviation (SD) of 28.25±7.6. From the total participants (83.14%) of neonate were ≤7days at admission and 56.8% of neonates were males (table 2).

Table 2:Socio-demographic characteristics of neonates and mothers of neonates admitted to Neonatal Intensive Care Unit of Public Hospital in Bahir Dar, North West, Ethiopia, 2020

Variable	Frequency	Percent
Age of Mother (in years)		
<20	38	11.24
20-34	220	65.09
>=35	80	23.67
Age of neonate (in days)		
<=7	281	83.14
>=8	57	16.86
Sex of neonate		
Male	192	56.80
Female	146	43.20

7.2. Maternal and Obstetric related characteristics

From 338 study participants 34% of mother were had history of urinary tract infection during index child pregnancy. From the total study participants majority of (93.49%) neonates' mother had had ANC follow up. About 134 (39.76%) of mother had history of fever experienced maternal fever during index neonate pregnancy. Where us 203(60.24%) of neonates' mothers were no had history of fever.

Concerning parity, more than half 178 (52.66%) of neonates' mother were primiparous and 81 (23.96%) of neonate's mother were had meconium-stained amniotic fluid during index neonate delivery.

Regarding duration of labor, 240 (71.01%) mothers had <12-hour, whereas 98 (28.99%) of mother had ≥12-hour duration of labor during index mother delivery. About prolonged rapture of membrane, 89(26.33%) of neonate's mother had prolonged rupture of membrane (Table 3).

Table 3: Obstetric related characteristics for neonates' mothers admitted to Neonatal Intensive Care Unit of Public Hospital in Bahir Dar, North West, Ethiopia, 2020

Variables	Frequency	Percent
History of Maternal UTI		
Yes	34	10.06
No	304	89.94
ANC follow Up		
Yes	316	93.49
No	22	6.51
History of Maternal fever		
Yes	134	39.76
No	203	60.24
History foul-smelling liquor		
Yes	100	29.67
No	237	70.33
History chorioamnionitis		
Yes	74	21.89
No	264	78.11
Meconium-stained Amniotic fluid		
Yes	81	23.96
No	257	76.04
Premature rupture of membrane		
Yes	89	26.33
No	249	73.67
Parity of mother		
Primiparous	178	52.66
Multiparous	160	47.34
Mode of delivery		
. SVD	180	53.25
Assisted vaginal delivery	57	16.86
cesarean section	101	29.88
Duration of Laboure (in hours)		
<12	240	71.01
≥12	98	28.99
What was the type of Pregnancy		
Single	316	93.49
Multiple	22	6.51

7. 3. Neonatal related characteristic

Majority of study participants 201(59.47%) were had ≥2.5 KG birth weight. The mean birth weight and standard deviation of neonates was 2.66 ± 0.67 (SD). Concerning gestational age, 217 (64.2%) of neonate were delivered after completing 37 or more weeks. The mean gestational age of neonates was 37.86 ± 2.8(SD) (Table 4).

Table 4: Neonatal related characteristics for neonates admitted to Neonatal Intensive Care Unit of Public Hospital in Bahir Dar, North West, Ethiopia, 2020

Variables	Frequency	Percent
Birth weight in KG		
<2.5	137	40.53
≥2.5	201	59.47
Gestational age of neonate in weeks		
<37	121	35.80
±37	217	64.20
Fifth minute APGAR score		
<7	156	46.15
≥7	182	53.85
Resuscitated		
Yes	172	50.89
No	166	49.11

7.4. Prevalence of neonatal sepsis among NICU admitted neonates

From the total 338 participants, 47.63% (95% CI, 42.28-52.98) neonates were diagnosed with sepsis. Among neonates diagnosed with sepsis 135 (83.85%) and 26 (16.15%) were developed early and late onset neonatal sepsis respectively.

7.5. Associated factors of neonatal sepsis

In bi-variables analysis; mode of delivery, resuscitation, PROM, gestational age, birth weight, history of foul-smelling liquor, 5^{th} minute APGAR score parity and history of fever were showed association with neonatal sepsis at P-value <0.25. Mode of delivery, PROM, Gestational age, Birth weight, foul smelling liquor, 5^{th} minute APGAR score were factors associated with neonatal sepsis.

The odds of neonatal sepsis among PROM were 2.26 times higher than their counter parts (AOR 2.26; 95% CI 1.22, 4.16).

The odd of neonatal sepsis among women who delivered through assisted vaginal delivery were 3.53 times higher than those with spontaneous vaginal delivery (AOR=3.53,95%CI, 1.65-7.58).

The odds of experiencing neonatal sepsis was 2.1 times more among neonates with low-birth-weight neonates compared to neonates with normal birth weight (AOR= 2.10, 95%CI; 1.16-3.78).

This study showed that neonates delivered from mother having foul smelling liquor were 5.7 times more likely to develop sepsis than neonates delivered from mother without history of foul liquor (AOR=5.7, 95%CI; 2.87-11.32).

The probability of getting neonatal sepsis from those who had <7 APGAR score at fifth minute 2.2 times higher than neonates with ≥7 APGAR score (AOR=2.20, 95%CI;1.60-4.59).

The odds of developing neonatal sepsis among premature neonates were 2.2 times more likely than their counter parts (2.20, 95%CI;1.23-3.88) (Table 5).

Table 5: Factors associated with neonatal sepsis in Bahir Dar town public hospitals, northwest, Ethiopia, 2020

Variables	Neonatal sepsis				
	Yes	No	COR (95%CI)	AOR (95%CI)	p-value
PROM					
Yes	52(58.4%)	37(41.6%)	1.81(1.11-2.95)	2.26 (1.22-4.16)	**0.009***
No	109(43.7%)	140(56.3%)	1	1	
Resuscitated					
Yes	95(55.2%)	77(44.8%)	1.87(1.21-2.88)	0.93 (0.44-1.97)	0.87
No	66	100			
Mode of delivery					
SVD	74(41%)	106(59%)	1	1	
AVD	37(65%)	20(35%)	2.65(1.42-4.92)	3.53 (1.65-7.58)	**0.001***
C/S	50(50%)	51(50%)	1.40 (0.52-2.29)	1.65 (0.91-3.01)	0.1
Gestational age					
<37	76(62.8%)	45(37.2%)	2.62(1.66-4.15)	2.20(1.23-3.88)	0.007
>=37	85(39.2%)	132(60.8%)			
Birth weight in KG					
<2.5	82(60.7%)	55(39.3%)	2.30(1.48-15)	2.10 (1.16-3.78)	**0.014***
>=2.5	79(39.3%)	12260.7%)			
Foul smelling liquor					
Yes	76(76%)	24(24%)	5.77(3.39-9.80)	5.7 (2.87-11.32)	**<0.001***
No	84 (35.5%)	153(64.5%)	1	1	
5^{th} minute APGAR score					
<7	94(60.2%)	62(39.8%)	2.60 (1.68-4.04)	2.20 (1.60-4.59)	**0.036***
≥7	67(36.8%)	115(63.2%)	1	1	
Parity					
Primiparous	77 (43.3%)	101(56.7%)	0.69 (0.45-1.06)	0.70 (0.42-1.17)	0.18
Multiparous	84 (52.5%)	76(47.5%)	1	1	
History of fever					
Yes	80(59.7%)	54(40.3%)	2.28 (1.46-3.56)	1.14 (0.60-2.14)	0.69
No	80(39.4%)	123(60.6%)	1	1	

* significant association, 1 reference category

8. Discussion

The overall prevalence of neonatal sepsis in the current study was 47.63% (95%CI, 42.28-52.98). This was higher than a studies conducted in Arsi 34% [33], Welayta Sedo 33.8% [22] , Tanzania 15.4% [28], South Sinai Egypt 8.6% [29], Dareselam 31.4% [30], Egypt 40.7% [9], southern Mexico 4.3% [19] , western Mexico 4.7% [26], and Iran 18.4%[27]. However also lower conducted than a studies Gondar 67.5% [31], Bishoftu general hospital 72..2% [32], Shashemene 77.9% [20], Arbaminch 78.3% [34]. This difference might be due to different diagnosis strategy (some used blood culture), different clinical case definition, advancement of health care and in sociodemographic difference. The other possible explanation increasing health seeking behavior and socioeconomic status of the community may bring the difference.

The odds of developing neonatal sepsis among neonates with low APGAR score were higher compared to neonates with normal APGAR score. The finding of this study was in line with previous studies conducted in Arbaminch [34], Mekele [37], Gondar [31], Arsi [33], Shashemanie [20], Ghana [35, 36], and Dareselam [30]. The reason for this could be due to neonates with low APGAR resuscitated. The procedure of resuscitation may expose the neonate to infection causing microbes. Additionally, a decreased in respiratory might have effect on other body function at birth which expose a risk to infection. On the other hand, asphyxia causes an immunological deprivation.

Neonates with low birth weight were more likely to have neonatal sepsis compared to neonates with normal birth weight. This finding was agreed with studies done at Gondar [31], Arbaminch [34], Arsi [33], Ghana [35], Egypt [29], and Mexico [26]. This might be due to low-birth-weight neonates have reduced subcutaneous fat, increase risk of hypothermia due to high body surface area to weight ratio, and poorly developed immune system related to low birth weight.

The odds developing neonatal sepsis among neonate delivered from mother with PROM higher compared with their counter parts. This finding was in line with a study conducted at Mekele [37], Arsi [33], Debre Markos [38], Ghana [35, 36], Egypt [29], and Mexico [37]. This may be due to the fact early rupture of membrane increases the chance of ascending

microorganism from birth canal in to amniotic sac cases chorioamnionitis and fatal compromise as well as asphyxia which lead to sepsis.

In the current study assisted vaginal delivery showed positive association with neonatal sepsis. This finding supported by a study conducted at Bishofitu hospital [32]. The possible reason for this, the procedure may result fetus suffocation and environmental contamination with nosocomial infections at the time of delivery may result sepsis.

The odds of developing neonatal sepsis among premature neonates were 2.2 times more likely than there counter parts. This finding in line with a study conducted at Gondar [31], Debre Markos [38], Arbaminch [34], Arsi [33], Egypt [29], Ghana [35], and Mexico [26]. This could be due to the fact preterm babies are under developed, having compromised immune system and have poor breast suckling which predispose them poor nourishment and body defense that explained by the fact these groups of new born had poorly developed immune system. Additionally, preterm baby has limited capability to increased neutrophil production in according to demand to overcome the problem and may predispose to sepsis. Furthermore, preterm neonates are more likely to receive parenteral medication or some form of medication via IV cannula. This may predispose them to high risk of infection [23].

The current study showed that neonates delivered from mother having foul smelling liquor were 5.7 times more likely to develop sepsis than neonates delivered from mother without history of foul liquor. This finding supported by a study conducted at Ghana [35]. This may be the fact foul smelling liquor usually associated infection. Therefore, the dissemination of this smelling case microorganism may result sepsis to neonate.

9. Limitation of the study

Since this study was public health institutional based, it may difficult to generalize for the community

10. Conclusion

The perveance of neonatal sepsis in this study was high. Neonates who have low birth weight, being low APGAR score, having history of foul-smelling liquor, being premature and assisted vaginal delivered were factors associated with neonatal sepsis.

11. Recommendations

I. For Hospitals and health professionals

- Strengthen early diagnosis and management of mother with PROM and foul-smelling liquor
- It is better to give special attention to the neonate with low APGAR score, low birth weight, preterm and delivered through assisted vaginal delivery

II. For researchers

- Identify further detailed extra independent factors of neonatal sepsis considering more different hospitals and using other designs like prospective cohort.

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10: Annexes

Annex 1: information sheet and consent form

Good morning/afternoon/evening.

My Name is ----------

I am from the research team of Bahir Dar University School of public health, which is currently carrying out study on the prevalence of neonatal sepsis and its associated factors among neonates admitted in Bahir Dar town public hospitals. As part of this study we are collecting information, socio-demographic, obstetric history and neonatal related characteristics.

We are reviewing charts of admitted in NICU in last one year. The finding of this study will be used to improve the quality of care to neonates and the information gained from participants chart will have its significant value for decreasing neonatal morbidity and mortality. The information will be extracted from chart will be used for this study only and confidentiality of information will be kept.

Name of data collector----------Signature----------Date----------

Name of supervisor……signature……. date

hospital----------

please direct any questions or problems you may encounter during this study to

Mequanent Getasew

Department of Reproductive health and Population studies

College of Health Science

Bahir Dar University

Mobile +251918220368

Email- mequanentgetasew01.mg@gmail.com

Annex 2: Data Extraction checklist

000	**Questionnaire Code**	

1. Scio demographic characteristics of Mother and neonate

Sn.	Variable	Response	
100	Age of Mother (in years)	_____	
101	Age of neonate (in Days)	_____	
102	Sex of neonate	1. Male 2. Female	
103	Where the mother did give birth	1.Facility 2. Home 3. Other	

2. Maternal Obstetric related characteristics

Sn	Variable	Response	
200	Did the mother have History of Maternal UTI	1. Yes 2. No	
201	Did the mother have ANC follow Up during Index Child pregnancy	1. Yes 2. No	
202	Did the mother have History of Maternal	1. Yes	

	fever	2. No	
203	Did the mother have of foul-smelling liquor during index child pregnancy	1. Yes 2. No	
204	Did the mother have chorioamnionitis during current pregnancy	1. Yes 2. No	
205	Did the mother have Meconium stained Amniotic fluid during delivery	1. Yes 2. No	
206	Did the mother have premature rupture of membrane	1. Yes 2. No	
207	If yes for Q-206 Duration of Prom in hours	_____	
208	Parity of mother	1. Primiparous 2. Multiparous	
209	What was the Mode of delivery	1. SVD 2. Assisted vaginal delivery 3. cesarean section	
210	What was the duration of Laboure in hours	_____	
211	What was the type of Pregnancy	1. Single 2. Multiple	

3. Neonatal related characteristic

SN.	Variables	Response	
300	Diagnosis on admission (Specify)	_____	
301	Birth weight of neonate in KG	_____	
302	Gestational age of neonate in weeks	_____	
303	Fifth minute APGAR score	_____	
304	Did the neonate resuscitated (asphyxiated)	1. Yes 2. No	

Annex 3: Declaration

The undersigned agrees to accept responsibility for the scientific, ethical and technical conduct of the research project and for provision of required progress reports as pre-terms and conditions of the research and publications office of Bahir Dar University.

Name of the student: -

Mequanent Getasew

Signature: _____date: _____

Approval of the advisor (s)

Advisors Name

1. Examiner

Signature: - _____ date: - _____

2. Endalkachew Worku (MPH/RH, ASSISTANT PROFESSOR)

Signature: - _____ date: - _____

3. Yibeltal Alemu (MPH/RH, ASSISTANT PROFESSOR)

Signature: - _____ date: - _____

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