ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
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PREDICTORS OF NEONATAL SEPSIS IN PUBLIC REFERRAL HOSPITALS OF EAST AND WEST GOJJAM ZONES OF AMHARA REGIONAL STATE, NORTH WEST ETHIOPIA: A CASE CONTROL STUDY

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This thesis by Tadesse Yirga is accepted in its present form by the board of examiners as satisfying thesis requirement for the degree of masters in pediatrics and child health Nursing.

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LIST OF ABRIVATIONS

ANC	Antenatal Care
APH	Antepartum Hemorrhage
APGAR	Activity, Pulse, Grimace, Appearance, Respiration
CBC	Complete Blood Count
CI	Confidence Interval
CRP	C-reactive Protein
DMRH	Debre Markos Referral Hospital
EDHS	Ethiopian Demographic and Health Survey
EONS	Early Onset Neonatal Sepsis
FHRH	Felege Hiwot Referral Hospital
LONS	Late Onset Neonatal Sepsis
MSAF	Meconium Stained Amniotic Fluid
NICU	Neonatal Intensive Care Unit
NMR	Neonatal Mortality Rate
NS	Neonatal Sepsis
OR	Odds Ratio
PIH	Pregnancy Induced Hypertension
PROM	Prolonged Rupture Of Membrane
PSBI	Possible Serious Sever Bacterial Infection
RR	Relative Risk
SVD	**S**pontaneous Vaginal Delivery
UTI	Urinary Tract Infection
YICSS	Young Infant Clinical Sign Study

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Introduction: Globally, neonatal sepsis is one of the most leading reasons for inflated death and illness of neonates. It is also one of the most common causes of neonatal death in Ethiopia. Identification of the determinants for neonatal sepsis and treatment of newborns with sepsis, is not adequate in low income countries. Despite few studies related to neonatal sepsis there are inconsistencies among findings. Identification of risk factors and early initiation of therapy can significantly reduce the burden of neonatal death and illness.

Objective: The main aim of this study was to assess predictors of neonatal sepsis in public referral hospitals of East and West Gojjam Zones in Amhara Region, North Ethiopia from March-April 2018.

Methods: Institutional based unmatched case-control study was conducted among a total sample size of 231 (77 cases and 154 controls) in Debre Markos referral hospital and Felege Hiwot referral hospital from March 2018- April 2018. Neonates diagnosed as sepsis were considered as cases and neonates diagnosed with other problem except sepsis were controls. Study participants were selected from NICUs in the two referral hospitals. For each case two consecutive controls were selected by lottery method. Data was collected using structured pretested questionnaire through face to face interview with index mothers and by neonatal record review using checklists. It was entered into Epi data version 3.1 and exported to STATA/ SE software version 14. Finally, it was analyzed by logistic regression model. Variables with ($p< 0.25$) in bivariate analysis, were entered to multivariable logistic regression. Statistical significance was declared at $P<0.05$.

Result: In this study**,** 77 cases and 154 controls with their mothers were included with the overall response rate of 100%. After multivariable logistic regression analysis, significantly associated variables with sepsis were; Number of maternal ANC service ≤ 3 (AOR=4.35, 95%CI=1.66-11.45), Duration of rupture of membrane $\geq$ 18hours (AOR=10.37, 95%CI= 2.31-46.52), meconium stained amniotic fluid (AOR =3.87, 95%CI=1.53-9.77), urinary tract infection during pregnancy (AOR=10.8, 95% CI=3.44-33.97), intranatal fever (AOR=3.19, 95% CI=1.07-9.47), first minute APGAR score <7 (AOR=3.17, 95% CI=1.30-7.71), resuscitation at birth (AOR= 5.35, 95% CI= 1.86-15.45), nasogastric tube (NGT) insertion (AOR=3.73, 95% CI=1.37-10.16).

Conclusion: In this study, neonatal invasive procedures, neonatal and maternal variables were found to be significantly associated with the risk of neonatal sepsis. Therefore, Professionals should adapt risk based early recognition systems and implement standardized emergency treatments. Potential researchers on sepsis should include neonates in the community which may increase external a validity of the study.

Key words: East and West Gojjam, case control, neonate, sepsis,

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 [1-3]. It comprises abundant systemic infections of the neonate like septicemia, meningitis, pneumonia, arthritis, Urinary tract infection but, it does not embrace muco-cutaneous infections like conjunctivitis and oral thrush [2]. Neonatal infections in healthcare facilities are still a reason for inflated death and illness in NICUs [2].

Neonatal sepsis is categorized as early onset neonatal sepsis (EONS) and late onset neonatal sepsis (LONS) based on the onset of clinical features [4]. EONS is sepsis occurring within seven days of life after birth and LONS is sepsis from after seventh day of life[5]. Guidelines for the treatment of neonatal sepsis have been formulated and its implementation along with timely initiation of better treatments would satisfactorily reduce morbidity and mortality of neonates by sepsis [5].

The manifestations of neonatal sepsis are nonspecific and vary among neonates [6]. World health organization (WHO) has recognized seven clinical indicators [difficulty feeding, convulsions, movement only while stimulated /lethargy, respiratory rate of $\geq$60 breaths in a minute, chest in drawing, or axillary temperature of $\geq$37.5 °C or $\leq$35.5 °C and respiratory distress][7]. Another study has additionally incorporated cyanosis and grunting[8].

Among the predictors for neonatal sepsis, an immature immune system, reduced phagocytic activity of white blood cells, inadequate production of cytokines and weak humoral immune system[9]. As documented in different literatures, neonatal sepsis is caused by factors related to both maternal and neonatal factors [10-12]. Delivery by caesarian section, male sex and prematurity have been showed as risk factors of neonatal sepsis [12, 13]. Maternal factors such as prolonged rupture of membrane, urinary tract infection, intra-partum fever, instrumental delivery and place delivery are significant predictors of neonatal sepsis [11, 14].

Studies revealed that, use of endotracheal intubation, resuscitation at birth, surgery are significant predictors [12, 15, 16]. Neonates born from women with meconium stained amniotic fluid, more than three times digital per vaginal examination and never attend antenatal care (ANC) are at higher risk for neonatal sepsis [17-19]. Neonates born from women with age less than 20 years old are at higher risk for sepsis[20].

Although the gold standard for the diagnosis of NS is identification of the pathogen in blood culture, it takes a minimum of one to two days to report and has low sensitivity. Thus, NS will not be excluded despite blood culture is negative [21, 22]. Auxiliary laboratory tests have limited value and are difficult to interpret due to low sensitivity and changing normal ranges in neonatal age group[22]. As a result, identification of the risk factors for risk based diagnosis of neonatal sepsis may contribute in better interventions and studies that help to reduce the burden of neonatal mortality resulting from these risks**.**

1.2. Statement of the problem

Globally, sepsis in neonates is still among the leading causes of neonatal mortality and morbidity, especially in the first one week of life in low and middle-income countries (LMIC) [23, 24]. An estimated 6·9 million newborns reported to have a possible serious bacterial infection (PSBI) every year in sub-Saharan Africa, south Asia, and Latin America [23]. In 2015, from 5.941 million Global deaths in under-five years old children, 45% of them died in the neonatal period. The death is greater than 50 % in lots of regions including Tanzania, Uganda, Congo and India [24]. Near one-third of these, (640,000) is due to neonatal sepsis [25]. It is the 3rd (following preterm birth complications (35 %), intra-partum related complications (24 %), and neonatal sepsis (15 %)) most major cause of neonatal death with 0.401 million deaths in 2015 [24, 26, 27].

About four million worldwide deaths in neonates per year, from this 98 % is from developing countries particularly in sub-Saharan Africa[28]. The risk of neonatal death is estimated to be six times more in the low and middle income countries compared to developed [29].Timely diagnosis is challenging due to its nonspecific clinical features. Besides, treating neonates with antibiotics merely by subtle manifestations is likely to over treat non infected neonates [30]. The ideal approach will be identifying high risk neonates and targeting them for intensive therapy[28].

In sub Saharan Africa, seventeen percent among all neonatal death results from neonatal sepsis as compared to only six percent in developed countries. To increase the survival of neonates, efforts should be targeted to decrease neonatal sepsis particularly in sub-Saharan Africa and South Asia[31, 32]. NS is also one of the most common cause of neonatal death in Ethiopia, which is estimated for more than one-third of neonatal deaths [31]. A recent population based study in rural part of Ethiopia showed that, sepsis as the first which results in neonatal death[14].

According to 2016 Ethiopian Demographic health survey (EDHS) report, the neonatal mortality rate (NMR) is 29/1000 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 [33, 34]. To achieve sustainable development goal (SDG) reducing newborn and under five mortality as low as12/1000 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 [35]. In a number of developing countries, identification of predictors for neonatal sepsis and treatment of neonates with sepsis is not satisfactory. Moreover, reports from low income countries revealed inconsistencies in the incidence, 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 [31].

Despite the presence of few studies regarding risk factors and etiology of neonatal sepsis, there are some contradicting or inconsistent findings on some predictors for neonatal sepsis, like prematurity, low birth weight and residence. Besides some factors specifically neonatal invasive procedures were not incorporated [11, 12, 36]. A study in Ethiopia showed that, prematurity, low birth weight and residence were not predictors of NS [11]. On the contrary a study in Mexico showed, all the three variables as significant predictors for NS [12]. Even though there are some other studies that focus on neonatal sepsis in Ethiopia, they only focused on prevalence and treatment out come and they were cross sectional in their design which is not the recommended for causal inference. Most of them were limited to one institution only. As far as literature searching showed, there is no study conducted in Amhara region regarding predictors of neonatal sepsis. Therefore, this study was aimed to assess predictors of neonatal sepsis in neonatal intensive care unit of the two public referral hospitals of East and West Gojjam, Amhara Region.

1.3. Significance of the study

The main purpose of this study was identification of determinants of neonatal sepsis that helps to reduce the burden of neonatal mortality by sepsis**.** Findings from this study will help neonatal care providers through risk based diagnosis of neonatal sepsis which is one of the common difficulties for treatment of neonatal sepsis with true diagnosis.

This study will also provide an input to program planners and decision makers at various aspects of neonatal care and support programs. In addition, it helps health professionals for earlier screening and treatment, by giving health education to mothers before and after delivery and create awareness to the community about different risk factors. It will also have a valuable input for the development of the profession particularly for risk based care of newborns and young infants. Besides, it will serve as a baseline data for further research.

2. Literature review

2.1. Introduction

Different kinds of literatures which were directly or indirectly related to neonatal sepsis were reviewed systematically and carefully from national to international level. For the literature searching different search engines like PubMed, Cochrane library, Google scholar, Hinari, BMC 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 and bacteremia). Indicators of target age group (neonates, infant, and newborn) were used. 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 and neonatal factors related to neonatal sepsis. All used literatures have been cited.

2.2. Overview of prevalence and incidence of neonatal sepsis

According to a study in Nepal, the prevalence of neonatal sepsis in NICU was (37.12%). Of which, EONS accounts the highest proportion with the prevalence rate of (91.39%) much higher than LONS (8.60%). Sepsis was the most cause of death in neonates (62%) followed by the neonates born from CRP positive mothers (21.33%)[37]. A study in USA, the prevalence of neonatal colonization among neonates of infected women ranged from 30.9-45.5% based on the pathogen. The prevalence of neonatal lab-confirmed sepsis among neonates of women with determinant factors (PROM, maternal infection) was 2.9-19.2% based on the determinant factors [38].According to a study in Egypt, the incidence of neonatal sepsis among neonates admitted to NICU was 45.9%, of which EONS accounts 44.2% and LONS accounts 55.8% . The NMR by sepsis was 51% and 42.9% for EONS and LONS respectively [39]. According to a recent study in African countries, mortality by sepsis in NICU, was 34% [40]. Many literatures revealed that the incidence and prevalence of sepsis is more common in male neonates than females [9, 11, 41-44].

2.3. Socio-demographic characteristics associated with neonatal sepsis

According to a study in Nepal, male babies showed odd of 2.91 higher chance of developing sepsis than females, and maternal illiteracy was associated with the likelihood of developing neonatal sepsis despite do not statistically significant[9].Another study in Nepal, neonates with female sex were more likely to develop neonatal sepsis, although it is not statistically significant [37].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 >20years[20]. The result of a similar study revealed that birth weight and male sex were significant predictors of LONS (P< 0.05) [45].

According to a study in Ghana, sex of the neonate was significantly associated with the risk of neonatal sepsis. Specifically males were 1.806 times more likely to suffer from neonatal sepsis compared to females (OR =1.806, p = 0.040). Maternal age was a significant factor (p = 0.017). Particularly, women aged 21-30 years were more likely to have neonates with neonatal sepsis compared to women less than 20 year old (OR = 1.052). Women aged 31-40 years were 61% less likely to have neonates with sepsis compared to those aged less than 20 years (OR = 0.390).Women aged over 40 years were 52% less likely to have neonates with sepsis compared to those aged less than 20 years old (OR = 0.480) [46]. Based on study in India, male sex was associated with a significantly increased risk of PSBI (RR = 1.20, 95 % CI 1.10–1.31)[13]. Another study in Israel, there was statistical association on maternal age(p=0.012),which was noted to have statistically significant for neonatal sepsis[47].

2.4. Maternal factors associated with neonatal sepsis

According to a study in Mexico; neonates born from women with meconium - stained amniotic fluid (MSAF) [RR=1.5, 95 % CI =1.1-1.9] were more likely to have sepsis 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 compared to those delivered from women without PROM [12]. Based on a study in Debrezeit Ethiopia: Neonates born in health center (OR=4.2, CI= 1.934-9.333) were 4.2 times more likely to develop sepsis compared to the neonates born in home. The risk of acquiring sepsis in neonates born using an instrument (OR=6.3, CI-1.252-31.768) was 6.3 times more likely to develop sepsis compared to neonates delivered through spontaneous vaginal route. Neonates born from women with UTI (OR=2.9, CI=1.489-5.527) were 2.9 times more likely to had sepsis compared to neonates delivered from women without UTI [48]. A similar study revealed that, neonates from women with PROM (p=0.001) were more risk than without[42].

A study in Ethiopia, history of UTI during the index pregnancy also showed a statistical significant association with neonatal sepsis. This study revealed that, neonates born from mothers who had UTI during the index pregnancy had 5 times higher odds of developing sepsis compared to those neonates born to mothers who did not have a UTI during the index pregnancy [AOR = 5.23; 95% CI (1.82, 15.04)][11]. Neonates delivered from women with PROM and intra-partum fever had significant association with risk of neonatal sepsis. The odds of neonatal sepsis among mothers with PROM was

7.4 times higher than those mothers who gave birth before 18 hours of rupture of membrane [AOR = 7.43; 95% CI (2.04, 27.71)]. Similarly, neonates born from mothers who had fever during labor had 6 times higher odds of developing sepsis compared to those neonates whose mothers did not have intrapartum fever[AOR = 6. 08; 95% CI (1.29, 28.31)][11].

According to a study in USA, neonates delivered from women with PROM and premature delivered (95% CI = 1.01–5.4) were 2.3 times higher odds of having neonatal sepsis than newborns of mothers without PROM [49].According to a study in Ghana, Parity of the mothers was significantly associated with the risk of neonatal sepsis. Particularly primigravida were 3.436 times more likely to have neonates with sepsis compared to multiparous women (OR =3.436, 95%CI;1.784-6.884) [46].

Meconium-Stained Amniotic Fluid (MSAF) was significantly associated with the risk of neonatal sepsis. Particularly neonates delivered from women who had MSAF were 3.625 times more likely to suffer from neonatal sepsis compared to those who born from women without MSAF (OR= 3.625,95% CI:1.730-8.103) [46]. Neonates born from women with foul smelling liquor were 13.401 times likely to have sepsis compared to controls (OR =13.599, 95%CI; 2.606-5.655). This variable had the largest effect on the likelihood of infants suffering from neonatal sepsis. Neonates born from women with UTI were 3.993 times more likely to develop sepsis compared to controls (OR= 3.007,95%CI; 1.477-6.425)[46]. According to a study In South Africa, meconium-stained amniotic fluid (MSAF) (RR = 2.8, 95% CI: 2.2–3.7) was associated with sepsis[18].

Another study in Uganda: the odds of sick newborns whose mothers had no ANC follow up were 3.21 times more likely to have sepsis compared to control (OR = 3.21; 95 % CI 1.24–8.33)[17]. A similar study in India: more than three per vaginal examinations after rupturing of membrane (AOR = 8.57, CI=3.10–23.6) was 8.57 times more likely to develop neonatal sepsis. Neonates delivered from women with intra-partum fever (OR = 3.54 95%= CI 1.30–9.67) were 3.54 times more likely to have sepsis compared to those without fever and neonates born from women with UTI (OR=2.88, 95%=CI 1.08–7.63) were 2.88 times more likely to have sepsis compared to without UTI. Neonates born from women with MSAF [OR= 2.52 (95% 1.18–5.37)] were 2.52 times more likely to have sepsis compared to those delivered from women without MSAF [19].

According to a study in Nepal: the maternal factors having a significant risk for the development of sepsis were PROM, MSAF and foul smelling liquor. The risk of sepsis in neonates delivered from women with PROM and MSAF were about 2 times higher as compared to those delivered from women without. Maternal illiteracy, primigravida mothers, PIH/Eclampsia and APH in mother had no statistically significant association [9]. Another study in Nepal neonates delivered via cesarean section (OR =1.95, 95% =CI 1.15-3.31) were 1.95 times more likely to had sepsis compared to neonates

delivered from women with SVD, neonates delivered from women with fever during delivery (OR =1.02, 95%=CI 0.48-2.34) , multi-parity (OR= 1.33, 95% CI 0.82-2.16),and PROM > 18 hours (OR= 1.55, 95% CI 0.29-8.11) were more likely to develop neonatal sepsis, despite none of these were statistically significant[37].

According to another similar study, neonates delivered from women with meconium stained amniotic fluid (OR =2.535, 95%CI 1.225-5.245) were 2.535 times more likely to develop sepsis compared to neonates born from women without MSAF and neonates delivered by caesarian section (OR = 1.895, 95% CI =1.087-3.303) were 1.895 times more likely to develop sepsis compared to those with spontaneous vaginal delivery [50].Another study in China, neonates born from maternal age >35(OR=4.835, p=0.029) were 4.835 times more likely to have sepsis compared to neonates delivered from women <35 years old, neonates delivered by cesarean section (OR=0.103, p=0.000) were about 90% less likely to had neonatal sepsis compared to SVD. Neonates born from women with PROM (OR=0.207,p=0.001) were about 80% less likely to had sepsis compared to without [51].

Based on study in India parity was associated significantly increased risk of PSBI: neonates born from women with null parity (RR= 1.13, 95 % =CI 1.03–1.23) were 1.13 times at risk to have sepsis compared to para one, neonates born from women with multi-parity (RR= 1.30, 95 % CI= 1.07–1.57) were 1.3 times at risk to develop sepsis compared to para one, neonates born from women with no ANC (RR= 3.21, 95 % CI =1.66–6.20) were 3.21 at high risk compared to neonates born from women who had ANC follow up and delivery through cesarean section was associated with a lower risk of PSBI (RR= 0.48, 95 % CI= 0.36–0.63)despite not statistically significant[13]. A study in Pakistan, neonates from women with fever (p = <0.001; AOR, 36.6) were 36 times more likely for sepsis than without fever, PROM > 18 hours. (p < 0.001; AOR, 8.2), neonatal prematurity (p < 0.001; AOR, 4.1) and low birth weight < 1,500 grams (p 0.001; AOR, 9.8) were found to be independent risk factors significantly associated with culture-proven sepsis[52].

Global systemic review in USA: Neonates delivered from women with PROM had a 2.2 (95% CI =0.6–7.4) times greater odds of developing neonatal sepsis compared to neonates delivered from women without PROM, which was not statistically significant [49]. According to a study in Israel, there were a significant association among neonates born from women with PROM >18hours (p=0.039) [47].Another study neonates born from women with PROM> 18 hours before delivery were 25.8 times more likely to had sepsis compared to without PROM and neonates born from women with intra-partum fever were ten times more likely for sepsis compared to without fever [53].

2.5. Neonatal factors associated with neonatal sepsis

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[10].

According to another study neonates delivered with low birth weight<2500gm (OR= 2.75, 95% CI 1.454-5.200) were 2.75 times more likely to develop sepsis compared to neonates with birth weight >2500gms, premature neonates (OR= 4.073, 95% CI=2.180-7.609) were about 4 time more likely to had sepsis compared to term neonates [50].Another study in Mexico, neonates with premature delivery (<37 wks.) [RR=2.4, 95 % CI =1.7-3.4] were 2.4 times more likely to develop sepsis compared to term neonates; and neonates who needed resuscitation [RR=1.7, 95 % CI =1.1-2.5] were about 1.7 times more likely to have sepsis compared to neonates who did not need resuscitation [12]. Another study shows that, PROM >18hours AOD=3.41 (2.23–5.20) and intra-partum fever were AOR=2.38 (2.05–2.77) were statistically significant predictors of neonatal sepsis [54].

According to a study In South Africa, neonates delivered prematurely[AOR = 2.6; 95% CI: (1.4–4.8)] were 2.6 times high risk to have sepsis compared to mature neonates; neonates with low birth weight(<1500 g: [AOR= 6.5, 95%, CI =2.4–17.3)] were 6.5 more likely to had sepsis compared to neonates with weight ≥2500grams,neonates delivered with weight1500-2500grams (AOR=1.8,95%CI= (1.1–2.9; and neonates with first birth order [AOR= 1.8; 95% CI= (1.4–2.3)] were 1.8 high risk to had sepsis [18].

A study in Pakistan, neonates with prematurity < 34 weeks (p< 0.001; AOR, 4.1) and low birth weight (p 0.001; AOR, 9.8) were found to be independent risk factors which are significantly associated with culture-proven sepsis[52].

A study in Ghana, gestational age of the neonates was significantly associated with neonatal sepsis. Particularly, neonates aged 37 – 42 weeks were 5.235 times more likely to suffer from neonatal sepsis compared with those who were below 37 weeks gestation (OR= 5.765, p=0.000).Neonates above 42 weeks were 2.757 times more likely to suffer from neonatal sepsis compared to the preterm neonates aged < 37 weeks (OR =2.243, p=0.00)[46]. Neonates with APGAR scores < 7 were 5.802 times more likely to suffer from neonatal sepsis compared to those ≥7 (OR 5.198, p = 0.000). Neonates who weighed < 2.5kg were 6.823 times more likely to suffer from neonatal sepsis. Compared with those ≥ 2.5kgs (OR 6.177, p=0.00)[46].

Based on study in India, neonates with low birth weight (RR 3.10,95 % CI= 2.17–4.42) were 3.1 high likelihood of developing neonatal sepsis compared to those neonates with normal birth weight [13]. Another study in Tanzania, neonates who were resuscitation at birth (AOR=1.251 95%CI= 22-3.88) were 1.251 times more likely to develop sepsis compared to neonates who did not resuscitated at birth[20]. A study in Mexico; neonates born being premature (≤37 weeks) (RR=2.4, 95 % CI =1.7-3.4) were 2.4 times high risk for sepsis compared to mature neonates, neonates who require assisted ventilation (RR=1.7, 95 % CI =1.1-2.5)were 1.7 times high risk for sepsis than those neonates who did not need assisted ventilation, neonates with any invasive medical procedure required (RR=3.01, CI= 2.13-4.26) were three times high risk for sepsis compared to neonates without invasive procedures and neonates with any type of surgical procedure (RR=9.6, 95 % CI =3.3-27.7) were 9.6 times high risk sepsis compared to those without[12].

Immediate cry after birth was significantly associated with the risk of neonatal sepsis specifically infants who cried immediately following birth were 92 % less likely to suffer from neonatal sepsis compared to those who did not cry immediately (OR 0.081, p = 0.001).Resuscitation at birth was significantly associated with the likelihood of neonatal sepsis. Infants who were resuscitated at birth were 5.274 times more likely to suffer from neonatal sepsis compared to those who were not resuscitated (OR 5.274, p = 0.004)[46].

According to a study in Ethiopia, place of delivery showed significant association with the risk of onset of neonatal sepsis. The odds of having neonates with sepsis among mothers who gave birth at health center was 5.7 times higher compared to those who gave birth in hospitals [AOR = 5. 70; 95% CI (1.71, 19.00)][11]. Neonates who had APGAR score<7 at 5th minute had higher odds of developing sepsis compared to neonates who had APGAR score <7 [AOR = 68. 9; 95% CI (3.63, 1307.90]. Similarly, neonates who cried immediately at birth were 99% less likely to develop sepsis as compared to neonates who did not cry immediately [AOR = 0. 01; 95% CI (0.00, 0.16)][11].

Another study in Nepal, low birth weight and prematurity carried 4.85 times each risk for development of sepsis and were highly significant. Similarly for 1 minute Apgar score where a low Apgar score (<7) carried 5.7 times risk for the development of sepsis[9]. Similarly a study in this country, neonates with APGAR < 7 at 5 minute of birth (P=0.00) were more likely to develop neonatal sepsis compared to APGAR score ≥7 [37].According to a study in Israel, there was no statistically significant differences were noted between gestational age (p=0.091), 5 min APGAR score (p=0.071) at delivery for neonatal sepsis. But birth weight (p=0.023) found as independent risk factors for neonatal sepsis [47]. Another study in Turkey, neonates with 5 minute APGAR score <7 (OR= 1.42, CI=1.03 - 1.96) were 1.42 times more likely to had sepsis compared to those with ≥7, neonates with invasive procedures (nasogastric or

orogastric tube insertion, umbilical catheterization) and surgical procedures were associated with neonatal sepsis despite not statistically significant[44].

According to a study in Indonesia, Apgar score (AOR= 14.05, 95% CI= 5.45-35.98) neonates with Apgar score <7 in the first minute had14.05 times greatest risk of sepsis compared to ≥7. On gestation (AOR =13.45, 95% CI =3.91-46.26) neonates with gestational age <37 weeks had 13.45 times more likely to develop sepsis compared to neonates with gestation age ≥37 weeks. While birth weight (AOR= 4.9, 95% CI =1.08-22.25) neonates with birth weight <1500 gram has 4.9 times greatest risk of sepsis compared to ≥1500 gram [55].According to a study in Vietnam, neonates with umbilical catheter (AOR=5.3,95, CI=2.5-11.3) were five times more likely to had sepsis compared to without [56]. Another study in Taiwan, neonates with history of nasogastric and endotracheal intubation were more likely to develop sepsis despite not statistically significant [57].

2.6. Conceptual framework

This conceptual framework was developed after systematic and careful review of different literatures which are related to neonatal sepsis. It shows the possible relation of neonatal sepsis with different independent variables and it was developed based on evidences found from findings of literatures. There was a stated association on neonatal sepsis with maternal factors, socio-demographic characteristics and neonatal factors.

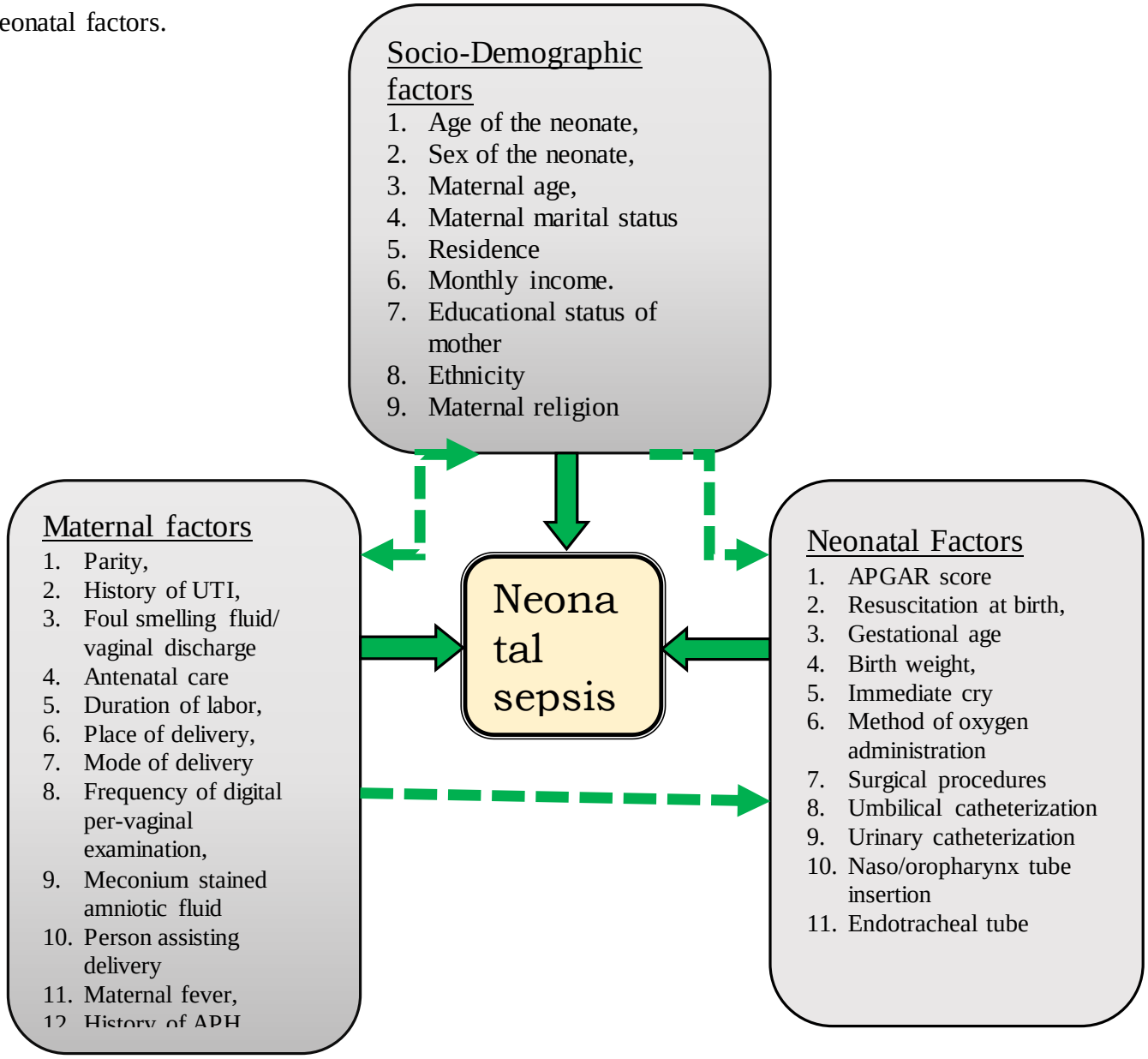

Figure 1: Conceptual framework adapted based on literatures by principal investigator [10-12, 46, 48, 55].

3. Objectives

3.1. General objective

The main aim of this study was to assess predictors of neonatal sepsis among neonates admitted in neonatal intensive care units in public referral hospitals of East and West Gojjam, Amhara Regional state, North West Ethiopia, 2018.

3.2. Specific objectives

1. To identify socio-demographic factors associated with neonatal sepsis in neonatal intensive care unit of public referral hospitals of East and West Gojjam, Amhara Region, 2018.
2. To determine maternal related factors associated with neonatal sepsis in neonatal intensive care unit of public referral hospitals of East and West Gojjam, Amhara Region, 2018.
3. To determine neonatal related factors associated with neonatal sepsis in neonatal intensive care unit of public referral hospitals of East and West Gojjam, Amhara Region, 2018.

4. Methods and materials

4.1. Study area and period

The study was conducted in the two referral Hospitals of East and West Gojjam zones, Amhara Region, Ethiopia, from March 2018- April 2018. FHRH found in Bahir Dar, the town of Amhara regional state, whereas DMRH found in Debre Markos, the town of East Gojjam Administrative Zone. DMRH and FHRH are found in Northern direction 299 Kilometers and 565 Kilometer far from Addis Ababa (capital City of Ethiopia) respectively. According to information obtained from administrative offices of these hospitals, they provide different services in outpatient department, inpatient department and operation room theatre department. DMRH and FHRH serve for more than 3.5 million and 5 million population in their catchment area respectively. FHRH had six physicians and 20 nurses and 30 beds in NICU with total annual neonatal admission of more than 3500 of which more than 800 was by sepsis[58]. DMRH had 20 beds with annual admission of above1400 neonates of which, more than 400 neonates were by neonatal sepsis. There were three physicians and 21 nurses in NICU[59].

4.2. Study design

Institutional based unmatched case control study was conducted among neonates admitted in NICU.

4.3. Population

4.3.1. Source population

The source population was all neonates who were delivered including all neonates who got service in the two public referral hospitals of the two zones.

4.3.2. Study population

The study population was all neonates fulfill the inclusion criteria who were admitted to the two public referral hospitals.

Cases: presence of one of the seven clinical signs and ≥2 hematologic criteria**.** Neonates with clinical signs of possible serious bacterial infection (PSBI), according to the Young Infants Clinical Signs Clinical Study(YICSS) criteria of WHO's Integrated Management of Neonatal and Childhood Illness (IMNCI) guidelines, are defined as the presence of any one of a history of [difficulty feeding, history of convulsions, movement only when stimulated, respiratory rate of 60 or more breaths per min, severe chest retractions, or a temperature of 37.5 °C or higher or 35.5 °C or lower and change in level of activity][7]. Cyanosis and grunting have been included by another study[8]. Presence of any one of

seven clinical signs and symptoms predict severe illness (based on an expert pediatrician's assessment) and was associated with a sensitivity and specificity of 85% and 75 % respectively in 0–6 day old neonates and 74 and 79 % respectively in infants aged 7–59 days[7].including others like bradycardia, tachycardia, irritability, oxygen requirement, increased frequency of apnea, poor capillary refill, along with ≥2 of the hematological criteria; total leukocyte count (<5000 or>12000 cells/µl, absolute neutrophil count (<1500 cells/ µl or>7500 Cells/µl), erythrocyte sedimentation rate (ESR) (>15/1 h) and platelet count (<150 $x10^3$ or>450 $x10^3$ cells/ µl), elevated CRP > 1 mg/dl(>15mg/L), Glucose intolerance confirmed at least 2 times: hyperglycemia (blood glucose >180 mg/dL) OR hypoglycemia (glycaemia < 45 mg/dl) when receiving age specific normal range glucose amounts [7]. And who were admitted to NICUs of the two public referral hospitals.

Controls: neonates who were not diagnosed as neonatal sepsis (do not fulfill sepsis criteria) and admitted with other health problems in the two referral hospitals. Cases and controls were identified through record review after physician diagnosis and using prepared clinical sign checklists for the neonate during the study period in NICU. The diagnosis includes history taking, clinical manifestations (objective findings), and laboratory tests.

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria for cases

All neonates (≤28 days) who were admitted with their mothers in the two public referral hospitals with clinical sign and symptoms of sepsis at the time of data collection, being diagnosed with sepsis by the attending physician and fulfill sepsis criteria.

4.4.2. Inclusion criteria for controls

Neonates admitted to NICU who were not diagnosed with sepsis and do not fulfill sepsis criteria, congenital anomalies, LBW, prematurity, failure to start/sustain breast feed and neonates with birth trauma admitted in the two public referral hospitals were included as control.

4.4.3. Exclusion criteria for cases

Neonates with early discharge, neonates with incomplete chart, neonates passed-away on arrival, neonates admitted without their mothers and neonates who were diagnosed with sepsis by the attending physician and not fulfill sepsis criteria (case definition of sepsis) were not included in the study.

4.4.4. Exclusion criteria for controls

Neonates with early discharge, neonates with incomplete chart, neonates passed-away on arrival, neonates admitted without their mothers and neonates who were diagnosed with sepsis by the attending physician and not fulfill sepsis criteria (case definition of sepsis) were not included in the study.

4.5. Sample size determination and procedure

4.5.1. Sample size determination

The sample size was determined using double population proportion exposure difference formula by using major determinant variables (place of delivery, maternal UTI, intra-partum fever, women with PROM and 5 minute APGAR score <7) from another study[11]. Considering place of delivery (at health center comparing to those who gave birth in hospitals) as independent predictor exposure variable since, it gave the maximum sample size which reduces the role chance (**Table-1**). From that study, proportion of women among controls with health center delivery was 8.3% and the proportion of women among cases with health center delivery was 26.9%[11]. Using Epi-Info version7, one to two ratio of case to control (1:2) was assumed. Finally, by using 95% level of confidence, with a power of 90% and adding 10% non-response rate, the total sample size was 231 with 77 cases and 154 controls.

$$n = \frac{(r+1)}{r} \frac{(\bar{p})(1-\bar{p})(Z_{\beta} + Z_{\alpha/2})^2}{(P_1 - P_2)^2}$$

Table 1 : Sample size calculation to assess predictors of neonatal sepsis among public referral hospitals in East and West Gojjam Zones, Amhara regional state, Ethiopia, 2018

Variables	Proportions	Sample size			After adding 10% non-response rate
		Cases	Controls	Total	
UTI	P_1=51.3 % P_2=13.5 %	26	52	78	86
Place of delivery	P_1=26.9 % P_2=8.3 %	70	140	210	231 (77 cases and 154 controls)
Intrapartum fever	P_1=28.2 % P_2=4.5 %	41	82	123	136
APGAR score5th min<7	P_1=21.8 % P_2=1.9 %	45	89	134	148
PROM	P_1=30.5 % P_2=3.8 %	34	67	101	111

Where:-

1. n: Sample size in the case group

2. $(\bar{p})(1-\bar{p})$: A measure of variability
3. Z_{β}: the desired power (90% power)
4. $Z_{\alpha/2}$: the desired level of statistical significance (1.96)
5. $(p_1 - p_2)$: effect size (the difference in proportions)
6. P_1: is percent of cases with exposure variable (delivery at health center)
7. P_2: is percent of controls with exposure variable(delivery at health center)
8. And **r** is the ratio of cases to controls 1:2

Then the largest sample size (n=231) was selected as a final sample size for the study.

4.5.2. Sampling procedure

Cases were selected consecutively among those neonates admitted in the neonatal intensive care unit of the two referral public hospitals.

The next immediate two corresponding controls were selected by lottery method at the same day and in the same neonatal intensive care unit.

4.6. Variables of the study

4.6.1. Dependent variable

Neonatal sepsis

4.6.2. Independent variables

Socio-demographic variables

1. Age of the neonate,
2. Sex of the neonate,
3. Maternal age,
4. Residence
5. Monthly income.
6. Educational status of mother
7. Ethnicity

Maternal variables

1. Parity,
2. History of UTI,
3. Foul smelling amniotic fluid,
4. Meconium stained amniotic fluid
5. ANC,
6. Duration of rupture of membrane,
7. Person assisting the delivery
8. Place of delivery,
9. Frequency of PV examination,
10. Maternal fever,

11. Mode of delivery
12. History of APH,
13. PIH/Eclampsia

Neonatal variables

1. APGAR score,
2. Resuscitated,
3. Gestational age
4. Any surgical procedure
5. Birth weight,
6. Immediate cry
7. Method of oxygen administration
8. Umbilical catheterization
9. Urinary catheterization
10. Naso/oropharynx tube insertion
11. Endotracheal tube

4.7. Data collection procedures

4.7.1. Data collection instrument

A questionnaire was prepared by reviewing different literatures and other checklists which were related to risk factors of neonatal sepsis. Most questions were adopted from questionnaires used in other studies to investigate risk factors for neonatal sepsis [10, 11, 14]. Then the designed questionnaires were changed from English to Amharic and back to English to check the consistency of the questionnaire. Data were collected through record review (laboratory results:-CBC, CRP, ESR,) and a face to face interview of the index mothers using pretested structured and interviewer administered questionnaires by trained experienced health professionals. Rechecking on 5% of participants was made each day to confirm the reliability of the data collected. They were interviewed about their socio-demographic characteristics, maternal factors and neonatal factors by trained health personnel in each NICU in the two public referral hospitals.

4.7.2. Data collectors

Data were collected by four trained BSc nurses and they were supervised by one BSc nurse having previous experience in data collection. Continuous follow up and supervision was made by principal investigator throughout the data collection period from March 2018- April 2018.

4.8. Operational definitions and measurement of variables

Neonatal sepsis: neonates with presence of at least one clinical sign plus at least two laboratory results which are suggestive for neonatal sepsis (CRP,WBC,ANC,ESR, 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.

Meconium stained amniotic fluid (MSAF): will be considered if the amniotic fluid was green/brown in color or mixed with meconium, or appears meconium stained on the baby.

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

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

4.9. Data processing and analysis

Data were checked for completeness and consistencies and then it was cleaned, coded and entered using Epi data version 3.1 and it was exported to STATA software version 14 for analysis. Descriptive statistics was used to describe the study population in relation to relevant variables. Chi-square and odds ratio (OR) were used to assess the relationship between factors associated with the occurrence of neonatal sepsis. Then variables that had association in the bivariate model ($p<0.25$) were entered and analyzed by a multivariable logistic regression model to identify independent effect of different factors for occurrence of sepsis. Statistical significance was declared at $P<0.05$. Finally, the result was presented in the form of texts and tables.

4.10. Data quality management

Training was given for data collectors and supervisors for two days to familiarize with the questionnaires, the data collection procedures, the ethical consideration during data collection and the objective of the study before data collection. A pretest was conducted in 12 respondents (4 cases and 8 controls) before actual data collection to check consistency and any ambiguous of the language after changing the English version to Amharic version. Pretest was done in finote selam district hospital which is found in West Gojjam. Based on the pretest result some questions were modified. A clear

explanation about the purpose and objective of the study was provided for the respondents at the beginning of the interview. A close supervision was carried out by the principal investigator during data collection time. Data from each respondent were checked for its completeness, clarity, consistency and accuracy by the supervisor.

4.11. Ethical consideration

Ethical clearance was obtained from Addis Ababa University college of Health science school of nursing and midwifery ethical review board. Then officials at different levels in the hospitals were communicated through letters. The responsible bodies at neonatal intensive care unit were told about the purpose of the study and written informed consent was obtained from participants to confirm willingness. They were notified that they have the right to refuse or terminate at any point of the interview. Confidentiality of the information was secured throughout the study process.

4.12. Dissemination of the result

The result was disseminated for Addis Ababa University, college of Health science school of nursing and midwifery. The result was disseminated to West and East Gojjam Zonal Health Bureaus. After public defense and incorporation of comments, the result will also be disseminated through presentations on specific conferences and attempt will be made to publish the paper in reputable peer reviewed journal.

5. Results

5.1. Descriptive statistics results

5.1.1. Socio-demographic characteristics of the respondents

This study was intended to assess predictors of neonatal sepsis in public health facilities of East and West Gojjam, Ethiopia. A total of 231 neonates (77 cases and 154 controls) who were admitted in NICU with their mothers were included with the overall response rate of 100%. According to this study, the mean age of neonates was 8.04(S.D ±6.12) days and they were in the age group of 1-28 days. The mean age of mothers was 28.21 (S.D ±6.35) with the age group of 16-44 years. Most of the participants were from urban areas (63.6% cases and 61.0% controls) and more than half 45(58.4% cases were males and 74(51.9%) of controls were females. Most of the study participants were Orthodox Christian followers. Concerning marital status of mothers, 66(85.7%) of cases and 133(86.4%) controls were married. Regarding occupation of mothers, 40(51.9%) of cases and 77(50.0%) controls were housewives whereas 15(19.5%) of cases and 28(18.2%) of controls were civil servants. (**Table-2**).

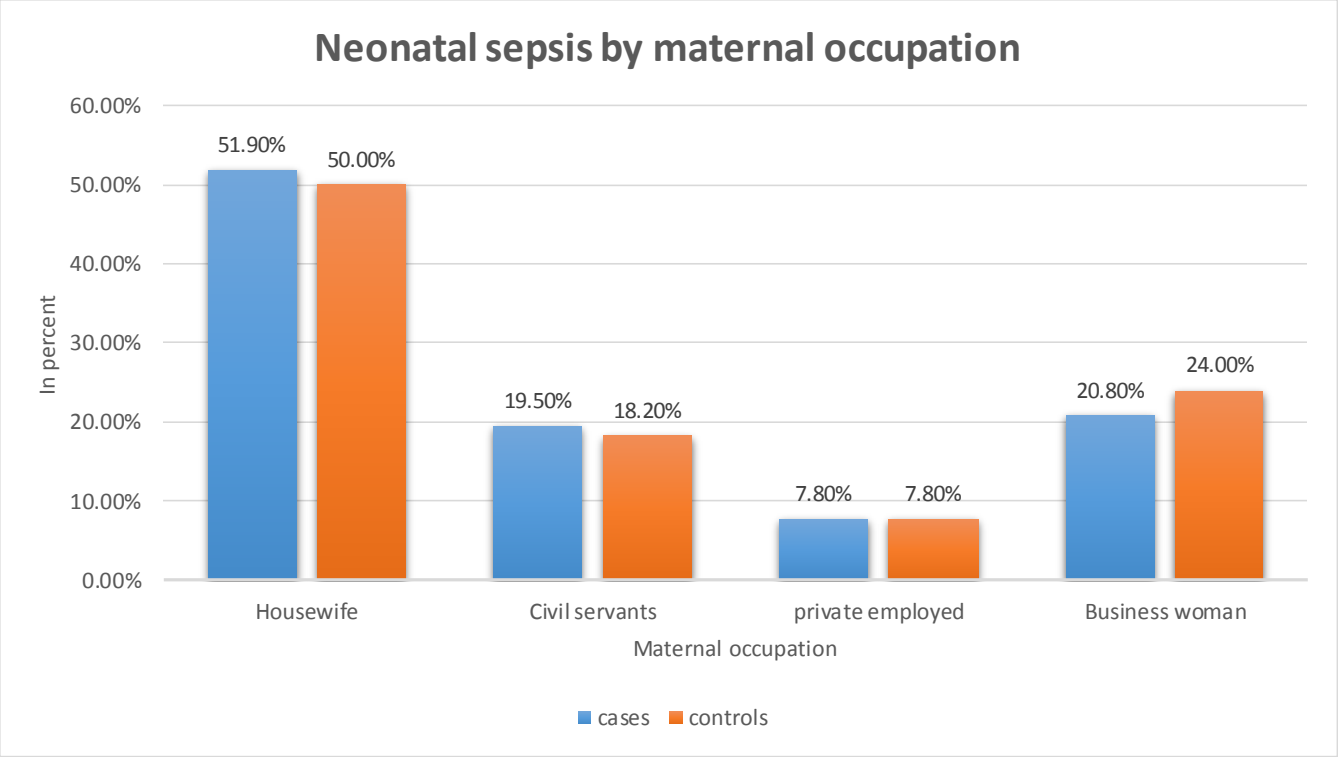

Figure 2: Maternal occupation for the study of predictors of neonatal sepsis in public referral hospital of East and West Gojjam Zones Amhara region, Ethiopia, 2018

Table 2: Socio demographic characteristics of neonates and their mothers for the study of determinants of neonatal sepsis in public referral hospitals of East and west Gojjam zones Amhara regional state, Ethiopia, 2018

Exposure Variables	Responses	Cases	Controls
		Count (%)	Count (%)
Marital status	Single	6(7.8)	14(9.1)
	Widow	5(6.5)	7(4.5)
	Married	66(85.7)	133(86.4)
Maternal religion	Orthodox	59(76.6)	103(66.9)
	Muslim	13(16.9)	42(27.3)
	Protestant	5(6.5)	9(5.8)
Maternal residence	Urban	49(63.6)	94(61.0)
	Rural	28(36.4)	60(39.0)
Maternal educational status	unable to read and write	24(31.2)	52(33.8)
	Primary	27(35.1)	39(25.3)
	Secondary	13(16.9)	36(23.4)
	college and higher	13(16.9)	27(17.5)
Neonatal sex	Male	45(58.4)	74(48.1)
	Female	32(41.6)	80(51.9)
Maternal age	≤20	15(19.5)	13(8.4)
	21-34	46(60.0)	110(71.4)
	≥35	16(20.8)	31(20.1)
Neonatal age	<7	33(43.9)	98(63.6)
	7-28	44(57.1)	56(36.4)

5.1.2. Descriptive statistics of maternal factors for neonatal sepsis

This study revealed that, most of mothers 57(74.0%) of cases and 133(86.4%) of controls had ever got ANC service whereas 20(26.0%) of cases and 21(13.6%) of controls had never got ANC service during their pregnancy of the current neonate. The proportion of women who got ANC service less than three times is higher in cases 23(40.4%) than controls 25(18.8%) similarly the proportion of women with duration of labor after rupture of membrane >18hrs is higher in cases 20(26.0%) than controls 3(1.9%). More than half of women had given birth at hospital 4(57.1%) of cases and 83(53.9%) of controls. The proportion of women who had intrapartum fever was three times higher in cases 33(42.9%) than controls 22(14.3%). Regarding mode of delivery, more than half 102(66.2%) controls and 41(53.2%) of cases had spontaneous vaginal delivery. Women who had meconium stained amniotic fluid, were more 43(55.8%) in the cases than controls 35(22.7%).The proportion of women who had pregnancy induced hypertension was higher in cases 15(19.5%) compared to controls 16(10.4%).Similarly women with history of urinary tract infection (UTI) during their pregnancy was eight times higher among cases 29(37.7%) than controls 7(4.5%) (**Table-3**).

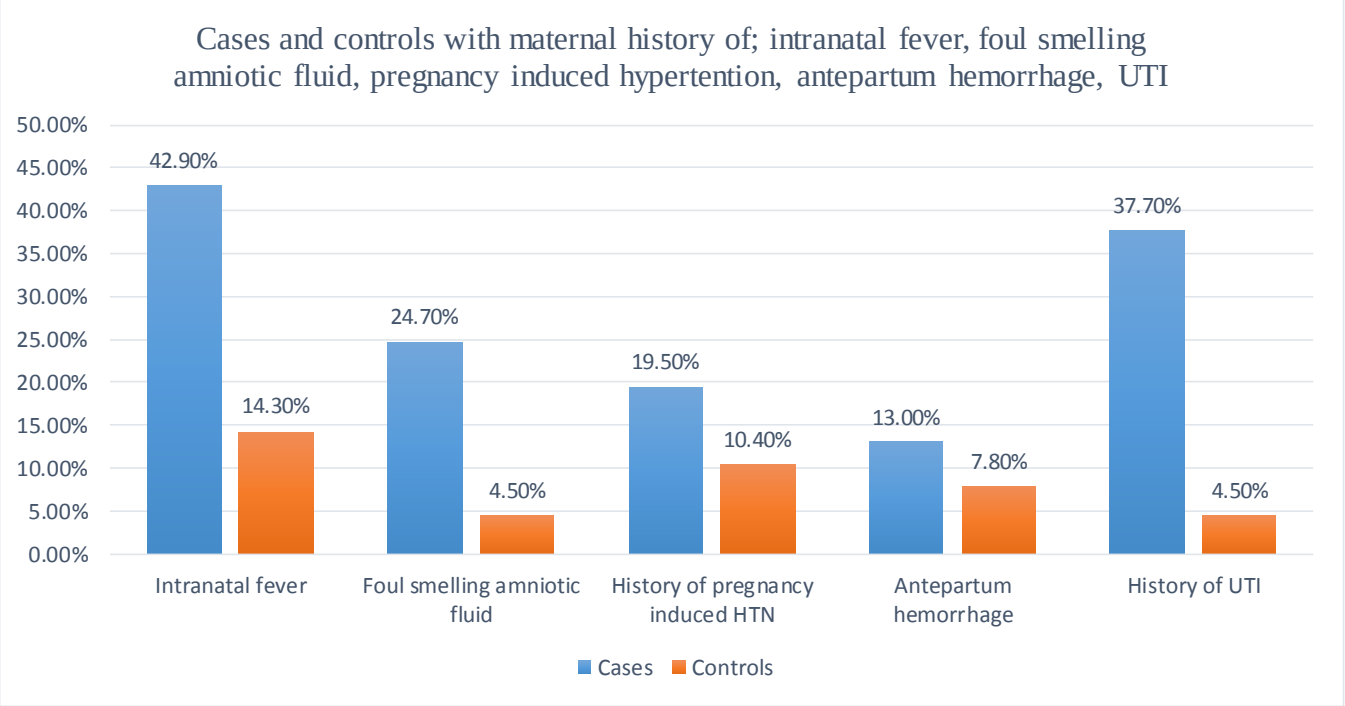

Figure 3: The distribution of mothers with intranatal fever, Foul smelling amniotic fluid, pregnancy induced hypertension, antepartum hemorrhage, UTI, among cases and controls for the study of determinants of neonatal sepsis in public referral hospitals of East Zones 2018

Table 3: Description maternal characteristics for the study of determinants of neonatal sepsis in public referral hospitals of East and west Gojjam zones Amhara, Ethiopia, 2018

Exposure Variables	Responses	Cases	Controls
		Count (%)	Count (%)
Maternal parity	Nullipara	26(33.8)	37(24.0)
	Paraone	30(39.0)	54(35.1)
	Multipara	21(27.3)	63(40.9)
Maternal ANC follow up	Yes	57(74.0)	133(86.4)
	No	20(26.0)	21(13.6)
Number of ANC services	≤3	23(40.4)	25(18.8)
	>3	34(59.6)	108(81.2)
Place of birth	Home	6(7.8)	9(5.8)
	Hospital	44(57.1)	83(53.9)
	Health center	27(35.1)	62(40.3)
Mode of delivery	Cs	20(26.0)	10(6.5)
	Instrumental	16(20.8)	42(27.3)
	SVD	41(53.2)	102(66.2)
Who attends delivery	TBA	7(9.1)	9(5.8)
	Health professional	70(90.9)	145(94.2)
Duration of labor after rupture of Membrane	<12 hrs	25(32.5)	121(78.6)
	12-18hrs	30(39.0)	28(18.2)
	>18hrs	22(28.6)	5(3.2)
Meconium stained amniotic fluid	Yes	43(55.8)	35(22.7)
	No	34(44.2)	119(77.3)
Number of pervaginal examination	≤3	21(27.3)	88(57.5)
	>3	56(72.7)	65(42.5)

5.1.3. Descriptive statistics of neonatal factors for neonatal sepsis

In this study more than half of 42(54.5%) cases and nearly three fourth of controls 110(71.4%) were in the gestational age group of 37-42 completed weeks whereas the proportion of neonates with gestational age <32 completed weeks was higher in cases 8(10.4%) than controls 6(3.9%).Similarly the proportion of neonates with first and fifth minute APGAR score <7 was 45(60.0%) and 24(32.0%) in cases respectively which was higher than controls 23(15.9%), 6(4.1%) in first and fifth minute respectively. Similarly the proportion of neonates with gestational age 1500-2500grams was higher in cases 35(45.5%) than controls 43(27.9%). More than half of cases 46(59.7%) and less than one fourth of controls 25(16.2%) have been resuscitated at birth. The proportion of neonates with nasogastric tube insertion was higher in cases 38(49.4%) than controls 16(10.4%) similarly the proportion of neonates who cried immediately at birth was more than half which was higher in cases 40(51.9% than controls 41(26.6%) (**Table-4**).

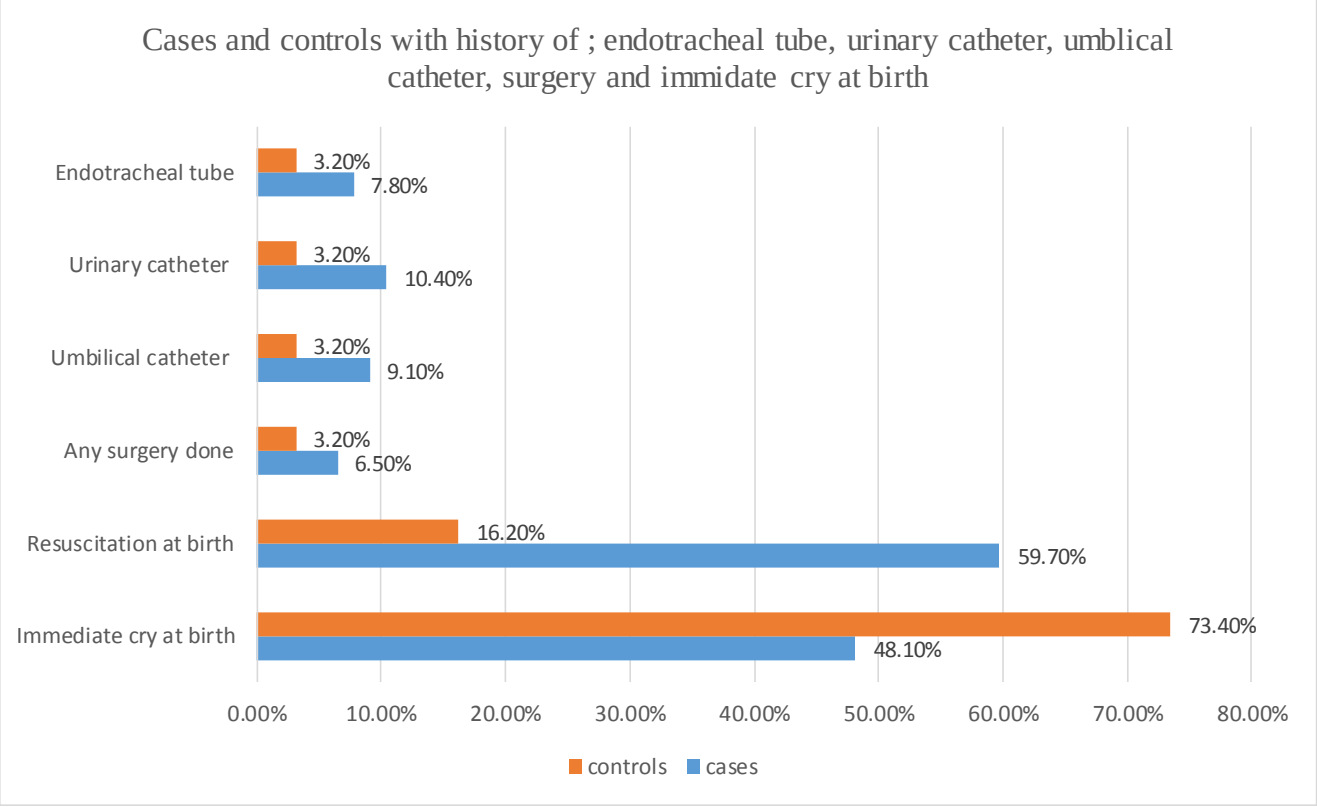

Figure 4: The distribution with history of endotracheal tube, urinary catheter, umbilical catheter, surgery and immediate cry at birth among cases and controls for the study of determinants of neonatal sepsis in public referral hospitals of East and West Gojjam Zones 2018

Table 4: Description neonatal characteristics for the study of determinants of neonatal sepsis in public referral hospitals of East and west Gojjam zones Amhara, Ethiopia, 2018

Exposure Variables	Responses	Cases	Controls
		Count (%)	Count (%)
Gestational age	≥42 weeks	5(6.5)	7(4.5)
	37-42 weeks	42(54.5)	110(71.4)
	32-37 weeks	22(28.6)	31(20.1)
	<32 weeks	8(10.4)	6(3.9)
First minute APGAR score	<7	45(60.0)	23(15.9)
	≥7	30(40.0)	122(84.1)
Fifth minute APGAR score	<7	24(32.0)	6(4.1)
	≥7	51(68.0)	140(95.9)
Birth weight	≥4000 grams	5(6.5)	9(5.8)
	2500-4000 grams	30(39.0)	97(63.0)
	1500-2500grams	35(45.5)	43(27.9)
	<1500 grams	7(9.2)	5(3.2)
Oxygen requirement	Yes	46(59.7)	44(28.6)
	No	31(40.3)	110(71.4)
Method of oxygen administration	Nasal catheter	33(71.7)	26(59.1)
	Nasal cannula	6(13.0)	13(29.5)
	Ambubag/mask	7(15.2)	5(11.4)
Naso gastirc tube insertion	Yes	38(49.4)	16(10.4)
	No	39(50.6)	138(89.6)

5.2. Bivariate and multivariable logistic regression analysis results of the study

The multivariable logistic regression result shows that, number of maternal ANC service was found to be significantly associated with neonatal sepsis. Those women who had ANC service ≤3 times were about four times more likely to hav**e** neonates suffered from sepsis compared to women who got ANC service >3 times (AOR=4.35, 95%CI=1.66-11.45). Similarly duration of rupture of membrane was significantly associated with neonatal sepsis. Women with duration of rupture of membrane ≥ 18hours were around ten times more likely to have neonates with sepsis compared to women with duration of rupture of membrane <12 hours (AOR=10.37, 95%CI= 2.31-46.52).

Meconium Stained Amniotic Fluid (MSAF) was found to be significantly associated with the risk of neonatal sepsis. Particularly, neonates delivered from women with meconium stained amniotic fluid were nearly four times more likely to develop sepsis compared with those neonates delivered from women without MSAF (AOR =3.87, 95%CI=1.53-9.77). Similarly maternal urinary tract infection (UTI) and maternal fever during labor were significantly associated with the risk of neonatal sepsis. Particularly women with UTI were nearly eleven times more likely to have neonates suffering from neonatal sepsis compared to those without UTI (AOR=10.8, 95% CI=3.44-33.97). In addition to this, those women with fever during labor were around three times more likely to give birth to neonates who suffered from neonatal sepsis compared to those without intranatal fever (AOR=3.19, 95% CI=1.07-9.47).

Neonatal variables, like first minute AGAR score <7 was found to be significantly associated with the risk of neonatal sepsis. Specifically neonates with first minute APGAR score <7 were approximately three times more likely to suffer from neonatal sepsis compared to neonates whose first minute APGAR score was ≥7 (AOR=3.17, 95% CI=1.30-7.71). In addition resuscitation at birth was significantly associated with the risk of neonatal sepsis. Particularly those neonates who had been resuscitated at birth were around five times more likely to suffer from sepsis compared to those without resuscitation at birth (AOR= 5.35, 95% CI= 1.86-15.45). Besides, nasogastric tube insertion was significantly associated with the risk of neonatal sepsis. Specifically neonates who were with nasogastric tube (NGT) were around four times more likely to get sepsis compared to neonates without NGT (AOR=3.73, 95% CI=1.37-10.16) (**Table-6**)

Table 5: Bivariate and multivariable logistic regression analysis result for the study of determinants of neonatal sepsis in public referral hospitals of East and west Gojjam zones Amhara regional state, Ethiopia, 2018

Exposure Variables	**Responses**	**Cases**	**Controls**	COR with 95%CI	AOR with 95%CI
		Count (%)	**Count (%)**		
Maternal parity	Nullipara	26(33.8)	37(24.0)	2.11(1.043-4.26)	
	Para-one	30(39.0)	54(35.1)	1.67(.86-3.24)	
	Multipara	21(27.3)	63(40.9)	1	
Maternal age	<20 years	15(19.5)	13(8.4)	2.76(1.22 -6.26)	
	21-34 years	46(60.0)	110(71.4)	1	
	≥35 years	16(20.8)	31(20.1)	1.23(0.62-2.48)	
Neonatal age	<7 days	33(43.9)	98(63.6)	1	
	7-28 days	44(57.1)	56(36.4)	2.33(1.34- 4.08)	
Maternal ANC follow up	Yes	57(74.0)	133(86.4)	1	
	No	20(26.0)	21(13.6)	2.22(1.12- 4.41)	
Number of ANC services	≤3	23(40.4)	25(18.8)	2.92(1.47- 5.80)	4.35(1.66-11.45)**
	>3	34(59.6)	108(81.2)	1	1
Mode of delivery	Cs	20(26)	10(6.5)	4.5(2.12-11.54)	
	Instrumental	16(20.8)	42(27.3)	1.11(.57- 2.16)	
	SVD	41(53.2)	102(66.2)	1	
Duration of rupture of membrane	<12 hrs.	25(32.5)	121(78.6)	1	
	12-18hrs	30(39.0)	28(18.2)	5.18(2.65-10.14)	
	>18hrs	22(28.5)	5(3.2)	4.1(1.37 - 12.32)	10.37(2.3-46.5)**
Meconium stained amniotic fluid	Yes	43(55.8)	35(22.7)	4.3(2.4-7.73)	3.87(1.53-9.77)**
	No	34(44.2)	119(77.3)	1	1
Number of PV examination	≤3	21(27.3)	88(57.5)	1	
	>3	56(72.7)	65(42.5)	3.61(2.0-6.55)	
Intra-natal fever	Yes	33(42.9)	22(14.3)	4.5(2.38- 8.52)	3.19(1.07-9.47)**
	No	44(57.1)	132(85.7)	1	1
Foul smelling amniotic fluid	Yes	19(24.7)	7(4.5)	6.88(2.75-17.23)	
	No	58(75.3)	147(95.5)	1	
History of UTI	Yes	29(37.7)	7(4.5)	12.69(5.2230.81)	10.8(3.44-33.97)*
	No	48(62.3)	147(95.5)	1	1

Gestational age	≥42 weeks	5(6.5)	7(4.5)	1.87 (0.56-6.22)	
	37-42 weeks	42(54.5)	110(71.4)	1	
	32-37 weeks	22(28.6)	31(20.1)	1.86(0.97- 3.57)	
	<32 weeks	8(10.4)	6(3.9)	3.49(1.14-10.67)	
First minute	<7	45(60.0)	23(15.8)	8.02(4.22-15.24)	3.17(1.30-7.71)**
APGAR score	≥7	30(40.0)	123(84.2)	1	1
Fifth minute	<7	24(32.0)	6(4.1)	10.98(4.25-28.4)	
APGAR score	≥7	51(68.0)	140(95.9)	1	
Birth weight	≥4000 gm.	5(6.5)	9(5.9)	1.8(.56- 5.77)	
	2500-4000 gm.	30(39.0)	97(63.0)	1	
	1500-2500 gm.	35(45.4)	43(27.9)	2.63(1.44- 4.82)	
	<1500 gm.	7(9.1)	5(3.2)	4.52(1.34-15.31)	
Immediate cry	Yes	37(48.1)	113(73.4)	1	
	No	40(51.9)	41(26.6)	2.98(1.68-5.28)	
Resuscitation at	Yes	46(59.7)	25(16.2)	7.66(4.10-14.31)	5.35(1.86-15.45)**
birth	No	31(40.3)	129(83.8)	1	1
Oxygen requirement	Yes	46(59.7)	44(28.6)	3.71(2.09- 6.59)	
	No	31(40.3)	110(71.4)	1	
Endotracheal	Yes	6 (7.8)	5 (3.2)	1	
intubation	No	71 (92.2)	149(96.8)	2.52(0.74-8.53)	
Nasogastric tube	Yes	38(49.4)	16(10.4)	8.4(4.24-16.65)	3.73(1.37-10.16)**
insertion	No	39(50.6)	138(89.6)	1	1
Urinary catheter	Yes	8(10.4)	5(3.2)	3.45(1.10-10.95)	
insertion	No	69(89.6)	149(96.8)	1	

Key: CS Cesarean Section, SVD Spontaneous Vaginal Delivery, gm. gram *=p-value<0.001, **=p-value<0.05

6. Discussion

This case control study assessed predictors for neonatal sepsis in public health facilities. Maternal variables include number of ANC services, duration of rupture of membrane (≥18hours), Meconium stained amniotic fluid (MSAF), number of antenatal care (≤3 times) and maternal fever during labor and neonatal variables like first minute APGAR score <7, nasogastric tube (NGT) insertion and resuscitation at birth were the independent predictors of neonatal sepsis (**Table-6**).

Duration of rupture of membrane (>18hours) was significantly associated with the risk of neonatal sepsis. Specifically neonates born from women with duration of labor after rupture of membrane >18hrs were approximately ten times more likely to suffer from sepsis compared with those neonates born from women with duration of rupture of membrane <12 hours. This finding is comparable with studies conducted in Mexico (2012), Pakistan (2014), Nepal (2006), Tigre (2016), USA (2013), Israel (2006) and United Kingdom (2002)[9, 11, 12, 38, 47, 52, 53].These finding 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)[60].

The number of maternal antenatal care service was found to be significantly associated with neonatal sepsis. Particularly neonates born from women who had antenatal care service ≤ 3 times in their pregnancy were around four times more likely to suffer from sepsis compared to neonates born from women who had ANC service >3 times during their pregnancy. This might be due to difference in understanding of maternal and other risk factors. It is fact that, women who had full ANC service could have better understanding and medical care on risk factors than those women with incomplete ANC service. Previous studies conducted in Uganda (2015), India (2016) stated that, women who ever had ANC service were less likely to have neonates suffering by sepsis [13, 17], But previous studies didn't see the number of ANC services those women had got during their pregnancy, merely they saw its presence or absence regardless of the number.

Besides, Meconium stained amniotic fluid (MSAF) had significant association with the occurrence of neonatal sepsis; specifically neonates delivered from women with meconium stained amniotic fluid were nearly four times more likely to develop sepsis compared with those without. This is consistent with studies conducted in Mexico (2012), Ghana(2014), South Africa (2012), India (2017), Nepal and

Indonesia (2015) [9, 12, 18, 19, 46, 50] which revealed that, meconium stained amniotic fluid was an independent predictor of neonatal sepsis. This might be due to that, 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) [61]**.**

Similarly maternal fever during labor had significant association with neonatal sepsis. Particularly neonates born from women with intrapartum fever were nearly four times more likely to suffer with neonatal sepsis compared to those without fever (**Table-6**). This is comparable with findings from Pakistan (2014), India (2017), United Kingdom (2002) and Tigre (2016) [11, 19, 52, 53] which revealed that, fever during delivery was an independent predictor of neonatal sepsis. This might be due to the fact that, women in fever is an indicator of local or systemic infections like Chorioamnionitis or urinary tract infection. This results in hematogenious spread and vertical transmission of pathogens to the newborn before or during labor and delivery which further results in neonatal sepsis.

Despite different studies documented that gestational age (GA), birth weight, residence and sex as an important predictor of neonatal sepsis [9, 10, 12, 41, 42, 50, 54], this study could not found any significant association in multivariable logistic regression analysis with these factors (**Table-6**) which is comparable with a study in Tigre and Bishoftu hospital [11, 48]. This difference might be duet to methodological difference and also might be due to selection bias in recruitment of study participants, in spite of, using a clear case definition for cases and controls to reduce bias.

This study revealed that, maternal urinary tract infection (UTI) was significantly associated with neonatal sepsis. Specifically neonates born from women with UTI during their pregnancy were around eleven times more likely to suffer from sepsis compared to those neonates born from women without UTI (**Table-6**). This finding is in line with findings of studies conducted in Tigre (2016), Mexico (2012), India (2017), and Debrezeit Ethiopia (2014) [11, 12, 19, 48] which revealed that maternal urinary tract infection as an independent risk factor of neonatal sepsis. This might be due to, the wall of birth canal in women with urinary tract infection are colonized with pathogens. The most common microorganisms that cause neonatal sepsis are found across the birth canal and possibly increases the risk while the newborn was born and pass through the vaginal wall [62].

Another neonatal variable which was found to be significantly associated with neonatal sepsis was first minute APGAR score <7. Specifically, neonates who had first minute APGAR score < 7 were around three times more likely to be affected by neonatal sepsis compared to those neonates who had first minute APGAR score >7. This finding was supported by studies conducted in Ghana (2014), Indonesia (2015) and Nepal (2006) revealed that, first minute APGAR score less than seven was an independent risk factor of neonatal sepsis [9, 46, 55]. It is fact that, APGAR core is the overall indicator for the state of the newborn in the extra uterine environment and neonates with low APGAR score, could be in a state of bradycardia asphyxia and need emergency support. This might result in exposure for pathogenic microorganisms through unsterile assisting equipment. Besides, the newborn could have acquired the pathogen vertically (mother to fetus) in utero before delivery which results in sepsis.

In this study**,** resuscitation at birth was a significant risk factor for neonatal sepsis, neonates who were resuscitated at birth were nearly five times more likely to develop sepsis compared to those who were not resuscitated (**Table-6**). This finding is in line with findings from other studies: Ghana (2014), Mexico (2012) and Tanzania (2016) revealed that resuscitation at birth as an independent predictor of neonatal sepsis [12, 20, 46, 63]. These findings might be due to the fact that, if procedure of resuscitation is done forcefully, it may cause laceration to the susceptible and easily breakable mucous membrane of the neonate and serve as a route of entry for pathogens from unsterile equipment [64]. It may also lead microbes into the lower air way of the newborn with an immature immune system. This is due to the lumen of airways of the neonate is too narrow, and respiratory secretions are copious compared to older children which could predispose to easily destruction of smaller air sacs and sepsis.

Besides, nasogastric tube insertion was found to be significantly associated with neonatal sepsis, specifically, neonates who were on nasogastric tube (NGT) feeding were around four times more likely to be affected by neonatal sepsis compared to those without nasogastric tube (NGT). This finding was comparable with studies conducted in Turkey (2016) and Taiwan (2016) revealed that nasogastric tube insertion was an independent predictor of neonatal sepsis [44, 57]. This might be due to the possibility of easily accessibility of pathogenic organisms during the procedure. The other possible reason might be those neonates with NGT are likely to be lacerated while passing the tube since they have fragile mucus membrane and might be an entry point for pathogens which results in sepsis.

7. Strength and limitations of the study

7.1. Strength of the study

We used case control study design which is appropriate to address the research question and enabled to identify the possible predictors of neonatal sepsis.

Besides, we used 90% power of the study which increases the probability of detecting the true exposure difference between the cases and controls.

The other strength of this study was, it was conducted in relatively larger area and 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.

8. Conclusion and recommendation

8.1. Conclusion

The findings of this study suggest that, among neonates aged 0–28 days, admitted in neonatal intensive care units (NICU) of the two hospitals, both maternal and neonatal variables including some invasive procedures were significantly associated with neonatal sepsis. Maternal variables; (number of ANC services, duration of rupture of membrane (≥18hours), Meconium stained amniotic fluid (MSAF), number of Antenatal care (>3 times) and maternal fever during labor) and neonatal variables (first minute APGAR score <7, resuscitation at birth and nasogastric tune insertion) were significantly associated with 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 NICUs should adhere to aseptic techniques while carrying out neonatal invasive procedures. And attention should be given for neonates delivered from women with intranasal fever to prevent neonatal sepsis. Pregnant women should be screened for UTI and those diagnosed with urinary tract infection should be treated with full course of antibiotics for the prevention of neonatal sepsis.

8.2.2. For mothers

Women who didn't have complete ANC services, should get all their antenatal care schedules according to Ethiopian Ministry of Health (EMH) and take prompt action in seeking medical help during obstetric emergencies including rupture of membrane before labor.

8.2.3. For Ministry of health and health service organizations

Government should increase the political priority given to sepsis by improving awareness of the growing medical and economic burden of neonatal sepsis. Primary care organizations should increase

their support towards maternal education and incorporate routine neonatal sepsis screening into the care of neonates and mothers.

8.2.4. 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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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, School of Nursing and Midwifery. And now I am conducting a study to assess determinants of neonatal sepsis in public referral hospital of East and West Gojjam Zones Amhara Regional state, Ethiopia, 2018.

Title of the research: predictors of neonatal sepsis in public referral hospitals in East and West Gojjam Zones Amhara Regional state, Ethiopia.2018.

Objective: this study was aimed to identify determinants of neonatal sepsis

Participants: Neonates admitted to NICU in the two hospitals

Potential Risks: There is no foreseen risk by being involved in this study.

Benefits: 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. Your honest response to the questions can make the study to achieve its objective. All the information that you give will be kept confidential and private. Only the principal investigator and interviewer will have access to the information. You are kindly requested to respond voluntarily. You can also choose not to participate in this study totally or if you become uncomfortable during the study, you will be allowed to leave the interview at any time. At any time that you have questions, you can contact me by using the following Addresses**:**

Tadesse Yirga

Mobile: 09 20 01 01 20

E-mail: tadesseyirga680@gmail.com

Appendix II: Consent form

In signing this document, I am giving my consent to participate in the study entitled "determinant factors of neonatal sepsis in public hospitals of East and West Gojjam Zones".

I have been informed that the purpose of this study is to identify determinant 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 Tadesse Yirga is the contact person if I have questions about the study or about my rights as a study participant.

Respondent's signature_____

Date of interview: _____ Time started: _____ Time finished: _____

Interviewer Name_____Signature_____Date_____

Supervisor's name _____ 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 maternal and neonatal risk factors associated with neonatal sepsis among mothers and their index neonate in public referral hospitals of East and West Gojjam Zones.

1. Questionnaire ID number _____
2. Status 1. **Case** ☐ 2. **Control** ☐
3. Address: Kebele _____
4. 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 (age 0-28 days)

No.	Question	Response	Skip
101	Mother's age	_____(in years)	
102	Marital status	1. Single 2. Married 3. Widow 4. Divorced 5. Separated 6. Cohabitated	
103	What is your religion?	1. Orthodox 2. Muslim 3. Catholic 4. Protestant 5. Other (specify)_____	
104	Ethnicity	1. Amhara 2. Oromo 3. Tigre 4. Other (specify)	
105	Residence	1. Urban 2. Rural	
106	Maternal education	1. Can't read and write 2. Can read and write but no formal education 3. Primary 4. Secondary 5. college and higher	
107	Occupation of mother	1. Housewife 2. Civil servants 3. Business woman 4. Private Organization 5. Daily laborer 6. Student	
108	Monthly income of the household	_____ in Ethiopian Birr	
109	Neonate's age	_____in days	
110	Neonate's sex	1. Male 2. Female	

PART II. Maternal health related factors			
201	Parity	_____ in number	
202	Did you visit health facility for ANC during your pregnancy for this neonate?	1. Yes 2. No	If 'no' skip to 204
203	If yes, how many times did you receive antenatal care during your time of pregnancy for this neonate	_____ times	
204	Where did you gave birth to this neonate /Place of delivery	1. Home 2. Hospital 3. Health center 4. Other (specify)___	If in 'home', skip to 206
205	If the place of delivery is in hospital or health center, what was the mode of delivery?	1. Spontaneous Vaginal delivery 2. Instrumental vaginal delivery 3. Caesarean section	
206	Who helped you during delivery?	1. TBA 2. HEW 3. Health professional 4. Other (specify)_____	
207	What was the duration of rupture of membrane?	_____ in hours	
208	Was the amniotic fluid brown/green discoloration	1. Yes 2. No	
209	How many times did the birth attendant performs vaginal examination	_____ times	
210	Did you have any fever during the time of this labor	Yes _____ No_____ Specify _____	
211	Did the amniotic fluid was foul smelling	Yes _____ No _____	
212	Did you have pregnancy related hypertension PIH/ Eclampsia during the pregnancy of this neonate?	Yes _____ No _____ Specify _____	
213	Did you have any bleeding during the pregnancy of this neonate?/ APH	Yes _____ No _____ Specify _____	
214	Did you have any UTI/STI during the pregnancy of this neonate?	Yes _____ No _____ Specify _____	
Thank you for your participation!			

OART III: A checklist on neonatal health related factors

301	Gestational age	_____ in weeks	
302	APGAR score	At 1st minute_____ At 5th minute_____	
303	Birth Weight at birth	_____ in grams	
304	Did the neonate cries immediately after birth?	Yes _____ No_____	
305	Did the neonate resuscitated at birth?	Yes _____ No ____	
306	Did the neonate had any type of surgery done?	Yes _____ No _____ Specify _____	
307	Was the neonate on oxygen?	Yes _____ No _____	If in 'No', skip to 310
308	If yes what was the method of oxygen administration?	1. Intranasal catheter 2. Mask 3. Nasal cannula	
309	Did the neonate had endotracheal intubation?	Yes _____ No _____ Specify _____	
310	Did the neonate had NG tube inserted?	Yes_____ No_____	
311	Did the neonate had umbilical catheter inserted?	Yes_____ No_____	
312	Did the neonate had urinary catheter inserted?	Yes_____ No_____	
IMNCI clinical criteria for diagnosis of neonatal sepsis			
401	Convulsions	Yes _____ No ____	
402	Respiratory rate ≥ 60 breaths/min	Yes _____ No ____	
403	Severe chest in drawing	Yes _____ No ____	
404	Nasal flaring	Yes _____ No ____	
405	Grunting	Yes _____ No ____	
406	Bulging fontanels	Yes _____ No ____	

407	Pus draining from the ear	Yes _____ No ____
408	Redness around umbilicus extending to the skin	Yes _____ No ____
409	Temperature >37.5^{o}C or <35.5^{o}C	Yes _____ No ____
410	Lethargic or unconscious	Yes _____ No ____
411	Reduced movements	Yes _____ No ____
412	Not able to feed	Yes _____ No ____
413	Not attaching to breast	Yes _____ No ____
414	No sucking at all	Yes _____ No ____
Laboratory investigation findings		
415	Complete blood count (CBC)	1. Total WBC_____ /mm^3 2. ANC _____/mm^3 3. ESR _____/1hr 4. Platelet count_____cells/mm^3 5. CRP_____mg/dl or _____mg/L
416	Blood culture	Identified bacteria_____
417	Blood glucose	_____mg/dl or _____mmol/L _____mg/dl or _____mmol/L
*WBC=white blood cells, ANC= absolute neutrophil count, ESR= erythrocyte sedimentation rate, CRP=c reactive protein		

Appendix IV፡ የተሳታፊዎች የመረጃ ቅፅ በአማረኛ

እንደምን አደሩ/ዋሉ?

ሥሜ_____ እባላለው፤ በአዲስ አበባ ዩኒቨርሲቲ፣ ጤና ሳይንስ ኮሌጅ፣ ነርሲንግና ሚድዋይፍሪ ትምህርት ክፍል በህፃናት ጤና የ2ኛ ዓመት የማስትሬት ድግሪ ተመራቂ ተማሪ ነኝ፡፡ በአሁኑ ሰዓት በደብረ ማርቆስና በፈለገ ሂወት ሪፈራል ሆስፒታሎች ውስት በጨቅላ ህጻናት ሰውነት ውስጥ በሚከሰተው የሰውነት መመረዝ አጋላጭ ሁኔታዎችን ለመለየት በማጥናት ላይ ነኝ፡፡

<u>የጥናቱ ርዕስ፡</u> - ለጨቅላ ህጻናት የሰውነት መመረዝ አጋላጭ ሁኔታዎችን በደብረማረቆስና ፈለግሂወት ሪፈራል ሆስፒታሎች አማራ ብሔራዊ ክልላዊ መንግስት፣ ኢትዮጵያ፣ 2010 ዓ.ም፡፡

<u>የጥናቱ አላማ፤</u> በጨቅላ ህጻናት ውስት የሰውነት መመረዝ አጋላጭ ሁኔታዎችን ለመለየት፡፡

<u>ተሳታፊዎች</u>፡ - ከ28 ቀናት በታች የሆኑ ከእናታቸው ጋር ሆስፒታል ውስጥ የተኙ ጨቅላ ህፃናት

<u>የጎንዮሽ ጉዳት</u>፡ - በዚህ ጥናት መሳተፍ ምንም አይነት ጉዳት የለውም፡፡

<u>ጥቅማጥቅም</u>፡ - 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፡፡ በሙሉ ፈቃደኝት እንዲሳተፉ እየጠየቅሁ ያለመሳተፍ ወይም በማንኛውም ጊዜ ራስዎን ከጥናቱ የማግለል ሙሉ መብት አለዎት፡፡ ማንኛውም ጥያቄ ካለዎት በሚከተለው አድራሻዬ ማግኘት ይችላሉ፡፡

ታደሰ ይርጋ

ስ.ቁ. 0920010120

ኢ.ሜይል፡ tadesseyirga680@gmail.com

Appendix V: የስምምነት መግለጫ ፎርም - በአማርኛ

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 መንኛውንም ያልገባኝን ጥያቄ መጠየቅ እንደምችል ተገልጾልኛል፡፡

የመረጃ ሰጪ ፊርማ _____ቀን _____

የተጀመረበት ሰዓት _____ ያለቀበት ሰዓት_____

የጠያቂው ስም _____ፊርማ_____ቀን_____

የተቆጣጣሪ፤ስም_____ፊርማ_____ቀን_____

የመጠይቁ ውጤት

1. ሙሉ በሙሉ የተሞላ
2. ያልተስማሙ
3. በከፊል የተሞላ

Appendix VI:መጠይቅ - አማርኛቅጽ

አዲስ አበባ ዩኒቨርሲቲ፤ ጤና ሳይንስ ኮሌጅ ፤ነርሲንግ ዲፓርትመንት፤ ድህረ ምረቃ ፕሮግራም

ይህ መጠይቅ የተዘጋጀው ነደብረማርቆስና ፊለገሂወት የህዝብ ሪፈራል ሆስፒታሎች ውስጥ በህጻናት ሰውነት ውስት የሰውነት መመረዝን ሊያመጡ የሚችሉ አጋላጭ ሁኔታዎችን ለመለየት ነው::

የመጠይቁ መለያ ቁጥር_____አድራሻ፤ቀበሌ_____የተቋሙ ስም_____

Status 1. **Case** ☐ 2. **Control** ☐

ክፍል አንድ፡- የወላጅ የጨቅላ ህጻኑ እና የእናቱ አጠቃላይ ሁኔታ

ተ.ቁ	ጥያቄ	መልስ	ይዝለሉ
101	እድሜዎ ስንት ነው?	_____(በዓመት)	
102	የጋብቻ ሁኔታ?	1. ያላገባች 2. ያገባች 3. ባሏ የሞተባት 4. ባሏን የፈታች 5. የተለያየች 6. ሳታገባ አብራ የምትኖር	
103	የየትኛው ሀይማኖት ነዎ?	1. አርቶዶክስ 2. ሙስሊም 3. ካቶሊክ 4. ፕሮቴስታንት 5. ሌላ(ይጥቀሱ)_____	
104	ብሄርዎ ምንድ ነው?	1. አማራ 2. ኦሮሞ 3. ትግሬ 4. ሌላ(ይጥቀሱ)_____	
105	የመኖሪያ ቦታዎ የት ነው?	1. ከተማ 2. ገጠር	
106	የትመህርት ደረጃዎ ስንት ነው?	1. ያልተማረች የተማረች 2. የመጀመሪያ ደረጃ 3. ሁለተኛ ደረጃ የተማረች 4. ኮሌጅና ከዛ በላይ	
107	የርስዎ የስራ ሁኔታምንድነው?	1. የቤት እመቤት 2. የመንግስት ሰራተኛ 3. ነጋዴ 4. በግል ተቋም 5. የቀን ሰራተኛ 6. ተማሪ	
108	ወራዊ ገቢዎ ምንየህል ነው?	_____በኢትዮጵያ ብር	
109	የህጻኑ አድሜ ስንት ነው?	_____(በቀናት)	
110	የህጻኑ ፆታ ምንድ ነው?	1. ሴት 2. ወንድ	

ክፍል ሁለት፤ከእናት ጤና ጋር የተያያዙ አጋላጭ ሁኔታዎች

201	ንት ህጻናት 7 ወር ከሞላቸው በኋላ ወልደዋል ሞተው የተወለዱትንም ጨምሮ)?	_____(በቁጥር)	
202	የቅድመ ወሊድ ክትትል አግኝተዋል?	1. አዎ 2. አላገኘሁም	አላገኘሁም ካሉ ወደ ጥያቄ 204 ይሂዱ
203	መልስዎ አዎ ከሆነ ስንት ጊዜ?	_____ጊዜ	
204	ጻኑን የት ነው የወለዱት?	1. ቤት 2. ጤናጣቢያ 3. ሆስፒታል 4. ሌላ የጥቀሱ_____	ቤት ካሉ ወደ ጥያቄ ቁጥር 206 ይሂዱ
205	ሆስፒታል ወይም ጤ/ጣቢያከሆነ በምን ነውየወለዱት?	. በቀዶጥገና . በመሳሪያ በመታገዝ . በተፈጥሮ/በምጥ	
206	ወልዱ ማን አዋለደዎት?	1. የባህል አዋላጅ 2. ጤናኤክስቴንሽን ባለሙያ 3. ጤና ባለሙያ 4. ዘመድ 5. ሌላ ይጠቀሱ_____	
207	ኣነረሽርት ውሃ ከፈሰሰ በኋላ ምጡ ምንያህል ጊዜ ቆየብዎት?	_____በሰዓት	
208	እንሽርትውሃ ሲፈስ መልኩ ቡናማ ወይም አረንጓዴ የሚመስል ነበር?	1. አዎ 2. አልነበረም 3. ልላ የጠቀሱ_____	
209	ያዋለደዎት ሰው በእጁ ማህጸንዎን ስንት ጊዜ አየዎት?	_____ጊዜ	
210	ምጥ ሰዓት ትኩሳት ነበረዎት?	4. አዎ 5. አልነበረም 6. ልላ የጠቀሱ_____	
211	እንሽርትውሃ ሲፈስ የተለየ/ መጠፎ ጠረን ነበረው?	1. አዎ 2. አልነበረውም 3. ሌላ የጠቀሱ_____	
212	ርግዝና ጋር የተያያዘ ደም ግፊት ህመም ነበር?	1. አዎ 2. አልነበረም 3. ሌላ የጥቀሱ_____	
213	ዚህ ህጻን አርግዝና ጊዜየደም መፍሰስ ነበር?	1. አዎ 2. አልነበረም 3. ሌላ ይጥቀሱ	
214	በዚህ ህጻን እርግዝና ጊዜያባላዘር በሽታ/የሽንት ቱቦ መመረዝ ታመው ነበር?	1. አዎ 2. አልነበረም 3. ሌላ የጥቀሱ_____	
			አመሰግናለሁ

<u>ክፍል ሦስት</u>፤ከህጻኑ ጋር የተያያዙ አጋላጭ ሁነታዎች

301	የእርግዝና እድሜው ስንት ነው?	_____(በሳምንት)	
302	APDAR score?	1. በ 1 ደቂቃ ውስጥ___ 2. በ 5 ደቂቃ ውስጥ___	
303	ሲወለድ ክብደቱ ስንት ግራም ነበር?	_____ግራም	
304	ሲወለድ ወዲያውኑ አለቀሰ?	1. አዎ አለቀሰ 2. አላለቀሰም	
305	ህጻኑ ሲወለድ ታፍኖ እርዳታ ተደርጎለት ነበር?	1. አዎ ተደረገለት 2. አልተደረገለትም	
306	ህጻኑ ቀዶጥገና ተሰርቶለት ነበር?	1. አዎ 2. አልተሰራለትም 3. ይግለጹ_____	
307	ህፃኑ ኦክስጅን ላይ ነበር?	1. አዎ 2. አልነበረም	መልስዎ አልነበረም ከሆነ ወደ ጥያቄ 310 ይሂዱ
308	መልስዎ አዎ ከሆነ በምን ነበር የተሰጠው?	1. ማስክ 3 በካኑላ 2. በናዛል ካቴተር 4. በአምቡባግ	
309	ህጻኑ በጉሮሮው የመተንፈሻ ቱቦ ገብቶለት ነበር?	1. አዎ 2. አልገባለትም	
310	ህጻኑ ባፍንጫው/ባፉ ቱቦ ገብቶለት ነበር?	1. አዎ 2. አልገባለትም	
311	ህጻኑ በእምብርቱ ቱቦ ገብቶለት ነበር?	1. አዎ 2. አልገባለትም	
312	ህጻኑ የሽንት ቱቦ ገብቶለት ነበር?	1. አዎ 2. አልገባለትም	