POTENTIAL RISK FACTORS OF NEONATAL SEPSIS AMONG NEONATES ADMITTED AT NEONATAL INTENSIVE CARE UNIT IN THE TAMALE TEACHING HOSPITAL

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THESIS SUBMITTED TO THE DEPARTMENT OF PUBLIC HEALTH, SCHOOL OF ALLIED HEALTH SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN COMMUNITY HEALTH AND DEVELOPMENT.

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DECLARATION

I Cynthia Maambo declare that, except the references cited which have been acknowledged this study is my own piece of work undertaken in the Tamale Teaching Hospital under the supervision of Dr. Michael Wombeogo. This script has never been submitted in whole or part to this University for an academic award.

I hereby submit it as a research in partial fulfillment of the requirement for the award Masters of Philosophy (MPHIL) in Community Health and Development degree of University for Development Studies.

CYNTHIA MAAMBO ................................................. ........................................
(STUDENT) SIGNATURE DATE

DR. MICHAEL WOMBEOGO ........................................
(SUPERVISOR) SIGNATURE DATE
I dedicate this work to my family for their support.
ACKNOWLEDGEMENT

All thanks to Almighty God for the grace given to me in making this work come to reality. The success of this work is highly due to many people support.

My profound gratitude goes to all respondents who volunteered to be part of this work. I could not have done it without you. May God replenish all the energy used. I am grateful to all staff at TTH for your unfailing support.

I am sincerely thankful to all my supervisors for his unforgettable roles he played for this study to be a success. I express my sincere thanks and gratitude to my supervisor, Dr. Michael Wombeogo head of the Public Health Department for his immense assistance and encouragement to ensure only relevant materials are included in this work.

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Finally, my sincere thanks go to the numerous writers whose work served as reference materials for this work.
ABSTRACT

Neonatal sepsis remains a global public health problem. The aim was to examine the risk factors of neonatal sepsis among neonates admitted at Neonatal Intensive Care Unit in the Tamale Teaching Hospital. A descriptive cross-sectional study at Neonatal Intensive Care Unit between the periods of February and May, 2018. Data was via standardized questionnaire and interview guide with 77 mothers and 8 key informants. Diagnosis of neonatal sepsis done clinically. Data obtained on socio-demographic data of mother and newborn, maternal, neonatal and health care factors. Data analysis done with computer software SPSS version 20.0. A correlation (significant level of 0.05) coefficient to establish association and multivariate logistic regression done to assess the strength of association between variables. Thematic content analysis was used to analyze qualitative data. The significant risk factors of neonatal sepsis were: male sex baby (AOR=5.02; 95% CI 1.69-3.51; P-value-0.005), baby ageless than 24hours (AOR=1.43; 95% CI 1.02-3.48; P-value-0.000), birth position of first (AOR=4.76; 95% CI 3.26-5.71; P-value -0.002), maternal ageless than 20 years (AOR=3.47; 95% CI 2.39-5.28; P-value -0.000), number of children four (4) and above (AOR=3.82; 95% CI 1.49-3.77; P-value -0.000, family size five to eight (AOR=3.51; 95% CI 1.97-4.76; P-value-0.025), baby fed on any other feed (AOR=5.04; 95% CI 1.38-4.87; P-value-0.001) and gestational week of delivery between 25-36 weeks (AOR=3.11;95% CI 1.05-4.59; P-value-0.012). Neonatal sepsis risk factors in the Tamale Teaching Hospital are; maternal and neonatal related factors. It is important; Obj.1. Mothers should report early to antenatal and post-natal care for prompt assessment and intervention by health workers while ensure good infant feeding practices. Obj.2. Mothers should be counseled to adopt and adhere to good newborn care practices. Obj.3. Health staff should adhere to infection prevention protocols and attend refresher trainings and put in to practice.
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<td>Antenatal Care</td>
</tr>
<tr>
<td>APGAR</td>
<td>Appearance, Pulse Rate, Grimace Activity and Respiration</td>
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<td>C</td>
<td>Celsius</td>
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<td>CDC</td>
<td>Center for Disease Control</td>
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<td>CSF</td>
<td>Cerebro Spinal Fluid</td>
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<td>C/S</td>
<td>Cesarean Section</td>
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<td>EOS</td>
<td>Early Onset Sepsis</td>
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<td>E. Coli</td>
<td>Escherichia Coli</td>
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<td>GDHS</td>
<td>Ghana Demographic and Health Survey</td>
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<td>Ghana Health Service</td>
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<td>G6PD</td>
<td>Glucose 6 Phosphate-Dehydrogenase Deficiency</td>
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<td>Group B Streptococcus</td>
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<td>HB</td>
<td>Haemoglobin</td>
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<td>HS</td>
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<td>Hep B</td>
<td>Hepatitis B</td>
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<td>Hr</td>
<td>Hour</td>
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<tr>
<td>HIV/AIDS</td>
<td>Human Immuno Virus/Acquired Immuno Deficiency Syndrome</td>
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<tr>
<td>IPC</td>
<td>Infection. Prevention and Control</td>
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<td>IV</td>
<td>Intravenous Vein</td>
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<td>LOS</td>
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<td>LBW</td>
<td>Low Birth Weight</td>
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<tr>
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<td>Description</td>
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<tr>
<td>NICU</td>
<td>Neonatal Intensive Care Unit</td>
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<td>NNS</td>
<td>Neonatal Sepsis</td>
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<tr>
<td>N/A</td>
<td>Not Applicable</td>
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<td>PICC</td>
<td>Peripheral Inserted Central Catheter</td>
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<td>PROM</td>
<td>Prolong Rupture of Membrane</td>
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<td>STI</td>
<td>Sexually Transmitted Infection</td>
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<td>SPSS</td>
<td>Statistical Package for Social Scientist</td>
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<td>SDG</td>
<td>Sustainable Development Goal</td>
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<td>TTH</td>
<td>Tamale Teaching Hospital</td>
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<td>UN</td>
<td>United Nations</td>
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<tr>
<td>UNICEF</td>
<td>United Nations International Children Emergency Fund</td>
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<tr>
<td>UDS</td>
<td>University for Development Studies</td>
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<tr>
<td>UTI</td>
<td>Urinary Tract Infection</td>
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<tr>
<td>VE</td>
<td>Vaginal Examination</td>
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<td>WHO</td>
<td>World Health Organization</td>
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CHAPTER ONE

INTRODUCTION

1.0 Background of the study

Neonatal sepsis, according to the international pediatric sepsis consensus conference 2005 is defined as “systemic inflammatory response syndrome in the presence of or as a result of suspected or proven infection which could be bacterial, viral, fungal or rickettsia origin (Goldstein, Giroir & Randolph, 2005).

Neonatal sepsis remains a global public health problem despite many interventions to reduce its effect in many newborns across the globe. It is a common cause of morbidity and mortality in newborns according to Medicine Net, (2016). The neonatal period is only twenty-eight (28) days and yet is responsible for 40% of all deaths in children under five years Liu, Cousin, Perini, Law & Scott et al. [Liu et al.], 2012). Culture sensitivity method is a gold standard in diagnosing neonatal sepsis, however due to lack of good laboratory facility and services, clinical diagnosis is sometimes used; which is either done by using the World Health Organization’s criteria or other predator confirmed from previous studies (English, Mwalekwa & Pesh, 2004).

Studies by Levy (2007); Marodi (2006) findings showed that, the infants’ transition from a sterile, intrauterine environment, to the ecologically complex and changing microbiologic milieu that they confront for the remainder of their lifetime, requires extreme shifts in immune function. They added that, newborns are the most profoundly immune compromised, this is because their immune system is typified by comparatively poor innate and adaptive immune responses. Even though children <12month old have the highest risk of death from sepsis, much of this mortality is driven
by the high incidence of sepsis and the high rate of sepsis-related mortality in infants born very prematurely (Watson et al., 2003).

Also, according to WHO (2013), more than one third of the estimated 2.8 million neonatal deaths each year are caused by severe infection, and a quarter of these deaths are due to neonatal sepsis and pneumonia alone. Although newborn mortality has seen a decline of about 40% since 1990, it has not kept pace with the faster decline in under five deaths and this has resulted in a higher proportion (44%) of under five deaths now attributable to the newborn (United Nation Inter-Agency Group, 2014).

The risk of severe infection in high mortality countries (NMR>44) is roughly 11-fold the risk in low mortality countries (NMR15) (Lawn, Cousens & Zupan [Lawn et al.], 2005). The reasons for the high number of neonatal deaths from infection are as a result of under-recognition of illness, delay in care seeking by the family and lack of access to appropriately trained health workers and high quality services to manage the illness and even if quality services are available, the cost of treatment is beyond the reach of many (WHO, 2013). However, some other researchers believed that, the disproportionate high mortality and morbidity from sepsis in countries with high incidences are as a result of high incidence bacterial, parasitic and HIV infection coupled with low hygienic standards and vaccination rates, wide spread malnutrition and lack of resources (Becker, Theodosis, Jacob, Wira & Groce [Becker et al.], 2009; Yasmeen, Nedhal, & Sevan [Yasmeen et al.], 2012).

Neonatal Sepsis is very prevalent in sub-saharan Africa and contributes up to 69% to neonatal deaths in Nigeria and other parts of Africa (Okechukwu & Achonwa, 2009). A study in Ethiopia by Gebremedhin, Berhe & Gebrekiristos [Gebremedhin et al.] (2016), showed that neonatal sepsis is the major newborn killer still claiming more than one third of neonatal deaths. The situation is
not different in Tanzania where it is estimated that neonatal sepsis accounts for 29% of neonatal deaths (Manji, 2009).

According to Siakwa, Kpikpitse, Mupepi, John, Doe, Ebu, Dare & Garzienye [Siakwa et al.] (2012) some causes of neonatal deaths like congenital abnormalities may be unpreventable, but neonatal sepsis which becomes a major cause of deaths among neonates can be reduced through prevention, early diagnosis and treatment. The spectrum of organisms that causes neonatal sepsis changes over time and varies from region to region even within the same hospital (Shrestha et al., 2007). According to their study is as a result of the changing pattern of antibiotic use and changes in lifestyle. A Ghana Health Service/ United Nations International Children Emergency Fund [GHS/UNICEF], (2014) made known that infections may be underestimated in some developing countries situations where care is less than adequate.

Studies in some parts of Africa such as Nigeria, Kenya and Tanzania revealed the following maternal factors to be associated with neonatal sepsis as; foul smelling amniotic fluid, multiple gestation, mode of delivery, pregnancy induced hypertension (PIH) and non-attendance to prenatal services whiles neonatal factors include; birth asphyxia resuscitation during delivery, low birth weight, congenital anomaly, perinatal nutrition, invasive procedures and low APGAR score (Chacko & Sohi, 2005; West & Tabansi, 2012).

Despite the fact that neonatal sepsis has non-specific clinical features, the following features are given by Karen, Rebort, Kliegman, Richard & Behrman [Karen et al.] (2010) in Nelson paediatric textbook as the features; poor feeding, fever (temperature instability or hypothermia), vomiting, apnoea and bradycardia, respiratory distress, abdominal distention, jaundice, lethargy, neutropenia, hypo/hyperglycemia, shock, irritability and seizures.
Ghana is among the many countries in Africa battling to reduce neonatal deaths. According to Ghana & United Nation International Children Emergency Fund [Ghana / UNICEF], (2014) infections are the largest culprit about 31% of death in newborns in Ghana. For Ghana to reduce neonatal death rate 21 per 1000 live births from current 32 per 1000 live births by 2030, much need to be done on maternal and neonatal care. Efforts such as rolling out, and enforcement of policies in health care settings to reduce neonatal sepsis is much needed, in order to meet the Sustainable Development Goal (SDG) 3 target two.

Indeed, various governments have drawn and implemented a number of initiatives and frameworks to help improve newborn and maternal care in the country. Some of such initiatives include: focused antenatal care, early postnatal services, hand washing protocols, exclusive breastfeeding, ensuring clean births among others. Despite these, neonatal sepsis still poses a big challenge in health facilities in the country/ regions and remained a major cause of admission and death in many neonatal intensive care units. However, successful implementation of Infection, Prevention and Control (IPC) guidelines in addition to proper management of neonatal sepsis will help to reduce its burden on neonatal deaths. Health facilities in low and middle countries though maybe aware of the importance of these guidelines, they may be limited with resources to make things work. Prompt identification of risk factors, in addition to appropriate interventions will aid to bring good outcome of neonatal sepsis (decreased morbidity and mortality) among newborns.

Moreover, published data on risk factors of neonatal sepsis in the neonatal unit is not available in the study area. However, there are studies such as; why are babies dying in the first month after birth?, in the Kasena-Nankana district of the Upper East region by Welaga et al. (2013); Antibiotic Susceptibility Pattern of blood culture isolates of neonates with sepsis, Ho municipality by Yayra (2016); Maternal and neonatal risk factors for neonatal sepsis: A case control study in the Cape
Coast Teaching Hospital, Ghana by Siakwa et al. (2012), Pattern, Causes and Treatment Outcomes of Neonatal admission in Tamale Teaching Hospital by Walana et al. (2016) among others. Therefore, this study sought to fill in the gaps in literature by examining the risk factors to neonatal sepsis among neonates admitted at Neonatal Intensive Care Unit (NICU) in the Tamale Teaching Hospital which will help inform policies and develop strategies to enable the hospital, region, the country and the whole world at large reduce newborn morbidity and death.

1.1 Problem statement

A WHO report on neonatal mortality demonstrated that the first 28 days of life represents the most vulnerable time for a child’s survival. This in 2016 resulted in 2.6 million deaths or roughly 46% of all under-five deaths in the neonatal period and translated into 7000 newborn deaths every day. The report further established the importance of reducing neonatal deaths not only because the proportions of under-five deaths that occur during the neonatal period is increasing but also because the health interventions needed to address the major causes of neonatal deaths generally differ from those needed to address other under-five deaths. Also, it was reported that more than 60 countries will miss the SDG target of reducing neonatal mortality to at least as low as 12 deaths per 1000 live births by 2030 (World Health Organization [WHO], 2017).

Moreover, the profound morbidity in preterm babies is associated with neonatal sepsis which contributes to a significant neurological damage in the neonate, traumatizes mothers and care givers with eventual loss of productive hours as neonates had to be on admission for days or weeks (Stoll, Hansen & Adams-Chapman [Stoll et al.], 2004). Also, some organisms are associated with worse prognosis, in much particularly fungi, and infections with antibiotic-resistant bacteria,
including gram-negative bacilli, nosocomial pathogens and Methicillin Resistant Staphylococcus Aureus (Burke (2009); Hounsom, Grayson & Melzer [Hounsom et al.] (2011)). In African continent, 17% of neonatal deaths is attributed to neonatal sepsis in the sub-Saharan region (Gebremedhin et al., 2016).

In Ghana it has been reported that, more than half of infant deaths occur in the first 28 days of life demonstrating that newborn mortality rate has not improved by Ghana /UNICEF (2014). The Ghana Demographic and Health Survey [GDHS] (2014) also stated that neonatal mortality rate for preceding five years is 29 per 1000 live births, 2.2 times the post neonatal mortality rate. Data on neonatal, infant and under-five mortality rates in Ghana since 1998 reveals that neonatal mortality has decreased at a slower pace than infant and child death. This brought about an increase in the contribution of neonatal deaths to infant deaths from 53% in 1998 to 71% in 2014 (GDHS, 2014). The chances of survival are slim for newborns with serious infections whether hospitalized or in the community (World Health Organization [WHO], 2013). It further established that the problem of infection in newborns is that identification and treatment is weak in many developing countries and this is because sick newborns present with non-specific signs and symptoms. Diagnosing neonatal sepsis is difficult even in the most sophisticated settings.

Neonatal sepsis and other neonatal infections are considered as one of the deadliest neonatal disorders in Ghana (World Bank, 2013). A study by Welaga et al. (2013) in the Kasena - Nankana district revealed that infection accounted for 59% of late neonatal deaths. In many neonatal intensive care unit, neonatal sepsis cannot be ruled out as it is one of the top causes of newborn admissions and deaths. A study by Walana et al. (2016) at the Tamale Teaching Hospital revealed sepsis as one of the commonest causes of neonatal admission (29.2%) and placed third (13.5%) as a cause of neonatal death in the Neonatal Intensive Care Unit.
Newborn health has a major link with Maternal, Newborn and Child health (MNCH) for continuity of care (World Health Organization [WHO], 2016). The adage “an ounce of prevention worth a pound of cure” certainly is of importance to neonatal sepsis (Medicine Net, 2016). Despite the advances in medicine and technology, babies are still getting sepsis and even die out of it. This study examined the risk factors of neonatal sepsis among neonates admitted at neonatal intensive care unit in the Tamale Teaching Hospital.

1.2 Research questions

1. Which mother’s socio-demographic data and maternal factors are risk factors of neonatal sepsis?
2. Which newborn demographic data and neonatal factors are risk factors of neonatal sepsis?
3. Which health care factors are risk factors of neonatal sepsis?

1.3 Research objective

1.3.1 Main research objective

To examine the risk factors of neonatal sepsis among neonates admitted at neonatal intensive care unit in the Tamale Teaching Hospital.

1.3.2 Specific research objectives

1. To identify mother’s socio-demographic data and maternal factors that are risk factors of neonatal sepsis?
2. To determine newborn demographic data and neonatal factors that are risk factors of neonatal sepsis?

3. To establish the health care factors that are risk factors of neonatal sepsis?

1.4 Justification /significance of the study

According to some report in the globe every year, 2.7 million neonates die during the neonatal period, which constitutes 45% of under-five mortality and approximately 58% of infant death and 75% of the deaths occur during the first week in the neonatal period (Leif et al., 2009; World Health Organization, United Nation International Children Emergency Fund, United Nation & World Bank, [WHO et al.], 2015). It is however a worry that if the trend continues like this the share of neonatal deaths to under-five is projected to increase from 45% in 2015 to 52% in 2030 (United Nation International Children Emergency Fund, World Health Organization, United Nation & World Bank group (2015 [UNICEF et al.], 2015). Studies to assess NNS is crucial for the implementation of strategies geared to improve the care delivered to newborns and to prevent the factors that exposes babies to microorganisms that causes sepsis. There is however, the need to examine the risk factors of neonatal sepsis, to enable the facility practice or ensure appropriate care to neonates, thereby reducing neonatal morbidity and mortality rate.

This study undertaken assessed NNS based on: socio-demographic data of mothers and neonates, maternal, neonatal and health care factors. The study will help inform the hospital authorities/policy makers in the TTH about these factors to draw policies/protocols to tackle neonatal sepsis. It will inform health workers at TTH the need to adhere to universal standard precautions/ protocols to help reduce the cases of neonatal sepsis.
Also, it will serve as a baseline data for the management of the organization (TTH) to build staff capacity on infection, prevention and control, newborn care etcetera. It will also help create awareness of neonatal sepsis for corporate and benevolent societies in the Northern region and beyond to support in the fight against sepsis by helping to broadcast it on air, provision of soap for washing of hands by mothers at the hospital among others. Also, it will help reduce neonatal deaths and improve newborn health for the achievement of SDG 3 in the world at large. Lastly, the study will be used as a baseline data for researchers and also recommend areas for further studies.

1.5 Operational definition of term

Risk: means a situation involving exposure to danger to a baby

Factors: means a circumstances, fact, or influence that contributes to a result.

Neonate: means an infant in the first 28 days after birth; whether premature, full term, or post-mature.

Newborn: refers to a recently born child.

Neonatal Intensive Care Unit: means a special area in the hospital where newborn babies who need intensive medical attention are often admitted in to.

Sepsis: means invasion of the human system by organisms
CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter discussed the frameworks used, which served as a guide to the study and also relevant literature review of the phenomenon was also done. The theoretical frame used was Social ecological model of health behavior and a modified conceptual framework from UNICEF was also applied in order to contextualize the research findings. It gave some highlights on other studies relevant findings that looks in to the physiology of NNS, causative organism, types, clinical features/ signs and symptoms, diagnosis, prognosis, as well as reviewed socio-economic, cultural, lifestyle, neonatal, maternal and health care risk factors to NNS.

2.1 Physiology of neonatal infection

In the work of Chiesa et al. (2004) it is indicated that throughout pregnancy and until the membranes rupture, the fetus is relatively protected from the microbial flora of the mother by the chorioamniotic membranes, the placenta, and poorly understood antibacterial factors in amniotic fluid (Klein, 2001). However, there are many ways that infectious agents can reach the fetus or newborn to cause infection. Procedures disturbing the integrity of the uterine contents, such as amniocentesis (Gibbs & Dubb, 1991), cervical cerclage (Charles & Edwards, 1981), transcervical chorionic villus sampling (Fejgin et al, 1993), or percutaneous blood sampling (Wilkins et al., 1989; Gibbs & Dubb, 1991), can permit entry of skin or vaginal organisms, causing amnionitis and secondary fetal infection. Certain bacteria, particularly Treponema pallidum and Listeria monocytogenes, can reach the fetus through the maternal bloodstream despite placental protective
mechanisms, causing transplacental infection. This process is uncommon, but it leads to either congenital infection not unlike infections caused by certain viruses or *Toxoplasma* or to stillbirth resulting from overwhelming infection.

Initial colonization of the neonate usually takes place after rupture of the maternal membranes (Klein, 2001). In most cases, the infant is colonized with the microflora of the birth canal during delivery. However, particularly if the rupture of membranes lasts longer than 24 hrs, vaginal bacteria may ascend and, in some cases, produce inflammation of the fetal membranes, umbilical cord, and placenta (Bernirschke, 1960; Geme, 1984). Fetal infection can result from aspiration of infected amniotic fluid (Blanc, 1961), leading to stillbirth, premature delivery, or neonatal sepsis (Yoder et al., 1983; Geme, 1984; Gibbs & Dubb, 1991; Hillier et al., 1991). Prober (1997) and Klein (2001) indicated that infection of the mother at the time of birth, particularly genital infection, is the principal pathway of maternal transmission and can play an important role in the development of infection in the neonate. Chiesa and colleagues (2004) reported that transplacental hematogenous infection during or shortly before delivery (including the period of separation of the placenta) is possible, although it seems more likely that the infant is infected during passage through the birth canal. It was further stated that, bacteria can be introduced after birth from the environment surrounding the baby, either in the nursery or at home.

Saez-Llorens (1998) study revealed that many pre- and intrapartum obstetric complications are associated with an increased risk of infection in newborn infants. Many of such are premature onset of labor, prolonged rupture of the fetal membranes, uterine inertia with high forceps extraction, and maternal pyrexia.
Also, sophisticated equipment for respiratory and nutritional support combined with invasive techniques provide life support to the ill infant. It is further indicated that arterial and venous umbilical catheters, central venous catheters, peripheral arterial and venous cannulas, urinary indwelling catheters, hyper alimentation infusions, and assisted ventilation provide enormous opportunities for relatively nonvirulent pathogens to establish infection and to invade the host (Saez-Llorens, 1998).

A study by Freedman & Baltimore (1990) showed that, transient bacteremia may accompany procedures that traumatize the skin and mucosal membranes. Bacteremia was identified in infants who received endotracheal suctioning; the bacteremia was present immediately after the procedure, but culture results were negative at 10 minutes. After invasion of the bloodstream takes place, it may follow multiplication of the organisms in the upper respiratory tract or other foci. As bacteria gain access to the blood stream, mechanisms are activated by the host to eliminate the microbial intruder. Mostly the organism is efficiently cleared by the monocyte-macrophage system after opsonization by antibody and complement. Thus, the bacteremia produces only short-lived illness. At times, however, depending on the age of the patient, the virulence and number of bacteria in the blood, the nutritional and immunologic status of the host, and the timing and nature of therapeutic intervention, a systemic inflammatory response is established that can progress independently of the original infection (Saez-Llorens & McCracken, 1993; Saez-Llorens & Lagrutta, 1993).
2.2 Causative bacteria of neonatal sepsis

Organisms that causes neonatal sepsis are of varied species of gram positive and negative organisms. These are: *Escherichia coli* (*E. coli*), *staphylococcus aureus*, *klebsiella pneumonia*, *coagulase negative staphylococcus*, *haemophilus influenza*, *acinebacter*, *Group B streptococcus* (*GBS*), *Serratia*, *anaerobes*, *candida*, *pseudomonas*, *enterobacter* and *listeria monocytogenes*. According to Patel & Saiman (2010), gram positive organisms causes up to 70% of nosocomial infections in newborns in many hospitals. However, the spectrum of organisms that causes neonatal sepsis changes over time and varies from region to region and even within the same hospital. This is because of the changing pattern of antibiotic use and changes in lifestyle (Shrestha et al., 2007).

2.3 Categories/types of neonatal sepsis

Early-onset sepsis (EOS): It occurs in the first 7 days of birth (maternal intrapartum transmission) according to Cortese et al. (2016). Its onset is acute and progresses rapidly and usually involves multiple organ systems. Early-onset sepsis is associated with acquisition of microorganisms from the mother. Trans placental infection or ascending infection from the cervix may be caused by organisms that colonize the mother’s genitourinary (GU) tract, the neonate acquires the microorganisms as it passes through the colonized birth canal at delivery. The microorganisms most commonly associated with early-onset infection include the following; *Group B Streptococcus* (*GBS*), *Escherichia coli*, *coagulase-negative Staphylococcus*, *Haemophilus influenza*, *Listeria monocytogeness* (Klinger et al., 2009). Other factors that are associated with
EOS according to Arnon & Litmanovitz (2008); Simonsen, Anderson-Berry, Delair & Davies, [Simonsen, et al.] (2014) include:

- Low APGAR score (<6 at 1or 5minutes)
- Maternal fever greater than 38° C
- Maternal UTI
- Poor prenatal care
- Poor maternal nutrition
- Low socioeconomic status
- History of recurrent abortion
- Maternal substance abuse
- Low birth weight
- Difficult delivery
- Birth asphyxia
- Meconium stain
- Congenital abnormalities

Late onset sepsis (LOS): It occurs after the first 7 days from delivery (postnatal acquisition) according to Cortese et al. (2016). This is acquired from the caregiving environment with organisms implicated to cause sepsis such as; coagulase-negative staphylococcus, staphylococcus, aureaus, E.Coli, Klebsiella, GBS, Candida, Serratia, Pseudomonas, Enterobacter, anaerobes, and Acinetobacter (Hoogen et al., 2010). The infant’s skin, respiratory tract, conjunctivae, gastrointestinal (GI) tract, and umbilicus may become colonized from the environment and such colonization to the possibility of LOS from invasive microorganisms. Vectors for such
colonization may include vascular or urinary catheters, other indwelling lines or contact with caregivers who have bacterial colonization (Anderson-Berry, 2015). She reviewed that, the most important risk factor in late-onset sepsis is preterm delivery. Others include;

- Prolonged use of intravascular catheters
- Associated illnesses (which may, however, be only a marker for the use of invasive procedures)
- Exposure to antibiotics (which selects resistant bacterial strains)
- Prolonged hospitalization
- Contaminated equipment or IV or enteral solutions

Gram-positive organisms (e.g coagulase-negative staphylococci and *Staphylococcus aureus*) may be introduced from the environment or the patient’s skin. Gram-negative enteric bacteria are usually derived from the patient’s endogenous flora, which may have been altered by antecedent antibiotic therapy or populated by resistant organisms transferred from the hands of personnel (the major means of spread) or contaminated equipment. Therefore, situations that increase exposure to these bacteria (e.g, crowding, inadequate nurse staffing, or inconsistent provider hand washing) result in higher rates of hospital-acquired infection (Caserta, 2015). LOS there are some factors at home that can lead to a baby acquiring sepsis in the community which are inadequate hygiene, bottle-feeding, poor cord care and prelacteal feeds (AIIMS, 2014). This however made breastfeeding one of the best method to help prevent sepsis among newborns.
2.4 Clinical features of neonatal sepsis

According to Caserta (2015), the early signs of neonatal sepsis are mostly nonspecific and subtle and do not distinguish among organisms (including viral). The most common early signs are:

- Diminished spontaneous activity
- Less vigorous sucking
- Anorexia
- Apnea
- Bradycardia
- Temperature instability (hypothermia or hyperthermia)

Other symptoms and signs include respiratory distress, neurologic findings (e.g., seizures, and jitteriness), jaundice (especially occurring within the first 24 hrs of life without Rhesus or ABO blood group incompatibility and with a higher than expected direct bilirubin concentration), vomiting, diarrhea, and abdominal distention.

2.5 Diagnosis of neonatal sepsis

Diagnosis of neonatal infection has remained a challenge because sick newborns often present with non-specific signs and symptoms and blood cultures (Maternal and Child Survival program, 2017). Therefore, when there is suspected serious infection, the practice is to treat newborns presumptively with antibiotics (Maternal and Child Survival program, 2017).

Caserta work pointed out the need for early diagnosis of neonatal sepsis which is important and requires awareness of risk factors (particularly in LBW neonates) and a high index of suspicion
when any neonate deviates from the norm in the first few weeks of life. Also, neonates with clinical signs of sepsis should have a Complete Blood Count (CBC), differential with smear, blood culture, urine culture (not necessary for evaluation of early-onset sepsis), and lumbar puncture (LP), if clinically feasible, as soon as possible. However, neonates with respiratory symptoms require chest x-ray. Diagnosis is confirmed by isolation of a pathogen in culture (Caserta, 2015). There is an urgent need to know whether the baby has sepsis to institute treatment as quickly as possible. Some real cases of infection will produce negative test results, whereas some babies without infection will test positive, hence the potential usefulness of the test will depend, above all, on the clinical condition of the baby. If the baby is really very sick, the test will not give very much additional information. It is in situations in which the clinical picture leaves the physician in doubt about the infection status that a diagnostic test is likely to be most useful. Thus, the result of a diagnostic test must be evaluated in the light of the clinical condition of the baby (Chiesa et al., 2004).

2.6 Prognosis of neonatal sepsis

A review by Caserta, indicated that the fatality rate of neonatal sepsis cases is 2 to 4 times higher in LBW infants than in full-term infants. It further showed that the mortality rate of early-onset sepsis is 3 to 40% (that of early-onset GBS infection is 2 to 10%) and of late-onset sepsis is 2 to 20% (that of late-onset GBS is about 2%). However, late-onset sepsis mortality highly depends on the causative organisms of the infection for example infections caused by gram-negative bacilli or Candida spp have rates of up to 32 to 36%. Also, extremely LBW infants who develop bacterial or candida sepsis have a significantly greater risk of poor neurodevelopmental outcome aside mortality (Caserta, 2015).
2.7 Prevention of neonatal sepsis

Maternal and Child Survival program documented some strategies to reduce the opportunity for infection by improving intrapartum practices which includes; Hand washing by birth attendants, disinfection and sterilization of equipment, minimization of Vaginal examinations, and prompt diagnosis and treatment of prolonged labour. Also, infection prevention warrants early and exclusive breastfeeding, clean cord care (including umbilical applications of chlorhexidine), improved maternal health and nutrition, maternal and infant immunizations and antibiotics prophylaxis (Maternal and Child Survival program, 2017).

A collaborative initiative on “I am a newborn, keep me clean, help me live” between WHO and other key players such as UNICEF, USAID, MOH and GHS outlined nine (9) ways to prevent newborn infection. These are;

- Wash your hands with soap under clean running water
  - Before handling every newborn
  - Before and after each procedure
  - After visiting toilet

- Disinfect and sterilize all equipment used.

- Clean all contaminated surfaces with the right concentration of disinfectant

- Keep the health facility’s environment (inside and compound) clean and neat always.

- Check Tetanus diptheria (Td) status of every pregnant woman and vaccinate if necessary.

- Support mothers to put the baby to the breast within the first 30 minutes after delivery.

- Encourage caregivers to continue attending child welfare clinic till the child is five years old.
• Remind mothers to attend post-natal clinic two times within the first week.
• Treat mothers and caregivers with respect (WHO, et al. poster)

Some findings also demonstrated that a single application of 4% chorhexidine to the umbilical stump following delivery reduces the incidence of omphalitis and neonatal mortality, especially in preterm newborns (Goldenberg, McClure & Saleem, 2012). However, WHO recommends dry cord for newborns (WHO, 2003).

According to Caserta (2015) neonates who appear well may be at risk of group B streptococcus infection. According to Caserta (2015), all pregnant women should be screened for GBS colonization late in gestation and take the appropriate actions as stated.

2.8 Complications of neonatal sepsis

The short-term consequences of NNS are respiratory failure, pulmonary hypertension, cardiac failure, shock, renal failure, liver function and cerebral oedema. The long-term complications, some of them include; developmental delays, sensory and neurological dysfunction (Milka, 2014).

2.9 Socio-economic factors as risk factors of neonatal sepsis

Newborns of parents of low socio-economic status and staying in poor environmental conditions have an increased risk of acquiring or developing sepsis Adejuyigbe, Adeodu, Ako-Nai, Taiwo & Owa [Adejuyigbe et al.] (2001); Edmond & Zaidi, 2010). Findings from studies of Shah, Budhathoki, Das & Mandal [Shah et al.] (2006) & Siakwa et al. (2012) in Nepal and Ghana respectively revealed that maternal education and employment status had a strong relation to
Women with formal education are more likely to understand issues related to newborn care and hygiene better than those without formal education (Onyedibe et al., 2012). Also, women who are employed and financially empowered may be in a better position to cater for the needs of themselves and their babies like provision of good nutrition that helps to improve their immunity and ability to fight infections (Orwenyo, 2011). Another study by Siakwa and colleagues entitled Risk factors of neonatal sepsis in rural Ghana; a case control study was a contradictory to the study findings above where maternal education and employment were not found to be significant factors to neonatal sepsis (Siakwa, Kpikpitse, Mupepi & Semuatu [Siakwa et al.], 2014).

According to a study finding in Nigeria there was a prove that place of domicile, level of education of mother, poor cord care and poor feeding were factors that contributed significantly to neonatal sepsis (Onyedibe et al., 2012). Study finding from Mwankwo and colleagues also added that poor water supply, poor cord handling and birth outside the hospital with unsupervised antenatal care and delivery have been cited as risk factors for neonatal sepsis (Mwankwo, Shehu & Farouk [Mwankwo et al.], 2011). Onyedibe et al. (2012); Muthwii (2017) shown that neonates can get sepsis due to overcrowding in families and also due to pit latrines vectors can transfer infections to the babies.

In the work of Onyedibe and colleagues, poor feeding of the neonates was a significant factor of sepsis and can worsen the prognosis in neonates due to the further impaired immunity arising from inadequate nutrients received by the neonates and the reduced maternal antibodies transferred from mother to the neonate Onyedibe, et al. (2012). Also, such neonates are predisposed to hypoglycemia which has been identified as an important predictor of neonatal mortality as indicated in some Ugandan and Nigerian studies (Mugalu, Nakakeeto, Kiguli & Kaddu [Mugalu,

type of feeding baby fed (formula feed) was significantly associated (0.011) to NNS.

2.10 Cultural factors as risk factors of neonatal sepsis

be neglected considering the achievement of better neonatal care in developing countries, basically
because most deliveries occur at home and health services may not be available. It was added that,
even those babies delivered in hospitals may be affected by traditional practices after discharge
and these practices have a greater impact on neonatal morbidity and mortality pattern.

Sethi and the colleagues in their study revealed that mothers’/caretakers’ behavior were influenced
by mother-in-law advice, traditional beliefs, and pursuance of a practice because it was the norm
in the community (Sethi et al., 2005).

The use of traditional birth attendants and delivery at home has been associated with higher risk
of newborns developing sepsis especially in developing countries (Bhutta, Darmstadt, Hasan &
Haws [Bhutta et al.], 2005; Ojukwu, Abonyi, Ugwu & Orji [Ojukwu et al.], 2006; Edmond &Zaidi,
2010).This is because home deliveries are done using unsterilized instruments during deliveries
and separation of cord; lack of proper hand washing procedures, dirty and unhygienic delivery
environment as well as improper cord hygiene after birth which exposes the neonate to infective
pathogen (Onyedibe et al., 2012). WHO recommend hand-washing with clean water and soap
before and after handling the infant in the postnatal period to prevent infection (WHO, 1998).
There are some cultural practices for cord care that contribute to incidence of sepsis (Lawn,
Cousens & Zupan [Lawn et al., 2005]. A study in Kenya by Muthwii, (2017) revealed that majority of mothers used cotton and spirit to care for their babies’ cord.

2.11 Lifestyle factor as risk factors of neonatal sepsis

Simonsen et al. (2014) findings saw substance abuse to be a risk factor of NNS.

2.12 Neonatal Factors as risk factors of neonatal sepsis

A study according to Gebremedhin et al. (2016) showed that neonatal factors had a significant effect on the risk of neonatal sepsis. Some factors that are associated with EOS according to Simonsen et al. (2014) include; LBW/prematurity, congenital abnormalities, complicated or instrument-assisted delivery and low APGAR scores (≤6 at 5 minute).

The mean age of neonates at time of study was 2.73 days. The sex distribution was a definite male preponderance of a 70:30 ratios (Sheikh, Javed, Afzal & Sheikh [Sheikh et al.], 2010). Previous works have identified the male gender as an associated factor for neonatal sepsis (Gargi, Neelima, & Abbay [Gargi et al., 2010; Onyedibe et al., 2012; Siakwa et al., 2014). In the work of Siakwa and colleagues, the reason for this is not well explained but some authors have suggested that circumcision, although may reduce the risk for contracting HIV/AIDS in the long round, could be a possible factor contributing to sepsis in males (Centre for disease control [CDC], 2011). Other authors suggest that since the male gender is a risk factor for prematurity and low birth weight (Utomo, 2010; Lawn, Kerber, Laryea & Cousens [Lawn et al.], 2013) and as these factors have also been associated with neonatal sepsis, then it is likely that the relationship between sex and...
neonatal sepsis is mediated by birth weight and prematurity. According to Shahla, Amin, Amir, Susan & Zohreh [Shahla et al.] (2012) death due to neonatal sepsis was significantly higher in the male gender and in low birth weight infants. However, except for urosepsis which may be more common in females, no gender tendency for a particular type of sepsis has been found in any other studies (Jacobi, 2002; Burke, 2009).

An earlier study results by Linda observed 85% of neonates with early onset sepsis present within 24 hours of birth (Linda, 2004). Sheikh et al. (2010) study indicated the mean age of neonates at time of their study was 2.73 days. The findings of a study by Bua et al. (2013) revealed that there was a higher proportion of confirmed sepsis cases among sick newborns in the first week of life, born before term. A Current study by Muthwii (2017) also found 0-7days babies to be significantly associated (0.020) with sepsis. Onyedibe et al. (2012) work observed that 37 weeks and above (term) was recorded in 71.1% of the neonates.

A baby with low Apgar score after birth follows the physiological mechanism that it may be associated with neonatal sepsis and could also show poor adaptation to extra uterine life due to the stress encountered during labour and therefore making them more prone to infection (Simonsen et al., 2014). Earlier studies have indicated Apgar score at 5th minute was significantly associated with sepsis (Al-Dasoky, 2009; Siakwa et al., 2014; Gebremedhin et al., 2016; Jabiri et al., 2016).

2.13 Mothers characteristics as risk factors of neonatal sepsis

Newborns especially preterm, are more susceptible to infections than children at any other period (Camacho, Spearman & Stoll, 2013). Innate immunity is affected by impaired cytokine production,
decreased expression of adhesion molecules in neutrophils and a reduced response to chemotactic factors (Levy, 2007). Also, trans-placental passage of antibiotics starts during the second trimester and achieves its maximal speed during the third trimester (Malek et al., 1996). Also, Camacho, Spearman & Stoll (2013) indicated in their study that the cytotoxic T-cell activity is also impaired during the newborn period. It was further explained that, the multiple skin punctures and invasive procedures that preterm newborns commonly undergo increase even more the risk of infections. Polin et al. (2012) shares similar view that, the premature newborn skin and mucus membrane barrier function is diminished and also compromised in sick premature babies due to multiple invasive procedures, which include placement of invasive fetal monitoring devices, IV access and intubation.

A study finding by Marcdante and colleagues also found that, maternal humoral immunity is capable of protecting the fetus against some neonatal pathogens such as GBS and Herpes simplex virus (HSV). This is done as the neonate acquires the immunity from the mother during pregnancy. They were quick to add that, various deficiencies of the neonatal antimicrobial defense mechanism are more important as a contributing factor to infection than the maternal immune status (Marcdante, Jenson & Berman [Marcdante et al.] (2011).

Previous work by Siakwa et al. (2014) in Ghana which found that about three quarters (84/96) of babies with sepsis cried immediately after birth.

A study finding in Ethiopia by Gebremedhin et al. (2016) in a case control study where more cases had Apgar score of <7 in the 5th minute. Resuscitation according to Fraser, Cooper & Nolte [Fraser et al.] (2006) can be performed on newborn who may not have an established breathing pattern or those who are asphyxiated at birth. It is added that it is aim to improve ventilation in the lungs of
the neonates that will help with tissue oxygenation, correct acidosis, preventing hypothermia and ensure effective circulation.

A study by Onyedibe et al. (2012) in Nigeria shown that, the birth weight of a neonate was a significant factor with neonatal sepsis as evidenced by higher culture positivity amongst low birth weight neonates. It was argued that the fact that the baby was born with a low birth weight could be due to maternal complications such as eclampsia or pre-eclampsia, PROM or maternal infections. Moreover, Onyedibe and colleagues further indicated that; low birth weight could also be as a result of maternal malnutrition and recurrent maternal illness compounded with inaccessibility to healthcare facilities for ANC and management of the recurrent maternal illnesses (Onyedibe et al., 2012).

In the study of Sheikh and colleagues (2010), reluctance to feed (65 %), temperature instability (36 %), respiratory distress (45 %), lethargy (48 %), fever (36 %) and seizures (15 %) were common presenting complaints from mothers of neonates with sepsis. Also, a study by Metzger and colleagues showed that fever was common in newborns 1-4 days of age, delivered by Caesarean section (Metzger, Mazkereth & Kunit [Metzger et al.], 2003). A similar study by Fok, Ng & Chan (1990) shows that about 50% of the babies with proven sepsis were febrile, 15% were hypothermic while remaining were normothermic.

Circumcision is a minor procedure to remove the foreskin (the sleeve of skin around the head of the penis). This according to Marie Stopes (2015), can avoid moisture getting trapped between the penis and the foreskin which creates an ideal environment for bacteria to grow.

Study findings by Marcdante et al. (2011) proved that genetic factors of the neonate have been implicated in the ability of a bacteria to cross the blood brain barrier. The penetration was noted for organisms such as *GBS, E. coli, listeria, citrobacter* and *streptococcus pneumonia*. 
2.14 Maternal factors as risk factors of neonatal sepsis

Various studies have revealed that the dominant young adult age category that is less than 20 years’ mothers are at higher risk with neonates with sepsis as compared to their counterparts in other age category (Siakwa et al., 2014; Muthwii, 2017). One reason for that was challenges the young mothers may face with in relation to new born care which could result in the baby contracting NNS (Muthwii, 2017). The study by Muthwii (2017) in Kenya results did not find maternal age to be significantly associated with neonatal sepsis.

Results from Muthwii (2017) study on characterization of neonatal sepsis among patients admitted in Kenyatta national hospital, Kenya found that over 80% of mothers with their babies with sepsis had achieved level of education higher than primary level. This means that majority of the people have embraced formal education as a form of intellectual development and could also show the appreciation for girl child education. Siakwa et al. (2014) a Ghanaian study and Onyedibe et al. (2012) a Nigerian study showed that majority of mothers with their neonates with sepsis attained primary level education.

A study by Onyidibe et al. (2012) shows that mothers of 44.3% of neonates with culture proven sepsis were resident in urban locations. Also, a study by Gebremedhin et al. (2016) found place of residence not to be a predictor of NNS.

A qualitative study by Sossou (2006) in Ghana indicated that women work out of dire necessity for the survival of their families, most especially for their children by toiling under extreme economic conditions. Muthwii (2017) reported an alarming unemployment rate of (47.1%) among mothers thereby making them economically dependent on other economic network system.

A study in Ghana shown that the largest number of children per woman is found in the rural areas where the traditional concept of family was strongest and also uneducated urban women had large
families compared to average, urbanized, educated and employed women had fewer children by Sossou (2006). Research findings of Muthwii (2017) stated that majority of mothers with number of children was below three. Her findings further saw that number of children a mother has was not associated to neonatal sepsis (Muthwii, 2017).

Place of delivery, 41% of neonates were delivered at home and 59% at private clinics or public hospitals (Sheikh et al., 2010). A study finding from Nigeria by Onyedibe et al. (2012) revealed that hospital was the commonest place of birth with 87.5%. Home delivery is a risk factor for development of NNS because of suboptimal hygienic environment of delivery rooms (Ashiq & Jamal, 1996). Earlier studies have showed majority of mothers with neonates with sepsis were delivered SVD (Gebremedhin et al., 2016; Muthwii, 2017).

Studies have revealed that more than half of sepsis cases were born to mothers who had a history of urinary tract infection (UTI) / sexually transmitted infection (STI) during the index pregnancy with five times higher odds of developing sepsis compared to neonates born to mothers who did not have a UTI/STI diagnosis (Gebremedhin et al., 2016; Muthwii, 2017; Woldu, Guta, Lenjsa, Tegegne, Tesafye & Dinsa [Woldu et al.], 2014).

Maternal history of abortions has been found to be a risk factor for neonatal sepsis (Siakwa et al., 2014; Simonsen et al., 2014). Also, a case control survey that aimed to investigate the relationship between history of induced abortion and preterm delivery in the Europe, it was shown that previous induced abortions were significantly associated with preterm delivery and the risk of preterm birth increased with the frequency of abortions (Ancel, Lelong, Papiermik, Saurel-Cubizolles & Kaminski [Ancel et al.], 2004).

According to Bua et al. (2013) a study in rural eastern Uganda shown that the odds of sick newborns whose mothers never attended antenatal at the health facility were three times higher
than those whose mothers did attend, to have blood culture confirmed sepsis. Also, the odds of sick newborns whose mothers received no treatment for bacterial infection during the antenatal period were three times higher than those whose mothers were treated, to have blood culture confirmed sepsis. A study in Rio de Janeiro, Brazil showed that neonates whose mothers had less than six antenatal visits were under risk significantly higher for early-onset neonatal healthcare associated infection (Mizumoto et al., 2015). In contrast, a study finding by Siakwa et al. (2014) in rural Ghana and Gebremedhin et al. (2016) found that a number of ANC/History of ANC was not a factor associated with neonatal sepsis. However, the main aim of ANC is to prepare women for birth and motherhood as well as manage, check, identify and alleviate the three types of health problems during pregnancy that affect mothers and babies. These include complications of pregnancy, pre-existent conditions that worsen throughout the pregnancy period and the effects of unhealthy lifestyle (Lincetto, Monthebesoane-Andoh, Gomez & Munjanja [Lincetto et al.], 2006).

A standard of four (4) antenatal visits is recommended for a healthy pregnant woman from a skilled health care (World Health Organization [WHO], 2002). Findings from Muthwii (2017) showed 69% of mothers started their first ANC in the second trimester. She further explained the implication as that, pre-conception as well as first trimester interventions were missed among these mothers. Her finding did not show the gestational trimester ANC started to be associated with NNS.

Studies have shown that maternal age is a significant factor on neonatal sepsis. Women aged 21-30 years were less likely to have infants with neonatal sepsis compared to those aged less than 20 years (Jabiri et al., 2016; Siakwa et al., 2014). Contrary to this, a study by Muthwii (2017) in Kenya revealed that maternal age was not significantly associated with neonatal sepsis.

Parity of women remains a significant factor in contributing to newborn sepsis. The primigravida were more likely to have neonates with sepsis compared to multiparous women (Siakwa et al.,
However, Gebremedhin and the colleagues (2016) study in Ethiopia demonstrated that parity was not a predictor of NNS.

Premature rupture of membranes is a significant factor on sepsis. Women who had premature rupture of membranes were more likely to have newborn with sepsis compared to those without (Chacko & Sohi, 2005; Glorgiana, Ioan, Ioan, Marioara, Elena, Calin, & Nilima, [Glorgiana et al.], 2010; Shah et al., 2006; West & Tabanssi, 2012).

GBS has been known to cause 95 % of neonatal sepsis. A history of previous infant with GBS infection is another identified risk factor in subsequent pregnancy (Faxelius, Bremme, Kvist-Chritensen, Christensen & Ringertz [Faxelius et al.], 1988; Zaleznik, 2000).

Health education to mothers during antenatal period about their pregnancies after delivery and their baby care had lessor odds of their sick newborns having blood culture confirmed sepsis than those who did not receive health education (Bua et al., 2013).

Previous studies have reported intrapartum fever as a significant factor on neonatal sepsis (Hasan & Mahmood, 2011; Alam, Saleem, Shaikh, Munir & Qadir [Alam et al.], 2014). Intrapartum fever is an indication of maternal infection that can be passed on to the baby during birth or in utero through the mothers’ birth canal and results in EOS (Soman, Green & Daling, 1985; Hasan & Mahmood, 2011).

Muthwii study observed that 74 % of mother’s liquor color was clear while 20.6 % was greenish. Her advance analysis further proof of mother’s liquor color greenish to be significantly more proportion of severe neonatal sepsis (63.6 %, P=0.006) compared to those with clear liquor. A Nigerian study revealed that, 37 weeks and above (term) was recorded (71.1%) in neonates with sepsis (Onyedibe et al., 2012). Christina and colleagues concluded in their study that premature
infants were more susceptible to hospital – acquired infections as opposed to those with a normal gestational age (Christina et al., 2015). Muthwii (2017) findings in Kenya revealed that majority of mothers did not experience any medical illness during their pregnancy.

2.15 Health care factors as risk factors of neonatal sepsis

Health-care associated infections represent a significant factor for neurological complications and death, which is aggravated by an inevitable prolonged hospital stay (Legeay, Bourigault, Lepelletier, Zahar [Legeay et al.], 2015). It is estimated that 85% of all neonatal intensive care units harbor nosocomial pathogens due to transgressions of infection and prevention (IPC) principles (Uwaezuoke & Obu, 2013). Evidence by Patel & Saiman (2010) shown that, gram positive organism’s causes up to 70% of nosocomial infections in newborns in many hospitals.

An Ethiopian study on risk of neonatal sepsis saw that a significant number of neonates born in health centre had a 4.2 times higher chances of developing NNS when compared to the neonates born at home (Gebremedhin et al., 2016). A study in Bishoftu & Oromia (in Ethiopia) shown a proportion of neonates who were born at health center had higher risk compared to home delivery (Woldu et al., 2014). The reason given to this was based on health center inability to screen base on risk approach and to treat with intrapartum antibiotic prophylaxis (Edmond & Zaidi, 2010).

VEs in labor is a routine part of intrapartum care. A finding by shepherd et al. (2013) study revealed approximately half of the sample 52% had 3 or more VEs during labor. Also, at most 70% of women had more VEs than expected when the criteria of 4 hourly VEs was applied. The commonest reason given by midwives for performing a VE was to assess labour progress and to assess the commencement of labor.
However, every time VE is done, there is the potential for bacteria to be pushed up to the vagina and toward the cervix. It is more a concern when the amniontic sac has released, as there is no protection for your baby against potential infection. (Sam, 2018). A study finding in Kenya revealed that frequency of VEs done during labour, 24.3% were done more than four. She commented that this is more than the recommended four VEs through the process of labour (Muthwii, 2017).

For some years now more concern has been raised on the risk of cross infection in NICUs (Yasmeen et al., 2012). Risk factors that result in an increased incidence of nosocomial infections are contaminated water, poor physical designs of NICUs, overcrowding of neonates and staff shortages resulting in an inadequate nurse-patient ratio, as well as poorly implemented antibiotic policy and infection prevention and control programmes (Uwaezuoke & Obu, 2013). Neonates admitted to health facilities with other notable risk factors include; age at admission and history of instrumentation or invasive procedures are some health factors to sepsis (Gargi et al., 2010; Mohammad, 2011; Nithin, Nithin, & Nitha [Nithin et al.], 2009; Yelda, Jose, Juan, Ulises, Nidia & Etna [Yelda et al.],2012).

Moreover, newborn infections can come from hospital or home environment where poor hygienic delivery practices and quality of neonatal care exposes them to environmental pathogens during and after delivery (Ganatra, Stoll & Zaidi, 2010). Most facilities do not have adequate running water for cleaning and disinfection and even some facilities are not able to properly sterilize multiple used equipment and overcrowding of wards predispose many hospitals in developing world to infection (Ganatra & Zaidi, 2010).
Also, Thaver & Zaidi (2009) revealed that lack of laboratory facilities, medical supplies, inequities in service provision, inadequate health funding are some of the health factors that contribute to severity of newborn sepsis.

Moreover, previous studies have found that late-onset sepsis is related to the stay of newborns in NICU where they are exposed to the use of peripherally inserted central catheter (PICC), mechanical ventilation and parenteral nutrition (Merchant, Boyce, Sadarangani & Lavoie [Merchant et al.], 2013; Romanelli et al., 2014). These findings have proved that, the stated factors contribute to the increase in the risk for infections in NICU, as a result of exposure to several invasive procedures that often required in the treatment of their conditions (Hsieh et al., 2012; Tragante, Cecon, Falcao, Seiti, Sakila, & Vieira [Tragante et al.], 2008). Previous researches have indicated that nurses may not be knowledgeable about how to care for intravenous cannula in situ, regarding its cleaning or how long it is supposed to be in position in the work of Siakwa et al. (2014). Cecilia and colleagues in a review study concluded that the following factors are related to the NICU setting contributing to neonatal sepsis which include; the average length of hospital stay, use of invasive devices such as PICC, invasive mechanical ventilation and parenteral nutrition, which are aggravated by the immunological immaturity of the newborns (Cecilia, Juliana, Regimar, Alexandra & Nuba [Cecilia et al.], 2016). Previous study has implicated IV line access as a risk factor for neonatal sepsis (Camacho, Spearman & Stoll, 2013).

Health education to mothers during antenatal period about their pregnancies after delivery and their baby care had lessor odds of their sick newborns having blood culture confirmed sepsis than those who did not receive health education (Bua et al., 2013).
2.16 Theoretical framework (Social ecological model of health behavior)

2.16.0 Introduction

The Social Ecological model was adopted to explain the objectives of the study.

According to UNICEF (2015) the Social Ecological model is a theory-based framework for understanding the multiple and interactive effects of personal and environmental factors that determine behaviors, and for identifying behavioral and organizational leverage points and intermediaries for health promotion within organizations.

The ultimate goal of the study is to reduce neonatal mortality by tackling it from the neonatal sepsis point as a major cause of neonatal death and prevention requires the understanding of underlying factors that can lead to neonatal sepsis. This model comprises complex interrelation between the individual, relationship, community and societal factors. It gives a comprehensive explanation with its overlapping rings (shown below) to the various factors that contribute to newborns being at risk of neonatal sepsis that can result in neonatal deaths and therefore improvement of neonatal and maternal health is a key and need to be looked at, at all levels in society at the same time. The model approach will sustain the improvement and prevention efforts of the problem under studied than using single intervention approach.
Source: Center for Disease Control and prevention CDC, 2015

It has a logical link between the four levels of the model which is directly proportional to the intervention strategies that are put at each level such that if one intervention strategies not being instituted will not yield a desired result. For instance, at the biological level if strategies are not put in place cannot lead to good outcomes of reducing neonatal sepsis, so to the interpersonal level, to the community and to the policy level.
2.16.1 Individual level

This is the first level of the model and it identifies biological and personal factors that increase the risk of individual babies developing sepsis after birth and can die from it. These include the age categories, genetic make-up of the various categories of neonates and mothers which make them susceptible to suffering neonatal sepsis that can lead to death. Prevention strategies at this level are mostly geared toward promoting attitude, behavior and belief such as good attitude toward health, managing stress, and practicing good eating habit that can improve the health of mothers and neonates.

2.16.2 Interpersonal /relationship level

The second level establishes close relationships that can increase the baby risk of neonatal sepsis. The model explains the individual babies and their mother’s relationship with the culture of the family members that influence the health of both neonate and mother and how the lifestyle behavior or relation of the people around the women during pregnancy and after birth which makes their babies acquire neonatal sepsis. For instance, the culture of nutrition taboos for mothers during pregnancy reduces baby immunity when born and makes baby not to be able to fight infections. Also, some cultural practices on newborn care is a source of infection for babies. Intervention strategies at this level include educating individuals and the public on the importance of good lifestyle behaviors and newborn care, promoting healthy relation and discouraging families from harmful cultural practices such as application of shea-butter on babies cord, administration of herbs to babies to treat certain diseases like stomach upset, diarrhea and malnutrition and promoting
cultural practices such as application of shea-butter to babies skin after bathing which insulates the baby’s skin and provides warmth to the baby.

2.16.3 Community level

The third level explains the features of the location such as work place and neighborhoods that the individual baby and mother relate with that can promote or affect the health of both baby and mother as far as neonatal sepsis is concern. Prevention strategies at this level are geared toward improving working environment, processes and policies at work place and homes to promote the health of mothers and babies.

2.16.4 Societal/ policy level

This is the fourth and last level of the model and it explains the broad societal factor that can promote the health of neonate and mother. They include social and cultural norms that promote health and also economic, educational, health and societal policies. Some of such government policies are providing more health facilities and upgrading them and including newborn care centres and Newborn Intensive Care Units (NICU) in some health facilities across the country, promoting newborns and maternal specializations and formation of baby friendly facilities, exclusive breastfeeding and among others are all measures to improve on the health of babies and mothers.
2.17 Conceptual framework of the study on neonatal sepsis

Immediate causes
- Staphylococcus
- Listeria
- E. coli
- Streptococcus
- Klebsiella
- Pseudomonas

Underlying factors/factors contributing
- Maternal
- Neonatal
- Socioeconomic, cultural and lifestyle
- Health care

Basic/root causes
- Ignorance
- Illiteracy
- Poverty
- Inadequate resources

Source: A modified framework from UNICEF (2013)

The conceptual frame has five main concepts which are explained below:

Immediate causes: The immediate causal agents/bacteria of neonatal sepsis are gram positives and gram negatives. These bacteria include streptococcus strains, listeria, Escherichia coli (E. coli), staphylococcus and klebsiella.

Underlying factors/causes: The underlying factors are means the agents can pass through to the person (newborn) to cause neonatal sepsis. These factors include neonatal, maternal and health care.
Basic/Root causes: These are the root causes of the problem (sepsis). The root causes are ignorance, illiteracy, poverty and inadequate resources which put neonates at risk to acquire sepsis.

Short-term consequence: The short-term consequences of neonatal sepsis are morbidity, mortality and disability. The mortality rate due to neonatal sepsis can make the country not meet Sustainable Development Goal three. The effect of having a child with disability has many consequences on the family.

Long-term consequence: The long-term impact of neonatal sepsis is that the baby may grow to have poor cognitive ability and thereby leading to decrease in economic productivity.

This study considered the underlying factors/ causes (in the above conceptual framework) contributing to neonatal sepsis among neonates admitted at the NICU of the Tamale Teaching Hospital.
CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter covers the research design and methods used to conduct the study. The study examined the risk factors of neonatal sepsis (NNS) among newborns in the neonatal intensive care unit (NICU) of Tamale Teaching Hospital. The area where the study took place is also elaborated as well as data collection techniques used to sample, collect and analyze the data.

3.1 Research setting

Research setting; It is where the study is carried out. This is a hospital-based study. The study was conducted in the neonatal intensive care unit of the Pediatric Department of the Tamale Teaching Hospital in the Northern region of Ghana. It is one of the four teaching hospitals in the country and the only teaching hospital in the Northern part of Ghana. The Tamale Teaching Hospital provides tertiary health services to Northern, Upper West, Upper East and some parts of Brong Ahafo region. The hospital is located at the Eastern part of Tamale Metropolis along the Tamale-Yendi/Salaga road. It shares boundaries with Kukuo to the East, Tutingli to the North, Dabokpaa to the South and Dohinayili to the West in the Tamale Township.

The hospital was originally commissioned in 1974 as a Regional Hospital. It became a teaching hospital in the year 2005. It has four hundred and fifty (450) bed capacity according to the hospital 2017 performance review. It provides specialist services in Obstetrics and Gynaecology, Surgery, Orthopedics and trauma, Internal medicine, Child health, Pathology, Ear, Nose and Throat,
Endoscopy, Neurosurgery, Anaesthesia and Intensive care, Psychiatry, Dentistry and ophthalmology. The hospital also provides general in-patient and outpatient services with auxiliary non-clinical services like the administration and finance.

The hospital serves as the main teaching hospital for the School of Medicine and Health Sciences of the University for Development Studies. The hospital has been mandated (by Act 525 of the Ghana Health Service (GHS) and Teaching Hospitals Act of 1996) to develop and ensure the provision of advanced clinical health service, to support training for both undergraduate and postgraduate medical professionals and to undertake research in to health issues to support a healthier Ghanaian population.

The NICU is a unit under the Pediatrics department of the hospital which provides both inpatient and outpatient services for babies aged up to 28 days. It’s been operating in the current location since April 2015 when the new unit was commissioned. The unit has 40 beds/cribs and admits an average of 180 babies per month.

3.2 Study design

Research design means an outline, plan or strategy used by the researcher in order to get answers to the research questions (Atindabila, 2013). A prospective, descriptive, cross-sectional mixed method study design was employed in answering the research question “what are the factors contributing to neonatal sepsis among neonates admitted in the NICU of the Tamale Teaching Hospital? Cross-sectional design; is where the data of the people is captured at one point in time.

This is because it is practical, relatively economical and easy to manage (Atindabila, 2013). The general aim of a mixed study is to both quantify and also understand the problem or the
phenomenon from a perspective. This method usually aims to address questions about the ‘what’, ‘how’ or ‘why’ (qualitative method) and ‘how many’ or ‘how much’ (quantitative method) (Bricki, 2007). This approach was considered based on the kind of data the researcher sought to address the research questions.

3.3 Target population

Target population; Refers to the entire set of individuals who meet the sampling criteria (Atindanbila, 2013). The target study population in the area under studied was a mother with her neonate diagnosed with neonatal sepsis and the baby is undergoing treatment at the NICU of TTH. Key informants were eight comprising of nurses and doctors who worked in NICU, ANC, Labor, Maternity (pre-natal and post-natal) and theatre. This is because they handle neonates and pregnant women which had factors related to the topic under studied. Key informant should have at least six (6) months working experience.

3.4 Inclusion criteria

Mothers of babies who were clinically diagnosed of sepsis with two or more of the following clinical signs and on admission at the NICU of TTH;

- Diminished spontaneous activity
- Vomiting
- Jaundice
- Less vigorous sucking
• Anorexia
• Apnea
• Bradycardia
• Temperature instability (hypothermia or hyperthermia)

Mother’s baby should be below twenty-eight (28) days and a mother who consent to partake in the study. Key informants who have at least six (6) months working experience with neonates/pregnant women and were currently working in the selected units and consented to the study.

3.5 Exclusion criteria

A mother whose baby was not clinically diagnosed with sepsis, an infant older than 28 days but diagnosed with sepsis. Key informants with less than six months’ experience and are not working in the selected units.

3.6 Sample size determination

Sample size determination is an act of choosing the number of observations to include in a statistical sample (Atindanbila, 2013). This is to enable the researcher make inferences about a population from a sample. The sample size determination was according to Yamane’s (1969) sample size formula. The number of babies admitted with NNS in a month is averagely 38. The data collection took two and half months.
Therefore, the total number of babies admitted with NNS was averagely 94 (NICU monthly report, 2017), out of this a sample of 77 was taken. Below is Yamane’s (1969) formula used to get the sample size.

\[ n = \frac{N}{1+N(e)^2} \]

Where;

- \( n \) = the sample size
- \( N \) = total population of cases for the period.
- \( e^2 \) = margin of error

\[ N = 94 \]
\[ e^2 = 0.05 \]
\[ n = \frac{94}{1+94(0.05)^2} \]
\[ = \frac{94}{1+0.23} \]
\[ = \frac{94}{1.23} \]
\[ = 76.42 \approx 77 \]

### 3.7 Sampling technique

A simple random sampling technique was used to collect quantitative data. This was to allow every mother equal opportunity to be part of the study. Simple random sampling probability method was used; this method is used when the study population is small (Atindanbila, 2013). This was
done by writing on slips of paper according to the sample size Yes and some No, mixed them up and put in a container. Each day when a qualified baby is identified, the mother who is the potential participant picks one of the slips and if it is yes, then forms part of the study after consenting. This was done till the desired sample size was gotten.

The qualitative study used purposive sampling method to select participants (key informants) for the study. Purposive sampling also known as judgmental/ expert sampling is non-probability sample which the researcher selects a sample of elements (participant) that represents a cross-section of a population in a nonrandom manner (Lavrakas, 2008). This was chosen to help the researcher to deliberately recruit clinical staff working at the hospital to give needed data in the subject matter per their working experiences. Eight key informants (one (1) doctor (pediatrician), three (3) nurses and four (4) midwives) were purposively selected and were NICU nurse in-charge, Doctor in charge, one representative of NICU (nurse), a representative of ANC (midwife), pre-natal (midwife), post-natal (midwife), labour (midwife) and theatre (theatre nurse).

3.8 Data collection tool/instrument

The quantitative study research collection tool that was used was questionnaires. The questions construction was closed- ended and some few open- ended. The questionnaire was put into four parts.

Part one: Socio-Demographic data of mother and newborn

Part two: Maternal factors posing as risk factors of neonatal sepsis

Part three: Neonatal factors posing as risk factors of neonatal sepsis
Part four: Health care factors posing as risk factors of neonatal sepsis

The qualitative study data was collected by face-to-face interview using an interview guide. Eight key informants were purposively selected and were interviewed (NICU nurse in-charge, Doctor in charge of the NICU, one representative of NICU (nurse), in-charge/a representative of ANC (midwife), pre-natal (midwife), post-natal (midwife), labour (midwife), and theatre (theatre nurse)). They had at least six (6) months experience in their respective units. These wards/units were part because the units all have roles that they can play in order for a neonate to acquire sepsis. The interview that was conducted was based on the objectives of the study.

3.9 Training of research assistant

Two research assistants who were registered nurses and one of them was pursuing her masters were trained to aid in the data collection process.

3.10 Pre-testing of the study instrument

The data collection tool was pre-tested with two mothers in a different hospital (Tamale Central Hospital). The qualitative study was also pre-tested with one key informant at the same facility. The purpose of the pre-test is that it will help the researcher to make amendment to the questions if there is the need. It will also give an opportunity to the data collection (research assistants)/translator to familiarize himself/herself with the study tools.
3.11 Sources of data

Data were gathered from both primary and secondary sources. The primary source of data was obtained from the interview that was administered to mothers and key informants and data from antenatal and child welfare cards that was served as ‘first hand’ data. The secondary data were collected from the internet through the use of search journals, articles, and annual reports and was also served as ‘second hand’ data.

3.12 Data collection procedure

An introductory letter from UDS was sent to the research department of TTH. When permission was granted, the researcher met the staff (head of unit (doctor) and two nurse in-charges) of NICU and briefed them the purpose of the study and solicited their support.

3.12.1 Recruitment process

Participants eligible for the study were mothers whose babies met inclusion criterion. These babies were recruited from the TTH Neonatal Intensive Care Unit. When a baby met the inclusion criteria, the mother was given information on the purpose of the study and procedures for consenting began. Their ANC card, Child Welfare Card as well as medical records was used to help collect the data. Key informants who met the inclusion criteria were informed of the aim of the study to enable them support the study.
3.12.2 Consenting

When the research assistant got in contact with a participant, the research assistant introduced self and invited her to partake in the study. The research assistant explained to her what it entails to participate in the study and to help her give an informed consent. The key informant interview, participants were given information on the study to read and if accepted, sign a consent form. The interviews were audiotaped from key informants to aid in the analysis of the data.

3.12.3 Data collection interview procedure

After meeting every prospective participant, the purpose of the study was explained to her. When she agrees, face to face interview was conducted in a room within the unit using a structured questionnaire which was asked by the research assistant and response given by the respondent and he fills in the appropriate response.

The researcher with another research assistant also conducted an interview with eight key informants on the topic which was audio-taped to help in analysis.

The questions and interview were administered through the language that both respondent and researcher/translator are fluent in.

3.13 Data management

Upon collection of data after interviewing mothers with babies suffering from neonatal sepsis in the NICU each day, the researcher checked to ensure that questionnaires were well completed. While being in the field, the data was obtained through questionnaire administration. Data from
each day trip to field were stored in a much secured place. Following the completion of data analysis and presentation of findings, all paper works, audio and questionnaire containing participants were immediately kept save.

### 3.14 Data processing

Data was coded and analyzed using SPSS version 20.0 computer software. This software analyzed the data by grouping the key variables that were identifiable to the information gathered from respondents. Through this, the study was able to come out with clear picture of the thematic areas of neonatal sepsis. Moreover, non-parameters which in other ways are related to neonatal sepsis within the Tamale Teaching Hospital were also identified.

### 3.15 Data analysis and presentation of findings

Frequency distribution, percentages and bar charts were used for simple reporting purposes and easy understanding by readers. With the graphical illustration of the answers given by respondents, ample interpretation and explanation were given to them to make them more meaningful to readers. In addition, bivariate correlation (0.05 significant level) coefficient was used to establish the relationship between variables and neonatal sepsis. Multivariate logistic regression was further used to establish the association of confounders (variable responses) with neonatal sepsis. The qualitative data was analyzed through thematic content analysis (sorting, categorization and formed sub-themes and themes).
3.16 Validity and reliability of the study

3.16.1 Research validity

Validity in research means to the extent in which the data collection instrument/ tool or one scientific observation measure or collect what it intends to measure (factors) to neonatal sepsis. Content validity was done by ensuring that the questionnaires are made available to my supervisors and colleagues’ students to go through for corrections. Also, study tools were pre-tested at Central hospital NICU to further correct all errors that are likely to be faced during data collection. Furthermore, data collection assistant was taken through a two-hour time training, also took part in the pre-test exercise to enable him have the practical experience on the tools that will help the data to be valid. After necessary corrections made in the study tool, data collection begun.

3.16.2 Reliability of the study

Reliability in research means the consistency of results when experiment is replicated under the same conditions (Psucd, 2011) or when findings are repeated that is if one carries out the same study again, and it gives the same results. The study ensured mothers consent voluntarily to be part of the study this is to enable them to genuinely contribute to the subject matter. Also, mothers were explained to their understanding the language that they understood.
3.17 Ethical consideration

Permission was sought from the research department at Tamale Teaching Hospital after an introductory letter from University for Development Studies was submitted. The researcher applied the principles of conducting a medical research. These include informed consent and confidentiality, risk and benefits.

**Informed consent and confidentiality**

To be able to achieve consent, the researcher or assistants first introduced self to each subject and enquired about how she and the baby are fairing and that of their families in line with the customary greetings of the people. The study purpose, risks and benefits were then explained in the local language (Dagbani) or English or the language of participant of which the research assistants or researcher were fluent and they were allowed to make an informed decision either to accept or not. Confidentiality was paramount to the study and was adhered to. This was done by ensuring that the names of participants were not documented anywhere in the study as well as any other data that can trace to her. The study was explained to every participant and everything was done with their permission. The participant was explained to, her right to withdraw from the study or decline to any question they considered inappropriate and were given an ample time to decide whether to form part of the study in order not to impose anything on her. Their voluntary consent in the end was sought and participants thumb printed or signed a consent form to participate in the study.
Beneficence and risk

**Beneficence in research principles means** an ethic in research which mandates a researcher to have his or her research participant’s welfare paramount in research study. This is to avoid maleficence which is an act that opposes the welfare of any research participant.

**Risk in research principles refers** to the probability of harm or injury (physical, psychological, social, or economic) occurring as a result of participation in the research study.

This study had no direct or immediate benefits for participants. Studying the potential risk factors of neonatal sepsis, will inform health care policies in the hospital. Participation in the study equally entailed little or no risk at all for subjects. Although it never manifested, some respondents however, might have felt uncomfortable in sharing their encounter either family or hospital-based life experiences with someone who is a stranger.

3.18 Study limitation

The researcher acknowledges some limitations of the study. These are as follows;

1. **Sample size:** The sample size of the study was relatively small and as a result, the sample may not be a true representation of the general populace and hence generalization of the results should be done with caution though some findings are consistent with some earlier study results in the continent.

2. **Culture test:** The inability to do laboratory test to culture organisms from neonates for confirmation of diagnosis but heavily dependent on clinical diagnosis using signs of sepsis was a weakness of the study as some cases could be wrongly diagnosed by medical staff.
CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the study results. The study assessed 77 mothers of babies who were clinically diagnosed and were undergoing treatment for sepsis. The presentation covers the descriptive analysis of the following factors of the study as; the socio-demographic data of mother and newborn, maternal, neonatal, and health care. A correlation (0.05 significant level) coefficient was used to establish the relationship between variables and neonatal sepsis. Multivariate logistic regression was further used to establish the association of confounders (variable responses) with neonatal sepsis. Also, recommendations from mothers and key informants are also presented. The interview from key informants in the hospital findings were also put in to categorize and themes with some supporting quotes presented under each objective. The socio-demographic data of newborns and mothers are firstly presented and followed in order as stated above

4.1.0 Socio-demographic data

The study sought responses on the socio-demographic data of both newborn and mother to determine common demographic factors that are posing as risk factors for neonatal sepsis. The results obtained in that regard are presented below.
4.1.1 Newborn socio-demographic data

Under this category, respondents indicated age of baby, sex of baby, birth position of the baby in question among others. The below table presents the results obtained in that regard.
### Table 4.1 Distribution of newborn socio-demographic data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex of baby</td>
<td>Male</td>
<td>46</td>
<td>59.7</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>31</td>
<td>40.3</td>
</tr>
<tr>
<td>Age of baby</td>
<td>Less than 24 hours</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>24 hours - 2 days</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td>3 - 6 days</td>
<td>29</td>
<td>37.7</td>
</tr>
<tr>
<td></td>
<td>7 - 14 days</td>
<td>27</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>15 - 21 days</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>22 - 28 days</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Baby discharged from hospital before sickness started</td>
<td>Yes</td>
<td>43</td>
<td>55.8</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>29</td>
<td>37.7</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>5</td>
<td>6.5</td>
</tr>
<tr>
<td>When sickness started after delivery</td>
<td>Within 24 hours</td>
<td>14</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>24 hours - 3 days</td>
<td>40</td>
<td>51.9</td>
</tr>
<tr>
<td></td>
<td>4 days - 7 days</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td>8 days - 14 days</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>15 days - 28 days</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Birth position of baby</td>
<td>First</td>
<td>23</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>32</td>
<td>41.6</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>15</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>7</td>
<td>9.1</td>
</tr>
</tbody>
</table>

**Source:** Field survey, 2018

Out of the 77 respondents sampled for the study, 46 representing 59.7 % indicated their babies were males whereas 40.3 % (31/77) indicated their babies were females. Of the 77 babies suffering from neonatal sepsis, 3 (3.9 %) were less than 24 hours of age, 13 representing 16.9 % fell within
the age category of 24 hours to 2 days, majority 37.7 % of the babies fell in the age category of 3 to 6 days whereas 35.1 % fell within the category of 7 to 14 days. Also, 5.2 % of the babies were within the age category of 15 to 21 days whilst one baby (1.3 %) was between 22 to 28 days.

Information sought to find whether babies were discharged from hospitals before the sickness (neonatal sepsis) started or not revealed that most (55.8 %) were discharged from hospitals before sickness started whilst 37.7 % of the respondents indicated they were not certain as to whether sickness started in the hospital or at home after they have been discharged. However, 6.5 % of the respondents were not asked to provide information on this particular question because they did not deliver their babies at the hospital.

On time sickness started, 18.5 % respondents pointed out their babies’ sicknesses started within 24 hours after they had delivered whereas majority 51.9 % indicated their babies’ sicknesses started within a time range of 24 hours to 3 days. A percentage of 16.9, 5.2 and 7.8 of the respondents showed their babies’ sicknesses started within the time range of 4 days to 7 days, 8 days to 14 days and 15 days to 28 days respectively.

About 29.5 % of respondents indicated the birth position of their babies were first whereas 41.6 % of their babies’ birth positions were second. Also, 19.5 % of respondents’ babies’ birth positions were third whilst 9.1 % of respondents’ baby’s birth positions were others (Above three).

4.1.2 Mother’s socio-demographic data

Responses were sought from respondents on their ages as at the time they delivered their babies in question; educational level, occupation, places of residences among others. The result is presented below in the following table.
Table 4.2 Distribution of mother’s socio-demographic data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s age at delivery</td>
<td>Less than 20 years</td>
<td>17</td>
<td>22.1</td>
</tr>
<tr>
<td></td>
<td>21 - 30 years</td>
<td>46</td>
<td>59.7</td>
</tr>
<tr>
<td></td>
<td>31 - 40 years</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td>Educational level</td>
<td>Illiterate</td>
<td>10</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>19</td>
<td>24.7</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>31</td>
<td>40.3</td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>17</td>
<td>22.1</td>
</tr>
<tr>
<td>Occupation</td>
<td>Employed</td>
<td>10</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>Self employed</td>
<td>32</td>
<td>41.6</td>
</tr>
<tr>
<td></td>
<td>Not employed</td>
<td>25</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>Student</td>
<td>10</td>
<td>13.0</td>
</tr>
<tr>
<td>Place of residence</td>
<td>Urban</td>
<td>40</td>
<td>51.9</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>37</td>
<td>48.1</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>72</td>
<td>93.5</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Religion</td>
<td>Muslim</td>
<td>52</td>
<td>67.5</td>
</tr>
<tr>
<td></td>
<td>Christian</td>
<td>23</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>Traditionalist</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>Number of children</td>
<td>1</td>
<td>25</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>32</td>
<td>41.6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Above 4</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Any of children ever suffered from</td>
<td>Yes</td>
<td>21</td>
<td>27.3</td>
</tr>
<tr>
<td>neonatal sepsis</td>
<td>No</td>
<td>55</td>
<td>71.4</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Place of delivery</td>
<td>Hospital</td>
<td>47</td>
<td>61.0</td>
</tr>
<tr>
<td></td>
<td>Health centre</td>
<td>24</td>
<td>31.2</td>
</tr>
<tr>
<td></td>
<td>Home</td>
<td>6</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

From the table above, it can be seen that 22.1 % of respondents indicated they were less than 20 years of age as at the time they delivered their babies. A larger percentage of 59.7 % were in the age category of 21 to 30 years whereas 18.2 % were in the age category of 31 to 40 years.
On educational level of respondents, 13% were illiterates whereas 24.7% indicated their level of education was primary. A larger percentage of 40.3% of the respondents showed their level of education was secondary (second cycle) whilst a 22.1% of the respondents revealed their level of education was tertiary.

On occupation, 10 respondents (13.0%) were employees at other places whereas 41.6% of the respondents showed they were self-employed. Also, slightly over a quarter (32.5%) of mothers were not employed whilst 13.0% were students.

Responses on place of residence revealed that 40 respondents representing 51.9% were in the urban areas whereas 48.1% were in the rural areas. Also, an overwhelming percentage of 93.5% of the respondents were married whereas 5.2% were single with one respondent also representing 1.3% was separated.

On religion, 67.5% of the respondents were Muslims whereas 29.9% were Christians. Two respondents representing 2.6% were Traditionalists. In terms of number of children, 32.5% of the respondents showed they have only 1 child at the time this study was carried out whereas 41.6% revealed they had 2 children. About 13.0% chose that they have 4 children whilst 13% were having more than 4 children.

A 27.3% of respondents indicated that their children have ever suffered from neonatal sepsis whereas 71.4% indicated otherwise. However, 1.3% of the respondents indicated they could not ascertain whether their children have ever suffered from neonatal sepsis or not.

From the above table, it can be noted that 61.0% of the respondents sampled for the study indicated they delivered their babies at the hospital whereas 31.2% indicated they delivered their babies at
health centers. Six (6) respondents representing 7.8% of the respondents indicated they delivered their babies at home.

4.2 Maternal characteristics, socio-economic, cultural and lifestyle behavior of mothers posing as risk factors for neonatal sepsis

4.2.1 Maternal Characteristics posing as risk factors for neonatal sepsis

Maternal factors refer to factors related by way of the mother or characteristics of the mother. This is presented according to three parts; before and during pregnancy, during delivery and after delivery.
Table 4.2.1a Maternal Characteristics posing as risk factors for neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother's parity</td>
<td>Primigravida</td>
<td>32</td>
<td>41.6</td>
</tr>
<tr>
<td></td>
<td>Multiparous</td>
<td>45</td>
<td>58.4</td>
</tr>
<tr>
<td>History of abortion/miscarriage</td>
<td>Yes</td>
<td>39</td>
<td>50.7</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>38</td>
<td>49.3</td>
</tr>
<tr>
<td>ANC attendance during pregnancy</td>
<td>Yes</td>
<td>60</td>
<td>77.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>17</td>
<td>22.1</td>
</tr>
<tr>
<td>Gestational trimester ANC attendance started</td>
<td>First trimester</td>
<td>27</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>Second trimester</td>
<td>46</td>
<td>59.7</td>
</tr>
<tr>
<td></td>
<td>Third trimester</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td>Time of ANC attendance during pregnancy</td>
<td>1-3</td>
<td>25</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>5 and above</td>
<td>24</td>
<td>31.2</td>
</tr>
<tr>
<td>Urinary tract infection/STI during pregnancy</td>
<td>Yes</td>
<td>18</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>25</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>34</td>
<td>44.2</td>
</tr>
<tr>
<td>Premature rupture of membranes</td>
<td>Yes</td>
<td>15</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>34</td>
<td>44.2</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td>If yes, gestational age at rupture</td>
<td>25-30 weeks</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>31-34 weeks</td>
<td>5</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td>GBS status checked during pregnancy</td>
<td>Yes</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>52</td>
<td>67.5</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>22</td>
<td>28.6</td>
</tr>
<tr>
<td>Medical illness during pregnancy</td>
<td>Yes</td>
<td>58</td>
<td>75.3</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>19</td>
<td>24.7</td>
</tr>
<tr>
<td>Mode of delivery</td>
<td>Cesarean section (C/S)</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td></td>
<td>Forceps delivery</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td></td>
<td>Spontaneous vaginal delivery</td>
<td>49</td>
<td>63.6</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

From the table, it is revealed that 41.6 % of the respondents were primigravida when responses were sought about their parity whereas 58.4 % were multiparous. Respondents were also made to give information on history of abortion and out of the total respondents constituting the sample,
49.3 % indicated they have either aborted pregnancy or had miscarriages in time past whereas 50.7 % stated otherwise.

On ANC attendance during pregnancy, 77.9 % of respondents indicated they were going for antenatal care during pregnancy whereas 22.1 % revealed they were not going for antenatal care during pregnancy. On gestational trimester ANC attendance started, 27 respondents representing 35.1 % showed they started antenatal care attendance during the first trimester of their pregnancy whereas 59.7 % stated they started antenatal care attendance during the second trimester of their pregnancy. A 5.2 % of the respondents indicated they started ANC attendance during the third or last trimester of their pregnancy.

With regards to times respondents made ANC attendance during pregnancy, 32.5 % of respondents stated their times of ANC attendance fell within the range of 1 to 3 whereas 36.4 % of respondents indicated they made 4 antenatal care attendances during their pregnancy. A percentage of 31.2 % also indicated the times of antenatal care attendance were 5 and above.

In relation to urinary tract infection, 23.4 % of the respondents cited they had urinary tract infection during pregnancy whereas 32.5 % indicated they had no urinary tract infection during pregnancy. A 44.2 % of the respondents revealed they do not know or cannot remember if they had urinary infection or not.

Respondents were also made to indicate whether they had premature rupture of membranes during pregnancy or not, and out of the 77 respondents sampled for the study, 19.5 % showed they had premature rupture of membranes during pregnancy whereas 44.2 % stated they had no premature rupture during pregnancy. Slightly over one quarter (36.4 %) indicated they do not know or cannot remember if they had premature rupture during pregnancy or not. Also, in relation to those who
had premature rupture, their gestational age at rupture were; 7.8 % at 25-30 weeks, 6.5 % at 31-34 weeks and 5.2 % could not tell the age at rupture.

On whether GBS status was checked during pregnancy or not, 3.9 % of respondents indicated their GBS status was checked during pregnancy whereas 67.5 % revealed their GBS status was not checked. About a quarter (28.6 %) of the respondents pointed out they are unaware if their GBS status were checked or not. Looking at medical illness during pregnancy, 75.3 % of the respondents indicated they suffered from illness during pregnancy whereas 24.7 % revealed otherwise.

Out of the 77 respondents sampled for the study, 18.2 % revealed their mode of delivery was C/S whereas 18.2 % shown their mode of delivery was Forceps delivery. A percentage of 63.6 of the respondents indicated their mode of delivery was Spontaneous vaginal delivery.
Figure 4.2 Illness suffered during pregnancy

A 41 respondents suffered from malaria during pregnancy whereas 11 suffered from anaemia and 6 of the respondents also suffered from Urinary Tract infection.
Table 4.2.1b Maternal Characteristics posing as risk factors for neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of time membranes broke before procedure was done if C/S</td>
<td>4 - 6 hours</td>
<td>11</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>As soon as the membranes broke</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Duration of labour</td>
<td>Between 3 - 6 hours</td>
<td>25</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>Between 6 - 10 hours</td>
<td>47</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>10 hours and above</td>
<td>5</td>
<td>6.5</td>
</tr>
<tr>
<td>Intrapartum fever</td>
<td>Yes</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>31</td>
<td>40.3</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>33</td>
<td>42.9</td>
</tr>
<tr>
<td>Prolonged rupture of membrane</td>
<td>Yes</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>46</td>
<td>59.7</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>17</td>
<td>22.1</td>
</tr>
<tr>
<td>Color of liquor</td>
<td>Clear</td>
<td>51</td>
<td>66.2</td>
</tr>
<tr>
<td></td>
<td>Dark</td>
<td>10</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td>Gestational week of delivery</td>
<td>25 - 36 weeks</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>37 - 38 weeks</td>
<td>36</td>
<td>46.8</td>
</tr>
<tr>
<td></td>
<td>39 - 41 weeks</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td>Length of stay in the health facility after delivery</td>
<td>Less than 24 hours</td>
<td>19</td>
<td>24.7</td>
</tr>
<tr>
<td></td>
<td>1 - 2 days</td>
<td>8</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>3 - 5 days</td>
<td>27</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>5 - 7 days</td>
<td>5</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>7 days and above</td>
<td>12</td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Seek health information from health staff after delivery</td>
<td>Yes</td>
<td>37</td>
<td>48.1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>40</td>
<td>51.9</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

Of the respondents (18.2 %) who mode of delivery was C/S in the previous table (Table 4.2.1a), 14.3 % showed the length of time membranes were broken before procedure was done was between 4 to 6 hours whereas 2.6 % pointed C/S procedure was done as soon as membranes were
broken. One respondent (1.3 %) did not or cannot remember the length of time membranes were
broken before the procedure was done.

Information from the table above revealed that 32.5 % of the respondents spent between 3 to 6
hours during labor whereas 61.0 % were in labor within the time range of 6 to 10 hours. Also, 6.5
% cited they spent 10 hours and above during their labor period. On intrapartum fever, 16.9 % of
respondents indicated they had intrapartum fever during labor whereas 40.3 % had no intrapartum
fever. A 42.9 % of the respondents demonstrated they could not remember or do not know if they
had intrapartum fever during labor.

Information on prolonged rupture of membranes, from the table revealed that 18.2 % had
prolonged rupture of membranes whereas 59.7 % did not. About 22.1 % of the respondents also
indicated they do not know or could not remember if they had prolonged rupture of membrane.
All the respondents (18.2 %) who cited they had prolonged rupture of membrane indicated the
duration was between 18 – 20 hours.

On color of liquor, 66.2 % pointed the color of their liquor was clear whereas 13.0 % showed the
color of liquor was dark. Two respondents (2.6 %) indicated the color of liquor was neither clear
nor dark whereas 18.2 % of the respondents revealed they do not know what the color of the liquor
was.

Information from the above table also revealed that 36.4 % of the respondents delivered their
babies within a gestational week range of 25 to 36 whereas 46.8 % delivered within 37 to 38 weeks.
Also, 16.9 % indicated they delivered within a gestational week range of 39 to 41 weeks.
Information further showed that 24.7 % of respondents shown their length of stay in health
facilities after delivering their babies were less than 24 hours whereas 10.4 % spent between 1 to
2 days after the delivery. A little above a quarter (35.1 %) mentioned they stayed in health facilities between 3 to 5 days whilst 6.5 % spent between 5 to 7 days. Also, 15.6 % indicated they spent more than 7 days at the health facilities whilst 5.2 % of the respondents were not allowed to provide information on length of stay in health facility after delivery because they delivered in their respective homes. Information in the table above also revealed that 48.1 % indicated they seek health information from health staff after delivery whereas 51.9 % indicated they did not seek health information from health staff after delivery.

Figure 4.3. Health information seek from health staff after delivery

A 25 respondents sought health information on newborn care after delivering at the health facility whereas 13 sought information on breastfeeding. A respondent of 4 sought information on immunization schedules.
The following below were maternal factors believed by key informant to be posing as risk factors for neonatal sepsis. Majority of the informant’s revealed maternal hygiene as a major factor posing as risk factor for neonatal sepsis:

- Maternal hygiene
- Sexually transmitted Infections (STI)
- Sick mothers after delivery
- Caesarean section mothers/cases
- Transferring of babies to each other(mothers)
- Delay initiation of lactation by mothers
- Group B Streptococcus mothers

4.2.2 Socio-economic factors of mother’s posing as risk factors for neonatal sepsis.

Economic factors refer to the characteristics of the mother’s economy. This section of the study presents the results and description on socio-economic findings. The aim was to assess how socio-economic related factors influence neonatal sepsis among newborns. Below are the findings;
Table 4.2.2 Socio-economic factors of mothers posing as risk factors for neonatal sepsis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family size</td>
<td>Three</td>
<td>14</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>Four</td>
<td>24</td>
<td>31.2</td>
</tr>
<tr>
<td></td>
<td>Five to eight</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Nine and above</td>
<td>19</td>
<td>24.7</td>
</tr>
<tr>
<td>Is there a toilet facility in the house</td>
<td>Yes</td>
<td>40</td>
<td>51.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>37</td>
<td>48.1</td>
</tr>
<tr>
<td>Type of toilet if existing in the house</td>
<td>Flushing toilet</td>
<td>12</td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td>Pit latrine</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td>Household income level</td>
<td>Low level</td>
<td>49</td>
<td>63.6</td>
</tr>
<tr>
<td></td>
<td>Middle level</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td>Household water source</td>
<td>Pipe</td>
<td>27</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>Borehole</td>
<td>32</td>
<td>41.5</td>
</tr>
<tr>
<td></td>
<td>Dam</td>
<td>19</td>
<td>24.6</td>
</tr>
<tr>
<td></td>
<td>Well</td>
<td>21</td>
<td>27.3</td>
</tr>
<tr>
<td>Having problem with breastfeeding after birth</td>
<td>Yes</td>
<td>33</td>
<td>42.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>44</td>
<td>57.1</td>
</tr>
<tr>
<td>Baby fed on any other feed either than breast milk</td>
<td>Yes</td>
<td>29</td>
<td>37.7</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>48</td>
<td>62.3</td>
</tr>
<tr>
<td>Mode of feeding if yes</td>
<td>Bottle feeding</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>Cup feeding</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Reason for feeding baby with other feed either than breast milk</td>
<td>Breast milk inadequate</td>
<td>19</td>
<td>24.7</td>
</tr>
<tr>
<td></td>
<td>Baby refusal to suck</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>Baby was too small</td>
<td>1</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018
Of the 77 respondents sampled for the study, 18.2 % indicated their family size was three, 31.2 % shown their family sizes were four, 26.0 % of respondents’ family size fell between five to eight whereas 24.7 % of the respondent’s family sizes were nine and above.

Almost two quarters (51.9 %) of the respondents indicated they were having toilet facilities in their houses whereas 48.1 % mentioned they were not having toilet facilities in their houses. Out of the respondents who indicated they had toilet facilities in their houses, 15.6 % stated the type of toilet facilities in their respective homes were flashing ones whereas 36.3 % revealed the type of toilet in their homes were pit latrines.

On household income level, 63.6 % shown they were living in households with low income level whereas 36.4 % were from households with middle income level. In relation to household water source, 35.1 % of respondents indicated their source of water was pipe borne whereas 41.5 % revealed their water source was borehole. Almost a quarter (24.6 %) of the respondents stated their water source was dam whereas 27.3 % of respondent’s water source was well.

Information was also obtained from respondents on whether their babies were having problems with breast feeding after birth or not and out of the respondents sampled, 42.9 % revealed their babies were having problems with breastfeeding after birth whereas 57.1 % demonstrated otherwise.

Respondents showed babies were fed with different feed other than breast milk, and the results obtained revealed that 37.7 % of respondents fed their babies with different feed other than breast milk whereas 62.3 % of respondents’ babies were fed with only breast milk. Of those who pointed out their babies were fed with other feed other than breast milk, 11.7 % were using bottle as mode of feeding their babies whereas 26.0 % were using cups to feed babies. With regards to reasons
why babies were fed with different feed other than breast milk, 24.7 % of respondents mentioned their breast milk was inadequate whereas 11.7 % indicated their babies refused to suck. One respondent representing 1.3 % revealed her reason for not feeding baby with breast milk was that the baby was too small.

During the qualitative study, key informants were of the view that, poverty level of mothers’ plays a role in contributing to neonatal sepsis. Some mothers are not able to purchase babies’ items for delivery and after delivery and have to depend on old clothes and dresses.

4.2.3 Cultural Factors of mothers posing as risk factors for neonatal sepsis.

Cultural factors refer to factors relating to mother and their habits, beliefs and traditions of society. Collectivistic and individualistic cultures can give rise to different views on human health as well as treatment, diagnoses and causes of illness depending on where the person fits along their cultural continuum and consent for certain diagnostic and therapeutic interventions may be needed. Views were sort from respondents on some of the cultural practices and interventions on new born and the revelations are presented in the table below.
Table 4.2.3 Distribution of cultural practices related to neonatal care

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care for umbilical cord</td>
<td>Apply shea butter</td>
<td>29</td>
<td>37.3</td>
</tr>
<tr>
<td></td>
<td>Use cotton to clean with spirit</td>
<td>45</td>
<td>58.4</td>
</tr>
<tr>
<td></td>
<td>Clean with hot water</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Expose cord for air to dry it</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Is there some care given to newborns in your locality that can lead to sepsis</td>
<td>Yes</td>
<td>50</td>
<td>64.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>14</td>
<td>18.2</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td>Bathing practices</td>
<td>Bath baby with some herbs</td>
<td>40</td>
<td>51.9</td>
</tr>
<tr>
<td></td>
<td>Give baby bathed water as a drink</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
<td>Person assisting mother to take care of baby (care-givers of neonate)</td>
<td>Mother in-law</td>
<td>66</td>
<td>85.7</td>
</tr>
<tr>
<td></td>
<td>Husband</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Neighbor</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>7</td>
<td>9.1</td>
</tr>
<tr>
<td>Do people wash their hands before picking the baby in living area</td>
<td>Yes</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>37</td>
<td>48.1</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>31</td>
<td>40.3</td>
</tr>
<tr>
<td>Do you face challenges applying health education to baby at home</td>
<td>Yes</td>
<td>62</td>
<td>80.5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>15</td>
<td>19.5</td>
</tr>
<tr>
<td>Challenges faced at home if yes</td>
<td>Handwashing before picking/touching baby</td>
<td>69</td>
<td>89.6</td>
</tr>
<tr>
<td></td>
<td>Applying spirit to cord</td>
<td>8</td>
<td>10.4</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018
It is revealed from the table that 37.3% of respondents were applying shea-butter to baby cord after delivery whereas 58.4% were using cotton to clean baby cord with spirit. Also, 3.9% were also cleaning baby cord with hot water whereas respondent (1.3%) showed people in her locality expose baby cord for air to dry it.

Responses were sought on whether they are some care given to newborns in respondent locality that can lead to sepsis or not, and out of the total respondents, 64.9% showed they were such kind of care whereas 18.2% indicated they were no such kind of care. A percentage of 16.9 of the respondents pointed out they were not certain as to whether such kind of care exist within the locality or not. On bathing practices in the localities that can lead to the sickness, 51.9% cited people in their localities bath babies with herbs whereas 11.7% indicated bathed water is given to baby as a drink.

Information obtained revealed that 85.7% of those who helped in taking care of their babies were their mother in-laws whereas 3.9% cited their husbands. Also, one respondent (1.3%) indicated it was her neighbor and 9.1% of respondents indicated other category of people such as sister in-law and so on were those helping them to care for their babies at home. Finding out whether people in respondents’ living area wash their hands before picking their (respondents) babies, 11.7% showed people washed their hands before picking their babies whereas 48.1% indicated people were not washing their hands before picking their babies. A little above one quarter (40.3%) of the respondents revealed they were not aware if people wash their hands before picking their (respondents) babies or not.

About 80.5% of the total respondents further indicated they were facing challenges applying health education given to them by health staff whereas 19.5% were not facing challenges applying such health education to their babies. Also, on challenges faced at home applying health education
given to mothers by health staff, 89.6 % indicated their challenges were hand washing before picking the baby whereas 10.4 % of respondents’ challenge was application of spirit to baby cord.

From the key informant’s interview, the results demonstrated some cultural practices of mothers that can pose babies to sepsis. The major finding was poor cord care and the minor findings were circumcision at home, habit of giving/treating with local substances/preparations and giving marks.

Below are statements of narrations from them: “Some will just tell you that oh it is only two days, when they go home, they will put Shea-butter because we are wasting their time causing their babies pain.” (HS3). Some reasons why mothers want the cord to fall off fast is that they can do the baby’s naming ceremony. Due to that, some apply remedies to let it drop off. HS4 shares similar to her “you know, some of these mothers if you don’t put an eye on them, especially the locals, I learnt when they come, they have chalk and what not, that they can put on the cord but we are very strict on them, so unless they go home that they may do it there, because we are not there but we educate them.”

4.2.4 Lifestyle behavior of mothers posing as risk factors for neonatal sepsis.

Lifestyle factors of mothers refer to the modifiable habits and ways of life of mothers that can greatly influence overall health and wellbeing of their babies. Although lifestyle consists of so many dimensions but this section in particular was mainly on self-care of the mother in terms of her hand hygiene and alcohol consumption. The findings are presented in the table below to determine the likelihood of an infant infection through the mothers’ lifestyle;
Table 4.2.4 Lifestyle factors of mothers of mothers posing as risk factors for neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother washing hands before attending to baby</td>
<td>Yes</td>
<td>67</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>How often if mother washes hands</td>
<td>Rare</td>
<td>7</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>Very rare</td>
<td>25</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>Frequent</td>
<td>33</td>
<td>42.9</td>
</tr>
<tr>
<td>Mother drink alcohol during pregnancy</td>
<td>Yes</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>64</td>
<td>83.1</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

Responses were sought on whether respondents wash their hands before attending to baby or not, and out of the 77 respondents sampled, 87.0 % shown they were washing their hands before attending to their babies whereas 13.0 % indicated otherwise. Of the respondents who showed they were washing their hands before attending to their babies, 9.1 % mentioned it was rare whereas 32.5 % indicated it was very rare. A majority of 42.9 % stated they were washing their hands always before attending to their babies. In addition, 16.9 % of the respondents revealed that mothers drink alcohol during pregnancy whereas 83.1 % did not.

During the key informant’s interview of health staff, results indicated that some lifestyle behaviors of mothers can contribute to sepsis among neonates. These are categorized into three: Hygiene, attitude and feeding factors.

Mothers’ personal hygiene was a major concern raised by key informants. Some mothers don’t wash their hands before caring for their babies. Here are some reports of their narration.

“The person changes the baby’s diapers without washings hands and they breastfeed their babies.” (HS7)
“See how many doors they have to open before reaching their babies and when you ask them to express breast milk they will not wash their hands, pick the cup, open it and put the lid on the floor, remove their breast, use their hands and go and wipe the breast before they express and after that pick the lid on the floor and cover it. Hand washing by mothers is confronting us.” (HS8).

Attitude factors: This was another concern raised by some key informants. These are about mothers sitting on their colleague’s beds, their exposure of babies to relatives and sharing/giving of their babies to other mothers.

“You see when they are in the ward for some time, they begin to make friends. With time a mother can get up and sit on another mother’s bed, which is not healthy. When you sit on another mother’s bed, you don’t know what is on the mother’s bed sheet, and you go back and pick your baby, you are exposing your baby to sepsis.” She added “it can be that worst off a patient(mother) relatives who come in and don’t wash their hands, you don’t know the infections they are carrying around and they pick this neonate” (HS3).

Feeding factors: This was a least concerned from the key informants. It was revealed that some mothers are not trying to initiate breast feeding early and others perception of giving other feeds to their babies were factors raised under this category.

“Some too breast feeding the baby like this, after they deliver, when you tell them that oh, they should breast feed the baby in the 30 minutes’ time after birth, some will say they are tired. Some will pick up the baby and you think they are about to breast feed, when you turn back, they will put the baby down. Others will say that there is no breast milk.” (HS5).
4.3.0 Neonatal factors posing as risk factors of sepsis

4.3.1 Neonatal factors of neonate posing as risk factors of sepsis

Neonatal factors refer to factors related by way of the new born or characteristics of the newborn. Responses were sought on baby cried immediately after delivery, Apgar score, birth weight and other factors posing as risk factors to neonatal sepsis. The results obtained in that regard are presented below.

Table 4.3.1 Neonatal factors of neonates posing as risk factors for neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baby cried immediately after delivery</td>
<td>Yes</td>
<td>45</td>
<td>58.4</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>23</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>9</td>
<td>11.7</td>
</tr>
<tr>
<td>Apgar Score at 5th minute</td>
<td>&gt; 7</td>
<td>31</td>
<td>40.3</td>
</tr>
<tr>
<td></td>
<td>≥ 7</td>
<td>38</td>
<td>49.4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Birth weight of baby (in kilograms)</td>
<td>1.9 - 2.4</td>
<td>35</td>
<td>45.5</td>
</tr>
<tr>
<td></td>
<td>2.5 - 3.4</td>
<td>38</td>
<td>49.5</td>
</tr>
<tr>
<td></td>
<td>3.5 - 4.4</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td>Surgical procedure performed before onset of</td>
<td>Yes</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>sickness</td>
<td>No</td>
<td>71</td>
<td>92.2</td>
</tr>
<tr>
<td>Type of surgical procedure</td>
<td>Circumcision</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>First time of baby's admission at the hospital</td>
<td>Yes</td>
<td>73</td>
<td>94.8</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>4</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018
Responses on whether baby cried immediately after delivery, findings revealed that 58.4% of babies cried immediately after birth whereas 29.9% did not. About 11.7% of mothers indicated they could not remember or were not certain on whether their babies cried immediately after delivery or not.

On APGAR score, 40.3% indicated their babies’ APGAR score at 5th minute was less than 7 whereas 49.4% indicated their babies’ APGAR scores were greater or equal to 7 at 5th minute. Also 2.6% of the respondents indicated the APGAR score of their babies was 10 at 5th minute whereas 7.8% indicated they do not know anything about that. On birth weight of baby in kilograms, 45.5% of the respondents indicated the birth weight of their babies fell within 1.9 to 2.4 kg whereas majority 49.5% indicated the birth weight of their babies fell between 2.5 to 3.4 kg. One respondent (1.3%) stated her baby’ birth weight was between 3.5 to 4.4 kg whereas 3.9% of respondents showed they do not know the birth weight of their babies.

On surgical procedure performed before onset sickness, 7.8% of the respondents indicated surgical procedure was performed on their babies before onset sickness whereas 92.2% stated otherwise. The 7.8% of respondents who indicated surgical procedure was performed on their babies before onset of sickness stated the type of surgical procedure performed on their babies was circumcision. Moreover, 94.8% of the total respondents revealed it was the first time their babies have been admitted in the hospital whereas 5.2% shown it was not the first time their babies were admitted in the hospital.
Figure 4.3 Clinical signs presented to the hospital

A number of 34 respondents indicated that the clinical signs present in their babies were fever, 21 mentioned their babies were crying at night, 14 mothers indicated seizure whereas majority of mothers (38 respondents) stated feeding problems.

The qualitative study revealed that, the following were some neonatal factors posing as risk factors for neonatal sepsis:

- Preterm
- Sucking/feeding problems
- Tiredness of baby after delivery
- Babies with congenital abnormalities/defects
- Babies age
- Vein access
Majority of staff believed that preterm baby has higher chances of acquiring sepsis. This was followed by sucking/feeding problems and tiredness of baby after delivery.

4.4.0 Health care factors of the hospital posing as risk factors of sepsis

This section was aimed to ascertain information on healthcare-acquired infections. That is infection that is contracted while the mother or the baby is at the healthcare facility. The details of the findings are as follows;
Table 4.4.0 Health care factors of the hospital posing as risk factors of sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory investigation during ANC</td>
<td>Yes</td>
<td>64</td>
<td>83.1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td>Put on treatment during pregnancy</td>
<td>Yes</td>
<td>56</td>
<td>72.7</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>17</td>
<td>22.1</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td>Number of vaginal examinations during labor</td>
<td>1--2</td>
<td>30</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>36</td>
<td>46.8</td>
</tr>
<tr>
<td></td>
<td>Zero</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>4 and above</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Time of breastfeeding initiation started after delivery</td>
<td>30 minutes after birth</td>
<td>46</td>
<td>59.7</td>
</tr>
<tr>
<td></td>
<td>1 hour</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>2 - 3 hours</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td>Baby shared cot/bed with another baby</td>
<td>Yes</td>
<td>8</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>57</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Stayed in health facility for an extended time after delivery</td>
<td>Yes</td>
<td>43</td>
<td>55.8</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Baby taken immunization</td>
<td>Yes</td>
<td>62</td>
<td>80.5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>15</td>
<td>19.5</td>
</tr>
<tr>
<td>Baby had central line prior to sepsis</td>
<td>Yes</td>
<td>23</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>48</td>
<td>62.3</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Staff gave health education to prevent neonatal sepsis</td>
<td>Yes</td>
<td>68</td>
<td>92.2</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>1</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

Information from the table has shown that 83.1 % of respondents had laboratory investigations done during antenatal care whereas 16.9 % did not. A majority 72.7 % of the total respondents made known they were put on treatment during their pregnancy period whereas 22.1 % mentioned
they were not. Also, 5.2% of the respondents showed they were not entirely certain as to whether they were put on treatment or not. On number of vaginal examinations during labor, 39.0% indicated number of vaginal examinations was between 1 and 2 whereas 46.8% stated they were examined 3 times during labor, 5.2% of the respondents shown they were not examined at all during labor whilst one respondent (1.3%) stated she had 4 or more vaginal examinations during labor. Six (6) respondents delivered at home so they were excluded here.

Information further revealed that 59.7% of respondents started initiation of breastfeeding 30 minutes after delivery whilst 36.4% started the initiation 1 hour after delivery. Few 3.9% started initiation of breastfeeding between 2 to 3 hours after delivery. It is also revealed that 10.4% of respondents had their babies shared cot or bed with other babies within the health facilities after delivery whereas 74.0% of respondents did not. A 7.8% of respondents indicated they do not know or cannot remember if their babies shared cot or bed with others or not and 7.8% of respondents were not allowed to give responses in this regard because they delivered their babies at home.

On extended time stayed at health facility after delivery, 55.8% of respondents indicated they stayed in health facilities for an extended time after delivery whereas 36.4% did not. A 7.8% of the respondents were excluded once again because they delivered at their homes. Information from the table also showed that majority (80.5%) of respondents’ babies had immunization whereas 19.5% did not.

A 29.9% of the total respondents sampled indicated their babies had central line (IV access) prior to sepsis whereas majority (62.3%) demonstrated their babies were not having central lines prior to sepsis. Also 7.8% stated they do not know whether their babies were having central line before sepsis or not. On health education, an overwhelming 88.3% respondents mentioned they received
health education from health staff to prevent neonatal sepsis whereas 10.4 % said they did not receive health education from health staff to prevent neonatal sepsis.

![Drugs put on during ANC](Image)

**Figure 4.4. Drugs put on during ANC**

Majority of 65 respondents revealed the drug they put on during antenatal care was hematinic whereas 8 indicated they were put on antibiotics. A least of 1 respondent showed she was put on a different either than hematinic and antibiotics.
Figure 4.5 Laboratory tests done during pregnancy

The above figure demonstrated that majority (53/77) respondents had laboratory test HB and 51/77 G6PD done whereas 46, 42, 41, 26 respondents had test of HIV /AIDS, RDT, Blood group and Urine R/E respectively done. A 23and 21 of the respondents also indicated they had sickle cell and hepatitis B laboratory investigation done during ANC.
Of those who indicated they received health education from health staff after delivery, 57/77 indicated they received education on immunization follow-ups whereas 43 showed they received education on hand hygiene before taking care of baby. A 23 also indicated they received education on caring of baby cord at home whilst 29 received education on good breastfeeding practices.

The qualitative study revealed the following health care factors contributing to NNS. The results are under the themes of economic factors of the hospital, cultural factors of the hospital, lifestyle of health staff, staff actions and inactions.
4.4.1 Economic factors of the hospital posing as risk factors for neonatal sepsis

Table 4.1.1 Hospital economic factors posing as risk factors for neonatal sepsis

<table>
<thead>
<tr>
<th>Factors</th>
<th>Sub-themes</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erratic supply of consumables</td>
<td>Inadequate health care</td>
<td>Economic factors of the hospital</td>
</tr>
<tr>
<td>and logistics</td>
<td>funding</td>
<td></td>
</tr>
<tr>
<td>Erratic supply of water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate provision of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not feeding NICU mothers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congestion/overcrowding</td>
<td>Inadequate infrastructure</td>
<td></td>
</tr>
<tr>
<td>Inadequate sleeping place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for NICU mothers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

Economic factors are factors related to the economy of the hospital. In other words, the characteristics of the hospital. The narrations of key informants in the hospital revealed some economic factors that can contribute to sepsis. Two sub-themes that emerged were inadequate funding available in the hospital and inadequate infrastructure to babies and their mothers in the hospital.

1. Inadequate health care funding available at the hospital. Inadequate health care funding refers to the hospital not being able to provide all the things needed for the smooth running of the hospital. There were four main factors which were; inadequate supply of consumables and logistics, equipment, water and feeding of NICU patient’s mothers.
All key informants expressed inadequate supply of consumables and logistics in their units.

HS3, Narration below

“One of the things we use a lot in this ward and we advise mothers to use is methylated spirit but sometimes we don’t have. They can give ½ a gallon, what they give is woefully inadequate because we use it a lot. If it is finished and it is not provided and mothers too can’t afford to buy then we just bath the baby like that without care of the cord.”

Meet HS6 expression “inadequate provision of some logistics like 5cc, 10cc syringes are not there where you are compelled to use a bigger one which comes with more pressure and can dislodge the cannula and you have to pass again and it poses a lot of risk to them.” She added “neonatal nasal prone like this we don’t have them. So, we have to use the bigger ones and sometimes when we use, you can realize that the place is inflamed. What have you done, but at that point breathing is more important than that”

Inadequate equipment was also a concern raised which compelled staff to pair babies in critical situations. Follow HS8 narration “incubators we have to put more than one baby inside one incubator. Sometimes when you are attending to these babies you even forget that they are separate babies with different conditions. Look at the radiant warmers, three different babies inside it. We have instances where a baby can vomit on the others” HS 6 said “the incubators, one baby one incubator should have been the best, but the hospital is not able to provide”.

The least in this category was erratic water supply in the units which makes staff not to wash hands at times before performing procedure on a baby and hospital not providing food for mothers with their babies at NICU.

2. Inadequate infrastructure.
Inadequate infrastructure means the inability of basic facilities and systems to serve the hospital. Congestion/Overcrowding and place of sleep for mothers received the same concern from some informants.

Congestion/Overcrowding: HS4 “inadequate space causing congestion. As you can see some mothers and their babies have to lie on floor beds (mattresses put on the ground)”. She added “we have beds but because of the lack of space” She is however hopeful the problem will be solved when they move to the new maternity building which is more spacious.

HS6 “the spacing of our patients/babies in the unit are crowded so there is congestion in the unit”

Place of sleep for mothers at the hospital were also seen to be factors for sepsis. Only one room which can take about 4-8 mothers and what happens to the remaining 36 or 32 mothers is questionable. Here are some narrations from key informants.

HS7 “place of sleep for mothers is only one room outside the unit which can take about four-eight mothers where does the remaining over 36 or 32 sleep remains a concern. They pick all kinds of things with their hands and clothes and then come to take their babies which can be an issue”

HS6 share similar thing “only one room which can accommodate about 8 and when you see them going there it means it is raining. They are far, far more than that, some are coming from far places and so they sleep outside, sometimes in the night I learnt you have to jump over them at the reception”. She laments “you will do everything you can as a nurse to prevent infection and the mother will lie on the floor and get up and pick their babies”.
4.4.2 Cultural factors of the hospital posing as risk factors for neonatal sepsis

Cultural factors of the hospital refer to factors relating to the hospital norms, habits, beliefs and traditions of doing things.

The major finding shows the hospital is very dynamic pointed by informants. The least of the findings was the misconception that every baby with fever should be transferred to NICU and they can end up getting sepsis there. She said that “some of these babies that are transferred to NICU end up getting sepsis because of the many procedures that would be carried on the baby in NICU”. She added “the fever could have been the result of hunger or over dressing.”

4.4.3 Lifestyle behavior /factors of health staff posing as risk factors for neonatal sepsis

Lifestyle factors refer to the modifiable habits and ways of life of health staff that can influence overall health and wellbeing.

The findings from the qualitative study demonstrated that there were some lifestyle factors of staff that can contribute to the baby acquiring sepsis in the hospital. The major finding was staff hand hygiene when caring for a baby. The minor findings were staff wearing bungles whiles on duty, use of phones while on-duty /working on the babies and the dressings by staff while caring for the babies. This is because of the microorganisms these can contain. Two key informants indicated that they go by standards thereby reported no lifestyle factor of staff that can contribute to neonatal sepsis.

Here are some narrations from informants:

“People supposed to wash their hands after attending to every baby but don’t do it.” (HS7)
“As for watches we have been able to do away with but the problem now is phones. The most contaminated item with us is our phones. We use it to calculate drugs. Phones was not a Ghanaian thing so it is difficult to change.”

4.4.4 Health staff actions posing as risk factors for neonatal sepsis

Action is something which is done by a person.

The findings show that there are some actions of health staff that can lead a newborn contract sepsis. These are categorized in to three as; inadequate aseptic practices, poor care of baby after delivery and staff with cold nursing babies.

Inadequate aseptic practices were a major finding that majority of key informants expressed could be factors in the hospital that can lead to septic. These include; compromise in feeding of babies, use instrument that are not well cleaned or disinfected, poor aseptic practices during cord cutting and use of disposable consumable more than once or severally. The least of the findings was staff with cold nursing babies.

4.4.5 Staff inactions posing as risk factors for neonatal sepsis

Inaction is something which is not done by a person.

The findings from key informants demonstrated there are some staff inaction that may lead a baby acquire sepsis at in the hospital. These are put in to three categories. These include Non-adherence to IPC practices, poor attitude of staff and poor baby care.
4.5 Health education given to mothers by health staff

Key informants revealed that mothers are given health education on their baby’s care. It was indicated that sometimes they do one on one counseling especially for preterm and first time (primigravida) mothers. It was also revealed that all preterm babies one criteria for discharge is that mother brings one or some influential people from home for counseling before baby is released to them. Some areas that mothers are educated on are: Cord care, hand washing, personal hygiene, exclusive breastfeeding, eating good diet and care of baby at home.

4.6 Measures/ways to prevent/control neonatal sepsis at the hospital

Key informants believed if the following measures are put in place by hospital authorities/staff that could help to prevent or control neonatal sepsis;

- Adequate supply of consumables and logistics such as syringes, nasal catheters, among others
- Adequate and constant supply of newborn essential drugs like vitamin K.
- Render proper ANC services to mothers e.g assess and treat mothers with UTI
- Staff adhere to universal standard precautions
- Midwives give proper care to newborns at maternity
- Adequate supply and maintenance of equipment like incubators etc.
- Nurses and midwives should ensure good personal hygiene practices by mothers
- Restrict visitors/relatives in to labour and NICU to reduce their contact with the baby
- Ensure clean environment of the hospital most especially maternity and NICU by nurses and midwives
Education to mothers and relatives on good newborn care practices and the need to abolish harmful practices to newborn

Adequate provision of infrastructure for NICU and maternity

4.7 Challenges of health staff in the hospital to prevent neonatal sepsis

Challenges in this study means faced with a difficult situation.

Staff that has the responsibility to prevent neonatal sepsis in the study area encounters some difficulties according to the interview from key informants. These challenges are categorized into four (4); inadequate health care funding, mother’s practices/compliance, sanitation and security.

The major finding was inadequate health care funding by key informants. Inadequate health care funding challenges was experienced which had to do with non-availability/ inadequate supply of consumables and logistics, overcrowdings /congestion, inadequate equipment, inadequate accommodation for mothers with their babies on admission at NICU, no refresher trainings to staff, inadequate support for radio education program resulting in inadequate information on newborn health to general public.

Security issue was less pointed by key informants. Patient relatives are hard to control by the security man seated by the entrance of the wards.
4.7 Relationship of risk factors to neonatal sepsis

4.7.1 Maternal/Socio-economic factors /characteristics associated with neonatal sepsis

Table 4.7.1a Maternal/Socio-economic factors associated to neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>$\chi^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at delivery</td>
<td>Less than 20 years</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 - 30 years</td>
<td>46</td>
<td>0.468</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>31 - 40 years</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td>Employed</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self employed</td>
<td>32</td>
<td>0.247</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>Not employed</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Number of children</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>32</td>
<td>0.620</td>
<td>0.000</td>
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<td></td>
<td>4</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Above 4</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Family size</td>
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<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four</td>
<td>24</td>
<td>0.465</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Five to eight</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nine and above</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby fed on any other feed</td>
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<td>29</td>
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<td>0.032</td>
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<tr>
<td>either than breast milk</td>
<td>No</td>
<td>48</td>
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<td></td>
</tr>
<tr>
<td>Place of baby delivery</td>
<td>Hospital</td>
<td>47</td>
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</tr>
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<td></td>
<td>Health center</td>
<td>24</td>
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<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Home</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

The findings of the study revealed that mother’s age at delivery which is 46.8 % ($\chi^2=0.468$, p=0.000) has a positive influence on neonatal sepsis. The employment status of mothers which
stood at 24.7 % ($\chi^2=0.247$, $p=0.032$) is directly related to the ability of baby being affected by sepsis. The study also found out that the number of children a mother has have an effect on sepsis with 62 % ($\chi^2=0.620$, $p=0.000$). In relation to family size with a percentage of 46.5 % ($\chi^2=0.465$, $p=0.000$), it indicates the family size has an influence on the child’s ability to resist or become vulnerable to sepsis. With regards to the place of delivery of 35.7 % ($\chi^2=0.357$, $p=0.002$) was an indication of the existence of a relationship between the place of delivery and neonatal sepsis.

### Table 4.7.1b Maternal/Socio-economic factors associated with neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>$\chi^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational trimester ANC attendance started</td>
<td>First trimester</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Second trimester</td>
<td>46</td>
<td>0.262</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td>Third trimester</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GBS status checked during pregnancy</td>
<td>Yes</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>52</td>
<td>0.229</td>
<td>0.046</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational week of delivery</td>
<td>25 - 36 weeks</td>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>37 - 38 weeks</td>
<td>36</td>
<td>0.293</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>39 - 41 weeks</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stayed in health facility for an extended time after delivery</td>
<td>Yes</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>28</td>
<td>0.308</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Field survey, 2018

Gestational trimester a pregnant woman starts ANC attendance also is 26.2 ($\chi^2=0.262$, $p=0.022$) associated with the sickness. Other variables that are associated with neonatal sepsis are GBS
status ($\chi^2=0.229$, $p=0.022$), gestational week of delivery ($\chi^2=0.293$, $p=0.019$) and baby stay in hospital for extended time ($\chi^2=0.308$, $p=0.020$).
Table 4.7.2 Neonatal factors / Characteristics and health care factors associated with Sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Frequency</th>
<th>$\chi^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex of baby</td>
<td>Male</td>
<td>46</td>
<td>0.312</td>
<td>0.018</td>
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<tr>
<td></td>
<td>Female</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of baby</td>
<td>Less than 24 hours</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 hrs - 24 days</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 - 6 days</td>
<td>29</td>
<td>0.665</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>7 - 14 days</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 - 21 days</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22 - 28 days</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Birth position of baby</td>
<td>First</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>32</td>
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<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apgar Score at 5th minute</td>
<td>Less than 7</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Greater/Equals 7</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>3</td>
<td>0.285</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baby had IV access prior to sepsis</td>
<td>Yes</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>48</td>
<td>0.263</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

There was also an attempt to measure if the sex of the baby has any influence on sepsis and the findings has revealed that sex of a neonate is 31.2% ($\chi^2=0.312$, p=0.018) associated with neonatal sepsis. Age of baby is also 66.5% ($\chi^2=0.665$, p=0.000) associated with sepsis. On birth position of baby, the study revealed it was 67.1% ($\chi^2=0.671$, p=0.000) associated with the study.
topic. It is also revealed that APGAR score ($\chi^2=0.285, p=0.012$) was associated with neonatal sepsis and therefore can be used to determine if a child has sepsis or not. Baby had central line prior to sepsis is also 26.3 % ($\chi^2=0.263, p=0.048$) associated with neonatal sepsis and is the only health care factor.
4.8 Multivariate Logistic Regression analysis on risk factors associated to neonatal sepsis

Table 4.8.1 Maternal factors as risk factors of neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Number (%)</th>
<th>AOR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at delivery</td>
<td>Less than 20 years</td>
<td>17 (22.1)</td>
<td>3.47</td>
<td>2.39-5.28</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>21-30 years</td>
<td>46 (59.7)</td>
<td>2.81</td>
<td>0.09-1.63</td>
<td>0.067</td>
</tr>
<tr>
<td></td>
<td>31-40 years</td>
<td>14 (18.2)</td>
<td>0.89</td>
<td>1.63-3.04</td>
<td>0.017</td>
</tr>
<tr>
<td>Number of children</td>
<td>1</td>
<td>25 (32.4)</td>
<td>0.54</td>
<td>0.32-2.79</td>
<td>0.071</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>32 (41.6)</td>
<td>0.76</td>
<td>0.51-2.83</td>
<td>0.270</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>10 (13.0)</td>
<td>3.82</td>
<td>1.49-3.77</td>
<td>0.000</td>
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<tr>
<td></td>
<td>Above 4</td>
<td>10 (13.0)</td>
<td>3.99</td>
<td>1.50-4.37</td>
<td>0.001</td>
</tr>
<tr>
<td>Family size</td>
<td>Three</td>
<td>14 (18.5)</td>
<td>1.65</td>
<td>0.09-1.39</td>
<td>0.058</td>
</tr>
<tr>
<td></td>
<td>Four</td>
<td>24 (31.2)</td>
<td>1.90</td>
<td>0.27-2.44</td>
<td>0.066</td>
</tr>
<tr>
<td></td>
<td>Five to eight</td>
<td>20 (26.0)</td>
<td>3.51</td>
<td>1.97-4.76</td>
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</tr>
<tr>
<td></td>
<td>Nine and above</td>
<td>19 (24.7)</td>
<td>3.84</td>
<td>1.63-6.71</td>
<td>0.010</td>
</tr>
<tr>
<td>Baby fed on any other feed</td>
<td>Yes</td>
<td>29 (37.7)</td>
<td>5.04</td>
<td>1.38-4.87</td>
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</tr>
<tr>
<td></td>
<td>No</td>
<td>48 (62.3)</td>
<td>1.37</td>
<td>0.99-1.07</td>
<td>0.093</td>
</tr>
<tr>
<td>Place of baby delivery</td>
<td>Hospital</td>
<td>47 (61.0)</td>
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<td>0.27-1.53</td>
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<tr>
<td></td>
<td>Health centre</td>
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<td>0.67-3.41</td>
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<tr>
<td></td>
<td>Home</td>
<td>6 (7.8)</td>
<td>1.96</td>
<td>1.98-7.81</td>
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</tr>
<tr>
<td>Gestational week of delivery</td>
<td>25-36 weeks</td>
<td>28 (36.4)</td>
<td>3.11</td>
<td>1.05-4.59</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>37-38 weeks</td>
<td>36 (46.8)</td>
<td>0.65</td>
<td>0.07-1.66</td>
<td>0.051</td>
</tr>
<tr>
<td></td>
<td>39-41 weeks</td>
<td>13 (16.9)</td>
<td>0.30</td>
<td>0.54-2.15</td>
<td>0.078</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018

The findings of the study from the above table revealed that maternal age at delivery of less than 20 years (AOR=3.47; 95 % CI 2.39-5.28; P-value-0.000), number of children of four (4) and above (AOR=3.82; 95 % CI 1.49-3.77; P-value -0.000) and family size of five to eight and nine
and above (AOR=3.51; 95% CI 1.97-4.76; P-value-0.025 and AOR=3.84; 95% CI 1.63-6.71; P-value -0.010) were at high risk of neonatal sepsis compared to other categories. Baby fed on any other feed (AOR=5.04; 95% CI 1.38-4.87; P-value=0.001) and gestational week of delivery between 25-36 weeks (AOR=3.11; 95% CI 1.05-4.59; P-value-0.012) were also significantly at risk of neonatal sepsis.

Table 4.8.2 Neonatal characteristics/ factors as risk factors of neonatal sepsis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Number (%)</th>
<th>AOR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex of baby</td>
<td>Male</td>
<td>46 (59.7)</td>
<td>5.02</td>
<td>1.69-3.51</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>31 (40.3)</td>
<td>0.92</td>
<td>0.37-1.16</td>
<td>0.320</td>
</tr>
<tr>
<td>Age of baby</td>
<td>Less than 24 hours</td>
<td>3 (3.9)</td>
<td>1.43</td>
<td>1.02-3.48</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>24 hrs - 2 days</td>
<td>13 (16.9)</td>
<td>3.59</td>
<td>2.77-4.58</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>3 - 6 days</td>
<td>29 (37.7)</td>
<td>3.88</td>
<td>2.93-6.71</td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td>7 - 14 days</td>
<td>27 (35.1)</td>
<td>0.89</td>
<td>0.67-1.43</td>
<td>0.051</td>
</tr>
<tr>
<td></td>
<td>15 - 21 days</td>
<td>4 (5.2)</td>
<td>0.72</td>
<td>0.23-1.20</td>
<td>0.058</td>
</tr>
<tr>
<td></td>
<td>22 - 28 days</td>
<td>1 (1.3)</td>
<td>0.43</td>
<td>0.11-1.09</td>
<td>0.147</td>
</tr>
<tr>
<td>Birth position</td>
<td>First</td>
<td>23 (29.5)</td>
<td>4.76</td>
<td>3.26-5.71</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>32 (41.6)</td>
<td>2.09</td>
<td>3.15-4.07</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>15 (19.5)</td>
<td>0.78</td>
<td>0.43-1.33</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>7 (9.1)</td>
<td>0.40</td>
<td>0.29-1.22</td>
<td>0.077</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018
From the table above the neonatal significant risk factors to neonatal sepsis were male sex of the baby (AOR=5.02; 95% CI 1.69-3.51; p-value 0.005), age of the baby of less than 24 hours and 24 hours to 2 days (AOR=1.43; 95% CI 1.02-3.48; P-value 0.00; AOR=3.59; 95% CI 2.77-4.58; P-value 0.009 respectively) and birth position of first (1st) (AOR=4.76; 95% CI 3.26-5.71; P-value =0.002).
CHAPTER FIVE

DISCUSSION

5.0 Introduction

In this chapter, the results of this study have been discussed by comparing and relating the key findings to existing literature presented in chapter two. The comparison is to help bring out the extent to which the findings of the study agree or disagree to existing literature. The discussion covers the objectives of the study.

5.1 Socio-demographic Data

5.1.1 Newborn socio-demographic data posing as risk factors to neonatal sepsis

In this study, majority of the babies were males (59.7 %). This finding is consistent to many studies conducted in Africa (Jabiri et al., 2016; Onyedibe et al, 2012; Siakwa et al., 2014) where male sex was dominant among neonates with sepsis.

The findings in this study shown that, age of the majority of the neonates were between 3 to 6 days. This result is consistent to findings by Gebremedhin et al. (2016) study in Ethiopia which found most of the neonates with sepsis in cases and controls under the age of 7 days. The study is not consistent with the finding of Muthwii (2017) which revealed the age of majority of neonates to be between 8-28days.

The finding showed that majority (55.8 %) of babies were discharged from health facility before onset of sickness. As raised by Muthwii (2017) with concern over the new born care after
discharged and called for the need for mothers to be informed of care for the new born. However, it is not to say delivery practices were perfect, there is the need for all standard precautions be applied during and after delivery.

Majority (51.9%) of the babies’ sickness started within 24 hours to 3 days after delivery. This finding is similar to the results of Linda who observed 85% of neonates with early onset sepsis present within 24 hours of birth (Linda, 2004).

Birth position, of about 41.6% of the babies with sepsis were second by birth order. It will not be out of place to reason that it is not first born to first time mothers that are at high risk of sepsis as some studies finding saw first time mothers whose babies are at more risk in getting sepsis (Siakwa et al., 2014 & Onyedibe et al., 2012). This finding implies that any birth position of a baby can get sepsis.

5.1.2 Mothers socio-demographic data posing as risk factors to neonatal sepsis

The study demonstrated that majority (59.7%) of respondents age at delivery was between 21 to 30 years. This finding is a contradictory to various studies which revealed that the dominant young adult age category that is less than 20 years’ mothers are at higher risk with neonates with sepsis as compared to their counterparts in other age categories (Muthwii, 2017; Siakwa et al., 2014). One reason for that was challenges the young mothers may face with in relation to new born care which could result in the baby contracting NNS (Muthwii, 2017).

The study observed that majority (40.3%) of mothers with babies with NNS attained secondary education. It is in line with finding from Muthwii (2017) study on characterization of neonatal sepsis among patients admitted in Kenyatta national hospital, Kenya which found that over 80%
of mothers with their babies with sepsis had achieved level of education higher than primary level. This she means that majority of the people have embraced formal education as a form of intellectual development and could also show the appreciation for girl child education. This finding however, contradicts the findings of Siakwa et al. (2014) a Ghanaian study and Onyedibe et al., (2012) a Nigerian study which showed that majority of mothers with their neonates with sepsis attained primary level education.

The study finding from Nigeria by Onyedibe et al. (2012) revealed that hospital was the commonest place of birth with 87.5 %. This finding is consistent with the current study where a percentage of 61.0 babies were delivered at the hospital.

A study by Onyedibe et al. (2012) shows that mothers of 44.3 % of neonates with culture proven sepsis were resident in urban locations. This study finding is in line with the above findings where 51.9 % of mothers with babies with sepsis are urban residents. It could be because of the location of the study been in an urban area even though the setting is a tertiary hospital that receives cases from all parts of the northern sector. A study by Gebremedhin et al. (2016) found place of residence not to be a predictor of NNS.

This study revealed that about 71.4 % mothers have no child whoever suffered from NNS. However, about one quarter (27.3 %) of mothers indicated that their child ever suffered from NNS. Studies have shown that, history of previous infant with GBS infection is another identified risk factor in subsequent pregnancy (Faxelius et al., 1988; Zaleznik, 2000).

This study demonstrated that 41.6 % of mothers were self-employed. This could mean that many women are making effort to raise (improve) their standard of living through self-economic empowerment. It supports a qualitative study finding by Sossou (2006) in Ghana which indicated
that women work out of dire necessity for the survival of their families, most especially for their children by toiling under extreme economic conditions. This is contrary to Muthwii (2017) which revealed an alarming unemployment rate of (47.1 %) among mothers thereby making them economically dependent on other economic network system.

Majority (93.5 %) of mothers were married. This may imply that mothers will have some economic support from their partners which can help empower them. With regards to religion majority (67.5 %) of mothers were Muslims with (29.9 %) been Christians. This is basically because the indigenes are predominantly Muslims in the region.

In respect to number of children, majority (41.6 %) of mothers had two children while 13.0 % had 4 and above as the least. A study in Ghana shown that the largest number of children per woman is found in the rural areas where the traditional concept of family was strongest and also uneducated urban women had large families compared to average, urbanized, educated and employed women had fewer children by Sossou (2006). The study supports the findings of Muthwii (2017) where majority of mother’s number of children were below three.

5.2 Maternal characteristics / factors posing as risk factors to neonatal sepsis

5.2.1 Maternal characteristics posing as risk factors to neonatal sepsis

Previous studies have found primigravida to have neonates with sepsis as compared to multiparous. The study finding rather observed that multiparous (58.4 %) had babies with sepsis more than the primigravida (41.6 %).

History of abortion/miscarriage had many respondent (50.9 %) with neonatal sepsis. The finding is supported by previous reports which have identified abortion as a risk factor to NNS. Siakwa
and colleagues study observed maternal history of abortion as a significant risk factor for neonatal sepsis (p=0.002) (Siakwa et al., 2014). Also, the famous EUROPOP case control survey that aimed to investigate the relationship between history of induced abortion and preterm delivery in the Europe, it was shown that previous induced abortions were significantly associated with preterm delivery and the risk of preterm birth increased with the frequency of abortions (Ancel et al., 2004).

A 23.4 % of mothers experienced UTI/STI during their pregnancy while majority (44.2%) could not tell their UTI/STI status. Previous studies have identified UTI/STI as a risk factor to neonatal sepsis (Gebremedhin et al., 2016; Muthwii, 2017; Woldu et al., 2014).

Premature rupture of membranes has been implicated in previous studies as a risk factor to neonatal sepsis (Chacko & Sohi, 2005; Shah et al., 2006; Glorgiana et al., 2010; West & Tabansi, 2012). This study found 19.5 % of mothers to had experienced premature rupture of membranes while 44.2 % of them did not encounter that.

The results revealed that 36.4 % of women attended ANC four (4) times. This is in line with previous studies where majority of women with babies with sepsis attended ANC (Siakwa et al., 2014 & Muthwii, 2016). This is in accordance to WHO standard of four (4) antenatal visits recommendation for a healthy pregnant woman from a skilled health care provider (WHO, 2002).

The study showed that most (59.7 %) mothers started their first ANC at their second trimester. This observation supports Muthwii findings where 69.5 % of mothers started their first ANC in the second trimester.

Majority (75.3 %) of mothers had experience medical illness during their pregnancy while 24.7 % did not have. This is contrary to Muthwii finding in Kenya where majority of mothers indicated that they did not experience any medical illness during their pregnancy.
The results shown that 63.6 % mothers’ mode of delivery was SVD while C/S and forceps delivery were the least and shared equal points (18.2 %). This finding further supports previous studies where majority of mothers with neonates with sepsis were delivered SVD (Gebremedhin et al., 2016; Muthwii, 2016). Earlier finding has demonstrated that trans-placental infection or ascending infection from the cervix may be caused by organisms that colonize the mother’s genitourinary (GU) tract, the neonate acquires the microorganisms as it passes through the colonized birth canal at delivery (Klinger et al., 2009).

The study found that 59.7 % of mothers had no prolonged rupture of membranes whiles 18.2 % had it. A case-control study in Ethiopia by Gebremedhin et al. (2016) seen that PROM was higher in cases (30.8 %) than controls (3.8 %).

Majority of women reported not to have known their intrapartum fever status. However, 16.9 % mothers indicated they had it during labour. Previous studies have reported intrapartum fever as a significant factor on neonatal sepsis (Hasan & Mahmood, 2011; Alam et al., 2014). Intrapartum fever is an indication of maternal infection that can be passed on to the baby during birth or in utero through the mothers’ birth canal and results in EOS (Soman, Green & Daling, 1985; Hasan & Mahmood, 2011).

Those with C/S done, majority 14.3 % of them, the length of time membranes broke before C/S procedure was between 4-6 hours. About 51 (66.2 %) mothers indicated that the color of liquor was clear whereas 13 % shown that the color of liquor was dark. These findings agree with Muthwii study where 74.8 % of mother’s liquor color was clear while 20.6 % was greenish.
Most of the mothers delivered at gestational week of 37-38 weeks which showed that most of the babies were delivered at term. This support a finding in Nigeria where 37 weeks and above (term) was recorded (71.1 %) in neonates with sepsis (Onyedibe et al., 2012).

The finding revealed that the maximum length of stay at the facility after delivery was 3-5 days which scored 35.1 %. The longer a baby stay at the hospital, the more he/she is prone to hospital acquired-infections.

The study also observed that 51.9 % of mothers did not seek for health information from health staff after delivery as far as their baby’s care is concern. This may imply that mothers are saturated with health education given to them during ANC or maybe did not do out of ignorance or fear of health staff. This therefore, calls for staff to be friendly to mothers to enable them to ask questions for clarification.

5.2.2 Socio-economic factors of mothers posing as risk factors to neonatal sepsis

The study finding revealed that majority (31.2 %) of mothers had a family size of 4 and also majority of 36.4 % of those using toilet facility are using a pit latrine. Onyedibe et al. (2012) & Muthwii (2016) shown that neonates can get sepsis due to overcrowding in families and also due to the pit latrines vectors can transfer infections to the babies. In relation to household income level, 63.6 % indicated they belong to low income level. This further supports the findings of Onyedibe et al. (2012) as well as Simonsen et al. (2014) acknowledged that low socio-economic factor is a risk factor for NNS.

With regard to breastfeeding after birth, 57.1 % of mothers revealed they had no problems while almost half (42.9 %) of mothers expressed they had breastfeeding problems after birth. Mothers
who don’t breastfeed their babies, their most mode of feeding was use of cup (26.0 %) while minority used feeding bottles (11.7 %). The danger with the use of bottle for feeding babies is maintenance of bottle hygiene which cannot be guaranteed with every mother. Also, babies feeding on any other feed, a 62.3 % of mothers said their babies had no any other feed either than breast-milk while 37.7 % of mothers indicated they did. This could mean that majority understands the importance of breastfeeding. However, a good number of mother’s who were not able to breastfeed their babies gave major reasons as; breast milk inadequacy (24.7 %) and baby refusal to suck (11.7 %). In the work of Onyedibe and colleagues, poor feeding of the neonates was a significant factor of sepsis and can worsen the prognosis in neonates due to the further impaired immunity arising from inadequate nutrients received by the neonates and the reduced maternal antibodies transferred from mother to the neonate (Onyedibe et al.,2012). The inability to feed baby with breast milk might have been a factor since the kind of feed and the process these feeds are made maybe questionable and also the nutritional value compared to breast milk to the baby is not the same and can result in poor transfer of immunoglobulins.

5.2.3 Cultural practices on neonates posing as risk factors to neonatal sepsis

The study revealed that the major umbilical cord care practice by mothers was use of spirit and cotton (58.4 %) which is in line with a study in Kenya by Muthwii (2017) where majority of mothers used cotton and spirit to care for their babies’ cord. However, a good proportion of mothers (37.3 %) also used shea-butter which is contrary to umbilical cord care standards by WHO. There are some cultural practices for cord care that contribute to incidence of sepsis (Lawn et al., 2005). This is possible because the shea-butter leaves the cord not to dry and for that matter...
attracts dirt which can enable microorganisms to penetrate through the veins of the umbilical cord into the bloodstream and lead to sepsis.

This study also observed that most mothers (64.9%) stated there are some newborn bathing practices given to newborns in their localities that can lead to neonatal sepsis. They mentioned care such as bath of baby with herbs (51.9%) and given baby bathed water (drink) (11.7%) as some bathing practices to newborns. This implies poor newborn care practices in communities which call for health care providers to intensify public education on newborn care. Majority (85.7%) of mothers indicated their mother—i.e., law helped to care for their babies. Sethi et al. (2005) study stated that mothers’/ caretakers’ behavior was influenced by mother—i.e., laws advice.

Majority of mothers (48.1%) stated people do not wash their hands before picking their babies in their living area. This finding was further revealed by mothers that they faced challenges applying health education given to them at home such as people washing their hands before picking their babies and application of spirit and cotton to care for their babies’ cord. Sethi and the colleagues (2005) in their study observed that mothers’/ caretakers’ behavior were influenced by traditional beliefs, and pursuance of a practice because it was the norm in the community. This explains the complex nature of extended family system where a mother does not have much control over the baby and decisions concerning the baby is taking by family members which most happens to mothers who live in the family house.
5.2.4 Lifestyle behaviour posing as risk factors to neonatal sepsis

The study revealed majority (87.0%) of mothers wash their hands before attending to their babies. In terms of how often they wash their hands, most (42.9%) pointed out they wash their hands frequent. The qualitative study from informants disagree with this finding by mothers and revealed that and hygiene of mothers is a major factor.

On drinking of alcohol during pregnancy, majority (83.1%) said they did not drink alcohol while a 16.9% shown they did. Simonsen et al. (2014) findings revealed substance abuse to be a risk factor of NNS.

5.3 Neonatal factors posing as risk factors to neonatal sepsis

The finding of the study shown that 58.4% of mothers had their babies cried immediately after delivery. This study result is in agreement with previous work by Siakwa et al. (2014) in Ghana which found that about three quarters (84/96) of babies with sepsis cried immediately after birth.

The study results revealed that 40.3% of babies had Apgar score at 5th minute of <7 while majority of babies Apgar score was ≥7. This study finding is contrary to Gebremedhin et al., 2016 in a case control study where more cases had Apgar score of <7 in the 5th minute.

Previous authors have revealed that majority of babies with NNS were above the birth weight of 2.5kilograms (Onyedibe et al. (2012); Siakwa et al. (2014). This research result did agree with the above study findings as most (49.5%) of babies were between the births weights of 2.5-3.4kilograms.
In the study of Sheikh et al. (2010), reluctance to feed (65%), temperature instability (36%), respiratory distress (45%), lethargy (48%), fever (36%) and seizures (15%) were common presenting complaints of a baby with neonatal sepsis. This study is similar to the above findings as majority (38 respondents) of mothers identified feeding problems to be their major complaints followed by 34 respondents with fever, 21 chose crying at night and 14 seizures.

Majority (92.2%) of babies had no surgical procedure performed before onset of sickness however 7.8% indicated otherwise. The type of procedure done was circumcision (7.8%). Circumcision is a minor procedure to remove the foreskin (the sleeve of skin around the head of the penis). This according to Marie Stopes (2015), can avoid moisture getting trapped between the penis and the foreskin which creates an ideal environment for bacteria to grow.

5.4 Health care factors posing as risk factors to neonatal sepsis

More than three quarters 83.1% of mothers in the study confirmed that laboratory investigation during ANC was carried out on them. Majority (53 respondents) of mothers had laboratory test of HB done while 51, 46, 42 and 41 respondents had G6PD, HIV/AIDS, RDT, and Blood group test respectively done. The least test done among respondents was hepatitis B while 26 of the respondents also indicated they had urine R/E laboratory investigation done during ANC. Though there are laboratory investigations done through the pregnancy period among respondents, it is not enough to rule out sepsis among newborns and more efforts need to be employed especially Urine R/E, hepatitis B and HIV/AIDS screening tests.

From the study, majority (65/77) of mothers illustrated drugs put on was hematinic. Hematinic (folic acid) is part of the routine ANC services render to pregnant women in Ghana to prevent low
blood levels. It can be deduced from the findings that the health facility did not undermine this maternal health policy.

Majority of mothers had VEs performed on them during labour. Three VEs emerged as the highest (46.8 %) number of VEs during labour that was done on mothers. VEs in labour is a routine part of intrapartum care. The study finding agreed with shepherd et al. (2013) study which revealed approximately half of the sample 52 % had 3 or more VEs done during labor. However, at most 70 % of women had more VEs done than expected when the criteria of 4 hourly VEs was applied. The commonest reason given by midwives for performing a VE was to assess labour progress and to assess the commencement of labor. However, every time VE is done, there is the potential for bacteria to be pushed up to the vagina and toward the cervix. It is more a concern when the amniontac sac has released, as there is no protection for your baby against potential infection. (Sam, 2018).

Majority (59.7 %) of mothers-initiated breastfeeding within 30 minutes after birth whiles a 36.4 % of mothers initiated in 1 hour, the least of them was 3.9 % of mothers who initiated breastfeeding between 2-3hours. This finding supports WHO ways of preventing neonatal sepsis which says breastfeeding should be done within 30minutes after delivery (WHO et al., 2015).

Majority of mothers in the study indicated that their baby did not share cot/ bed with another baby on the health facility but 10.4 % responded yes to it. The key informants’ interview revealed Congestion/Overcrowding in both NICU and maternity units: HS4 “inadequate space causing congestion. As you can see some mothers and their babies have to lie on floor beds (mattresses put on the ground)”. She added “we have beds but because of the lack of space” She is however hopeful the problem will be solved when they move to the new maternity building which is more spacious.
Over half (55.8%) of mothers stayed in the health facility for an extended period of time after delivery. This may mean that there were some complications after delivery resulting in longer stay for possible monitoring of mother or neonate or both and also to teach first time mothers. Unfortunately, this extended stay could imply that babies can get nosocomial infection.

Baby taken immunization, majority 80.5% of mothers indicated their babies have taken some immunization while 19.5% of babies not taken. This shown many mothers have not underscore the importance of immunization which is protecting their babies from life threatening diseases and should be encouraged continue.

A quarter (29.9%) indicated that their babies had an IV line passed on them before the onset of sepsis whiles majority (62.3%) said no. Previous studies have implicated IV line access as a risk factor to neonatal sepsis (Camacho, Spearman & Stoll, 2013).

This study finding has observed a 92.2% of mothers indicating that the health staff has given them health education on neonatal sepsis prevention. Of those who indicated they received health education from health staff after delivery, majority (57/77) indicated they received education on immunization follow-ups whereas the least (23/77) also mentioned they received education on caring of baby cord at home.

Health education to mothers during antenatal period about their pregnancies after delivery and their baby care had lessor odds of their sick newborns having blood culture confirmed sepsis than those who did not receive health education (Bua et al., 2013). This may imply there is a gap between knowledge and application.
5.5 Significant risk factors to neonatal sepsis

5.5.1 Socio-demographic data

5.5.1.1 Newborn socio-demographic data

The study demonstrated the following neonatal characteristics to be associated to neonatal sepsis:

**Sex of the baby:** The study observed sex of the baby (male) to be significantly associated (AOR=5.02; 95 % CI 1.69-3.51; P-value-0.005) with neonatal sepsis. This study supports previous works which have identified the male gender as an associated factor for neonatal sepsis (Gargi et al., 2010; Onyedibe et al., 2012; Siakwa et al., 2014). In the work of Siakwa and colleagues the reason for this is not well explained but some authors have suggested that circumcision, although may reduce the risk for contracting HIV/AIDS in the long round, could be a possible factor contributing to sepsis in males (CDC, 2011). Other authors suggested that since the male gender is a risk factor for prematurity and low birth weight (Utomo, 2010; Lawn et al., 2013) and as these factors have also been associated with neonatal sepsis, then it is likely that the relationship between sex and neonatal sepsis is mediated by birth weight and prematurity. However, except for urosepsis which may be more common in females, no gender tendency for a particular type of sepsis has been found in any other studies (Jacobi, 2002; Burke, 2009).

**Age of baby:** Sheikh et al., (2010) study indicated the mean age of neonates at time of their study was 2.73 days. The findings of a study by Bua et al. (2013) revealed that there was a higher proportion of confirmed sepsis cases among sick newborns in the first week of life, born before term. A current study by Muthwii (2017) also found 0-7days babies to be significantly associated (0.020) with sepsis. This study found that age of baby less than 24hours (AOR=1.43; 95 % CI 1.02-3.48; P-value-0.00) and 24hours to 2 days (AOR=3.59; 95 % CI 2.77-4.58; P-value-0.009) was at higher risk of neonatal sepsis and however supports these earlier findings.
Birth position of baby: Also, birth position of baby first (1st) (AOR=4.76; 95 % CI 3.26-5.71; P-value -0.002) stands at high risk of neonatal sepsis compared to other birth category. This implies that a baby born to a first-time mother may have some challenges in regards to newborn care and need to be given appropriate counseling on newborn care.

5.5.1.2 Mothers socio-demographic data as risk factors of neonatal sepsis

Maternal age at delivery: Mothers whose age at delivery less than 20 years had neonates with strong association (AOR=3.47; 95 % CI 2.39-5.28; P-value-0.000) with sepsis than mothers in different age group. This study finding supports earlier studies reported maternal age < 20 to be significantly associated with neonatal sepsis (Siakwa et al., 2014; Gebremedhin et al., 2016). The study by Muthwii, (2017) in Kenya results contradicts this study finding where maternal age was not significantly associated with neonatal sepsis.

Number of children: The findings revealed that number of children mothers have (four (4) and above) was highly associated (AOR=3.82; 95 % CI 1.49-3.77; P-value -0.000) with neonatal sepsis. This finding is contrary to Muthwii study in Kenya where number of children a mother has was not associated to neonatal sepsis (Muthwii, 2017). This could be explained that, the older siblings of baby can transfer organisms to baby through touching with the baby after he/she had picked organisms. So, the fewer the number of children, the lessor the risk to neonatal sepsis.
5.5.2 Maternal characteristics/ factors as risk factors of neonatal sepsis

5.5.2.1 Maternal characteristics as risk factors of neonatal sepsis

**Gestational week of delivery:** Gestational week of delivery by mothers where mothers who delivered within 25-36 weeks were at significant risk of neonatal sepsis (AOR=3.11; 95 % CI 1.05-4.59; P-value-0.012) than their counterparts. Christina et al. concluded in their study that premature infants were more susceptible to hospital – acquired infections as opposed to those with a normal gestational age (Christina et al., 2015)

5.5.2.2 Socio-economic factors as risk factors of neonatal sepsis

**Family size:** This study has found family size of five to eight and nine and above to be strongly associated (AOR=3.51; 95 % CI 1.97-4.76; P-value-0.025 and AOR=3.84; 95 % CI 1.63-6.71; P-value -0.010) with sepsis. This could be explained that the larger the family size of a family the more the baby is predisposed to sepsis. The mother may not be able to control them from picking the baby without proper hand hygiene or stop those with illnesses like respiratory tract infection.

**Kind of baby feeding:** The study results observed that babies who were fed with feeds other than breast milk was found to be significantly associated (AOR=5.04; 95 % CI 1.38-4.87; P-value-0.001) with newborn sepsis. This finding is similar to Muthwii, (2017) findings where type of feeding baby fed (formula feed) was significantly associated (0.011) to NNS. In the work of Onyedibe and colleagues, poor feeding of the neonates was a significant factor of sepsis and can worsen the prognosis in neonates due to the further impaired immunity arising from inadequate nutrients received by the neonates and the reduced maternal antibodies transferred from mother to the neonate. Also, such neonates are predisposed to hypoglycemia which has been identified as an
important predictor of neonatal mortality as indicated in some Ugandan and Nigerian studies (Mugalu et al., 2006; Ogunlesi & Ogunfowora, 2010).
CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter provides study conclusion and recommendations.

6.1 Study conclusion

The study critically examined maternal, neonatal and health care factors that poses as risk factors to neonatal sepsis in the Tamale Teaching Hospital. It established sex of baby, age of baby, birth position, age at delivery, number of children, gestational week at delivery, baby feeding practices and family size were significant risk factors of neonatal sepsis. The following conclusions were made:

On socio-demographic data and maternal factors as risk factors of neonatal sepsis.

- Mother’s aged less than 20 years at delivery posed babies at higher risk to neonatal sepsis compared to other age group and therefore one-on-one counselling should be given to such mothers on newborn care before they are discharged from the hospital.

- Mothers with four or above children babies are at more risk of neonatal sepsis and there is the need for mothers to be observant on baby siblings not to touch or handle baby without proper washing hands.

- Another factor is the gestational week of delivery by mothers where mothers who delivered within 25-36 weeks were at significant risk of neonatal sepsis. Mothers should be
encouraged for prompt antenatal care while health staff does proper assessment and intervention during antenatal care.

- Also, babies fed with other feeds were a factor that exposed them strongly to neonatal sepsis and good infant feeding practices should be encouraged by health personnel.
- One significant factor that was a risk factor was family size of five and above and it is important for mothers to ensure that anyone who is to pick the baby is not suffering from any illness and washes hands before and also limit the number of people who come in contact with the baby if possible.

Socio-demographic characteristics of baby and neonatal factors as risk factors of neonatal sepsis

- The study indicated male sex to be more vulnerable to neonatal sepsis than their counterpart. It is important for mothers to adopt good newborn care practices like circumcision of male child be done at the hospital instead of been done at home locally when the sterility of the procedure is questionable.
- The age of baby was significantly at risk of neonatal sepsis. The younger the baby the more fragile he/she is to sepsis and there is the need to protect babies from getting sepsis through health staff adhering to aseptic techniques while ensuring mothers practice good newborn care.
- Also, first born babies to their mothers stand at more risk to sepsis as compared to other birth positions. Mothers should be given appropriate counselling on newborn care/health and encouraged to join mother-to-mother support group in her locality if there is one to further help them care for their babies when the need arises.

On health care factors that poses as risk factors to neonatal sepsis
• Inadequate health care funding and infrastructure were major economic factors that pose risk factors of neonatal sepsis. Therefore, hospital authorities and policy makers should ensure constant supply of consumables and logistics and provide newborn equipment while building more infrastructure to decongest the units.

• Inadequate hand hygiene by health staff was seen to be a major lifestyle factor that exposes babies to sepsis in the hospital. It is necessary for staff to adhere to aseptic protocols.

6.2 Study Recommendations

The following recommendations were made to the following people;

6.2.1 To Mothers

• Mothers should report early for antenatal care and post-natal care services, report any unusual signs to midwife and deliver at health facility to improve on maternal and neonatal health.

• Mothers should eat nutritious diet during pregnancy and after birth to improve on their/baby nutrition and general health.

• Mothers should ensure less contact to baby by relatives and family members where not possible ensure they wash hands.

• Mothers should ensure good newborn care practices like good cord care, exclusive breast feeding, changing of diapers among other practices.
6.2.2 To Community Members

- Community members should also limit their contact to newborn babies and ensure they wash their hands before handling the baby in order to reduce the risk of neonatal sepsis.
- Community members especially relatives should support pregnant women and mothers by helping them with their house chores to enable them have enough time to rest and care for their babies.
- Abolish harmful cultural practices to pregnant women and newborns.
- Donors or benevolent people should assist the intensive care unit and maternity unit of the hospital with some baby items like clothes, diapers, food etc. to be given to mothers/babies who are in need of them.

6.2.3 To Health Staff

- Health staff should adhere to the Focus antenatal care and do one-on-one counselling to mothers while educate the general public on good maternal and child health care practices such as infant feeding, maternal nutrition, cord care, etc. to improve on maternal and neonatal health.
- Improve communication skills to pregnant women and nursing mothers to gain their understanding on health concepts.
- Health Staff should encourage pregnant women and mothers for antenatal care and post-natal care for routine services and for early detection of illness.
- Ensure aseptic techniques are adhered to and maintain good professional standards to reduce the risk of neonatal sepsis.
• Attend workshops on maternal and neonatal health and implement the knowledge acquired to improve on maternal and neonatal health care.
• Form mother-to-mother support group in communities to enable mothers to help each other especially those mothers who are first timers

6.2.4 To Hospital Authorities

• Hospital authorities should organize workshops at least twice a year on maternal and neonatal health to staff who work with pregnant women, mothers and newborns especially new recruits and to serve as refresher trainings to all staff and also allow interested staff to pursue specialization courses on maternal and neonatal health.
• Hospital authorities should consistently supply newborn care consumables, logistics, equipment, essential drugs like vitamin K, cot sheets etc. to improve on newborn care.
• Hospital authorities should ensure newborn areas in the hospital are always clean and also ensure constant supply of water to enable staff wash their hands before and after performing procedures.
• Hospital authorities should improve on maintenance culture to reduce pairing of babies in incubators, radiant warmers etc. as a number of equipment were broken down without repairs resulting in pairing of neonates in the few functional equipment.

6.2.5 Policy Makers

• Ghana health service/ Ministry of health should build more facilities to reduce the congestion in the neonatal intensive care unit and maternity units in the hospital.
- Ministry of health /Ghana health service should provide more qualified health personnel and monitor their performances to improve quality of care render to pregnant women and babies by health personnel.

- Ghana health service should provide public education on self –medication especially to pregnant women during pregnancy to reduce premature deliveries.

- Ministry of health and national health insurance authority should consider adding feeding mothers with sick newborns in intensive care units to the national health insurance scheme to ensure mothers are psychologically stable to help in the care of their babies.

- Ministry of health/ Ghana health service should consider providing resting place /accommodation for mothers with their babies at intensive care units to reduce the risk of transmission of germs to their babies.
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APPENDICES

Appendix 1: Study questionnaire for mothers

Questionnaire on risk factors of neonatal sepsis among neonates on admission at the neonatal intensive care unit of Tamale Teaching Hospital.

Serial Number……….. Date questionnaire administered……………..

Instructions: Please tick [✓] the appropriate response. This interview will last about 35-40 minutes.

PART ONE: SOCIO-DEMOGRAPHIC DATA

SECTION A: NEWBORN SOCIO-DEMOGRAPHIC DATA

1.1 What is the sex of the baby? {} M {} F

1.2 What is the age of the baby (specify in hours if less than 24 hours or days)? {} Less than 24hrs {} 24hrs-2days {} 3-6days {} 7-14days {} 15-21days {} 22-28days

1.3 Was your baby discharge from hospital after delivery before sickness started? {} Yes {} No {} Unknown

1.4 When did the sickness start after delivery? {} within 24hrs after birth {} 24 hrs -3days {} 4days-7days {} 8days-14days {} 15days-28days

1.5 What is the birth position of this baby? {} first {} second {} third {} other(specify)

SECTION B: MOTHERS SOCIO DEMOGRAPHIC DATA

1.6 What is your age at delivery? {} Less than 20years {} 21-30years {} 31-40years {} Above 40years

1.7 What is your educational level? {} Illiterate {} primary {} secondary {} Tertiary
PART TWO: MATERNAL CHARACTERISTICS /FACTORS POSING AS RISK

FACTORS OF NEONATAL SEPSIS

SECTION B: MATERNAL CHARACTERISTICS POSING AS RISK FACTORS OF
NEONATAL SEPSIS

2.1 What is your parity? { } Primi gravida { } Multi parous

2.2 Any history of abortion / miscarriage? { } Yes { } No { } Unknown

2.3 Were you attending ANC during your pregnancy? { } Yes { } No

2.4 Which gestational trimester did you start your first ANC? { } First trimester { } Second trimester { } Third trimester

2.5 How many times have you attended ANC services before delivery? { } zero { } 1-3 { } 4 { } 5 and above

2.6 Was GBS status checked during pregnancy? { } Yes { } No { } Unknown

2.7 Did you have any urinary tract infection/STI during the pregnancy? { } Yes { } No { } Unknown

2.8 Did you have premature rupture of membranes before delivery? { } Yes { } No { } Unknown
2.9 If yes, indicate gestational age at rupture { } 25-30 weeks { } 31-34 weeks { } 35-36 weeks { } Unknown { } Others (specify)
2.10 During pregnancy did you have any medical illness? { } Yes { } No
2.11 Which medical illness suffered during pregnancy (select as many as applicable)? { } Malaria { } Anemia { } Urinary tract infection { } Others (specify)
2.12 What was your mode of delivery? { } Cesarean Section (C/S) { } Forceps delivery { } Spontaneous Vaginal Delivery (SVD)
2.13 If C/S how long did your membranes break before the procedure was done? { } 4-6 hours { } As soon as the membranes broke { } Others (specify)……
2.14 What was the duration of your labor? { } Between 3-6 hours { } Between 6-10 hours { } 10 and above { } Did not labor
2.15 Did you have intrapartum fever (Temp. > 38 degrees Celsius)? { } Yes { } No { } Unknown
2.16 Did you have prolonged rupture of membrane (PROM > 18 hours prior to delivery)? { } Yes { } No { } Unknown
2.17 What was the color of the liquor? { } Clear { } Dark { } Others (specify) { } Unknown
2.18 At what week of gestation did you deliver? { } 25-36 weeks { } 37-38 weeks { } 38-41 weeks { } Others (specify)
2.19 How long did you stay at the health facility after delivery? { } Less than 24 hours { } 1-2 days { } 3-5 days { } 5-7 days { } 7 days and above { } N/A
2.20 Did you seek for any health information from health staff after delivery during your facility stay? { } Yes { } No { } N/A
2.21 If yes what were some of the health information seek from health staff (select as many as applied)?

- Newborn care
- Breastfeeding
- Baby immunization schedules
- Signs of illness in a baby
- Others (specify)

SECTION B: SOCIO-ECONOMIC FACTORS OF MOTHER

2.22 What is your family size?
- Three
- Four
- Five to eight
- Others (specify)

2.23 What is your household income level?
- Low income
- Middle income
- Higher income level

2.24 What is your household source of water?
- Pipe
- Bore hole
- Well
- Dam
- Others (specify)

2.25 Do you use a toilet facility in your house?
- Yes
- No

2.26 If yes what type of toilet facility?
- Flashing toilet
- Pit latrine
- Others (specify)

2.27 Did your baby have any problem with breastfeeding after birth?
- Yes
- No

2.28 Was the baby fed on any other feed other than breast milk?
- Yes
- No

2.29 If yes, what was your mode of feeding?
- Bottle feeding
- Cup feeding
- Others (specify)

2.30 What was the reason for feeding the baby other than breast milk?
- Breast milk inadequate
- Baby refusal to suck
- Baby too small
- Mother not well
- Others (specify)

SECTION C: CULTURAL PRACTICES OF MOTHER

2.31 How do you care for your baby unbilical cord?
- Apply shea butter
- Use cotton to clean with spirit
- Clean with hot water
- Exposure of baby cord for air to dry it
- Others (specify)
2.32 Are there some care that is given to a newborn in your locality that can lead to this sickness? { } Yes { } No { } Unknown

2.33 What are they? { } Bath baby with some herbs { } Give baby bathed water as a drink { } others (specify)

2.34 Who helps in caring for your baby at home (care-givers)? { } Mother in-law { } Husband { } Neighbor { } Others (specify)

2.35 Do you face challenges applying some health educations from health staff to your baby at home? { } Yes { } No

2.36 If yes, what are the challenges you face in your home?

..............................................................................................................................................................................
..............................................................................................................................................................................

SECTION D: LIFESTYLE BEHAVIORS OF MOTHERS

2.37 Do you wash your hands with clean water and soap before attending to your baby? { } Yes { } No

2.38 If yes how often do you wash your hands in a day before attending to your baby? { } rare { } very rare { } frequent { } very frequent

2.39 Did you drink alcohol during your pregnancy? { } Yes { } No

PART THREE: NEONATAL FACTORS POSING AS RISK FACTORS OF NEONATAL SEPSIS

3.1 Did your baby cry immediately after delivery? { } Yes { } No
3.2 What was the APGAR score at 5th minute? { } <7 at fifth minute { } ≥ 7 at 5th minute { } 10 at 5th minute { } Unknown

3.3 What was the birth weight of the baby in kilograms? { } 1.9-2.4kg { } 2.5-3.4kg { } 3.5-4.4kg { } 4.5kg and above { } Unknown

3.4 Any surgical procedure performed before on set of this sickness? { } Yes { } No

3.5 If yes, specify type of surgical procedure……………………

3.6 What were the presenting clinical signs of sepsis (select as many as applied)? { } Fever { } Feeding problems { } Seizure { } Others (specify)

3.7 Is it the first time the baby is on admission? { } Yes { } No

PART FOUR: HEALTH CARE FACTORS POSING AS RISK FACTORS OF NEONATAL SEPSIS

4.1 Did you do any laboratory investigation during ANC? { } Yes { } No { } Unknown

4.2 Were you put on any treatment during your pregnancy? { } Yes { } No { } Unknown

4.3 What were some of the drugs you were put on during ANC? { } Hematinic { } Antibiotics { } Antihypertensive { } Anti-diabetics { } Others (Specify)

4.4 How many vaginal examinations were done on you during labor? { } 1-2 { } 3 { } zero { } 4 and above

4.5 When did initiation of breastfeeding start after delivery? { } 30 minutes after birth { } 1 hour { } 2-3 hours { } others (specify)

4.6 After delivery did your baby share baby cot/ bed with another baby? { } Yes { } No { } Unknown { } N/A
4.7 Did your baby stay for an extended period of time after delivery in the hospital? { } Yes { } No { } N/A

4.8 Did the baby have IV access (peripherally inserted central catheter line, central venous line/umbilical line prior to the sepsis? { } Yes { } No { } Unknown { } N/A

4.9 Has the baby taken any immunization? { } Yes { } No

4.10 Did health staff give you any health education on newborn care to prevent neonatal infections? { } Yes { } No

4.11 What are some of the health educations you have received from health staff to prevent neonatal infections (select as many as applied)? { } Immunization follow-ups { } Hand hygiene before care of baby { } Cord care of baby { } Good breast-feeding practices { } Early identification of sick baby{ } Others(specify)
RECOMMENDATION FROM MOTHERS

What recommendation will you make to mothers to ensure their babies do not suffer from the same condition?

What recommendation will you make to health staff and authorities of the hospital to ensure that babies do not suffer from this condition?

What recommendation will you make to government to ensure that babies do not suffer from this condition?

God richly bless you for completing this form.
Appendix 2: Key informants interview guide (semi-structured questionnaire)

1. What are the socio-economic, cultural and lifestyle factors of mothers that pose as risk factors of neonatal sepsis?

2. What are the maternal and neonatal factors that pose as risk factors of neonatal sepsis?

3. What are the health care factors that pose as risk factors of neonatal sepsis?

4. What can staff do to ensure that cases of sepsis are reduced among newborns?

5. What can the hospital authorities do so that the cases of sepsis and its related deaths are reduced among newborn?

6. What recommendation will you make to mothers and their community members in order to help reduce neonatal sepsis cases and its effect?

God richly bless you for completing this form.
Appendix 3: Key informant (health staff) interview consent form

Good day, I am Cynthia Maambo a student of University for Development Studies, department of Public Health conducting the study entitled ‘Risk factors of neonatal sepsis among neonates admitted at neonatal intensive care unit in the Tamale Teaching Hospital’

The study has been authorized by the research unit of TTH. In brief the outcome of the study would contribute the structuring / formulation of policies/ protocols towards reducing neonatal sepsis and its death rate among newborns. All information acquire from you would be treated with confidentiality. There is no direct benefit to a respondent however the potential benefit of your participation would be that, responses given would help safe many children live. You would also not be exposed to any risk by participation. You can withdraw from the study any time you deem it necessary. In case you need any information/ complaint of the study please contact the following contacts/ office:

1. CYNTHIA MAAMBO 0549969294
2. DR. WOMBEOGO 0208043042
3. DR. ALHASSAN ABDUL-MUMUN 0540491218
4. TAMALE TEACHING HOSPITAL RESEARCH UNIT HEAD

Principal Investigator/Research assistant’s Name……………………………………
Signature……………………
Date……………………………………Time……………………
Appendix 4: Mothers consent form

ADDRESS: UNIVERSITY FOR DEVELOPMENT STUDIES

DEPARTMENT OF PUBLIC HEALTH

PRINCIPAL INVESTIGATOR: CYNTHIA MAAMBO

STUDY TITLE: RISK FACTORS OF NEONATAL SEPSIS AMONG NEONATES ADMITTED IN THE NICU OF THE TAMALE TEACHING HOSPITAL (TTH).

MOTHER’S INFORMED CONSENT FORM

Good day, I am Cynthia Maambo a student of University for Development Studies, department of Public Health conducting the study entitled ‘Risk Factors of Neonatal Sepsis Among Neonates admitted in the NICU of the Tamale Teaching Hospital (TTH)’

The study has been authorized by the research unit of TTH. In brief the outcome of the study would contribute the structuring / formulation of policies/ protocols towards reducing neonatal sepsis and its death rate among newborns. All information acquire from you would be treated with confidentiality. There is no direct benefit to a respondent however the potential benefit of your participation would be that, responses given would help save many children live. You would also not be exposed to any risk by participation. You can withdraw from the study any time you deem it necessary.

I (participant) read/ had translated to me with the above information and I confirmed that every portion of the study been duly explained to my understanding; I hereby accept voluntarily to partake fully and provide all needed information for this study.

Participant signature/thumbprint………………………….
Appendix 5: Letters

Department of Research & Development
Tamale Teaching Hospital

TTH/R&D/SR/137
21/12/2017

TO WHOM IT MAY CONCERN

CERTIFICATE OF AUTHORIZATION TO CONDUCT RESEARCH IN
TAMALE TEACHING HOSPITAL

I hereby introduce to you Ms. Cynthia Maambo, a final year Master of Philosophy student in Community Health and Development, from the University for Development Studies, Tamale. She has been duly authorized to conduct a study on “Contributing Factors on Neonatal Sepsis as a Key Causation of Neonatal Death in the Neonatal Intensive Care Unit of the Tamale Teaching Hospital”.

Please accord her the necessary assistance to enable her complete her study. If in doubt, kindly contact the Research Unit at the second floor of the administration block or on Telephone 0209281020. In addition, kindly report any misconduct of the Researcher to the Research Unit for necessary action.

Please note that this approval is given for a period of six months, beginning from 21st of December, 2017 to 21st of June, 2018.

Thank You.

Alhassan Mohammed Shamudeen
(HEAD, RESEARCH & DEVELOPMENT)
UNIVERSITY FOR DEVELOPMENT STUDIES
School of Allied Health Sciences

P. O. BOX TL 1350
Tamale Campus
Tamale - Ghana
11th December, 2017

To:
Head Research Unit, TTH

Dear Sir/Madam,

LETTER OF RECOMMENDATION FOR MISS CYNTHIA MAAMBO, AN MPhil STUDENT IN COMMUNITY HEALTH AND DEVELOPMENT

I am recommending to you Miss. Cynthia Maambo. She is an MPhil Student in Community Health and Development, at the Department of Public Health, School of Allied Health Sciences, UDS and is doing a research on the topic “Contributing factors on neonatal sepsis as a key cause of neonatal deaths in the NICU of the Tamale Teaching Hospital”. She is seeking permission to and assistance with, some primary and secondary data to enable her complete her study.

I therefore humbly recommend her for your kind and considerate assistance as much as possible.

Yours Sincerely,

Michael Wombeego (PhD)
Senior Lecturer, HOD/SAHS/UDS

C:
Head, NICU, TTH

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