UNIVERSITY FOR DEVELOPMENT STUDIES

MATERNAL DETERMINANTS OF ADVERSE BIRTH OUTCOMES (ASPHYXIA, LBW AND PPH) IN LAMBUSSIE DISTRICT, GHANA

FRANCIS ZINENUBA TAABIA

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BY

FRANCIS ZINENUBA TAABIA [BSC. COMMUNITY NUTRITION]

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

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Declaration

I, Francis Zinenuba Taabia, hereby declare that this thesis is my own work towards the partial fulfillment for the award of an MPhil degree submitted to the University for Development Studies, School of Allied Health Sciences. This work has not been previously published by another person nor has it been accepted for the award of any other degree of the University or another and contains no material previously published except where due acknowledgement has been made in the text.

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Abstract

Adverse birth outcomes continue to be global public health challenges, particularly in poor resource setting. Policy makers are often focused on curative medical care to the neglect of the impaired functioning and the life-long disabilities of these adverse birth outcomes in populations. This cross sectional study was aimed at assessing the nutritional, socioeconomic, health service and maternal risk factors associated with birth or pregnancy outcomes. About 183 mothers were systematically sampled among six sub-districts for this study. Data was analyzed with the use of STATA version 13. Multivariate logistic and univariate regression models were estimated to assess the association between dependent and independent variables at a confident level of 95%. The results from the study showed that the prevalence of low birth weight, moderate asphyxia and postpartum haemorrhage were 8.2%, 9.3% and 7.1% respectively. Factors that were significantly associated with low birth weight included alcohol intake (P<0.034), GWG (p<0.036), maternal height (p<0.028), food taboos (p<0.017), religion (p<0.037), transportation (p<0.001), gravidity (p<0.013) and parity (p<0.008). For instance, babies of mothers with history of alcohol (pito intake) were 130g lighter in birth weight as compared with babies of mothers with no alcohol history. Also, the results revealed that maternal education (p<0.001), nutrition counseling during pregnancy (p<0.023), meal frequency (p<0.045) and gestational weight gain of the mothers (p<0.018) were significantly associated with moderate asphyxia among the babies of respondents in the study. Lastly, postpartum haemorrhage as experienced by some mothers during delivery was also influenced by daily food supplements (p<0.057), knowledge of four star meal (p<0.011), malnutrition (p <0.058), transportation (p<0.0321) and parity of the respondents (p<0.046). As a conclusion, socioeconomic background of the respondents, nutritional and health service related factors played a significant role in the outcomes of deliveries of the pregnant mothers. Therefore, nutrition stakeholders at the district level needs to double up their efforts in health promotion and education programmes to discourage the women on “pito” intake prior to conception and during pregnancy.

Acknowledgement

My infinite gratitude first of all goes to the Almighty God for the gift of life, knowledge, guidance and providence given me throughout the research period.

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Besides the above, I am thankful to my parents, relatives, friends, colleagues and all persons who provided assistance to me for this research to come to a reality.

All said and done, my profound gratitude to the mothers and caregivers of the Lambussie District, for responding to my questionnaires. My warmest gratitude also goes to the Midwives and Community Health Officers who assisted with the administration of the questionnaires to the respondents.

Dedication

This thesis is dedicated to all students who died in the course of their University education

List of Abbreviations / Acronyms

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
BMI	Body Mass Index
BSc	Bachelor of Science
CETS	Community Emergency Transport System
CHD	Community Health and Development
CHPS	Community-based Health Planning and Service
CI	Confidence Interval
CRH	Corticosterone Hormone
ELBW	Extreme Low Birth Weight
FAE	Foetal Alcohol Effects
GDHS	Ghana Demographic and Health Survey
GWG	Gestation Weight Gain
Hb	Haemoglobin
HGB	Blood Haemoglobin
HIE	Hypoxic Ischaemic Encephalopathy
HIV	Human Immune Virus
IFA	Iron Folic Acid
IOM	International Organization for Migration
IQ	Intellect Quota
IUGR	Inter-Uterine Growth Restriction
LBW	Low Birth Weight
MICS	Multiple Index Cluster Survey
N	Sample Size
NBW	Normal Birth Weight
OECD	Organization for Economic Co-operation and Development
OR	Odds Ratio
PH	Power of Hydrogen
PhD	Doctor of Philosophy
PIH	Pregnancy-induced hypertension
PNC	Postnatal Care
PPH	Postpartum Haemorrhage
RR	Relative Risk
TBAs	Traditional Birth Attendance
UDS	University for Development Studies
VLBW	Very Low Birth Weight
WHO	World Health Organization
WIFA	Women in Fertility Age

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CHAPTER ONE

1.0 Introduction

Nutrition and fitness play a major role in maternal and child health. After conception, mothers or pregnant women provide the basic precursors or building blocks for the foetal growth and development. These building blocks in turn set the pace and to a larger extent determine the survival or otherwise of the child. Poor maternal health and nutritional status have been related to adverse birth outcomes such as low birth weight/macrosomia, asphyxia, Still births, postpartum haemorrhage, maternal deaths among others. However, the inter relationship between maternal determinants and birth outcome is webbed and is said to be effected by many biologic, socioeconomic, and demographic factors, which vary widely in different populations (Abu-saad & Fraser, 2010).

Birth asphyxia, also called asphyxia neonatorum, is the inability of an infant to establish regular respiration following birth (Seattle Children's, 2017). Some school of thought also refer to birth asphyxia as neonatal or perinatal asphyxia. The condition results from an inadequate supply of oxygen to an infant while in the womb or during the delivery process. Decreased oxygen intake by the baby can result in chemical changes in the infant's body that could include low levels of oxygen (hypoxemia) in the blood, and too much of acid build up (acidosis) in the blood (Nandyal, 2013). Hypoxia and acidosis can depress heart muscle (myocardial) function which can lead to low blood pressure (hypotension) and lack of sufficient blood flow (ischemia). Ischemia will then lead to decreased oxygen delivery, which can further compromise, and disrupt delivery of substrate and removal of metabolic and respiratory by-product (e.g. lactic acid, carbon dioxide). Low blood pressure can also lead to decreased blood flow to the various organs (brain, heart and adrenals affected later) of the body (Nandyal, 2013).

At birth, doctors and nurses check the baby's condition carefully and give a number rating from 0 to 10. This number is called an Apgar score. The Apgar score is a rating of the skin color, heart rate, muscle tone, reflexes and breathing effort. A very low Apgar score (0 to 3) lasting longer than five minutes may be a sign of birth asphyxia. A baby who has not had enough blood flow or oxygen to its body may have abnormal breathing, poor circulation, lethargy (lack of energy), lack of urine output and blood-clotting abnormalities (Birth Injury Guide). The amount of harm to the newborn depends on how long and how severe the period of asphyxia is, and how quickly the right treatment is given. Two stages of injury can happen with birth asphyxia. The first stage happens within minutes without oxygen. Cell damage occurs with the initial lack of blood flow and oxygen. The second stage of damage is called "reperfusion injury" and can last for days or even weeks. This injury occurs after restoration of normal blood flow and oxygen to the brain, and is due to toxins released from the damaged cells. It should be noted that, in many cases, the timing of asphyxia cannot be established with certainty (Luana et al., 2016).

Babies with mild or moderate asphyxia may recover fully. Babies whose cells did not get enough oxygen for a longer time may have permanent injury to their brain, heart, lungs, kidneys, bowels or other organs. When a premature baby has asphyxia, the damage may lead to cerebral palsy, developmental disabilities, attention deficit hyperactivity disorder or impaired sight. In the most severe cases, asphyxia can lead to organ failure and death. It is considered a medical emergency and immediate steps must be taken to establish respiration to prevent long-term damage or death. About one quarter of all neonatal deaths globally are caused by birth asphyxia (Ariawan et al., 2011).

Birth weight is the first weight of the foetus or newborn obtained soon after the birth. It is ideally measured within the first hour of life to avoid significant postnatal weight loss occurring. Low

birth weight (LBW) is defined as weight at birth of less than 2500 gram while very low birth weight (VLBW) is defined as birth weight of less than 1500 grams (WHO, 2013). The infants may be grouped into three categories using birth weight as the criterion: Low birth weight (< 2500 g). Very low birth weight (< 1500 g). Extremely low birth weight (< 1000 g) (Care of the Newborn in Developing Countries)

Postpartum haemorrhage (PPH) is one of the main causes of maternal death worldwide. It is an obstetric emergency that needs to be managed promptly and effectively to reduce the risk of morbidity and mortality. Postpartum haemorrhage is defined as blood loss greater than 500mls and continuing (W&CH/GL/M0021, 2014; the women's, 2013). This definition is used as a marker for audit and to mobilize extra resources. However, clinically significant postpartum haemorrhage is more usefully defined as any excessive bleeding that causes the woman to become symptomatic. Primary postpartum haemorrhage occurs in the first 24 hours postpartum and secondary postpartum haemorrhage occurs 24 hours to 6 weeks after birth (W&CH/GL/M0021, 2014). The causes of primary postpartum haemorrhage may include: Uterine atony, Genital tract trauma, Retained placenta and clots, Inherited or acquired coagulation defects, uterine inversion and Placenta previa and placenta accrete (Oyelese & Ananth, 2010).

A major postpartum haemorrhage is defined as such when there is continued bleeding and failure to respond to first-line management and cases where blood loss is approaching or exceeding 1000mL (the women's, 2013). Women may lose up to a third of their blood volume (1500-1800mls) without showing signs of shock. Assessment of signs and symptoms is more clinically useful than blood estimation alone. These include; feeling unwell, lightheaded and/or fainting, pallor, cold peripheries and/or goosebumps, hypotension and/or tachycardia (occasionally bradycardia), agitation and/or confusion (W&CH/GL/M0021, 2014).

The immediate consequences of postpartum haemorrhage may include: failure of or impaired lactation leading to an undernourished child prone; Anemia leading to susceptibility to post-partum infections; deterioration of existent diseases, especially in mothers who are anemic, or have tuberculosis, HIV, and cardiac lesions; postpartum mental alterations, especially in the sick mother who cannot fend for her child (Walvekar & Virkud, 2006). Delayed consequences may also include: prolonged collapse with pituitary failure and Sheehan's syndrome, with resultant secondary amenorrhea and infertility; premature aging, apathy and mental confusion; Chronic and debilitating anemia (Walvekar & Virkud, 2006)

Low birthweight is found to be closely associated with inhibited infant growth and cognitive development, foetal and neonatal mortality and morbidity, and chronic diseases later in life. Multiple factors affect the duration of the gestation and foetal growth, and thus, the birthweight. These factors are related to the mother, the physical environment or the infant, and play a significant role in determining the birthweight and the future health of the infant (UNICEF & WHO, 2004). The consequences of low birth weight for both the interim and long run are enormous. More common in developing than developed countries, a birthweight below 2,500 g contributes to a range of poor health outcomes. The mortality range varies from 100-fold across the spectrum of birth weight and rises continuously with decreasing weight. Low birthweight due to restricted foetal growth is found to affect the person throughout life and is associated with poor growth in childhood and a higher incidence of adult diseases, such as hypertension, cardiovascular disease, and type 2 diabetes. An additional risk for girls is having smaller babies when they become mothers (Asia, 2012; UNICEF & WHO, 2004). Also, low birth weight places infants at risk of longer initial hospital stays, neurological impairments, low IQ scores, higher initial hospital costs, health complications such as chronic lung disease or brain haemorrhaging, and developmental

problems such as language delays, attention disorders, emotional disorders etc. (Weight, 2009; Sharma & Mishra, 2013; Sutan, et al., 2014).

Birthweight is reported to be affected in a greater extent by the mother's own poor foetal growth and diet from the period of her own birth to the recent pregnancy, and also, her body composition at conception. Mothers in deprived socio-economic conditions commonly have low birthweight infants. In such instances, the baby's low birth weight is chiefly as a result of maternal poor nutrition and ill-health over a long period of time, particularly during pregnancy, increased rates of infections, and pregnancy complications. This problem has been compounded by the demanding workload during pregnancy for women in these settings (Weight, 2009; UNICEF & WHO, 2004).

Perinatal asphyxia may also result in foetal demise, neonatal death, or a period of recovery during which there is organ dysfunction with possible long-term effects, particularly in neurological function. Clinical manifestations of perinatal asphyxia include: Depression of the neonate at birth with a low Apgar score and acidosis, Multiorgan system dysfunction: Renal compromise with oliguria and elevated creatinine, Hypoxic cardiomyopathy (ECHO or ECG abnormality), Pulmonary complications including respiratory distress and persistent pulmonary hypertension of the neonate, Disseminated intravascular coagulation, Hepatic failure, and Necrotising enterocolitis; Fluid, electrolyte and metabolic abnormalities including: Fluid overload, hyperkalaemia, hypoglycaemia, and acidosis (Royal Prince Alfred Hospital, 2007). One third or more of infants with HIE will have 2 or more organ systems involved, which may include lung, heart, liver, brain, kidneys and hematological (Royal Prince Alfred Hospital, 2007).

Signs and symptoms of neonatal asphyxia may not be very visible, but the most common ones may include; abnormal fetal heart rate, low pH levels, cyanosis, low heart rate, weak muscle tone,

grasping or weak breathing, and meconium stained amniotic fluid (Nandyal, 2013). Another most widely studied symptom of neonatal asphyxia is hypoxic ischemic encephalopathy, because it has the most serious squeal. It is an involvement of the brain from low flow of blood and oxygen resulting in a poor neurological prognosis. It is estimated that this symptom occurs in one per 1000 live births in the U.S.A. whiles 25% of the infants with hypoxemic Ischemic Encephalopathy die in their neonatal period. Also 33 to 50% of the survivors are most likely to suffer from permanent neurodevelopmental disabilities (Nandyal, 2013).

According to World Health Organization low birth weight continues to persist as a significant public health problem globally and is connected to a broad range of both short- and long-term consequences. Overall, it is reported that 15% to 20% of all infants worldwide are born with a lower birth weight than 2500 g, representing more than 20 million births a year. The report showed that the prevalence of low birth weight in developing countries (16.5%) is more than double the prevalence in developed regions (7%). It is indicated that about 50% of the low birth weight prevalence is found in South-central Asia, where about a quarter of all infants weigh less than 2,500 g at birth. In sub-Saharan Africa, the prevalence are around 15%. Central and South America have, on average, much lower rates (10%), while the Caribbean has a level of 14%, almost the level in sub-Saharan Africa. Also about 10% of births in Oceania are low birthweight births (UNICEF & WHO, 2004). In Ghana, Fosu et al., (2013) reported a prevalence rate of 9.2% low birth weight in Ghana. Then again, in the Northern Region of Ghana which share almost the same geographic characteristics with the study sitting, the prevalence of low birth weight was reported to be 26% (Abubakari et al., 2015).

Overall, the global prevalence of postpartum haemorrhage is estimated to be 10.8% and of severe postpartum haemorrhage is 2.8%. However, research has showed a wide regional variation in

postpartum haemorrhage prevalence, ranging from 7.2% of women giving birth in Oceania to 25.7% in Africa (Calvert et al., 2012). The frequency of postpartum haemorrhage is related to the management of the third stage of labor. This is the period from the completed delivery of the baby until the completed delivery of the placenta (Medscape, 2014). Data from several sources, including several large randomized trials performed in industrialized countries, indicate that the prevalence rate of postpartum haemorrhage of more than 500 mL is approximately 5% when active management is used versus 13% when expectant management is used. The prevalence rate of postpartum haemorrhage of more than 1000 mL is approximately 1% when active management is used versus 3% when expectant management is used (Medscape, 2014).

About 40% of all under five deaths occurred in the neonatal period in 2008; in the same period asphyxia was the cause of 9% of all under five deaths (WHO, 2011). About one quarter of all neonatal deaths globally are caused by birth asphyxia (WHO, 2012).

Several factors that occur in utero and during the delivery process can lead to adverse birth outcomes. These factors can be maternal factor (hypoxia, anaemia, diabetes, hypertension, smoking, nephritis, and heart disease, too old or too young), delivery factor/condition (placental abruption, placenta Previa, prolapsed cord, premature rupture of membranes) and foetal factor (multiple birth, congenital or malformed fetus etc.) (Lecture III Neonatal Asphyxia and its Complication). In term newborns, asphyxia can occur in utero and during labor and delivery as a result of impaired placental gas exchange. Preconception risk factors for asphyxia are maternal age $\geq$ 35 years, social factors, family history of seizures or neurologic disease, infertility treatment, previous neonatal death etc. Other risk factors include maternal diseases or conditions, multiple gestation, intrauterine growth restriction, breech presentation, antepartum hemorrhage and fetal heart rate during labor among others (Samad et al., 2016)

The mother's health during pregnancy and delivery could directly affect the overall health of the foetus, and physiological factors inside the womb may also contribute to the development of birth asphyxia (Birth Injury Guide, wiseGEEK; Nandyal, 2013). Once the child is born, the risk of asphyxia does not diminish until regular respiration is established. While in the womb, the foetus' first stool that is passed, known as meconium, can block the foetus' airways, impeding his or her ability to breathe. A compression of the umbilical cord can also result in restricted blood flow that interferes with the ability to breathe properly. Compromised pulmonary (lung) gas exchange or placental abruption occurs when there is a premature separation of the placenta from the uterus, which may lead to asphyxia (wiseGEEK; Namdyal, 2013).

Studies have showed that primed mothers and women with multiple births have higher prevalence of postpartum haemorrhage. Others have also showed that religion, blood loss measurement method, type of management of deliveries, mode of delivery, and study location, are additional factors leading to postpartum haemorrhage among women (Calvert et al., 2012). Low birthweight is found to be closely associated with inhibited infant growth and cognitive development. Multiple factors affect the duration of the gestation and foetal growth, and thus, the birthweight. Predictors of low birth weight are said to include pre-pregnancy weight, maternal height, gestation weight gain, smoking, food supplementation, Hb level, antenatal care and alcohol (Sharma & Mishra, 2013; Chevalier et al., 2007; Isiugo-abanihe, 2011; Abubakari et al., 2015). Studies showed that multiparity are predictors of haemorrhage, caesarean section, multiple pregnancy, foetal macrosomia previous postpartum haemorrhage (Ononge et al., 2016; Calvert et al., 2012; Mpemba et al., 2014).

Importantly, the mother's condition prior to and during delivery also directly affects the welfare of the baby and further determines the overall health status of both the baby and mother thereafter.

There is therefore the need for proactive measures to be taken both at the individual and health facility levels to help minimize the dangers associated with birth outcomes that is if at all they do occur. Poorer communities and facilities are especially at risk due to the lack of modern intervention strategies to help babies and mothers recover from such birth outcomes. It is against this background the study seeks to assess the maternal risk factors influencing birth outcomes so as to help contribute to the scientific knowledge in improving the health of rural women and their babies

1.2 Problem Statement

Maternal birth outcomes are reflections of the physical manifestations of the interplay of underlying multiple factors during the periods of pre-pregnancy, pregnancy and delivery. Evidently, any major alteration in the process could pose a significant difference or effect on the birth outcomes of expectant mothers. These adverse birth outcomes such as low birth weight, birth asphyxia and postpartum haemorrhage among others have been shown to be the main causes of maternal/neonatal deaths worldwide or are associated with several undesirable health outcomes including neurological malfunction- chronic diseases in adulthood such as increased risk of diabetes type 2, hypertension, and cardiovascular diseases-inhibited infant growth and cognitive development (WHO, 2012).

Perinatal asphyxia is found to be associated with 22% of early neonatal deaths (Daripa et al., 2013) and about 9% of all under five deaths globally (Nairi et al., 2015). Whiles, low birth weight stands at 16.5% and 7% in the developed and developing regions respectively (Calvert et al., 2012). In Ghana, Abubakari et al., (2015) reported a prevalence rate of 26% low birth weight specifically in the Northern Region. Also, 15.8% postpartum haemorrhage prevalence was reported among

women who delivered at the Komfo Anokye Teaching Hospital in Kumasi, Ghana (Owiredu et al., 2016).

National data as well as findings from few studies in Ghana suggest high prevalence of these adverse birth outcomes (GDHS, 2014; Abubakari et al., 2015; Owiredu et al., 2016). Given that Lambussie is a resource constrained District, coupled with limited knowledge on the general prevalence and determinants of these adverse birth outcomes (Asphyxia, PPH and LBW), there is a possibility that many of these cases go un-noticed or ignored or under reported. Beside these, there is limited studies on the general prevalence of adverse birth outcomes in Ghana, particularly regional and more so district level studies. The few studies conducted on birth outcome focused mainly on birth weight. To the best of the author's knowledge there is no single study in Ghana that investigated multiple adverse birth outcomes including perinatal asphyxia

Moreover, given the numerous consequences of adverse birth outcomes on the quality of life, it is of great importance to identify factors contributing to adverse birth outcomes and hence understand the relation between maternal determinants and birth outcomes which would provide a basis for developing maternal sensitive and specific interventions that will improve birth outcomes and long-term quality of life and reduce disease occurrence, deaths, and hospital stay and health-care costs, even among the rural women in remote places like Lambussie. This study sought to provide local level information on the prevalence of these adverse birth outcomes and maternal determinants in the Lambussie District.

1.3 Research Study Questions

1.3.1 Main Research Question

1. What are the maternal factors associated with adverse birth/pregnancy outcomes (LBW. PPH and Asphyxia)?

1.3.2 Specific Research Questions

1. What are the prevalence rates of low birth weight, asphyxia and postpartum haemorrhage in the District?
2. What are the nutritional influences of these adverse birth outcomes?
3. What are the maternal socio-economic and health service factors, associated with these adverse birth/pregnancy outcomes in the Lambussie District?

1.4 Theoretical Framework

The theoretical framework used in this study showed that improved birth outcomes are not just a product of health systems and service providers but considered the individual as producers of their own health. Individual factors such as household income, education, age, ethnicity among others influence access to health services which in turn affect the behaviours of the pregnant women regarding mineral and vitamin supplementations and maternal nutrition. This also subsequently has impact on maternal birth outcomes. This could negatively lead to still births, low birth weight, perinatal asphyxia or postpartum haemorrhage among others. The positive effect is that adequate maternal nutrition coupled with good behavioural changes alongside improved access to health services would result in improved birth outcomes such as improved birth weight, reduced perinatal asphyxia or postpartum haemorrhage and others (See Figure 1).

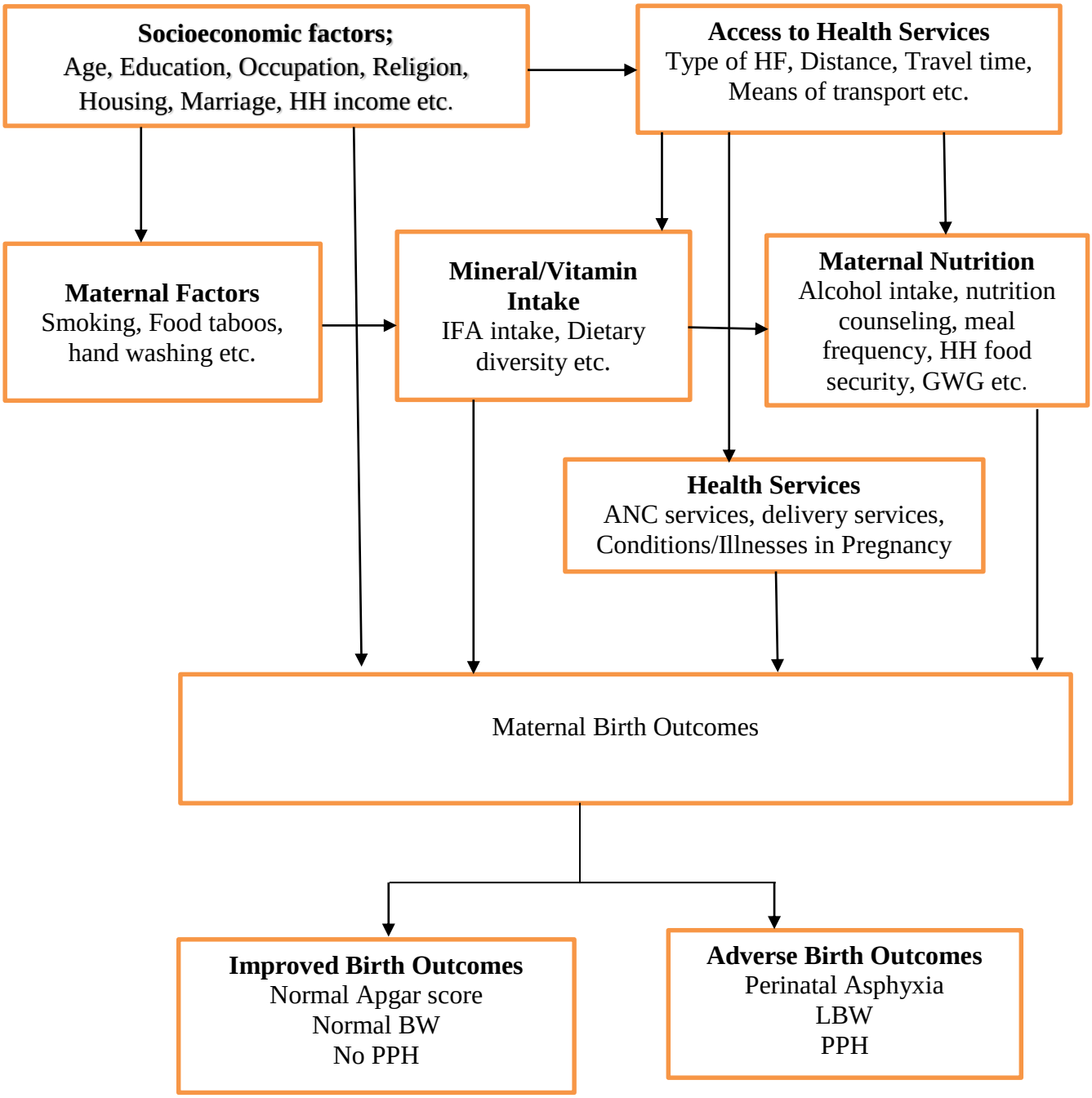


Figure 1: Conceptual Framework for Studying Maternal Determinants of Birth Outcomes

1.5 Research Objectives

1.5.1 Main Research Objective

To assess maternal risk factors associated with adverse birth or pregnancy outcomes (Birth Asphyxia, LBW and PPH)

1.5.2 Specific Objectives

1. To determine the prevalence rates of adverse birth outcomes (Birth Asphyxia, LBW and PPH) in the Lambussie District
2. To assess the nutritional influences of these adverse birth outcomes
3. To assess socio-economic and health service determinants of these adverse birth outcomes in the District

1.6 Significance of the Study

Information on the factors that either hinder or enhance pregnancy/birth outcomes would help health professionals and generally health educators to provide appropriate health services and general health education to improve maternal health status and subsequently impact on the quality of birth outcomes. Findings from the study will also help boost mothers' ability of self-care in practicing certain behaviours that will help improve birth outcomes. Knowledge obtained by mothers from the study will help them minimize risk factors that will obviously impact birth outcomes. Findings from the study may also serve as guide in maternal, neonatal and child health interventions (both specific and sensitive) and help midwives and community health workers to adequately help pregnant women with the relevant health and nutrition information to improve on their birth outcomes.

Improvements of maternal birth outcomes would also set the pace for child survival and continuous development. Thereby helping to reduce infant and maternal morbidity and mortality that are as a result of the continuous increasing risk factors mothers are exposed to. Lastly this study will provide the bases for further studies in maternal, neonatal and child health in related fields.

1.7 Conceptual Definition of Terms

Birth-outcomes: Birth outcomes are a category of measures that describe the health of babies and mothers at birth. Birth outcomes represent a child's current and future morbidity and mortality as well as the mother's morbidity (Gomora et al., 2015). In this study adverse birth outcomes meant low birth weight, low Apgar score, still births, and post-partum haemorrhage.

The main outcome variables, Asphyxia is defined as a delay in the establishment of normal respiration at birth; Postpartum Haemorrhage is bleeding from the genital tract after delivery of the baby amounting to 600ml or more (300ml in anaemic patient and 750ml for women with packed cell of 40%), or any amount of bleeding that can cause deterioration in the patient's condition, and Birth weight is categorized as LBW (< 2,500 grams) and normal birth weight (≥ 2,500).

The main independent variables to be examined in this study will include maternal preterm birth, Continuum of care, weight changes, maternal diet, health education (including bed preparedness plan), and malaria prevention therapy in the pregnancy. Gestational age will be categorized as preterm birth (gestational age < 37 weeks) and term birth (gestational age ≥ 37 weeks). Covariates to be examined will include race/ethnicity, age, education, marital status, tobacco use during pregnancy (yes/no), and alcohol use during pregnancy (yes/no), maternal race and ethnicity data were combined into a single variable with four categories: Dagaare, Sissala and other. Maternal age was grouped into six categories: 19 yrs and under, 20-24 yrs, 25-29 yrs, 30-34 yrs, 35-39 yrs,

and 40 yrs and older. Maternal education reflected the highest level attained at the time of birth and was categorized into four levels: primary, secondary, tertiary and no formal education. Marital status was categorized as married and unmarried, which included the single, divorced, widowed and separated groups.

Self-care is defined by Orem as behaviour that exists in concrete life situations directed by persons to self or to the environment to regulate factors that affect their own development and functioning in the interests of life, health or well-being. Self-care practices are key concept in health promotion that involves decisions and actions that an individual can take to cope with a health problem or to improve his or her health, (Gomora et al., 2015).

Pregnancy: A period from conception to delivery of the fetus, normal duration is 40 weeks, (Gomora et al., 2015).

1.8 Organization of Chapters

The study was organized into six (6) chapters as outlined below: chapter one was the introductory chapter and contained such sub-sections such as the background of the study, problem statement, relevance of the study, scope of the study, the research questions, the objectives of the study, the conceptual framework, the study variables and the organization of the study.

Chapter two contains the literature review section of the research in which all the articles, journals, books, websites and the other sources of information that are relevant to the study will be cited

Chapter three of the study focused on the research methodology and design. Sub-topics that will be covered here include profile of the study area, study design and type, study population, sample size and technique, methods of data collection, ethical considerations and limitations of the study.

Chapter four will also comprise of data processing/analysis and the presentation of the results from the data, while chapter five contained the discussion of the results. Lastly, chapter six will capture the conclusion and the recommendations from the study. References and other figures/tables will form the appendices.

CHAPTER TWO
2.0 LITERATURE REVIEW

2.1.1 Introduction

This chapter involved a thorough examination of existing knowledge related to the current topic of study. Herein are related findings from other parts of the world on the globally and regional prevalence of adverse birth outcomes and also, the maternal predictors of these birth outcomes among different population groups. The predictors examined in this chapter included maternal nutrition, socioeconomic characteristics and health service determinants of birth outcomes. It helped the current researcher to understudy the best research design appropriate for such research, the tools for data collection and the appropriate methods for the data analysis. Lastly, it helped the current researcher to discuss his findings in the light of other existing knowledge.

2.1.2 Adverse birth outcomes

The prevalence of adverse birth outcomes has assumed a global dimension for both the developed and the developing countries (Daniel, 2013). Studies showed that the prevalence of low birth weight in the developing countries (16.5%) is about twice the prevalence of low birth weight in the developed countries (7%) (Daniel, 2013). About 50% of the low birth weight prevalence is reported to come from South and Central Asia whiles 15% is found in Sub-Saharan Africa (Asia, 2012.). Globally, 10.8% of women suffer from postpartum haemorrhage and 2.8% suffer from severe form of postpartum haemorrhage. Africa contribute as high as 25.7% of the cases, 8% in Asia and 13% in Europe and Northern America. Africa recoded the highest (5.1%) also in the prevalence of severe postpartum haemorrhage and Asia recorded the lowest (1.9%) (Calvert et al., 2012). Perinatal asphyxia is found to be associated with 22% of early neonatal deaths (Daripa et

al., 2013) and one-third of all still-births (Aggarwal & Paul, 2001). Also, 33-50% of the survivors of perinatal asphyxia are most likely to suffer from permanent disabilities (Nandyl, 2013).

2.2.1 Low Birth Weight

Low birth weight infants are those born weighing less than 2500 g. These are further subdivided into: Very Low Birth Weight (VLBW): Birth weight <1,500 g, and Extremely Low Birth Weight (ELBW): Birth weight <1,000 g. The primary causes of Very Low Birth Weight are said to be premature birth (born <37 weeks gestation, and often <30 weeks) and intrauterine growth restriction (IUGR). It could be as a result of problems with the placenta, maternal health, or birth defects of the mother from her own childhood. Many Very Low Birth Weight babies with IUGR are preterm and thus are both physically small and physiologically immature.

According to MICS, (2011) Weight at birth is a good indicator for not only the mother's health and the nutritional status but also the newborn's chances of survival, growth, long-term health and psychosocial development of the infant. Low birth weight carries a range of grave health risks for children. As contained in the report, babies who are undernourished in the womb face a greatly increased risk of dying during their early months and years (MICS, 2011). Those who survive have impaired immune function and increased risk of disease; they are also likely to remain undernourished, with reduced muscle strength, throughout their lives, and, which also suffer increased prevalence of diabetes and heart disease in later life. Children born underweight also tend to have a lower IQ and cognitive disabilities, affecting their performance in school and their job opportunities as adults (MICS, 2011).

The prevalence of adverse birth outcomes is no less a challenge for only developing or low income countries. It has assumed a global dimension, manifesting in greater proportion even in the most

advanced countries like the USA and the UK. For example, 12.2% of all USA births were preterm in 2009 (Daniel, 2013). Pre-term birth is closely linked to low birth weight (LBW) and very low birth weight (VLBW)—infants weighing less than 2,500 grams and 1,500 grams, respectively. Globally, low birth weight infants are said to have a 20 times higher risk of death than heavier infants. Low birth weight infants account for 8.2% of all live births in the USA and 4.8% to 7.1% of all live births in Western European countries (Daniel, 2013). Overall, it is estimated that 15% to 20% of all births worldwide are low birth weight, representing more than 20 million births a year (Asia, 2012). Sharma & Mishra, (2013) also noted that Low birth weight is one of the most serious challenges in maternal and child health and is the single most important factor that determines the changes of child survival. The study reported that nearly 50% of neonatal deaths occur among low birth weight babies. Low birth weight was found to be a major determinant of mortality, morbidity and disability of infancy and childhood and also has a long term impact on health in adult life (Sharma & Mishra, 2013). Again, Daniel, (2013) reported that there are disproportionate levels of infant mortality or adverse birth outcomes within the Western European nations. The UK exhibited large variations in infant mortality among different ethnic groups. Pre-term birth rates varied widely geographically, and were particularly high in the UK's Northern and Trent regions. The report indicated that these differences in Pre-term birth rates also existed among ethnic groups in France and Germany, even though these geographic difference where somehow small. Similar patterns of social inequalities in fetal/perinatal mortality were also observed in Nordic countries, although less consistently (Daniel, 2013). Poor or developing Countries suffer the double burden of high incidence of diseases and food insecurity, which have posed serious threat to the survival of vulnerable groups like pregnant or lactating mothers and their babies. This confirmed the findings of the Multiple Indicator Cluster Survey conducted in Ghana. It stated that

low birth weight in the developing world stems primarily from the mother's poor health and nutrition. Three factors were said to have shown the most impact on child health and nutrition statuses: the mother's poor nutritional status before conception, short stature (due mostly to under nutrition and infections during her childhood), and poor nutrition during the pregnancy (MICS, 2011).

Similar to this study, report from the Organization for Economic Co-operation and Development (OECD) family database, on the average across OECD countries about 6.5% of live births were recorded as low-weight births. However, this rate varied considerably from country to country. Rates of low-weight births were lowest in the Nordic and Baltic OECD countries (Estonia, Finland, Iceland, Latvia, Norway, Sweden), where in all cases around or less than 5% of live births were recorded as low weight births. On the contrarily, rates were shown to be by far higher in Greece and Japan, where low-weight births made up around 9.5% of the live births (OECD, 2016). The report indicated that though the prevalence of low birth weight infants had increased in most of the OECD countries since 1990, it has remained stable in some part whiles others like Hungary, Mexico, Poland and New Zealand had recorded a decrease in low weight births. For those countries which recorded an increased in low weight births, the report indicated this was partly due to the increased in the number of multiple births as a result of the rise in fertility treatments, the advanced age of mothers at childbirth and the increased in smoking among young women from the 1970s onwards. Despite the increased in the low weight births in these countries, it did not translate into infant mortality due to the successes made in medical care for newborns (OECD, 2016). In line with these findings, Asia, (2014) also reported that there is considerable variation in the prevalence of low birth weight across regions and/or within countries; however, the great majority of low birth weight births occur in low- and middle-income countries and especially in the most vulnerable

populations. Regional estimates of low birth weight as contained in the report showed 28% in south Asia, 6% in East Asia and Pacific, and 9% in Latin America. According to the report these rates are high, in spite of the fact that the data on low birth weight remained limited or unreliable, as many deliveries occurred in homes or small health clinics and were not reported in official figures, which might have resulted in an underestimation of the prevalence of low birth weight (Asia, 2012). A country specific study in Brazil by Silvestrin et al., (2013) revealed that the rates of low birth weight varied among different age groupings of mothers. For example, the study recorded the prevalence of low birth weight among adolescents and women older than 35years to be 12.3% and 12.5% respectively. This finding were similar to the results obtained from a study in Scotland, among the 9,506 records of births, which also recorded variations in low birth weight among adolescent mothers and late-age mothers (Silvestrin et al., 2013).

In Sub-Saharan Africa the prevalence of infant with low birth weight was found to be 13%. Even though these share somehow similar demographic characteristics and socio-economic challenges. The report indicated a slight variation in the prevalence rate of low birth weight in Sub-Saharan Africa. For example, as contained in the report Eastern and Southern Africa had a prevalence rate of 11% of infants born with low birth weight whiles West and Central had 14%. However, the report did not capture data on Middle East and North Africa (Asia, 2012). According to MICS, (2011) Ghana, out of the 54 percent of births that were weighed at birth in the Multiple Indicator Cluster Survey, approximately 11%of infants were estimated to have weighed less than 2500 grams at birth. However, these estimates are said to be biased for most developing countries for the reason that the majority of newborns are not delivered in health facilities, and those who were represented are only a selected sample of all the births. As such the reported birth weight could not have appropriately represented the estimated prevalence of low birth weight among all children

in Ghana (MICS, 2011). Then again, in Ghana, studies have indicated that 128,000 babies are born too soon each year and 8,400 children under five die directly due to preterm complications. Sub-Saharan Africa and south Asia account for most of the cases (over 60% of preterm births) worldwide (Every Preemie Scale, 2016). The report showed that out of the fifteen million babies born too early each year, more than one million die due to complications related to preterm birth. Low birth weight, due to prematurity and/or restricted growth in utero, is found to be a major contributor of newborn and child deaths, as well as disability and non-communicable diseases globally. About 85% of preterm babies are born between 32 and 37weeks gestation and even though the majority of these babies do not necessarily need intensive care for survival (Every Preemie Scale, 2016). Then again, in a study to examine the prevalence of low birth weight among infants and its association with maternal factors in Ghana, Fosu et al., (2013) reported a prevalence rate of 9.2% low birth weight in Ghana. Then again, in the Northern Region of Ghana which share almost the same geographic characteristics with the study sitting, the prevalence of low birth weight was reported to be 26% (Abubakari et al., 2015). The authors of the study found that, generally, pre-pregnancy body mass index and gestational weight gain were most important determinants of birth weight among the women of the Northern region of Ghana.

2.2.2 Asphyxia

Even though there are challenges with data, available figures are likely to underestimate the real proportion of the burden of the problem. Epidemiological research is still needed to accurately estimate the contribution of birth asphyxia to perinatal morbidity and mortality particularly at the community level (Nair et al., 2015). There are also challenges partly because of the difficulty in collecting accurate epidemiological data on birth asphyxia due to the lack of a common definition of the condition among health professionals. At the moment a gold standard for the diagnosis of

birth asphyxia is not available even in most developed settings. Therefore, most of the studies conducted on the birth asphyxia are conducted in hospital settings in developed countries and these may not represent the real situation particularly at the community level in developing countries (Nair et al., 2015). Neonatal asphyxia and its complication (Hypoxemic Ischemic Encephalopathy, and intracranial hemorrhage) are the most dangerous conditions with high mortality and incidence of poor neurological outcome (Nandyal, 2013)

In a study in Sao Paulo, Brazil to determine the influence of perinatal asphyxia on early neonatal mortality, (Daripa et al., 2013) showed that 1.71 deaths per 1,000 live births were associated with perinatal asphyxia, which corresponded to 22% of the early neonatal deaths. The study observed that even though this value was similar to the national neonatal mortality rate of 1-2 by 1,000 live births observed in developed countries such as Finland, France, Japan, Norway, Sweden and Singapore in 2004, but that the perinatal asphyxia in 22% of early neonatal deaths was 3 times higher than the rate of 8.2%, regarding the period of 2001 to 2003 in the state of São Paulo, as released by SEADE Foundation and by the Department of Informatics of the Brazilian Unified Health System (Daripa et al., 2013). The study attributed the discrepancy to the fact that the institutions considered intrauterine hypoxia and asphyxia at birth as an underlying cause, which is defined as a disease that starts a chain of morbid events leading directly to death, according to World Health Organization (WHO) recommendations. Additionally, that the vital statistics took into consideration the presence of maternal morbidities or prematurity as the underlying cause of early neonatal death, even when hypoxia and/or perinatal asphyxia were reported on the Death Certificate, which might have underestimated asphyxia as a contributor for this outcome (Daripa et al., 2013). However, the study was limited in the sense that it underreported the data because it has to rely on Physicians and institutions to provide the information.

In India, data collected from 17 tertiary neonatal intensive care units, showed that Apgar scores <7 at 1 minute (includes moderate and severe asphyxia) were documented in 9% of all intramural deliveries. 2.5% babies continue to have Apgar scores <7 at 5 minutes of age. Bag and mask ventilation was used in 4.5% infants and less than 1% infants needed cardiac compressions and/ or medications for resuscitation at birth. Perinatal asphyxia was responsible for 20% of all neonatal deaths. Manifestations of HIE were seen in approximately 1.5% of all babies. Perinatal asphyxia was the commonest cause of still-births accounting for one-third of all such cases (Aggarwal & Paul, 2001)

According to a study in Pakistan, birth asphyxia contributed to 16.52% of hospital admissions and is responsible for 21% of infant deaths ((Aslam et al., 2014). In a Retrospective Case control study conducted in the Civil Hospital Karachi, Pakistan for the period of two years, out of the 240 cases fulfilled in the inclusion criteria, 123 were of birth asphyxia representing 51.3% and the remaining 117 (48.7%) were normal. However, the study was only conducted in one tertiary care hospital of Karachi which did not include people of the upper class and as such the data could not predict the overall situation in the country. Secondly, the sample size of the study was very small which may have also limited its ability to detect small differences among the general population (Aslam et al., 2014). Apgar index is used as a good indicator for long-term perinatal results. Additionally, it is considered a useful indicator for examining the well-being and early prognosis of the newborn (Silvestrin et al., 2013). Silvestrin et al. (2013) showed that newborns to adolescent mothers were of higher times (1.44) to be present with an Apgar index within the first five-minute of lower than 7 score. The prevalence of low birth weight and Apgar index were both found to be extremely higher among younger women than 18years old (Silvestrin et al., 2013). In a descriptive cross sectional study in Bangladesh among 9373 live births, out of the 132 neonatal deaths, birth

asphyxia was responsible for 52(39%), whiles the cases of birth asphyxia stood at 266 representing 2.83% of all the live births. Out of the 7961 health facility deliveries in hospitals/clinics, the neonatal death stood at 90 (68%) and birth asphyxia accounted for 33% of all neonatal deaths. Among the 1412 home delivery cases, birth asphyxia accounted for 53% of the neonatal death (42) (Sampa, Hossain, & Sultana, 2012).

About one quarter of all neonatal deaths globally are caused by birth asphyxia and about 40% of all under five deaths occurred in the neonatal period in 2008 (WHO, 2012); in the same period asphyxia was the cause of 9% of all under five deaths (WHO, 2012). 23% of neonatal deaths in low-income countries are due to birth asphyxia (Nair et al., 2015). Similarly, in a descriptive retrospective study at Charlotte Maxeke Johannesburg Academic Hospital, South Africa, among the causes of death according to the Perinatal Problem Identification Programme (PIPP) classification, perinatal asphyxia accounted for 88.3% of the total deaths (53/60) under the study period. The study review indicated that perinatal asphyxia was the main common problem at the Hospital, with approximately 6 admissions every month. Even though the in-hospital mortality was low (60/450, 13.3%), but there was a higher burden anticipated to be in the disabled survivors (Padayachee & Ballot, 2013).. In South Africa Johannesburg, the rate of perinatal asphyxia (5-minute Apgar score <6) was found to be 4.7 per 1 000 live births, and the study also showed evidence of hypoxic ischaemic encephalopathy (HIE) in 3.6 per 1 000 live births which is one of the most serious complications of perinatal asphyxia (Padayachee & Ballot, 2013). Also in a related study to determine the prevalence, risk factors and outcome of perinatal asphyxia in newborns seen in the Special Care Baby Unit, Gusau, Nigeria, Ilah et al., (2015) found out that the overall prevalence rate of perinatal asphyxia was 21.1%. This high rate was attributed to the fact

that the hospital was the state referral center where complicated cases were referred to (Ilah et al., 2015).

2.2.3 Postpartum Haemorrhage

Postpartum haemorrhage (PPH) is one of the main causes of maternal death worldwide. It is an obstetric emergency that needs to be managed promptly and effectively to reduce the risk of morbidity and mortality. Overall, the global prevalence of postpartum haemorrhage is estimated to be 10.8% and of severe postpartum haemorrhage to be 2.8%. However, research has showed a wide regional variation in postpartum haemorrhage prevalence, ranging from 7.2% of women giving birth in Oceania to 25.7% in Africa (Calvert et al., 2012). A little over 8% of women giving birth were estimated to suffer from postpartum haemorrhage ≥500 ml in both Latin America and Asia and prevalence was approximately 13% in Europe and in Northern America. The prevalence of severe postpartum haemorrhage (blood loss ≥1000 ml) was highest in Africa at 5.1% and lowest in Asia at 1.9% (Calvert et al., 2012). According to the study, women with multiple births had a higher prevalence of postpartum haemorrhage compared with women who had singleton births, at 32.4% versus 10.6% respectively. Women who were having their first baby had a prevalence of postpartum haemorrhage of 12.9% compared with 10.0% amongst women who were multiparous. Within all regions the study found a strong evidence between-study heterogeneity. In the univariate meta-regression there was evidence that: region, blood loss measurement method, type of management of deliveries, mode of delivery, and study location, influenced the between-study variation in the prevalence of postpartum haemorrhage of blood loss ≥500 ml (Calvert et al., 2012). Also, within Australia and New Zealand the figure is not very different, the incidence of postpartum haemorrhage is between 5-15% (Jhipiego, 2011). The developing countries are

disproportionately burdened with high incidence of maternal mortality. Despite the great effort in reducing maternal deaths in the areas of improved antepartum, intrapartum, and postpartum care in developing nations, mortality rates are continuing to be high in many countries which lack the capacity to provide advanced medical care. Postpartum haemorrhage accounts for a substantial proportion of maternal deaths in developing countries (Snelgrove, 2009). Healthy mothers were the focus of United Nations' Fifth Millennium Development Goal, with the aim of lowering maternal mortality ratios by 75% between 1990 and 2015. Whiles the traditional and the developed countries recorded a substantive reduction in maternal deaths, postpartum haemorrhage remained a significant cause of death among women of reproductive age in the developing world (Snelgrove, 2009). This was clearly evident when the statistics showed that 99% of the world's half-million annual maternal deaths occurred in the developing countries. The review indicated that lifetime risk of maternal mortality was as high as one in every six women living in the poorest nation as compared to one in 30,000 women on Northern Europe (Snelgrove, 2009). Maternal mortality can be conceptualized as a direct or indirect result of obstetrical complication leading to death, or a previously existing maternal conditions for which pregnancy exacerbates the pathology or contributes to increased severity of illness. Direct causes account for the great majority of maternal deaths in the developing world. A systematic review conducted by the WHO found that postpartum haemorrhage is the leading cause of maternal mortality in Africa and Asia, accounting for up to half of the total number of deaths in these regions. Overall, postpartum haemorrhage accounts for an estimated 25% of maternal mortality worldwide, meaning that developing countries contributed to 12.5% of this global figure (Snelgrove, 2009).

In a retrospective study to determine the pregnancy related causes of deaths in Ghana, Der et al., (2013) indicated that out of the 5,247 deaths among women within the ages 15-49, 12.1% (634)

were pregnancy-related. Eighty-one percent of these pregnancy-related deaths (517) occurred in the community or in the health facility (18.5%) upon admission within 24 hours. Out of 634 pregnancy-related deaths, 79.5% (504) were due directly from obstetric causes, including: haemorrhage (21.8%), abortion (20.8%), hypertensive disorders (19.4%), ectopic gestation (8.7%), uterine rupture (4.3%) and genital tract sepsis (2.5%) (Der et al., 2013). This risk was found to be especially acute in rural areas where health facilities and trained health care providers were said not to be readily accessible. It was clearly shown that more than one-fifth of pregnancy-related maternal deaths in the study were due to haemorrhage, of which 86.2% occurred in the community. This suggested that only a few cases of bleeding that was associated with childbirth made it to health facilities safely (Der et al., 2013). The study attributed the reasons for the maternal deaths to be the likely lack of adequate clinical history, an inherent limitation of retrospective studies, delayed in seeking early medical care, delayed in reaching a health facility, or the delayed with the initiation of the appropriate intervention or a combination of these and other factors on the part of the victims (Der et al., 2013). Also the authors found that 80% of all pregnancy related deaths were due to direct obstetric causes as results of the increased prevalence of infections such as HIV/AIDS and viral hepatitis in developing countries adding to the indirect causes of maternal deaths in those communities (Der et al., 2013). However, even though the study sampled a large number of cases (5,247) for the study, it relied solely on institutional records of deaths over the period of five years which lack internal validity since most of the hospital may not have the capacity to keep good records for such period.

(Udofia & Okonofua, 2008) indicated that primary postpartum hemorrhage (PPH) accounted for the estimated 25% of maternal mortality, and was a major cause of postpartum disability in Sub-Saharan Africa. This figure is similar to the finding of Sanghi and Harshad, who showed in 2006

that greater than half a million women die during pregnancy and childbirth each year, out of that 99% of them occurred in developing countries, from which 150,000 bleed to death. The timing of maternal deaths is said to occur in generally as follows: 24% during pregnancy, 16% during delivery and 60% postpartum (Sangwi, & Harshad, 2006). Over the years even though much progress has been made to reduce maternal deaths in general the postpartum continuous to be the leading obstetric condition still face by the continent of Africa. For example, according to WHO, (2015) postpartum haemorrhage is the most common type of obstetric haemorrhage and accounts for the majority of the 14 million cases that occur each year globally. Moreover, postpartum haemorrhage accounts for 25 per cent of maternal mortality in Africa. The most common (nearly 90%) cause of postpartum haemorrhage is the failure of the uterus to contract appropriately after childbirth (Udofia & Okonofua, 2008), and WHO, 2015). In the event of haemorrhage where there is an absence of timely and appropriate action, a woman could die within a few hours (WHO, 2015). Whereas in the developed world, postpartum haemorrhage is easily prevented and/or managed to eliminate adverse outcomes, mortality resulting from postpartum haemorrhage continuous to remain high in the developing countries. For instance, postpartum haemorrhage accounted for 59 per cent of maternal deaths in Burkina Faso, 53% in the Philippines, and 43 per cent in Indonesia. Nonetheless, some part of the developed world also suffers from the incidence of postpartum haemorrhage. For example, in Albania (Europe), 40% of maternal deaths are a result of haemorrhage whereas in the Western Pacific, Mongolia specifically, postpartum haemorrhage is the second leading cause of maternal mortality. Postpartum haemorrhage also caused considerable suffering for women and their families and places a heavy burden on national health systems (WHO, 2015).

In relating to us the historic burden of postpartum in Africa, Mpemba, Kampo, & Zhang, (2014) reported that the prevalence of postpartum haemorrhage in DR Congo 1997 was 16%, Mozambique 2007/08 was 14%, Senegal 2002 was 22%, South Africa 2002/03 was 10%, Tanzania 1998 was 23%, Zambia 1998 was 28 and Zimbabwe 2001 was 19%. In sub-Saharan Africa, the high rate of maternal mortality rate was found to be due directly to PPH as it accounted for more than one-third of all deaths. Postpartum haemorrhage in Sub Saharan African as of 2010 stood at 34% (Mpemba, Kampo, & Zhang, 2014). In the prospective cohort study to determine the incidence and risk factors for postpartum hemorrhage in Uganda, (Ononge et al., 2016) found that among the 1188 women surveyed, the overall incidence of postpartum hemorrhage was 9.0 %, (95 % CI: 7.5–10.6 %) and also severe postpartum hemorrhage (1000mls or more) was 1.2 %, (95 % CI 0.6–2.0 %). In a related study, conducted in Ghana by Owiredu et al., (2016) showed that the prevalence of postpartum haemorrhage was 15.8% among women who delivered at the Komfo Anokye Teaching Hospital in Kumasi.

2.3 Nutritional Influences of Adverse Birth Outcomes

Inadequate nutrition is the most single important cause of impaired foetal growth. Whereas the adequacy of fetal nutrition is dependent upon many factors and regulating mechanism, it is primarily the effect of nutrition obtained from maternal diet. These factors-regulating mechanism include nutrient intake of mother, nutrition supply to the uterus and placenta, transport of nutrients across the placenta, fetal uptake and regulation of the nutrients. The nutritional needs of woman differ according to the stages of the gestation. A malnourished woman may give birth to a growth restricted fetus that develops into a nutritionally deprived mother and gives birth to another child at similar disadvantage. Poor socio economic status is shown to aggravate the situation and

intergenerational cycle at the time becomes difficult to break. Most importantly malnutrition may cause stress in the foetus, which is one of the important risk factors for preterm birth (Sharma & Mishra, 2013).

According to Sharma & Mishra, (2013) Anthropometric factors associated with low birth weight or preterm births include maternal pre pregnancy weight, height and gestational weight gain. As indicated by the US Institute of Medicine, recommended weight gain according to Body Mass Index (BMI) prior to pregnancy are as follows- For BMI below 19.8= 28-4lb, for BMI 19.8-26=25-35lb, for BMI 26.1-29=15-25lb, and above 29 BMI=15lb (Sharma & Mishra, 2013). Gestational Weight Gain reflects increase in the uterine tissues, the fat stores placenta, plasma volume, the fetus and the breast tissue. It also reflects adequacy of calorie and micronutrients intake and poor weight gain reflects deficiency of these substrates, which are necessary for fetus growth. Nutritional deficiency can result in poor plasma volume expansion and undeveloped maternal tissues to support the fetus. Zinc deficiency is particularly found to cause improper weight gain as it suppresses appetite and also it impairs the synthesis of prostaglandins and collagen and affects uterine contraction. Nutritional deficiency is also shown to be affected by genetic factors, environmental factors and nutritional status, making it a possible determinant of birth weight. Pre-pregnancy weight adequacy and inadequacy of nutrients is reflected in the mother's pre pregnancy weight which further determine the growth and weight of fetus (Sharma and Mishra, 2013).

In a cohort study in Kaiser Permanente Northern California, their findings indicated that gestational weight gain during the 2nd and 3rd trimesters was more strongly associated with infant growth. For instance, respondents who gained weight in the 2nd and 3rd trimesters beyond the IOM recommendations, independently increased their odds of delivering a large for age infant whiles gestational weight gain below the recommendations of IOM also increased the likelihood of having

a small for age infant in the 2nd trimester only. The researchers concluded that interventions to achieve appropriate gestational weight gain may optimize infant size at birth (Sridhar et al., 2016). Comparatively to Chevalier et al., (2007) even though maternal BMI was found to have been related in a non-linear effect on the child health weight with the heaviest babies being born from overweight but not obese mothers. Conversely, maternal BMI were found to have been significantly related to the odds of having a normal weight baby. According to the authors, the higher the weight and height of the women, the less likely they were to have low birth weight babies (Isiugo-abanihe, 2011). Indicators such as smoking and BMI had expected impact on birth weight, with more smoking being associated with lower birth weight (Chevalier et al., 2007). In a study in Nigeria, to determine the maternal and environmental factors influencing infant birth weight in Ibadan, Isiugo-abanihe, (2011) reported that food supplements (such as vitamin/mineral and iron folates) was significant risk factor of low birth weight among women in Ibadan. The authors posit that the women were approximately 3 to 4 times more likely to have low birth weight babies. Also, the authors posit that women who had restricted their diet during pregnancy by observing some food taboo were 3 times more likely to have low birth weight infants.

In a study to determine maternal determinants of birth weight in Northern Ghana, Abubakari et al., (2015) reported of a significant association between lower birth weights and inadequate weight gained (-0.51±0.81kg), lower Hb level (-0.16±0.09kg) and the mothers who experienced episode of diarrhoea during pregnancy (-0.20±0.09kg). Assert to this finding, the MICS, (2011) did also indicate that insufficient weight gain during pregnancy was particularly important since it was associated with the large proportion of foetal growth retardation. (Abubakari et al., 2015) identified pre-pregnancy BMI, gestational weight gain, gestational age, and sex of infant, mother location and diarrheal episodes during pregnancy to be the most influential factors in infants'

weight. Gestational weight gain was particularly showed to have been strongly associated with infant birth weight. Infants of mothers with excessive weight gain were heavier than mothers with adequate weight gain whiles infants of mother less weight gain were lighter (Abubakari et al., 2015). The study similarly found that overweight and obese mothers had infants heavier than infants of normal BMI whiles infants of underweight mothers were lighter. However, the study used routine data from the maternal health record booklet which could have been affected by measurement errors regarding the readings and recording of the parameters such as height, weight and Hb for which the author downplayed the effect of these errors (Abubakari et al., 2015). According to Sridhar et al., 2016 also indicated that, gestational weight gain is known to influence foetal growth. However, the researchers acknowledged that it was unclear whether the associations between gestational weight gain and foetal growth vary by trimester. Similarly, ("Impact of IFA Supplementation, 2015) noted that about half of the study respondents who were anaemic (hemoglobin below 10g/dl), were reduced to 10.8% after IFA intervention. The impact of the intervention was shown to be positive as thirty nine percent subject's hemoglobin came in 12 g/dl or more after the intervention. The authors concluded that nutrition and health education along with IFA supplementation brings a positive impact in improving health and nutritional status as well as in combating anemia. One can therefore infer that increased haemoglobin status of women through IFA supplementation could help reduce the risk of postpartum haemorrhage during delivery. On drug use, a study reported that the results of the paper confirmed and extended earlier findings that maternal smoking decreases birth weight and fetal growth, with smaller effects in sibling models. They also reported that the negative alcohol effect on birth outcomes was pronounced and remained intact in sibling models and that both effects suggested a dose-response relationship (Wüst & University of Aarhus Department of Economics, 2010)

2.4 Socio-Economic and Health Service Determinants of Birth Outcomes

Low birth weight is partially a consequence of choices made by the mother pre- and during pregnancy. Meaning that healthy choices made by the mother could also impact positively on the outcome of the pregnancy and the health of both the mother and the baby. Birth weight could be used as input or an output in a health production functions, such that any exposure to any unhealthy weight in the early stage of physical development increases infant mortality and serious short- and long term effects. Birth weight is said to have substantial returns for the broader society, which has seen organization like World Bank investing in pregnancies aimed at improving material health, nutrition and knowledge in developing Countries. Even in developed Countries, birth weight is still important predictor of health in public policies (Chevalier et al., 2007).

The Health of mother and her general medical conditions are said to affect the fetus in many ways, through the mother/placenta, the supply of several nutrients and oxygen are the two key factors for the growth of fetus. Any distortion in this process could result in altering the fetal growth (Sharma & Mishra, 2013). As such maternal infection transmitted through the placenta can also affect the growth of the foetus. Beside this medical conditions affecting oxygen carrying capacity, utero placental blood flow and the size of uterus can also affect the gestational period and the growth of the fetus. Sharma and Mishra, (2013) reported that maternal diabetes causes long term changes in placenta and may cause fetal growth restriction. In the same way maternal hypertension can also reduce fetal growth due to a reduction in blood flow or an increased risk of preeclampsia. Other chronic conditions shown to affect fetal growth are cystic fibrosis, asthma, pancreatitis, mal-absorption syndrome, starvation, short bowel, collagen vascular disorder, sickle cell (Sharma & Mishra, 2013). Among the pregnancy associated conditions, pregnancy induced hypertension is

said to be the most common disorder in which utero placental insufficiency is frequently seen in mothers. Gestational diabetes is also related to intrauterine growth restriction particularly if the mother has previous glucose intolerance. Maternal infections (like pneumonia, malaria and typhoid fever) during pregnancy were also found to be associated with preterm labor, and also intrauterine infections (Sharma & Mishra, 2013). Additionally, MICS, (2011) noted that diseases such as diarrhoea and malaria, more common in developing countries, which also significantly impair foetal growth if the mother becomes infected during pregnancy. The possible inter-generational effects of poor birth outcomes were reported in Sharma & Mishra (2013). The study revealed that pre-term birth and low birth weight tend to be repeated in families in the study. The epidemiological evidence indicated an increased risk of preterm or low birth weight births in a subsequent pregnancy for women with a previous history of such outcomes. As contained in Sharma & Mishra, (2013), Mercer et al., (1997) report in a prospective study, predicted that mothers with a previous history of a spontaneous preterm birth had a 2.5 fold increased risk of a repeat spontaneous preterm birth compared to women with no previous history of preterm births and as Shiono et al., (1997) reported also in a cohort study, found that the mean birth weight was 3,117g for infants born to women with a history of a previous low birth weight births while 3,429g for infants born to women with no history of a low birth weight births (Sharma & Mishra, 2013). Conversely, Fosu et al. (2013) could not find any association between malaria in pregnancy and low birth weight in a study to examine low birth weight and its association with maternal factors in Ghana. They also observed a high significant association between low birth weight and Antenatal Care at a p-value of 0.0010 in Ghana (Fosu et al., 2013)

In a cohort study in Britain, birth weight was identified as a predictor of child health and development. Maternal education was significantly (but in small measure-11grams) associated

with birth weight. Relaxing the assumption of exogenity of maternal education, it was estimated that an additional year of maternal education is estimated to have increased the average birth weight by 15grams (or 2%) (Chevalier et al., 2007). Generally, Chevalier et al. (2007) noted that the more education mothers receive, the more favorable the birth outcomes, even though he also noted that the difference in age and parity between mothers could have affected the outcome of the study, and that the result was potentially biased by the endogeneity of education. The research also downplayed the role of maternal education to have improved birth outcomes since the UK health system was mainly homogenous. The research included a cohort of women in their fifties, who probably have multiple parities and may have gathered some amount of experience and knowledge from previous outcomes (Chevalier et al., 2007). Similarly, in Nigeria it was revealed that the probability of delivery low birth weight was found to be higher among mothers with education lower than the tertiary education and the unmarried. Marital union in the study was related to the importance of socioeconomic support on maternal health and birth outcomes (Isiugo-abanihe, 2011). Then again, Silvestrin et al., (2013) also found out in a study in Brazil that maternal lower level of formal education was significantly associated with adverse birth outcomes like still birth. Similarly, in a study to determine the maternal risk factors and consequences of low birth weight in infant, Sharma & Mishra, (2013) indicated that there was an indication of increased risk of preterm/ intrauterine growth restriction births for unmarried women. The basis for this protective effects of marriage was attributed to the social, psychological, emotional and financial support partners derived from their union. Similarly, Fosu et al. (2013) observed that educational level of mother was a significant (p-value=0.0011) risk factor for low birth weight infants in Ghana.

Among OECD countries, comparisons of different population groups within countries suggest that the proportion of low birth weight infants were likely to have been influenced by differences in education, income and associated living conditions. For example, in the United States there were marked differences between ethnic groups in the proportion of low birth weight infant. Large differences were observed, also, when the researchers considered the indigenous and non-indigenous populations in Australia and Mexico (OECD, 2016). Similarly, as contained in Sharma & Mishra, (2013) Shiono et al., 1997 in a population based study of ethnic differences in birthweight found that maternal ethnic group was a strong correlate of birth weight. The authors again noted that the major factors associated with racial differences were nutritional deficiencies, unplanned pregnancies, pre-post-natal health, socio economic status and unhealthy behaviours. Fosu et al. (2013) reported of similar significant influence of mother location (Urban and rural) and economic status (p-value=<0.0001) on low birth weight in Ghana. However, they could not establish any relationship (p-value > 0.05) between ethnicity and marital status, and low birth weight.

A study in Nigeria, on the maternal and environmental factors influencing infant birth weight in Ibadan, Isiugo-abanihe, (2011) reported that mothers with gestational age of less than 37 full weeks were related to low birth weight deliveries (OR = 87. 39), with low gestational age being the strongest associated factor in low birth weight. The study emphasized the effect of intrauterine growth restriction as a predictor of low birth weight as compared to prematurity in developing countries (Isiugo-abanihe, 2011). Silvestrin et al. (2013) also found out in a study in Brazil that maternal age was significantly associated with adverse birth outcomes like still birth. For example, the result showed that the prevalence of low birth weight was higher in the extremes of reproductive life. The rates of low birth weight deliveries increased consistently with younger

maternal age, with that of mothers aged 15years or younger recording higher percentages. Similar to this finding, the MICS, (2011) reported that both in the developed and the developing countries alike, teenager mothers who are yet to finish growing run the risk of bearing underweight babies. Contrarily to the assumption that the higher the maternal age would automatically have dealt with low birth weights, advanced maternal age (>30years) however increased low birth weight among women in the study (Silvestrin et al., 2013). It was stated that maternal factors/conditions such as arthritis, chronic blood hypertension, depression, cancer and acute myocardial infarction were associated with advanced maternal age which also constituted independent risk factors for fetal growth restriction. Fetal growth restriction was found to be a leading cause of low birth weight among well-to-do mothers (Silvestrin et al., 2013). Similar to the finding of Fosu et al. (2013), there exist the risk for maternal age less than 24 and above 35years (p-value=1.3409E-19 and 3.8257E-21 respectively), alongside mothers who had given birth to more than four children (p-value=1.4519E-33) with low birth weight in Ghana. Sharma and Mishra (2013) also noted that advanced maternal age deserves special attention. The study suggested that Epidemiological studies pointed out the changing trend in developing countries to delay the age of first pregnancy whereas maternal age above 35 years for first pregnancies is found to be associated with reduced intrauterine fetal growth, which is a leading cause of low birth weight. Ironically, the study also pointed out that there was an increased trend of preterm birth or intrauterine growth restriction or low birth weight for the first child compared to subsequent children among women with multiple parity (Sharma & Mishra, 2013). Whereas across OECD countries, the increased in low birth weight infants is said to be associated with the increased in the number of multiple births as a result of the rise in fertility treatments, the increased age of mothers at childbirth and the increased in smoking among young women from the 1970s onwards. The report however, indicated that this

increased in the low weight births in these countries did not translate into infant mortality due to the successes made in medical care for newborns (OECD, 2016).

Isiugo-abanihe, (2011) also noted that mothers living in households with impoverished social services like latrines, water supply, household fuel, and sleeping rooms, had higher risk of delivering low birth weight babies. They also reported of other significant risk factors for low birth weight deliveries to be maternal age less than 25years, first parity, maternal weight and height, late initiation of ANC, pre-term delivery, and the presence of illness. Although the risk of association was distinctly lower for most of the maternal factors, pre-term delivery was showed to be the main factor affecting low birth weight rate in the study (Isiugo-abanihe, 2011).

In Ibadan, Nigeria Isiugo-abanihe, (2011) found that women who received inadequate prenatal care had increased risk of low birth weight infants. According to the authors, women who had fewer than six antenatal care visits had twice increased risk of low birth weight babies relative to those who had more than six ANC visits ($X^2 = 23.6$; $P<0.05$). Within both the USA and Western European countries, the evidence in roughly two-thirds of studies suggests that neighbourhood socio-economic status is a determinant of adverse birth outcomes. However, most of these studies have been cross sectional rather than prospective. Furthermore, no studies have yet explored whether specific neighbourhood material goods and services may be related to infant mortality or birth outcomes; such analyses are said could help unpack the specific mechanisms for the effects of neighbourhood socio-economic status (Daniel, 2013).

Birth Interval- both short (<18 months) and long (>60 months) intervals have been found to be associated with low birth weight and preterm birth. This is because short inter pregnancy interval is said to have resulted in inadequate replenishment of maternal nutrient stores, thereby affecting the amount and quality of maternal nutritional store for foetal growth. Women with short inter

pregnancy interval were also likely to have suffered from multiple associated risk factors such as high parity, previous history of preterm birth or low birth weight, poor education, minority race and use of tobacco. This affected the mother's ability to facilitate growth process of the foetus over the years after the first pregnancy, leading to stress and eventually preterm birth or low birth weight. Then again, women with longer inter-pregnancy interval are more likely to give in advanced ages (> 35years) which also predispose mothers to other medical risk factors that may eventually lead to preterm birth or low birth weight in mothers with long inter pregnancy intervals (Sharma & Mishra, 2013). According to "Every Preemie Scale, Ghana profile of preterm and low birth weight prevention and care, the major risk factors associated with low birth weight delivery (14% preterm birth rate and 11% low birth weight rate as indicated in the report) in Ghana were; Adolescent birth rate, Birth interval <24 months, Female short stature, Anemia in women of childbearing age, Female obesity, Diabetes prevalence in women, Hypertension in women, Adult HIV, Households with place to wash hands, soap and water, Household solid fuel for indoor cooking, Violence against women in pregnancy (Every Preemie Scale, 2016). Female babies were significantly more likely to be low birth weight (OR =1.53, CI=1.17-2.00) relative to male babies (Isiugo-abanihe, 2011).

The relationship between the use of substance and adverse birth outcome have also been studied across difference settings. For example, among 5,166 mothers in Brazil during a postnatal interview, an increased risk of intrauterine growth restriction was found among smokers (adjusted OR 2.07, 95% CI1.69, 2.53) and the risk of preterm birth was also found to have increased for mothers who continued smoking throughout pregnancy (OR 1.54, 95% CI 1.24, 1.92). An etiological fraction of 17.7% for smoking in causing low birth weight was reported. A positive effect of interruption of smoking during pregnancy on birth weight was observed. Similarly, a

number of studies indicated that cigarette smoking or tobacco use amongst women during pregnancy is found to be leading cause of low birth weight (MICS, 2011 and Every Preemie Scale, 2016). Alcohol is the second most common substance studied in relation to pregnancy. Fetal alcohol spectrum disorders including fetal alcohol syndrome, foetal alcohol effects (FAE) and alcohol related neuro developmental disorders are all related to the use of alcohol prior to and during pregnancy (Sharma & Mishra, 2013). Societal factors such as psychological disturbance, alcohol use, poor self-esteem and abuse may aggravate the impact of low birth weight. Both chronic and acute stress may increase release of Corticosterone hormones and trigger the cascade resulting in preterm labor, which is a leading cause of low birth weight (Sharma & Mishra, 2013) Environmental Factors were also found to be associated with adverse birth outcomes according to Sharma & Mishra, (2013). Psychosocial Factors like Stress and Socioeconomic status (Racial and social differences) and their impact on pregnancy outcomes are the most extensively studied factors. During the period of chronic stresses, the concentration of glucocorticoid and cate cholamine in mother are released from the placenta. These hormones intern increase production of prostanoids which are implicated in the onset of labor. The authors further noted that mothers with onset of preterm labor had high level of plasma CRH than mothers who did not experience preterm labor. Catecholamine released as a result of stress were also found to have reduced the placental blood flow and affected the growth of fetus (Sharma & Mishra, 2013).

2.4.2 Factors Influencing Asphyxia

The amount of children born at 37 weeks or more who died with perinatal asphyxia, mainly within the countryside of the State, was significant. The deaths in newborns are considered a sentinel event, and can be avoided by simple and inexpensive interventions during labor and delivery. Such measures also include the use of appropriate techniques for neonatal resuscitation, with the

possibility of reducing neonatal mortality by asphyxia within 45% of cases. The report of the Apgar score less than seven at 5 minutes of life in 71% of 2,548 infants who had this information available is a strong association observed in several studies, such as the Brazilian Neonatal Research Network. The report expressed the time and degree of fetal distress or even ineffective implementation of neonatal resuscitation procedures due to the conditions of deficient infrastructure and human resources of health services, promoting death of newborns in the first 24 hours of life (Daripa et al., 2013)

According to Aslam et al., (2014) antepartum risk factors of birth asphyxia included maternal age between 20–25 years which was of a higher risk factor of developing Birth asphyxia as compare to elder mothers. They also reported that Pre-eclampsia and Gestational diabetes were significantly associated with increased risk of birth asphyxia among the newborns in Karachi. The risk of birth asphyxia increased significantly with decline in booking status of mother (Aslam et al., 2014).

According to a study conducted by Aslam et al., (2014), socioeconomic factors were associated non-significantly with risk of birth asphyxia. Maternal and fetal conditions such as Pre-eclampsia, Antepartum hemorrhage, oligohydrominos, primigravidity, home delivery and fetal distress were found to be associated significantly with increased risk of birth asphyxia (Aslam et al., 2014). Additionally, pre-term delivery and maternal fever also served to have increased neonatal risk of birth asphyxia. The authors explained that mothers have a common inflammatory pathway with neonatal brain injury involving cytokines and chemokines which stems from exposure to maternal infection and pre-maturity (Aslam et al., 2014). However, maternal hypertension and anemia did not emerge as a risk factors for birth asphyxia but were found more common among the neonates with birth asphyxia. The study also indicated that low birth weight was one of the major culprits for causing birth asphyxia among the neonate in Karachi. The authors explained the effect of low

birth weight on neonate asphyxia status were confounded, in the sense that mothers with low birth weight babies suffered other complications such as hypertension and diabetes during the pre-conception or the antepartum periods (Aslam et al., 2014). Again, in a related study in India on the Antenatal and intrapartum risk factors for perinatal asphyxia: a case control study, risk factors identified to be associated with perinatal asphyxia included instrumental deliveries, meconium stained liquor, maternal age, primiparity, inadequate antenatal care, pregnancy-induced hypertension (PIH), antepartum hemorrhage, and chorioamnionitis. Authors further indicated that instrumental delivery was the most significant risk factor, followed by maternal anemia, lack of antenatal care and meconium stained liquor (Gane et al., 2013). Similarly, on a community-based study on risk factors for birth asphyxia mortality Nepal, Lee et al., (2007) Maternal swelling, convulsions, vaginal bleeding, and prolonged rupture of membranes were found to be associated with higher risk for birth asphyxia, although the results were not statistically significant in the adjusted analysis. The authors further explained that births attended by doctors or auxiliary nurse midwives were found to be associated with increased risk of asphyxia mortality than non-attended births (RR: 2.51). again, premature infants (< 37 weeks) according to the authors were more likely to die of birth asphyxia (RR: 2.28), and the combination of maternal fever and prematurity resulted in a synergistic elevation in risk for birth asphyxia mortality (RR: 7.53) (Capstone & Lee, 2007).

2.4.3 Factors Influencing Postpartum Haemorrhage

According to Owiredu et al. (2016) although, many studies found an association between multiparty and PPH over the years, his study among women at the Komfo Anokye Hospital did not find any such association and also that of BMI and primary postpartum haemorrhage. However, Owiredu et al. (2016) found an association between blood haemoglobin level (and thus

Anaemia) and primary postpartum haemorrhage. Although the median blood haemoglobin of the participants were generally within the limits of the pregnancy, the women who experienced postpartum haemorrhage had a significantly lower blood haemoglobin (10.7g/dl) as compared to 12.1g/dl in the non-postpartum haemorrhage control group. The study reported that women with normal blood haemoglobin levels and mild anaemia (HGB>10g/dl) were associated with an OR of 0.07 and 0.18 respectively. The study concluded that women with blood haemoglobin level below the 10g/dl were more likely to develop primary postpartum haemorrhage, even with minor blood losses as this could lead to haemodynamic compromise (Owiredu et al., 2016). In the prospective cohort study to determine the incidence and risk factors for postpartum hemorrhage in Uganda, Ononge, et al. (2016) found out that among the 1188 women surveyed, the overall incidence of postpartum hemorrhage was 9.0%, and also severe postpartum hemorrhage (1000mls or more) was 1.2 %. The majority (1157 -97.4 %) of these women received an uterotonic after childbirth for postpartum hemorrhage prophylaxis. Risk factors for postpartum hemorrhage among all deliveries according to Ononge et al., (2016) were: cesarean section delivery; multiple pregnancy; foetal macrosomia ≥4000 g; and HIV positive Sero-status. Also, risk factors among vaginal deliveries only, were similar in direction and magnitude as in all deliveries, namely: multiple pregnancy; macrosomia,; and HIV positive Sero-status (Ononge et al., 2016).

Conversely, Mpemba et al. (2014) stated that the traditionally cited risk factors such as high parity, multiple pregnancy, previous postpartum haemorrhage, distended uterus, etc. do not currently predict postpartum haemorrhage well, and many women with these factors do not significantly experience postpartum haemorrhage. Contrarily, more than two-thirds of women who experience postpartum haemorrhage have no identifiable risk factors. Therefore, this has necessitated the need to assess every pregnancy for possible risk factor of postpartum haemorrhage, and offer prevention

to every woman at childbirth. Because prevention and early interventions are the keys to survival (Mpemba et al., 2014)

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

The study took place in Lambussie district, Upper West Region. The main occupation of the people in the Lambussie district is agriculture and its related activities. The Lambussie District was created and inaugurated on the 29th February, 2008. It is one of the least developed in terms of infrastructure in the region. It is hilly, vast and mainly rural therefore, has a sparse and scattered population that makes infrastructure development difficult. The district population projection in 2016 population estimation is 57,829. The district capital is Lambussie, which is about 140 km away from the Regional capital, Wa. It lies in the North Western corner of the Upper West Region of Ghana. It shares boundaries to the south with Jirapa District, to the East with Sissala West District, to the West with Nandom District and to the North by Burkina Faso. The District therefore serves as a National gateway to Burkina Faso from the North Western part of the country. It's land mass is about 1078km² which lies between latitude 9° 55''N and 10° 25''N, longitude 1° 10''W, 2° 5''W. The location of the area is remote in relation to the rest of the region. There is poor distribution of electricity in the district.

The District has five (5) health centres, one (1) polyclinic and nineteen (19) functional CHPS zones, which provide curative and preventive services. There is currently no Hospital in the District; in view of this most of the challenging cases are always referred outside the District capital to the nearest District Hospitals. Officially, two medical officers have been posted to the District to work in the Hamile Health Centre and the Lambussie Polyclinic but up until now only one Medical Officer is at post at the Polyclinic. The District faces a critical need for health staff; Midwives, Physician Assistants, Laboratory Technicians among others to deliver wide range of quality health services for its populace.

3.2 Study Design

The study was a facility-based descriptive cross-sectional survey. The study covered the six Sub-Districts Health Facilities (five Health Centres and one Polyclinic) in the Lambussie District, Upper West Region. The Sub-Districts involved were Hamile, Billaw, Piina, Karni, Samoa and Lambussie. These Sub-Districts were sampled in proportion to their population estimates to represent a mixture of Dagaaba, Moshi, and Sissala Communities, peri-urban and rural populations, therefore ensuring that the distribution in social groups of the study population were assumed to be similar to the entire population of the Lambussie District. A fairly mixed population is also necessary because of the effect of confounding among the population

3.3 Study Method

This research study considered the use of quantitative method of data collection. Structured questionnaire was used to gather quantitative data. Therefore, all the interpretations to the data were done with respect to quantitative variables.

3.4 Study Population

The study population comprised of all lactating women aged between 15 to 49 years. However, for the purposes of measuring the outcome variables only women who delivered at the required health facility and by a midwife, medical officer, physician assistant and received health services were included in the study.

Respondents included in the study were lactating mothers who deliver at the selected health facilities by health professionals with the requisite/necessary equipment (weighing scale, Hb meter, delivery kit etc.). Respondents who receive delivery services from traditional birth attendants (TBAs) other than midwives or medical officer/physician assistants were excluded from

the study. For the reason that traditional birth attendants most likely than not lack the expertise to conduct standard delivery and also provide the proper documentation for the purpose of the study

3.5 Study Sample

Estimation of the sample size in this study was based on significance level, statistical power and the prevalence of LBW in the Upper West Region. The significance level (also known as the p value or alpha) of 0.05 and confident level of 95% was used in this study. Any significant relationship between variables was accepted if and only if the p-value was less than 0.05.

Using a significance level of 0.05 for calculating the sample size in this study is an index of the probability that the findings were reliable. (Avelyn, 2012).

Using the formula proposed by Cochran, (1977) and the rate of LBW in the Upper West Regional Statistics which is 12.12% (Ghana Demographic and Health Survey-Upper West Regional figure, 2014); sample size was calculated as follows:

$$N = \frac{[Z^2 \times P\,(1 - P)]}{e^2}$$

Where N = sample size per group,

Z = the critical probability value for 95% confidence level (1.96),

P = prevalence of LBW rate (12.12%), and

e = margin of error, (0.05).

Hence, the Sample size (N) was approximately 164. Moreover, 10% attrition rate was added to give a total sample size of 180 respondents for the study.

3.6 Sampling Techniques

The combination of the sample size and the sample selection process both determine the representativeness of the sample.

Stratified sampling procedure was used to ensure that important characteristics of the population were fairly represented in the sample and not left to chance. This helped to reduce the effect of confounding that may occur due to some geographic factors peculiar to some few sub-districts. The study categorized the District into strata (sub-districts) and each stratum was assigned a proportion of the sample size with regards to the projected population for that particular stratum (sub-district); Billaw Sub with a population of 8434 presented a sample of 26 respondents, Hamile Sub population of 14,775 (45 respondents), Karni Sub of 11,629 (36 respondents), Lambussie Sub of 5,032 (15 respondents), Piina Sub of 7,047 (21 respondents) and Samoa Sub of 12,936 (40 respondents). In each sub-district, the study included only health facilities that had designated midwife, trained community health officer and/or medical doctor at the facility and further assigned these facilities a quota of the sub-district sample size per their percentage of expected annual ANC registrants or deliveries. The researcher used the register of women who had delivered and were receiving PNC services at the health facility. The study systematically sampled the Nth delivery case per the number of respondents assigned to that health facility until the proportion assigned to that stratum (sub-district/health facility) was obtained. The confident interval (Nth) varied for each facility due to the proportion of the sample size assigned to that facility's coverage zone

3.7 Study Variables

The study measured maternal risk predictors (independent variables) in relation to adverse birth outcomes as the main dependent variable. The infants were assessed in terms of infants' weight

and Apgar score of infants, as continuous variables. Whiles the mothers' postpartum haemorrhage status was also assessed for the categorical variable, i.e. bleeding after delivery as one of the birth outcomes measured. Maternal diet history and socioeconomic data such as education level, household wealth index, occupation of caregivers also served as the independent variables. The birth outcomes (birth weight, postpartum haemorrhage and Birth Asphyxia) as the results of the pregnancies were measured as the main outcome variables in relation to the maternal risk factors that affected these birth outcomes.

3.8 Data Collection Procedure

A structured questionnaire was used in collecting both qualitative and quantitative data from respondents. Data were solicited from respondents through interviews, using the questionnaire. The data collectors read out or asked the respondents to read the content of the consent form to solicit participants' voluntary consent to participate in the study. The respondents were then asked to sign/thump print the consent form to indicate their willingness to participate in the study.

3.9 Data Collection

Interviews and closed ended questionnaires were used to assess the variables of the study. The instruments used for the data collection in this study were structured questionnaire, pencils, pens, my clear bags and erasers. Data were obtained directly from the respondents on the socio-demographic, socioeconomic and dietary history. Also, included in the study were data on the health services that the respondents had received from the health facilities during pregnancies and other maternal factors documented in health records booklets. These data included ANC services, nutrients supplementation, HB testing & counseling, records on pregnancy classes, maternal

illnesses, pre-existing maternal condition and the frequency of visits to the health facilities. They were extracted from the maternal health record booklet and the Continuum of Care card.

3.10 Data Analysis and Presentation of the Results

The data was entered using SPSS version 22.0 and later imported to STATA version 13.0 for analysis. Descriptive statistics include means and standard deviations for continuous variables and, frequency distributions and proportions for categorical variables

Bivariate analyses were done using chi-square statistics to determine the associations between categorical variables with statistical significance set at $p < 0.05$.

Multivariate logistic regression models were used to determine the predictors of adverse birth outcomes (low birth weight, asphyxia and postpartum status) among the study population. The dependent variable for the analyses were birth weight, apgar score and postpartum haemorrhage while the independent variables were delivery type, maternal factors (gestational weight gain, maternal height, and age), religion, occupation, household net income, parity, maternal education, house ownership, number of pregnancies by respondents, birth spacing, nutritional counseling, anaemia status, nutrients supplementations, food taboos, hand washing, food security status, dietary diversity score maternal condition, malaria status in pregnancy and illnesses in pregnancy. Results of associations were described in terms of odds ratios and significance was set at $p < 0.05$ (2-sided). Multiple testing was controlled for by the use of Bonferroni analysis.

3.11 Quality Control

Adequate training of the data collectors was the first measure that was taken to ensure data quality. Due to the wide spread of the data collection points across the District; filled questionnaire were

collated at the close of each week for safe keeping. This ensured that the data gathered are checked for possible corrections that is if any before the subsequent week. This also ensured that information obtain from respondents were kept confidential from any third parties. Facility-based equipment for data collection such as Hb meters, weighing scales and others were re-calibrated each day to take valid readings for the study. Finally, all completed questionnaires were edited before the data was entered for analysis.

3.12 Training and Pre-Testing

Trainings were conducted for the data collectors (Midwives and Community Health Officers) before the study. Data collectors were also taken through how to administer questionnaire using the appropriate interviewing skills. The questionnaire was written in the English language and were translated orally into any of the locally spoken languages (mainly Dagaare and Sassali). Measures were taken to ensure that the key words or main concepts in the questionnaire were not lost when the questionnaire was being translated to a respondent.

The questionnaire was first of all pre-tested before the commencement of the main research study. This was to ensure that the questionnaire was able to communicate the right information and also solicit the right responses needed for the purpose of the study. The necessary corrections identified during the pre-testing were corrected before the final administration of the questionnaire. Then again, on-job-coaching was also conducted for each of the health staff (Midwives and Community Health Officers) on the first few days of the survey to further make adjustments and the necessary inputs for valid data for the study.

3.13 Ethical Considerations

All relevant authorities including the Head of Department, the Regional Health Directorate, and the District Health Administration among others were involved to ensure that all the appropriate policies and regulatory measures were taken to protect respondents. Respondents' consent form was issued to the individual respondents to seek their voluntary participation in the study before we conducted the interviews with the respondents. The confidentiality of the information obtained from respondents was assured, because respondents' privacy was protected through anonymity and voluntary participation.

Importantly, ethical clearance was obtained from the Navrongo Research Institute to guarantee all the protocol used in the research procedure.

The respondents were given explanations on the purpose of the interview after a formal introduction by the investigator. The respondents were informed of the amount of time it would take to complete the prepared questionnaire.

3.14 Limitations of the Study

The study relied on community health officers, and midwives in the health institutions to provide some part of the information through the health record booklets. However, quite a number of deliveries occurred outside the health facility sittings making it difficult to capture data such as birth weight and Apgar score. And as such the estimates contained in this study may have underreported the cases at the community level.

Lastly, due to the small actual WIFA population in the district, the study only employed a small sample size which could have limited the study from identifying any small differences in the results.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic Characteristics of Respondents

In all, the study employed a total of 183 study participants across the district. This sample size was shared among the six sub-districts as follow; Hamile Sub-district (45), Samoa Sub-district (40), Karni Sub-district (36), Billaw Sub-district (26), Piina Sub-district (21) and Lambussie Sub-district (15). The District is mostly rural, so 86.9% (159) of the respondents were rural residents and 13.1% were urban residents. The youngest mother in the study was 15years old and the oldest was 44years and a mean age of the respondents was 27.6±5.53yrs. Within the age groups, <20years made up 8.7% of the study sample, 20-30years were 63.4% and above 30years were also 27.9% (Table 4.1.1). The Dagaara ethnic group (60.7%) were the greater majority group in the study. This was followed by Sissala 27.9%, Moshi 4.4% and 'Others' (combination of all other smaller ethnic groups) were 7.1%. The study participants mostly lived in mud houses with zinc roofing (79.8%), block houses with zinc roofing (15.8%), mud houses with thatch roofing (2.7%) and mud only houses (1.6%). 84.7% of all the respondents owned the houses they lived in and only 10.9% of them lived in rented houses (Table 4.1.1). The remaining 4.4% lived in houses with other forms of arrangements (either living in official bungalow or in an extended family houses). Christians were the majority (60.7%) religious group in the study, followed by Muslims (29.5%) and then African Tradition (9.8%). The majority (55.2%) of the study sample had at least primary education, up to the tertiary level and 44.8% of them did not receive any form of formal education. Almost every one of the respondents (97.3%) was married or lived with a man at the time of the study, 2.2% never married and only 0.5% was either widowed, divorced or separated.

Table 4.1.1a Socio-Demographic Characteristics of the Respondents

SN	Variables	Percentages
1.	Sub-district of Respondents	
	Hamile Sub	24.6%
	Samoa Sub	21.9%
	Billaw Sub	14.2%
	Lambussie Sub	8.2%
	Piina Sub	11.5%
	Karni Sub	19.7%
2.	Category of Delivery Health Facility	
	CHPS Compound	10.9%
	Clinic/Health Centre	45.4%
	Polyclinic/Hospital	43.7%
3.	Mode of Delivery by Respondents	
	Caesarean Session	12%
	Natural Vaginal Delivery	88%
4.	Age Groups of Respondents	
	<20years	8.7%
	20-30years	63.4%
	>30years	27.9%
5.	Residential Status of Respondents	
	Rural Residents	86.9%
	Urban Residents	13.1%
6.	Types of Housing	
	Block with Zinc Roof	15.8%
	Mud with Zinc Roof	79.8%
	Mud with Thatch Roof	2.7%
	Mud Only	1.6%
7.	Housing Ownership	
	Tenant	10.9%
	House Owner	84.7%
	Other Arrangement	4.4%
8.	Ethnicity	
	Sissala	27.9%
	Dagaara	60.7%
	Moshi	4.4%
	Others	7.1%
9.	Religion	
	Christianity	60.7%
	Islam	29.5%
	African Traditional R.	9.8%

Table 4.1.1b Socio-economic Characteristics of the Respondents

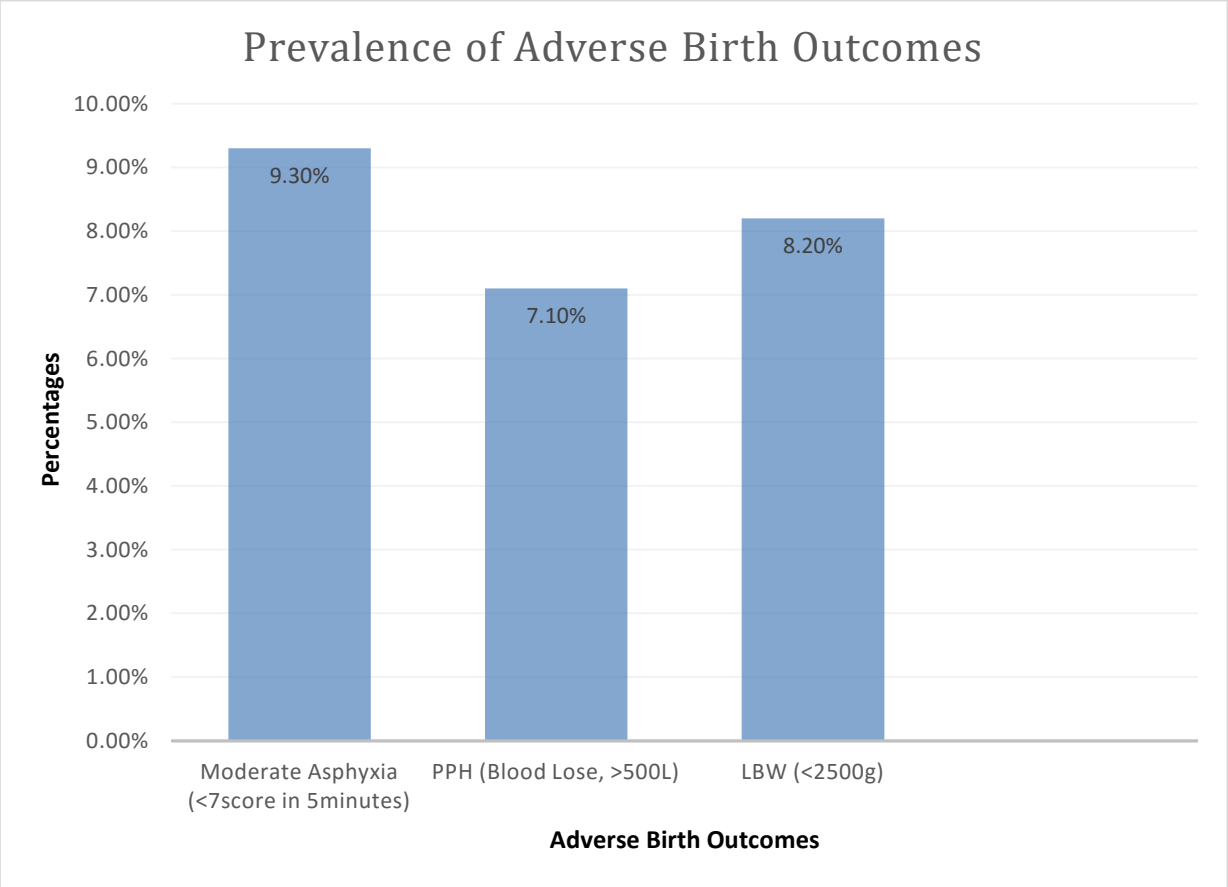
SN	Variables	Percentages
10.	Education Level of Respondent	
	No Formal Education	44.8%
	Primary Education	29.5%
	Secondary Education	19.1%
	Tertiary Education	6.6%
11.	Marital Status	
	Single	2.2%
	Married/Cohabitation	97.3%
	Separated/Divorced/Widowed	0.5%
12.	Alcohol Intake in Pregnancy	
	Yes	55.2%
	No	44.8%
13.	Smoking status of Respondents	
	No	99.5%
	Yes	0.5%
14.	Travel Time to Nearest Health Facility	
	<30Minutes	71.6%
	About 1hour	22.4%
	>1hour	6.0%
15.	Means of Transport to Delivery Facility	
	Motorbike/Tricycle	62.3%
	Footing	30.1%
	Lorry/Vehicle	4.4%
	Bicycle	2.2%
	N/A	1.1%
16.	Occupation	
	Farming	72.1%
	Petty Trading	14.8%
	Formal Sector	4.4%
	Housewives	8.7%
17.	HH Annual Net Income	
	<100.00ghc	38.8%
	101.00-500.00ghc	39.9%
	501.00-1000.00ghc	14.2%
	>1000.00ghc	7.1%

Field Survey, 2017

4.2.1 Prevalence of Adverse Birth Outcomes

From the study sample, the general prevalence of adverse birth outcomes as indicated by Moderate Birth Asphyxia (<7 Apgar score), Low Birth Weight (<2500g) and maternal postpartum haemorrhage (<500ml) were 9.3%, 8.2% and 7.1% respectively among the study population in the Lambussie District.

Figure 4.1: Bar Chart Presentation of the Overall Prevalence of Adverse Birth Outcomes among Study Population



Field Survey, 2017

4.2.2 Low Birth Weight

Infants' low birth weight in the study was evenly distributed among the various sub-districts in the Lambussie District, except for the Samoa and Billaw Sub-districts that recorded higher proportions; 33.3% and 20.0% respectively. For mothers who delivered at different level of health facilities, 53.3% who delivered at the Polyclinic/Hospital had low birth weight babies whiles 20.0% lbw was recorded among those who delivered at the Clinic or Health Centre level and 26.1% also among respondents who delivered at the CHPS Compound level.

Majority of the low birth weight babies came from mothers from the rural settings (93.3%) and mothers within the ages of 20-30 years (80.0%) (Table 4.2.1). Majority of the low birth weight babies 53.3% were males whiles the remaining 46.7% were females. About 86.7% of the low birth weight were born through virginal delivery compared with 13.3% who were born through Caesarean Session. Mothers who carried their pregnancies to full term delivery (birth at ≥37 weeks) rather contributed more to babies with low birth weight whiles the rest of the babies were born <37weeks but not <32weeeks (preterm birth babies) (Table 4.2.1).

Infants of mothers of the Dagaara ethnic background contributed to 66.7% of the low birth weight babies whiles the Sissala and the Moshi ethnic groups also contributed 26.7% and 6.7% (1) respectively. Majority (about 66.7%) of the babies with low birth weight were from Christian families whiles 20% and 13.3% of them were from the African Tradition and Islamic families respectively. Respondents who lived in Mud houses with zinc roofing accounted for 86.7% of the low birth weight babies. Mothers with no form of formal education contributed to 60.0% of the low birth weight babies. Almost all of the low birth weight babies (93.3%) were from mothers who were married or cohabited with a man at the time of the study (Table 4.2.1).

Mothers with a history of alcohol intake during pregnancy contributed to 86.7% of the low birth weight babies. Respondents who lived within a walking distance of 30minutes to a health facility accounted for 73.3% of the babies with their birth weight being less than 2500g. Mothers who used motorbikes or tricycle as a means of transport to their delivery facility accounted for 53.3% of the low birth weight babies. Babies with low birth weights skewed towards mothers who were mostly farmers 93.3% and had household annual net income of <100.00ghc (46.7%), followed by 101.00-500.00ghc with about 40.0% of the respondents (Table 4.2.1).

Table 4.2.1a: Distribution of low birth weight among the socio-economic and demographic characteristic

SN	Variables Names	LWB (2.5kg)	P-Value
	Sub-district of Respondents		0.355
	Hamile Sub	6.7%	
	Samoa Sub	33.3%	
	Billaw Sub	20.0%	
	Lambussie Sub	13.3%	
	Piina Sub	13.3%	
	Karni Sub	13.3%	
2	Category of Delivery Health Facility		0.038
	CHPS Compound	26.7%	
	Clinic/Health Centre	20.0%	
	Polyclinic/Hospital	53.3%	
3	Residential Status of Respondents		0.697
	Rural Residents	93.3%	
	Urban Residents	6.7%	
4	Sex of the Infants		0.810
	Male	53.3%	
	Female	46.7%	
5	Age Groups of Respondents		0.108
	<20years	13.3%	
	20-30years	80.0%	
	>30years	6.7%	
6	Mode of Delivery		0.698
	Caesarean Session	13.3%	
	Natural Vaginal Delivery	86.7%	
7	Term of Gestation at Delivery		0.068
	Preterm Birth(<37wks)	26.7%	
	Full Term Birth(≥37wks)	73.3%	
8	Ethnicity		0.688
	Sissala	26.7%	
	Dagaara	66.7%	
	Moshi	6.7%	
9	Religion		0.159
	Christianity	66.7%	
	Islam	13.3%	
	African Traditional R.	20.0%	

Field Survey, 2017

Table 4.2.1b: Distribution of low birth weight among the socio-economic and demographic characteristic

SN	Variables Names	LWB (2.5kg)	P-Value
10	Types of Housing		0.324
	Block with Zinc Roof	6.7%	
	Mud with Zinc Roof	86.7%	
	Mud Only	6.7%	
11	Housing Ownership		0.842
	Tenant	13.3%	
	House Owner	86.7%	
	Other Arrangement	0.0%	
12	Education Level of Respondent		0.454
	No Formal Education	60.0%	
	Primary Education	33.3%	
	Secondary Education	6.7%	
13	Marital Status		0.114
	Married/Cohabitation	93.3%	
	Separated/Divorced/Widowed	6.7%	
14	Alcohol Intake in Pregnancy		0.013
	Yes	86.7%	
	No	13.3%	
15	Travel Time to Nearest Health Facility		1.000
	<30Minutes	73.3%	
	About 1hour	20.0%	
	>1hour	6.7%	
16	Means of Transport to Delivery Facility		0.002
	Motorbike/Tricycle	53.3%	
	Footing	20.0%	
	Bicycle	20.0%	
	N/A	0.6%	
17	Occupation		0.472
	Farming	93.3%	
	Petty Trading	6.7%	
18	HH Annual Net Income		0.266
	<100.00ghc	46.7%	
	101.00-500.00ghc	40.0%	
	>1000.00ghc	13.3%	

Field Survey, 2017

4.2.2 Asphyxia

Infants with Apgar scores less than seven (7) in the first five minutes after birth were considered to have moderate asphyxia in this study. The overall prevalence of birth asphyxia in the study was 9.3% excluding severe birth asphyxia (Apgar score <3). Moderate birth asphyxia in the study ranges from 29.4% in the Samoa Sub-district to 11.8% in the Lambussie sub-district except the Karni sub-district that recorded no birth asphyxia. The majority of these infants 52.9% were delivered in a Polyclinic or hospital, whiles the remaining 35.3% and 11.8% were delivered in the clinic or health centre and CHPS facilities respectively. Babies of mothers within the age group categories of 20-30years contributed 76.5% of the babies with birth asphyxia whiles <20years and >30years contributed equally to about 11.8% each to the babies with birth asphyxia (Table 4.2.2). All the birth asphyxia 100% were born through a normal or SVD. Out of the total birth asphyxia, 88.2% were carried to full term delivery (≥37weeks) and 11.8% were preterm birth (>32weeks but <37weeks). The greater majority 58.8% of the babies with birth asphyxia were females and the rest 41.2% were males. Mothers of rural residents contributed to 82.4% of the birth asphyxia and only 17.6% were urban residents. Respondents of the Dagaara ethnicity accounted for 52.9% of the infants with birth asphyxia, whiles Sissala 29.4%, 'Others' 11.8% and Moshi 5.9%. Respondents who owned and stayed in their houses accounted for 76.5% of the birth asphyxia (Table 4.2.2). Infants with birth asphyxia from Christian origin were 52.9% whiles those of Islam were 41.2% and African Tradition 5.9%. Mothers with no form of formal education contributed to 47.1% of the birth asphyxia and the remaining 52.9% of the infants were of mothers with at least primary education up to the tertiary education. All the asphyxia cases 100% were babies of mothers who were all married or were staying with a man as at the time of the interview. Mothers with history of alcohol during the period of pregnancy contributed to 58.8% of the asphyxia cases and

41.2% of the infants' mothers who did not take any form of alcohol during pregnancy. Respondents who lived within 30minutes of a walking distance to a formal health facility accounted for 70.6% whiles 29.4% were within an hour walking distance. About 70.6% of the infants with birth asphyxia were from mothers who were farmers, and who also had household annual net income within the range of 101.00-500.00ghc (Table 4.2.2).

Table 4.2.2a: Distribution of Moderate birth asphyxia among the socio-economic characteristic of Respondents

SN	Variables Names	Moderate Asphyxia (<7 Apgar score)	P-Value
1	Sub-district of Respondents		0.091
	Hamile Sub	17.6%	
	Samoa Sub	29.4%	
	Billaw Sub	17.6%	
	Lambussie Sub	11.8%	
	Piina Sub	23.5%	
2	Category of Delivery Health Facility		0.66
	CHPS Compound	11.8%	
	Clinic/Health Centre	35.3%	
	Polyclinic/Hospital	52.9%	
3	Age Groups of Respondents		0.221
	<20years	11.8%	
	20-30years	76.5%	
	>30years	11.8%	
4	Mode of Delivery		0.032
	SVD	100%	
5	Term of Gestation at Delivery		0.736
	Preterm Birth(<37wks)	11.8%	
	Full Term Birth(≥37wks)	88.2%	
6	Sex of the Infants		0.648
	Male	41.2%	
	Female	58.8%	
7	Residential Status of Respondents		0.576
	Rural Residents	82.4%	
	Urban Resident	17.6%	
8	Ethnicity		0.539
	Sissala	29.4%	
	Dagaara	52.9%	
	Moshi	5.9%	
	Others	11.8%	
9	Type of Housing of Respondents		0.559
	Block with Zinc Roofing	17.6%	
	Mud with Zinc Roofing	76.5%	
	Mud with Thatch Roofing	5.9%	

Field Survey, 2017

Table 4.2.2b: Distribution of Moderate birth asphyxia among the socio-economic characteristic of Respondents

SN	Variables Names	Moderate Asphyxia (<7 Apgar score)	P-Value
10	Housing Ownership by Respondents		0.049
	Tenant	5.9%	
	House Owner	76.5%	
	Other Arrangement	17.6%	
11	Religion		0.001
	Christianity	52.9%	
	Islam	41.2%	
	African Traditional R.	5.9%	
12	Educational Level of Respondent		0.881
	No Formal Education	47.1%	
	Primary Education	35.3%	
	Secondary Education	11.8%	
	Tertiary Education	5.9%	
13	Marital Status		-
	Married/Cohabitation	100%	
14	Alcohol Intake in Pregnancy		0.803
	Yes	58.8%	
	No	41.2%	
15	Travel Time to Nearest Health Facility		0.601
	<30minutes	70.6%	
	About 1hour	29.4%	
16	Occupation		0.479
	Farming	70.6%	
	Petty Trading	11.8%	
	Housewives	17.6%	
17	HH Annual Net Income		0.039
	<100.00ghc	23.5%	
	101.00-500.00ghc	70.6%	
	>1000.00ghc	5.9%	

Field Survey, 2017

4.2.3 Postpartum Haemorrhage

Similarly, the prevalence of maternal postpartum haemorrhage at delivery was evenly or equally distributed among all the study sub-districts, with the exception of Piina sub-district that recorded the lowest percentage of 7.7%. Within the facilities that the respondents delivered, polyclinic/hospital delivery recorded the highest postpartum haemorrhage cases of 61.5%, followed by Clinic/Health Centre delivery. Mothers within the age group of 20-30years among the study sample accounted for 53.8% of the cases of postpartum haemorrhage. This was followed by mothers greater than 30 years group (38.5%) and then mothers less than 20years age group (7.7%). Again, mothers who went through natural vaginal delivery contributed 92.3% of the cases of postpartum haemorrhage and only 7.7% of the cases were from mothers who had Caesarean session done on them (Table 4.2.3).

Respondents who carry their pregnancies to full term (≥37weeks) recorded 84.6% of the postpartum haemorrhage cases and the remaining 15.4% were recorded by mothers with preterm births (<37weeks but >32weeks). Mothers with males' deliveries accounted for higher cases of postpartum haemorrhage (84.6%) and female deliveries were 15.4%. Also, rural residents contributed to 84.6% cases of postpartum haemorrhage as compared to urban residents of 15.4%. Mothers (61.5%) of Dagaara ethnic background had the highest cases of postpartum haemorrhage, followed by Sissala (30.8%) and 'Others' 7.7%. House owners (mostly mud houses with zinc roofing) accounted for almost all the cases 92.3% of postpartum haemorrhage (Table 4.2.3). Married respondents contributed all the cases 100% of the postpartum haemorrhage prevalence in the study.

History of alcohol intake among respondents during pregnancy showed a marked difference in the presentation of postpartum haemorrhage. Those with history of alcohol had 61.5% of the cases

whiles the others with no alcohol history had 38.5% cases. Farming mothers presented with the majority of cases (84.6%). Generally, respondents with an estimated annual net household income of <500.00ghc were victims of postpartum haemorrhage. This accounted for 69.2% of the cases of postpartum haemorrhage whiles the 30.8% had estimated annual net household income greater than 501.00ghc (Table 4.2.3).

Table 4.2.3a: Distribution of Postpartum Haemorrhage of Mothers among the socio-economic characteristics

SN	Variables	Post-Partum Haemorrhage Blood lose >500L	P-Value
1	Sub-district of Respondents		0.705
	Hamile Sub	15.4%	
	Samoa Sub	15.4%	
	Billaw Sub	23.1%	
	Lambussie Sub	15.4%	
	Piina Sub	7.7%	
	Karni Sub	23.1%	
2	Delivery Health Facility		0.42
	CHPS	7.7%	
	Clinic/Health Centre	30.8%	
	Polyclinic/Hospital	61.5%	
3	Age Groups of Respondents		0.739
	<20years	7.7%	
	20-30years	53.8%	
	>30years	38.5%	
4	Mode of Delivery		-
	Caesarean Session	7.7%	
	Natural Vaginal Delivery	92.3%	
5	Term of Gestation at Delivery		0.674
	Preterm Birth (<37wks)	15.4%	
	Full Term Birth (≥37wks)	84.6%	
6	Sex of the Infants		0.018
	Male	84.6%	
	Female	15.4%	
7	Residential Status of Respondents		0.681
	Rural Resident	84.6%	
	Urban Resident	15.4%	
8	Ethnicity		-
	Sissala	30.8%	
	Dagaara	61.5%	
	Others	7.7%	
9	Type of Housing		-
	Block with Zinc Roofing	15.4%	
	Mud with Zinc Roofing	84.6%	

Field Survey, 2017

Table 4.2.3b: Distribution of Postpartum Haemorrhage of Mothers among the socio-economic characteristics

SN	Variables	Post-Partum Haemorrhage Blood lose >500L	P-Value
10	House Ownership		-
	Tenant	7.7%	
	House Owner	92.3%	
11	Religion		0.906
	Christianity	69.2%	
	Islam	23.1%	
	African Traditional R.	7.7%	
12	Education Level of Respondent		0.73
	No Formal Education	53.8%	
	Primary Education	30.8%	
	Secondary Education	7.7%	
	Tertiary Education	7.7%	
13	Marital Status		-
	Married/Cohabitation	100%	
14	Alcohol Intake in Pregnancy		0.775
	Yes	61.5%	
	No	38.5%	
15	Occupation		0.527
	Farming	84.6%	
	Petty Trading	7.7%	
	Formal Sector	7.7%	
16	HH Annual Net Income		0.689
	<100.00ghc	30.7%	
	101.00-500.00ghc	38.5%	
	501.00-1000.00ghc	23.1%	
	>1000.00ghc	7.7%	

Field Survey, 2017

4.3 Nutritional Influences of Adverse Birth Outcomes

4.3.1 Nutritional Factors Influencing LBW

In a multivariate logistic analysis of all the nutrition variables solicited, ranging from maternal alcohol history to changes in maternal weight gain during pregnancy showed varied degree of influences on the birth weights of infants. Almost all the variables influenced the birth weights of the infants, even though only a few were statistically significant. History of alcohol (spirit, beer, wine whisky, pito etc.) intake in the period of the pregnancies is showed to predict birth weights of babies in the Lambussie District. The mean weight of infants of mothers with history of alcohol intake was 3.02±0.34 kg. The results was statistically significant at p-value of 0.034 within a confident interval of 0.105 and 0.836. Babies of mothers with no history were 130g of birth weight heavier as compared with mothers who took alcohol regularly during pregnancy.

About 24% of the mothers in the study sample tabooed various foods groups during the period of their pregnancies including Carbohydrate food sources (45%), protein food sources (45%), fruits and Vegetables (5%) among others food groups. Infants of mothers with no food taboos in pregnancy had a mean birth weight of 2.95±0.38 kg as compared with infants of mothers with food taboos of a mean birth weight of 2.94±0.45 kg. This result was statistical significant at p-value of 0.017. The result showed that mothers with food taboos in pregnancy were 5.6 times more likely to give birth to a baby with low birth weight. However, the univariate analysis of birth weights of infants of mothers with various food taboos showed no significant difference between the two.

The prevalence of malnutrition among mothers at the first trimester of their pregnancy was 19.67% (Undernutrition-8.2% and Overnutrition-11.48%). At the 36 weeks of gestation of the mothers or at delivery, the prevalence of under nutrition had completely been reduced whiles the prevalence of over-nutrition had increased from 11.48% to 33.88% among the study respondents. Maternal

nutrition status as measured by their Body Mass Index (BMI) status at Antenatal Care (ANC) registration and also at 36weeks of pregnancy or delivery was another nutritional influence on the birth weights of infants in the study. Babies of mothers who were malnourished at ANC registration had average birth weight of 3.01±0.41kg, babies of over-nourished mothers (3.20±0.94kg) as compared with babies of mothers who were well-nourished (2.90±0.39 kg). Also, the mean change in gestational weight gain at ANC registration specifically for underweight mothers was 7.55±2.77kg, normal weight mothers 5.98±3.26 kg, Over-weight mothers 6.24±3.18 kg and obese mothers was 7.3±7.71kg. Moreover, the mean adequate gestational weight gain was 3.056±0.469 kg and was a significant determinant of low birth weight in the study ($p<0.036$). Mothers with adequate gestational weight gain had infants weighed 116.5g heavier than infants of mothers with inadequate gestational weight gain. Similarly, regarding maternal BMI above 36weeks to delivery, well-nourished mothers and over-nourished mothers had an average infant birth weight of 2.861±0.38kg and 3.108±039kg respectively. From the multivariate analysis, however, malnourished mothers above 36weeks of pregnancy were 2.1 times more at increased risk (Coefficient=0.765) of delivering babies with low birth weight, although the result was not statistically significant ($P<0.408$). Over-nourished mothers at 36weeks of pregnancy or at delivery had infants weighed 246.91g heavier than the well-nourished mothers. On the univariate analysis moreover, infants of well-nourished mothers were 193.19g lighter in birth weight at ANC registration and 223.45g lighter at above 36weeks gestation as compared with malnourished mothers ($p<0.009$ and $p<0.000$ respectively).

Respondents who practiced the intake of four star meal (ate from the four foods source by health worker education; animal source foods, fruit and vegetables, cereal and tubers, and legumes) during the period of pregnancies were 1.5 times less likely to give birth to babies with low birth

weight. The mean infants' weight of mothers who practiced this dietary intake was 2.99±0.39kg as compared with 2.83±0.40kg for mothers who did not practice this dietary intake. This result was not significant at p<0.633 from the multivariate analysis. On the other hand, from the univariate analysis Infants of mothers who practiced this dietary habit weighed 156.62g heavier than the other infants whose mothers did not practiced this dietary intake. The result showed that the practice of four star meal intake by the mothers significantly (p<0.016) influenced the birth weights of infant among the study population. Results from the individual dietary diversity score also indicated that mothers who consumed 2-3 food groups had an average infants' birth weight of 2.93±0.40kg and were lighter than the others whose mothers consumed all the four major food groups (2.96±0.40kg). Infants of mothers who ate all the four food groups were 24.87g heavier than infants of mothers who consumed 2-3 food groups during the period of pregnancy. Household food insecurity was another nutrition factor that influenced the birth weights of infants in the study sample. Particularly, respondents who were faced with acute food insecurity had a lighter mean infants' birth weight (2.95±0.37kg) as compared with 2.97±0.41kg mean birth weight of infants of respondents who were food secured. Infants of mothers with any form of household food insecurity were 168.4g lighter than infants of mothers who were food secured, and the mothers of food insecure households were 1.4 times more likely to delivered babies with low birth weight. This result was however, not statistical significant (p<0.691).

The prevalence of anaemia in pregnancy in the study revealed that at the first contact of mothers with the ANC clinic, 52.5% of the pregnant women were anaemic and 37.7% of the same women were still anaemic at 36weeks of pregnancy or at delivery. Maternal anaemia status at ANC registration and at 36 weeks or delivery did not show major difference in the birth weights of the infants. The mean weights of infants of mothers who were anaemic at registration and at above 36

weeks were 2.92±0.39kg and 2.92±0.41kg as compared to mothers with normal Hb levels at registration (2.975±0.41kg) and at above 36weeks (2.96±0.39kg) of pregnancy. Babies of respondents with normal Hb level (>11g/dl) at registration and at above 36 weeks were 57g and 37g heavier than babies of anaemic mothers, though the results were not significant factors ($p<0.334$ and $p<0.543$ respectively). Moreover, Counseling on maternal anaemia, Hand washing before cooking or eating, food supplements intake and nutrition counseling during pregnancy did not show any significant influence on the birth weights of infants in the study.

Table 4.3.1: Association between Nutrition-related Factors and Infants' Birth Weights

4.3.1a Association between Nutrition-related factors and Infants' Birth Weight

	Variable Name	OR	CI		P-value
1	Alcohol intake during Pregnancy				
	Women who took alcohol	0.1	0.105	0.836	0.034
2	Nutrition Counseling during Pregnancy				
	Women who were not counseled	0.3	0.033	2.808	0.293
3	Additional meal in Pregnancy (3+1)				
	Women who took <3meals/day	0.3	0.058	1.335	0.110
4	Dietary Diversity Score				
	Consumption of 2-3 food groups	1.9	0.463	7.477	0.381
5	Food Supplements Intake (Iron, Folate & Multivitamin)				
	Partially Complied	1.1	0.183	6.300	0.938
	Did not Comply	0.6	0.009	44.375	0.829
6	Food Taboos				
	Women with no food taboos in Pregnancy	5.6	1.356	23.125	0.016
7	Knowledge of Four Star meals				
	Somehow good knowledge	1.4	0.276	6.885	0.696
8	Practiced Four Star Meals Intake in Pregnancy				
	Women who did not Practice	1.5	0.300	7.228	0.633
9	Hand Washing before Cooking				
	Washes with only water	0.6	0.055	6.281	0.662

Field Survey, 2017

4.3.1b Association between Nutrition-related factors and Infants' Birth Weight

	Variable Name	OR	CI		P-value
10	Hand Washing before Eating				
	Washes with only water	0.8	0.096	6.325	0.815
11	Household Food Security Situation				
	Moderate Food Insecurity	1.1	0.191	6.069	0.934
	Acute Food Insecurity	1.4	0.271	7.192	0.691
12	Mothers' BMI at Registration				
	Malnourished Mothers	0.3	0.042	2.932	0.332
13	Mothers' BMI at 36wks/Delivery				
	Malnourished Mothers	2.1	0.351	13.168	0.408
14	Net Change in GWG				
	Adequate Weight Gain	0.1	0.018	0.891	0.036
15	Mothers' Hb Test Score at Registration				
	Anaemic Mothers at Registration	1.0	0.241	4.392	0.97
16	Mothers' Hb Test Score at 36wks/Delivery				
	Anaemic Mothers at 36weeks/delivery	0.6	0.141	2.365	0.446
17	Counseling on Anaemia				
	Mothers who were not Counseled	0.5	0.058	3.945	0.494

Field Survey, 2017

Regression Model Analysis of Birth Weight and Maternal Variables

With the exception of all maternal height, there was no significant association between the under-listed maternal factors and that of birth weight of infants. Maternal height is showed to be a significant influence on the birth weight of infants in the study. A meter increased in the maternal height is equivalent to 10g of infants' birth weight ($p<0.028$). In the univariate regression model also, a meter increased in maternal height was equivalent to 11.7g of infant birth weight ($p<0.009$)

Table 4.3.2: Regression Model Analysis of Birth Weight and Maternal Variables

	Regression Analysis of Nutrition/Maternal Indicators with Infants' Birth Weights			
	Variable Name	**P-Value**	**CI**	
1	Mothers Ages	0.605	-0.0075154	0.0128683
2	Mothers' Heights	0.028	0.0012088	0.0207867
3	Mothers' Hb at Registration	0.713	-0.0326346	0.047605
4	Mothers' Hb at 36wks/Delivery	0.236	-0.017065	0.068701
5	Mothers' BMI at Registration	0.294	-0.0668309	0.2194175
6	Net Change in GWG in Pregnancy	0.166	-0.0172272	0.0994581
7	Mothers BMI at 36wks/Delivery	0.493	-0.1937201	0.0937037

Field Survey, 2017

4.3.2 Nutritional Factors Influencing Asphyxia

In a multivariate analysis, ironically, mothers with history of alcohol intake in pregnancy rather had a reduced risk (coefficient = -0.209) of birth asphyxia among the study group, there was however, no significant association between maternal alcohol history and infants birth apgar scores (P<0.769; OR=1.2). Again, with the univariate analysis, although mothers with no history of alcohol had a mean infant apgar score of 0.00725 higher as compared to infants of mothers who did take alcohol during pregnancy, the result was not significant (p<0.947).

Maternal nutritional counseling during pregnancy was found to have a significant influence on the apgar score of infants (P<0.023). Also, with the univariate analysis, the mean Apgar score on infants of mothers who were counseled were 0.464 higher (P<0.027) in than infants of mothers who did not receive nutrition counseling during pregnancy. Serving size or meal portion size and frequency of meals during pregnancy was another significant factor that influenced infants' Apgar score in the study. Pregnant women who regularly ate less than three times a day during pregnancy had increased risk of delivery a baby with lower apgar score as compared to infants of mothers who ate more than three average meals per day (P<0.045). The odds of association was high as 19.44 times for mother who ate less than three times per day during pregnancy. However, in the univariate analysis although infants of mothers with more than 3 meals per day were 0.049 lower in infants apgar score than infants of mothers with less than three meals per day, the difference was not statistical significant.

The knowledge of four star meals (eating from four food sources; animal food source, fruit and vegetables, legumes and cereal and tubers) was also a significant influence of Apgar score of infants of mothers in the study. Mothers with somehow good knowledge and poor knowledge had both increased risk of delivering infants with birth asphyxia as compared to infants of mothers

with adequate knowledge. Mothers with somehow good knowledge and poor knowledge were 4 times and 3.4 times respectively more likely to deliver infants with birth asphyxia, though the association was not significant (P<0.071 and P<0.346 respectively). With the univariate analysis, infants of mothers with poor knowledge on four star meal were 0.0286 and 0.1427 lower in apgar scores as compared to infants of mothers with adequate knowledge and somehow good knowledge of four star meals in pregnancy respectively, though there was no significant difference between knowledge of four star meal and infants birth asphyxia.

Maternal malnutrition as measured by change in gestational weight gain(p<0.018) and BMI scores below 18.5kg/m^2 or above 24.49kg/m^2 had increased risk of birth asphyxia. Maternal malnutrition during ANC registration and at above 36weeks of pregnancy had 1.7 times (P<0.591) and 1.6 times (P<0.577) likelihood of delivering infants with birth asphyxia respectively. In the univariate analysis, infants of well-nourished mothers at ANC registration and at above 36 weeks of pregnancy were 0.232 (P<0.089) and 0.137 (P<0.238) lower in apgar scores as compared with infants of malnourished mothers, though not significant.

However, household food security (P<0.166), Anaemia counseling (P<0.255), Hb testing and counseling at registration and at 36weeks (P<0.719 and P<0.206), food taboos (P<0.545), dietary diversity score (P<0.100), and food iron-folate supplementation (0.522) were not risk factors to birth asphyxia in the study.

Table 4.3.3: Association between Nutrition-related factors and Infants' APGAR Scores

4.3.3a Association between Nutrition-related factors and Infants' APGAR Scores					
SN	**Variable Name**	**OR**	**CI**		**P-value**
1	Alcohol intake during Pregnancy				
	Women who took alcohol	0.8	0.202	3.269	0.769
2	Nutrition Counseling during Pregnancy				
	Women who were counseled	0.05	0.0032	0653	0.023
3	Additional meal in Pregnancy (3+1)				
	Women who took <3meals/day	19.4	1.068	353.7	0.045
4	Dietary Diversity Score				
	Consumption of 2-3 food groups	0.29	0.071	1.259	0.100
5	Food Supplements Intake (Iron, Folate & Multivitamin)				
	Partially Complied	0.5	0.081	3.576	0.522
6	Food Taboos				
	Women with no food taboos in Pregnancy	0.6	0.093	3.499	0.545
7	Knowledge of Four Star meals				
	Somehow good knowledge	4.0	0.889	18.205	0.071
	Poor knowledge	3.4	0.266	43.85	0.346
8	Practiced Four Star Meals Intake in Pregnancy				
	Women who did not Practice	2.7	0.244	29.79	0.418
9	Hand Washing before Cooking				
	Washes with only water	3.3	0.109	100.1	0.492
	Washes with water & soap	6.2	0.177	255.09	0.305
10	Hand Washing before Eating				
	Washes with only water	0.7	0.0776	6.648	0.771

Field Survey, 2017

4.3.3b Association between Nutrition-related factors and Infants' APGAR Scores

SN	Variable Name	OR	CI		P-value
11	Household Food Security Situation				
	Moderate Food Insecurity	9.0	0.309	264.41	0.201
	Acute Food Insecurity	6.8	0.243	192.34	0.259
	Food Secured	10.3	0.380	280.25	0.166
12	Mothers' BMI at Registration				
	Malnourished Mothers	1.7	0.252	11.195	0.591
13	Mothers' BMI at 36wks/Delivery				
	Malnourished Mothers	1.6	0.329	7.429	0.577
14	Net Change in GWG in Pregnancy				
	Adequate Gestational Weight Gain	0.1	0.097	1.774	0.018
15	Mothers' Hb Test Score at Registration				
	Anaemic Mothers at Registration	0.8	0.186	3.193	0.719
16	Mothers' Hb Test Score at 36wks/Delivery				
	Anaemic Mothers at 3wks/Delivery	0.4	0.0945	1.664	0.206
17	Counseling on Anaemia				
	Mothers who were not Counseled	0.4	0.0597	2.109	0.255

Field Survey, 2017

4.3.3 Nutritional Factors Influencing PPH

In the study results, maternal alcohol history in pregnancy was an increased risk factor (coefficient = 0.832) of postpartum haemorrhage during delivery. Mothers with history of alcohol were 2.3 times more likely to experience postpartum haemorrhage during delivery as compared to mothers who did not take alcohol during pregnancy. However, the odds of association between history of alcohol in pregnancy and postpartum haemorrhage was not significant (P<0.351). The practice of four star meals intake in pregnancy was shown to have an increased risk of postpartum haemorrhage at delivery. In the univariate analysis, mothers who did not practice this dietary intake were 6.6 times more likelihood to experiencing postpartum haemorrhage during delivery. This difference was however not statistically significant (P<0.131)

Table 4.3.4: Association between Nutrition-related factors and Postpartum Haemorrhage

4.3.4a Association between Nutrition-related factors and Postpartum Haemorrhage					
SN	**Variable Name**	**OR**	**CI**		**P-value**
1	Alcohol intake during Pregnancy				
	Women who took alcohol	0.4	-0.0757	2.500	0.351
2	Nutrition Counseling during Pregnancy				
	Women who were not counseled	0.2	0.0085	3.516	0.253
3	Additional meal in Pregnancy (3+1)				
	Women who took <3meals/day	0.7	0.0954	5.470	0.753
4	Dietary Diversity Score				
	Consumption of 2-3 food groups	1.0	0.2339	4569	0.965
5	Food Supplements Intake (Iron, Folate & Multivitamin)				
	Partially Complied	0.2	0.0390	1.498	0.127
	Did not Comply	0.0	0.0085	1.203	0.057
6	Food Taboos				
	Women with no food taboos in Pregnancy	1.1	0.211	5.566	0.922
7	Knowledge of Four Starr meals				
	Somehow good knowledge	0.6	0.0779	4.694	0.631
	Poor knowledge	0.0	0.0031	0.4667	0.011
8	Practiced Four Star Meals Intake in Pregnancy				
	Women who did not Practice	6.6	0.569	77.64	0.131

Field Survey, 2017

4.3.4b Association between Nutrition-related factors and Postpartum Haemorrhage

SN	Variable Names	OR		CI	Coefficient	P-value
9	Hand Washing before Cooking					
	Washes with only water	27.5	0.750	1011.18	3.316	0.071
10	Hand Washing before Eating					
	Washes with only water	0.2	0.019	3.215	-1.394	0.286
11	Household Food Security Situation					
	Moderate Food Insecurity	0.6	0.0785	3.945	-0.586	0.558
	Acute Food Insecurity	1.8	0.220	14.010	0.562	0.596
12	Mothers' BMI at Registration					
	Malnourished Mothers	0.2	0.033	1.062	-1.681	0.058
13	Mothers' BMI at 36wks/Delivery					
	Malnourished Mothers	1.9	0.343	10.913	0.660	0.454
14	Mothers' Hb Test Score at Registration					
	Anaemic Mothers at Registration	1.8	0.397	7.899	0.572	0.454
15	Mothers' Hb Test Score at 36wks/Delivery					
	Anaemic Mothers at 36wks/Delivery	1.1	0.234	5.077	0.087	0.912

Field Survey, 2017

4.4 Socio-economic and Health Related-Service Determinants of Birth Outcomes

4.4.1 Factors Influencing LBW

Again, from the multivariate analysis between the socio-economic and health service related determinants of birth weight, the results showed that the occupation of respondents showed a varied influence on the birth weight of infants. Respondents who were engaged in small scale trading (petty traders) in the study area, had increased risk of delivering low birth weight infants than farming mothers. Petty traders were 2.5 times more likely to deliver low birth weight infants, though the odds of association between occupation and low birth weight was not significant. From the univariate analysis, the mean weights of infants of petty traders (3.03±0.39kg) and formal sector workers (3.1kg±0.28kg) were 109.1g and 200.8g respectively heavier than infants of farming mothers. However, infants of housewives were 49.2g lighter than the infants of farmers in the study. Again, these results were not significant. The results also showed that infants of respondents with household net annual income of >1001.00ghc had decreased risk of low birth weight as compared with infants of respondents with household net annual income of <100.00ghc. Infants of these respondents were 4.4 times more likely to have low birth weight at birth. However, there was no significant association between household net annual income and birth weight of infants in the study ($p<0.133$). The result also showed a weak association between infants of mothers with household net annual income of 501-1001.00ghc and those of 101-500.00ghc, and that of infants' birth weight in the study sample.

The analysis showed a significant association between mothers' religion and birth weight of babies among the study respondents. Infants of mothers of both Islam and African Traditional religion had increased risk of low birth weight. Muslims in the study were 5.9 times more likely to deliver babies with low birth weight ($p<0.037$) than infants of Christian background. However, the mean

weight of infants of Muslims was higher than that of Christians, and they were 134.5g heavier than the Christians' infants and 220.4g heavier than the infants' mothers of African Traditional religion. Also, the results from the study indicated that the means of transport to the delivery facilities by the respondents during labour was a significant determinant of the infants' birth weight. Respondents who used bicycle as a means of transport and those who lived within the vicinity of the health facilities, both had decreased risk of delivering infants with low birth weight as compared to infants of respondents who relied on motorbike or tricycle ($p<0.001$ and $p<0.048$). However, the odds of association between the means of transport and infants' birth weight was of no statistical significance.

Again, gravidity of respondents between 4-6births were also at increased risk of delivering low birth weight than mothers with 2-3 pregnancies in their life time. There was an association between mothers of 4-6 multiple pregnancies and low birth weight ($p<0.013$). However, respondents of single pregnancies were 2.6 times less likely to give birth to low birth weight babies ($p<0.829$), though this relationship was not significant. Then again, respondents of multi-parity (4-6 births) had a decreased risk of low birth weight among the study population ($p<0.008$). Also from the univariate analysis, infants of respondents of multi-parity (4-6 births) were 271.5g heavier than infants of primed respondents ($p<0.004$) and 141.9g heavier than parity 2-3 respondents ($p<0.228$).

Table 4.4.1: Association between Socio-economic and Health-related services, and Infants' Birth Weight

4.4.1a Association between Socio-economic and Health-related services, and Infants' Birth Weight

	Variable Names	OR	CI		P-value
1	Occupation of Respondents				
	Petty Traders	2.5	0.137	6.0934	0.531
2	Household Net Annual Income				
	101.00-500.00ghc	1.5	0.343	6.141	0.614
	>1000.00ghc	4.4	0.0	-	0.996
3	Ethnicity of Respondents				
	Sissala	0.3	0.0417	2.210	0.157
	Others	0.0	0.001	1.469	0.085
4	Housing of Respondents				
	Block with Zinc Roofing	0.2	0.011	4.931	0.348
	Mud Only	0.1	0.005	1.947	0.128
5	Religion of Respondents				
	Islam	5.9	0.465	74.336	0.037*
	African Tradition	0.5	0.055	4.986	0.220
6	Maternal Age Categories				
	<20years	0.5	0.070	3.246	0.447
	>30years	6.2	0.636	60.451	0.116
7	Educational Level of Respondents				
	Primary Education	0.3	0.020	4.800	0.399
	Secondary Education	0.15	0.01	2.321	0.175
8	Residential Status				
	urban Residents	1.1	0	-	0.996
9	Transport to Delivery Facility				
	Footing	1.3	0.180	9.644	0.785
	Bicycle	0.0	1.42	0.012	0.001
	Living within health facility	0.5	0.005	43.638	0.048

Univariate analysis*

4.4.1b Association between Socio-economic and Health-related services, and Infants' Birth Weight					
	Variable Names	OR		CI	P-value
10	Travel Time to Delivery Facility				
	About 1Hour	1.0	0.187	5.553	0.984
	> 1Hour	1.0	0.043	25.657	0.976
12	Gravidity				
	1st Pregnancy	2.6	0.0004	17706.88	0.829
	4-6th Pregnancy	590.19	3.9245	88757.52	0.013
13	Parity				
	Premed	0.2	0.0000	1424.05	0.728
	4-6th Birth	0.0	0.0001	0.2423	0.008
14	Birth Spacing				
	First Timer	0.1	0.0004	29.387	0.437
	2-3years Spacing	1.6	0.045	55.903	0.800
	>4years spacing	0.3	0.003	24.583	0.561
15	Bed Preparedness Plan				
	No bed plan	0.8	0.119	5.723	0.845
16	Number of SP doses				
	< 2 Doses	1.1	0.232	5.32	0.894
17	ANC Service/Pregnancy Classes				
	ANC 4+ Visits & Pregnancy Classes	0.2	0.035	1.450	0.117
18	Illness during Pregnancy				
	Diarrhoea	0.3	0.032	2.703	0.279
	Malaria	0.8	0.022	28.231	0.899
	No illnesses in pregnancy	0.4	0.027	0.666	0.543
19	Maternal Condition in Pregnancy				
	Mother who presented with no condition	1.1	0.105	33.845	0.667

Field Survey, 2017

4.4.2 Factors Influencing Asphyxia

Maternal conditions among mothers in the study population included hypertension and diabetes among the others. A total of 8.2% of the respondents presented with these maternal conditions in pregnancy. Among the study groups, mothers who presented with no condition had reduced risk of delivering infants with birth asphyxia as compared with mother who presented with one or the other maternal conditions. On the other hand, the univariate analysis showed that infants of mothers with maternal condition had 0.191 lower apgar score than infants whose mothers were free from any medical condition in pregnancy (P<0.336).

Also, from the multivariate analysis, mothers who accessed pregnancy classes in addition to regular Antenatal care services rather had an increased risk of delivering babies with birth asphyxia. Upon those services, the mothers with access to pregnancy classes were 3.9 times more likely to give birth to babies with lower apgar score or birth asphyxia (p<0.808) as compared to mothers who attended only Antenatal care for about four times (ANC 4+ visits). Again, the univariate analysis showed that the average apgar score of infants of mothers with only four visits to the Antenatal care services (8.55±0.68kg) was higher than infants of mothers with the additional pregnancy classes (8.39±0.87kg). The result further showed that the infants of mothers with only four visits for ANC services were 0.160 apgar score higher (p<0.207) than the other infants. Maternal age was also another factor from the multivariate analysis to have been associated with infants' Apgar score. As compared with infants of mothers within the ages of 20-30years, adolescents mothers (<20years) had reduced risk of delivery infants with lower apgar score and were 6.6 times less likely to have had infants with birth asphyxia. However, mothers above the age of 30years had increased risk (coefficient=21.299) of delivering babies with birth asphyxia as

compared to mothers within 20-30years and the odds of association were 1.1 times likelihood for mothers above 30years, though the odds of association was not statistically significant (p<0.996). From the multivariate analysis also respondents from the Islamic and African Tradition religions both had increased risk of delivering babies with lower apgar scores in comparison with Christian mothers. Muslims and Traditionalists were 20.2 and 0.6 times more likely to give birth to babies with birth asphyxia. The means apgar scores for infants of Traditionalists were 8.33±0.59SD, Muslims 8.46±0.79SD and Christians 8.56±0.72SD. Infants of mothers from Islamic and Traditionalist backgrounds were 0.100 (p<1.000) and 0.225 (p<0.685) respectively lower in apgar scores to infants of Christians background, and the infants of Traditional mothers had 0.12 lower apgar score than infants of Islamic background. From the study results, maternal education was a significant determinant of birth asphyxia. Mothers with primary education (P<0.000) and secondary education (P<0.000) had increased risks of delivering babies with birth asphyxia as compared with mothers with no formal education. Mothers of infants with primary and secondary education were 6.6 and 2.1 time respectively more likely to deliver babies with birth asphyxia. Maternal residential status and travel time to nearest health facilities were also associated factors with infants' birth asphyxia. Mothers who stayed in rural communities were 2.5 times more likely to deliver infants with lower Apgar score than infants of mothers in urban settings. Mothers who traveled within 1 hour to the nearest health facilities had higher risk of delivering birth asphyxia babies than those mothers who traveled within 30 minutes to the nearest health facility. These mothers' infants had 0.023 lower Apgar score and were 4.6 times more likely to deliver birth asphyxia babies. There was however, no significant association between travel time and infants' birth asphyxia among the study respondents.

Table 4.4.2: Association between Socio-economic and Health-related services, and Infants' Apgar score

	4.4.2a Association between Socio-economic and Health-related services, and Infants' Apgar Score				
	Variable Names	**OR**	**CI**		**P-value**
1	Occupation of Respondents				
	Petty Traders	1.5	0	-	0.996
	Housewives	0.5	0.005	37.928	0.728
2	Household Net Annual Income				
	101.00-500.00ghc	0.1	0.002	2.214	0.128
	>1000.00ghc	1.5	0.001	1631.44	0.9.15
3	Ethnicity of Respondents				
	Sissala	0.0	4.60	147.99	0.408
	Others	0.0	5.80	1.416	0.058
4	Housing of Respondents				
	Block with Zinc Roofing	2.8	0	-	0.997
5	Religion of Respondents				
	Islam	20.2	0.319	1257.2	0.156
6	Maternal Age Categories				
	<20years	6.6	0	-	0.996
	>30years	1.1	0	-	0.994
7	Educational Level of Respondents				
	Primary Education	6.6	0.717	24.359	0.001
	Secondary Education	2.1	0.249	22.491	0.001
8	Residential Status				
	Rural Residents	1.9	0.000	629.35	0.693
9	Transport to Delivery Facility				
	Footing	0.7	0.028	19.16	0.853
	Lorry/Vehicle	0.2	0.000	62.97	0.560
10	Travel Time to Delivery Facility				
	About 1Hour	4.7	0.124	178.87	0.404

4.4.3a Association between Socio-economic and Health-related services, and Infants' Apgar Score

	Variable Names	OR	CI		P-value
11	Health Facility Visits during Pregnancy				
	3-5 Times	1.2	0.040	34.550	0.926
	> 6 Times	0.0	0.000	4.140	0.130
12	Gravidity				
	1st Pregnancy	1.3	0.002	945.690	0.931
	4-6th Pregnancy	0.0	6.180	18.880	0.235
13	Parity				
	Premed	8.7	0	-	0.993
	4-6th Birth	2.8	0.002	4401.73	0.782
14	Birth Spacing				
	First Timer	0.3	0	-	1.000
	2-3years Spacing	0.2	0.001	52.56	0.592
15	Bed Preparedness Plan				
	No bed plan	1.4	0	-	0.993
16	Number of SP doses				
	< 2 Doses	1.1	0.026	49.853	0.949
17	ANC Service/Pregnancy Classes				
	ANC 4+ visits & Pregnancy Classes	3.9	0.007	2169.65	0.672
18	Illness during Pregnancy				
	Fever	3.9	0.039	398.98	0.559
	Diarrhoea	4.7	0	-	0.993
	Malaria	0.67	0.006	76.700	0.869
19	Maternal Condition in Pregnancy				
	Mother who presented with no condition	0.0	0.001	2.149	0.110
20	Term of Gestation at Birth				
	Preterm Birth	0.2	0.021	6.44902	0.695

Field Survey, 2017

4.4.3 Factors Influencing PPH

From the multivariate analysis of the socio-economic and related-health service determinants of postpartum haemorrhage among the respondents, the results showed that the means of transportation by the pregnancy women to the delivery centres or facilities was a significant determinant ($p<0.032$) of postpartum haemorrhage at delivery. For instance mothers who used lorry or vehicles for transport services to the delivery facilities had a decreased risk of experiencing postpartum haemorrhage at delivery, whereas mothers who walked on foot had increased risk of experiencing postpartum haemorrhage and were 4.8 times more likely to experience postpartum haemorrhage at delivery than those mothers who used vehicle, though the result was not statistical significant ($p<0.223$). Also, from the univariate analysis, pregnant women who used vehicles to their delivery facilities had decreased risk (coefficient= -0.046 and -0.070) of postpartum haemorrhage as compared with mothers who used motorbikes or tricycle and those who walked respectively to their delivering health facilities.

Educational status of mothers was another determinant of maternal postpartum haemorrhage among the study population. Educated mothers in the study were at increased risk of postpartum haemorrhage than the mothers with no formal education. For instance, the odds of association between maternal postpartum haemorrhage and education showed that mothers with primary education and secondary education were 1.5 and 110.7 times respectively more likely to experience postpartum haemorrhage than the uneducated mothers. However, the odds of association between maternal education (both primary and secondary education) and postpartum haemorrhage was not statistically significant ($p<0.168$ and $p<0.092$). The results also showed that mothers <20years of age were also at increased risks (coefficient = 2.824) of postpartum

haemorrhage and were 17.2 times more likely to experience postpartum haemorrhage at delivery than mothers within 20-30years ($p<0.335$).

Gravida 7 and above respondents in the study were at increased risk of postpartum haemorrhage than gravida 2-3 respondents ($p<0.977$). Likewise, parity of respondents was a significant determinant ($p<0.046$) of postpartum haemorrhage at delivery. Respondents above the parity of four were 185 times more likely to experience postpartum haemorrhage at delivery than women of 2-3 parity. Respondents who presented with a medical condition like hypertension and/or diabetes were 6.6 times more likely to experience postpartum haemorrhage, though there was no significant association between maternal conditions in pregnancy and postpartum haemorrhage at delivery ($p<0.258$).

Table 4.4.3: Association between Socio-Economic and Health-Related Services, and Maternal Postpartum Haemorrhage Status

4.4.3a Association between Socio-economic and Health-related services, and Maternal PPH Status

	Variables Names	(n/N)%	OR	CI		P-value
1	Occupation of Respondents					
	Petty Traders	7.7	1.3	0.007	228.98	0.924
	Formal Sector Workers	7.7	3.1	0	-	0.997
2	Household Net Annual Income					
	101.00-500.00ghc	38.5	2.1	0.208	22.572	0.519
	501.00-1000.00ghc	23.1	1.2	0.069	24.023	0.866
	>1000.00ghc	7.7	1.4	0.009	244.54	0.887
3	Ethnicity of Respondents					
	Sissala	30.8	0.6	0.026	13.804	0.747
	Others	7.7	0.3	0.0004	179.45	0.686
4	Housing of Respondents					
	Block with Zinc Roofing	15.4	1.3	0.0129	133.10	0.908
5	Religion of Respondents					
	Islam	23.1	1.4	0.0362	52.715	0.862
	African Tradition	7.7	13.9	0.145	1344.19	0.258
6	Maternal Age Categories					
	<20years	7.7	17.2	0.057	5161.4	0.329
	>30years	38.5	0.1	0.005	1.622	0.103
7	Educational Level of Respondents					
	Primary Education	30.8	6.2	0.456	85.378	0.170
	Secondary Education	7.7	110.7	0.410	29916.1	0.099
	Tertiary Education	7.7	1.5	0	-	0.996
8	Residential Status					
	Urban Residents	15.2	0.1	0.001	3.058	0.160
9	Mean of Transport to Delivery Facility					
	Footing	23.1	4.8	0.356	65.583	0.236
	Lorry/Vehicle	7.7	0	2.860	0.563	0.032

4.4.3b Association between Socio-economic and Health-related services, and Maternal PPH Status

	Variables Names	(n/N)%	OR	CI		P-value
10	Travel Time to Delivery Facility					
	About 1Hour	30.8	0.1	0.005	2.889	0.191
	> 1Hour	7.7	2.9	0.060	146.68	0.583
11	Health Facility Visits during Pregnancy					
	3-5 Times	30.8	3.4	0.395	30.315	0.263
	> 6 Times	7.7	5.7	0.182	173.39	0.324
12	Gravidity					
	1st Pregnancy	30.8	4.8	0.008	2984.0	0.628
	4-6th Pregnancy	30.8	0.1	0.002	2.612	0.156
13	Parity					
	Primed	30.8	1.7	0.003	913.88	0.874
	4-6th Birth	23.1	1.9	1.017	33732.5	0.049
14	Birth Spacing					
	First Timer	30.8	0	0.000	8.934	0.200
	2-3years Spacing	46.2	0.1	0.005	4.446	0.271
	>4years spacing	15.4	0.2	0.008	7.730	0.424
15	Bad Preparedness Plan					
	No bed plan	7.7	1.9	0.072	48.947	0.706
16	Number of SP doses					
	<2 Doses	23.1	0.8	0.050	10.886	0.825
17	ANC Service/Pregnancy Classes					
	ANC 4+ Visits & Pregnancy classes	30.8	0.2	0.0249	2.204	0.205
18	Illness during Pregnancy					
	Fever	15.4	1.8	0.097	36.749	0.74
	Diarrhoea	7.7	0	0.000	3.976	0.166
	Malaria	7.7	2.2	0.042	120.03	0.691
19	Maternal Condition in Pregnancy					
	Mother who presented with condition	15.4	6.6	0.272	158.22	0.246

Field Survey, 2017

CHAPTER FIVE

5.0 DISCUSSION

5.1 Prevalence of Adverse Birth Outcomes

The mothers in this study were generally within the ages of 20-30years and had a mean age of 27.6±5.526yrs. On the categories of health facilities available to the respondents in the district, 45.4% of them delivered in a Clinic/Health Centre whiles 43.7% delivered in a polyclinic/hospital and 10.9% delivered in CHPS Compounds. Majority of the mothers (88%) went through natural vaginal delivery and 12% delivered through Caesarean Session. From the study sample, the general prevalence of adverse birth outcomes as indicated by moderate birth asphyxia (<7 Apgar score), low birth weight (<2500g) and maternal postpartum haemorrhage (>500ml) were 9.3%, 8.2% and 7.1% respectively among the study population in the Lambussie District.

The study finding on low birth weight of 8.2% was the same as that of USA and very much closer to 7.1% in Western European Countries (Daniel, 2013), 9% in Latin America (WHO, 2014), and 9.5% in Greece and Japan (OECD, 2016). This finding is slightly higher than the 6% prevalence in East Asia, 6.5% in Nordic and Baltic OECD Countries and the 5% lowest mean rate in all the OECD Countries (OECD, 2016). The prevalence of low birth weight in the study is still further lower than that of Sub-Saharan Africa (13%), West and Central Africa (14%) as reported by WHO in 2014. However, the result in this study may under estimate the actual low birth weight prevalence because the study included only women who delivered with skilled attendants with the requisite skills and resources for measurement and as such the result may not reflect the real situation on ground. Worldwide prevalence rate of 15-20% low birth weight and 28% in South Asia are still higher than the finding in this study. With particular studies in Ghana, the prevalence in the current study is lower than that of the finding of MICS, 2011 (11%), but similar to the 9.2%

in Ghana as revealed by Fosu et al., 2013, but much lower than the 26% in the Northern region of Ghana (Abubakari et al., 2015), which share similar geographic characteristics with the study area. Also, from the data set of GDHS, 2014 the current study finding found a lower prevalence as compared with 12.1% low birth weight rates in the Upper West Region and 9.94% National prevalence rate. Comparatively, the small sample size in the current study could have accounted for the slight difference in the prevalence rates as compared with the Regional and the National studies of the GDHS. The study low birth weight prevalence showed variation among the age groupings as also indicated by Silvestrin et al., (2013) among adolescents and mothers older than 35years. Although, in the current study only few mothers were above the age of 30years, adolescents showed similar prevalence of 12.3% as against 13.3% (Angela et al., 2013) in the current study, though the sample size in the current study was much smaller.

The study also recorded prevalence of moderate birth asphyxia (<7 Apgar score) of 9.3% in the study population. As acknowledge by WHO, 2014, there are difficulties in estimating accurately the rates of birth asphyxia particularly at the community level. In the current study 10.9% of the respondents delivered at the CHPS facilities, which mostly do not have the capacity to conduct deliveries and the necessary skills to estimate birth asphyxia. Apart from the health centres, almost all the CHPS compounds in the study area did not also have a resident midwife. And also, partly because there is no gold standard for the diagnosis of birth asphyxia. As such, the prevalence rate in this study may only serve as indication of the existence of this birth defect but may underestimate the actual prevalence rates and it impact especially in this limited resource setting as reported also by Daripa et al., (2013). The prevalence rate in the current study was similar to the rate of 9% 1 minute asphyxia rate in India but almost 4 times higher than 2.5% 5minutes prevalence rate in the same study (Rajiv 2007) and 2.83% prevalence in Bangladesh (Sampa et al.,

2012). However, the finding in the study was much lower compared with 21.1% prevalence in Nigeria (Ilah et al., 2015).The difference in this study could be attributed to the different levels of health care in the two studies. The current study sampled normal deliveries whereas the former study was conducted in a tertiary health facility that dealt mostly with referrals or complicated cases. Similar to the sample size of the current study, Aslam et al., 2014 found in Pakistan about six times the prevalence rate in this study. Although the sample size of the current study was very small which may limit its ability to detect small differences among the general population. However, the majority of studies across the globe are directed towards the percentages of death due to perinatal or birth asphyxia in hospital setting but are often limited to the actual prevalence of this birth outcome in the general population (WHO, 2007; WHO, 2012; Padayachee & Ballot, 2013)

Maternal postpartum haemorrhage (>500ml bleeding) at delivery among the study population in the Lambussie District was 7.1%. Again, the low prevalence rate in the current study could be due to the small sample size. However, similar prevalence rates were found in Uganda (9%) and Pakistan (7.4%) by (Ononge et al., 2016). Comparatively, the prevalence rate contained in this study is much lower than that of the overall prevalence in Sub-Saharan Africa 34% (Mpemba et al., 2014), and some selected studies in African countries like 23.6% in Cameroon (Edie Halle-Ekane et al., 2016) and even the 15.8% in Ghana as indicated by Owiredu et al., (2013). Comparatively to the global study conducted by Fan et al., (2017), the current study finding is still lower than the global postpartum haemorrhage prevalence of 22.3%; 26.3% in North America, 20.7% in Asia, 19.2% in Australia and 17.8% in Europe. Also in another study in Pakistan, 21.3% prevalence rate is still 3 times higher than the result of this study (Gani & Ali, 2013). The authors attributed the difference in their prevalence rate to the higher average number of pregnancies in

the study population, lack of access to health facilities and lower socio-economic status of the respondents. Also, Fyfe et al., (2012) found in a retrospective cohort study in New Zealand a postpartum haemorrhage prevalence rate of 8.9%, which is slight lower than the finding of this current study.

5.2 Nutritional Influences of Adverse Birth Outcomes

The mothers in this current study who had adequate knowledge and somehow good knowledge on the four main food sources (animal source food, fruits and vegetables, legumes and cereal & tubers) they could eat from during pregnancy were 28.96% and 53.1% respectively. About 72% of these mothers practiced the intake of these foods and 92.9% also received nutrition counseling during the period of their pregnancies. The majority of the mothers (83.52%) complied fully with the IFA supplementation received from the ANC clinics. Some mothers (24.04%) in the study had some related food taboos in pregnancy and overall 60.11% suffered from some forms of household food insecurity. The mothers in this current study were generally well nourished at the time of initiating ANC services in the early stages of their pregnancies (underweight 8.2%, normal 80.3%, overweight 8.7% and obesity 2.7%). The mean change in gestation weight gain in this study was 6.17±3.39 but almost all mothers could not gain adequate weight according to IOM recommendations (low weight gain 92.3%, adequate weight gain 4.9% and excessive weight gain 2.7%). The proportion of low birth weight was 8.2% among the infants of the mothers in the study. The most important nutrition determinants of low birth weight as identified in this study were alcohol (pito intake) history in pregnancy, gestational weight gain, maternal height, and food taboos during the period of pregnancy. Adequate weight gain in pregnancy according to the IOM recommendations was shown to be strongly associated with infant birth weight, infants of mothers

with adequate weight gain in pregnancy were 116.5g heavier than infants of mothers who experienced lower gestational weight gain. In related studies, the authors acknowledged that changes in gestational weight gain had significant association with infants' birth weights (MICS, 2011; Uche & Olubukola, 2011; Abubakari et al., 2015; Sridhar et al., 2016). Some authors observed that adequate gestational weight gain not only reflect the increased in the maternal and foetal tissues but also the adequacy of calorie and micronutrients intake, whereas lower gestational weight gain give evidence of the deficiency of these nutrients necessary for foetal growth. They also noted that nutritional deficiency could result in poor plasma volume expansion and undeveloped maternal tissues to support the foetus (Sharma & Mishra, 2013). This reaffirmed the need for adequate nutrition in pregnancy for improved birth outcome, since more than half the study population experienced some forms of household food security. In another study, the authors could not clarify the associations between gestational weight gain per trimester and foetal weight at birth (Sridhar et al., 2016). In this study however, gestational weight gain on trimester bases did not influence birth weight of infants. This probably was due to the fact that mothers in the study experienced marginal increased weight gain per each trimester. However, in a cohort study in Kaiser Permanente Northern California, gestational weight gain in the 2nd and 3rd trimesters strongly determined infants' growth. The study also observed that an increased in maternal height was significantly associated with 10-11.7g of infant birth weight in the study. Similarly, other studies also showed a significant association of maternal height with infant birth weights (Sharma & Mishra, 2013; Abubakari et al., 2015).

Most studies on food taboos in pregnancy are limited in their relationship with infants' birth weights as continuous variable. These studies only examined the magnitude of food taboos in pregnancy. In Africa and Ghana in particular, to the best of the authors' knowledge food taboos in

pregnancy with respect to infants' birth weights appear not to be available. For instance, in Ethiopia Biza Zepro, 2015 found that about half of the women in the study to determine food taboos and misconceptions among pregnant women in the District of Shashemene had tabooed at least one food item. Again, (Ekwochi et al., 2016) reported of 37% of a study respondents in Nigeria that avoided some foods during pregnancy. However, both studies and other related studies did not related the impact of these food taboos to infants' birth weights, making it difficult to compare any observations with the current study.

In a prospective cohort study in Leeds, UK researchers similarly found consistently adverse association between intake of alcohol prior to and during pregnancy, and birth weight. Alcohol consumption was found to have been associated with an approximately 100g reduction in infants' birth weights (Vaktskjold et al., 2010). Comparing with those who did not drink, the authors reported that alcohol intakes of <2 units/week and >2 units/week in the first trimester were associated with an adjusted −5.8 and a −8.2 decrease in customized birth centile, respectively (Vaktskjold et al., 2010). Comparatively in this study, I found that "Pito", a local alcoholic drink (with 5units of alcohol per 1000mls) was shown to be a strong determinant of birth weight, reducing infants' birth weights by 130g. Also, from the Danish National Birth Cohort data, (Wüst & University of Aarhus Department of Economics, 2010) maternal alcohol consumption significantly reduced birth weight by 147g for each daily unit, specifically, 26g at the mean alcohol consumption, and foetal growth by 3.7g/week and 1g/week at the mean alcohol consumption. This local alcoholic drink is sometimes consumed as a complete meal or substitute of a main meal in some particular days. However, the study was limited in quantifying the measure of the daily intake of this alcoholic drink, hence the need for further investigation to measure a unit pito intake in relation with birth weight loss.

From the study results, the most significant determinants of infants' low Apgar score (moderate asphyxia) were nutrition counseling during pregnancy, meal frequency and gestational weight gain of the mothers. For instance, infants of mothers who were counselled during pregnancy had an apgar score 0.5 higher than those infants whose mothers were not counselled. However, there was no odds of association in infants who did not receive nutrition counseling and birth asphyxia. Again, infants of mothers who ate less than 3 times in a day during the period of pregnancy were 19.4 times associated with lower Apgar score. The author in this study could not find related studies on association of low Apgar score and the above mentioned nutritional factors.

The most important nutrition determinants of maternal postpartum haemorrhage in the study were also daily food supplements intake, knowledge of four star meal, and malnutrition (both under and over nutrition) at 36 weeks or delivery of the respondents in the study. Ironically, poor compliance to IFA supplementation and poor knowledge of four star meal had reduced risk of postpartum haemorrhage. Comparatively, a related study have shown that even though intermittent supplementation were shown to have improved iron status more than no supplementation, but systematic review of the research proven that women receiving daily iron supplements tended to have lower haemoglobin and ferritin concentrations, and they were equally likely to be anaemic as those receiving intermittent iron supplements (WHO, 2011). However, the current study could not confirm the effectiveness of those mothers who reportedly complied with the daily IFA supplementation since they are often challenges with some mild side effects, such as darken stools, gastrointestinal pain, diarrhoea, constipation and vomiting, which could have affected their complete compliance to the daily supplementation. This may have reflected in the reduction of anaemia from 52.5% to 37.7% among the women from the first to the third trimester respectively, hence the likelihood of about 37.7% of these mothers to postpartum haemorrhage due to anaemia

in pregnancy. An Indian study also revealed that nutrition and health education along with IFA supplementation was a positive means of improving both health and nutrition status of mothers, together with eradicating anaemia. The study showed that mothers who received IFA supplementation together with nutrition education reduced anaemia prevalence from 53.8% to 39% (Monika et al., 2015), which is similar to the finding in the current study. However, further studies are required to evaluate the significant impact of IFA supplementation on maternal postpartum haemorrhage status. Generally, malnourished mothers with BMI score outside the range of 18.49-24.49 kg/m^2 were of a higher risk of postpartum haemorrhage. Comparatively, in New Zealand Fyfe et al., (2012) specifically found that overweight and obesity were both risk factors for postpartum haemorrhage. Obesity was particularly having a twofold increase in risk for postpartum haemorrhage than nulliparous.

5.3 Socio-economic and Health Service Determinants of Birth Outcomes

From the socio-economic and health service data as indicated in the study, the most significant determinant of birth weight were religion of the respondents, means of transport by the mothers to the delivery health facility, multiple pregnancies and parity of the mothers. Even though the results indicated that infants of Muslims mothers were 134.5g and 220.4g heavier than infants of Christian and African Tradition mothers, being a Muslim was a significant predictor of low birth weight in the study. Muslim infants were 5.9 times at risk of low birth weight in comparison with Christian infants. The magnitude of the finding were similar to a study in the United State of America. Researchers reported that maternal religious attendance (mainly Protestantism, Catholicism and Other faith) was protective against low birth weight. They also reported that the same maternal religious attendance was associated with lower odds of poor nutrition (Burdette et al., 2012),

though the current study did not show any significant difference in their household food security and BMI status by religion of the mothers. Further investigations are needed to clearly explain the inter-relationship between being Muslims and low birth weight

Also, mothers who lived within the vicinity of health facility and those who traveled to the facility using bicycle as a means of transport for delivery had low risk to low birth weight. This could probably be attributed to the readily access to health services and nutrition information from the health facilities due to their close proximity and frequency of attendance to the facility. Multiparous mothers (mothers with 4-6th births) were at reduced risk of low birth weight as compared with parity of less than three. Comparative finding was reported in a study in Vietnam. For instance, the study found parity to be positively and independently associated with birth weight. The authors reported that infants of mothers with previous two deliveries were 216g to 552g heavier than those of mothers with no previous deliveries (Vaktskjold et al., 2010). The current study showed that parity was also independently associated with infants' birth weight; infants of grand parity women were 271.5g heavier than those of nullparity mothers ($p<0.004$). Whiles multigravidas (as explained by 4-6 times of pregnancies), as compared with mothers of less than three pregnancies were at increased risk of low birth weight, with 5.9 odds of association. This probably may be attributed to the fact that mothers in poor resource settings are unable to build maternal nutritional stores with multiple pregnancies to ensure adequate foetal weight and general growth. Similarly to the finding, in Kaduna State, Sadiq et al., (2016) also found higher number of pregnancies to be associated with adverse outcomes. However, in a cohort study in Italy, Boguzzi et al., (2012) instead found significant association between nullparity and low birth weight among the study women, and so does Shah, (2010). For instance Shah, (2010) rather found that nullparity was associated with increased unadjusted odds of low birth weight. They further

indicated that grand parity and great grand multiparity had no association with low birth weight (Motsi, 2006; Shah, 2010; Boguzzi et al., 2012). The authors found no significant association between high parity and birth weight. But as indicated, the biological mechanism of how parity may have influenced the incidence of low birth weight is not clearly understood (Shah, 2010). Hence, grand multiparas should be encouraged to deliver in health facilities where specialists and effective emergency treatment options are available

On the other hand, the most socio-economic and health service significant determinants of birth asphyxia were maternal education and ethnicity of the mothers. Similar to this findings, Lee, (2007) found ethnicity (Madeshi) and rather low paternal education to have increased relative risk of birth asphyxia but the later was not statistically significant. The association between the Sissala ethnicity group and birth asphyxia was however very weak ($p<0.062$) in this study. Mothers with primary and secondary education were 6.6 and 2.1 times respectively likely to deliver babies with birth asphyxia than their uneducated counterparts. These factors to the best of the author's knowledge are not investigated in many other studies.

Importantly, means of transport to the delivery health facility and parity were also the most influential variables for postpartum haemorrhage among the study group. For instance, mothers who were transported with vehicles to the delivery facilities were of lower risk of postpartum haemorrhage than those with motorbikes or tricycles. The road network in the District is very bad making it difficult and sometimes risky for the use of motorbike and tricycles when transporting pregnant women in labour. It might have led to increased pressure and stress on the uterus from the pregnant women sitting on the motorbikes or tricycle, leading to activities on the uterus that may precipitate uterine contractions and injuries on arrival at the health facilities. In a case control study in Pakistan, Jaleel and Khan, (2010) also reported that high parity was significant risk of

postpartum haemorrhage. Other studies also suggest that multiparty is significant risk for postpartum haemorrhage (Tako et al., 2014; Kodla, 2015; Edie Halle-Ekane et al., 2016). For instance, in South Sudan Tako et al., 2014 found that exposure to multiparity bore a fourfold risk of developing postpartum haemorrhage. This is said to be attributed to the laxity of the uterus and reduced strength for contraction during labour due to the multiple deliveries by the mothers.

CHAPTER SIX

6.0 CONCLUSION/RECOMMENDATIONS

6.1 Conclusion

During pregnancy an expectant mothers need extra food to meet the growing demand of nutrients for themselves and also to provide substrate for the foetal development and growth. The most important nutrition determinants as identified in this study were alcohol (pito) history, gestational weight gain, maternal height, and food taboos during the period of pregnancy. From the socio-economic and health service data as indicated in the study, the most significant determinant of birth weight were religion of the respondents, means of transport by the mothers to the delivery health facility, multiple pregnancies and parity of the mothers

From the study results, the most significant factors associated with infants' low Apgar score (moderate asphyxia) were nutrition counseling during pregnancy, meal frequency and gestational weight gain of the mothers. On the other hand, the most socio-economic and health service significant determinants of birth asphyxia were maternal education and ethnicity of the mothers.

Then again, the significant nutrition factors associated with maternal postpartum haemorrhage in the study were also daily food supplements intake, knowledge of four star meal, and malnutrition at 36weeks or delivery of the respondents in the study. Importantly, means of transport to the delivery health facility and parity were also the most influential variables for postpartum haemorrhage among the study group.

No doubt maternal nutrition and access to adequate health service are key ingredients to improving birth outcomes among all groups. In conclusion the cross-sectional study revealed that the mothers

in the Lambussie District do not gain the appropriate gestational weight prior to delivery. This predisposes them to various adverse birth outcomes. District nutrition stakeholders need to double their efforts to ensuring mothers benefits from ongoing and new nutrition interventions in the District.

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6.2 Recommendations

1. Although, the prevalence of adverse birth outcomes as determined in the study were lower, the DHA should double-up their efforts to further reduce them to the barest minimum in the Lambussie District.
2. The DHA should educate mothers on the negative impact of nutritional factors (such as alcohol intake, food taboos etc.) on birth outcomes.
3. GHS/DHA should strongly discourage the use of motorbike as emergency transport for pregnant women to their delivery health facilities to reduce their exposure to postpartum haemorrhage

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ANNEXES

1.1 Consent Form

UNIVERSITY FOR DEVELOPMENT STUDIES
SCHOOL OF ALLIED HEALTH SCIENCES, TAMALE

MSC/MPHIL COMMUNITY HEALTH AND DEVELOPMENT PROGRAMME

Respondent's Consent Form

Section A: Background Information

Tittle of Study	Maternal Determinants of Birth Outcomes in Lambussie, Ghana
Principal Investigators	Francis Zinenuba Taabia (BSc) and Abubakari Abdulai (PhD)
Category of Participants	Lactating Mothers aged 15-49years

Section B: Consent to Participate in the Research

General Information about Research

Purpose

I am a student of the above mentioned school and I am conducting a research study on the topic "Maternal Determinants of Birth Outcomes in Lambussie District, Ghana". A research study is a way to learn more about people. If you decide that you want to be part of this study, you will be asked to provide your dietary information, health services received and related information, socio-demographic and socio-economic data, and the birth outcomes of your pregnancy. Any information obtained is for the purposes of fulfilling the requirements of the academic research in the MSc/MPhil programme. It will also contribute to the literature of knowledge on maternal and child health in the academic world

Study Procedure

The study will interview mothers who have given birth within the most recent two weeks to the commencement of this study. The mothers will be interviewed through the use of a questionnaire which will take about 40 minutes to answer all the questions. Additionally, key maternal and child health indicators relevant to the study, and health services received by the mother will be extracted from the maternal health record booklet and the Continuum of Care card on to the questionnaire.

Benefits/Risks of the Study

There is a slight risk that you may share some personal or confidential information by chance, or that you may feel uncomfortable talking about some life styles especially your food practices. However, I do not wish for this to happen, and you may refuse to answer any question or not take part in the interview if you feel uncomfortable. There is no direct benefit in taking part in this study. A benefit means that something good happens to you. But your participation is likely to help save lives of many children and pregnant women by using the information given in the development of strategies that will improve maternal and newborn health.

Confidentiality

A number will be assigned to you and so your name will not be recorded during the interview process. Your information will be collected and written down for our analysis. The information about you will be stored in a file that will not have your name written on it, but a number assigned to it instead. The information that we collect from you will be kept private. Your data will be secured from unauthorized access. When we are finished with this study we will write a report about what was learned. This report will not include your name or that you were in the study.

Compensation

Should you agree to participate in the study, there will be no payment (either in cash or in kind) for your participation in the study. In the event of any injury resulting directly from your participation in the study, the principal investigator will assess the situation, and together with the respondent arrive at an agreed solution. There will be no anticipated expenses on the part of the respondent for participating in the study

Withdrawal from Study

Your participation is voluntary and it is up to you to participate or not. The choice that you make will have no bearing on your medical care in any health facility in the Lambussie District. You can withdraw your consent at any time, without specification of reasons and without any disadvantage for your medical care. You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that's okay too. In the event that the researcher determine that your respondents are not appropriate for the study s/he may terminated the interview.

Questions

Participants in the study have the full right to ask questions and also to receive satisfactory answers in line with the study. Participants with questions or concerns regarding the study and their rights in the event of study-related injury may contact the study team through the information provided below.

Contact for Additional Information

Please contact the principal Investigator or Local Investigator at the following addresses if you have any further questions, need clarifications about your rights or experience any problems in this study.

Francis Zinenuba Taabia (BSc)
Ghana Health Service, DHA
Box 6, Lambussie District
0207832401/ftzinenuba@gmail.com

Abubabkari Abdulai (PhD)
Department of Community Nutrition, UDS
Box 118, Tamale Campus.
0540874670/abubakariabdulai@yahoo.com

Mr. Cletus Tindana
Chair-Ethical Committee
Navrongo Health Research Centre
0244712474/Cletus.tindana@navrongo-hrc.org/tindana@gmail.com

Signature of volunteer willing to participate

I have read or have had someone read all of the above, asked questions, received answers concerning areas I did not understand, and am willing to give consent for me, to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records.

Name: _____

Signature/thumbprint of participant/Her Legal representative

Witness to Consent Procedures (if volunteer cannot read the form themselves, a witness must sign here) I was present while the benefits, risk and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research

Name:

Signature: Date:

Investigator or attending Health Care Professional's Affidavit

I certify that I have explained to the above individual(s) the nature and purpose of the study, potential benefits and possible risks associated with the participation in this research project. I have answered any questions that have been raised and have witnessed the above signature on the date indicated below.

Name: _____ Signature: Date:

1.2 Assent Form

Signature of Teenager willing to participate

I have read or have had someone read all of the above, asked questions, received answers concerning areas I did not understand, and am willing to give consent for me, to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records.

Name: _____

Signature/thumbprint of participant/Her Legal representat

Caregiver's/Guardian's Consent: I was present while the benefits, risk and procedures were read to the Teenager. All questions were answered and the teenager has agreed to take part in the research. I therefore give my consent to allow the teenager participate in the study.

Name:

Signature: Date:

Investigator or attending Health Care Professional's Affidavit

I certify that I have explained to the above individual(s) the nature and purpose of the study, potential benefits and possible risks associated with the participation in this research project. I have answered any questions that have been raised and have witnessed the above signature on the date indicated below.

Name:

_____

Signature: Date:

1.3 Questionnaire

TOPIC: Maternal Determinants of Birth Outcomes in Lambussie District, Ghana.

Section A: Socio-demographic Characteristics of the Respondent

1. Sub-district of the respondent

1. Hamile [ ]
2. Samoa [ ]
3. Billaw [ ]
4. Lambussie [ ]
5. Piina [ ]
6. Karni [ ]

2. Category of the delivery facility

1. CHPS [ ]
2. Clinic/Health Centre [ ]
3. Polyclinic/Hospital [ ]
4. Home delivery [ ]

3. Mode of delivery of the mother?

1. Caesarean Session [ ]
2. Natural Virginal Delivery [ ]
3. Others [ ]

4. What is the age of the mother? .....

5. Ethnicity of the mother

1. Sissala [ ]
2. Dagao [ ]
3. Moshi [ ]
4. Others [ ]

6. Type of housing of the respondent?

1. Block with zinc roof [ ]
2. Mud with zinc roof [ ]
3. Mud with thatch roof [ ]
4. Mud only [ ]

7. Household ownership of the mother?

1. Tenant [ ]
2. Household owner [ ]
3. Other arrangement [ ]

8. Religious affiliation of the respondent?

1. Christianity [ ]
2. Islamic [ ]
3. Traditionalist [ ]
4. Others [ ]

9. Educational level of the mother?

1. No formal education [ ]
2. Primary education [ ]
3. Secondary education [ ]
4. Tertiary education [ ]

10. Educational level of the mother in completed years?.....

11. Marital status of respondents at delivery?

1. Single [ ]
2. Married/ Co-habitation [ ]
3. Separated/Divorced/Widowed [ ]

Section B: Socio-economic Characteristics of the Respondent

12. Did you take any form of alcohol (beer, pito, akpeteshie, etc.) during your pregnancy?

1. Yes [ ]
2. No [ ]

13. Did you smoke during the period of the pregnancy?

1. Yes [ ]
2. No [ ]

14. What is the estimated travel time on foot to the nearest health facility in your locality?

1. Less than 30minutes [ ]
2. About 1hour [ ]
3. More than 1hour [ ]

15. What was your means of transport to the delivery centre?

1. Motorbike/Tricycle [ ]
2. Foot [ ]

3. Lorry/Vehicle [ ]
4. Bicycle [ ]

16. What is the occupation of the respondent?

1. Farming [ ]
2. Petty trading [ ]
3. Government/formal sector worker [ ]
4. Housewife [ ]

17. What is your estimated net household annual income?

1. >₵100.00 [ ]
2. ₵101.00-₵500.00 [ ]
3. ₵501.00- ₵1000.00 [ ]
4. >₵ 1001.00 [ ]

Section C: Nutrition Information of the Respondent

18. Did you receive counseling on nutrition during pregnancy?

1. Yes [ ]
2. No [ ]

19. Did you practice the intake of additional meal (3+1) during the period of your pregnancy?

1. Yes [ ]
2. No [ ]

20. How many days in a week did you take the food supplements (Iron, folic acid & vitamins) from the ANC services?

1. All 7 days in a week [ ]
2. Some days of the week [ ]
3. Didn't comply [ ]

21. Were there some foods that you were not allowed to eat during your pregnancy?

1. Yes [ ]
2. No [ ]

22. If yes to Q22, what food?
……
……

23. If yes to Q22, why?
……
……

24. What is four-star diet?

1. Correctly explained [ ]
2. Explained but not accurate [ ]
3. Couldn't explained [ ]

25. Did you practice the four-star diet during pregnancy?

1. Yes [ ]
2. No [ ]

26. What do you use in washing your hands before cooking?

1. Don't wash hand before cooking [ ]
2. washes with only water [ ]
3. Washes with soap under water [ ]

27. What do you use in washing your hands before eating?

1. Don't wash hand before eating [ ]
2. washes with only water [ ]
3. Washes with soap under water [ ]

28. Now I would like to ask you questions about your food consumption in the past 12months. During the last 12 months, was there time when (0=no, 1=yes)

a. You were worried you would run out of food because of the lack of money or other resources? [ ]
b. You were unable to eat healthy and nutritious food because of the lack of money or other resources? [ ]
c. You ate only a few kind of foods because of the lack of money or other resources? [ ]
d. You had to skip a meal because there was not enough money or other resources to get food? [ ]
e. You ate less than you thought you should because of the lack of money or other resources? [ ]
f. Your household ran out of food because of the lack of money or other resources? [ ]
g. You were hungry but did not eat because there was not enough money of other resources for food? [ ]
h. You went without eating for a whole day because of the lack of money or other resources? [ ]

Section D: Health Services and Information of the Respondent

29. What was the Gestational weight of the mother at first ANC? ……..

30. What was the Gestational weight of the mother at second ANC? .....

31. What was the Gestational weight of the mother at third ANC? ……

32. What was the gestational weight of the mother at 36 weeks? ……..

33. What is the Height of the mother at 36 weeks? .....

34. Gestational age at delivery?

1. ≤ 32weeks [ ]
2. ≤ 37weeks [ ]
3. ≥ 37weeks [ ]

35. Any pre-existing maternal conditions of the mother?

1. Yes [ ]
2. No [ ]

36. If yes to Q36, kindly indicate the pre-existing maternal condition? ……

37. Within a month to the delivery, have you experienced any of the following illnesses

1. Fever [ ]
2. Diarrhoea [ ]
3. Malaria [ ]
4. No illnesses [ ]

38. What is the birth spacing of the mother?

1. First timer [ ]
2. < 1year [ ]
3. 2-3years [ ]
4. ≥4years [ ]

39. In addition to this current delivery, how many pregnancies have you had?

1. One [ ]
2. Two-three [ ]
3. Four-six [ ]
4. ≥ seven [ ]

40. What is the parity of the delivery?

1. Once [ ]
2. 2-3 times [ ]
3. 4-6 times [ ]
4. ≥ 7 times [ ]

41. What is the respondent's Hb at ANC registration? …….

42. What is the respondent's Hb at 36 weeks? ……..

43. Did you receive counseling on maternal anaemia?

1. Yes [ ]
2. No [ ]

44. Did the respondent make adequate bed preparedness plan?

1. Yes [ ]
2. No. [ ]

45. Has the mother being on malaria prevention therapy (SP/IPT) during pregnancy and taken at least 3-7 doses of SP

1. ≤ 2 doses [ ]
2. 3-4 doses [ ]
3. 5-7 doses [ ]

46. Did the respondent complete the Continuum of Care services?

1. Fully completed [ ]
2. Partly completed [ ]
3. Poorly completed [ ]

47. Did respondent attend ANC services/pregnancy classes

1. ANC (4+) only [ ]
2. ANC (4+) & P-classes [ ]
3. ≤ 4+ ANC & P-classes [ ]

48. Your main reason for attending ANC services?

……

……

49. How many times have you visited the health facility for additional

health services during the pregnancy?

1. Less than 2 times [ ]
2. Between 3 to 5 times [ ]
3. More 5 times [ ]
4. No visits [ ]

Section E: Birth Outcomes of the Respondent

50. What is the birth weight of the baby? …….

51. What is the five minutes Apgar score of the baby?
……

52. Term of gestation at delivery

1. Very preterm birth (less than 32weeks) [ ]
2. Preterm birth (>32 but less than 37weeks) [ ]
3. Full term birth (>37weeks) [ ]

53. Sex of the neonate

1. Male [ ]
2. Female [ ]
3. Others [ ]

54. Did the mother experience post-partum hemorrhage (500ml) during the delivery?

1. Yes [ ]
2. No [ ]