

**SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA**



**A RETROSPECTIVE ANALYSIS OF SOCIO DEMOGRAPHIC AND MATERNAL
FACTORS AFFECTING LOW BIRTH WEIGHT AT ST. THERESA'S HOSPITAL,
NKORANZA**

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**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON,
IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE
MASTER OF PUBLIC HEALTH DEGREE**

JULY, 2021

DECLARATION

I, **AGYEMANG YEBOAH PRINCE** declare that this thesis is my original work, except for duly referenced ones and that no form of this work has been presented elsewhere for another research.

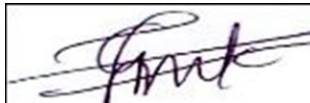


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DEDICATION

I dedicate this work to my family who supported me throughout the course of my study.

ACKNOWLEDGEMENT

I am grateful to God Almighty for life, wisdom and strength given to us to carry out this piece of work successfully.

I also express our profound gratitude to my supervisor, **Dr. John K. Ganle**, who gave me encouragement, guidance and corrections which enabled me to complete this work.

To my respondents, i say thank you for your willingness which added to the completion of this work.

LIST OF ABBREVIATIONS

ANC	-	Antenatal Care
BMI	-	Body Mass Index
DHIMS	-	District Health Information Management System
GDHS	-	Ghana Demographic and Health Survey
ICD	-	International Classification of Disease
IUGR	-	Intrauterine Growth Restriction
LBW	-	low birth weight
LMIC	-	Low- and Middle-Income Countries
MDG	-	Millennium Development Goals
PTB	-	Preterm birth
SDG	-	Sustainable Development Goals
SVD	-	Spontaneous Vaginal Delivery
WHO	-	World Health Organization
CS	-	Caesarian section
ELBW	-	Extremely Low Birth Weight
VLBW	-	Very Low Birth Weight
GSS	-	Ghana Statistical Service

UNFPA	-	United Nation's Population Fund
UNICEF	-	United Nation's International Children's Emergency Fund
GDHS	-	Ghana Demographic and Health Survey
GHS	-	Ghana Health Service
GoG	-	Government of Ghana

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DEFINITION OF TERMS

Low birth weight: This is defined as the weight of a baby measured immediately after birth and is below 2500grams.

Extremely low birth weight: This is defined as the weight of a baby measured immediately after birth and is below 1000 grams,

Very low birth weight: This is defined as the weight of a baby measured immediately after birth and is 1500grams or less, but not lower than 1000grams.

Normal birth weight: This is defined as the weight of a baby measured immediately after birth and its 2500grams or more but not exceeding 3400grams.

Chronic medical illness: This is defined as the presence of a pre-existing medical illness of the mother that was documented in the medical record with an onset prior to the current pregnancy.

Parity: It is defined as the number of deliveries after at least 28 completed weeks of gestation. This is categorized into primiparous (mothers with one delivery) and multiparous (mothers with more than one delivery).

Body mass index (BMI): This is defined as the weight measured in kilograms per height in meters squared. Normal BMI is 18.5-24.9, underweight is <18.5 and overweight/obese >25)

Gestation at booking: This is defined as the gestation at which the mother initiated/started ANC care. The gestation is calculated from either the mothers last menstrual period or from an early ultrasound scan done.

Gestation at delivery: This is the gestation at which the mother delivered.it determines the duration of the pregnancy prior to delivery.

Caesarian section: This is defined as the surgical procedure used in the delivery of a baby.

ABSTRACT

Background:

Globally, it is estimated that in excess of 20 million newborns were delivered with low birth weight (LBW) and contributed more than 80% of neonatal mortality. Sub-Saharan Africa is the second continent (14.3%) to Asia (18.3%) with the highest prevalence of low birth weight babies.

Objective: The general objective of the study was to examine the factors affecting low birth weight (LBW) at St Theresa's Hospital, Nkoranza.

Method: This study adopted a facility-based retrospective cross-sectional design to assess the factors that are linked to low birth weight at the St Theresa's Catholic Hospital, Nkoranza. Due to the outbreak of Covid-19 and associated ethical concerns and time limitations, a retrospective study was appropriate because it allowed the researcher to retrospectively examine the factors affecting low birth weight without having to conduct a prospective cohort study that would have involved recruiting and following up with pregnant women until delivery.

To identify factors associated with low birth weight, bivariate analysis using chi-square corrected (Yates) test and Fisher exact test (for situations where the value in the cells of the two-by-two table was less than 5) were done. Those variables that showed p-values of less than 0.05 were assumed to be statistically associated with birth weight. To determine the strength of the associations between independent variables and the outcome (birth weight) variable, those variables found to have p-value less than 0.05 in the bivariate analysis were fitted into multiple logistic regression models where the effect of potential confounders were adjusted for. Odds ratios with their corresponding 95% of confidence intervals (CI) were computed and variables

having p-value less than 0.05 in the multiple logistic regression models were considered significantly associated with the dependent variable.

Results: The results showed that 49% of the women were aged between 26-35 forming the majority group. The results also showed that 78.8% of the women had at least basic level of education while 21.2% of them did not have any form of education. The analysis further revealed that prevalence of low birth weight at the St Theresa Catholic hospital was 9%. This means that, about 9 low birth weight are recorded out of every 100 deliveries at the hospital for the period under review. The findings show that when compared to mothers who had no level of education, those who had at least primary level of education have reduced odds of having low birth weight babies (cOR = 0.17; CI=0.03-0.57; p=0.021). It further shows that the odds of a first child being born low birth weight was 0.5 times (cOR= 0.45; CI=0.13-0.83; p=0.003). After the potential cofounders were controlled for in the logistic multiple regression, the odds increased marginally to 0.51 times (aOR=0.51; CI=0.21-0.85; p=0.001) but still protective.

Conclusion: The study revealed that parity, age of mothers and education status of the mother are significantly associated with low birth weight. It however indicates that women aged between 18-25 are at greater risk of having low birth weight. Measures targeting teenage pregnancies should be pursued to avoid early births.

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

Birth weight is regarded as an index for determining the health condition of a given society (Abubakari et al., 2015). For instance, better maternal care, coupled with healthy living conditions, significantly determine and contribute to elevated population mean birth weight (Adam et al., 2010). WHO (1992) argues that birthweight is the primary indicator that determines the likelihood of a newborn baby survival. In basic terms, birth weight refers to the weight of a new born upon delivery. According to the Centre for Disease and Control (CDC, 2017), birth weights have been classified into various categories as per the grams in measurement. For instance, birth weight measuring below 1000 grams is considered as extremely low birth weight, between 1000 grams and 1500 grams is considered as very low birth weight, those measuring below 2500 grams are considered as low birth weight. According to the World Health Organisation (2014), normal birth weight refers to any weight of a newborn between 2500 grams and 3400 grams.

Globally, it is estimated that in excess of 20 million newborns were delivered with low birth weight (LBW) and contributed more than 80% of all the neonatal mortality, especially in southern Asia and Sub-Saharan Africa (Alemu et al, 2019). According to WHO (2016), the prevalence of LBW babies is higher in developing countries, about 90% of the LBW cases can be found in sub-Saharan Africa. UNICEF&WHO (2019) further suggest that Africa is the second continent (14.3%) to Asia (18.3%) with the highest prevalence of low birth weight babies. It is further argued that the prevalence of LBW could be higher than the recorded statistics because

delivery often occurs at homes or in informal facilities where weights of babies are either not measured or reported to give true representation of the situation (UNICEF, 2015).

In Ghana, 10% of newborns were reported to have LBW according to the 2014 Ghana Demographic and Health Survey (GDHS) (GSS et al., 2015). There is however an unequal distribution in prevalence across the country. Various studies in parts of the country have reported varied prevalence rate including 26% prevalence rate in Northern region (Abubakari et al., 2015). Michael et al. (2013) in their study reported 21% prevalence in the Ashanti region.

According to Abubakar et al. (2013), low birth weight is a proxy measure of intrauterine malnutrition and a risk factor for fetal and neonatal mortality and morbidity, and chronic diseases which occur later in life such as increased risk of type 2 diabetes, hypertension, and cardiovascular diseases - the fetal origins hypothesis (Abubakari et al., (2015). Low birth weight (LBW) has also been associated with deficits in growth and neurocognitive development (Kramer, 1987). According to WHO (2005), the cost involved in handling low birth weight babies is often enormous both to the health sector and the general larger community.

In most times, low birth weight infants are characterized by either too small, too early (preterm) or both. These outcomes are usually attributed to a number of factors and enablers identified in literature. In current literature, low birth weight is influenced by several factors, including hereditary, factors related to the environment, and characteristics of the mother (Agorinya et al., 2018). In low-income countries in particular, LBW babies are born primarily to women located in poverty-stricken communities without adequate nutritional support whereas the lifestyles of women in high income countries such as smoking within the duration of pregnancy largely

influenced LBW outcomes (Manyeh et al., 2016). In both low- and high-income countries however, teenage girls have been identified as a notable group that is highly associated with delivering LBW infants (Boerma et al., 1996). Other researchers have also reported in sub-Saharan Africa and other developing countries that status of education, income levels, nutrition of mothers especially during period of pregnancy are major determinants of LBW (Prentice, Watkinson, Whitehead, Lamb, & Cole, 1983; Magadi, Madise, & Diamond, 2001; Onah, Ikeako, & Iloabachie, 2006; Fotso, Ezeh, & Essendi, 2009). Similarly, how births are spaced, the number of years between births of a woman and the parity were key influencers of LWB (Rawlings et al, 1995; Wilcox Allen, 2001; Zhu, et al., 2001; Smith, Pell, & Dobbie, 2003; Conde-Agudelo, Rosas-Bermúdez, & Kafury-Goeta, 2006).

Given the potential for LBW to adversely affect health outcomes later in life, it is important that measures are taken to mitigate the incidence of low birth weight for better health (Blencowe et al., 2019). For this reason, a number of interventions have been implemented over the years to address LBW. These include a Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition which specified six global nutrition targets, including 30% reduction in the number of LBW livebirths between 2012 and 2025 (WHO, 2014). Additionally, “A World Fit for Children” is a Declaration and Plan of Action adopted by the United Nations General Assembly in 2002 to reduce the rate of low birth weight by one third (UN, 2002).

Despite these global and local efforts to address LBW, low birth weight is a significant contributor to overall infant mortality rate and a major factor in high neonatal mortality rate (Meresa et al., 2015). This suggests a need for continuous research to better understand the

drivers of LBW in different contexts and to institute context appropriate interventions to address the situation. This study contributed to this research need by analysing birth records to identify the factors affecting low birth weight at St. Theresa's hospital in Nkoranza.

1.1 Problem Statement

The World Health Organisation (2010) defines low birth weight (LBW) as a birth weight that measures below 2500 grams. Its incidence is occasioned by two key factors: intrauterine growth and the duration of gestation (WHO, 1995; Urquia and Ray, 2012). Thus, LBW is either the outcome of a short period in gestation (37 weeks) or a retarded intrauterine growth or the combine effect of both factors (Kramer, 1987; Urquia and Ray, 2012). It is however important to state that not all small babies/preterm births result from disease process and not all babies affected by intra-uterine growth restriction (IUGR) are small (Urquia and Ray, 2012). This notwithstanding, the proportion of infants weighing less than 2.5kg at birth in a particular country generally reflects the health status of the population (Maana et al., 2013).

Globally, it has been estimated that 15% to 20% of all births worldwide are low birth weight, representing more than 20 million births a year. Approximately 91% of LBW babies come from low- and middle-income countries mainly Southern Asia (48%) and sub-Saharan Africa (24%) (Blencowe et al., 2019). According to UNICEF (2013), the prevalence of LBW deliveries in Ghana is 13%. However, in some parts of Ghana, the prevalence is higher.

The Bono East region of Ghana where this study was conducted, is among the regions with better than average health indicators including antenatal care coverage, facility-based deliveries,

use of bed nets against malaria carrying mosquito and lower malnutrition indices such as stunting, wasting and underweight as available data on maternal mortality at the Regional Health Directorate indicates that the ratio reduced from 105 per 100,000 live births in 2019 to 92 per 100,000 live births in 2020 (Ministry of Health, 2019; Ghana Health Service, 2020). There is an apparent improvement in health indicators in the region compared to other regions as observed in the Ghana demographic and health survey (GSS et al., 2015). However, the Bono East has notable districts (e.g. Nkoranza South and Nkoranza North districts) with the highest proportion of teenagers who start childbearing early (22%) (GHS, 2019), a recognized risk factor for low birth weight and stillbirth (UNICEF & WHO, 2009). According to the records at the St Theresa's Hospital, the facility on average records 750 live births every year, out of which an average of 300 babies are born with LBW. This represents a hospital rate of about 40% LBW.

While low birth weight remains an important public health challenge in Ghana more generally and in the Bono East region in particular, very few studies have been conducted to understand the factors affecting it (Michael et al., 2013; Abubakari et al., 2015). Although recent studies from the Northern (Abubakari et al., 2015) and Ashanti (Michael et al., 2013) regions provide some insights into the prevalence and determinants of low-birth weights, little research has been done in the Bono East region on the subject. In particular, studies using health facility birth records are limited. Given the apparent variation in LBW rate between different regions in Ghana as revealed by previous research coupled with the limited research in the Bono East region on the topic, it is important that research is conducted to understand the magnitude of low birth weight and the factors affecting low birth weight. Therefore, this study contributed to

filling the current knowledge gap by using birth records to examine factors affecting low birth weight at St. Theresa's hospital, Nkoranza.

1.2 Objectives of the study

1.2.1 General objective

The general objective of the study was to examine the factors affecting low birth weight (LBW) at St Theresa's Hospital, Nkoranza.

1.2.2 Specific objectives

The specific objectives were to:

1. Estimate the prevalence of low birth weight among the 2020 birth cohort at the ST. Theresa's hospital.
2. Describe and compare the characteristics of low birth weight births to normal weight births at the ST. Theresa's hospital in 2020.
3. Determine the factors that influence low birth weight among the 2019 birth cohort at the ST. Theresa's hospital.

1.3 Research Questions

The following research questions guided the study:

1. What is the prevalence of low birth weight among the 2020 birth cohort at the St. Theresa's hospital?
2. What are the characteristics of low birth weight births compared to normal weight births at the ST. Theresa's hospital in 2020?

3. What are the factors that influence low birth weight among the 2020 birth cohort at the ST. Theresa's hospital?

1.4 Justification of the Study

Despite the fact that children dying from low birth weight complications are experiencing a gradual fall, the decrease has been slow and LBW continue to be among major cause of child mortality (Darmstadt, Munar & Henry, 2014). Care for low birth weight babies poses substantial cost to the health system in many low-income countries, including Ghana. There is therefore a need to focus on finding the preventable and/ or modifiable factors that contribute to LBW in order to reduce this cost to the health system and eventually reduce neonatal and child mortality. This study aimed to identify these modifiable factors. Identifying the determinants of LBW based on health facility birth records could help policy makers and service providers to develop strategies to tackle this public health concern. Knowing the local factors specific to a health facility will make it more efficient and effective tackling the menace and finding solution to the problem. Also, the study could add to the existing pool of knowledge on the subject and may serve as a future reference maternal.

1.5 Chapter summary and organization of the dissertation

This chapter of the dissertation outlined the background to the study, explained the research problem and presented the general and specific objectives as well as the research questions. The rest of the dissertation is organized into five more chapters. Chapter two focuses on literature review. Chapter three describes the methods. Chapter four presents the results while the results

are discussed in chapter five. In chapter six, the conclusion and policy recommendations, including suggestion for further research are presented.

CHAPTER TWO

LITERATURE

2.0 Introduction

This chapter covers the review of literature related to factors affecting low birth weight (LBW). The review focuses on the meaning and measurement of birth weights, global and regional prevalence of LBW, policies and interventions to address LBW, and the factors that influence low birth weight. The chapter also outlines and discusses the conceptual framework for the study.

2.1 Birth Weights: Conceptual clarifications

Birth weight can be described as the weight of the fetus or infant at delivery. This excludes the weight of other by-products of the delivery including amniotic fluid or the placenta. The traditional format of recording birth weight involves either recording the weight units in a metric system or avoirdupois (pounds and ounces). External standardization is done in order to make birth weight a reliable measured indicator in high income countries (Samantha and Cohen-Wolfowitz, 2019).

According to Kamai et al. (2018), birth weight is among the most commonly studied health outcome in environmental epidemiology because most of the time it is considered a critical determinant of maturity and to some extent the physical makeup of newly born infants. Birth weight is of great relevance in informing the development potential of a newborn (Abubakari et al., 2015). The duration of pregnancy and the rate and extent of fetal growth determines the weight of the baby at birth (Kramer, 1987; Paneth, 1995). However, other factors such as genetic

predisposition and environmental exposures can also influence birth weight (Lunde et al., 2007). With the assumption that the fetal will develop at a normal rate, the rule of thumb is that infants born earlier than normal would be of a birth weight smaller than the average owing to the fact that they did not have ample time develop and increase their size and mass (Panti et al., 2012).

2.2 Birth Weight Categories, measurement and effect on child health

The categorization of birth weight is often done to enable an appropriate classification of the varied weights who either can be termed high to low risk-birth weight groups. When a birth weight is less than 2500g at delivery, it is classified as low birth weight. For the purposes of facilitating international comparison, the WHO in 1948 recommended this cut-off point as the standard definition. Pediatricians, Arvo Ylppo and Ethel Dunham (1992) made an observation that babies born weighing less than the 2500g could suffer some negative consequences including death and as a result, recommended the 2500g cut off point. According to Adams et al., (2010) there has been significant improvement in the fields of medical practice and technology, as such, it has considerably reduced likelihood of mortality and morbidities of infants with their weight nearer to 2500g. There exist other categories of birth weight (see table 2.1), that over the years have been categorized by various policy makers and researchers and used to make informed decisions regarding people considered the greatest risk (Shiono and Behrman, 1995; Adams et al., 2010).

In this study, low birthweight has been defined in line with the WHO's (1992) definition: a new born with a weight below 2,500 grams (5.5 pounds). In practical terms, Krammer (1987)

portends that on the basis of epidemiological observations infants that weigh below 2,500g were about 20 times more likely to die compared to infants weighing heavier.

Table 2.1: Birth Weight Categories...

Category	Measurement
Low birth weight	2500 g (~5 lb, 8 oz)
Moderately low birth weight	1500–2499 g
Very low birth weight	1500 g (~3 lb, 5 oz)
Extremely low birth weight	1000 g (~2 lb, 3 oz)
Macrosomia (high birth weight)	4000 g (~8 lb, 10 oz)
Grade 1	4000–4499 g
Grade 2	4500–4999 g
Grade 3	5000 + grams

Source: Adams et al. (2010)

The fetal brain often starts to develop few weeks after conceiving. More especially, the early years of life and the prenatal period are often regarded as the most critical times for the development of the brain. This forms the basic foundation for children to adapt for a long-term achievement, and resilience (Webb, Monk, & Nelson, 2001; Hack et al., 1991). Despite the fact that 37 weeks is often regarded as the full-term birth, consistently, studies have revealed that births made at 39 weeks or even at later weeks have greater advantage with respect the development of their brains as a result of the rapid brain growth that usually take place in the last weeks of gestation (Park, 2012; De Bie et al., 2010). On the contrary, children born full-term

with normal birth weight (NBW) who are neurologically mature at birth are better able to organize and regulate external and internal sensory input and more able to adapt to the external world (Kessenich, 2003). Although LBW infants can take information through their sensory systems, they lack proficiency in the integration, organization, and regulation of the sensory inputs, which may result in deficits in various learning and cognitive skills, and socioemotional outcomes (Hack et al., 1995; Landry et al., 2000; Kessenich, 2003; Poehlmann et al., 2011). Thus, being born LBW places a child at increased risk of cognitive deficits. Virtually all of the VLBWs/ELBWs are born premature, whereas the MLBW babies are a mix of preterm/full-term, and or Intrauterine Growth Restriction (IUGR)/Small for Gestational Age (SGA), that may be a consequence of several intrauterine factors (e.g. smoking, substance use, inadequate maternal nutrition, and low weight gain during pregnancy), and extrauterine/environmental factors (e.g., socio-demographic factors, home and social environmental factors, quality of parenting/parenting behaviors, and postnatal growth pattern) (Child Health USA, 2013; De Bie et al., 2010; Roberts et al., 2007). Thus, these infants share some common risk factors that contribute to adverse birth outcomes and have long-term developmental consequences.

The advancements in technology and perinatal medicine has led to an improvement in the outcomes for LBW children in recent decades, particularly the rates of survival of very small and premature infants (Ballot et al., 2012; Hack et al., 2004, Hack et al., 1995). However, the LBW infants are often prone to a higher risk of morbidity and consequently a functional impairment in across various parts of development compared to infants born with normal birth weight (Ballot et al., 2012; Bhutta et al., 2002). Practitioners therefore ought to consider not just the short-term

neonatal survival and health-outcomes, but in addition consider minimizing the outcomes of long term development (Horwood et al., 1998).

2.3 Global and regional prevalence of LBW

In 2000, UNICEF/WHO (2016) revealed that about 20.6 million LBW livebirths were estimated globally. There however are no modern-day globally, regionally and nationally recognized estimates, relevant for keeping track of progress made towards global nutrition goals (Blencowe et al., 2019). In the analysis by Blencowe et al. (2019), it was estimated that 20.5 million livebirths with an uncertainty range of 17.4–24.0 had a birthweight less than 2500g in 2015. Most of the babies (91%) were found in low-income and middle-income countries, with nearly three-quarters in sub-Saharan Africa and southern Asia. The study used records from 57 high-income countries that had a comparatively low baseline and the findings suggest that the prevalence in LBW remained the same. Additionally, the study estimated a 17% reduction in the prevalence of LBW for the rest of the countries spanning the period 2000-15. Blencowe et al, (2019) estimated that there has been 23% annual rate of reduction in LBW globally from 2000 to 2015.

The data reveal that South Central Asia has half of all low birthweight babies, which has more than a quarter (27%) of all infants weighing below the 2,500g cut-off point at birth. In sub-Saharan Africa, low birthweight levels are around 15%. Much lower rates are recorded in Central and South America (10%), while about (14%) is recorded in the Caribbean, close to the level of sub-Saharan Africa. In Oceania, about 10% of the births are low birthweight (Cutland, 2017).

Across the various main geographic regions, the incidence of low birth weight varies significantly from 6% to 18% (Blencowe et al.,2019). The highest prevalence of low birthweight occurs in the subregion of South-Central Asia, where 27% of infants are low birthweight (UNICEF & WHO, 2019). The incidence is much lower for other subregions within Asia, despite there being considerable variation. More than half of the 49 Asian countries and territories have low birthweight rates below 10%, while seven countries have levels above 20% (UNICEF & WHO, 2019). The incidence in China is low incidence in China (6%) and dominates the average for Eastern Asia, but as a result its huge size of population, contributes significantly to the overall number of low birthweight births (UNICEF &WHO, 2019).

In sub-Saharan Africa, the low birthweight ranges between 13 -15%, with notable variation across the region as a whole (UNICEF &WHO, 2019). Whereas few countries are noted for very high or very low rates, the majority fall between 10% and 20%. In other subregions of the world, these rates tend to be higher and presents a major challenge (OECD/FAO, 2016). Averagely, much lower rates (10%) have been recorded in the Central and South America, whereas the rates are as high in the Carribean as in sub-Saharan Africa. About 10% of births in Oceania are low birthweight. Among the more developed regions, North America averages 8%, while Europe has the lowest regional average of 6% (Esimai and Ojofeitimi, 2014).

2.4 Policies and interventions to address LBW

Efforts to minimize the incidence of low birth weight has seen a number of global policies and strategies deliberated presented in the form of research papers, policy briefs, etc. these policies and strategies includes but not limited to enhancing the maternal nutritional status, treating

pregnancy related conditions such as pre-eclampsia and providing enough maternal care, perinatal clinical services and social support (WHO, 2014). The objective of minimising low birthweight by at least one third between 2000 and 2010 was one of the major goals in ‘A World Fit for Children’, the Declaration and Plan of Action adopted by the United Nations General Assembly Special Session on Children in 2002. The reduction of low birth weight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. Activities towards the achievement of the MDGs were required to ensure a healthy start in life for children by making certain that women commence pregnancy healthy and well nourished, and go through pregnancy and childbirth safely (UNICEF and WHO, 2019). Low birthweight is therefore an important indicator for monitoring progress towards these internationally agreed-upon goals. In 2012, the World Health Assembly Resolution 65.6 endorsed a Comprehensive implementation plan on maternal, infant and young child nutrition, which specified six global nutrition targets for 2025 (Resolution WHA65.5, 2012).

In attempt to push the progress of reducing low birth weight, WHO (2014) recommends that affordable, accessible and appropriate healthcare is critical for preventing and treating low birth weight. It is believed that a reduction in neonatal morbidity and mortality will only be achieved if pregnancy care is fully integrated with appropriate neonatal and post-neonatal medical and nutritional care for preterm and small for gestational age infants. There is growing evidence on the recommendations for nutritional and medical care for high-risk infants. The following interventions have been recommended *in the WHO (2014) Low birth weight Policy Brief* to be implemented at various levels:

Interventions at country/regional level

- Support for women's empowerment and educational attainment.
- Social protection systems (e.g. cash-transfer programmes) for improving healthcare visits.
- Food-distribution systems for subpopulations at risk of food insecurity.
- Improvement of clean and adequate water, sanitation and hygiene.
- Support for national salt iodization programmes to ensure that salt consumed by households is adequately iodized (for which there are new guidelines harmonizing iodine levels with reductions in salt consumption).
- Improvement in facility-based perinatal care in regions with low coverage.
- Universal simplified perinatal data collection system with electronic feedback systems.

Interventions at community level

- Adequate nutrition for adolescent girls.
- Promotion of smoking cessation during and after pregnancy.
- Community-based packages of care to improve linkage and referral for facility births.
- Intermittent iron and folic acid supplements for women of reproductive age and adolescent girls, in settings where the prevalence of anaemia is 20% or higher.
- Prevention of malaria during pregnancy.

Pre-pregnancy interventions

- Birth spacing.
- Peri-conceptional daily folic acid supplementation for reduction of congenital anomalies
- Promotion of smoking cessation.

2.5 Factors that influence low birth weight

A number of factors affect low birth weight. For the purposes of this review, these factors have been categorized into sociodemographic factors, medical factors, reproductive factors, and community factors. These factors are discussed below.

2.5.1 Socioeconomic and Demographic Factors

Education: The educational level of individuals in the family has a huge influence on the social welfare of members of the family. Therefore, higher levels of education have relatively larger and increasing benefits (Rolleston, 2011). Mothers who have less education are known to have lowbirth weight infants (Chiavarini, Bartolucci, Gili, Pieroni & Minelli, 2012). Infants of women with low/intermediate education have significantly higher odds of having an LBW baby than those with higher education (Gisselmann, 2005).

Age: Women above the age of 35 are known to have higher chances of giving birth to low birth weight infants (Tabcharoen, Pinjaroen, Suwanrath, & Krisanapan, 2009; Chiavarini, Bartolucci, Gili, Pieroni, & Minelli, 2012). LBW disparities by maternal age are complex, related with socio-economic disadvantage and current social and behavioral factors. It has been established that LBW risk does not operate uniformly by maternal age (Dennis & Mollborn, 2013). According to Abbasi (2015) mothers less than 18 years of age and those aged 35 or more had more risk of low birth weight outcomes. Maternal age was a significant indicator in low birth weight infants and the incidence of low birth weight reduced with increase in maternal age and the association was statistically significant ($p < 0.01$) (Humera et al., 2013).

Women above the age of 35 may also have more medical and obstetric complications (diabetes mellitus, chronic hypertension, malpresentation, pregnancy-induced hypertension, placenta

praevia, multiple pregnancies, pre-term labor, fetal distress, retained placenta, postpartum hemorrhage and endometritis), all these conditions have adverse fetal outcomes such as low birth weight, low Apgar scores and congenital anomalies (Tabcharoen et al., 2009). Adolescents or teenage mothers (< 20 years of age) often have worse socioeconomic and reproductive conditions and perinatal outcomes when compared to other age groups such as those between 20-29 years. A study by Guimaraes et al. (2013) showed that among mothers with no prenatal care and who were at risk of low birth weight, adolescence was a risk factor for LBW only for mothers who did not have a partner.

Occupation: Some occupations have been known to have a negative effect on birth weights. Belonging to certain occupational groups during pregnancy could increase the risk of low birth weight and preterm birth (Ronda, Hernández-Mora, García, & Regidor, 2009). A study by Ronda et al. (2009) found that women that worked in the agricultural sector showed the highest prevalence of preterm infants (10.8%) and the lowest in professional women (6.6%). Humera et al. (2013) also indicated that low birth weight in relation to occupation was not statistically significant (Humera et al., 2013).

A study done on the prevalence and associated factors of adverse birth outcomes among women attending maternity ward at Negest Elene Mohammed Memorial General Hospital in Hosanna Town, Ethiopia, showed that being a government employee [AOR=4.5,95%CI (1.25,15.9)] was associated with low birth weight (Abdo and Tesso, 2016).

Maternal anthropometry: A key determinants often associated with LBW involves the anthropometry characteristics of the mother. According to Mohanty et al. (2006), women with critical limits of maternal height, weight and mid upper arm circumference as well as maternal BMI of 45 kg, 152 cm, 22.5 cm, 20 kg/m² are often predicted with LBW. A number of research studies however failed to establish any connection between low birth weight and anthropometric measurements. In Nigeria for instance, Ezugwu, Onah, Odetunde, & Azubuike, (2010) established no significant relationship between weight and height of women and low birth weight. Similarly, Hughes et al. (2015) in their findings also argued that they did not find any statistically significant relationship between low birth weight and height. Ojha & Malla (2007) conducted a study in Nepal and established that the risk is lower for women with height below 146cm albeit not significant. The study however revealed that low BMI (<18.5) is significantly associated with LBW. The risk with respect to overweight and obesity has been shown to increase the risk of preterm delivery (McDonald, Han, Mulla, & Beyene, 2010). Goto (2015) in a meta-analysis suggested that anthropometric measurements are not sufficient determinants of low birth weight.

Residential status: Rural areas in sub-Saharan Africa are often deprived of a number of essential and social amenities including health facilities, schools and good roads infrastructure sufficient to reduce the risk of LBW among women residing in such areas (Sahn and Stifel, 2003). In Ghana, Kayode et al. (2014) conducted a study and established that the chances of having a low birth weight infant increased with rural dwellers. Similarly, a New York study accordingly revealed that residing in rural areas was strongly associated with occurrence of low birth weight (Strutz, Dozier, van Wijngaarden, & Glantz, 2012).

2.5.2 Medical Factors

Existing maternal medical condition: Several medical conditions have been established to be strongly associated with having a low birth weight baby. Among pregnant women, diabetes and hypertension happen to be the most common medical issues confronting them. Tshotetsi, (2019) argued that there exists a strong relationship between maternal diabetes and hypertension and negative birth outcomes. Additionally, there is an established significant association of low birth weight with maternal cardiac diseases among African Americans (Graham, Zhang, & Schwalberg, 2007).

Illness during pregnancy: Maternal illnesses during pregnancy are known to influence the birth outcomes of a newborn (Singh, 2009). Medical conditions such as anemia, malaria and pregnancy hypertension are commonly associated with women during pregnancy. Jammeh (2011) revealed that low birth weight is strongly linked to hypertensive pregnancy disorder and antepartum hemorrhage.

Maternal Hemoglobin Level: Anemia in pregnancy, basically refers to a concentration of hemoglobin (Hb) $< 11.0\text{g/L}$ (Goonewardene, Shehata, & Hamad, 2012), is one common cause of LBW and its prevention has a significant potential in minimising the incidence of LBW (Imdad & Bhutta, 2012). In sub-Saharan Africa, the use of folic acid and iron supplementation during pregnancies have proven to be major trigger for the reduction of low birth weight incidence (Imdad & Bhutta, 2012).

Maternal nutrition: According to Gebrmedhin (2015), the requirement of maternal micronutrient during periods of pregnancy increases to meet the physiologic changes in gestation and fetal demands for growth and development. In many settings, maternal micronutrient deficiency is often high and tend to coexist. Birth outcomes are hence determined by deficiency of nutrients such as calcium, folic acid, iron and protein. As a result, pregnant women are generally advised to take folic acid or iron throughout the duration of the pregnancy.

A randomized trial of iron supplementation during the period of pregnancy revealed a decrease in child mortality at offspring stage as in comparison to the control group. Also, a number of other individual micronutrients given during antenatal such as vitamin A, zinc, and folic acid, have been systematically shown to confer such benefits (Christian, 2010).

A meta-analysis of 12 trials of multiple micronutrient supplementation with iron-folic acid suggest that an overall 11% decrease in low birth weight but no impact on preterm birth and perinatal or neonatal survival (Christian, 2010). Preventive iron supplementation during pregnancy has a strong benefit in reducing incidence of anaemia in mothers and low birth weight in neonates. (Imdad & Bhutta, 2012b).

2.5.3 Reproductive Factors

History of premature/preterm delivery: Premature delivery refers to situation where a baby is delivered before 37 completed weeks from the last menstrual period. There is established evidence from Tanzania (Siza, 2008) and Nigeria (Ezugwu et al., 2010; McManemy et al., 2007), that suggest that premature delivery has a strong relationship with LBW, which showed that, women who previously had preterm delivery stand a higher risk of recurrence of preterm

delivery and as a result increases the chances of an LBW delivery. Similarly, a prior history of preterm delivery is shown to be significantly associated with low birth weight (Ip et al, 2010).

Parity: This is referred to as the number of deliveries a woman has had after a pregnancy duration of at least 28 completed weeks. Parity was found to have a positive influence on foetal weight (Adam, 2019). Maternal parity is a well-recognized predictor of infant birthweight, with the lowest birthweights observed among infants born to nulliparous women (Shah, 2010). It is generally believed that birth weight increases from the first child up until the fourth child. A study conducted by Idowu et al. (2019) established that birth weights increased progressively from the nulliparous woman (3.131 ± 0.5350) to a woman with four parous experiences (3.327 ± 0.5311), after which there was a decline in the mean birth weight from women with five parous experiences (2.950 ± 0.5192).

According to Ghana Demographic and Health Survey (2014), the rate of fertility in Ghana is estimated to be at 4.2. Machiyama and Cleland (2014) suggest that this rate remains high although there has been a significant fall in the total fertility rate from 1988 to 2008. Previous studies revealed that mothers who had given birth to one child were 80% more likely to have a child who is LBW compared with mothers who had given birth to 5 or more children (Muula, Siziya and Rudatsikira, 2011). The reasons adduced for this include the fact that uteroplacental blood flow improves with subsequent pregnancies and the fact that the structural factors that limit uterine capacity decreases with parity leading to increase in size of the uterus and the baby (Prefumo et al., 2004).

Number of antenatal visits: This basically refers to how often pregnant women make visits to clinic to receive antenatal care till delivery. The WHO recommends at least eight contact till time of delivery: five contacts in third trimester, one contact in first trimester and two contacts in the second trimester (WHO - RHR, 2018). According to the Ghana Statistical Service (GSS, 2014), Ghana has a very high antenatal coverage, which is 97% for at least one ANC visit. Da Fonseca et al. (2014) posit that, inadequate number of ANC visits, laboratory studies and exams have over time indicated increased risk of LBW newborns.

Gestation at delivery: The birth weight of a baby is greatly influenced by the gestation at which the baby is born. A duration of less than 37 completed weeks mostly lead to the delivery of a LBW baby. A study done in the Gambia suggested that 94% of LBW infants were estimated to be preterm births (gestation below 37 weeks) (Jammeh, 2011). In an earlier study by Ezugwu et al. (2010), it was revealed that 69.19% of LBW babies were preterm deliveries. The study concluded that gestational age at delivery significantly affects the incidence of low birth weight.

2.5.4 Community Factors

A study done on the prevalence of LBW and associated maternal factors in Ghana showed that mothers in rural areas tend to give birth to low birth weight children than women who live in urban areas (Ofori-Fosu and Nsowah-Nuamah, 2013). In studies among pastoralists in Eastern Africa, high proportions of low birth weights were associated with the observations that women spend most part of the day standing while looking after cattle or squatting during milking thus straining their bodies and possibly get little time for resting (Kinabo, 1993; Tema, 2006). Siza

(2008) also suggests that tribes in various communities and their respective behaviours and habits determine the outcomes of birth weight.

2.6 Conceptual framework

The conceptual framework of the study is defined by the various factors that have been identified in literature to be significantly associated with low birth weight. These factors have been categorized under four main thematic areas. These include socioeconomic and demographic factors, reproductive factors, medical factors and community factors. The details of these factors have been explained in the above.

The framework hence depicts the interrelationship between the different categories of factors influencing or determining low birth weight in the study St Theresa Catholic Hospital. For example, Ofori-Fosu and Nsowah-Nuamah, (2013) linked low birth weight to community factors such as location and residence. They argued that women in rural areas have higher chances of giving birth to low birth weight children than women who live in urban areas.

Medical factors have also been revealed to be significantly associated with low birth weight. Singh (2009) revealed that maternal illnesses during pregnancy are known to influence the birth outcomes of a newborn. Malaria, anemia, pregnancy induced hypertension are some medical conditions that pregnant women develop during the course of their pregnancy.

The framework however does not capture all possible factors that could be associated with low birth weight. The study has limited itself to just these key factors with consideration of other factors.

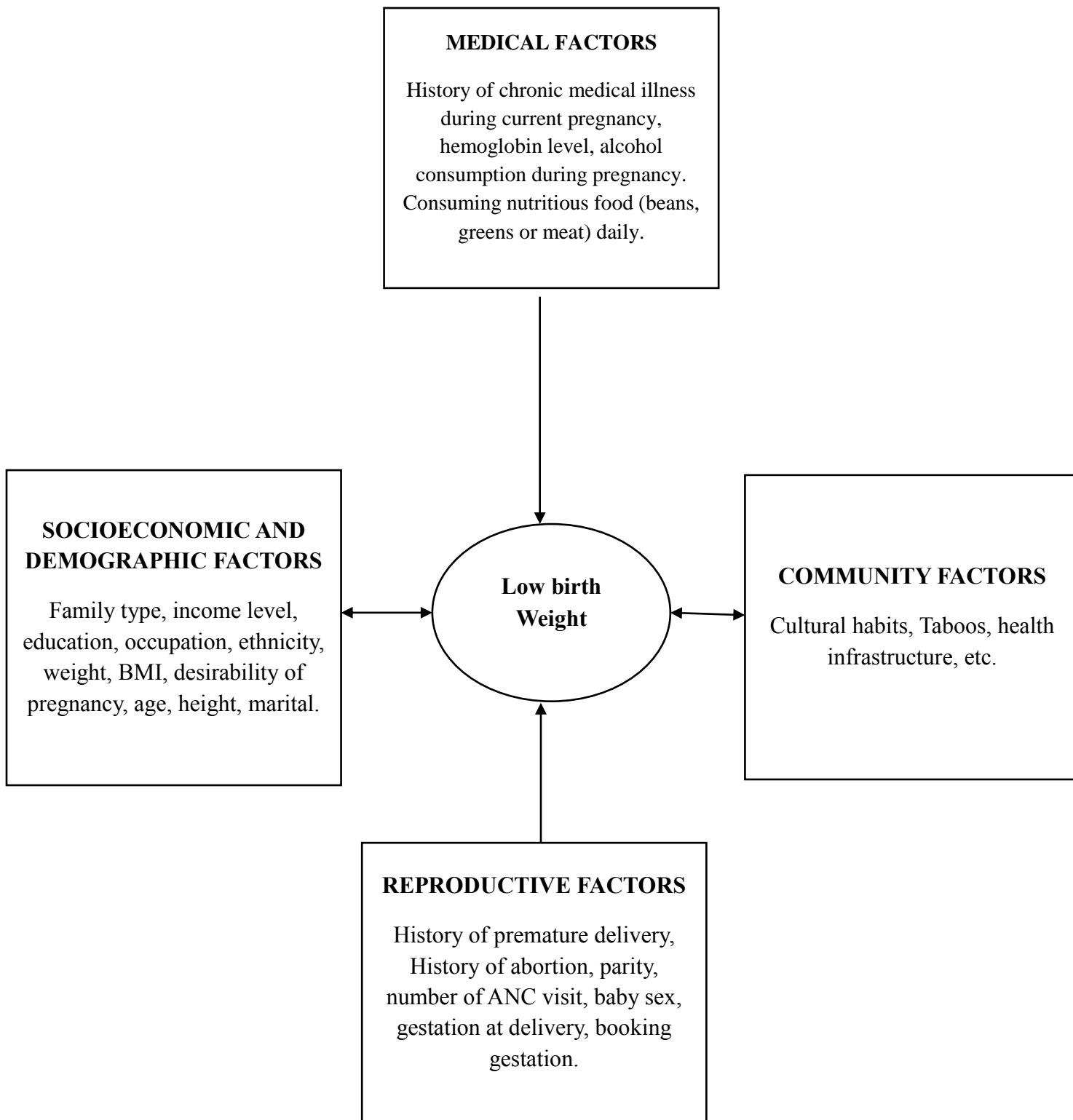


Figure 1. Conceptual framework showing potential factors that affect low birth weight

2.7 Chapter summary and gaps in literature

This chapter of the study reviewed relevant literature to provide proper understanding and context of the present study. It focused on prevalence of low birth weight, and key factors driving or influencing low birth weight. The chapter also outlined and discussed a conceptual framework for the study. From the literature reviewed, there is limited evidence on the relationship between key factors and low birth weight with respect to the study area, Nkoranza and Ghana as a whole.

CHAPTER THREE

METHODS

3.0 Introduction

This chapter discusses the methods and techniques adopted to conduct the study. The chapter gives a detailed description of the study design and context, sample and sampling, data source and data collection, study variables, and techniques of analysis. Ethical issues are also discussed.

3.1 Study Design

This study adopted a facility-based retrospective cross-sectional design to assess the factors that are linked to low birth weight at the St Theresa's Catholic Hospital, Nkoranza. Due to the outbreak of Covid-19 and associated ethical concerns and time limitations, a retrospective study was appropriate because it allowed the researcher to retrospectively examine the factors affecting low birth weight without having to conduct a prospective cohort study that would have involved recruiting and following up with pregnant women until delivery.

3.2 Study Site Description

The St Theresa Catholic Hospital is located at Nkoranza in the Nkoranza South Municipality of the Bono East Region. The Municipality shares boundaries with Nkoranza North District to the north, Techiman Municipal to the West, all in the Bono East Region and Offinso North and Ejura-Sekyedumase Municipal (all in Ashanti Region) to the south and south-east. The Municipality has about 126 settlements. The population of the Municipality according to the 2010 Population and Housing Census stands at 100,929, comprising 50,071 males and 50,858 females (GSS, 2014).

The St Theresa's hospital is a district hospital. The hospital was chosen for this study because it is the largest hospital in the district and the main referral centre for about 15 health facilities in both Nkoranza South Municipality and Nkoranza North district. This means that the data obtained from this hospital is largely representative of the general population in the district.

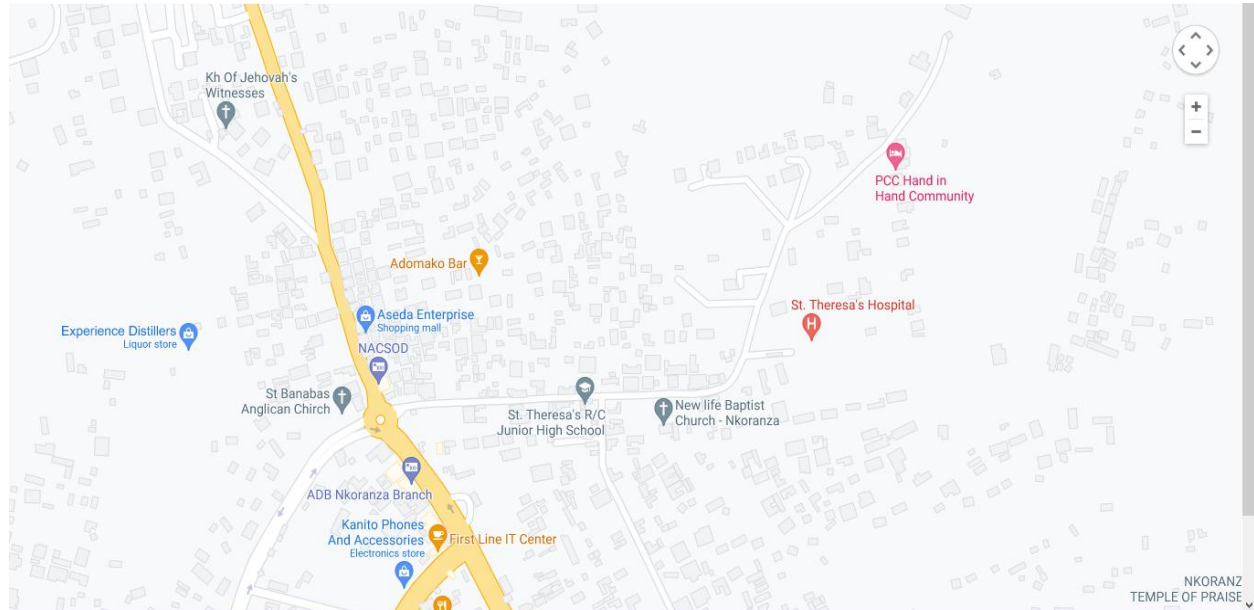


Figure 2: Map showing The St Theresa Catholic Hospital, Nkoranza in the Nkoranza South Municipality of the Bono East Region

3.3 Study Population

The research involved all women who delivered and had their deliveries recorded in the delivery record book at the St Theresa Hospital, Nkoranza, from 1st January 2020 to 31st August 2020. Only live births were considered for inclusion in the study.

3.3.1 Inclusion criteria

For a birth to be included in this study, the delivery must have been recorded in the delivery log book of the hospital which contains key vital information necessary for this study. The information included the following: Age of mother, educational level of mother, parity, occupation of mother, marital status, religion, gravidity, number of antenatal visits, whether there were any complications during delivery, haemoglobin level, gestational age at delivery, the birth weight at delivery, Retro status and syphilis status.

3.3.2 Exclusion criteria

Mothers with multiple births and stillbirths were excluded. Additionally, women with medical conditions in pregnancy (e.g. Hypertension, Diabetes, Sickle cell disease, and Systemic Lupus Erythromatosus) were excluded from the study. Lastly, women who expelled fetuses less than 28 weeks' gestation were also excluded. These exclusions were because those conditions hardly make pregnant women reach term. Their pregnancies are cut short and so are always likely to have low birth weight or preterm babies.

3.4 Sample size and Sampling Technique

The sample used in the study comprised of all live births at the St Theresa Catholic hospital which had been recorded in the hospital delivery log book from 1st January 2020 to 31st August 2020. Between 1st January 2020 and 31st August 2020, approximately 500 births were recorded in the delivery log book at the St Theresa Catholic hospital. Using the inclusion and exclusion criteria for the study, a total of 208 births were eligible for inclusion. A total population census

of all the 208 eligible records was therefore conducted. The hospital wasn't having proper records till the year 2020 hence difficulty in estimating sample size.

3.5 Data collection tool and procedures

A worksheet was designed using Microsoft excel (see Appendix 1). This was used to collect data from the delivery records books of all eligible births. The data collection process was electronic, whereby direct entries were made into the excel worksheet. The data extraction was done with the assistance of 3 student trainee nurses undertaking their clinicals with the St Theresa Catholic hospital. They were trained by the Principal Investigator on how to extract the required information. The data collection was carried out within a period of two weeks including the verification and other necessary checks to ensure accuracy.

The data collection tool had 3 parts. The first part collected data on socio-demographic characteristics from the delivery records. The second part collected data on maternal characteristics and medical conditions (haemoglobin level, syphilis, hepatitis, obstetric complication). The last category of data extracted were on pregnancy outcome (gestational age at delivery, birth weight, birth outcome and Apgar score at 1 and 5 minutes). The Apgar score at 1 minute is a score that is used to assess fetal wellbeing in the first minute of delivery. It is based on five parameters. The parameters are Appearance (colour), pulse (heart rate), grimace (muscle tone), activity (reflex irritability) and respiration. The parameters are scored a maximum of 2 marks (so either 0, 1 or 2). For the five various components, a total score ranging from 1-10 was generated for each record to be extracted.

3.6 Analysis

3.6.1 Data processing and management

The data that were extracted from birth records were directly entered into Microsoft word excel 2013 spread sheet (**See Appendix 1**) and later exported to Stata version 16 for cleaning and analysis with all files password encrypted. Data was cross checked for completeness, consistency and to ensure no missing data. Preliminary analysis was conducted on the data to check the normality of the data distribution. The dataset was further examined for unexpected and obvious errors and corrections were made.

3.6.2 Study Variables

Table 2.0 Study variables

Variable Name	Variable Definition	Variable Measurement	Scale of Measurement
Dependent Variable			
Birth weight	Low birth weight (LBW) is defined by WHO as a birth weight less than 2500g (WHO, 2010).	2.5kg or more Less than 2.5kg	Dichotomous
Independent Variables			
Sociodemographic variables			
Maternal Educational level	Educational level of participant	None, Primary, JHS, SHS, Tertiary	Categorical
Residence	Locality of residence	Rural, urban, peri-urban	Categorical
Religion	Participant religion of worship	Christianity, Islam, Traditional, Budhueism,others.	Categorical
Maternal Occupation	Participant currently working	Yes No	Binary
Age of the mother	Age of participant	18-25 26-35 36-45 46+	Categorical
Maternal factors of the respondent			
Parity	Postnatal women parity level	Raw number of parity level. Categorized as Low (<5 parity) or high (≥5)	Binary
Pregnancy complications	Complications experienced by the women during child bearing	Yes or No	Binary
STI during current pregnancy	Test for STI	Yes or No	Binary
Gravida	Number of times being pregnant	1 2 3 4	Discrete

		5 More than 5	
Number of ANC	Number of times participants visited the clinic for antenatal	1 2 3 4 5 6 More than 6	Discrete
Gestational age	Duration of Pregnancy	>28 weeks and <28 weeks	Binary

3.6.3 Statistical analysis

3.6.3.1 Descriptive analysis

Descriptive statistical techniques such as frequency and percentage distributions were used to describe the socio-demographic characteristics of mothers and their newborns. These characteristics included place of residence, mother's level of education, partner's level of education, employment status of mother and partner, place of employment, occupation of mother and partner, religious background and marital status. In addition, measures of central tendency and measures of dispersion were calculated for the following continuous variables, number of antenatal visits, hemoglobin level, maternal height, maternal weight, BMI, MUAC, Apgar score and birth weight. The prevalence of low birth weight was determined using the following formula: Low Birth weight Prevalence = number of infants <2500 grams born during the study period /total live births during the same study period.

3.6.3.2 Bivariate analysis

To identify factors associated with low birth weight, bivariate analysis using chi-square corrected (Yates) test and Fisher exact test (for situations where the value in the cells of the two-by-two

table was less than 5) were done. Those variables that showed p-values of less than 0.05 were assumed to be statistically associated with birth weight.

3.6.3.3 Logistic regression analysis

To determine the strength of the associations between independent variables and the outcome (birth weight) variable, those variables found to have p-value less than 0.05 in the bivariate analysis were fitted into multiple logistic regression models where the effect of potential confounders were adjusted for. Odds ratios with their corresponding 95% of confidence intervals (CI) were computed and variables having p-value less than 0.05 in the multiple logistic regression models were considered as significantly associated with the dependent variable. The Taylor series method was used to report the confidence intervals for cross-product odds ratio, while Fisher exact confidence intervals was considered where cells in the two-by-two table were less than 5. The data analysis was done using Stata software version 16.

3.7 Quality assurance

The data for the study was extracted from the hospital record documents for analysis. To ensure data quality, training was organized for the research assistants who collected the data. The data collection was piloted using the delivery records of 10 women who delivered in 2018. The tool was found to be appropriate, and minimal revisions were made to it. In addition, unique numbers were assigned to the various entries on the register book. This prevented double entry of records of details of a person on the register. The unique numbers also ensured that the identities of people were kept anonymous. In furtherance of quality assurance of the data, two research assistants independently verified the data captured on the excel worksheet after completing entry.

3.8 Ethical issues

Ethical approval was sought from management of the St Theresa Catholic Hospital for permission to use the recorded information in the birth record book by official application letter. For the purposes of keeping the data anonymous, codes were assigned to each birth record extracted from the log book.

3.9 Chapter summary

This chapter outlined the various techniques adopted to facilitate the data collection, analysis and discussion. It explains how the data were collected and the tools for analysis. The next chapter presents results of the study.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the results of the study. The first section describes the background characteristics of respondents. The second part examines the prevalence of low birth weight. The third section looks at factors affecting low birth weight. The final section summarises the chapter.

4.1 Socio-demographic characteristics of participants

The study involved 208 recorded registered births at the St Theresa Catholic Hospital, Nkoranza. The results show that majority of the mothers that delivered between the period under study were aged between 26-35 years (table 4.1). This represents 49% of the total sample studied. At the same time, majority of the respondents (32.7%) had primary level education while about 23.6% and 15.4% either obtained Junior high or Senior high school levels of education respectively. However, 21.2% of the population had no form of education. Most of the mothers in the study (63.5%) were engaged in some form of employment, while 75% of them were married. In terms of religion, the majority (49.4%) were Christians while 15.5% were either traditionalist or belonged to other religious groups. About 56.3% of mothers indicated they got married at the age range of 25-35. With regard to the number of children, 36.5% of the mothers had three children. Majority of births were vaginal births (61.5%).

Table 4.1 Socio-demographic characteristics of respondents

Variable	Number	Percentage
Age of Mother	208	100%
18-25	55	24%
26-35	112	49%
36-45	23	11%
46+	18	8%
Education of Mother	208	100%
Tertiary Education	15	7.2%
SHS Education	32	15.4%
JHS Education	49	23.6%
Primary Education	68	32.7%
None	44	21.2%
Mother's Employment of status	208	100%
Employed	132	63.5%
Not Employed	76	36.5%
Marital Status	208	100%
Married	156	75%
Single	28	13.5%
Divorced	24	11.5%
Age at Marriage	158	76%
18-25	51	32.2%
26-35	89	56.3%
36-45	18	11.4%
46+	0	0%
Religion of Mother	198	95%
Christianity	98	49.4%
Islam	69	34.8%
Traditional	21	10.6%
Buddhism	0	0%
Others	10	5.05%
Parity	208	100%
1	44	21.2%
2	56	26.9%
3	76	36.5%
4	26	12.5%
5+	6	2.8%
Mode of Delivery	208	100%
Vaginal	128	61.5%
CS	80	38.5%

4.2. Prevalence of Low Birth Weight

The prevalence of low birth weight is shown in figure 4.1. The findings show that, out of the 208 birth records sampled, 9% of the women delivered babies with weight below 2500grams.

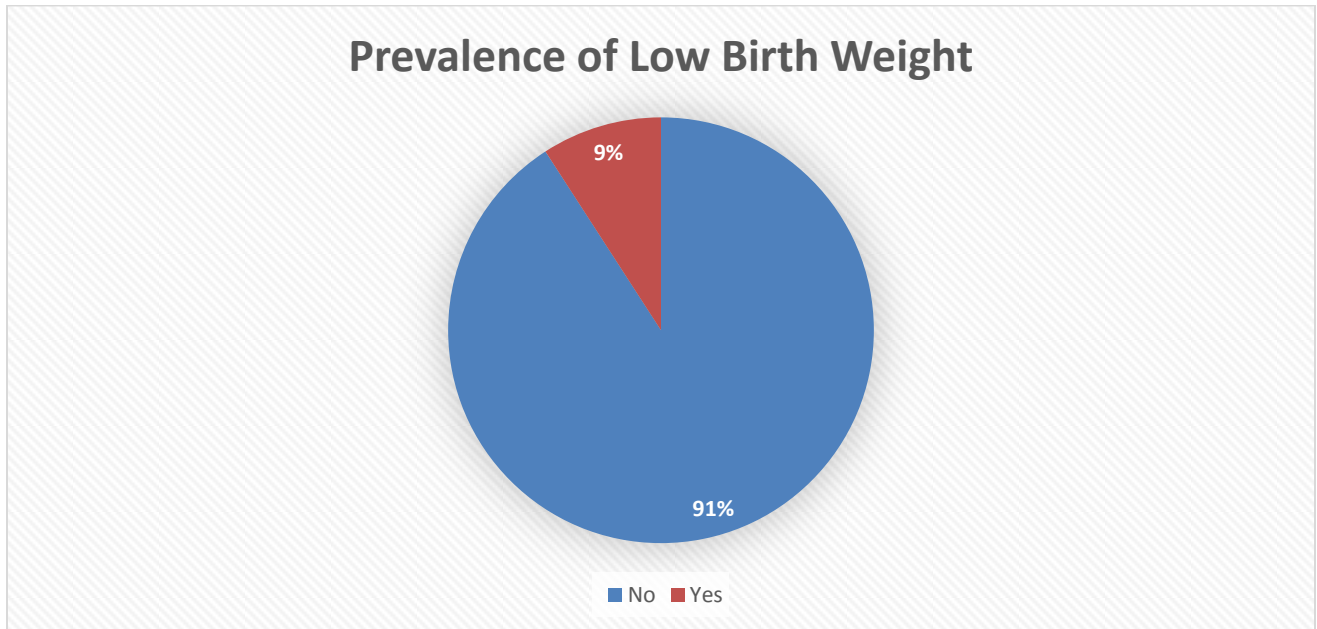


Figure 4.1: Prevalence of Low Birth Weight

4.3 Determinants of Low Birth Weight

4.3.1 Bivariate Analysis

Bivariate analysis was first to determine the association between low birth weight and various independent factors including socio-demographic, maternal, and reproductive factors. The findings of the bivariate analysis are presented in table 4.2.

The results show that, only age of the mother ($p < 0.01$) and education of the mother ($p < 0.01$) are the socio-demographic factors that are significantly associated with low birth weight. The rest of

the socio-demographic variables including occupation of mother, marital status of mother, age at marriage and religion of mother were not statistically associated with low birth weight.

On health characteristics of the mother during the period of pregnancy, the bivariate analysis suggests that only first trimester hemoglobin and iron supplementation intake were significantly associated with low birth weight ($p > 0.05$). The rest of the health characteristics of the mother during the period of pregnancy were not statistically associated with low birth weight.

Also, analysis of anthropometric characteristics that could contribute to low birth weights showed that none of those factors were statistically significantly associated with low birth weight. On reproductive health factors, the bivariate analysis indicates that, ANC visits ($p = 0.433$), gestation at booking ($p = 0.009$), mode of delivery ($p = 0.088$), and only parity of mother ($p = 0.022$) was statistically associated with LBW. Only one community-based factor was analysed in this study. The analysis revealed that the locality (i.e. urban or rural) did not have statistical association with low birth weight.

Table 4.2 Factors associated with Low Birth Weight (bivariate analysis)

Variable	Low Birth Weight		p-value
	YES, n (%)	NO, n (%)	
Age of Mother			
18-25	7 (12.7%)	48 (87.3%)	0.000
26-35	7 (6.3%)	105 (93.7%)	
36-45	3 (13.0%)	20 (87%)	
46+	2 (11.1%)	16 (88.9%)	
Education of Mother			
None	7 (15.9%)	37 (84.1%)	0.000
Primary	5 (7.4%)	63 (92.6%)	
JHS	3 (6.1%)	46 (93.9%)	
SHS	2 (6.3%)	30 (93.8%)	
Tertiary	2 (13.3%)	13 (86.7%)	
Mother's employment status			
Employed	6 (4.5%)	126 (95.4%)	0.740
Not Employed	13 (17.1%)	63 (82.8%)	
Marital Status			
Married	5 (3.2%)	151 (96.8%)	0.331
Single	9 (32.1%)	19 (67.9%)	
Divorced	5 (20.8%)	19 (79.2%)	
Age at Marriage			
18-25	10 (19.6%)	41 (80.4%)	0.337
26-35	5 (5.6%)	84 (94.3%)	
36-45	4 (22.2%)	14 (77.8%)	
46+	0(0%)	0 (0%)	
Religion of Mother			
Christianity	4 (%)	94 (%)	0.620
Islam	5 (%)	64 (%)	
Traditional	7 (%)	14 (%)	
Buddhism	0 (0%)	0 (0%)	
Others	3 (%)	7 (%)	
Parity			
1	9 (20.5%)	35 (79.5%)	0.022
2	4 (7.1%)	52 (92.9%)	
3	2 (2.6%)	74 (97.4%)	
4	2 (7.7%)	24 (92.3%)	
5+	1 (1.7%)	5(83.3%)	
Mode of Delivery			
Vaginal	12 (9.4%)	116 (90.6%)	0.088
CS	7 (8.6%)	73 (91.3%)	

Area of residence Urban Rural	7 (6.1%) 12 (12.8%)	107 (91.2%) 82 (87.2%)	0.881
Height of Mother during pregnancy 146cm or above Below 146	12 (9.4%) 7 (10.1%)	127 (91.4%) 62 (89.9%)	0.203
Weight of Mother at delivery 45kg and above Below 45kg	13 (9.6%) 6 (8.2%)	122 (90.4%) 67 (91.8%)	0.502
BMI of Mother at birth 18.5-24.9 (normal) Below 18.5 (underweight) Above 24.9 (obese)	9 (7.5%) 6 (10.2%) 4 (19.0%)	119 (93.7%) 53 (89.8%) 17 (80.9%)	0.211
Gestation at booking 1 st trimester 2 nd trimester 3 rd trimester	8 (8.4%) 6 (10.2%) 5 (9.3%)	87 (91.6%) 53 (89.8%) 49 (90.7%)	0.009
Number of ANC Visits None 1-3 4-6 7-9 10+	9 (25%) 5 (7.2%) 2 (3.3%) 2 (6.7%) 1(8.3%)	27 (89.8%) 64 (92.7%) 59 (96.7%) 28 (93.3%) 11 (91.7%)	0.433
Planned Pregnancy Yes No	8 (6.4%) 11 (13.3%)	117 (93.4%) 72 (86.7%)	0.203

First trimester hemoglobin 11g/dl and above Below 11g/dl	7 (5.7%) 12 (13.9%)	115 (94.3%) 74(86.0%)	0.066
Hospital admissions in pregnancy No Yes	11 (11.0%) 8 (7.4%)	89 (89.0%) 100 (92.6%)	0.303
Iron supplementation intake No intake Irregular Regular intake	7 (10.6%) 3 (3.8%) 9 (14.1%)	59 (89.4%) 75 (96.2%) 55 (85.9%)	0.44
Intake of herbal medications during pregnancy Yes No	11 (15.5%) 8 (5.8%)	60 (84.5%) 129 (93.5%)	0.809

4.3.2 Multivariate logistic regression analysis

From the bivariate analysis presented above, educational level of mother, age of mother and parity were significantly associated with low birth weight. As a result, these factors were further analyzed in a multivariate logistic regression models to determine the strength of the association. The results of the regression are presented in table 4.3.

The findings show that when compared to mothers who had no level of education, those who had at least primary level of education had reduced odds of having low birth weight babies (cOR = 0.17; CI=0.03-0.57; p=0.021). After adjusting for potential cofounders in the multivariate regression, the odds of mothers who had at least primary level of education reduced and were

less likely to deliver low birth weight babies (aOR =0.10; CI = 0.05-0.54; p=0.012). When compared with mother who had no form of education to mothers with at least JHS level of education, women with JHS level of education had significantly lower odds of having low birth weight (cOR=0.15; CI=0.10-0.92; p=0.001). When potential cofounders were controlled for in the multivariate regression, the odds further reduced and mothers with at least JHS education were less likely to deliver low birth weight babies, (aOR=0.11; CI=0.09-0.88; p=0.001). In addition, comparing mothers with no level of education to mothers with SHS levels of education, those with SHS education have reduced odds of having low birth weight babies. When adjustment was made for potential cofounders, mothers who had SHS had reduced odds of delivering low birth weight babies however not protective.

The analysis further indicates that parity was significantly associated with low birth weight. When compared with women delivering for the first time to women delivering the second time, those delivering their second babies had lower odds of having low birth weight. The results show that the odds of a first child being born low birth weight was 0.5 times (cOR= 0.45; CI=0.13-0.83; p=0.003). After the potential cofounders were controlled for in the logistic multiple regression, the odds increased marginally to 0.51 times (aOR=0.51; CI=0.21-0.85; p=0.001) but still protective. When compared women delivering for the first time to women who were delivering third baby, women delivering third child have reduced odds of having low birth weight babies (cOR=0.37; CI=0.27-0.96; p=0.000). After adjusting for potential cofounders, the women at third parity had increased odds (aOR=0.82; CI=0.29-1.60; p=0.041).

The findings further revealed that, when mothers within the age brackets of 18-25 are compared to mothers aged between 26-35, the mothers aged between 26-35 years have lower odds of having low birth weight babies than mothers aged between 18-26 (cOR=0.10(0.14-0.76; p=0.00). After the study controlled for potential cofounders in the multivariate regression, the odds of mothers aged between 26-35 having low birth weight babies did not change (aOR=0.10(0.14-0.76; p=0.01). Similarly, when mothers aged between 18-25 are compared to mothers aged between 36-45 years, mothers aged between 36-45 have reduced odds to delivering low birth weight babies (cOR=0.15; CI=0.22-0.74; p=0.022). After adjusting for potential cofounders, the odds of mothers aged between 36-45 increased (aOR=0.19; CI=0.25-1.82; p=0.39) and not protective.

Table 4.3: Determinants of low birth weight (*Multivariate logistic regression analysis*)

Variable	Low Birth Weight		cOR [95%CI]	p-value	aOR [95% CI]	p-value
	Yes, n (%)	No, n (%)				
Educational level of mother						
None	7 (15.9%)	37 (84.1%)		1		1
Primary	5 (7.4%)	63 (92.6%)	0.17(0.03-0.57)	0.021*	0.10(0.05-0.54)	0.012*
JHS	3 (6.1%)	46 (93.9%)	0.15(0.10-0.92)	0.001*	0.11(0.09-0.88)	0.001*
SHS	2 (6.3%)	30 (93.8%)	0.07(0.03-0.89)	0.03*	0.08(0.04-1.42)	0.08
Tertiary	2 (13.3%)	13 (86.7%)	0.15(0.12-1.75)	0.08	1.02(0.35-1.88)	0.09
Age of Mother						
18-25years	7 (12.7%)	48 (87.3%)		1		1
26-35years	7 (6.3%)	105 (93.7%)	0.19(0.14-0.76)	0.00*	0.10(0.17-0.74)	0.01*
36-45years	3 (13.0%)	20 (87%)	0.15(0.22-0.74)	0.022*	0.19(0.25-1.82)	0.39
46+	2 (11.1%)	16 (88.9%)	0.13(0.23– 2.78)	0.150	0.15(0.7-2.08)	0.25

Parity						
1	10 (22.7%)	34 (77.3%)		1		1
2	4 (7.1%)	52 (92.9%)	0.45(0.13-0.83)	0.003*	0.51(0.13-0.85)	0.001*
3	2 (2.6%)	74 (97.4%)	0.37(0.27-0.96)	0.000*	0.82(0.29-1.60)	0.041
4	2 (7.7%)	24 (92.3%)	1.07(0.33-1.93)	0.09	1.01(0.31-2.08)	0.06
5+	1 (1.7%)	5 (83.3%)	0.19(0.02- 0.67)	0.00*	0.14(0.02-0.52)	0.00*

cOR = crude odds ratio; aOR=adjusted odds ratio;CI=confidence interval; ref = reference category; *p<0.05

The results show that the odds of a second child being born low birth weight was 0.5 less when compared to first children (cOR= 0.45; CI=0.13-0.83; p=0.003). After potential cofounders were controlled for in the logistic multiple regression, the odds increased marginally to 0.51 times (aOR=0.51; CI=0.21-0.85; p=0.001) but still protective. When compared with women delivering for the first time to women who were delivering a third baby, women delivering their third babies had reduced odds of having low birth weight babies (cOR=0.37; CI=0.27-0.96; p=0.000). After adjusting for potential cofounders, the women at third parity had increased odds but it was still protective and statistically significant (aOR=0.82; CI=0.29-1.60; p=0.041).

The findings further revealed that, when mothers within the age brackets of 18-25 are compared to mothers aged between 26-35, the mothers aged between 26-35 years have lower odds of having low birth weight babies than mothers aged between 18-26 (cOR=0.10(0.14-0.76; p=0.00). After controlling for potential cofounders in the multivariate regression, the odds of mothers aged between 26-35 having low birth weight babies did not change (aOR=0.10(0.14-0.76; p=0.01). Similarly, when mothers aged between 18-25 were compared to mothers aged between 36-45 years, mothers aged between 36-45 had reduced odds of delivering low birth weight babies (cOR=0.15; CI=0.22-0.74; p=0.022). After adjusting for potential cofounders, the odds of

mothers aged between 36-45 having low birth weight babies remained lower when compared to those aged 18-25 but the relationship was not statistically significant (aOR=0.19; CI=0.25-1.82; p=0.39).

4.4 Summary of Chapter

This chapter presented the results of the study. The results revealed that 9% of the babies from the 208 mothers studied at the St Theresa Catholic hospital between January to August 2020 were low birth weight. It was further revealed that, age of the mother, education level of the mother, and parity were statistically significantly predictive of low birth weight. The next chapter discusses these results.

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter comprises the discussions and interpretation of the results presented in the previous chapter. The discussion consists of a summary key finding, consistency with findings from previous studies, explanation of the findings and their implications, strengths and limitations of the study, and chapter summary.

5.1 Summary of findings

The objectives of the study were to estimate the prevalence of low birth weight, compare the characteristics of low birth weight to normal weight as well as investigate the factors that influence low birth weight among women who have delivered at St Theresa's Catholic hospital over the study period. Descriptive, bivariate and logistic regression statistical methods were used to analyze the data.

Results revealed that the prevalence of low birth weight at the St Theresa Catholic hospital was 9%. This means that, about 9 low birth weight are recorded out of every 100 deliveries at the hospital for the period under review.

Low income level, illiteracy and higher maternal ages measured in this study were observed as the characteristics associated with low birth weight as compared to high income level, high literacy rate and lower maternal ages also associated with normal birth weights in this study.

In determining the factors that influence low birth weight, bivariate analysis was used and the findings revealed that age of the mother, educational status of the mother and parity were significantly associated with low birth weight. In a multi-level regression, the results indicated that, mothers who had at least basic education had significantly lower odds of delivering a low birth weight baby than mothers who had no form of education. It further indicated that, with higher level of education at JHS and Tertiary levels, mothers had lower odds of giving birth to LBW infant than mothers who have not had any form of education. Again, it is revealed that, the odds of a first child being born a low birth weight baby is significantly higher when compared subsequent births. This means that mothers who were delivering for the first time were at greater risk of having low birth weight baby than mothers who were delivering for the second and third time.

The findings of the study further indicated that, young mothers aged between 18-25 were at greater risk of delivering low birth weight babies. It is revealed that, older mothers had significantly lower odds of delivering low birth weight babies than younger mothers.

5.2 Consistency with previous research

International organizations such as the World Health Organization and United Nations Children's Fund (UNICEF) have emphasized low birth weight as an important health measure. Globally, the prevalence of low birth weight is about 15.5%, - 14.3% in Africa (Tampah-naah et al., 2016). This study appears to be the first of its nature conducted in the hospital. The results from the study showed that, the prevalence of Low Birth Weight (LBW) among the new-born at the St Theresa Catholic Hospital, Nkoranza was 9%. This finding is lower compared to the

national prevalence of 13% (UNICEF, 2013) and the global prevalence of 15.5% (Tampah-naah et al., 2016). The result is also almost two times lower than the observations made in the Northern region (Abubakar et al, 2015) and Ashanti region (Micheal et al.,2013). The result however falls within the WHO's target of <10% and also consistent with the findings (9.69%) of Agboson et al. (2016) in the Hohoe municipality. This difference might be due to a number of factors, including improvement in health delivery, the difference in sample size, study setting, delivery site, and type of health facilities. This is particular so as this study was carried out only among babies delivered in one center located in the Bono East region, while the study at national levels included the neonate delivered in multi-centres and multiple regions (Seid, Tolossa and Adugna, 2019).

From the findings, maternal age was found to significantly associated with LBW, with women within the age group of 18-25 having the greatest risk. Maternal age has been associated with LBW in previous studies (Amosu et al., 2011; Zeleke et al., 2012). Desire (2007) explains that pregnant teenagers are known to be associated with poverty and lack of good education, factors which have also been reported to significantly affect the prevalence of LBW (Siza, 2008; Lee & Lim, 2010). The classic pattern in many developing countries is that infant girls born with LBW continue to experience growth failure during early childhood and perhaps adolescence, and are most likely to have children at an early age, which further reduces their opportunity to reach an optimal body size with adequate nutrient (Siza, 2008).

A study by Guimarães et al. (2013) has showed that Adolescent (< 20 years of age) mothers have poorer socioeconomic and reproductive conditions as compared with other older age groups and

this poses a higher risk of having a LBW baby. They also stand a higher risk of having an LBW baby if they do not have a partner (Guimarães et al., 2013). Even though in this study there was an increased odds, this was not significant, but the above reason could explain the outcome in this study. Advocacy is therefore important to prevent teenage and adolescent pregnancy in order to help reduce the incidence of low birth weight babies.

With respect to the educational level, mothers no education generally have higher odds of delivering a low birth weight baby compared with mothers with at least basic education. A meta-analysis by Silvestrin et al. (2013) showed that having a higher education had a 33% protective effect, whereas having a medium education or low education had no protective effects. This is consistent with the findings of this study where it is shown that, women with basic education had lower odds of bearing low birth weight babies.

5.3 Explanation of findings and implications

The study used data extracted from the St Theresa Catholic hospital's log book on live births comprising of about 208 women over the period of study. The analysis revealed that, 18 births from the 208 women who delivered over the period were low birth weight infants representing 9% of the total population. This suggests that, from every 100 live births at the hospital, 9 of them would be low birth weight infants. Although in the context of national prevalence of LBW, this rate is lower and falls within the WHO's range, a lot more effort and interventions are required to drastically reduce the prevalence rate.

The findings of this study indicated that women below the age 25 were at a higher risk of delivery low birth weight infants. The demographic statistics however suggest that, women between the ages of 18-25 formed the second largest group of the total population. The Bono East region and more especially Nkoranza Municipality is reported to be among the areas with high and increasing teenage pregnancies in the country. This means that more interventions targeted at teenage girls to prevent teenage pregnancies are required since they are at high risk of delivering low birth weight infants. It further indicates that, the prevalence of low birth weight can be drastically reduced if efforts are put in place to drastically reduce or prevent teenage pregnancies in the municipality. A study in Vietnam revealed that teenagers often are immature both physically and emotionally to handle the stress that comes with pregnancies (Louangpradith Viengsakhone et al., 2010).

Consistent with other previous studies, this study also revealed that maternal parity is a significant determinant of infant birthweight where the lowest birth weights are observed among infants born to nulliparous women (Perdersen et al., 2007; Shah, 2010). A sibling study by Beaty et al. (1997) indicated that the first birth had the lightest weight among the siblings. Gluckman (2004) argued that, lower birth weight among first born infants can be a direct consequence of physiological conditions associated with nulliparity.

Education has also been identified as a key and significant determinant of low birth weight in this study and literature suggest that formal education is necessary for expectant mothers to make informed decisions on issues regarding pregnancies. This study reveals that, women without any form of education were at higher risk of giving birth to low birth weight infant as compared to

those with some form of education. This finding is in line with the expected theoretical curve where educated mothers are often linked with normal birth weight compared to their counterparts who did not have any education (Ko, Wu and Chang 2002; Silva et al., 2010; Silvestrin et al., 2013; Ngwira and Stanley, 2015).

5.4 Strengths and limitations of the study

The strength of this study lies in its unit of analysis - facility-based analysis. The study focused on determining the prevalence of low birth weight and the factors that significantly influence low birth weight in the facility. This study happens to be the first of its kind done on the facility, and the findings will inform health authorities in the Nkoranza Municipality on the necessary interventions needed to be put in place. The specificity of the findings makes it more useful for the municipal and the hospital authorities.

The study however is limited by the factors considered for the analysis. Only a few variables were captured in the birth records were used to assess low birth weight in the facility. It is possible that other confounding variables could have altered the outcome of the analysis if were added in the regression. Again, the context and scope of the study makes it difficult and inappropriate to draw inferential causalities from the associations identified between low birth weight and the key determinants.

5.5 Chapter summary

This chapter presented the discussion of the results of the study, including discussing areas of consistency with existing literature, the strengths and weaknesses of the study. The next chapter presents corresponding specific recommendations.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 Conclusion

This study was carried out with the main objective of determining the prevalence of low birth weight in the St Theresa Catholic Hospital in the Nkoranza Municipality of the Bono East region of Ghana. The study used data extracted from the birth records of the hospital spanning from January to August 2020. A total of 208 mother's information was extracted from the register and analysed using descriptive, bivariate and multiple logistic regression analysis.

The findings revealed that prevalence of low birth weight from the data analysed was 9%, which is lower than that of national prevalence of about 13%. This means that from every 100 births registered at the hospital over the period, 9 of them were low birth weight infants. Although, this figure is lower than the national prevalence and could be a representation of strong indicators of the health status of the community, there are serious implications that should be addressed accordingly.

The study showed age of the mother, education status of the mother, and parity were significantly associated with low birth weight. Based on this, it could be concluded that a combination socio-demographic and maternal factors affect low birth weight at the St Theresa Catholic Hospital in the Nkoranza Municipality of the Bono East region of Ghana.

6.1 Recommendations

6.1.1 for Practice and Policy Purposes

Maternal education status and age have been established to have statistically significant influence on an infant being born with low birth weight. Therefore, prenatal programmes on nutrition and counseling, should be designed by the Ministry of Health and health related non-governmental organizations (NGOs) targeting the sub-groups that have higher risks of giving birth to children with low birth weight in the country. It is obvious from the findings that, teenagers are at greater risk of bearing LBW and the increasing rate of teenage pregnancies particularly in the Bono East region is a serious threat to reducing the prevalence of low birth weight. It is therefore recommended that education modules be designed to educate teenagers especially either through formal means of education or informal systems of education. Also, policies targeting the prevention of adolescent pregnancies must be implemented. These policies could be in the form of prevention of child marriages, adolescent reproductive health campaigns to enlighten young girls against the risk of delivering or conceiving babies at early age.

6.1.2 Further Research Purposes

Recommendation is made to the public health and health research community to carrying out further studies to identify factors that increase the risks of teenagers to giving birth to low birth weight babies. This is important as the Nkoranza Municipal is reported to have soaring numbers of teenage pregnancies and identify means of curbing the menace.

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