

**UNIVERSITY OF GHANA**

**COLLEGE OF HEALTH SCIENCES**

**SCHOOL OF PUBLIC HEALTH**

**CONTRIBUTION OF VERY LOW BIRTH WEIGHT TO PRETERM  
NEONATAL MORTALITY AT 37 MILITARY HOSPITAL, ACCRA**

**BY**

**FLORENCE APEGWINE ATIAH**

**(10294978)**

**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA,  
LEGON, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE  
AWARD OF MASTER'S OF PUBLIC HEALTH DEGREE.**

**JULY, 2016**



## **DEDICATION**

This research is dedicated to the glory of the almighty God for providing me with the strength through the exhaustive times to be able to complete this study successfully. I also dedicate this work to my loving husband Mr Edward Ocansey, my darling children, Reginald K.A Ocansey and Gerald K.A Ocansey as well as to all family and friends.



## ACKNOWLEDGEMENT

“The race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill; but time and chance happeneth to them all” (Eccl. 9:11)

I am thankful to the omnipotent God for giving me wisdom and the blessing to enable me finish this research work. I also extend sincere gratitude to my supervisor, Prof Richard Adanu for his immense patience, guidance and tolerance in seeing me through to this stage. To my loving and supportive husband Edward K.A Ocansey, and my dearest mum Margaret Atiah who was there for my children Reginald and Gerald Ocansey when I was away.

I will also like to express my appreciation to the Incharge of Paediatrics department of 37 military hospital, Col P.K Ayibor, Dr Parbie a Paediatrician of 37 military and also the Sister in-charge of the Neonatal Intensive Care Unit for their support and contribution towards my thesis and all authors of the reference books I used.



## EXECUTIVE SUMMARY

**Background:** Babies delivered before term (ie. 37 completed weeks) are known as preterm birth. Preterm birth is the leading cause of neonatal mortality globally with associated long term disability. However, there are factors that affect the survival rate in premature babies; these include the use of corticosteroids during antenatal, the weight of babies at birth, the sex, gestational age and plurality. This study seeks to assess the association of preterm characteristics such as birth weight, mode of delivery, gestational age and mortality among preterm babies admitted at the 37 Military Hospital.

**Methods:** the study design used in this research is a retrospective descriptive design where all available records of preterm babies admitted to the NICU of the 37 Military Hospital, Accra, from January 2014 to December 2015 were used for the study. Variables were coded into SPSS (V 22.0) software to be analysed. Chi-square test was employed to find out how preterm characteristics such as birth weight, gestational age, mode of delivery relates to mortality among preterm.

**Results:** Preterm babies less than 1.5kg had significantly higher chance of dying compared to those who weighed 1.5kg or more ( $p<0.001$ ). Majority (85.5%) of the preterm babies less than 1.5kg died. Gestational age ( $p<0.001$ ) and mode of delivery ( $p<0.05$ ) of preterm babies had significant effect on mortality of preterm babies. Very preterm or extremely preterm babies had significantly higher probability of dying ( $p<0.001$ ) compared to late preterm babies.

**Conclusion:** There is therefore the need for concerted efforts to channel resources to improve upon neonatal health as well as maternal health in the country. Ghana Health Service in collaboration with stakeholders should intensify health campaigns on the need for all pregnant women to access antenatal health services for proper and skilled care throughout the period of pregnancy until delivery.

## TABLE OF CONTENTS

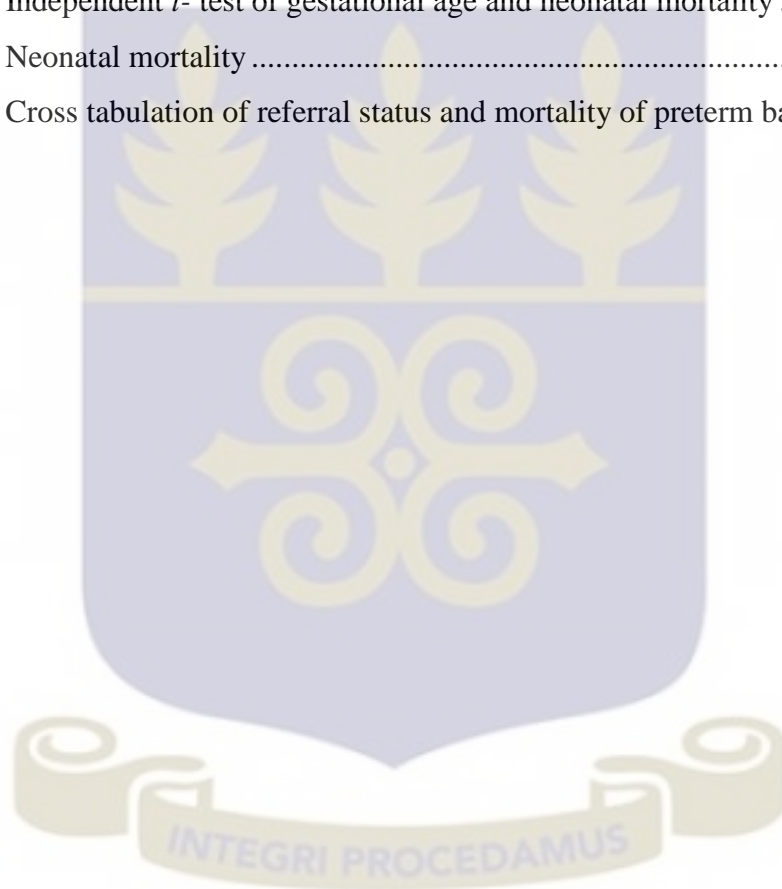
TITLE PAGE.....	i
DECLARATION.....	i
DEDICATION.....	ii
ACKNOWLEDGEMENT.....	iii
EXECUTIVE SUMMARY.....	iv
TABLE OF CONTENTS.....	v
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
LIST OF ABBREVIATIONS.....	x
CHAPTER ONE.....	1
INTRODUCTION.....	1
1.1 Background to the study.....	1
1.2 Problem statement.....	3
1.3 Conceptual framework.....	5
1.4 Justification of the study.....	6
1.5 Purpose of the study.....	7
1.6 Comprehensive question.....	7
1.7 General objective of the study.....	7
1.8 Specific objectives of the study.....	8
CHAPTER TWO.....	9
LITERATURE REVIEW.....	9
2.0 Introduction.....	9
2.1 Mortality of preterm babies.....	9
2.2 Risks associated with preterm birth.....	12
2.3 Effect of birth weight and gestational age on preterm mortality.....	15

2.4 Conclusion .....	28
CHAPTER THREE .....	29
METHODS .....	29
3.0 Introduction .....	29
3.1 Type of study .....	29
3.2 Study setting .....	29
3.3 Variables .....	31
3.4 Study population.....	32
3.5 Sample Size .....	32
3.6 Sampling method.....	32
3.7 Data Collection Technique .....	33
3.8 Quality Control.....	33
3.9 Data Processing and Analysis .....	34
3.10 Ethical Consideration .....	34
CHAPTER FOUR.....	36
FINDINGS .....	36
4.0 Introduction .....	36
4.1 Demographic data.....	36
4.2 Preterm neonatal mortality and weight of preterm babies.....	39
4.3 Preterm neonatal mortality and sex of preterm babies .....	40
4.4 Neonatal mortality and gestational age of preterm babies .....	40
4.5 Preterm neonatal mortality and mode of delivery of preterm babies .....	42
4.6 Neonatal mortality and referral status of preterm babies .....	43
CHAPTER FIVE .....	44
DISCUSSION .....	44
5.0 Introduction .....	44
5.1 Demographic data.....	44

5.3 Preterm neonatal mortality and sex of preterm babies .....	47
5.4 Neonatal mortality and gestational age of preterm babies .....	48
5.5 Preterm neonatal mortality and mode of delivery of preterm babies .....	48
CHAPTER SIX.....	50
CONCLUSION AND RECOMMENDATIONS.....	50
6.0 Introduction .....	50
6.1 Summary.....	50
6.2 Implications of the study .....	51
6.2.1 For practice.....	51
6.2.2 For policy formulation.....	51
6.2.3 For research .....	52
6.2.4 For education .....	52
6.3 Limitations of the study.....	52
6.4 Conclusion.....	53
6.5 Recommendation.....	53
REFERENCES .....	55
APPENDICES .....	60
APPENDIX A: CHECK LIST .....	60
APPENDIX B: ETHICS APPROVAL LETTER – GHANA HEALTH SERVICE.....	61
APPENDIX C: ETHICS APPROVAL LETTER – 37 MILITARY HOSPITAL .....	62
APPENDIX D: INTRODUCTORY LETTER .....	63

## LIST OF TABLES

Table 4.1: Demographic data of respondents .....	37
Table 4.2: Association between preterm neonatal mortality and year of birth.....	38
Table 4.3: Preterm neonatal mortality .....	39
Table 4.4: Association between preterm neonatal mortality and birth weight of preterm babies .....	39
Table 4.5: Association between sex and mortality of preterm babies .....	40
Table 4.6: Association between gestational age and mortality of preterm babies.....	41
Table 4.7: Independent <i>t</i> - test of gestational age and neonatal mortality .....	41
Table 4.8: Neonatal mortality .....	42
Table 4.9: Cross tabulation of referral status and mortality of preterm babies .....	43



**LIST OF FIGURES**

Figure 1.1: Conceptual framework on determinants of preterm neonatal mortality .....5

Figure 3.1: Map showing areal location of the 37 Military Hospital. ....31

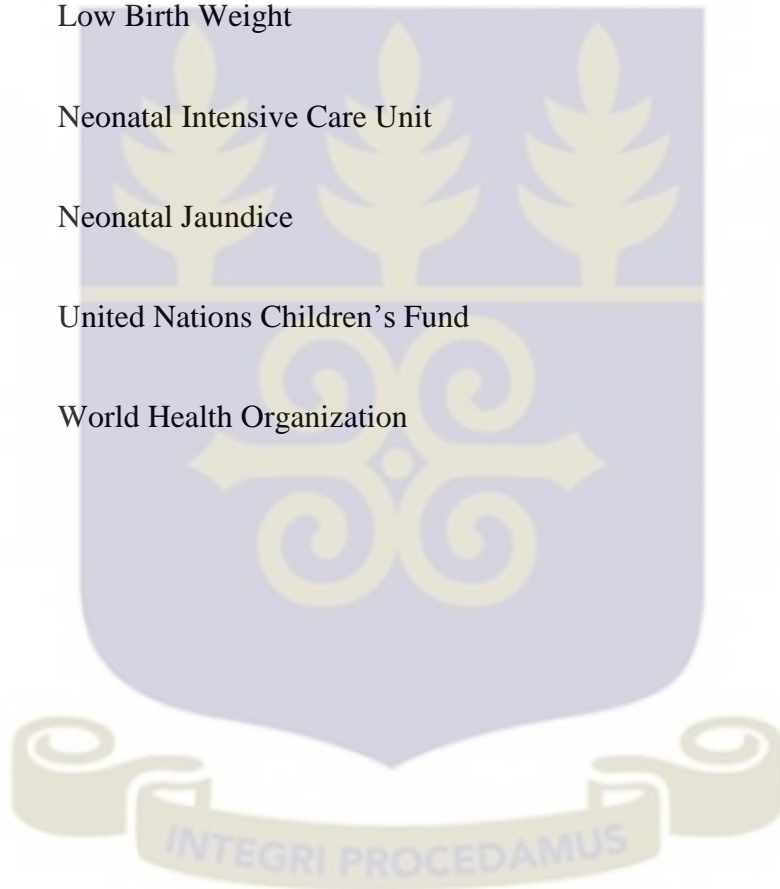
Figure 4.1: Gestational age category of babies .....37

Figure 4.2: Birth weight of babies .....38



## LIST OF ABBREVIATIONS

AGA:	Appropriate for Gestational Age
BWT:	Birth Weight
GDHS:	Ghana Demographic and Health Survey
IUGR:	Intrauterine Growth Restriction
LBW:	Low Birth Weight
NICU:	Neonatal Intensive Care Unit
NNJ:	Neonatal Jaundice
UNICEF:	United Nations Children's Fund
WHO:	World Health Organization



## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background to the study

Infant born before 37 completed weeks or less than 259 days counting from the first day of a woman's last menstrual cycle is referred to as preterm birth. Although the exact cause may not be always known, the risk factors associated with preterm birth include multiple pregnancies, physical and psychological stress, smoking of tobacco, underweight or overweight mother, diabetes, high blood pressure, (World Health Organization [WHO], 2014), to mention but a few. Most of the time, children who are born at term have less chance of developing disability such as sensory deficits, learning disabilities, respiratory illness and cerebral palsy as compared to premature babies (Beck et al., 2010). Premature babies are a major contributory factor in neonatal mortality and morbidity with lifelong negative effects on the overall health of babies that survive (Wang, Dorer, Fleming, & Catlin, 2004). The complications associated with preterm births are a significant direct cause of death among neonates.

Moreover, globally the major contributory causes of death among children is preterm birth (Blencowe et al., 2013). The complications associated with preterm births are a significant direct cause of death among neonates. Three point one million reported deaths that occur among children globally every year, 35% of such deaths are as a result of preterm babies. This continue to be the leading most important cause of mortality among children in both developed and developing countries (Liu et al., 2012).

Children who are delivered from 32 to 37 weeks of gestation are known as late preterm births. Eighty four percent of the total premature babies delivered are late preterm babies, however most of them survive with supportive care. This is mainly due to the

fact that they are close to term. On the other hand, the very preterm births are those delivered between 28 weeks to 32 weeks of gestations (Beck et al., 2010).

Although most of very preterm babies survive, extra supportive care is required to secure their survival. Extremely preterm births comprise births before 28 weeks of gestation. However, babies who are extremely preterm require seriously intensive and expensive care to survive. They mostly suffer long term neurological, physical and cognitive disabilities. In the developed countries, extremely preterm babies have a 90% chance of survival, however, only 10% have a chance of survival in less developed and low income countries (Blencowe et al., 2013). Hsu et al., (2015) states that the sex, gender, weight of babies at birth, plurality, use of corticosteroids are the main factors that affect the chances of survival of a preterm babies.

Babies with low birth (< 2500 g) that are delivered every year are estimated to be 20 million babies globally. These represent 15.5% worldwide prevalence of low birth weight born every year. Babies who are delivered with low birth weight has an increased mortality risk within their first year of life (WHO, 2015). The main causes of low birth weight in infants are (IUGR) intrauterine growth restriction, premature babies or the two combined (UNICEF/WHO. 2004).

In general, among all babies dying within their first seven days of life, known as early neonatal deaths, 28 percent of such death without any congenital malformations are as a result of preterm birth (Lawn, 2006).

In the developing countries, an estimated of 13.7 million children out of 135 million children delivered were premature babies. 2.8 million of such babies are as a result of small for gestational age (Blencowe et al., 2012)

In some developing countries, reported preterm deliveries are ranging from 5 percent to 7 percent of all live births and these rates continue to be on the increase in these countries (Lawn et al 2006). Possible contributory factors in the developing countries that may give some form of explanation to these increased rate of preterm birth are multiple birth among women who are old that is 34 years of age and also those that have had several caesarean section done in child birth (Beck et al., 2010)

Every year, fifteen million infants globally are born preterm, which contribute to a fraction of about more than one in 10 births, Out of this number, more than a million of these children die soon after birth (Blencowe et al., 2013) Majority of them generally suffer from some type of long term physical, neurological, or cognitive disability, which places additional burden on families and the society greatly.

Liu et al (2012). States that the contributing reason of death among children in high and middle income countries is preterm birth and these premature babies become vulnerable to death associated with other grounds such as neonatal infections (Lawn, Cousens, Zupan, & Neonatal Survival Steering Team, 2005). 50 percent of all neonatal deaths are equally a consequence of preterm birth (Lawn, Kerber, Enweronu-Laryea & Cousens, 2010).

## **1.2 Problem statement**

Globally 85 percent of all preterm birth are found in Africa and Asia (Beck et al 2010).

11.1 percent of the world's total live births, 60 percent is found in Sub-Saharan Africa and South Asia. Premature babies that are born among the poorest countries in the world is 12 percent as compared to 9 percent in the developed lands (Blencowe et al., 2012). Within sub-Saharan Africa, 1.2 million deaths in 2008 are as a result of neonatal deaths thus 41 per 1000 live births.

In a general observation, how late preterm mortality and weight for gestational age relates to it each other has not been well described (Pulver, Guest-Warnick, Stoddard, Byington, & Young, 2009). Compared to term new-borns, infant mortality among late preterm babies is higher (Pulver et al., 2009). Researches done in the developing countries shows just a few studies conducted in assessing the effect of gestational age on mortality of preterm babies (Petrou, 2005) and also infants who are small for gestational age and their associated risk of mortality (Goldenberg, Culhane, Iams, & Romero, 2008; Lawn et al., 2006).

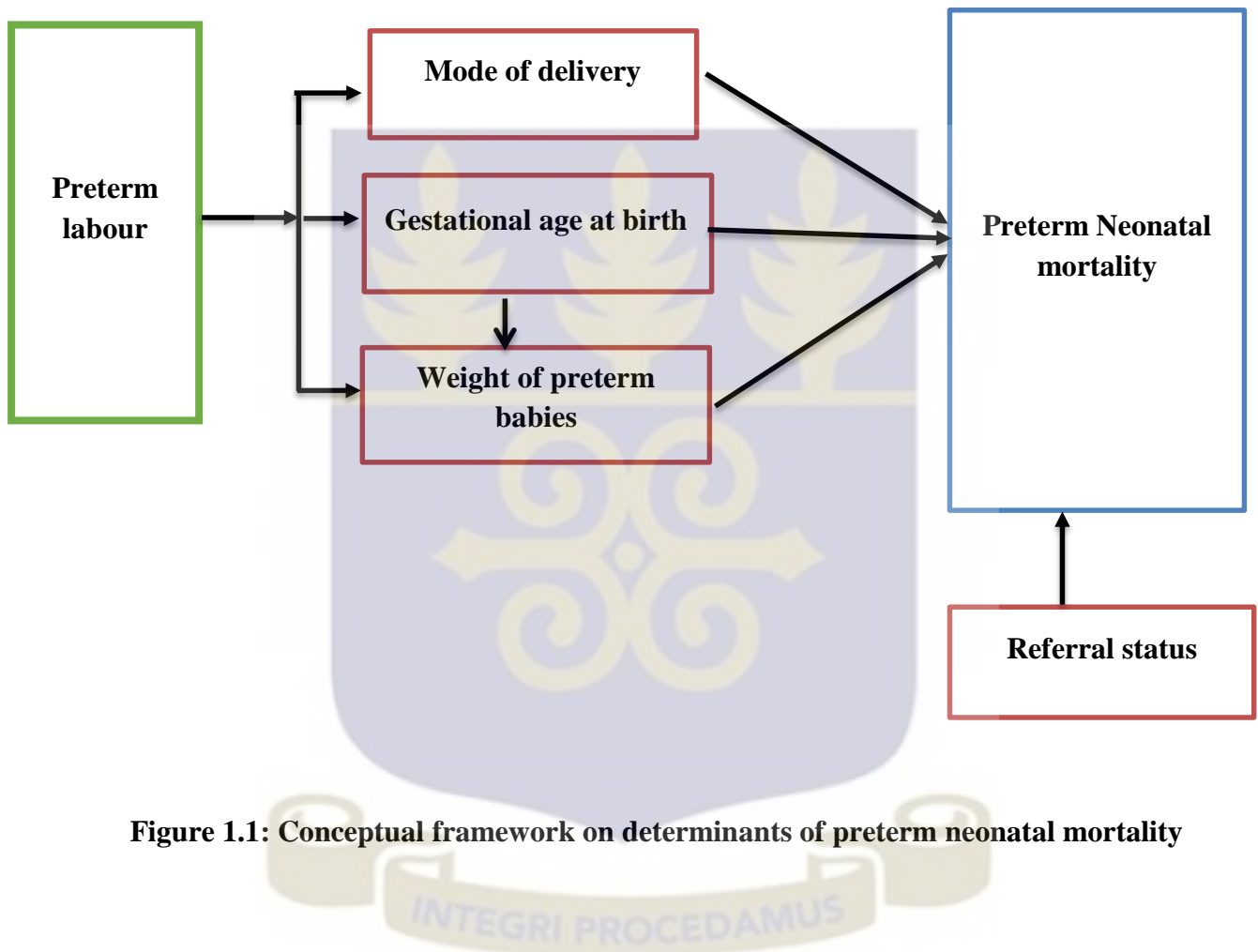
In the year 2010, out of 111,500 preterm births representing 14.5% live birth recorded in Ghana, 7,800 died from preterm complications (Global Action report, 2012). In addition the incidence of under-five years' mortality in Ghana has decrease by 40%. However, there has not been much decline in the death rate of infants in Ghana (Siakwa et al., 2015).

Furthermore, premature babies have higher chance of dying and their risk of mortality for both preterm births and those who are small for gestational age. Extend beyond the neonatal period. It can be deduced from this that premature infants who are small for gestational age or are severely underweight are more likely to have a higher risk of mortality. However, no known studies have been carried out in Ghana to assess this situation.

Although Ghana has chucked great success in the accomplishment of the millennium development goal 4 which pointed to bring down by two-thirds the under-five mortality rate and infant mortality rates between 1990 and 2015, there is the need to evaluate the risk that severely small gestational age and very low birth weight pose to the incidence of deaths among preterm babies. This will help meet the sustainable development goal

3 of ensuring healthy lives and promoting the wellbeing for all of all ages, especially for infants.

### 1.3 Conceptual framework



**Figure 1.1: Conceptual framework on determinants of preterm neonatal mortality**

When a woman goes into preterm labour depending on the nature and progress of labour it affects the mode of delivery and the gestational age. The mode of delivery of preterm babies, can either be spontaneous vaginal delivery, caesarean section or other forms of assisted deliveries such as forceps or the use of manual vacuum aspiration. With regard to gestations age, preterm babies can either be babies delivered before 28 weeks of gestation (extreme preterm), those delivered between 28-32 weeks of

gestation (very preterm) and those delivered between 32-37 completed weeks of gestation(moderate preterm)

Gestational age in turn determines the weight of the baby. All things being equal, the earlier the gestational age, the smaller the weight of the baby and vice versa. The mode of delivery, gestational age and weight then has influence on the incidence of preterm mortality. With regard to the referral status, babies delivered at a facility with NICU have a higher chance of survival than those who are referred to the facility.

#### **1.4 Justification of the study**

Results from these research will add to existing literature on the risk that the weight at birth, the sex and the gestational age of preterm babies have on the mortality among preterm babies.

Study findings will also help raise public awareness about this health problem in the country.

This will help inform health workers, parents and all stakeholders on the need to give serious attention to antenatal care of women, especially those with a higher risk of delivering preterm.

Results from these study will help sensitize health care workers on the need to identify in our antenatal clinics the women at risk of preterm deliveries and who require interventions that prevent these deliveries

UAB Edwin M. Dixon Professor of Paediatrics Walley A. said “Doctors today are able to keep smaller babies alive due to improved obstetrical and neonatal care,” yet still a number do not survive past their 28 days increasing neonatal mortality among preterm babies.

Findings from this research will help determine the percentage of preterm babies with very low birth weight <1.5kg and how it affects mortality among preterm babies.

It will also contribute to the existing literature on how very low birth weight and ones stage of pregnancy influences neonatal mortality among preterm babies.

Public awareness will also be created concerning preterm babies and their contribution to neonatal mortality in the country.

This will help inform health workers, parents and all stakeholders on the need to give serious attention to antenatal care of women, especially those with increased risk of preterm birth.

Findings in this subject will also sensitize health care workers on the need to identify in our antenatal clinics the women at risk of preterm deliveries and who need interventions that prevent these deliveries.

### **1.5 Purpose of the study**

This is to determine the association between the preterm characteristics such as the birth weight, mode of delivery, gestational age, and the referral status of the babies and mortality among preterm babies.

### **1.6 Comprehensive question**

What is the contribution of deaths among preterm babies with birth weight (BWT) < 1.5kg to mortality among preterm babies admitted at the NICU, 37 Military Hospital?

### **1.7 General objective of the study**

To determine the contribution of deaths among preterm with BWT <1.5kg to mortality among preterm admitted at 37 Military Hospital, NICU

### **1.8 Specific objectives of the study**

1. To determine the percentage of neonatal mortality among preterm babies weighing less than 1.5kg.
2. To assess the association between sex of preterm babies and mortality among preterm babies.
3. To identify the effect of gestational age on neonatal mortality among preterm babies.



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Introduction

This section gives an overview of mortality among preterm babies in addition to previous work such as birth weight and gestational age on preterm mortality.

#### 2.1 Mortality of preterm babies

Preterm is defined as all babies delivered before 37 completed weeks of gestation or less than 259 days from the first day of a woman's last menstrual period (WHO). Premature babies can further be categorised depending on the age of one's pregnancy. Babies that are delivered before twenty eight weeks of gestation are known as extremely preterm, those delivered between twenty-eight and thirty-two weeks of gestation are known as very preterm while those delivered from thirty-two weeks to thirty-seven completed weeks are the moderate preterm.

Babies that are born between thirty-two to thirty-seven weeks can further be split to concentrate on late preterm babies thus babies born between thirty-four to thirty-seven completed weeks.

Marlow (2012) cites that there is higher risk of mortality among lower gestational ages. His position confirms the positive directional relationship neonatal mortality has with age. A survey conducted by Lindstron, Lindblad & Hjen (2009) added that infants born in the 37 to 38 gestational weeks stand a higher danger of suffering from developmental disabilities as compared to infants born from 39 to 41 gestational weeks. The development challenges includes chronic lung disease, hearing loss, slow growth and premature retinopathy (Saigal & Doyle, 2008). According to McGuire (2004) preterm birth has toll on the host family and health institution. The negative effects lie in the

fact that families spend a lot of money and time on caring the preterm. According to Kramer et al (2012), counting only live births does to offer the full picture burden of preterm birth. There are so many factors that could induce spontaneous preterm birth. This is influenced by gestational age, social and environmental factors, but the cause remains unknown in about 50 % of all cases (Menon,2008; Steer, 2005).

Preterm birth can occur spontaneously following a premature rupture of membranes before labour start. Similarly, preterm birth can occur due to initiatives of service providers in the health care settings. This happens when labour is induced or an elective caesarean section is carried out before pregnancy comes to term due to a medical indication of the mother or foetus or a non-medical indication (Blencowe et al., 2013). Plunkett and Muglia (2008) noted that, maternal history of preterm birth is a high risk factor. They added that the reason rests in the genes, epigenes and the environment of the mother. Muglia and Katz (2010) mentions that young or old mothers, mothers that get pregnant soon after the first pregnancy and low maternal body mass index (BMI) as maternal factors that increases the chance of delivering a preterm baby spontaneously. Another significant factor is women with multiple pregnancy that result in uterine over distension.

Compared to singleton births, multiple gestations carry nearly ten times the risk of preterm birth (Blondel, Macfarlane, Gissler, Breart, & Zeitlin, 2006). Felberbaum (2007) attributes the cause of multiple gestations to rising maternal age and available supports to pregnant women in the advanced countries.

In the same vein, maternal infections poses a high risks of preterm birth these infections includes urinary tract infections, HIV and syphilis, malaria, bacterial vaginosis (Gravett, Rubens, & Nunes, 2010). However, conditions like cervical insufficiency as a result of

ascending intrauterine infection and also secondary premature cervical shortening with inflammation are shown to be associated with these infections (Lee, Romero, Park, Jun, & Yoon, 2008).

Also, Muglia and Katz (2010) cited excessive physical work and long standing times as precipitating factors of spontaneous birth. Similarly, alcohol consumption in excess, active or passive smoking and periodontal disease are also mentioned as risk factors of preterm (Gravett et al., 2010).

Premature deliveries is more common in boys than in girls, 55 percent of all preterm births occur in boys (Zeitlin et al., 2002), and is associated with a higher risk of dying when compared to girls born at a similar gestation (Kent, Wright, & Abdel-Latif, 2012). The number and causes of preterm delivery due to initiatives of service provider are more variable. In the United States, a study conducted showed that of all the preterm births performed at thirty-four to thirty-six weeks of gestation by providers initiatives, more than half was done without any strong medical indications (Gyamfi-Bannerman, Fuchs, Young, & Hoffman, 2011). Poor assessment of gestation can cause care provider to induce birth before term (Mukhopadhaya & Arulkumaran, 2007).

Maternal and foetal factor such as placental abruption, uterine rupture, cholestasis, foetal distress, preeclampsia and foetal growth restriction and abnormal tests are cited as direct causes of medically induced preterm (Ananth & Vintzileos, 2006). Maternal conditions that usually results in complications during pregnancy such as preeclampsia and preterm delivery are hypertension, obesity, diabetes and renal disease.

Both maternal and foetal factor are more common in pregnancy that happen after one has gone through assisted fertility treatment and this increases the risk of having a

spontaneous preterm birth and also provider initiated preterm birth. (Mukhopadhaya & Arulkumaran, 2007).

Tertiary facilities in low and middle income countries, where all premature births occurred due to provider initiated is reported to have ranged from 20% in Sudan and Thailand to 40% in 51 facilities in teaching hospital in Ghana and Latin America.(Alhaj, Radi, & Adam, 2010; Nkyekyer, Enweronu-Laryea, & Boafor, 2006). In the rural regions where diagnostic instrument is restricted, provider-initiated preterm birth will represent a smaller percentage of all preterm birth, however, if no elective delivery is done, the pregnancy will follow its natural course usually resulting in spontaneous premature delivery (Klebanoff & Shiono, 1995).

There are circumstances that preterm birth is needed to save the life of the mother and foetus. Circumstances that necessitate preterm birth are foetal distress, severe pre-eclampsia etc. preterm birth can be mistakenly induced due to error in assessing the gestational age or some other acts of negligence (WHO, 2012). Consequently, a significant percentage of the burden associated with preterm births globally might be unnecessary and could have been avoided.

## **2.2 Risks associated with preterm birth**

Shah et al. (2014) conducted a community-based cluster-randomized trial in the Sylhet district of Bangladesh from June 2007 and September 2009. 32,126 mothers were involved in the study. Obstetric data from 32,126 mothers were gathered and analysed. Majority (61.7%) of the women who took part in the study were 20–29 years old and almost all (95.5%) of them were Muslims. More than half (51.9%) of the women had some form of formal education. Higher level of education increases the chance of giving birth to a term baby as compared to lower level of education.

Women who were pregnant for the first time had nine percent chance of having a premature baby, 18.2 percent of the women had history of child mortality as a result of premature delivery. Women who had multiple birth such as twins, triplets and many more had a higher risk of premature delivery as compared to women that gave birth to single babies. Ninety one percent of female babies are more likely to be born at term than their male counterpart.

The researchers also compared the risk of attending antenatal clinic (ANC) to preterm delivery. Findings showed that compared to no antenatal clinic visit at all, visit to the ANC was associated with 75% higher chance of having a term delivery, in addition women who received a dose of tetanus vaccine when they were pregnant had a lower chance of premature birth. Furthermore, the risk of preterm delivery was also lower in women who received any dose of tetanus vaccine during pregnancy. Almost one-fifth (18.9%) of the women who received a dose of tetanus vaccine had a mid-upper arm circumference (MUAC) less than 214 mm. Nearly one-fifth (18.9%) of the women received a mid-upper arm circumference (MUAC) less than 214 millimetre. Further analysis indicated that maternal mid-upper arm circumference was inversely associated with preterm birth risk where each average increase in cm in average MUAC measures was associated with a risk preterm birth of 5.6% or lower.

With regards to antenatal complications, a 16% higher risk of preterm births was found in adult females with a history of antenatal complication compared with those who had not report of prenatal complications. It is inferred by authors that in under resourced countries, the risk of preterm birth can be ameliorated when women at risk pay timely visit to health institutions with qualified staff. Antenatal care is highly recommended.

Similarly, good nutrition and proper birth preparedness should be observed.

Vogel, Lee and Souza (2014) assessed maternal and perinatal health, they selected single gestational deliveries in one hundred and forty-five facilities across twenty-two low and middle income nations from Latin America, Asia and Africa. . This was a multi-country, facility-based, cross-sectional survey of maternal and perinatal outcomes following delivery. In general, preterm births and six maternal morbidities including height less than one hundred forty-five centimetres, HIV/AIDS, diabetes, malaria, urinary tract infections, pyelonephritis, preeclampsia were investigated.

Data on 172,461 live born singletons were assessed in the study. It was found that about 25% of all preterm births were initiated by providers. The remaining 75% preterm births were spontaneous. Preterm births were distributed across regions with Latin America recording the majority (31.7%). Asia recorded 22.6% and Africa recorded 11.8%. Maternal factors such as lower educational level, lower maternal height, younger age, less antenatal care, higher rates of malaria as well pre-eclampsia had a higher risk of spontaneous preterm births compared to women with term deliveries. Similar differences were found among babies that had term delivery and those that were delivered preterm as initiated by the service provider. Nevertheless, among women with provider initiated preterm deliveries, diabetes were 2.9 percent vs 0.8 percent,  $p < 0.001$ ),, pyelonephritis or UTI (8.2% vs 7.1%,  $p = 0.013$ ), and pre-eclampsia (18.2% vs 2.6%,  $p < 0.001$ ) were higher compared to women with term deliveries.

Generally less than ten percent of all provider initiated preterm deliveries were carried out with no medical indications. However the highest percentage of non-medical indication of provider initiated preterm deliveries were 22.3 percent in China, 23.8 percent in Sri Lanka, and 16.2 percent in India health facilities (Vogel et al., 2014).

### **2.3 Effect of birth weight and gestational age on preterm mortality**

McIntire and Leveno (2008) conducted a study comparing neonatal mortality and morbidity rates in term babies and late preterm babies and their main objectives of the study was to analyse mortality and morbidity in late preterm thus those delivered at 34 weeks, 35 weeks and 36 weeks of gestation as compared with babies born at term over the past eighteen years since it was a retrospective cohort study. In addition they also looked at the magnitude of risks of dying in late preterm babies as compared to term babies as well as the neonatal outcome for late preterm births and those delivered at 39 weeks of gestation.

In their study, they found out that all the single late preterm deliveries recorded accounted to seventy-six percent of all preterm births recorded in the hospital. Also, the mortality rates of neonates per thousand lives births in late preterm were 1.1 at 34 weeks, 1.5 at 35 weeks and 0.5 at 36 weeks of gestation compared with 0.2 at 39 weeks ( $p < 0.001$ ); indicating an inverse relationship between neonatal mortality rates and gestational age. Neonatal morbidity also increased significantly at 34, 35, and 36 weeks gestation as well as physical complications such as sepsis work-ups, transient tachypnea, intubation in the delivery room, hyperbilirubinemia requiring the need for phototherapy and intraventricular haemorrhage. In general eighty percent approximately of all late preterm births were due to idiopathic preterm labour or premature rupture of membranes, obstetrics complication accounted to twenty percent. Thus, the commonest type of birth were the late preterm, associated with the highest probability of neonatal mortality and morbidity as compared with births at 39 weeks gestation within the study population.

Research conducted by Katz et al. (2013) in low and Middle income countries, assessed mortality risk associated with babies born before 37 completed weeks and babies who

are small for gestational age. Out of the 20 cohort data sets of 2 015 019 lives birth assessed, available data on gestational age of babies were 2 008 675, both gestational age and weight of babies at birth were 1 996 763. Eighty-three percent of babies with low weight at birth were small for gestational age and thirty-three percent were born prematurely in Asian cohorts thus sixty-seven percent of babies delivered at term were low birth weight and small for gestational age. In Africa cohort, low birth weight babies who were small for gestational age accounts to seventy-nine percent and thirty-eight percent were premature babies, thus sixty-two percent of babies delivered at term were low birth weight babies and also small for gestational age.

Fifty-three percent of low birth babies were also small for gestational age whiles seven-one percent are made up of premature babies thus twenty-nine percent of all babies delivered at term were low birth weight and small for gestational age as recorded in the cohort of Latin American. The prevalence of premature birth and the number of babies born with low birth was high in South Asia.

Rate of neonatal deaths increased with severity of SGA. Across all the regions, the relative risk for SGA were 1.83 (1.34-2.50) for neonatal mortality and 1.90 (1.32-2.73) for post neonatal mortality rate. The highest relative risk for SGA in neonates below the 3<sup>rd</sup> percentile was in Latin America, compared with 1.91 (1.40-2.60) in Asia. The overall relative risk was 2.41 (1.66-3.50). The risks difference per thousand live births across all the regions for SGA below the third percentile ranged from 12 (10-15) to 23 (17-29) in Asia and Latin America respectively with 14 (9-19) as the overall risk difference per thousand live births. Babies born within the first 7 days (early neonatal) those from 7-28 days (late neonatal) and those after 28 days (post neonatal) had similar magnitude of risk associated with SGA. Comparing SGA and preterm, the magnitude

of relative risk in SGA were smaller than preterm and the association with increased death rate did not attenuate beyond the neonatal period and persisted through the first year of life.

Relative to term and appropriate for gestational age, premature babies-small for gestational age had a higher risk of neonatal mortality of (15.42;9.11-26.12) as compared to term-small for gestational age with a lowest neonatal mortality risk of (2.44;1.67-3.57). Asia and Africa had the same relative risk but this was high in Latin America. Comparing preterm-appropriate for gestational age and preterm-small for gestational age, babies born within the first 7 days had the highest relative risks as compared to babies after 28 days of life, although the confidence intervals overlapped thus not statistically significant between-group differences.

Kramer, Demissie, Yang, Platt, Sauvé and Liston (2000) conducted another cohort study in US and Canada with birth cohort of 1985, 1995 and 1985-1987 and 1992-1994 respectively using linked singleton live birth-infant mortality cohort files the main objective was to evaluate quantitative contribution of mild and moderate preterm birth to infant death. Among all single babies born at 32-33weeks of gestation, the relative risk for infant mortality in US read 6.6 for the year 1995 while in Canada it was 15.2 for the year 1992-1994 (95% confidence interval, 13.2-17.5). Preterm single babies born at 34-36 weeks of gestation, relative risk for US was 2.9 (95% confidence interval, 2.8-3.0) and 4.5 (95% confidence interval, 4.0-5.0) in Canada. Etiologic fraction at 32-33 weeks gestation are 3.2 percent and 4.8 percent respectively while 34-36 weeks gestation read 6.3 percent to 8.0 percent respectively; the sum of the EFs for babies born from 32-36 weeks gestation exceeded those born at 28 through 31 gestational weeks. For all the neonates observed, relative risks for early neonatal mortality in US and Canada was 14.6 and 33.0 respectively while the etiologic fraction read 3.6

percent to 6.2 percent in US and Canada respectively. For post neonatal period, the relative risk for babies born at 32-36 weeks gestation read 2.1-3.8 and 3.0-7.0 for US and Canada respectively while the etiologic fraction read 2.7%-5.8% in US and 3.0%-7.0% for Canada. These were the overall relative risks observed for the neonatal periods and mortality due to sepsis, birth asphyxia sudden infant death syndrome and external causes.

Furthermore, except for a reduction in the RR and EF for neonatal mortality due to infection, the patterns have changed little since 1985 in either country. Mild- and moderate-preterm birth infants were found to be at a high RR for death during infancy and are responsible for an important fraction of infant mortality.

In another retrospective study conducted by Tomashek, Shapiro-Mendoza, Davidoff and Petrini (2007), they reviewed differences in death between babies born within (34-36 weeks) late-preterm and term babies thus (37-41 weeks). Birth/infant death files for 1995 to 2002 were assessed to compare overall and cause-specific early-neonatal, late-neonatal, post-neonatal, and infant mortality rates between singleton late-preterm infants and term babies. Substantial falls in mortality rates were followed in late-preterm and term babies at all age-at-end categories, leave out the late-neonatal period. Despite the fall in rates since 1995, infant mortality rates in 2002 were 3 times higher in late-preterm infants than term babies (7.9 versus 2.4 deaths per 1000 live births); early, late, and post neonatal rates were 6, 3, and 2 times higher, respectively.

During infancy, late-preterm babies were approximately 4 times more likely than term babies to die of congenital malformations (leading cause), newborn bacterial infections, and complications of placenta, cord, and membranes. Early-neonatal cause-specific death rates were most disparate, especially deaths caused by atelectasis, maternal

complications of pregnancy, and congenital deformities. This work as well suggest that late-preterm infants have a high death rates than babies born at term throughout infancy.

Vogel et al (2014) in their worldwide survey on maternal and perinatal health found that for preterm babies that were delivered spontaneously and preterm delivery by provider initiative groups, the prevalence of all adverse neonatal outcomes decreased with increasing gestational age. The writers found that adverse outcomes among neonates by gestational age bands were like comparing to neonates born via spontaneous preterm delivery and neonates born via provider initiated preterm delivery. Nevertheless, rates of early neonatal mortality within early neonatal period were significantly and consistently higher among neonates born via provider initiated preterm delivery.

In Europe, Zeitlin et al. (2010) assessed the impact of being small for gestational age on very preterm mortality and morbidity rates. He used different birth-weight percentile thresholds. The study included singletons and twins alive at onset of labour between 24 and 31 weeks of gestation without congenital anomalies for very preterm births in 10 European regions. A sum of 4,525 preterm births was assessed. The death rate was significantly higher for children with birth-weights less than 25th percentile when compared to the 50th to 74th percentile. Kaushik, Parmar, Grover and Kaushik (1998) also conducted a study in the department of paediatrics and its neonatology unit at Indira Gandhi Medical College. They examined all live born children between July 1994 to June 1995, and found that although low birth weight infants accounted for 27.8 percent of the live births, they accounted for 79.5 percent of neonatal mortalities.

Wilcox and Skjaerven (1992) studied data from 400,000 singleton births in the Norwegian Medical Birth Registry to distinguish the contributions to perinatal mortality made by gestational age and by relative birth weight at each gestational age. Results

showed that relative mortality rates across gestational age groups were highest at the lowest birth weights and fell rapidly as weights increased. Perinatal mortality ranged from 4.3/1,000 births at 40 weeks gestational age to 364.9/ 1,000 births in 28 to 31 weeks.

A study reviewed birth and death certificate data for all infants with gestational age more than or equal to 34 weeks was carried out by (Pulver, Guest-Warnick, Stoddard, Byington, & Young, 2009) in Utah. Using appropriate for gestational age indices as reference, neonatal and infant mortality rates were estimated for each gestational age and birth weight. Data from 343, 322 new borns with gestational age more than or equal to 34 weeks were assessed, and it was found that late preterm babies who were diminished for their gestational age had approximately 44 times higher probability to die compared to those at term who were appropriate for their gestational age. They also had 22 times higher probability to drop dead within their first of life. Therefore, being small for gestational age significantly increased ones risk of death among the already vulnerable preterm babies with high mortality rates.

Hsu et al. (2015) assessed a nationwide birth weight and gestational age-specific neonatal mortality rate in Taiwan. This study involved an abstraction of the birth registration database from the Ministry of Interior in Taiwan from 1998 to 2002 which was then linked to the data to the death registration database from the Ministry of Health and Welfare in Taiwan between 1998 and 2003. The Poisson regression model was then used in modelling the mortality data. It was found that between January 1, 1998 and December 31, 2002, there were 1,342,203 live births. A total of 2,252 (0.1 %) live births prior to 20 weeks of gestation or after 44 weeks of gestation were excluded in the study. A total of 1,339,951 live births met the inclusion criteria for the study. The preterm birth and of new born with low birth weight populations showed significant

increases between 1998 and 2002, from 6.9% to 8.2% and from 6.3% to 7.1%, respectively.

They focused on 1,331,785 live births comprising 695,477 (52.2%) males and 636,308 (47.8%) females. The early neonatal, neonatal, and infant deaths were 2,920, 4,169 and 7,338, respectively, during the study period. The early neonatal, neonatal, and infant mortality rates for the different genders were 2.40 per 1000, 3.39 per 1000, and 5.91 per 1000 live births in males, and 1.97 per 1000, 2.80 per 1000, and 5.10 per 1000 in females, respectively. The mortality rate remained higher in the male population within the 1st year of life, whereas there was a general downward trend for both genders during the study period. The infant mortality rate decreased from 6.34 per 1000 in 1998 to 5.13 per 1000 in 2002 among the male study population, and from 5.22 per 1000 to 4.59 per 1000 in the female population.

Hsu et al. (2015) found that the gestational age-specific early neonatal mortality rate of male newborns was 757.1 per 1000 at 23 weeks and 601.4 per 1000 at 24 weeks of gestation regardless of birth weight. These rates were found to have decreased remarkably to 365.9, 99.1 and 16.0 per 1000 in those born at 25 weeks, 28 weeks, and 32 weeks of gestation, respectively. The gestational age-specific early neonatal mortality rate for full-term newborns (37e41 complete weeks of gestation) ranged from 0.5 per 1000 to 1.1 per 1000, whereas it increased to 2.4 per 1000 for those born at 42 weeks. Notably, late-preterm newborns (34e36 complete weeks) also had a higher risk of early neonatal mortality in comparison with full-term births, ranging from 2.1 per 1000 to 8.4 per 1000. Furthermore, newborns that were small for gestational age (SGA; below the 10th percentile of birth weight) had higher mortality rates compared with those who were adequate for gestational age (AGA; between the 10th percentile and

90th percentile). The early neonatal mortality rate, for example, was 395.3 per 1000 in SGA compared with 188.7 per 1000 in those between 750 g and 1000 g at 26 weeks of gestation.

In comparison with male newborns, females continued to have a lower risk of gestational age-specific early neonatal mortality, presenting as 664.43 per 1000 at 23 weeks and 473.17 per 1000 at 24 weeks of gestation. Showing a similar trend to males, the early neonatal mortality rate decreased remarkably from 363.64 per 1000 for females born at 25 weeks of gestation, to 94.81 per 1000 at 28 weeks, and to 14.73 per 1000 at 32 weeks.

Post-term female newborns had a higher mortality, ranging 0.87-2.50 per 1000, compared with 0.39-0.85 per 1000 at full-term. Late-preterm female newborns also exhibited higher risks of mortality in comparison with full-term births, ranging 2.36-13.79 per 1000. Furthermore, the early neonatal mortality rate was also higher in female SGA compared with AGA, being 260.87 per 1000 when SGA was between 500 g and 750 g at 28 weeks of gestation compared with 63.43 per 1000 when AGA was between 1000 g and 1250 g at 28 weeks.

In a retrospective cohort analyses, Escobar, Clark and Greene (2006) investigated short-term outcomes of infants born at 35 and 36 weeks gestation in the United States and England. Premature infant cohorts with infants whose dates of birth ranged from January 1998 through June 2004 were examined. The aim of the study was to examine available data permitting quantification of short-term hospital outcomes among infants born at 35 and 36 weeks gestation.

Solutions indicated that neonates delivered at 35 and 36 weeks gestation experienced considerable mortality and morbidity. Close to 8% required supplemental oxygen

support for at least 1 hour, almost 3 times the rate found in babies born at or after 37 weeks. Among 35 to 36 week newborns who progressed to respiratory failure and who survived to 6 hours of age and did not have major congenital anomalies, the mortality rate was 0.8%. Following liberation from the birth hospital, 35 to 36 week infants were a good deal more probable to be re-hospitalized than term infants, and this increase was evident both within 14 days as well as within 15 to 182 days after expiration. In addition, late preterm infants experienced multiple therapies, few of which have been officially evaluated for safety or efficacy in this gestational age group.

Marchant et al. (2012) reviewed for East African studies that birth weight, gestational age at birth using antenatal ultrasound or neonatal assessment, and neonatal mortality. Away of the 10 datasets that were distinguished, only four met the inclusion standards. From these four studies, from Uganda, Kenya, and two from Tanzania, 5,727 live births were observed, of whom 4,843 (85%) received a perfect set of event data and were included in the analysis. In the individual surveys, between 6.9% and 11.3% of infants were low birth weight, being 9.2% for all subjects combined. Between 2.7% and 5.7% of babies were preterm, being 4.0% for all subjects combined. Between 9.9% and 26.4% of infants were small for gestational age, being 20.4% for all subjects combined. Amongst low birth weight babies, 26.1% were preterm, 85.0% were small for gestational age, and 98.8% were either preterm or small for gestational age.

The odds of dying in the first 28 days of life were seven times higher for babies had low birth weight compared to those with normal birth weight (OR 7.6, 95% CI 4.8–12.1), and low birth weight infants experienced a neonatal mortality rate of 80.9/1,000 live births. The odds of death were over six times higher for babies born moderately preterm compared to those born term (OR 6.2, 95% CI 3.0–12.8), and about 60 times higher for

babies born very preterm compared to those born term (OR 58.7, 95% CI 28.4–121.4), with almost half of very preterm babies dying in the first 28 days of life. Neonatal mortality rate was 473.6/1,000 live births. The odds of death were twice as high for infants born small for gestational age compared to those born appropriate for gestational age (OR 2.1, 95% CI 1.3–3.5), the neonatal mortality rate of 29.3/1,000 live births.

Using babies born with weight appropriate for gestational age and at term as a citation, the odds for neonatal mortality were three times higher for those born appropriate for gestational age at 34–36 weeks but 75 times higher for those born appropriate for gestational age at <34 weeks. Again, using babies born appropriate for gestational age and term as a citation, the odds of mortality were doubled for babies born small for gestational age at term were 20 times greater for babies born small for gestational age at 34–36 weeks, and were 57 times greater for babies born small for gestational age at less than 34 weeks pregnancy.

Twenty three percent (1,125/4,843) of the live births, but 53% (45/87) of the new born deaths were amongst newborns were either small for gestational age or preterm. Less than 1% (37/4,843) of live births, but 20% (17/87) of deaths, were amongst very preterm infants (less than 34 weeks). Merely 1% (48/4,843) of live births, but 8% (7/87) of the deaths, were amongst those born moderately preterm (34–36 weeks) and small for gestational age. Overall, 28% of neonatal mortality was related with being born preterm and 39% of neonatal mortality was related with being born either preterm or small for gestational age, accepting that all babies would suffer the same risk of neonatal death if they were born term and appropriate for gestational age. The bulk (98%) of the mortality risk (the attributable risk percent) of babies born appropriate for gestational age at <34 weeks was attributed to them having been born very preterm. Complete 90% of the neonatal mortality risk of all small for gestational age and preterm

babies (<37 weeks) was imputed to them being born small for gestational age and preterm. This proves that children born either small for gestational age or preterm contributed 52% of neonatal deaths. So babies born preterm are at the greatest danger of death, but size for gestational age also plays a significant role especially in moderately preterm infants.

Chigbu et al. (2014) assessed the burden of preterm births in Aba, South-eastern Nigeria. In this study, a review of all preterm deliveries at the maternity hospital wing of the Abia State University Teaching Hospital, Aba, Nigeria was carried out between January 1, 2002 and December 31, 2006. Case records of the patients were obtained from the central delivery unit and the medical records department and analyzed to determine the proportion of parturients that had preterm delivery. During the studied period, 5566 women delivered at the hospital. Three hundred and ninety-three of them had preterm birth.

Majority of the women, 229 (58.2%) had late preterm birth, 55 (14.0%) had moderate preterm birth, 69 (17.6%) had very preterm birth, whilst 40 (10.2%) had extreme preterm birth. The sex distribution of the babies was 198 males and 195 females. Iatrogenic delivery was responsible for the preterm deliveries in 59 (15%) women due to hypertensive disorders, diabetes and intrauterine growth restriction. Spontaneous preterm labour was the cause in 334 (85%) parturients. The total number of preterm deaths was 157, giving a preterm mortality rate of 40%. Majority of the births, 230 (58.5%) occurred during the dry season (October to February), whilst 163 (41.5%) preterm births were during the rainy season (March to September). The mean birth weight of babies was 1700 g (range 550-2800 g). Babies with low birth weight ( $\leq 2500$  g) were 296 (75.3%).

The pregnancy complications associated with the preterm births included, premature rupture of the membrane in 14.8% of the women, malaria in 40.5%, antepartum haemorrhage in 10.4%, anaemia in 20% of the women, hypertensive disorders in 7.4%, and high order multiple pregnancies in 2%. Others were fibroid coexisting with the pregnancy in 7.5% of the women, polyhydramnios in 6%, intra uterine growth restriction in 7.6% of the cases, gestational diabetes mellitus in 4% and HIV infection in 2% of the women. More than one complication was encountered in many of the women delivering preterm.

In a similar study in in north central Nigeria, Onwuanaku, Okolo, Ige, Okpe and Toma (2011) carried out a retrospective descriptive study on the effects of birth weight and gender on neonatal mortality. The researchers analysed data of 278 neonates who were managed at the Special Care Baby Unit of Jos University Teaching Hospital, Jos, North- central Nigeria. The study was carried out from 1st July 2006 to 30th June 2008 using the Epi-info version 3.3.2 for the purposes of analysis. Out of 278 neonates that took part in the study, 159 (57.2%) were males and 119 (42.8%) were females. Eighty-seven (31.3%) of the neonates were preterm and 191(68.7%) were born at term. However, 12 of the babies comprising 7 (2.52%) males and 5 (1.80%) females died. There was not significant association between the neonatal mortality and gender of the neonates ( $p > 0.05$ ). However, the neonatal mortality rate observed was 25.2 deaths per 1000 live births for boys and 18.0 per 1000 live births for girls. Thus indicating a higher neonatal mortality rate for males compared with females.

Furthermore, the mean birth weight of the preterm and term babies was  $1.88 \pm 0.47$  kg and  $3.02 \pm 0.50$  kg respectively. The average gestational age observed among the preterm and term babies was  $30.62 \pm 3.65$  weeks and  $38.29 \pm 0.99$  weeks respectively. In addition, 87 (31.3%) of the babies were found to have low birth weight (LBW), 188

(67.6%) were of normal birth weight and 3(1.1%) had high birth weight. Out of the total number of the LBW babies, 6 (2.2%) were born at term and 81 (29.1%) were born preterm. However, 6 (2.2%) of the preterm babies were observed to have normal birth weight.

On the other hand, 11 of the babies who were observed to have died were preterm babies. The overall mortality rate was 4.32% (OR = 0.04, 95%CI 0.005-0.310,  $p = 0.002$ ) which was found to be higher in babies with birth weight less than 2.5 kg. The specific mortality rate associated with birth weight was observed to be 126 per 1000 for the preterm low birth weight and 5 per 1000 for the babies who were born at term. Two (0.7%) of the babies who were born preterm were delivered at 17-20 weeks of gestational age category and were observed to be large for their gestational age (LGA). Furthermore, 2 (0.7%) of the pre-term babies were small for gestational age (SGA), 38 (13.7%) were appropriate for gestational age (AGA) and 47 (16.9%) were large for gestational age (LGA). However a few of the preterm babies, thus 7(58.3%) and 4(33.3%) of the pre-terms, that died were observed to be AGA and LGA respectively.

Onwuanaku et al. (2011) also found that, birth weight unlike sex, was a significant predictor of neonatal mortality ( $p = 0.002$  and  $p = 0.453$  respectively). Although the gestational age was observed to have a positive effect on mortality, it was not statistically significant. Furthermore analysis in their study showed that gestational age was not a significant predictor of neonatal mortality ( $p = 0.595$ ). However, a significant difference in the mortality rate of babies with gestational age lower than 37 weeks and those of or greater than 37 weeks gestational age ( $p = 0.000$ ) was observed. The death rate of neonates was observed to be more among those born less than 37 weeks gestation. The babies had one or more major clinical indications for admission. Neonatal sepsis was found to be the most common indication for admission in 63

(22.7%) of the LBW babies and in 124 (44.6%) of the babies with normal birth weight. The least common indication that was found for admission was birth asphyxia. This was observed among 10 (3.5%) of the babies, with 3 (1.0%) occurring in the LBW babies. Other major indications include neonatal jaundice (NNJ) and malaria.

## **2.4 Conclusion**

In general, the literature review shows that preterm birth is both more common in males than in females and late preterm births associated with increased neonatal mortality and morbidity. However, most of these studies were carried out in the United States, Canada, Europe and Asia. Among the few studies carried out on mortality among preterm babies in Africa rates were similar to that of Asian countries. However, there are limited studies on preterm mortality in West Africa, and in Ghana in particular. Findings from the west and Europe may not be generalizable to the Ghanaian context due to differences in socio-cultural background. This study will therefore fill this gap.



## CHAPTER THREE

### METHODS

#### 3.0 Introduction

This section describes how the research problem was investigated and why particular designs and techniques were used. It also describes the setting in which the study was carried out. The chapter also describes sampling technique, data collection tool and technique, data processing and analysis and ethical issues are all contained in this section.

#### 3.1 Type of study

The research design is the overall strategy employed by the researcher to answer the research question or to test the research hypothesis (Polit & Beck, 2012). This study employed a retrospective descriptive study design. Retrospective studies involve the collection of data about past events (Jupp, 2006). It helps one to be able to study and understand contributory factors to any observed change over a period of time. The main goal of retrospective studies is to collect past data to serve as means of determining change in a phenomenon for descriptive or explanatory purposes. This allows the researcher to develop ideas about possible associations and to be able to investigate potential relationships. Descriptive designs describe trends, patterns and associations that actually exist and to determine the frequency with which it occurs (Burns & Grove, 2005). This design was adopted to help the researcher to investigate the phenomenon under study.

#### 3.2 Study setting

The setting for the study was the Neonatal Intensive Care Unit (NICU) of the 37 Military Hospital. The 37 Military Hospital is a specialist hospital located in Accra, on

the main road to central Accra. It is the largest military hospital in the Republic of Ghana. The name of the hospital is mostly used to refer to the community in which it resides.

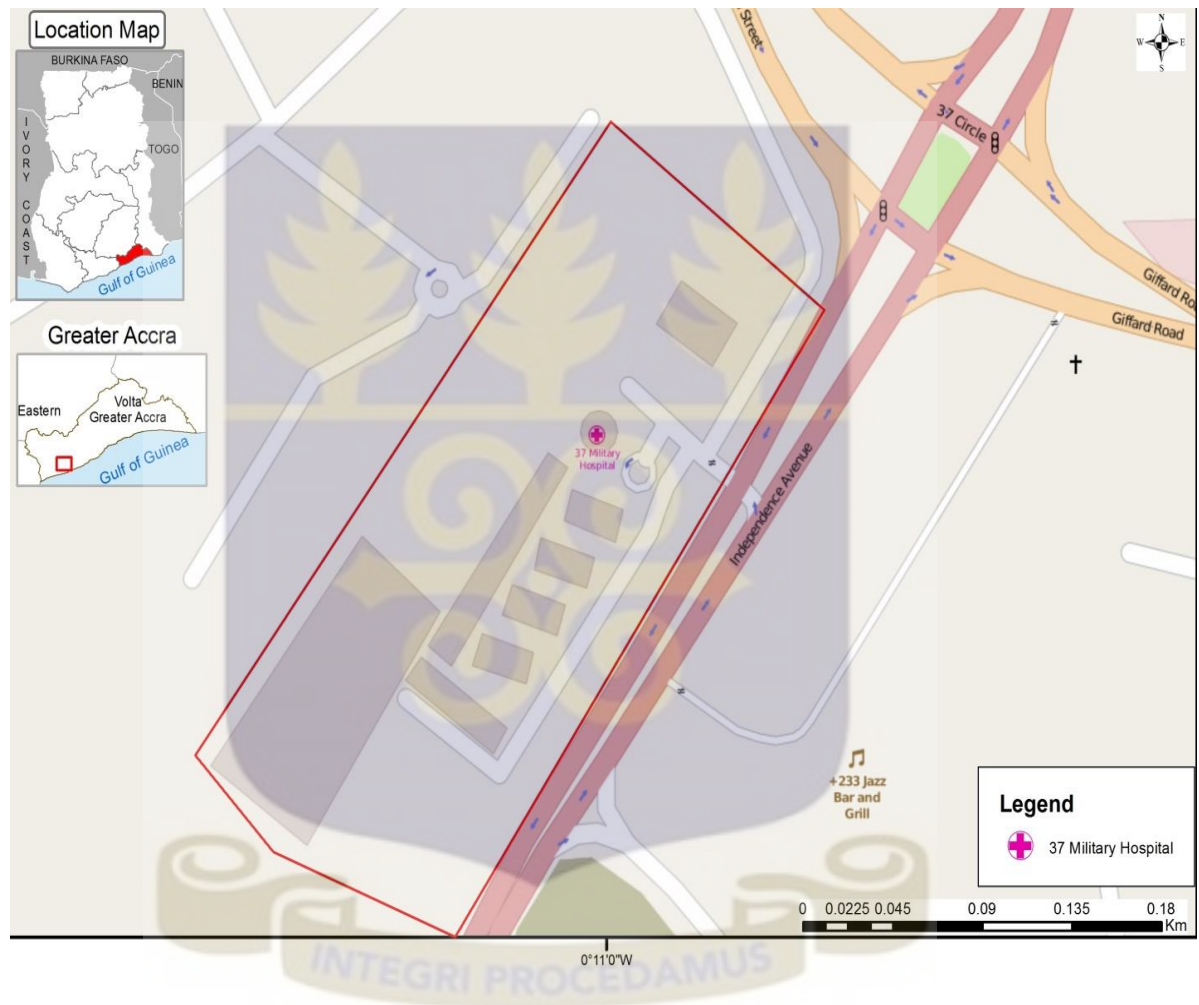
British military officer, General George Giffard, established the military hospital in 1941 with the main purpose of providing treatment for troops injured in the Second World War. The hospital's name at this time was No. 37 General Hospital; it was changed to 37 Military Hospital of the Gold Coast in 1956. The hospital was later expanded and opened to the public, although the hospital continues to be staffed primarily by military personnel.

In 2011, during a national strike by doctors in public hospitals, the Ministry of Health donated GH ₵230,000 worth of medical supplies to the hospital to enable it to continue treating an increased number of patients. The hospital has around 400 beds in total. The accident and emergency department, pharmacy and the polyclinic run 24 hours. Its x-ray facilities are also available 24 hours a day. Other departments include divisions for dental treatment, obstetrics and gynaecology, paediatrics, pathology, surgical and veterinary treatment. Its trauma department has been described by one travel guide as "the best in Accra". The hospital is also used as a teaching hospital for post-graduate medical students.

The Neonatal Intensive care unit is a subdivision of the paediatric department. It is located within the maternity unit of the hospital. The unit is also subdivided into two wards A and B. Ward A contains incubators and resuscitative equipment for preterm babies only whiles Ward B contains treasure cots where term but ill neonates are nursed. The ward state of the N.I.C.U department is 30. The unit has a total of 5 modernised incubators, 23 treasurer cots, 4 radiant warmer and 8 cam beds for neonatal

admissions. In addition, the unit has a modernised cpaps machines and neonatal ventilator for taking care of critically ill neonates.

The map below shows the location of the study area, it was obtained from Centre for Remote Sensing and Geographic Information Systems (CERGIS) University of Ghana.



**Figure 3.1: Map showing areal location of the 37 Military Hospital.**

### 3.3 Variables

- (i) Dependent variable;
  - a. Preterm neonatal mortality
- (ii) Independent variables are;
  - a. Preterm birth weight < 1.5kg

- b. Mode of delivery
- c. Referral status
- d. Sex composition
- e. Gestational age
- f. Mother's parity
- g. Preterm labour

### **3.4 Study population**

Records of preterm babies admitted to the NICU of the 37 Military Hospital were used for the study.

#### **3.4.1 Inclusion criteria**

Only admission records of preterm babies were used for the study. All records on preterm babies admitted to the NICU from January 2014 to December 2015 qualified for inclusion in this study.

#### **3.4.2 Exclusion criteria**

Admission records of all term babies were excluded from the study. All admission records of preterm babies before the year 2014 were also excluded from the study.

### **3.5 Sample Size**

All preterm admission records of babies admitted to the 37 Military Hospital NICU from January 2014 to December 2015 were used as the sample size for the study. A total of 527 pre-term births were recorded from January 2014 to December 2015.

### **3.6 Sampling method**

Available records of preterm babies admitted from January 2014 to December 2015 was reviewed. This involved the identification and selection of preterm admission records of

babies admitted to the 37 Military Hospital NICU from 2014 to 2015. By so doing, only available records on mortality of preterm babies admitted to the NICU from the year 2014 to 2015 were selected for the study.

### **3.7 Data Collection Technique**

Formal permission was sought from the commander of the 37 Military Hospital in the form of an introductory letter. A copy of the letter was also sent to the officer in-charge of the 37 Military Hospital NICU and the one in charge of NICU records. Available records on admissions, deaths and discharges on all babies at the NICU from 2014 to 2015 were assessed from patient folders, admission and discharge books and available electronic data.

Data collection was done using a self-developed check list (Appendix A) comprising of the following items: Mothers demographic data (Chronological age and type of delivery); baby's demographic data (Sex, gestational age); Baby's weight at birth, length of stay in the hospital, referral status and outcome (dead or alive). The data collection process lasted one month.

### **3.8 Quality Control**

Data collection was done by the researcher with the assistance of a records staff in the hospital. Available data on preterm babies from their folders and the admission and discharge records were compared and synchronized before recording. All data entered into the check list were cross-checked to ensure that they were complete in order to reduce the number of missing data. In addition, data cleaning was carried out to help eliminate or if not possible reduce errors to the minimum.

### **3.9 Data Processing and Analysis**

The SPSS (V. 22.0) was used for data analysis. The items on the check list were coded into the software after which data of each subject on the checklist was entered into the software. This was then edited to eliminate errors. Descriptive analyses of the various data were carried out. The Chi-square test was used to test the relationship between sex of preterm babies and mortality among preterm babies. The Chi-square test was also used to test the relationship between birth weight of preterm babies and mortality among preterm babies.

The independent “t” test was used to test if there exists and significant relationship between the actual gestational age and neonatal mortality among preterm babies using a P value of  $<0.05$  as the statistically significant value.

The relationship between gestational age (late preterm, very preterm, extremely preterm) and neonatal mortality among preterm babies was also tested using the Chi-square test with a P value of  $<0.05$  as the statistically significant value.

### **3.10 Ethical Consideration**

Institutional ethical clearance was obtained from Institutional Review Board, 37 Military Hospital and the Ghana Health Service to conduct the study. Data assessment and collection were only done by the researcher in consultation with a records staff in order to ensure privacy of patients’ records. Names of patients and their mothers were not taken. However, each entry was represented with a number in order to ensure anonymity.

All data collected were safely kept in the custody of the principal investigator and placed under lock in order to ensure confidentiality of all information collected. Data collected was only accessible to the principal investigator and the supervisor.



## CHAPTER FOUR

### FINDINGS

#### 4.0 Introduction

This chapter presents the results of the study and is divided into sections. The first section reports the demographic characteristics of participants. The rest of the sections present the results according to the objectives of the study.

#### 4.1 Demographic data

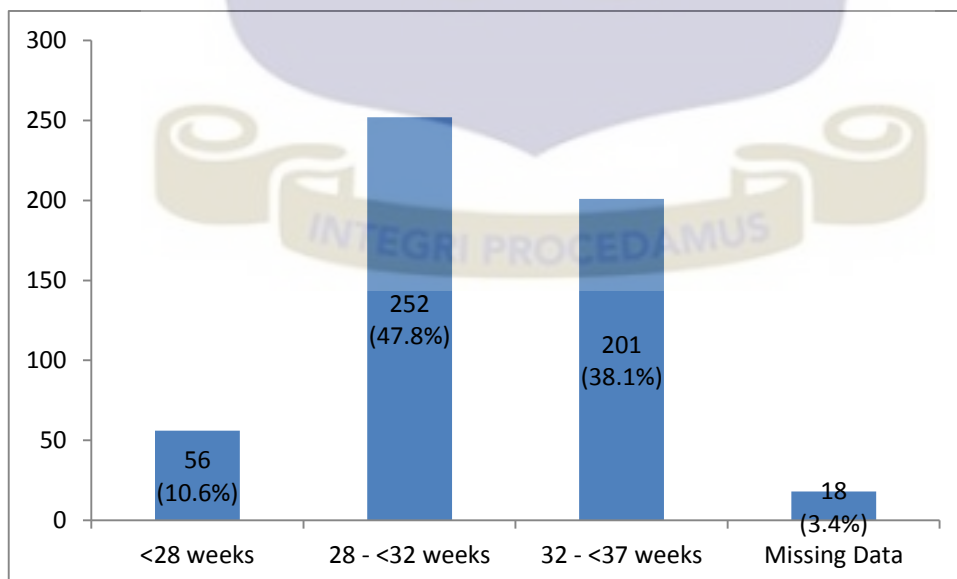
A total of 527 pre-term births were recorded in the years 2014 and 2015 with the year 2015 having the higher record of 312 pre-term births (59.2%). Males comprised 50.9% of the preterm birth records compared with females (49.1%). The most common mode of delivery of the preterm babies was by caesarean section (51.2%). The average length of stay in the hospital after delivery was 8.5 days (SD= 7.42), ranging from 1 to 45 days. The age range of their mother mothers was from 15 to 51 years with an average age of 31 years (SD= 5.61). Majority (71.9%) of the preterm babies were taken care of in the facility without any referral. Details of the demographic characteristics of participants are presented in table 4.1 below.



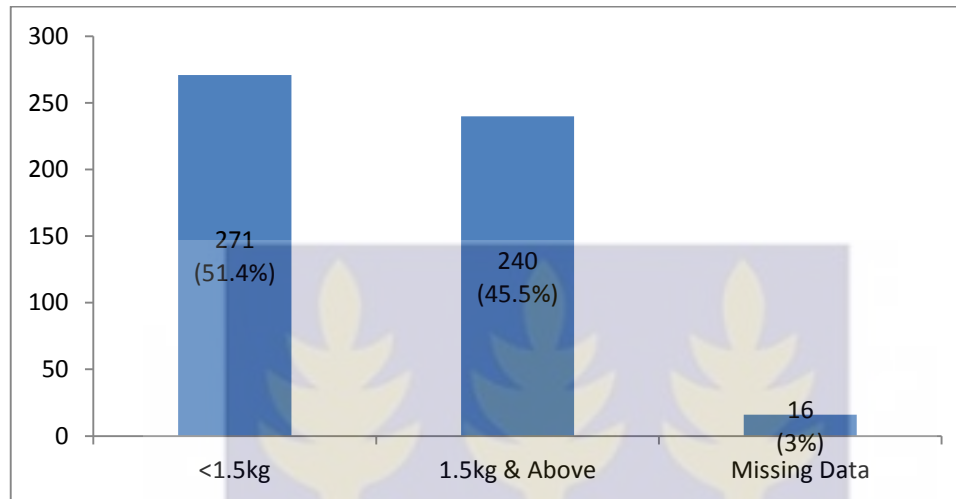
**Table 4.1: Demographic data of respondents**

Variable		Frequency (n)	Percent (%)
Year	2014	215	40.8
	2015	<b>312</b>	<b>59.2</b>
	Total	527	100
Sex	Male	269	50.9
	Female	259	49.1
	Total	527	100
Mode of Delivery	SVD	218	41.4
	CS	270	51.2
	Missing Data	39	7.4
	Total	527	100
Referral Status	Referred	145	27.5
	Not Referred	379	71.9
	Missing Data	3	0.6
	Total	527	100

Majority, 252 (47.8%), of the preterm births were 28 to 31 weeks old followed by 201 (38.1%) preterm births that were 32-37 weeks old. The mean age of the preterm babies was 31.4 weeks (SD= 2.94). This is shown in Figure 4.1 below.

**Figure 4.1: Gestational age category of babies**

Recorded weights of the preterm babies were from 0.4kg to 3.4kg with an average weight of 1.5kg (SD= 0.53). Majority (51.4%) of the preterm babies weighted less than 1.5kg. This is illustrated in Figure 4.2 below.



**Figure 4.2: Birth weight of babies**

The Chi-square test statistic was used to test the effect of year of birth of preterm babies on mortality among preterm babies. Majority (52.6%) of the preterm babies who died were born in the year 2015. The Chi-square statistics shows that year of birth of preterm babies had significant effect on mortality of preterm babies ( $X^2= 4.340$ ,  $p < 0.05$ ). This indicates that preterm mortality was significantly higher in the year 2015 than the year 2014. This is shown in table 4.2 below.

**Table 4.2: Association between preterm neonatal mortality and year of birth**

Year	Died n (%)	Alive n (%)	Chi-square test	P-values
2014	81 (47.4%)	128 (37.8%)	4.340	0.037
2015	90 (52.6%)	211 (62.2%)		

#### 4.2 Preterm neonatal mortality and weight of preterm babies

As shown in Table 4.3 below, total of 339 (64.3%) of the preterm babies were reported to be alive.

**Table 4.3: Preterm neonatal mortality**

Outcome	Frequency (n)	Percent (%)
Dead	171	32.4
Alive	339	64.3
Missing Data	17	3.2
Total	527	100

The Chi-square test statistic was used to test the effect of birth weight of preterm babies on mortality among preterm babies. Majority (85.5%) of the preterm babies who died were less than 1.5kg in weight and majority (63.3%) of the pre-term babies who were alive weighted 1.5kg or more. The Chi-square statistics shows that birth weight of preterm babies had significant association with mortality of preterm babies ( $X^2=104.954$ ,  $p < 0.001$ ). This indicates that preterm babies less than 1.5kg are more likely to die compared to those who weigh 1.5kg or more. Detail of the analysis is shown in Table 4.4 below.

**Table 4.4: Association between preterm neonatal mortality and birth weight of preterm babies**

Birth weight	Died n (%)	Alive n (%)	Chi-square test	P-value
<1.5kg	141 (85.5%)	122 (36.7%)	104.954	<0.001
1.5kg & Above	24 (14.5%)	210 (63.3%)		

### 4.3 Preterm neonatal mortality and sex of preterm babies

One of the cardinal objectives of the study was to assess the effect of sex on preterm mortality. The Chi-square test statistic was used to test the effect of sex of preterm babies on mortality among preterm babies.

Males constituted majority (54.4%) of the preterm babies who died whilst females constituted the majority (52%) of the preterm babies who were alive. The Chi-square statistics shows that sex of preterm babies had no significant association with mortality of preterm babies ( $X^2= 1.335, p > 0.05$ ). This indicates that being born male or female preterm baby does not predict whether one will die or survive. Details of the analysis are shown in table 4.5 below.

**Table 4.5: Association between sex and mortality of preterm babies**

Sex	Died n (%)	Alive n (%)	Chi-square test	P-values
Male	93 (54.4%)	166 (49%)	1.335	0.248
Female	78 (45.6%)	173 (51%)		

### 4.4 Neonatal mortality and gestational age of preterm babies

This sub-section provides findings on the effect of gestational age on neonatal mortality. The Chi-square statistics was used to assess the association between gestational age and preterm mortality among babies. Most (60%) deaths associated with preterm births occurred from 28 to 31 weeks, with 27.9% deaths occurring less than 28 weeks and the least occurring among preterm babies born at 32 to 36 weeks. The Chi-square statistics shows that gestational age of preterm babies had significant association with mortality of preterm babies ( $X^2= 113.856, p < 0.001$ ). This indicates that preterm babies who are born earlier have significantly less chance of survival compared to those born later. Detail analysis is shown in table 4.6 below.

**Table 4.6: Association between gestational age and mortality of preterm babies**

Gestational age	Died n (%)	Alive n (%)	Chi-square test	P-values
<28 weeks	46 (27.9%)	9 (2.8%)	113.856	<0.001
28 - <32 weeks	99 (60%)	145 (44.3%)		
32 - <37 weeks	20 (12.1%)	173 (52.9%)		

The relationship between the actual gestational age and neonatal mortality among preterm babies was tested using the independent *t*-test. This is because the dependent variable (outcome) is a categorical variable with two levels (dead versus alive) and the independent variable (gestational age) is assumed to be measured on an interval scale. The results are presented in Table 4.7 below.

The result in Table 4.7 indicates a significant difference in preterm death and preterm survivors [ $t_{(495)} = 13.135$ ,  $p < 0.001$ ]. This means preterm babies who are born very preterm or extremely preterm are significantly vulnerable to death than late preterm babies.

**Table 4.7: Independent *t*- test of gestational age and neonatal mortality**

Treatment	N	Mean	SD	df	<i>T</i>	Sig.
Died	165	1.15333	.466765	495	13.135	<0.001
Alive	332	1.72681	.454156			

#### 4.5 Preterm neonatal mortality and mode of delivery of preterm babies

This sub-section provides findings on mode of delivery of preterm babies and preterm mortality. The Chi-square statistics was used to test the effect of mode of delivery on preterm mortality among babies. Majority (52.5%) of deaths associated with preterm births were born by SVD whilst majority (59.1%) of preterm babies who were alive were born by CS.

The Chi-square statistics shows that mode of delivery of preterm babies had significant effect on mortality of preterm babies ( $X^2= 5.766, p < 0.05$ ). This indicates that preterm babies who are born through SVD have a significantly higher chance of dying compared to those born by CS. Details of the analysis are shown in table 4.8 below.

**Table 4.8: Neonatal mortality**

Mode of Delivery	Died n (%)	Alive n (%)	Chi-square test	P-values
SVD	84 (52.5%)	128 (40.9%)	5.766	0.016
CS	76 (47.5%)	185 (59.1%)		



#### 4.6 Neonatal mortality and referral status of preterm babies

This sub-section provides findings on the effect of referral status on neonatal mortality. The Chi-square statistics was used to test association between referral status and preterm mortality among babies. As shown in table 4.9 below, 29.2% of the preterm babies who died were referred and 26.5% of the preterm babies who were alive were also referred. The Chi-square statistics shows that referral status of preterm babies had no significant effect on mortality of preterm babies ( $X^2= 0.413, p> 0.05$ ). This indicates that the act of referring the preterm baby for further management in another hospital did not predict that the child would survive. Detail analysis is shown in table 4.9 below.

**Table 4.9: Cross tabulation of referral status and mortality of preterm babies**

Gestational age	Died n (%)	Alive n (%)	Chi-square test	P-values
Referred	50 (29.2%)	90 (26.5%)	0.413	0.520
Not referred	121(70.8%)	249 (73.5%)		



## CHAPTER FIVE

### DISCUSSION

#### 5.0 Introduction

This chapter presents the discussion of the findings of the study. The socio-demographic background of the participants is first discussed and the rest of the chapter is divided into sections according to the objectives of the study.

#### 5.1 Demographic data

This study was carried out to determine the association between the preterm characteristics such as the birth weight, mode of delivery, gestational age, referral status and mortality among preterm babies. Pre-term births recorded in the year 2015 (59.2%) was higher than recorded preterm births in the year 2014. This might be related to the general increase in population. This may also be attributed to increase in risk factors for preterm delivery such as multiple pregnancies, underweight or overweight mother, psychological stress, diabetes, high blood pressure, tobacco smoking among pregnant women (WHO, 2014).

Males comprised 50.9% of the preterm birth records compared with females (49.1%). This confirms the findings of Zeitlin et al. (2002), where preterm birth was found to be more common in boys, with around 55% of all preterm births occurring.

In this current study, majority (47.8%), of the preterm births recorded were 28 to 31 weeks old indicating that majority of them were very preterm. This is likely to affect their survival rate since most neonates born very preterm require some form of extra supportive care in order to survive (Beck et al., 2010). By so doing, extra resources and expenses will have to be allocated to the care of these preterm babies in order to

safeguard their survival which creates more financial burden to the facility and the parents of these neonates.

Only 38.1% of the preterm births recorded were late preterm (32-37 weeks). This is a lower percentage compared to that of Chigbu et al. (2014) who found that 58.2% of the women in their study had late preterm deliveries in South-eastern Nigeria. This also contradicts Beck et al. (2010) that late preterm births account for about 84% of the total preterm births. Furthermore, this finding did not agree with that of Katz et al. (2013) in Africa, where the prevalence of preterm birth (<37 weeks) in their study datasets ranged from 2.7% to 28%.

Recorded weights of the preterm babies show that some of them were very small 0.4kg whilst some were generally big (3.4kg). With an average weight of 1.5kg, 51.4% of the recorded preterm babies weighted less than 1.5kg. This might be linked to the fact that 61.9% of them were born less than 32 weeks old and might not have had the required time to gain the required average normal weight before they were born. This percentage of LBW babies according to the UNICEF/WHO (2004), can be linked first to their preterm birth and secondly to intrauterine growth restriction (IUGR), or a combination of the two.

In addition, caesarian section was the most common mode of delivery (51.2%) of the preterm babies. This percentage is a little high compared to that of some African countries, including Ghana, and Latin America, where the reported proportion of preterm births born via initiation by their health providers ranged from around 20% in Sudan and Thailand (Alhaj et al., 2010) to nearly 40% in 51 facilities in Latin America and a teaching hospital in Ghana (Nkyekyer, 2006). Meaning that the threat of the pregnancy or any complication to the life of either the mother or the baby was detected

early and this might have informed the decision of the health workers to carry out a caesarian section. However, this may also be as a result of unintended preterm delivery, which occurs as a result of elective delivery of a baby that was mistaken to be at term due to errors in gestational age assessment (Mukhopadhaya & Arulkumaran, 2007).

The recorded average length of stay in the hospital after delivery was 8.5 days ranging from 1 to 45 days. This is a reflection of the varying degree of the state of health of both mothers and their babies. Beck et al. (2010) posited that preterm babies certain defects, such as have higher rates of cerebral palsy, sensory deficits, learning disabilities and respiratory illnesses. As such they might require longer care in the hospital compared to other children who were born at term. This explains why some may require longer stay in the hospital compared to others. However, majority (71.9%) of the preterm babies were taken care of in the facility without any referral, which is an indication of the readiness and improved capacity and skill of the staff of the hospital to handle such cases.

Although the average age of the mothers of the preterm babies was 31 years, the recorded age range was from as young as 15 year old mothers to older women at the age of 51 years. These extremes in the age range of mothers of preterm babies highlight the risk involved in having preterm births among very young teenage mothers and older women. This agrees with Beck et al. (2010) and Muglia and Katz (2010). According to Beck et al. (2010), women over 34 years of age have increased risk of preterm birth. Furthermore, Muglia and Katz (2010) also linked young or advanced maternal age with an increased risk of spontaneous preterm birth.

Preterm mortality was found to be significantly higher in the year 2015 than the year 2014 with 52.6% of the recorded deaths occurring in the year 2015. However, this

might be linked to the proportionate increase in related births of preterm babies in the facility from the year 2014 to 2015. This can also be linked to Blencowe et al. (2013) and Liu et al. (2012) who indicated a rising trend in the number of preterm deliveries.

One of the cardinal objectives of the study was to determine the percentage of neonatal mortality among preterm babies weighing less than 1.5kg. Findings showed that majority (85.5%) of the preterm babies who did not survive were less than 1.5kg in weight. This is consistent with Zeitlin et al. (2010) in Europe where low birth weight babies accounted for 79.5% of neonatal deaths.

Further analysis showed that preterm babies less than 1.5kg had significantly higher chance of dying compared to those who weighed 1.5kg or more. This confirms the finding of Hsu et al. (2015), that gestational age, among other factors, affects the survival rate in premature infants. Similarly, Wilcox and Skjaerven (1992) found that in Norway, relative mortality rates across gestational age groups were highest at the lowest birth weights. In general babies less than 1.5 kg might not have developed fully in utero before been born. As such certain vital organs such the brain, heart, lungs and the liver might not be fully developed. This is likely to have severely compromised the health status of these preterm babies hence reducing their chance of survival.

### **5.3 Preterm neonatal mortality and sex of preterm babies**

The effect of sex on preterm mortality among preterm babies was also assessed. However, males constituted 54.4% of the neonatal preterm mortality cases which was found to be insignificant compared to their female counterparts. Therefore being a male or female preterm baby could not predict one's chance of survival. Although this was not significant, it is consistent with the finding of Zeitlin et al. (2002), where preterm birth was concluded as more common in boys, with around 55% of all preterm births

occurring in males. According to the findings of Hsu et al. (2015) in Taiwan, gender, among other factors affects the survival rate in premature infants. Kent et al. (2012) also concluded that premature boys were associated with a higher risk of dying compared to girls born at a similar gestation.

#### **5.4 Neonatal mortality and gestational age of preterm babies**

In this current study, gestational age of preterm babies had significant effect on mortality of preterm babies with 60% of deaths associated with preterm births occurring from 28 to 31 weeks gestation and 27.9% occurring less than 28 weeks gestation. Therefore, preterm babies who were born very preterm or extremely preterm had significantly higher probability of dying compared to late preterm babies. Similarly, Marchant et al. (2012) found that in East African countries, majority of the mortality risk among preterm babies was due to babies born between 28-32 completed weeks of gestation.

#### **5.5 Preterm neonatal mortality and mode of delivery of preterm babies**

The study also assessed the effect of mode of delivery on mortality of preterm babies. The mode of delivery of preterm babies was found to have significant effect on mortality of preterm babies. Majority (52.5%) of deaths associated with preterm births were born by SVD compared to 59.1% of live babies who were born via CS. Unintended preterm birth also can occur with the elective delivery of a baby thought to be term due to errors in gestational age assessment (Mukhopadhaya & Arulkumaran, 2007).

Further analysis showed that preterm babies who were born through SVD had significantly higher death rate compared to those born by CS. This can be linked to the fact that preterm babies delivered by CS find themselves in a hospital setting with the

needed skilled health professionals who provide them with the required professional attention and care in the right setting. By so doing, they have a higher chance of survival due to the availability of skilled health professionals and the needed resources to care for them.

However, preterm births are usually unannounced, and the woman might not be fully prepared or ready for the baby. Preterm birth may be caused by spontaneous preterm birth, thus spontaneous onset of labour or following pre-labour premature rupture of membranes (Blencowe et al., 2013). Some of them might end up giving birth at home, outside home or in a car on their way to the hospital. Without the assistance of the requisite skilled health professionals and the required hygienic conditions in the hospital setting, such children might be exposed to a lot of risks such as trauma, head injury or infection. According to Lawn et al. (2005), being born preterm increases a baby's risk of dying especially from neonatal infections. In the absence of the needed resuscitation materials, some of these babies might suffer delays in resuscitation which likely to reduce their chance of survival. Furthermore, some of the contributory factors in spontaneous preterm birth vary by gestational age (Steer, 2005).



## CHAPTER SIX

### CONCLUSION AND RECOMMENDATIONS

#### 6.0 Introduction

This chapter serves as the concluding chapter for the study. It presents a summary of the entire study, discusses the implications of the study, limitations and recommendations made based on the findings.

#### 6.1 Summary

One of the major contributory factors in neonatal mortality and morbidity is preterm birth. Extremely preterm births, thus babies born before 28 weeks, require intensive care to survive. In the developed countries, they have a 90% chance of survival but only 10% are known to survive in less developed and low income countries. This retrospective descriptive study was carried out to assess the effect of birth weight, mode of delivery, gestational age, and referral status on mortality of preterm babies. Records of preterm babies admitted to the NICU of the 37 Military Hospital from the year 2014 to 2015 were used for the study. A check list was used to collect data. Data collected was on mothers' demographic characteristics (Chronological age and type of delivery), demographic data of preterm babies (Sex, gestational age), the preterm baby's weight at birth, length of stay in the hospital, referral status and outcome (dead or alive preterm baby). Demographic data were analysed descriptively using frequencies, means and standard deviations. Data was analysed using the Statistical Package for Social Sciences (V. 22.0) software. The Chi-square statistic was used to test association between gestational age, sex, mode of delivery and birth weight of preterm babies on preterm mortality.

Findings on the effect of weight of preterm babies on preterm mortality showed that preterm babies less than 1.5kg had significantly higher chance of dying compared to

those who weighed 1.5kg or more. Majority (85.5%) of the preterm babies less than 1.5kg died. There was no significant association between sex of preterm babies and mortality of preterm babies. Furthermore, gestational age and mode of delivery of preterm babies had significant effect on mortality of preterm babies. Very preterm or extremely preterm babies had significantly higher probability of dying compared to late preterm babies. Preterm babies born by SVD significantly higher probability of dying compared to those born by CS.

## **6.2 Implications of the study**

The findings of this study have implications for health care professionals and health care management in general. The implications are grouped into practice, policy making, research and education.

### **6.2.1 For practice**

In this current study, mode of delivery of preterm babies, weight of preterm babies less than 1.5kg and gestational age had significant effect on mortality of preterm babies. This implies that health workers handling preterm babies less need to pay particular attention to those with lighter weight and the very preterm ones by monitoring them frequently and providing them with the needed care to promote their chances of survival. Moreover, health workers attending to pregnant women need not delay if a pregnant woman has some indications for CS in order to prevent her from giving birth preterm via SVD. If possible, preterm babies need to be managed only by specially trained paediatric nurses and doctors in order to avoid any preventable deaths.

### **6.2.2 For policy formulation**

The study indicated an increase in preterm births from the year 2014 to 2015. Literature also shows that caring for preterm babies is intensive and expensive. However, the

national health insurance scheme in Ghana does not cover such services provided. This necessitates a review of the of the national health insurance scheme to cover the cost of care of preterm babies and their mothers in order to help boost their chance of survival.

### **6.2.3 For research**

This study revealed a high mortality rate (85.5%) among preterm babies less than 1.5kg. This implies that future research should focus on testing and assessing more effective and efficient ways that can be employed within the Ghanaian setting to promote the survival of preterm babies less than 1.5 kg.

### **6.2.4 For education**

The high rate of death among preterm babies imply that health training institutions, especially nursing and midwifery training institutions, should include substantial paediatric care courses into their curriculum because their products become the frontline managers of preterm babies and their mothers.

## **6.3 Limitations of the study**

Research studies in general, aim to produce findings that can be applied in other settings. However, no study can provide findings that are universally generalizable (Khan, 2012). There are 10 regions in Ghana. This study was conducted in one hospital in only one region in Ghana to determine the association between the preterm characteristics such as the birth weight, mode of delivery, gestational age, and the referral status of the babies and mortality among preterm babies. However, this may not necessarily represent the holistic situation in Ghana.

This was a retrospective study that utilized child health records of preterm babies from the year 2014 to 2015. However, adequate records of all data concerning preterm births

within the specified period cannot be guaranteed. However, the researcher tried as much as possible to assess all relevant and available data on preterm births within the facility.

#### **6.4 Conclusion**

Conclusively, findings from the study showed that majority of preterm babies less than 1.5 kg have higher chance of dying. Very preterm and extremely preterm babies were also found to have higher chance of dying than late preterm babies. These findings were consistent with previous literature. In addition, preterm babies born by SVD had higher chance of dying compared to those born by CS. There is therefore the need for concerted efforts to channel resources to improve upon maternal and child health care in the country.

#### **6.5 Recommendation**

Based on the findings of the study, the following recommendations were made;

1. Due to the fact that the 37 Military Hospital is a referral center, there is the need for the in-service training unit to carry out regular in-service training of staff, especially those at the paediatric and maternity units on maternal and child health care issues. This will help update them with current knowledge and skill in maternal and child health care in order to improve upon the quality of care given to pregnant women and preterm babies.
2. The Ghana Health Service in collaboration with midwives, community health nurses and media partners should intensify health campaigns on the need for all pregnant women to access antenatal health services for proper and skilled care throughout the period of pregnancy until delivery. This will help in the early detection and treatment of conditions that may cause preterm delivery.

3. The Ghana Health Service in collaboration with district health directors and the municipal chief executives in the various parts of the country should provide funds to support health facilities in the country with the necessary facilities and trained staff to provide focus antenatal care for pregnant women. This will help in the early detection and management of some maternal conditions that cause preterm labour and delivery.



## REFERENCES

- Alhaj, A. M., Radi, E. A., & Adam, I. (2010). Epidemiology of preterm birth in Omdurman Maternity hospital, Sudan. *Journal of Maternal-Foetal and Neonatal Medicine*, *23*, 131–134.
- Ananth, C. V., & Vintzileos, A. M. (2006). Epidemiology of preterm birth and its clinical subtypes. *Journal of Maternal-Foetal and Neonatal Medicine*, *19*, 773–782.
- Beck, S., Wojdyla, D., Say, L., Pilar Bertran, A., Meraldi, M., Harris Requejo, J., & Van Look, P. (2010). The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity. *Bulletin of the World Health Organization*, *88*(1), 31–38. <http://doi.org/10.2471/BLT.08.062554>
- Blencowe, H., Cousens, S., Chou, D., Oestergaard, M., Say, L., Moller, A.-B., & the Born Too Soon Preterm Birth Action Group (see acknowledgement for full list). (2013). Born Too Soon: The global epidemiology of 15 million preterm births. *Reproductive Health*, *10*(Suppl 1), S2. <http://doi.org/10.1186/1742-4755-10-S1-S2>
- Blencowe, H., Cousens, S., Oestergaard, M. Z., Chou, D., Moller, A.-B., Narwal, R., & Lawn, J. E. (2012). National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *The Lancet*, *379*(9832), 2162–2172. [http://doi.org/10.1016/S0140-6736\(12\)60820-4](http://doi.org/10.1016/S0140-6736(12)60820-4)
- Blondel, B., Macfarlane, A., Gissler, M., Breart, G., & Zeitlin, J. (2006). Preterm birth and multiple pregnancy in European countries participating in the PERISTAT project. *British Journal of Obstetrics and Gynaecology*, *113*, 528–535.
- Chigbu, B., Onwere, S., Aluka, C., Kamanu, C., Feyi-Waboso, P., & Okoro, O. (2014). The burden of preterm births in Aba, Southeastern Nigeria. *Journal of Medical Investigations and Practice*, *9*(2), 55–58.
- Escobar, G.J., Clark, R.H. & Greene, J.D. (2006). Short-term outcomes of infants born at 35 and 36 weeks gestation: we need to ask more questions. *Semin Perinatol.*, *30*(1):28-33.
- Felberbaum, R. E. (2007). Multiple pregnancies after assisted reproduction - international comparison. *Reprod Biomed Online*, *15*(3), 53–60.

- Kramer, M.S., Demissie, K., Yang, H., Platt, R.W., Sauvé, R. & Liston, R. (2000). The contribution of mild and moderate preterm birth to infant mortality. Foetal and Infant Health Study Group of the Canadian Perinatal Surveillance System. *JAMA.*, 16;284(7):843-9.
- McIntire, D.D., & Leveno, K.J. (2008). Neonatal mortality and morbidity rates in late preterm births compared with births at term. *Obstet Gynecol.*, 111(1):35-41. doi: 10.1097/01.AOG.0000297311.33046.73.
- Goldenberg, R. L., Culhane, J. F., Iams, J. D., & Romero, R. (2008). Epidemiology and causes of preterm birth. *Lancet (London, England)*, 371(9606), 75–84. [http://doi.org/10.1016/S0140-6736\(08\)60074-4](http://doi.org/10.1016/S0140-6736(08)60074-4)
- Gravett, M. G., Rubens, C. E., & Nunes, T. M. (2010). Global report on preterm birth and stillbirth (2 of 7): discovery science. *BMC Pregnancy Childbirth*, 10(1), 2.
- Gyamfi -Bannerman, C., Fuchs, K. M., Young, O. M., & Hoffman, M. K. (2011). Nonspontaneous late preterm birth: etiology and outcomes. *American Journal of Obstetrics and Gynaecology*, 205(456), 451–456.
- Hsu, S.-T., Hsieh, C.-J., Chen, H.-W., Jeng, S.-F., Wu, H.-C., Chen, M.-H., & Hsieh, W.-S. (2015). Nationwide Birth Weight and Gestational Age-specific Neonatal Mortality Rate in Taiwan. *Pediatrics & Neonatology*, 56(3), 149–158. <http://doi.org/10.1016/j.pedneo.2014.07.006>
- Jupp, V. (2006). *The SAGE Dictionary of Social Research Methods*. 1 Oliver's Yard, 55 City Road, London England EC1Y 1SP United Kingdom: SAGE Publications, Ltd. Retrieved from <http://srmo.sagepub.com/view/the-sage-dictionary-of-social-research-methods/SAGE.xml>
- Katz, J., Lee, A. C., Kozuki, N., Lawn, J. E., Cousens, S., Blencowe, H., & Black, R. E. (2013). Mortality risk in preterm and small-for-gestational-age infants in low-income and middle-income countries: a pooled country analysis. *The Lancet*, 382(9890), 417–425. [http://doi.org/10.1016/S0140-6736\(13\)60993-9](http://doi.org/10.1016/S0140-6736(13)60993-9)
- Kaushik, S. L., Parmar, V. R., Grover, N., & Kaushik, R. (1998). Neonatal mortality rate: relationship to birth weight and gestational age. *Indian Journal of Paediatrics*, 65(3), 429–433.
- Kent, A. L., Wright, I. M., & Abdel-Latif, M. E. (2012). Mortality and adverse neurologic outcomes are greater in preterm male infants. *Paediatrics*, 129, 124–131.

- Klebanoff, M. A., & Shiono, P. H. (1995). Top down, bottom up and inside out: reflections on preterm birth. *Paediatric and Perinatal Epidemiology*, 9, 125–129.
- Kramer, M. S., Papageorghiou, A., Culhane, J., Bhutta, Z., Goldenberg, R. L., Gravett, M., & Barros, F. (2012). Challenges in defining and classifying the preterm birth syndrome. *American Journal of Obstetrics and Gynaecology*, 206, 108–112.
- Lawn, J. E. (2006). Estimating the causes of 4 million neonatal deaths in the year 2000. *International Journal of Epidemiology*, 35(3), 706–718.  
<http://doi.org/10.1093/ije/dyl043>
- Lawn, J. E., Cousens, S. N., Darmstadt, G. L., Bhutta, Z. A., Martines, J., Paul, V., ... Fogstad, H. (2006). 1 year after The Lancet Neonatal Survival Series—was the call for action heard? *The Lancet*, 367(9521), 1541–1547.  
[http://doi.org/10.1016/S0140-6736\(06\)68587-5](http://doi.org/10.1016/S0140-6736(06)68587-5)
- Lawn, J. E., Cousens, S., Zupan, J., & Lancet Neonatal Survival Steering Team. (2005). 4 million neonatal deaths: when? Where? Why? *Lancet (London, England)*, 365(9462), 891–900. [http://doi.org/10.1016/S0140-6736\(05\)71048-5](http://doi.org/10.1016/S0140-6736(05)71048-5)
- Lawn, J. E., Kerber, K., Enweronu-Laryea, C., & Cousens, S. (2010). 3.6 Million Neonatal Deaths—What Is Progressing and What Is Not? *Seminars in Perinatology*, 34(6), 371–386. <http://doi.org/10.1053/j.semperi.2010.09.011>
- Lee, S. E., Romero, R., Park, C. W., Jun, J. K., & Yoon, B. H. (2008). The frequency and significance of intraamniotic inflammation in patients with cervical insufficiency. *American Journal of Obstetrics and Gynaecology*, 198(633), 631–638.
- Lindstrom, K., Lindblad, F., & Hjern, A. (2009). Psychiatric morbidity in adolescents and young adults born preterm: a Swedish national cohort study. *Paediatrics*, 123, 47-53.
- Liu, L., Johnson, H. L., Cousens, S., Perin, J., Scott, S., Lawn, J. E., & Black, R. E. (2012). Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *The Lancet*, 379(9832), 2151–2161. [http://doi.org/10.1016/S0140-6736\(12\)60560-1](http://doi.org/10.1016/S0140-6736(12)60560-1)
- Marchant, T., Willey, B., Katz, J., Clarke, S., Kariuki, S., Kuile, F. ter, & Armstrong Schellenberg, J. (2012). Neonatal Mortality Risk Associated with Preterm Birth in East Africa, Adjusted by Weight for Gestational Age: Individual Participant

- Level Meta-Analysis. *PLoS Medicine*, 9(8), e1001292.  
<http://doi.org/10.1371/journal.pmed.1001292>
- Marlow, N. (2012). Full term; an artificial concept. *Archives of Disease in Childhood. Fetal and Neonatal Edition*, 97, 158.
- Menon, R. (2008). Spontaneous preterm birth, a clinical dilemma: etiologic, pathophysiologic and genetic heterogeneities and racial disparity. *Acta Obstet Gynecol Scand*, 87, 590–600.
- Muglia, L. J., & Katz, M. (2010). The enigma of spontaneous preterm birth. *N Engl J Med*, 362(529-535).
- Mukhopadhyaya, M., & Arulkumaran, S. (2007). *Current Opinion in Obstetrics and Gynaecology*, 19, 113–119.
- Nkyekyer, K., Enweronu-Laryea, C., & Boafor, T. (2006). Singleton preterm births in Korle Bu Teaching Hospital, Accra, Ghana - origins and outcomes. *Ghana Medical Journal*, 40, 93–98.
- Onwuanaku, C. A., Okolo, S. N., Ige, K. O., Okpe, S. E., & Toma, B. O. (2011). The effects of birth weight and gender on neonatal mortality in north central Nigeria. *BMC Research Notes*, 4(1), 562. <http://doi.org/10.1186/1756-0500-4-562>
- Petrou, S. (2005). The economic consequences of preterm birth during the first 10 years of life. *BJOG: An International Journal of Obstetrics and Gynaecology*, 112 Suppl 1, 10–15. <http://doi.org/10.1111/j.1471-0528.2005.00577.x>
- Plunkett, J., & Muglia, L. . (2008). Genetic contributions to preterm birth: implications from epidemiological and genetic association studies. *Ann Med*, 40, 167–195.
- Pulver, L. S., Guest-Warnick, G., Stoddard, G. J., Byington, C. L., & Young, P. C. (2009). Weight for Gestational Age Affects the Mortality of Late Preterm Infants. *PEDIATRICS*, 123(6), e1072–e1077. <http://doi.org/10.1542/peds.2008-3288>
- Saigal, S. & Doyle, L.W. (2008). An overview of mortality and sequelae of preterm birth from infancy to adulthood. *Lancet*. 371 (9608), 261-9.
- Shah, R., Mullany, L.C., Darmstadt, G.L., Mannan, I., Rahman, S.M., Talukder, R.R. ... Baqui, A.H. (2014). Incidence and risk factors of preterm birth in a rural Bangladeshi cohort. *BMC Paediatrics*, 14, 112. doi: 10.1186/1471-2431-14-112
- Steer, P. (2005). The epidemiology of preterm labour. *British Journal of Obstetrics and Gynaecology*, 112(1), 1–3. <http://doi.org/10.2471/BLT.08.062554>

- Tomashek, K.M., Shapiro-Mendoza, C.K., Davidoff, M.J., & Petrini JR. (2007). Differences in mortality between late-preterm and term singleton infants in the United States, 1995-2002. *J Pediatr.* 151(5):450-6, 456.e1.
- Tucker, J., & McGuire, W. (2004). Epidemiology of preterm birth. *BMJ.* 329 (7467), 675-8.
- UNICEF/WHO. (2004). *Low birthweight: country, regional and global estimates.* New York.
- Vogel, J.P., Lee, A.C.C., & Souza, J.P. (2014). *BMC Pregnancy and Childbirth*, 14:56. doi: 10.1186/1471-2393-14-5
- Wang, M. L., Dorer, D. J., Fleming, M. P., & Catlin, E. A. (2004). Clinical Outcomes of Near-Term Infants. *PEDIATRICS*, 114(2), 372–376. <http://doi.org/10.1542/peds.114.2.372>
- WHO (2012). *Born Too Soon: the Global Action Report on Preterm Birth.* Geneva, Switzerland: World Health Organization.
- Wilcox, A. J., & Skjaerven, R. (1992). Birth weight and perinatal mortality: the effect of gestational age. *American Journal of Public Health*, 82(3), 378–382.
- Zeitlin, J., El Ayoubi, M., Jarreau, P. H., Draper, E. S., Blondel, B., Künzel, W., ... MOSAIC Research Group. (2010). Impact of foetal growth restriction on mortality and morbidity in a very preterm birth cohort. *Journal of Paediatrics*, 157(5), 733–739.
- Zeitlin, J., Saurel-Cubizolles, M. J., De Mouzon, J., Rivera, L., Ancel, P. Y., Blondel, B., & Kaminski, M. (2002). Foetal sex and preterm birth: are males at greater risk? *Hum Reprod*, 17, 2762–2768.

**APPENDICES**

**APPENDIX A: CHECK LIST**

**CHECKLIST FOR PRETERM CHARACTERISTICS ON NEONATAL MORTALITY AMONG PRETERM BABIES**

Name of facility: \_\_\_\_\_

Unit: \_\_\_\_\_

Nº	Sex		Gestational Age	Gestational Age Classification			Birth weight	Birth weight classification		Outcome		Referral status		Age of mother	Mode of delivery		
	M	F		<28 weeks	28 - <32 weeks	32 - <37 weeks		< 1.5kg	1.5kg above	Died	Alive	Referred	Not referred		SVD	CS	Other
01.																	
02.																	
03.																	
04.																	
05.																	
06.																	
07.																	
08.																	
09.																	
10.																	

**APPENDIX B: ETHICS APPROVAL LETTER – GHANA HEALTH SERVICE**

**GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE**

*In case of reply the  
number and date of this  
Letter should be quoted.*



Research & Development Division  
Ghana Health Service  
P. O. Box MB 190  
Accra  
Tel: +233-302-681109  
Fax + 233-302-685424  
Email: [Hannah.Frimpong@ghsmail.org](mailto:Hannah.Frimpong@ghsmail.org)

My Ref. GHS/RDD/ERC/Admin/App/16/02  
Your Ref. No.

3<sup>rd</sup> February, 2016

Florence Atiah Apegwine  
University of Ghana  
School of Public Health  
Legon, Accra

**ETHICS APPROVAL - ID NO: GHS-ERC: 18/12/15**

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol titled:

**“Contributions of Very Low Birth Weight to Pre-Term Neonatal Mortality at the 37 Military Hospital NICU”**

This approval requires that you submit yearly review of the protocol to the Committee and a final full review to the Ethics Review Committee (ERC) on completion of the study. The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Please note that any modification without ERC approval is rendered invalid.

You are also required to report all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.

You are requested to submit a final report on the study to assure the ERC that the project was implemented as per approved protocol. You are also to inform the ERC and your sponsor before any publication of the research findings.

Please note that this approval is given for a period of 12 months, beginning 3<sup>rd</sup> February, 2016 to 2<sup>nd</sup> February, 2017. However, you are required to request for renewal of your study if it lasts for more than 12 months.

Please always quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....  
DR. CYNTHIA BANNERMAN  
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

**APPENDIX C: ETHICS APPROVAL LETTER – 37 MILITARY HOSPITAL**



**Institutional Review Board**

37 Military Hospital

Neghelli Barracks

ACCRA

Tel: 0302 769667

Email: [irb37milhosp@hotmail.com](mailto:irb37milhosp@hotmail.com)

26 May 2016

Our Ref: IRB/37MH/129/16

**37MH-IRB IPN 072/2016**

**Florence Apegwine Atiah**

School of Public Health

University of Ghana

Dear Madam,

**ETHICS REVIEW COMMENTS – APPROVED SUBJECT TO ADDRESSING THE UNDERLISTED CONCERNS**

Proposal Title: – “Contribution Of Very Low Birth <sup>Weight</sup> ~~Rate~~ to Preterm Neonatal Mortality at 37 Military Hospital, Accra”

Your proposal submission to the committee on the above named study refers.


Following a review your proposal was given conditional approval subject to you addressing the following recommendations:

Srl	Recommendations
1	Seek permission from Hospital Authorities to get access to data
2	Ensure confidentiality
3*	Timelines for the study require revision

Kindly make the necessary amendments and submit one revised copy each of your required proposal documents to IRB (Postgraduate College Secretariat, 37 Military Hospital) along with a letter explaining the changes you have made to each document.

Thank you, for your application.

Yours faithfully,

  
**Dr Edward Asumanu**  
Deputy IRB Chairman

**APPENDIX D: INTRODUCTORY LETTER**



**UNIVERSITY OF GHANA**  
DEPARTMENT OF POPULATION, FAMILY  
AND REPRODUCTIVE HEALTH  
SCHOOL OF PUBLIC HEALTH

---

Ref. No.: .....

15<sup>th</sup> March, 2016

Institutional Review Board  
37 Military Hospital  
Neghelli Barracks  
Accra

Dear Sir/Madam,

**LETTER OF INTRODUCTION: FLORENCE APEGWINE ATIAH**

I write to introduce to you **Florence Apegwine Atiah**, a Master of Public Health student of School of Public Health, College of Health Sciences, University of Ghana, Legon.

As part of her academic requirement, she is undertaking a Research on the topic "**Contribution of Very Low Birth Weight to Pre-term Neonatal Mortality at the 37 Military Hospital NICU**" and would therefore need your assistance to collect data in your facility.

The search protocol has already been approved by the Ghana Health Service Ethical Review Board (attached).

Your cooperation with her would be very much appreciated.

Thank you.

Yours faithfully,

Prof. Augustine Ankomah  
Head of Department

---

COLLEGE OF HEALTH SCIENCES

P. O. Box LG 13, Legon, Accra, Ghana.  
• Telephone: +233 (0) 289 109 021/ 0289 109 022 • Email: [pfrh@ug.edu.gh](mailto:pfrh@ug.edu.gh) • Website: [www.publichealth.ug.edu.gh](http://www.publichealth.ug.edu.gh)