ENSIGN COLLEGE OF PUBLIC HEALTH, KPONG EASTERN REGION, GHANA

MATERNAL ANAEMIA IN PREGNANCY AND ITS EFFECTS ON NEWBORN OUTCOMES AMONG MOTHERS ATTENDING POSTNATAL CARE CLINIC AT GA SOUTH MUNICIPAL HOSPITAL, WEIJA, ACCRA GHANA

by

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A Thesis submitted to the Department of Community Health in the Faculty of Public Health in partial fulfilment of the requirements for the degree

MASTER OF PUBLIC HEALTH

JUNE 2017

DECLARATION AND CERTIFICATION

I, Josephine Agborson, declare that this submission is my own work towards the MPH and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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DEDICATION

I dedicate this work to my husband Nelson, children Elikplim, Eyiram and Esinam and siblings for their immense support, and to my late Dad, Mr. J.E.K. Armah who sacrificed for his children even in his old age.

ACKNOWLEDGEMENT

I thank the Almighty God for making for seeing me through this Master of Public Health Programme. My profound gratitude goes to my supervisor Dr. Juliana Yartey Enos for her encouragement and guidance without which this study would not have been a success.

My gratitude also goes to the Dr. Lawrence Tetteh, former Dean of the College, Lecturers and staff of the Faculty of Public Health, Ensign College of Public Health.

I acknowledge Dr. Bright Davies-Teye, Municipal Health Director of Ga South Municipality for his inspiration and support, as well as the support and cooperation of the management and staff of Ga South Municipal Hospital, Weija, Accra, especially staff of the Reproductive and Child Health Unit.

My heartfelt gratitude also goes to my family for their sacrifice, encouragement and support during the times that I had to be away from home pursuing this course. To my employers for partially sponsoring this course, to my senior colleagues in the office, especially Mr. Abraham Bangamsi Mahama and Dr. Peter Baffoe, who tirelessly put me on my toes and devoted time out of their very busy schedules to provide technical inputs and questioning the logic behind some of my writing. To all my course mates (Ensign family members), I am grateful to you all for your support. I will always cherish the times we spent together on campus.

DEFINITION OF TERMS

Term	Definition
Anaemia	A condition in which of haemoglobin in the blood, resulting in pallor and weariness. Haemoglobin level below 11g/dl
Antenatal	Before birth
Gestation	Pregnancy
Gestation at registration	Number of months a woman is pregnant at the time she makes her first visit to antenatal care clinic
Low birth weight	Baby born with weight below 2.5kg
Newborn outcomes	Birthweight and maturity of a newborn baby at delivery (i.e. whether the baby is born low birthweight, normal birthweight, preterm, or at term)
Pregnancy	The condition or period of being pregnant
Preterm	Preterm is defined as babies born alive before 37 weeks of pregnancy are completed.
Trimester	A period of three months, especially as a division of the duration of pregnancy
Tertiary	Education higher than senior high school

ABBREVIATIONS

ANC	Antenatal care
GHS	Ghana Health Service
Hb	Haemoglobin
LBW	Low birthweight
MOH	Ministry of Health
NHIA	National Health Insurance Authority
SDG	Sustainable Development Goal
WHA	World Health Assembly
WHO	World Health Organisation

ABSTRACT

Anaemia is a global public health problem that affects all populations both developing and developed countries with enormous effect on health outcomes.

The objectives of the study were to assess prevalence of anaemia at registration and 36 weeks of gestation; determine the socio-demographic factors that contribute to anaemia; determine association between number of antenatal visits in relation to newborn outcomes and anaemia status. A cross-sectional study design, convenience sampling method quantitative method. A structured questionnaire was administered to the mothers with their consent.

Three hundred and eighty-six (386) women attending postnatal care clinic participated in the study. Sixty-six percent (66.8%) of the women made their first antenatal visit during the first trimester of gestation. Descriptive statistics and bivariate analysis was used to test association between variables of interest. Anaemia prevalence at registration was 41.2%, 32% in the second trimester, and 3% in the third trimester. Prevalence at 36 weeks gestation was 48.7%. The effect of demographic and socio-economic factors like age, education level, employment status, occupation and birth spacing was statistically insignificant ($p<0.05$). Majority of the mothers made their first antenatal care visit during the first trimester of gestation (67%). Among those who made their first visit during the second trimester, 41.4% indicated absence of ill health as the reason for not attending, whilst 19.5% felt it was the right time. An association between the number of antenatal visits and birth weight was observed but was not statistically significant ($p=0.056$). Ninety-five percent (95%) of the mothers who made more than four antenatal visits before birth delivered babies with normal weight (>2.5kg). However, there was a significant association between the number of antenatal visits and maturity of the baby ($p=0.021$). Furthermore, an association between anaemia at 36 weeks of gestation and birthweight of the newborn was found to be statistically significant ($p=0.009$), but insignificant between anaemia and maturity of the baby ($p=0.114$).

Intensive education of pregnant women to seek care early and adherence to testing of haemoglobin levels schedules will be important in managing anaemia, and contribute to the reduction in the burden of anaemia in pregnancy. Further research to establish association between anaemia and newborn outcomes (birthweight and maturity) is highly recommended.

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CHAPTER ONE

INTRODUCTION

1.1 Background Information

Anaemia is a global public health problem that affects all populations in the world – both developing and developed countries, with major consequences for health, social and economic development. It occurs at all stages of life, from childhood to adulthood, young children and pregnant women being the most vulnerable (de Benoist *et al.*, 2008). There are several causes of anaemia. The most common cause worldwide is iron deficiency, which results from negative iron balance in the body over a long period of time as a result of inadequate consumption of iron rich foods, or inadequate absorption of iron in the body. Other causes are increased iron losses as a result of menstruation, intestinal worm infestation, malaria, parasitic infections. Others are nutritional deficiencies, haemoglobinopathies or sickle cell, HIV, and unhealthy lifestyles, chronic inflammations, congenital disorders, and other infections such as tuberculosis. An estimated 50% of anaemia in women worldwide is due to iron deficiency (Weise, 2012; WHO & Chan, 2011; Guilbert, 2003).

Anaemia reduces the work capacity of individuals and entire populations which has negative effects on productivity with serious economic consequences (Weise, 2012). In its most severe form, anaemia causes mild mental retardation in children (Guilbert, 2003), and in adults, it is associated with fatigue, weakness, dizziness and drowsiness. Young children, pregnant and postpartum women are the most severely affected because of the high iron requirements needed for child growth and pregnancy. Pregnant adolescents are particularly vulnerable to anaemia because they have dual iron requirements - for their own growth and the growth of the foetus, and are less likely to access antenatal care. Iron deficiency is the only nutrient deficiency which

is also significantly prevalent in virtually all industrialized nations and considered to be one of the most important contributing factors to the global burden of disease (Guilbert, 2003).

According to WHO, an estimated 47% of children under the age of five, 42% in pregnant women, and 30% in non-pregnant women aged 15–49 years globally are anaemic. Africa and Asia account for more than 85% of the anaemia burden in the high risk groups. In 2011, the prevalence of anaemia was estimated at 9% in developed countries, while in least developed countries the prevalence was 43% (Balarajan *et al.*, 2011). The World Health Organisation (WHO) classifies anaemia into normal when haemoglobin level is >11g/dl; mild when it is between 10 and 10.9g/dl; moderate when it is haemoglobin 7.0 to 9.9g/dl; and severe when haemoglobin level is below 7g/dl. The minimum acceptable haemoglobin level during pregnancy as defined by WHO criteria is 11g/dl, while that of non-pregnant women is 12g/dl (Weise, 2012).

Anaemia is a serious health concern for women because it can be an underlying cause of maternal and neonatal morbidity and mortality (Sarin *et al.*, 2008). Women often become anaemic during pregnancy due to increased demand for iron and other vitamins to meet the body's physiologic needs. When a pregnant woman has anaemia, its impact on the health of the foetus as well as that of the mother is significant. Pregnant women who are anaemic at the time of delivery are prone to postpartum haemorrhage, low birthweight deliveries, babies with impaired cognitive development and high risk of mortality, especially during the prenatal period (Noronha *et al.*, 2012). Foetuses are at risk of being born preterm, low birth weight, sick morbidity and perinatal mortality due to the impairment of oxygen delivery to the placenta and foetus (Idowu, et al., 2005). Evidence shows that being born small for gestational age is associated with mild to moderate low performance in school during childhood and adolescence,

and lower psychological and intellectual performance during their early years as young adults. It can also lead to developmental delays and disability. In its most severe form, it will cause mild mental retardation in children (Guilbert, 2003). Babies born preterm or low birthweight are predisposed to long-term negative health outcomes including increased risk non-communicable diseases such as hypertension, cardiovascular diseases chronic kidney disease, intellectual and developmental disabilities. In low and middle income countries maternal anaemia was observed to have contributed to 12% of low birth weight, 19% of preterm births, and 18% of perinatal mortality (Rahman *et al.*, 2016).

Due to its public health importance, policies and strategies have been developed at the global, regional and national levels to reduce the burden of anaemia. For example, in 2012, the World Health Assembly (WHA) endorsed a thirteen-year Comprehensive Implementation Plan (2012-2025) on Maternal, Infant and Young Child Nutrition which included six targets which highlighted critical public health concerns, ranked anaemia second after stunting (UNICEF, 2015). The prevention and timely management of anaemia is therefore essential to attain Sustainable Development Goal (SDG) 3 targets 3.1 and 3.2 on ensuring healthy lives and promoting wellbeing (Montresor et al., 2016).

In Ghana, the prevalence of anaemia among women aged 15-49 years increased from 45% in 2003 to 59% in 2008 (GSS et al., 2008). However, it decreased slightly to 42.4% in 2014 (GSS et al., 2015). Even though Ghana has made some gains in reversing this trend, it is still very high as four in every ten women aged 15-49 years have some form of anaemia, with 32% having mild, 9.8% having moderate and 0.4% having severe anaemia. It is even more worrying to know that prevalence among children under age five years are far higher than adults at 66% (GSS et al., 2015). Anaemia prevalence among women 15-49 years disaggregated by region in

Ghana also indicates that prevalence ranges between 36.4% and 47.5% in the Brong-Ahafo and Northern regions, respectively. Greater Accra region however ranks 5th with 42.4%, equal to the national average (GSS et al., 2015).

Antenatal care (ANC) is one of the main strategies in place to reduce and manage anaemia in pregnancy and prevent adverse outcomes. The strategy is more effective when pregnant women seek care early and continue until delivery. The World Health Organization (WHO) recommends that a woman without complications makes at least four antenatal care visits at specified intervals and encourages pregnant women to make the first visit during the first trimester (Lincetto *et al.*, 2013). The number of visits has now been revised to a minimum of 8 visits by WHO in 2016 (WHO, 2016). During antenatal care clinics, problems such as anaemia and infections during pregnancy are identified and treated. It is during these visits that screening for complications and advice on a range of issues, including birth preparedness, place of delivery, and referral of mothers with complications, are given. Focused antenatal care has been the recommended practice where the emphasis is on targeted and individualized care.

In Ghana, 64% of pregnant women make their antenatal first visit within four months of gestation while 27% make their first visit between four and five months of gestation (second trimester of pregnancy). Available statistics also show that 87.3% of pregnant women in Ghana make more than four visits before delivery (as per WHO recommendation). Even though 92% of pregnant women who attended antenatal clinics were put on iron supplements, anaemia prevalence is still high (42.2%). Additionally, only 39% of pregnant women reportedly took medicines for intestinal parasites (GSS et al., 2015).

1.2 Problem Statement

Anaemia during pregnancy is a major cause of morbidity and mortality of pregnant women in developing countries, and has both maternal and foetal consequences (Bekele et al., 2016; Rahman *et al.*, 2016; Imran, 2011). The high prevalence (42.4%) of anaemia among women of reproductive age in Ghana classification is severe and of public health importance according to WHO classification of anaemia at the population level. The Greater Accra region, the national capital, also registered anaemia prevalence of 42.4% (GSS et al., 2015).

1.3 Rationale for the Study

Due to the importance of maternal health during the period of pregnancy, antenatal services provided by Ghana Health Service is given due priority. A package of services including routine iron folic supplementation, treatment of malaria, parasitic infestations, health education and counseling are provided at every visit. Although several studies related to anaemia in pregnancy have been done in other parts of Ghana, there is no evidence of similar work done in the Ga South Municipality of Accra, in particular. As an exploratory study, this research would contribute to existing knowledge and set the pace for further research on anaemia among women attending antenatal at Ga South and its effect on newborn outcomes. Findings from this study will also be useful in strengthening the antenatal care programme in Ghana as a whole.

1.4 Hypothesis/Conceptual Framework

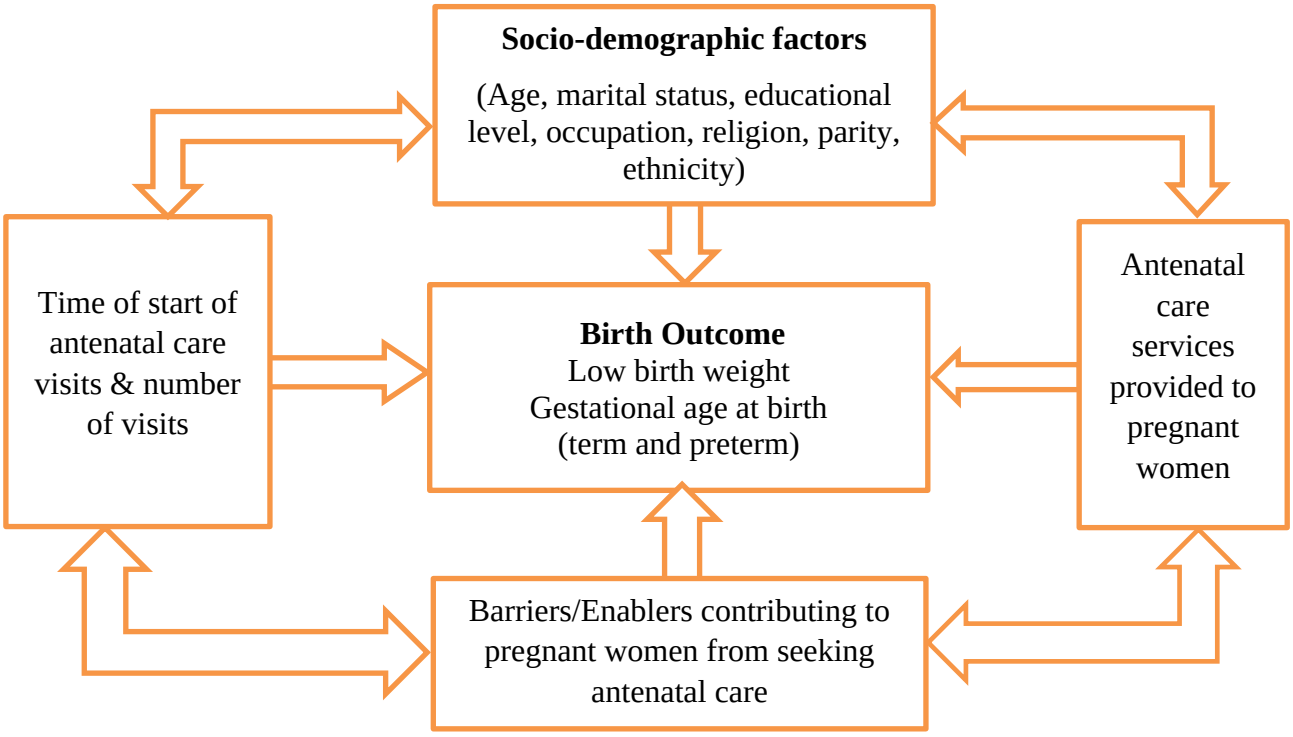
The use of health services by members of the society depend on factors such as their predisposition to the use of the kind of services provided, enablers or barriers they encounter in seeking health services, as well as their healthcare needs. The behaviour model of health services developed by Anderson (1995) provides an explanation on how various components influence the use of maternal health services. Overall, several studies have found that demographic characteristics such as level of education, ethnicity, age, marital status,

employment status, and parity contribute to influencing the decision by women to use maternal health services ((Dixon *et al.*, 2014; (Deo *et al.*, 2015; Gabrysch and Campbell, 2009). It can be argued that married women have to seek the consent and approval of their husbands in seeking healthcare services, compared to single or unmarried women who are more independent and easily make decisions on their own. It can further be argued that the age of a woman promotes the accumulation of knowledge on the use of maternal health services, such that traditional beliefs may be deeply rooted in elderly women as compared to younger women. This is because they may be exposed to modern medicine and hence acquire modern knowledge on health, which may influence younger women to seek modern maternal health services (Gabrysch and Campbell, 2009). Similarly, the high level of education attained by a woman may increase her understanding of health information and hence influence access to health services when compared with women with low levels of education (Deo *et al.*, 2015).

According to the framework put forward by Anderson (1995), previous delivery at home without complications, and some cultural perceptions may contribute to a woman attaching less importance to seeking antenatal care from health facilities. On the other hand, an understanding of the inherent dangers that may occur as a result of pregnancy may influence a woman to seek continuous antenatal care for all services provided, as well as going to deliver at the health facility in view of the quality of services she will receive from a skilled health professional. It can also be argued that a pregnant woman's predisposition to maternal health services requires personal and community enabling conditions in order to influence uptake or utilization of such services by the pregnant woman. For example, the availability of health personnel, the type of services provided such as antenatal care where haemoglobin levels and progress of pregnancy are monitored regularly, the nature of counselling provided to pregnant women, the equipment available to carry out relevant tests, the advice from the reference

network of the pregnant woman such as the mother in-law, and the attitude of health workers all contribute to the use of maternal health services by pregnant women and hence the outcome of pregnancy. Therefore, identifying anaemia status during pregnancy and its effect on birth outcomes requires data on geographical characteristics of pregnant women who attended antenatal care, their antenatal care seeking behaviour of pregnant women, the enablers and barriers to seeking antenatal care services, and the effects of all these and others on the outcome of the delivery, as explained by the behaviour model put forward by Andersen (1995).

Figure 1: Conceptual Framework for anaemia in pregnancy and birth outcomes



Adapted from: Andersen (1995)

1.5 Research questions

The study aimed to address the following research questions:

1. What are the factors contributing to anaemia in pregnancy?
2. What is the prevalence of anaemia in pregnancy at registration?
3. What is the prevalence of anaemia in pregnancy at third trimester?
4. What is the association between antenatal visits and anaemia in pregnancy?
5. What is the association between status and newborn outcomes?

1.6 General objective

The study assessed maternal anaemia in pregnancy and its effects on newborn outcomes among mothers attending postnatal care clinic at Ga South Municipal Hospital in Accra.

1.7 Specific objectives

Specifically, the study addressed the following objectives:

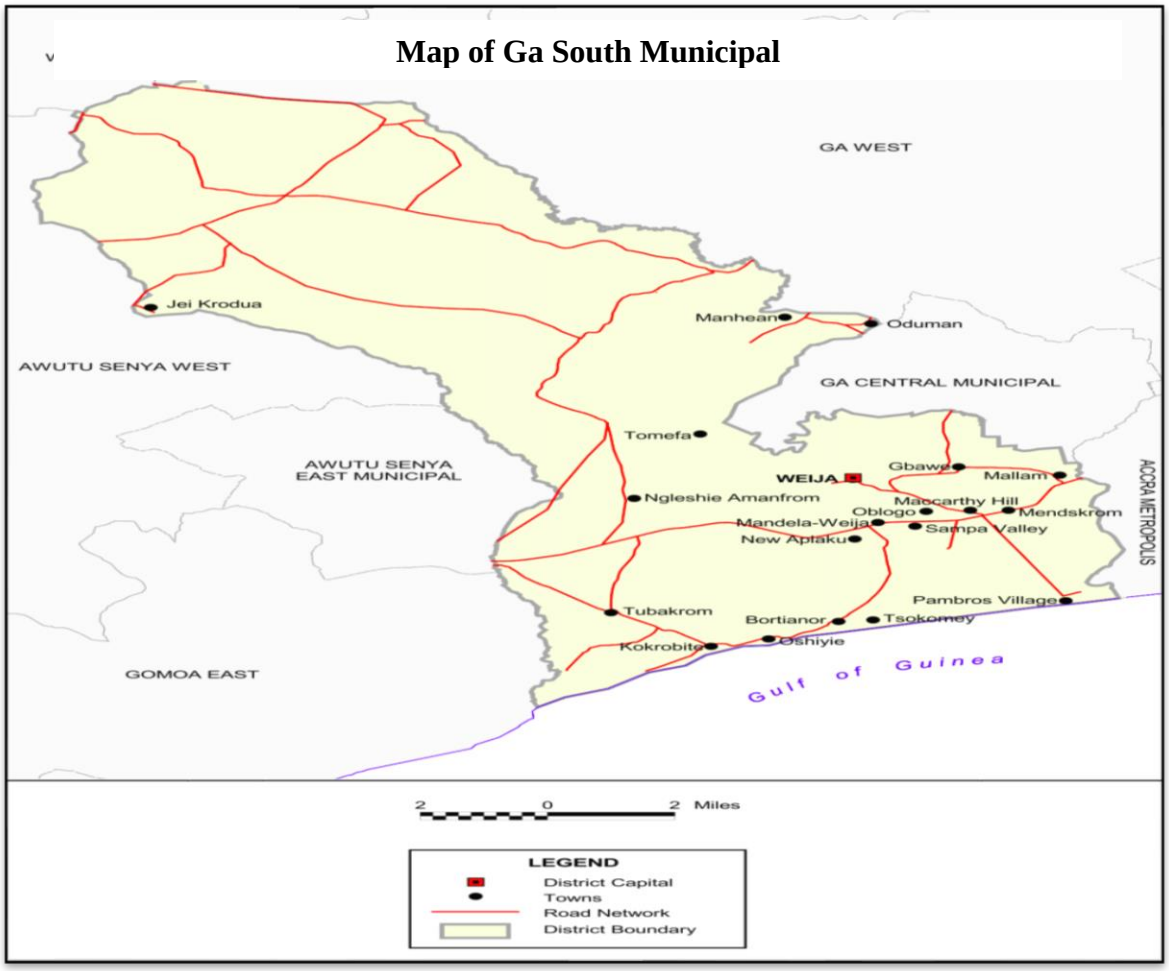
1. To determine the socio-economic and demographic factors that contribute to anaemia in pregnancy.
2. To assess the prevalence of anaemia in pregnancy at registration and third trimester.
3. To determine the association between antenatal visits and anaemia in pregnancy.
4. To determine the association between anaemia status and newborn outcomes.

1.8 Profile of Study Area

The study was carried out at the Reproductive and Child Health Unit of Ga South Municipal Hospital, Weija, Accra, a government hospital located in Ga South Municipality in Greater Accra Region. The hospital is a government owned district hospital which serves a population of over 500,000 in and around the catchment area with a mix of rural and urban settlers with an average of 273 deliveries per month. It offers a wide range of comprehensive health services

i.e. medical, surgical, dental, ear, nose and throat (ENT), dermatology, paediatric, obstetrics and gynaecology, basic emergency services and general medical care. Under the Reproductive and Child Health (RCH) Unit of the hospital are the maternity unit, labour and surgical wards. The hospital has no newborn unit, therefore all cases requiring neonatal intensive care are referred to the Korle Bu Teaching Hospital which is approximately 15km away. Average monthly ANC attendance is 458. Ga South Municipality is one of the 16 districts and municipals in the Greater Accra Region.

It lies at the South Western part of Accra and shares boundaries with the Accra Metropolitan Area to the South-East, Ga Central to South-East, Akwapim South to the North East, Ga West to the East, West Akim to the North, Awutu-Senya to the West, Awutu-Senya East to the South-East, Gomoa to the South-West and the Gulf of Guinea to the South.



Source: 2010 Population and Housing Census, Ga South Municipal

1.9 Scope of Study

This study was confined to the Reproductive and Child Health Unit of Ga South Municipal Hospital, Weija, with a focus on postnatal mothers who attended antenatal care and delivered at the same hospital. Variables used were socio-demographic information and obstetric history. Information was taken from the mother's health record booklet and delivery register when information needed was not well captured from the mother's record booklet.

1.10 Organisation of the Report

This dissertation is organized in five chapters. Chapter One gives introduction to the research, objectives and problem statement. Chapter Two reviews the literature relevant to the study. Chapter Three presents the methodology, methods of data collection and analysis, ethical considerations and limitations of this study. Chapter Four presents the analysed data collected from the field. Discussion of the findings of the study drawing on relevant literature to support arguments is also outlined in Chapter Five. Chapter Six sums up this research, and provides some recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides insights into other research works that have been done in relation to anaemia in pregnancy. It touches on all key elements of the issue under study, and provides an in-depth knowledge of what has been done on anaemia in pregnancy, as well as the existing gaps.

2.1 Prevalence of anaemia

Anaemia as a condition in which the number and size of red blood cells their oxygen carrying capacity is insufficient to meet the body's physiologic needs (WHO and Chan, 2011). People become anaemic when the body does not have enough store of iron to meet its iron requirements. Globally, 50% of all anaemia cases is as a result of iron deficiency due to specific physiologic needs which vary with a person's age, gender, residential elevation above sea level, smoking behaviour, and different stages of pregnancy (de Benoist *et al.*, 2008). Anaemia can be categorized into three—mild, moderate and severe anaemia. Mild anaemia, as per WHO definition, is when haemoglobin level is between the range of 10 and 10.9g/dl, moderate anaemia is between the range of 7 and 9.9g/dl, whilst severe anaemia is less than 7 g/dl for pregnant women. The range varies from men, non-pregnant women and children.

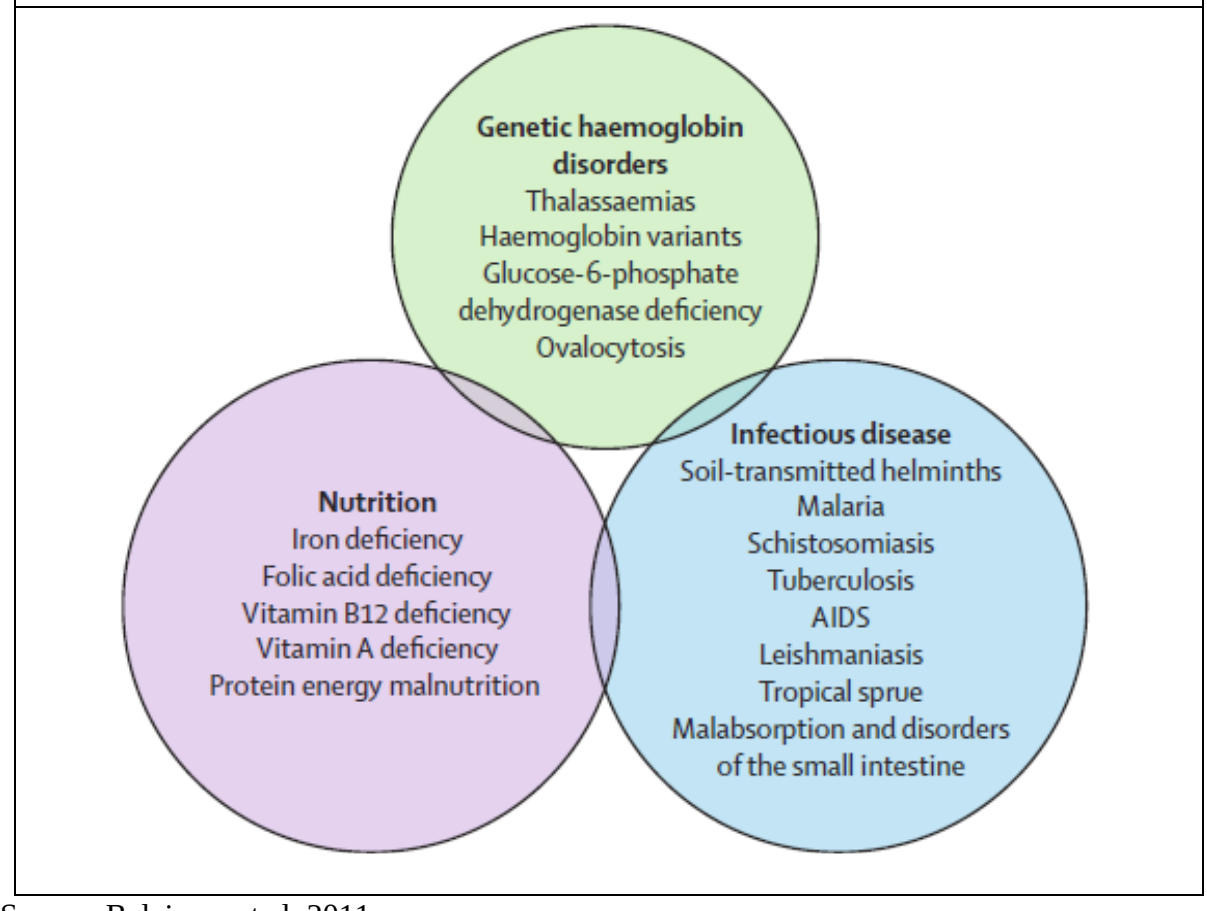
The World Health Organization (WHO) has also classified anaemia as a problem of public health significance at the population level, based on the prevalence of anaemia in a country. Therefore, in a country where prevalence of anaemia is 4.9% or less, it is considered as having no public health significance. However, prevalence of anaemia between 5.0% and 19.9% indicates a mild public health problem, whilst prevalence between 20% and 39.9% indicates a

moderate public health problem. If prevalence is 40% or more, it is considered as severe public health problem (de Benoist *et al.*, 2008).

2.2 Factors contributing to anaemia in pregnancy

Apart from the common causes of anaemia that range from nutritional deficiencies, parasitic diseases including malaria to congenital diseases including sickle cell and many more, there are underlying factors that also contribute to anaemia (Taner *et al.*, 2015). Balarajan (2011) has classified the causes of anaemia in countries with low or middle income into three main categories, as shown in Figure 2 below.

Figure 2 Causes of anaemia in countries with low or middle incomes



Source: Balajaran et al, 2011

2.3 Contribution of anaemia to maternal morbidity and mortality

An estimated 287,000 maternal deaths occurred worldwide in 2010, most of which were in low-income and middle income countries and were avoidable (WHO et al., 2012). Anaemia in pregnancy is common and linked to postpartum hemorrhage in terms of uterine atony. Studies show that the more severe the anaemia, the more likely the greater blood loss and adverse outcomes (Frass, 2015). Anaemia has been found to also contribute to maternal deaths caused by septicemia and eclampsia. A systematic review conducted by WHO between 2003 and 2012 revealed that among the causes of maternal deaths, postpartum haemorrhage accounted for 27·1% (Say *et al.*, 2014).

Maternal anaemia is a pregnancy complication that affects most women worldwide, and has been associated with a myriad of adverse perinatal and reproductive outcomes. It is estimated that 20% of maternal deaths in Africa can be attributed to anaemia. Estimates of maternal mortality resulting from anaemia range from 34/100,000 live births in Nigeria to as high as 194/100,000 in Pakistan. The risk of death is greatly increased with severe anaemia, but there is little evidence of increased risk associated with mild or moderate anaemia. Noronha (2012) reported that anaemic pregnant women are at greater risk of death during the perinatal period and that anaemia is a major contributory or sole cause of death in 20–40% of the 500,000 maternal deaths/year (Noronha *et al.*, 2012). A study from Indonesia illustrated a much higher risk of maternal deaths in anaemic women from rural areas than from urban areas, possibly as a result of problems with timely access to obstetric care. On the basis of the evidence available, it was assumed that the risk of maternal mortality is greatly increased with severe anaemia. The data available is said to only confirm an association and not a causal relationship (Frass, 2015). A cohort study conducted in Assam in India, also supports the finding that maternal anaemia was associated with adverse maternal and newborn outcomes (Nair *et al.*, 2016).

2.4 Prevalence of anaemia in pregnancy at registration

The World Health Organisation (WHO) estimates that more than 50% of pregnant women globally are anaemic. Women become anaemic due to the physiological changes that occur in their bodies, and the increased demand of nutrients that the body is unable to meet. The inability to meet the body's demands for all the nutrients, like iron and other nutrients gives rise to anaemia. A study done in two hospitals and a traditional birth home in Abeokuta, Nigeria revealed that anaemia among 365 pregnant women at registration (or first antenatal visit) was as high as 76.5% and highest among 15 to 19 age group, especially primigravidae (Idowu, 2005). A similar study done at Enugu in Nigeria also showed high prevalence of 40.4% among 530 women at antenatal unit of the University of Nigeria Teaching Hospital (Dim et al, 2007). This confirms anaemia prevalence in similar setting or geographic area.

2.5 Prevalence of anaemia in pregnancy at third trimester

Anaemia is more pronounced especially in pregnant women and children. Pregnant women by virtue of their condition are more vulnerable because the foetus requires more nutrients and iron stores from the mother. A study conducted at an antenatal clinic at Fayoum Teaching Hospital in Egypt showed prevalence 67% among 371 pregnant women in their third trimester. Multi parity, infrequent antenatal visits, irregular intake of iron supplements, low weekly intake of meat and fruits, and frequent daily tea consumption were identified as the main predictors. Another study conducted at a National Hospital in Tanzania recorded a prevalence of 68% among 1174 women admitted for delivery (Kidanto *et al.*, 2009). However, a study conducted in Mekelle, Addis Ababa revealed a rather lower prevalence of 19.7% among 632 pregnant women who were involved in the study (Abriha, 2015). This was attributed to dietary diversity and improved nutrition. Again, a retrospective case control study carried out in Turkey among 1221 pregnant women who went to deliver at the Tepecik Training and Research Hospital recorded prevalence of 41.6% (Taner *et al.*, 2015).

2.6 Association between antenatal visits and anaemia in pregnancy

WHO recommends that pregnant women make at least four visits to antenatal care clinics before delivery, and one of those visits should occur during the first trimester (Lincetto *et al.*, 2013). ANC provides a package of interventions that contributes to improving the survival and health of babies and mothers through the provision of evidence-based services that promote early detection and treatment/management of any pregnancy-related disorders that may threaten the pregnancy. Focused antenatal care accords the pregnant woman the opportunity of having more time with the health worker during ANC visits, and establishes a personal relationship.

Even though there is an argument that frequent antenatal visits may not necessarily translate into better improvement in nutrition and lifestyle of the pregnant woman, it is widely accepted that antenatal care presents opportunities to identify pregnancy risks, monitor and support the general health care of women who may be susceptible conditions including HIV, anaemia, malnutrition, tuberculosis, and malaria (Finlayson and Downe, 2013). Research has proven that pregnant women who make early visits to antenatal care clinics most often get positive birth outcomes better than those who report late during the second and third trimesters.

2.7 Association between anaemia during first trimester and new born outcomes

Research shows that the first three months of pregnancy is as crucial as the last three months to delivery. The growing foetus draws on the mother's store of iron and other nutrients. This becomes a problem when the mother is already anaemic. However, the iron requirement during this stage is lower than the other trimesters (Kumar *et al.*, 2013).

A retrospective cohort study conducted among 920 pregnant women showed no association between the first trimester anaemia and low birth weight or preterm baby. Most of these studies

have considered the haemoglobin levels in the third trimester or at delivery for comparison. Several studies have found very little effect of anaemia at first trimester having a significant impact on newborn weight and maturity compared to the other trimesters, except when anaemia is severe (Kumar *et al.*, 2013). However, a secondary data analysis of a prospective cohort study found that the probability of babies being born preterm when the mother is anaemic in early pregnancy is very high (Zhang *et al.*, 2009).

WHO recommends that pregnant women make antenatal care visits during the first trimester of pregnancy. This is very important for early detection and treatment of any disorders that may affect the pregnancy. Studies show that during the first trimester (the first three months of pregnancy), the rate of absorption of iron is lower and this is related to the reduction in iron requirement during this period compared to the non-pregnant. The growth rate of the foetus is very fast at the early stages implying that iron need is almost negligible in the first trimester. (Agyiri, 2011). However, it was emphasised that pregnant women who are severely anaemic i.e. <7g/dl are mostly at risk of delivering low birthweight or preterm babies. A cohort study contradicts the findings and concluded that the role of maternal anaemia in preterm birth remains poorly defined, and the association between anaemia and preterm birth clinical sub-types remain unclear.

2.8 Association between anaemia during second trimester and newborn outcomes

During the second trimester, the mother's haemoglobin level drops due to increase in plasma and viscosity of the blood. A study by Kumar et al (2013), intimated in his study that anaemia increases the risk of having preterm babies during the second and third trimesters. (Kumar *et al.*, 2013). It is a well-established fact that there is a physiological drop in haemoglobin (hb) in the mid trimester. This physiological drop is attributed to increase in plasma volume, and hence decrease in blood viscosity. This aids in better circulation in the placenta.

2.9 Association between anaemia at third trimester and newborn outcomes

There is marked demand of extra iron during pregnancy especially in the second half of pregnancy (Sabina et al., 2015). Irrespective of maternal iron stores, the foetus still obtains iron from the mother and transports them to the foetus. Gradually, however, such foetuses tend to have decreased iron stores due to depletion of maternal stores. Adverse perinatal outcomes in the form of pre-term and small-for-gestational-age babies and increased perinatal mortality rates have been observed in the neonates of anaemic mothers (Sabina et al.,2015). This could well suggest that haemoglobin level at third trimester is an important factor in determining birth weight.

It is well known that rapid growth of foetus occurs in the third trimester. Iron and other micronutrient rapidly increase in volume to meet the increasing needs of the growing foetus. Prevalence of anaemia is higher at this stage and are prone low birth weight and preterm deliveries. Except for the first trimester, anaemia in other trimesters has shown significantly increased incidence of preterm delivery.

This association appears strongest in the third trimester. There are many studies showing similar association. Kumar *et al*. and Monika *et al*. have found such an association only when mothers are severely anaemic, i.e. hb <7.0 g/dl. Another retrospective study found no association between first trimester anaemia and preterm delivery, similar to our study. In contrast, a secondary analysis of population-based prospective cohort study in 13 counties of East China found a significant association between anaemia and preterm at first trimester and weaker association at third trimester anaemia (Zhang *et al.,* 2009). Few other studies have also reported a similar trend (Kumar *et al.*, 2013). In his study, among 1,000 mothers recruited for delivery, Kumar et al found out that there was 6.5% increase in the incidence of low birth weight babies

and 11.5% increase in preterm deliveries in mothers who were anaemic in their third trimester. He concluded that the incidence of low birth weight babies was significantly higher in mothers who were anaemic in their third trimester. Preterm deliveries occurred more frequently in mothers who were anaemic in their second and third trimesters.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the various methods and tools deployed to collect data from respondents. It also describes the type of study, themes to be measured, sampling, analytical tools as well as ethical consideration.

3.1 Research methods and design

The researcher used a cross-sectional study design to achieve the study objectives. This design was appropriate because it provided a comparatively quicker and cheaper way to carry out the study, and also allowed the simultaneous collection of data on independent and outcome variables (Mann, 2003). Additionally, quantitative research methodology, unlike qualitative methodology, quantifies the problem using numerical data that can be transformed into useable statistics. However, unlike qualitative methodology, quantitative methodology fails to provide an in-depth description of the experiences of people (Wyse, 2011; Yauch and Steudel, 2003).

3.2 Data collection techniques and tools

A structured questionnaire was developed in English using *Microsoft Word.* The questionnaires were administered to the mothers who attended antenatal care and delivered at the same hospital to obtain information on socio-demographic characteristics such as employment status, and other background characteristics. Information on previous obstetric history, number of antenatal visits, and anaemia status during pregnancy were also extracted from the maternal health record booklets of respondents. Gestational age and level of haemoglobin at first antenatal visit and third trimester, gestational age at delivery, parity, number of antenatal visits, were also obtained from the mother's maternal health record booklets.

Prior to the start of each interview which was conducted in English and in one local language (Twi), the researcher provided participants with an Information Sheet (see Appendix A), and an Informed Consent Form (see Appendix B) to familiarize themselves with the study and its objectives, as well as to elicit their voluntary participation. The researcher further explained the contents of the Information Sheet and Informed Consent form to participants verbally, and answered all questions participants had in relation to the study.

3.3 Study population

The study population comprised postpartum women aged 15-49 years who attended antenatal clinic, and delivered at the Ga South Municipal Hospital, Weija, Accra between October 2016 and February 2017.

3.4 Study variables

3.4.1 Dependent variables

The dependent variables of the study were birthweight, maturity of pregnancy, anaemia status. The birthweights of newborns were categorised as low birth weight (below 2.5kg) and normal birthweight (2.5kg and above). Gestational age at birth was categorised as preterm (less than 37 completed weeks of gestation) or at term (37 weeks of gestation). Data on the dependent variables were obtained from the delivery register at the maternity unit of the Ga South Municipal Hospital, as well as from the information recorded in the Maternal Health Record booklets of participants.

3.4.2 Independent variables

The independent variables in the study were anaemia status at registration (first antenatal visit), anaemia status at first trimester, anaemia status at third trimester, anaemia status at 32 weeks, anaemia status at 36 weeks, number of ANC visits, gestational age at registration, gestational age at delivery, educational level, employment status, birth interval and age of study participants. Data on the independent variables were obtained from the questionnaire and from the information recorded in the Maternal Health Record booklets of participants.

3.5 Sampling

The researcher used convenience sampling method to select participants for the study. This sampling technique enabled the researcher to interview any mother who was available and willing to participate in the study, unlike the probability sampling technique which would have made it difficult for the researcher to obtain the sample size relevant to address the study objectives.

Raosoft software for sample size calculation was used to determine the sample size of 384 at 95% confidence interval and 5% margin of error. 2015 population estimate of 135,772 women of reproductive age (WIFA) obtained from the Ga South Municipality Health Directorate was used for the calculation.

3.6 Pre-testing

The structured questionnaire was pre-tested at Mamprobi Polyclinic in Accra, following approval by the Medical Director of the health facility. The reason for the choice of site for the pre-test was because Mamprobi Polyclinic has similar characteristics with the study site, Ga South Municipal Hospital, in terms to ANC attendance, deliveries and the population it serves. During the pre-test, ten (10) questionnaires were administered in English and one local

language (Twi) to eligible participants by asking them questions on the questionnaire and recording their responses, and also recording relevant data from participants' maternal health record books onto the relevant portions of the structured questionnaire. The findings of the pre-test helped the researcher to reformulate some of the questions to include appropriate responses, add a few more questions, and delete irrelevant or repetitive questions from the questionnaire. The pre-test exercise also helped the researcher to regulate the duration of the interviews conducted, and the flow of questions asked.

3.7 Data handling

Printed copies of the structured questionnaire were used to interview the participants and collect data collated from their antenatal record books. Socio-demographic and economic status, and other background characteristics, gestational age and level of haemoglobin at first antenatal visit and third trimester, gestational age at delivery, gravidity, number of antenatal care visits, were obtained from the mother's antenatal records with their consent. Two research assistants were trained to help administer the questionnaire.

The researcher ensured that the research assistants double-checked the responses that were captured on the questionnaire to ensure completeness before the study participant left. This was emphasised since incomplete data capture would have meant waiting for the participant's next visit in a month's time, or loss of data. The researcher also carried out daily data checks on all the data that were captured in each completed questionnaire to ensure all fields were properly filled. Through this daily exercise, the inconsistencies that were identified were resolved immediately by checking with the participant (respondent). In cases where the participant had left the hospital premises, those that could not be obtained from the hospital records (e.g. Hb test results at 32 and 36 weeks of gestation) were dropped. All completed questionnaires were coded, and the data entered into a data entry sheet designed using *Epi Info*

version 7.2.0.1. Following the completion of data entry, the data file was exported to *Microsoft Excel*, and the data cleaned by the researcher by ensuring all data was entered as in the completed questionnaires.

3.8 Data analysis

Data analysis was carried out using STATA version 13 (StataCorp LP). Data cleaning was done using Microsoft Excel 2013 and STATA to check data consistencies.

Tabulations were done to determine the overall distribution of information under the various exploratory variables. Pearson Chi-square (χ^2) test was used to determine any statistically significant associations between the independent variables and the outcome variables at 95% confidence interval. Logistic regression was used to explore the relationship between various demographic and social variables, as well as the relationship between haemoglobin levels at first and third trimester and newborn outcomes. Descriptive statistics was used to clearly describe the background characteristics such as age, gravidity, education, marital and employment status to determine the prevalence of anaemia. The data was presented using tables, graphs and charts.

3.9 Inclusion Criteria

Postpartum women who attended antenatal care and delivered at Ga South Municipal Hospital and had come for postnatal visits were included in the study. This ensured easy access to information needed from their maternal health record booklets, as they use them for postnatal care.

3.10 Exclusion Criteria

Mothers who did not attend antenatal care and did not deliver at the same hospital, as well as those who did not consent to be part of the study were excluded from the study.

3.11 Ethical consideration

Approval was sought from the Ethical Review Board of Ensign College of Public Health. Administrative clearance was sought from the Ga South Municipal Health Directorate. Only mothers who agreed to be part of the study and were willing to sign a consent form were enrolled in the study. Consent was sought from the mothers before questionnaire was administered by providing each with a hard paper copy of an Informed Consent form, and explaining verbally as well the content in English and Twi, depending on their preference. Respondents were given the option of either thumb printing or signing their signatures. Records were coded and clients' names excluded to ensure anonymity. All information collected were kept confidential and were used for purposes of the study only.

The District Director of Health Services of Ga South Municipality served as the main gatekeeper in this study. Gatekeepers provide the researcher the required assistance in obtaining access to study participants, their cooperation, as well as the required mutual trust between the researcher and study participants (Hatch, 2002). The Ga South Municipal Hospital Administrator also provided the researcher assistance in obtaining data from the relevant registers in the maternity unit of the health facility. In instances where there were challenges getting access due to congestion at the maternity ward due to emergency cases, the researcher stayed away stayed away till the situation normalised.

3.12 Limitations of study

Convenient sampling method used may cause bias as the study population was not sampled. Moreover, as the study was conducted in a health facility, it may not be representative of the population and therefore generalization may not be appropriate because of the iceberg phenomenon. Notwithstanding, it will give a good indication of the overall situation of anaemia during pregnancy and its effect on newborn outcomes.

3.13 Assumptions

To achieve the objectives of the study, the following assumptions were made:

- Study participants adhered to instructions given to them by professional health staff in the health facility to take their daily iron folic supplementation
- The researcher and data collection assistants carefully administered the questionnaire
- Respondents understood questions they were asked
- Prior to data entry, all responses provided by study participants were not altered in anyway
- All data obtained using the questionnaire was entered correctly
- Study participants provided truthful responses to questions asked, and not desirable responses.

Chapter Four presents and discusses results of the findings.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the presents the analysed data collected from the field.

4.1 Socio-demographic characteristics of study participants

The mean age of the respondents in this study was 29 years (± 5.2) with minimum age of 17 years and maximum age of 43 years. The majority (39.1%) were between the ages of 25-29 years, 74.6% were married and belonged to the Christian religion (89.6%). Of the 386 respondents, 6.7% had no formal education, 9.3% had primary education and the majority (44.3%) had middle or junior high school education with 39.6% attaining secondary and higher education.

Regarding occupation of respondents, the majority (39.1%) were traders. However, concerning the educational status of the spouses, the majority (36.8%) attained secondary education and were private sector employees (39.1%). The predominant ethnic group was Akan (63.7%) and almost all the respondents (99.7%) resided in peri-urban areas (Table 1).

Table 1: Socio-demographic characteristics of study participants

Variable	n=386	Percentage (%)
Age group		
15-19	9	2.3
20-24	62	16.1
25-29	151	39.1
30-34	91	23.6
35-39	63	16.3
40 and above	10	2.6
Marital status		
Single	52	13.5
Married	288	74.6
Cohabiting	46	11.9
Religion		
Christianity	346	89.6
Islam	40	10.4
Other	0	0.0

Variable	n=386	Percentage (%)
Educational level of respondent		
No education	26	6.7
Primary	36	9.3
Middle/Junior High School	171	44.3
Secondary	93	24.1
Tertiary	60	15.5
Educational level of husband/partner		
No education	36	9.3
Primary	7	1.8
Middle/Junior High School	103	26.7
Secondary	142	36.8
Tertiary	98	25.4
Ethnic group		
Ewe	50	13.0
Ga	34	8.8
Akan	246	63.7
Hausa	45	11.7
Others	11	2.8
Occupation of respondents		
Unemployed	61	15.8
Artisan	98	25.4
Trader	151	39.1
Private sector employee	45	11.7
Government sector employee	31	8.0
Occupation of husband/partner		
Unemployed	16	4.1
Artisan	94	24.4
Trader	81	21.0
Private sector employee	151	39.1
Government sector employee	44	11.4
Place of residence		
Urban	1	0.3
Peri-Urban	385	99.7

4.2 Factors associated with anaemia status at first ANC visit (registration)

The association between age, maternal education, employment status, birth spacing and the anaemia status of the respondent at ANC registration was explored in a bivariate analysis. The

result revealed that the association between the independent variables and the outcome variable i.e. anaemia status at ANC registration (1st visit), was not statistically significant (Table 2).

Table 2: Factors associated with anaemia status at first ANC visit (registration)

Variable	Anaemia status at registration			
	n	Anaemic n (%)	Normal n (%)	χ^2 (P-value)
Age				10.519 (0.062)
15-19	9	6 (66.7)	3 (33.3)	
20-24	62	28 (45.2)	34 (54.8)	
25-29	151	55 (36.4)	96 (63.6)	
30-34	91	37 (40.7)	54 (59.3)	
35-39	63	25 (39.7)	38 (60.3)	
40 and above	10	8 (80.0)	2 (20.0)	
Education				7.082 (0.132)
No education	26	17 (65.4)	9 (34.6)	
Primary	36	15 (41.7)	21 (58.3)	
Middle/Junior High Sch	171	67 (39.2)	104 (60.8)	
Secondary	93	38 (40.9)	55 (59.1)	
Tertiary	60	22 (36.7)	38 (63.3)	
Occupation				4.141 (0.387)
Unemployed	61	32 (52.5)	29 (47.5)	
Artisan	98	38 (38.8)	60 (61.2)	
Government employee	31	12 (38.7)	19 (61.3)	
Private sector employee	45	16 (35.5)	29 (64.5)	
Trader	151	61 (40.4)	90 (59.6)	
Birth spacing				1.982 (0.159)
Less than 2 years	64	22 (34.4)	42 (65.6)	
Two years and more	203	90 (44.3)	113 (55.7)	

4.3 Current obstetric history of respondents

The results in Table 2 show that all the respondents (100%) utilized antenatal care at least once during their recent pregnancy and most of the respondents initiated ANC in the first trimester (66.8%) and made four and more follow up visits before delivery (87.3%). The frequently mentioned reasons given by respondents for initiating ANC in the first trimester were: I felt it was the right time to attend (65.9%), I was sick and needed to see a doctor (30.6%) though

some also did not have any special reason for attending in the first trimester (3.9%) and others did not know why they started ANC care in the first trimester (2.7%). Of the 386 respondents, the majority (27.2%) had been pregnant twice, 24.9% had been pregnant four times and 23.1% had been pregnant for the first time. It was also revealed that the majority of the respondents (52.8%) had birth spacing of 2 years and more.

Table 3 : Current obstetric history of respondents

Variable	**n=386**	**%**
ANC use during recent pregnancy		
Yes	386	100
No	0	0
Gestation of pregnancy at ANC registration	**n= 386**	
First trimester	258	66.8
Second trimester	127	32.9
Third trimester	1	0.3
Reasons for attending ANC in the first trimester	**n=258**	
I felt it was the right time to attend	167	64.9
Was sick and needed to see a doctor	79	30.5
I did not have any special reason	7	2.9
Don't know	4	1.7
Gravidity of respondent		
1	89	23.1
2	105	27.2
3	91	23.6
4	96	24.9
5+	5	1.3
Number of Children under 5	**n=386**	
None	159	41.19
1	161	41.71
2	56	14.71
3	7	1.81
4	1	0.26
5 and more	2	0.52
Birth spacing	**n=386**	
First child	119	30.8
Less than 2 years	63	16.3
2 years and more	204	52.8
Number of ANC follow up visits made before delivery	**n=386**	
Less than 4 visits	49	12.7
Four and more visits	337	87.3

Variable	n=386	%
HB test done at first ANC registration	**n=386**	
Yes	386	100
No	0	0
Anaemia status at registration	**n=386**	
Anaemic	159	41.2
Normal	227	58.8
Anaemia status at 32 weeks	**n=300**	
Anaemic	142	47.3
Normal	158	52.7
Anaemia status at 36 weeks	**n=193**	
Anaemic	94	48.7
Normal	99	51.3
Mode of delivery	**n= 386**	
Normal	332	86
Caesarean section	54	14
Gestation of pregnancy at delivery	**n=386**	
Pre-term	142	36.8
Term	244	63.2
Birth weight of baby at delivery	**n=386**	
Low birth weight	21	5.4
Normal	365	94.6

4.4 Gestation of pregnancy at registration

Figure 3 shows the proportion of women who made their first visits at the various trimesters. There was a sharp decline in the number of women who made their first antenatal visit during the second and trimesters.

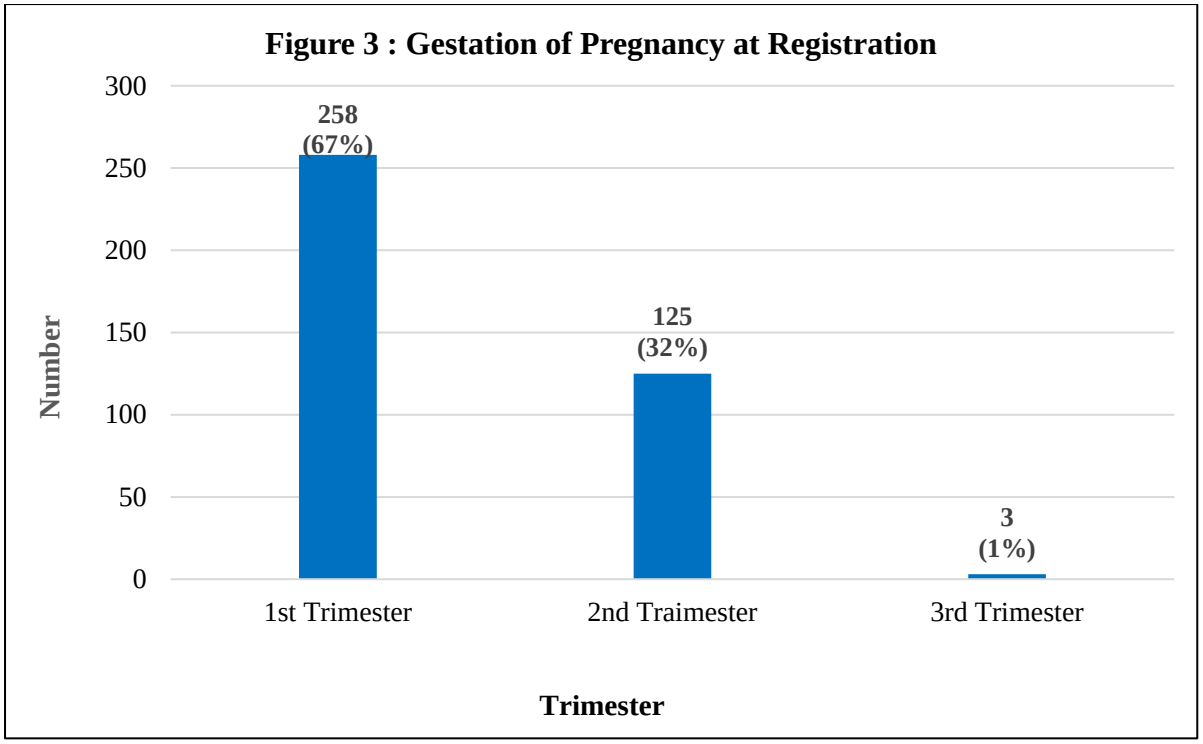
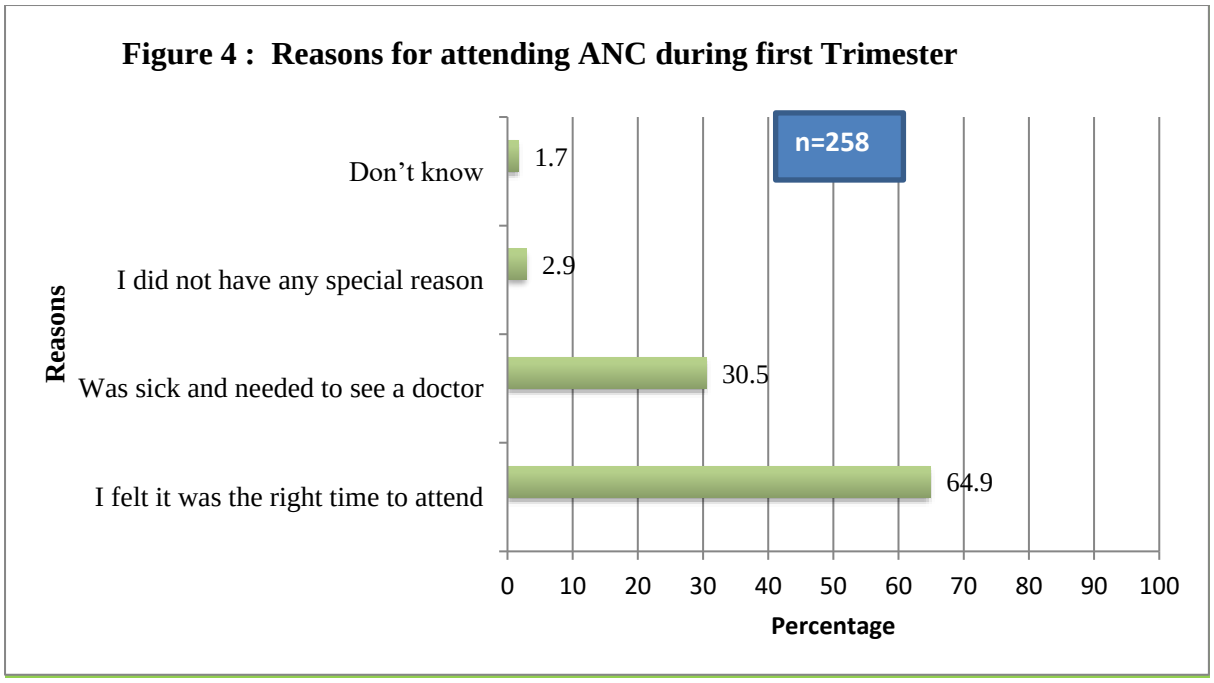


Figure 4 below shows the reasons given by those who made their first antenatal visit during the first trimester.



4.5 Prevalence of Anaemia at the various Trimesters

Anaemia status of the respondents was also assessed at registration, thirty-two weeks and at thirty-six weeks. The results show that of the 386 respondents who had their haemoglobin (hb) levels checked at registration, 159 (41.2%) were anaemic and 227 (58.8%) had normal haemoglobin levels. Of the respondents who had their hb checked at 32 weeks (300), 142 (47.4%) were anaemic and 94 (48.7%) of the 193 respondents whose HB was checked at 36 weeks were anaemic. Of the 386 respondents, the majority (64.2%) carried their pregnancy to term and 5.4% of the babies born were low birth weight. This is presented graphically in Figure 5.

Figure 5 : Prevalence of Anaemia at various Trimesters

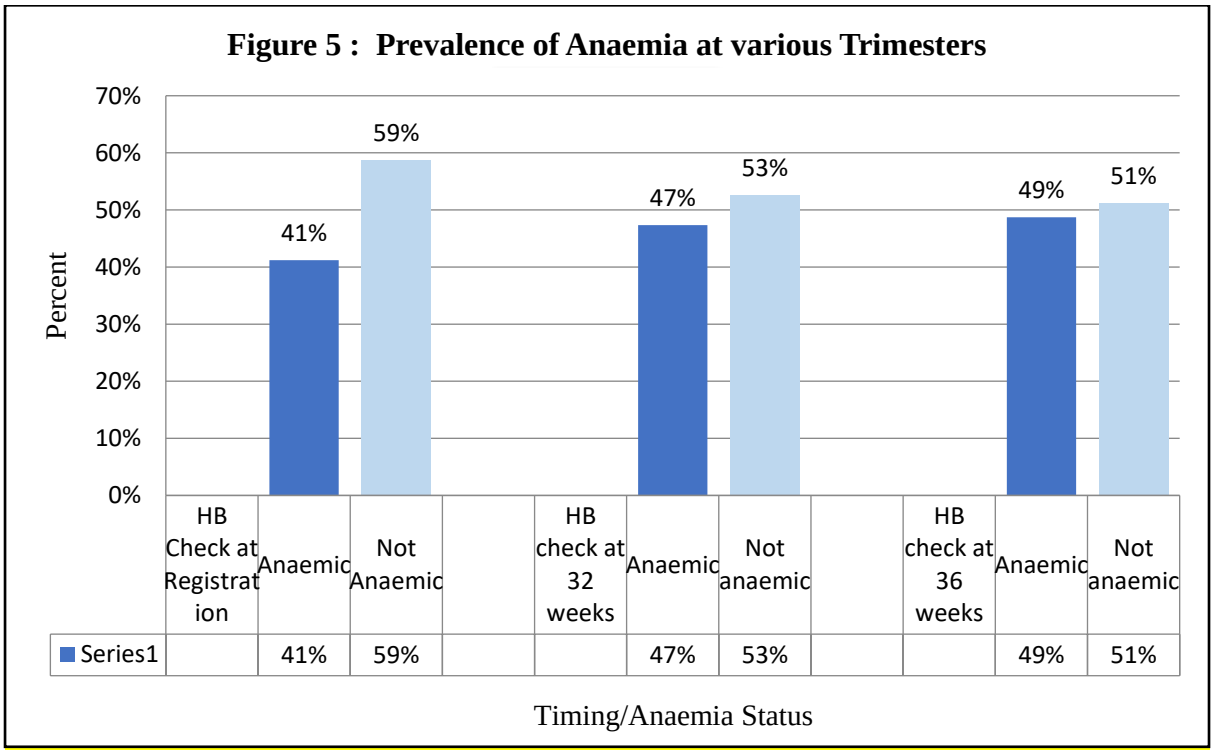
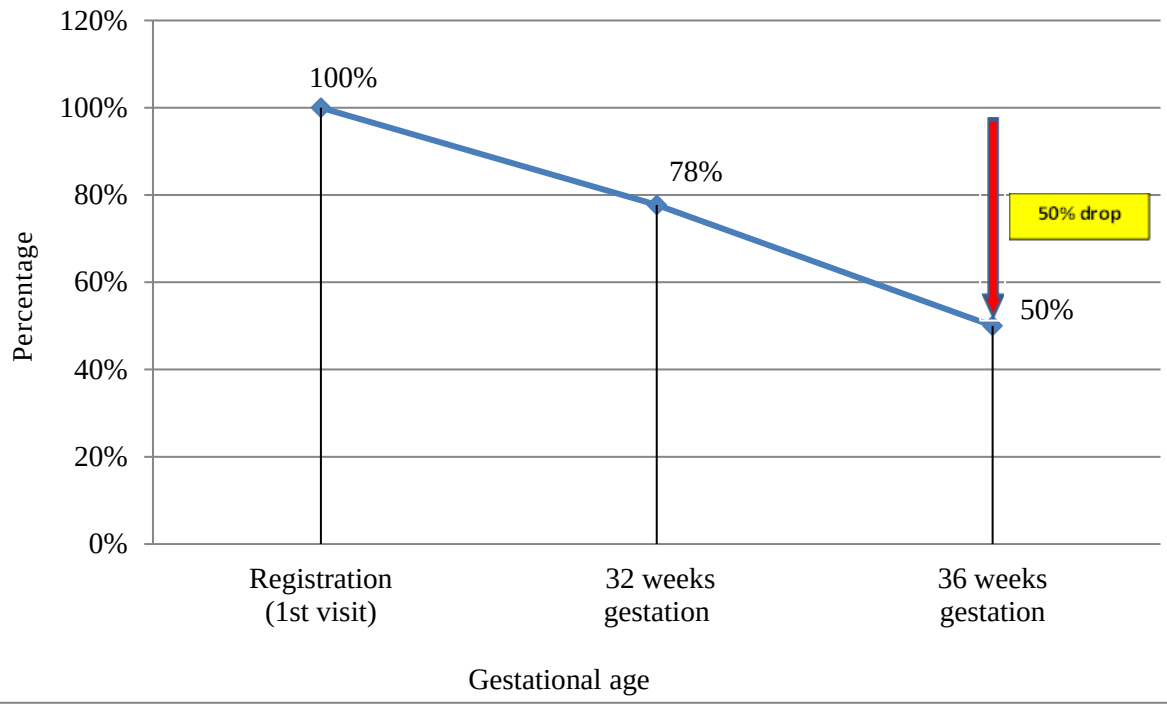


Figure 6 shows that the number of pregnant women that checked their haemoglobin levels at registration kept dwindling at 32 and 36 weeks of gestation. This could be attributed to the fact that haemoglobin test at registration is strictly enforced, but not at subsequent visits.

Figure 6: Haemoglobin testing at various trimesters



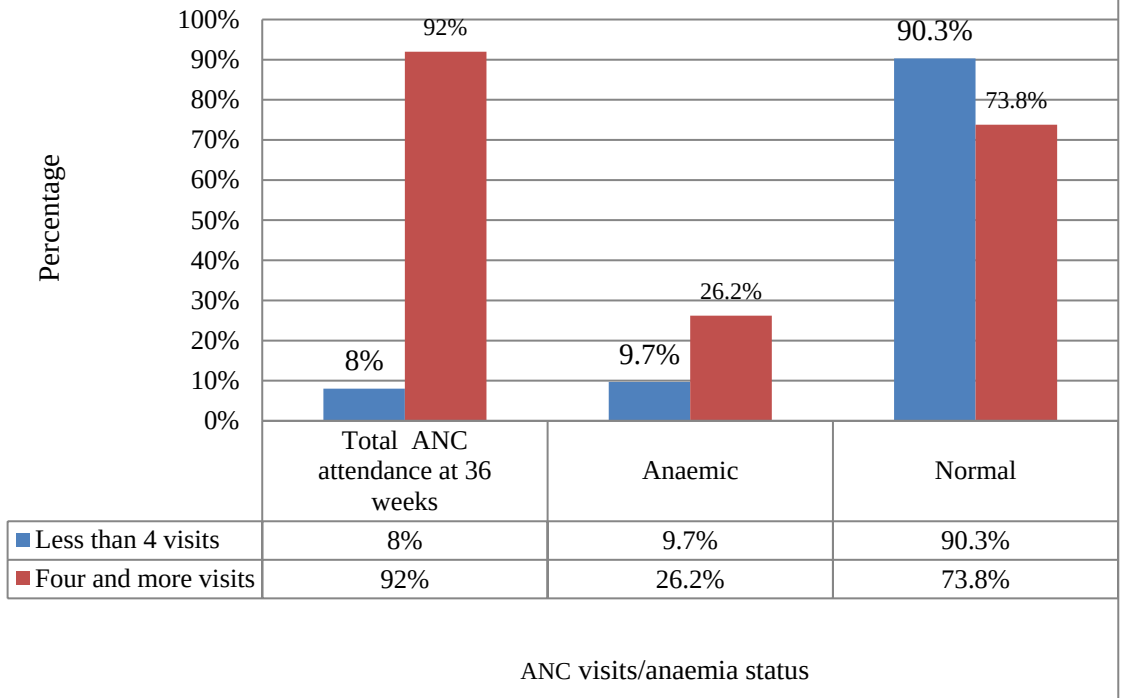
4.6 Factors associated with ANC visits and anaemia at delivery

Association between the number of antenatal visits and anaemia was explored using bivariate analysis (Table 4). It was observed that the proportion of women who made more than four ANC visits before delivery were higher 92% (n=355), however, out of this number, 26.2% (n=93) were anaemic at 36 weeks of gestation. Association between these variables were found to be statistically significant (p=0.041).

Table 4 : Factors associated with ANC visits and anaemia status

Variable	**ANC visits and anaemia status**			
	n	**Anaemic n (%)**	**Normal n (%)**	**χ^2 (P-value)**
Anaemia status at registration	386	159 (41.2)	227 (58.8)	
Anaemia status at 36 weeks	197	94 (48.7)	99 (51.3)	
Number of ANC follow up visits made before delivery	**n=386**			4.164 (0.041)
Less than 4 visits	31	3 (9.7)	28 (90.3)	
Four and more visits	355	93 (26.2)	262(73.8)	

Figure 7: Antenatal visits and anaemia status



4.7 Factors associated with the gestational age of pregnancy at delivery

In the bivariate analysis to determine factors associated with the gestational age of pregnancy at delivery, only the number of ANC follow up visits made before delivery showed a statistically significant association (p=0.021) with the gestational age of pregnancy at delivery (Table 5). As regards anaemia status at 36 weeks, it was observed that women who were had no anaemia had a higher proportion of preterm babies (31.3%) than those who were anaemic (21.3%). However, it was not statistically significant (p=0.114).

Table 5 : Factors associated with gestational age of pregnancy at delivery

Variable	Gestational age of pregnancy at delivery			
	n	Pre-term n (%)	Term n (%)	χ^2 (P-value)
Gestation of pregnancy at ANC registration (1st ANC visit)				1.584 (0.453)
First trimester	258	88 (34.1)	170 (65.9)	
Second trimester	125	50 (40.0)	75 (60.0)	
Third trimester	3	0 (0.0)	3(100.0)	
Number of ANC follow up visits made before delivery				5.346 (0.021)
Less than 4 visits	31	17 (54.8)	14 (45.2)	
Four and more visits	355	121 34.1)	234 (65.9)	
Anaemia status at registration				0.377 (0.539)
Anaemic	159	54 (34.0)	105 (66.0)	
Normal	227	84 (37.0)	143 (63.0)	
Anaemia status at 32 weeks				1.255 (0.263)
Anaemic	142	40 (28.2)	102 (71.8)	
Normal	158	54 (34.2)	104 (65.8)	
Anaemia status at 36 weeks				
Anaemic	94	20 (21.3)	74 (78.7)	2.498 (0.114)
Normal	99	31 (31.3)	68 (68.7)	

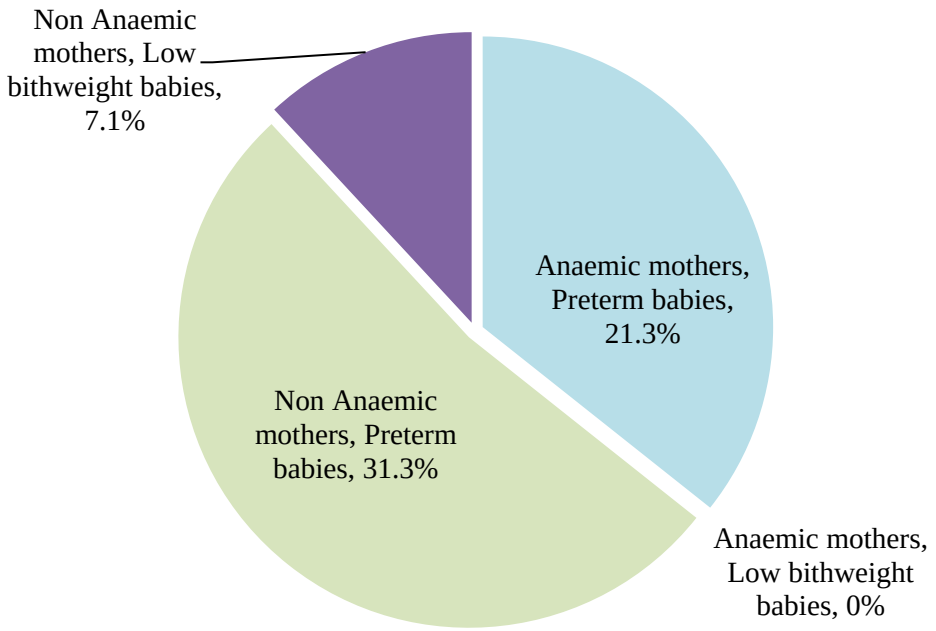
4.8 Factors associated with birth weight at delivery

The association between the independent variables: gestation of pregnancy at ANC registration, the number of ANC follow up visits made before delivery, the anaemia status at registration, the anaemia status at 32 weeks, the anaemia status at 36 weeks, and the gestational age of pregnancy at delivery and the dependent variable birth weight of baby at delivery was explored. The results show that anaemia status of the woman at 36 weeks and the gestational age of the pregnancy at delivery showed a significant association (p=009) with the weight of the baby at delivery. At 36 weeks, a higher proportion of low birthweight babies were born to mothers with no anaemia (7.1%) i.e. 7 out of 99 babies, whilst all 94 babies (100%) whose mothers were anaemic were born with normal weight (Table 6, Figure 8).

Table 6 : Factors associated with birth weight at delivery

Variable	Birth weight of baby at delivery			
	n	Low birth weight n (%)	Normal n (%)	χ^2 (P-value)
Gestation of pregnancy at ANC registration				
First trimester	258	17 (6.6)	241 (93.4)	22.015 (0.365)
Second trimester	127	4 (3.1)	123 (96.9)	
Third trimester	1	0 (0.0)	1 (100.0)	
Number of ANC follow up visits made before delivery				
Less than 4 visits	31	4 (12.9)	27 (87.1)	3.649 (0.056)
Four and more visits	355	17 (4.8)	338 (95.2)	
Anaemia status at registration				
Anaemic	159	9 (5.7)	150 (94.3)	0.025 (0.873)
Normal	227	12 (5.3)	215 (94.7)	
Anaemia status at 32 weeks				
Anaemic	142	4 (2.8)	138 (97.2)	0.551 (0.458)
Normal	158	7 (4.4)	151 (95.6)	
Anaemia status at 36 weeks				
Anaemic	94	0 (0.0)	94 (100.0)	6.897 (0.009)
Normal	99	7 (7.1)	92 (92.9)	
Gestation of pregnancy at delivery				
Pre-term	142	14 (9.9)	128 (90.1)	8.526 (0.004)
Term	244	7 (2.9)	237 (97.1)	

Figure 8: Association between anaemia at 36 weeks and newborn outcomes



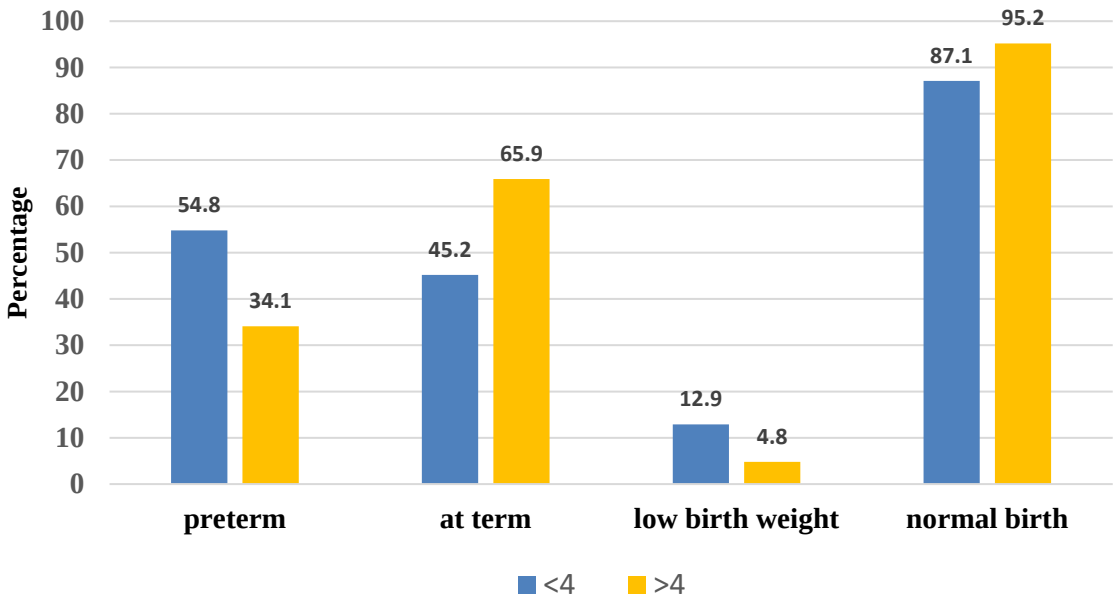
4.9 Predictors of gestational age of pregnancy at delivery

A logistic regression model was used to explore the strength of the association between the number of ANC follow up visits made before delivery that was significantly associated with the gestational age of pregnancy at delivery in the bivariate analysis. The results of the analysis show that the number of ANC visits made by a woman before delivery was a strong predictor of the gestational age of pregnancy before delivery (Table 7). Compared to women who made less than four ANC follow up visits, women who made four and more ANC follow up visits had more than two times the odds of carrying a pregnancy to term before delivery [(OR: 2.35, 95% CI: 1.12— 4.92, p=0.024)]

Table 7 : Predictors of gestational age of pregnancy at delivery

Variable	Gestational age of pregnancy at deliver	
	OR (95% CI)	p-value
Number of ANC follow up visits made before delivery		
Less than 4 visits	1	
Four and more visits	2.35 (1.12-4.92)	0.024

Figure 9 : Association between number of ANC visits and newborn outcomes



Number of ANC Visits vrs newborn weight and maturity

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter discusses the findings from the analysis of the data generated in this study. The discussion will contextualise the findings in relation to relevant literature presented in previous chapters within this dissertation, and assess the extent to which the research questions and objectives have been addressed.

5.1 Discussion

Findings from this study revealed that prevalence of anaemia among pregnant women in the study site was 41.2% at first ANC visit (or registration). This is an indication that anaemia is a major public health problem in this study area. This aligns with a similar study done in Enugu, Nigeria where prevalence at registration was 40.4% (Dim et al., 2007). It is also close to anaemia prevalence among women 15-49 years for Greater Accra Region (42.4%), as well as national average of 42.4% from the Ghana Demographic and Health Survey (GSS et al., 2015). However, in a similar study in Kenya, prevalence was 36.2% which is slightly lower than what was observed at this study site. Compared with anaemia prevalence in a different geographical location like Jerteh Terengganu, Malaysia, prevalence was much higher at 57.4% (Mohd et al., 2012). This confirms WHO's assertion that prevalence of anaemia varies by geography, altitude, and other factors.

It was again observed that prevalence of anaemia at 36 weeks of gestation was 47.8% which was higher than prevalence at registration of 41.2%. Going by WHO classification on public health significance at population level, anaemia status could be ranked as severe indicating that anaemia is a major public health problem in the study area.

With regards to socio-demographic factors contributing to anaemia in pregnancy, the results revealed that women aged 40 years and above had the highest level of anaemia 80% (n=10) followed by those in their teens, 15 and 19 years 66.7% (n=9). It was also noted that anaemia prevalence was highest among those with no education (65.4%) followed by those who had primary education (41.7%). The prevalence of anaemia among the unemployed was 52.5% (n=32) compared with those employed, 39.1% (n=127).

Association between antenatal visits and anaemia in pregnancy was observed to be significant (p=0.041). Those who made more than 4 visits rather recorded higher levels of anaemia (26.2%) than those who made less than four visits (9.7%).

It was noted that the proportion of women who had their hemoglobin levels tested at 36% weeks of gestation were 50% lower than those who tested at registration (100%). While some pregnant women might have defaulted their ANC visits at third trimester, the significant drop in haemoglobin testing in third trimester should be a public health concern for further investigation since it has implications for maternal and newborn outcomes.

Bivariate analysis was used to determine association between anaemia status and gestational or maturity of the newborn. It was observed that a lower proportion of the mothers who were anaemic at 36 weeks of gestation gave birth to preterm babies 21.3% (n=94), whilst 31.3% (n=99) of non-anaemic mothers gave birth to preterm babies. This does not corroborate with the fact that pregnant women who are anaemic at 36 weeks predisposes them to adverse birth outcomes.

In the same vein, bivariate analysis to test association between anaemia status at registration and birthweight showed that those with anaemia had 5.7% (n=9) of the babies born with low birthweight whilst those with no anaemia had 5.3% (n=12) born with low birth weight. Those with anaemia at 36 weeks had all the babies n=94 (100%) born normal weight at the time of

delivery, and those with no anaemia 7.1% (n=92) had low birth weight babies. This was found to be statistically significant (p=0.009). It is also in sharp contrast to the findings that anaemia at 36 weeks predisposes the newborn baby to low birthweight and prematurity (Kumar *et al.*, 2013; Sabina et al., 2015). Moreover, the numbers that tested for anaemia at 36 weeks were too small to show a true picture.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This chapter sums this research and provides some recommendations based on findings from the study and some recommendations.

6.1 Conclusions

Based on the objectives of this study, the methodology and the analysis that was done, the following conclusions were arrived at:

1. Prevalence of anaemia (41.2%) at ANC registration (mother's first antenatal visit) and at 36 weeks (47.8%) were very high and could be classified as severe by WHO classification of anaemia at the population level.
2. Sixty-seven percent (67%) of pregnant women make their first antenatal visit during the first trimester of pregnancy. This is positive as it is slightly higher than the national average of 64%. However, three (3) out of 10 pregnant women still report late for ANC.
3. Mothers with no formal education had a higher risk of being anaemic than those who had formal education.
4. Mothers who made more than four ANC visits before delivery were 2 times more likely to carry their pregnancy to term compared to those who made less than four visits.
5. Anaemia at 36 weeks was found to have a negative effect on birthweight among mothers who had no anaemia than anaemic mothers. This was found to be statistically significant (p=0.009). The same trend was seen among mothers who had no anaemia at registration and 32 weeks gestation. However, it was not significant (p-value=0.873 and p-value=0458), respectively.

6.2 Recommendations

Based on the findings outlined in the previous chapter, the following recommendations are made:

1. Ga South Municipal Health Directorate and hospital authorities in collaboration with civil society organisations in the municipality should identify strategies that will improve uptake of ANC services during the first trimester of pregnancy.
2. Hospital authorities with support from Ga South Municipal Health Directorate and Ghana Health Service should ensure adherence to the practice of haemoglobin testing at 32 and 36 weeks of gestation to enable them effectively manage anaemic conditions before delivery.
3. The Ministry of Health, Ghana Health Service and National Health Insurance Authority should make haemoglobin testing a priority in the free maternal health care package.
4. Further studies by Ga South Municipal Health Directorate or other researchers should be carried out:
   - to unravel the reasons behind late reporting at ANC, and
   - to generate more evidence to confirm the findings on the effects of anaemia on newborn outcomes in the Ga South Municipality in order to inform policy and practice.

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APPENDICES

APPENDIX A

Participant Information Sheet

Maternal anaemia during pregnancy and its effects on newborn outcomes among mothers attending Postnatal Care Clinic at the Ga South Municipal Hospital, Accra

My name is Josephine Agborson. I am a Master of Public Health student at the Ensign College of Public Health, Kpong in Eastern Region of Ghana.

I am currently working on a research on **Maternal anaemia during pregnancy and its effects on newborn outcomes among mothers attending Postnatal Care Clinic at the Ga South Municipal Hospital.** The purpose of the study is to find out how anaemia among pregnant women affects their newborn babies.

You have been selected as a participant because you happen to be one of the women who attended antenatal clinic and had your baby in this same hospital between November 2016 and January 2017. If you agree to be part of the study, I will ask you some questions for you to respond to, take some information about you and your baby from your ANC card and Child Health Record Booklet. Overall, *it* will take about 30 minutes to complete the exercise.

Participation in this study is purely on a voluntary basis, and hence you do not have to take part if you do not wish to. Also, there are no monetary benefits to agreeing to be part of this study. However, should you decide to be involved I think that the information you give will be of great value and could valuable information to the Ghana Health Service to help women stay healthy during pregnancy and deliver healthy babies.

Any information regarding your personal identity will be kept strictly anonymous and confidential. The records of the study will be kept strictly confidential and will be destroyed when the study is fully completed. The only time confidentiality might be broken is if you state that you want to harm yourself or others, then I will have an obligation to inform the relevant authorities.

Thank you for reading this information sheet. I hope you will take part in the study and look forward to meeting you.

If you have any further questions about the study, at any time feel free to contact me on 0264484295 or email akuakakra@gmail.com.

Alternatively, you can contact my research supervisor via email at email jenos@ensign.edu.gh

APPENDIX B

Informed Consent Form

Maternal anaemia during pregnancy and its effects on newborn outcomes among mothers attending Postnatal Care Clinic at the Ga South Municipal Hospital

CONSENT	Please tick (✓)
I confirm that I have read and understood the participant Information Sheet for the study and understand what is expected of me.	Yes □ No□
I understand that I am making a voluntary decision to participate in this study	Yes □ No□
I understand that I am free to withdraw from the study at any time and I am free to withdraw anything I say up to one week from the date of my interview	Yes □ No□
I agree that any information I will provide including the use of my name will be kept confidential	Yes □ No□
Any questions that I had about the study have been answered	Yes □ No□
I know Information about me will be kept safe by the researcher	Yes □ No□
I understand that the research might get published and I am fine with this	Yes □ No□

Your signature certifies that you have decided to participate, having read and understood the information presented. You will be given a copy of this consent form to keep.

_____ _____ _____

Name of Participant Signature/Thumbprint of Participant Date

I hereby confirm that the participant has decided to voluntarily participate in the study.

_____ _____ _____

Name of Researcher Signature of Researcher Date

APPENDIX C

QUESTIONNAIRE

Maternal anaemia during pregnancy and its effects on newborn outcomes among mothers attending Postnatal Care Clinic at the Ga South Municipal Hospital, Accra

Introduction

Hello. My name is _____. I am a Master of Public Health student at the Ensign College of Public Health, Kpong in Eastern Region of Ghana. I am conducting a research on maternal anaemia during pregnancy and its effects on newborn outcomes among mothers attending Postnatal Care Clinic at the Ga South Municipal Hospital. You have been selected to take part in this study. The questions usually take about 30 minutes. All of the answers you give will be confidential and will not be shared with anyone other than my supervisor. Your participation in this study is purely voluntary and you can decide not to participate at any point if you feel so. However, I hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time.

In case you need more information about the study, you may contact my Supervisor, Dr. Juliana Enos by email jenos@ensign.edu.gh

Do you have any questions? May I begin the interview now?

Signature of interviewer: _____ Date: _____

Respondent agrees to be interviewed . . . . . 1 (Continue)

Respondent **does not** agree to be interviewed . . . 2 (End)

Start time:
End time:

Serial # : _____

	Question	Response/Code	Skip
SECTION A : Demographic Information			
1.	How old are you?	<15 …… 1 15-19 …… 2 20-35 …… 3 36-45 …… 4 Above 45……..…… 5	
2.	What is your marital status?	Single …… 1 Married …… 2 Separated .....…… 3 Divorced ……..…… 4 Cohabiting …… 5 Other (specify)_____ _____6	
3.	How many children under five (5) years do you have?	None …… 1 One …… 2 Two …… 3	

	Question	Response/Code	Skip
		Three …… 4 Four …… 5 Above Four ...…… 6	
4.	Where do you live? *Write <u>Name of town/village/city below & circle appropriate classification of area</u>* _____	Rural …… 1 Urban …… 2 Peri-Urban…… 3	
5.	Have you ever attended school? *(Circle appropriate response)*	Yes …… 1 No …… 2 →	skip to Q7
6.	What is the highest level of school you attended?	Primary…… 1 Middle/JHS …… 2 SHS …… 3 Tertiary ……..,…… 4 Other (Please specify) ……... ……..,..6	
7.	Has child's father ever attended school?	Yes……. ……1 No…....……2 Don't know ……..…..3 →	skip to Q9
8.	What is the highest level of school child's father attended?	Primary…… 1 Middle/JHS …… 2 SHS …… 3 Tertiary ……..,…… 4 Don't know…….5	
9.	Which ethnic group do you belong to?	Ewe …… 1 Ga …… 2 Akan …… 3 Hausa …… 4 Other (specify)_____ _____5	
10.	What is your religion? _____	Christianity ……1 Islam ……...……2 Traditionalist/Spiritualist……3 No religion …… 4 Other (specify)_____ _____5	
11.	What work do you mainly do? _____	Artisan ……...……..……1 Trader ……...……2 Government employee ……..3 Private Sector ……4 Unemployed……...5 Other (please Specify)_____ _____6	

	Question	Response/Code	Skip
12.	What work does the child's father mainly do? _____	Artisan ……...1 Trader ……..2 Government employee …….……..,,3 Private Sector ……..4 Unemployed…….5 Other (please Specify)_____ _____6	
SECTION B : MOST RECENT OBSTETRIC HISTORY			
13.	What is the birth interval between last child and new baby?	<2yrs……. ……..…….. 1 2 years…….……..…..…… 2 >2yrs…....…….……..…… 3 First child (primiparous) …….……4	
14.	How many times have you been pregnant?	Once ……..…….…… 1 Twice ……..…….…… 2 Thrice ……..…….…… 3 Four times……..……..… 4 >4 times……..……..… 5	
15.	How old was your pregnancy when you first came for antenatal care?	One month ……..…… 1 Two months ……..…… 2 Three months ……..… 3 Four months ……..…… 4 Five months ……..…… 5 >5 months ……..…… 6	skip to Q17
16.	Why did you attend antenatal clinic during the first 3 months of pregnancy?	I thought that was the right time ……..…1 Fell sick and needed to see a doctor..…. 2 No specific reason…..……..…….. 3 Don't know…….....…4 Other (specify)_____ _____5	
17.	Why did you **not** attend antenatal clinic during the first 3 months of pregnancy?	I did not think it was necessary since I was not sick……....1 I thought that was the right time…….....2 I did not have money……...3 I did not have any serious problems..…..4 Felt sick and waited to be well …….....5 Fear of possible consequences that may follow making pregnancy public …….... 6 Misconceptions /cultural beliefs …..… 7 No reason…….. 8 Don't know……..…….... 9 Other (please specify)_____ _____10	
18.	How many times did you come for antenatal care during the last pregnancy?	Once ……..…… 1 Twice …… 2 3 times ……..…… 3	

	Question	Response/Code	Skip
		4 times ……. …… 4 5 times ……...…… 5 6 times ……...…… 6 7 times ……...…… 7 8 times ……...…… 8 >8times …… 9 Don't remember ....… ……. 10	
19.	During your last pregnancy with index child, were you given any medicine to take anytime you attended ANC?	Yes ……..…… 1 No ……..…… 2 Don't remember……..…… 3	skip to Q21
20.	If yes, what were you given?	Iron tablets ……..… 1 Sulfadoxine/Pyrimethamine (SP) …….. 2 Folic Acid tablets …….. 3 Albendazole ……..... 4 Calcium tablets ……..…….. 5 Vitamin C tablets ……6 Multvitamin ……..……...7 Other (please Specify)_____ _____8	
21.	If No, why were you not given?	Nurses said there was no medicine ……1 I did not have any money to buy……..2 My health insurance had expired ...……..3 Got tired of waiting ……4 Don't know ……..….5	
22.	Did you do blood test during your first antenatal visit?	Yes……...…….…… 1 No…….…….…...…….2 Don't remember…….…….…….....3	
Section C: Factors that contribute to anaemia in pregnancy			
23.	Have you ever heard of anaemia in pregnancy?	Yes ……..…… 1 No ……..…… 2 Don't know …….……3	skip to Q25
24.	Where did you get information about anaemia from?	Health worker…….…….…….. 1 Television …….…… 2 Radio ……..…….. 3 Other pregnant women …….…… 4 Other (specify)_____ _____5	
25.	Did you have anaemia when you were pregnant with index child?	Yes ……..……...1 No ……..……...…2 Don't know …….……..… 3	skip to Q28

	Question	Response/Code	Skip
26.	If yes, how did you know?	A health worker told me …….1 My neighbour told me ……..…….2 A family member told me ..……3 I was always feeling tired …….…….4 Other (please Specify)_____ _____5	
27.	What did you do when you got to know you had anaemia?	Went to buy blood tonic/iron tablets ..…1 Went to see a health worker …….……..2 Was given medication by a health worker…….……..…3 Bought herbal preparations …….....4 Did nothing …….……5 Other (specify)_____ _____6	
28.	Why do you think pregnant women get anaemia? (*Probe & circle all responses given)*	Not taking prescribed medicine……...1 Multiple pregnancies ……..…….……..2 Not sleeping under mosquito nets……...3 Not taking dewormer ……..……..4 Not eating nutritious foods …….…...5 Health facilities are too far away…….....6 Nurses do not have time to educate us…7 Foetus draws nutrients from mother to grow …… 8 Alcohol intake ……..……..9 Smoking ……..……10 Other (specify)_____ _____11	
SECTION D : INFORMATION ABOUT NEWBORN BABY			
29.	How old is your index child?	Day old …….……1 <1 week …….……2 <4 weeks …….……3 4-6 weeks ..…….…… ……..…….. 4 7-10 weeks .… …….…….…… ……..…5 11-14 weeks.…… …….…… ……6 Don't know …….…. 7	
30.	Is your baby a male or a female?	Male …….…….. 1 Female …….…….. 2	

	Question	Response/Code	Skip
Section E: REVIEW OF MOTHERS ANTENATAL CARD (Ask for mother's antenatal card & record information from card)			
	ANC Registration Number		
31.	Gestational age of baby at mother's first visit to antenatal clinic. **Please write the date as well**	1st trimester (0-3 months)… ……..…… 1 2nd trimester (4-6 months)… ……..…… 2 3rd trimester (7-9 months)… ……..…… 3	
32.	Mother's Haemoglobin (Hb) test result during **first antenatal visit (registration)**? *(Record actual number below, and circle classification)* _____g/dl	Normal >11g/dl ……..…… 1 Mild (10.0-10.9 g/dl) ……..……2 Moderate (7.0-9.9 g/dl) ……..…… 3 Severe (<7.0 g/dl) ……..……..…… 4	
33.	Mother's Haemoglobin (Hb) test result at **32 weeks of gestation**? *Record actual number below, and circle classification)* _____g/dl	Normal >11g/dl …… 1 Mild (10.0-10.9 g/dl) …… 2 Moderate (7.0-9.9 g/dl) ……..3 Severe (<7.0 g/dl) …… 4	
34.	Mother's Haemoglobin (Hb) test result at **36 weeks of gestation**? *Record actual number below, and circle classification)* _____g/dl	Normal >11g/dl ……..…… 1 Mild (10.0-10.9 g/dl) …… 2 Moderate (7.0-9.9 g/dl) …… 3 Severe (<7.0 g/dl) ……..…… 4	
35.	Medicines given during ANC visits	Iron tablets ……..… 1 Sulfadoxine/Pyrimethamine (SP) …….. 2 Folic Acid tablets …….. 3 Albendazole ……..... 4 Calcium tablets ……..…….. 5 Vitamin C tablets ……6 Multvitamin ……..……...7 Other (please Specify)_____ _____8	
36.	Number of times mother went for antenatal care during the last pregnancy	Once ……..…… 1 Twice …… 2 3 times ……..…… 3 4 times ……. …… 4 5 times ……...…… 5 6 times ……...…… 6	

		7 times ……...…… 7 8 times ……...…… 8 >8 times …… ...… …… 9	
37.	Gestational age of baby at delivery. **Please write date**	1st trimester (0-3 months)… ..... 1 2nd trimester (4-6 months)… ..... 2 3rd trimester (7-9 months)… 3	
38.	How was index child delivered?	Spontaneous Vaginal Delivery…..…… 1 Caesarean Section …….…… 2 Forceps…….…… 3 Vacuum …….…… 4	
39.	Conditions that may contribute to anaemia in pregnancy	G6PD positive (reactive) …….…..…1 Sickle cell anaemia…….…..…….2 Number 27 …….……..…….3 Other (please Specify)_____ _____4	
Section F: REVIEW OF BABY'S WEIGHING CARD (Ask for baby's weighing card & record information from card)			
40.	Age of index child?	Day old …….……1 <1 week …….……2 <4 weeks …….……3 4-6 weeks ..…….…… …….…….. 4 7-10 weeks …. …….…….…… …….…5 11-14 weeks.…… …….…..…… …….6 Don't know …….…..……. 7	
41.	Birth weight of index child	<2.5 kg …….…….. 1 2.5-4.0 kg…….…….. 2 >4.0 kg …….…….. 3	
42.	Sex of baby	Male …….…….. 1 Female …….…….. 2	

Thank you for your participation

APPENDIX D

Institutional Review Board Approval

ENSIGN COLLEGE OF PUBLIC HEALTH - KPONG

OUR REF: ENSIGN/IRB/M2
YOUR REF:
Tel: +233 245762229
Email: irb@ensign.edu.gh
Website: www.ensign.edu.gh

P. O. Box AK 136
Akosombo
Ghana

21st November, 2016.

INSTITUTIONAL REVIEW BOARD SECRETARIAT

Josephine Agborson,
Ensign College of Public Health.

Dear Mrs. Agborson,

OUTCOME OF IRB REVIEW OF YOUR THESIS PROPOSAL

At a meeting of the INSTITUTIONAL REVIEW BOARD (IRB) of Ensign College of Public Health held on 16th and 17th November 2016, your proposal entitled "**Effects of Anaemia on Newborn Outcome among Pregnant Women Attending Antenatal Clinic at Ga South Municipal Hospital, Accra** "was considered.

Your proposal has been approved for data collection in the following settings:

1. Amend the topic to include the Region.
2. Improve upon your referencing style.

We wish you all the best.

Sincerely,

Dr (Mrs) Acquaah-Arhin
(Chairperson)

Cc. Dean of Ensign College.

Cc: Ag. Academic Registrar, Ensign College.

APPENDIX E

Letter of Introduction from Ensign

ENSIGN COLLEGE OF PUBLIC HEALTH - KPONG

OUR REF: ECOPH/DO/EL/ST.JA/067
YOUR REF:
Tel: +233 245762229
Email: info@ensign.edu.gh
Website: www.ensign.edu.gh

P. O. Box AK 136
Akosombo
Ghana

November 25, 2016

The Municipal Director of Health Services
Municipal Health Directorate
GA South
Greater Accra

Dear Sir,

LETTER OF INTRODUCTION

We write to respectfully introduce to you Ms. Josephine Agborson (Student Identification number 157100067), a second year student of the Master of Public Health (MPH) degree program of the College.

As part of her graduation requirements, Ms. Josephine Agborson is writing a thesis on; **Maternal anaemia during pregnancy and its effects in newborn outcomes among mothers attending postnatal care at the Ga South Municipal Hospital.**

She has indicated that the research methodology she will use for the study includes structured questionnaire to be administered to mothers attending post-natal care clinic.

The study site for the thesis is the Ga South Municipal Hospital.

The Student seeks to conduct a confidential and anonymous study and also seeks the consent of the individuals involved.

We would be grateful if you kindly accede her any assistance she may require in this regard.

Thank you.

Respectively yours,

Dr. Christopher N. Tetteh
Dean/ Head of Institution

GA SOUTH MUNICIPAL HEALTH DIRECTORATE RECEIVED 1/12/16

APPENDIX F

Letter of introduction /Approval from Ga South Municipal Health Directorate

case of reply the number and the date of this letter should be quoted

My Ref. No. GHS/GSMHD/AMD-18

Your Ref. No.....

GHANA HEALTH SERVICE
Your Health · Our Concern

GHANA HEA...
GA SOUTH MUNI...
DIRE...
P.O BOX KN ...
KANESHIE ...

13th JANUAR... 2...

THE MEDICAL SUPERINTENDENT IN-CHARGE
GA SOUTH MUNICIPAL HOSPITAL
WEIJA

INTRODUCTORY LETTER
MS. JOSEPHINE AGBORSON - STUDENT (MPH) DEGREE

This is to introduce the above-named student from Ensign College of Public Health, Kpong who has permission to conduct a Project work on "Maternal anaemia during Pregnancy and its effects in newborn outcomes among mothers attending postnatal care at the Ga South Municipal Hospital, in your facility.

Kindly assist her to go through successfully.

Thank you.

DR. BRIGHT DAVIES-TEYE
SPECIALIST (PH)
MUNICIPAL DIRECTOR OF HEALTH

cc : The Dept. Obs. & Gynae, GSMH, Weija