

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



**ASSESSMENT OF THE IMPACT OF PREGNANCY SCHOOL ON PREGNANCY
OUTCOMES AND SKILLED DELIVERY IN NABDAM DISTRICT OF UPPER
EAST REGION**

BY

KOLOG TIMBIRE JONAS

10745155

**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA,
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DECLARATION

I, **Kolog Timbre Jonas** hereby declare that this dissertation was written independently, and that neither part nor the whole of this work has ever been presented in any institution for another degree, except references to people's work which I have duly acknowledged.

SIGNATURE..... DATE.....

KOLOG TIMBIRE JONAS
(STUDENT)

SIGNATURE..... DATE.....

DR. SAMUEL DERY
(SUPERVISOR)

DEDICATION

To the Almighty God, my family especially my sweet wife Damolug Mbamah Rita, my daughters Somtim Laudina Zusongpoka, Somtim Betty Sompogbil and my dear son Timbire Yenitehit Angel Gabriel., Dengba Tobiga, Madam Marilyn Schuster and My dear late Louis John Schuster III who was popularly known in Ghana as Daddy Lou !!.

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LIST OF ABBREVIATIONS

ANC	Antenatal Care
ATE	Average Treatment Effect

ATET	Average Treatment Effect on the Treated (Impact on the intervention group)
CDC	Centre for Disease Control and Prevention
CHPS	Community –based Health Planning and Services
CHPS	Community-Based Health Planning and Services
CRS	Catholic Relief Services
DHIMS	District Health Information Management System
GDHS	Ghana Demographic and Health Survey
GHS	Ghana Health Service
GMHS	Ghana Maternal Health Survey
GSS	Ghana Statistical Service
Hb	Haemoglobin Concentration
KDHS	Kenya Demographic and Health Survey
LBW	Low Birth Weight
MCH	Maternal & child health
MMR	Maternal Mortality Rate
PNC	Postnatal Care
PS	Propensity score
REST	Rural Emergency Health Services and Transport
SDGs	Sustainable Development Goals
UNICEF	United Nations International Children and Education Fund
WHA	World Health Assembly
WHO	World Health Organisation

DEFINITION OF TERMS

Pregnancy outcome: Low birth weight and anaemia in pregnancy.

Anaemia: Low haemoglobin concentration in the blood which is <12 g/dl for men and <13 g/dl for women.

Anaemia in Pregnancy: Haemoglobin concentration less than 11 g/dl in the blood of any pregnant woman.

Home Deliveries: Any delivery conducted outside a health facility or by any person other than a skilled health staff

Pregnancy school: It is a type of additional health education for pregnant women in addition to the routine antenatal care.

Study /Intervention group: The group of pregnant women who attended the pregnancy school within the study period

Control/Comparison group: Pregnant women who did not attend the pregnancy school.

Average Treatment Effect on the Treated: The impact of pregnancy school on those who really benefited from the intervention. (**Recommended and reported in this study**)

Propensity score: The probability of a woman benefitting from the pregnancy school given her background characteristics (**observed covariates**)

ABSTRACT

Background: Several health interventions have been put in place to improve pregnancy outcomes all over the world including Ghana. One of such interventions was the Community Pregnancy School (C-Press) strategy, which was implemented by Catholic Relief Services (CRS) in the Nabdam district from 2014 to 2016 as part of the Rural Emergency Health Services and Transport (REST) project to improve maternal and child health.

Objective: This study assessed the impact of the pregnancy school strategy on pregnancy outcomes and home deliveries in the Nabdam district.

Methods: A quasi-experimental study design with retrospective records review of 769 women was used out of which 398 of them benefited from the pregnancy school (intervention group) and 371 did not benefit from the pregnancy (control group). Data extraction tool was used to collect data on study participants and analysed using Stata version 15. Pearson's Chi square test of association was used to determine the association between dependent and independent variables whilst t-test was used to compare the mean difference in Hb levels at 36 weeks and mean birth weight among the intervention and control groups. Also, Propensity Score Matching procedures with nearest neighbour as well other sensitivity analysis were used in determining the impact of the pregnancy school intervention on anaemia in pregnancy.

Results: The study found that the impact of the pregnancy school was 34% reduced risk of anaemia at 36 weeks among the intervention group [95% CI: 21-46, $p < 0.001$]. This resulted in a mean Hb difference of 0.71g/dl between the two groups. The proportion of home delivery was also less (0.3%) in the intervention group compared to 7.5% in the control group whilst the prevalence of low birth weight was 5.2% in the intervention group

compared to 17.5% in the control group [95% CI: 10.17-10.62; p-value <0.001]. The mean birth weight of those in the intervention group was 116g higher than the control group. [95% CI: 56-176; p<0.001]

Conclusion: The pregnancy school had a positive impact on pregnancy outcomes and skilled delivery in the Nabdam district. There is therefore the need to scale up the project to other communities to improve maternal and child health.

CHAPTER ONE

INTRODUCTION

1.1 Background

The pregnancy school concept is an innovative way of improving communication between health staff and pregnant women as well as relevant stakeholders to ensure holistic package of service delivery during pregnancy. It is a type of additional health education for pregnant women to complement routine health education lessons they receive from health staff during antenatal care. The concept started five years ago in Ghana with the aim of improving pregnancy outcomes as well as to help in reducing maternal and child mortality (Van-Otoo., 2016).

In the Greater Accra region for instance, the La-Nkwantanang Municipal Health Directorate implemented the concept in a different style. Their pregnancy school grouped the pregnant women into levels 100 and 200 where level 100 was for pregnant women whose gestation period was from one to 28 weeks. The level 200 on the other hand consisted of pregnancies ranging from 29 weeks till delivery. Graduation ceremony was organised for five health facilities in the Municipality where certificates were presented to women who successfully completed their lessons in the pregnancy school. Some of the facilities that run the pregnancy schools included Danfa Health centre, Madina Polyclinic and Pantang Hospital among others (Ghana Health Service, 2017).

In line with this, Catholic Relief Services (CRS) a non-governmental organisation implemented the technique in a Project dubbed Rural Emergency Health Services and Transport (REST) Project. The project was implemented in three districts each in the Northern and Upper East Regions including the Nabdram district. It was implemented in eight (8) selected communities out of the 85 communities in the district. The project was

meant to improve MCH indicators in the district just like the MNCHP programme. (Nabdam District Health Directorate, 2019).

Despite all these interventions, pregnancy outcomes and home delivery remain key public health issues that are of primary concern especially in deprived and prototypical rural communities. The incidence of anaemia in pregnancy, low birth weight (LBW) and still births as well as home deliveries are still worrying despite the quantum of resources been invested into the sector. Globally, about 15% to 20% of all births are low birth weight (LBW) (Weise, 2012a). Also, according to the 2018 Global Nutrition Report, about 20 million babies are born with low birth weight every year (Development Initiative Poverty Research Ltd, 2018) . However, the incidence of low birth weight varies significantly from country to country. For example, it is as low as 9% in Latin America and as high as 28% in South Africa (Weise, 2012a). It is estimated that a female dies every minute in the globe as a result of childbirth complications and it is unfortunate to mention that nearly half a million females die from maternal causes each year and about 99% of fatalities happen in developing nations, including Ghana(WHO, 2016).

The challenge of decreasing maternal mortality remains a significant issue not only in Ghana, but also in several nations such as Kenya. (Yaya, Bishwajit, Okonofua, & Uthman, 2018)

The 2014 Kenya Demographic and Health Survey (KDHS) reported that there were about 525/100,000 live births in the maternal mortality ratio (MMR). Other estimates placed the ratio at 1,000/100,000 live births, which is one in 25 lifetime risk of maternal death(Kenya National Bureau of Statistics Nairobi & Ministry, 2015).

In Sub-Saharan Africa, the prevalence of low birth weight is about 13% and this seems lower in some areas due to under reporting resulting from home deliveries and deliveries at lower health facilities which may not be officially accounted for.

According to Ghana Demographic and Health Survey (2014), the prevalence of LBW in Ghana was 11% whilst the Upper East Region recorded about 9% in the same report. However, the situation is very bad in the Nabdram district. In 2017 for instance, the district recorded 101 low birth weight babies out of 945 live births representing a higher rate of 10.7%% (Ghana Health Service, 2017). In 2018, the prevalence increased to 12% (117 out of 993). The prevalence is much higher than both the regional and national average figures which are 11% and 9% respectively within the same period(Ghana Statistical Service/Ghana Health Service, 2017).

With regards to anaemia in pregnancy, the prevalence in 2012 was about 38% globally (Weise, 2012b). This is the same as the prevalence in Ghana according to the 2014 Ghana Demographic and Health Survey, which also pegged the prevalence at 38%. Once again, the situation was worse in the Nabdram district with over 45% prevalence of anaemia in pregnancy (Ghana Health Service, 2017). One of the sub-districts called Zanlerigu sub-district recorded over 70% of mild to severe anaemia in pregnancy which is largely due to iron deficiency anaemia. This is a cause to worry because a malnourished mother will give birth to a malnourished child, which could result in chronic cycle of malnutrition. It is worth noting that, the World Health Organisation has classified the prevalence of anaemia as a problem of public health significance as follows: No public health problem ($\leq 4.9\%$), mild problem (5-19.9%), moderate (20-39%) and severe public health problem ($\geq 40\%$) (WHO/CDC, 2012). This implies that any area or country with the prevalence of anaemia equal to or greater than 40% has a severe public health problem to deal with. In this

regard, the higher prevalence of 45% anaemia in pregnancy in the Nabdam district is a big issue that needs to be addressed.

In addition to the issues already identified above, home deliveries are also common in certain parts of the district despite MNCHP intervention put in place to curb the menace among. In the first quarter of 2017 alone, 10 home deliveries were reported in two of the sub districts with the district recording a total of 34 home deliveries that year. The number of home deliveries is believed to be an understatement due to under reporting.

The aim of the research was to determine whether the prevalence of anaemia in pregnancy, low birth weight and skilled delivery were different among the intervention group and the control group. The study thus assessed whether the pregnancy school concept was effective in reducing anaemia in pregnancy, low birth weight and home deliveries in the Nabdam district.

1.2 The Pregnancy School in Nabdam District

The Pregnancy school strategy was implemented in the Nabdam district by the Catholic Relief Services (CRS) in collaboration with Ghana Health Service since 2014. The concept was called C-Press which means Community Pregnancy School Session. C-Press was supported by the maternal and child health project dubbed the “Rural Emergency Health Services and Transport (REST project). As the name suggests, the pregnancy schools were organized at Ghana Health Service delivery points within eight (8) piloted communities where pregnant women received health education in the form of classes and group discussions. During the pregnancy school sessions, several topics relating to pregnancy outcomes were discussed. Some of these topics include good maternal nutrition using locally available food, dangers of home delivery, importance of antenatal care attendance, skilled delivery and many others. Some facilities introduced, a local millet

flour drink called “zoomkom” that was served to the pregnant women during the school sessions as a motivation for attendance.

Seating arrangements were made in a horseshoe shape during C-Press sessions and sessions were managed by trained Health staff such as Midwives and Community Health Nurses. The horseshoe seating arrangement was to ensure visibility among each other during the discussions or experience sharing. There were also pregnancy school registers for record keeping beside the normal antenatal and delivery registers that captured the necessary information on the women and their pregnancy outcomes. Some of the records that were documented in the register included demographic information, ANC and pregnancy school attendance. Anaemia status at registration, anaemia at 36 weeks, as well as place of delivery and birth weight among others were captured. The pregnancy school strategy did not consider health staff alone to be experts or “know it all” but it created an avenue for the women to share their personal experiences in pregnancy outcomes with other members.



Figure 1: Pregnancy School in Pictures

1.3 Problem Statement

Since the implementation of the pregnancy school concept in the Nabdam district, there has not been any evaluation of the strategy to critically examine whether it is yielding the intended results or not. Without a scientific evaluation, it cannot be clearly ascertained whether or not the pregnancy school approach is really contributing positively to maternal and child health indicators such as anemia in pregnancy, low birth weight and home delivery. Meanwhile, a lot of resources have been invested and continues to be pumped into maternal and child health programs. In 2014 for instance, the World Bank invested about three million United States dollars on Maternal, Child Health and Nutrition Improvement project (MCHNP) all in the quest to improving maternal health to reduce maternal and child mortality(OECD, WTO, & World Bank, 2014).

Moreover, there is no evidence of any single study in the Nabdam district to compare the pregnancy outcomes of pregnant women who attended the pregnancy school with those who did not. For instance, it was expected that pregnant women who were anaemic during antenatal registration will have their blood haemoglobin concentration levels improved by 36 weeks of the pregnancy before delivery. We cannot still tell whether the anaemia status of pregnant women who benefited from the programme were better or otherwise compared to those who did not attend the pregnancy school. Similarly, the incidence in home deliveries is not known among the two groups. It is worrying that comparison cannot be made to ascertain the impact of pregnancy school concept among the two groups of women for informed decisions to be made in order to improve pregnancy outcomes and skilled delivery.

In the same vain, low birth weight still persists in the Nabdam district however, it has not been proven whether the phenomena is coming only from pregnant women who did not attend the pregnancy school or the figures also include those who attended the pregnancy school.

1.4 Justification

There is a huge knowledge gap regarding the pregnancy school concept and pregnancy outcomes due to limited evaluation studies on pregnancy school that needs to be filled.

This study is therefore necessary to contribute to informed decision making on the pregnancy school concept. There are two schools of thought about the effectiveness of the pregnancy school concept. One of them suggests that pregnancy schools are effective in improving pregnancy outcomes. This position was confirmed in a study which indicated that the birth outcomes among a group of women who enrolled for the pregnancy school were better than those who did not (Bentil, 2015; Madhavanprabhakaran, D'Souza, & Nairy, 2016). Another view is that the effects of antenatal education remain unknown. In 2007, a Cochrane systematic review that assessed the effects of health education concluded that, the effect of antenatal education for childbirth or parenthood or both remains largely unknown (Brixval, Axelsen, Andersen, Due, & Koushede, 2014). With these dual positions, there is the need to ascertain whether or not the pregnancy school concept is contributing positively to the outcome variables in the Nabdam district. The findings of the study will therefore not only add to existing body of knowledge and evidences but it will also be useful in deciding whether to scale up the pregnancy school strategy to other communities in the district or not.

1.5 Research Questions

1. Is there any difference in mean Hb levels between pregnant women who attended the pregnancy school and those who did not attend the pregnancy school?
2. Is there any difference in mean birth weight among the group of women who attended the pregnancy school and those who did not attend the pregnancy school?
3. Is there any difference in the proportion of home deliveries among the two groups?
4. What is the impact of the pregnancy school on anaemia at 36 weeks?

1.6 General Objective

To determine the differences between pregnancy outcomes and proportion of home deliveries among pregnant women who attended pregnancy school and those who did not attend the pregnancy school in the Nabdam district.

1.6.1 Specific Objectives

The specific objectives of the study included:

1. To compare the differences in mean hemoglobin concentration levels at 36 weeks among pregnant women who attended the pregnancy school and those who did not attend.
2. To determine the differences in mean birth weight among pregnant women who attended the pregnancy school and those who did not attend the pregnancy school.
3. To compare the proportions of home deliveries among the two groups.
4. To estimate the impact of the pregnancy school intervention on anaemia at 36 weeks.

1.7 The Conceptual Framework

The conceptual framework was adopted from the “Interactive Quality Health Education Outcomes Model” by P. Mitchell, S. Frenetic, and B. Jennings in 1998 and modified to reflect the local dynamics. It can be observed that several factors play a role in

determining pregnancy outcomes and place of delivery. In other words, low birth weight, anaemia in pregnancy and home deliveries are associated with many factors and therefore need a multifaceted approach to address them. Some of these factors are briefly discussed here because they are potential confounders, which can affect the outcome variables in this study.

First of all, maternal age has a bearing on pregnancy outcomes. Older women from the ages of 35 to 40 years for instance are at increased risk of giving birth to preterm and low birth weight babies than younger women. The age of the mother has a bearing on her pregnancy outcomes. If a woman is too young or too old, there are negative consequences in their reproductive outcomes. The older a woman becomes the more likely she will become obese and could develop diabetes, which is associated with stillbirth (Bentil, 2015).

Secondly, the socioeconomic status of a woman which is highly influenced by occupation can affect her pregnancy outcome and place of delivery. Level of income is a factor as women with low economic status are more likely to be malnourished during pregnancy, a situation which could lead them to bring forth low birth weight babies.(Leary, Edmond, Floyd, Newton, & Thomas, 2017)

Moreover, the parity is another important factor. Prim gravidae have increased the risk of suffering from more severe forms of malaria in pregnancy which could lead to LBW than in multigravida (Leary et al., 2017).

The occupation of a woman also has an influence on her pregnancy outcomes. When a woman's job exposes her to environmental hazards such as pollution, smoke, heavy metals, poisonous chemicals and other risk factors among others, she is more likely to give birth to premature and low birth weight babies (Bentil, 2015). Similarly, women living in

highly polluted environments are likely to suffer some effects on their reproductive outcomes. For instance, smoking of cigarette by pregnant women can lead to the incidence of low birth weight (Hossain & Triche, 2009).

There is also a positive correlation between alcohol intake and pregnancy outcomes. High maternal alcohol consumptions can lead to premature births and LBW and could also be a risk factor for cardiovascular disease in the mother. (Nykjaer et al., 2014)

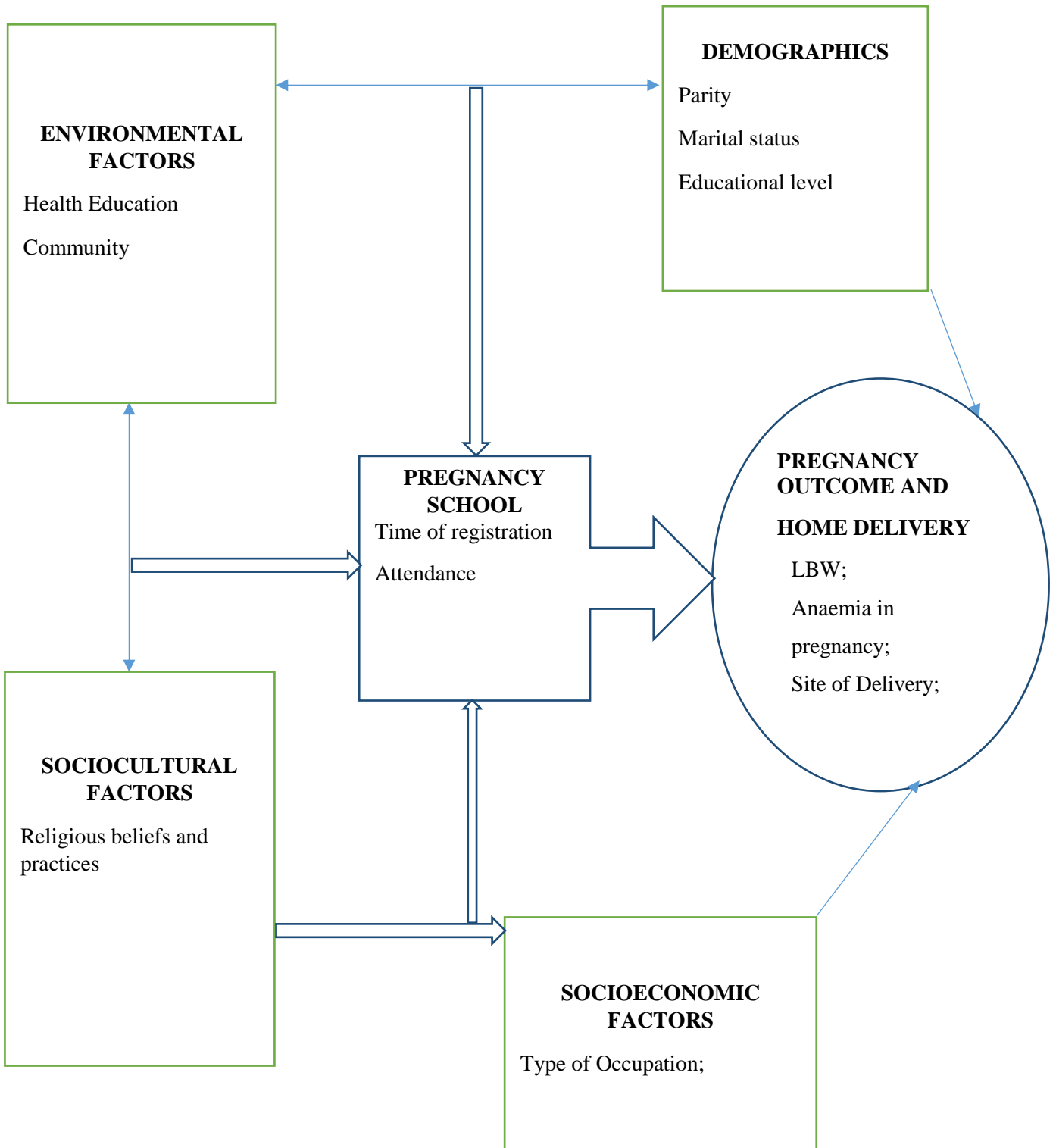


Figure 2: Conceptual framework on Pregnancy school, place of delivery and Pregnancy outcome

Source: adapted from P. Mitchell, S. Frenetic, and B. Jennings (1998) and modified by author (2019)

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

There are no much evaluation studies on the concept of pregnancy schools especially in Ghana. However, there are some related studies on various interventions on antenatal care and pregnancy outcomes. Thus, the literature review focused mainly on these similar studies some of which were systematic reviews.

2.1 Anaemia in Pregnancy

Anaemia simply means low haemoglobin (Hb) concentration in the blood. The World Health Organisation has different cut off points for anaemia depending on several factors such as age, physiological status and gender. With regards to anaemia in pregnancy, Hb concentration less than 11g/dl is anaemia but when it is less than 7.0g/dl it is severe anaemia. Globally the prevalence is about 38% (WHO, 2016) which is the same as the prevalence in Ghana (Ghana Statistical Service/Ghana Health Service/ICF International, 2014).

Several studies have been conducted on the effects of health education on pregnancy outcomes including anaemia in pregnancy. In January 2015, a similar study which was done in China and published in 2017 found out that, health education intervention has positive effects on pregnancy outcomes of patients. The study involved 120 participants who were randomly divided into study group and control group comprising 60 members each (Liu, Xie, & Guo, 2017). Another research in India showed that the incidence of anaemia was lowered by 35% among pregnant women who received antenatal care during pregnancy (Mishra et al., 2016).

Also in 2012, a retrospective study was performed in Hamadan city in which 264 prenatal care records were selected randomly from 12 health care centres. The results showed that prenatal care and health education can positively influence pregnancy outcome. In other words, Counselling nutritional support and education may have an important role to play in pregnancy outcomes (Parsa, Shobeiri, & Parsa, 2012).

However, in 2013 another evaluation study titled “The effect of antenatal education in small classes on obstetric and psycho-social outcomes: a systematic review and meta-analysis protocol” which reviewed about 17 different studies concluded that the effectiveness of antenatal health education remain unknown.(Brixval et al., 2014)

2.2 Low Birth Weight

According to the World Health Organisation, low birth weight is defined as any live birth weight less than 2500 grams. The prevalence of LBW is currently between 15% and 20%. Every year, over 20 million low birth weight babies are born in the world. This continuous to be a global public health problem that has both short-term and long-term consequences. For instance, Low Birth weight children are three times more likely to die compared to normal babies ((WHO, 2014). In recent studies, LBW is not only a predictor of morbidity and mortality but also shows that LBW babies have increased risk of developing non communicable diseases such diabetes and cardiovascular disease later in life. Due to the serious nature of these consequences, the World Health Assembly in 2012 resolved to bring down the prevalence LBW by 30% before the end 2025 (Fenwick et al., 2015; Weise, 2012b, 2012a).

Approximately, 14% of infants in low-income countries weigh less than 2.5 kg at birth and many of these low birth weight babies are born preterm. Many studies on mortality and illness among low-birth- weight infants has focused on the neonatal period and few studies

from sub-Saharan Africa have generated population-based estimates of post-neonatal outcomes (Leary et al., 2017).

In a randomized research examining the impact of instructional policies during home visits on obstetric outcomes such as birth weight, 1,178 pregnant females from 21 government prenatal care hospitals in Denver City, the United States discovered that the incidence of LBW among the intervention group (2.8%) was smaller than that of the 7.7% in the control group., (Lima, 2016).

Another study in Kenya discovered that, there was 1.42 kg reduction (95% CI 0.95 - 1.89 kg) in gestational weight gain with any intervention compared with control. However, with all the interventions combined, there were no significant differences in birth weight (mean difference -50 g, -100 to 0 g). Also, dietary intervention approach was found to have the largest impact with improved pregnancy outcomes compared with the other interventions. Thirty-one (31) of the randomised control trials revealed that there was no significant difference in birth weight in the other two approaches (-50g of mean birth weight difference) (Thangaratinam et al., 2012).

Moreover, an Australian Research Centre for Health of Women and Babies (ARCH) also conducted a review of 29 different studies which were aimed at assessing the effectiveness of community-based intervention packages in reducing maternal and neonatal morbidity and mortality; and improving neonatal outcomes. This research found that community-based intervention packages decrease women's morbidity, baby mortality and morbidity, and improve care-related results, especially in low-and middle-income nations. It identified the importance of incorporating maternal and newborn care, which can be packaged effectively for delivery through a range of community health workers and health promotion groups. It also showed that this approach could improve skilled delivery and

facility-based services for maternal and new-born by about 5% (CI 95%; P-value < 0.001)(Babies, 2015).

In West Africa specifically Nigeria which has similar socio economic, reproductive, demographic and general health characteristics like Ghana, a study of factors for low birth weight was done which showed among others that maternal age less than 20 years (58.5%) and haemoglobin less than 10 gm/dl (60.5%) are significant determinants of LBW (“Determinants of Low Birth Weight in Neonates Born In Three Hospitals in Brong Ahafo Region,” 2016).

In Ghana, a comparable research was conducted in the Northern Region to assess the impact on important maternal and child health results of the early Project Fives Alive, a domestic child survival enhancement project. This evaluation which was conducted in 27 health facilities in Northern Ghana, employed sensitivity analysis including interrupted time series analyses to determine whether improved changes in the outcomes were due to the intervention education in smaller classes is still questionable (Brixval et al., 2014).

2.3 Home Deliveries

Every year, about 60 million women deliver outside the health facility by unskilled attendant which is due to several factors and therefore require multifaceted approaches to address. Meanwhile, delivery at the health facility by qualified health staff can reduce 75% of maternal deaths. Several evaluation studies have revealed various findings on the impact of interventions put in place to address the issue of home deliveries. One of such studies which was conducted in the United State of America found that the proportion of home deliveries was higher among pregnant women who did not receive antenatal care than the intervention group that is 14% and 3% respectively (Darmstadt et al., 2009).

It was also discovered to be associated with enhanced health education and hospital triage skills delivery. There was a variety of change margins for the distinct classifications. The combination of enhanced qualified delivery ranged from 28% to 58%, while modifications in PNCs for health posts and health centers resulted in enhanced participation of underweight children in child welfare clinics (Singh et al., 2016).

Moreover, Studies in Kenya and Malawi have also shown that antenatal attendance during pregnancy is highly associated with delivery in health facilities in several developing countries like Ghana, Tanzania, Malawi, Kenya, and Burkina Faso (Sahoo, Singh, Gupta, Garg, & Kishore, 2015). In Kenya for example a study revealed that early initiation of antenatal care among women within the first trimester is associated with place of delivery. Women starting ANC services before the second semester are more likely to deliver in the health care facility compared to pregnant women who use antenatal care after the first trimester. In Asia and Africa, women who attend ANC four and more times have higher chances of delivering in health facilities with skilled personnel. In the same vein, a study in Southern Asia showed that the incidence of home delivery is five times more among women who never attended ANC compared to those who attended four plus visits (Jacobs, 2010).

Home or unskilled deliveries are still prevalent in sub-Saharan Africa especially in the rural areas. In line with this, stakeholders are looking at the best approaches including research to be able to make informed decisions on how to solve the problem. One of such studies was conducted in 744 facilities in Northern Ghana. The results studied were early antenatal care (ANC), qualified delivery, under-five mortality at the facility level, and participation of underweight children at child welfare clinics. The research used interrupted time series analysis and discovered that health education during routine services in health centres was associated with these variables (Sahoo et al., 2015).

They used quasi-experimental evaluation study design. The pregnancy outcomes studied included timely antenatal care, skilled delivery, children under-five mortality in health facilities and underweight infants' welfare clinic attendance. They stratified the data analysis by the type of facility thus the bigger health facility such as hospital, followed by health centres and smaller health posts. The major findings from this study showed that the association with specific category of changes and improved outcomes were significant. For instance, out of five changes, including early ANC, four plus ANC visits, health facility delivery as well as immediate postnatal care (PNC) were increased in the health posts.

According to the 2014 Ghana Demographic and Health Survey, health facility deliveries increased from 42% to 73% over the last two decades. This notwithstanding, close to about 27% of pregnant women still delivered at home (Ghana Statistical Service/Ghana Health Service/ICF International, 2014).

2.4 General Factors Influencing Pregnancy Outcomes

The Ghana Maternal Health Survey (GMHS) generates a lot of data on maternal health including pregnancy outcomes to supplement information from the Ghana Demographic and Health Survey. The first GMHS was conducted in 2007. The second survey which was conducted in 2017 sampled 27,000 households. The 2017 Ghana Maternal Health Survey showed that there was no much variation in pregnancy outcomes among some key maternal health indicators 5 years preceding the survey. The findings revealed that about 76% of all pregnancies resulted in live births, 2% in stillbirth, 12% miscarriages while 10% of pregnancies resulted in abortions. The survey also uncovered that there is no much difference between the proportions of live births with regards to the woman's age at the time of the pregnancy. However, women less than 20 years are more likely to have an abortion (19% of pregnancies) while women aged between 35 and 49 have higher chances

of getting a miscarriage (19% of pregnancies). In the same vein, rural women have more live births than urban women, whereas women in the urban areas have more miscarriages and abortion. This rural –urban difference is due to variation in lifestyle among the two groups difference (Ghana Statistical Service/Ghana Health Service 2017; Bentil 2015; Dijk, Anderko, and Stetzer 2010; Kotey et al. 2012; WHO 2016). This

The birth outcome of normal pregnancy is a normally a live baby with the recommended birth weight which ranges from 2.5kg to 3.5kg in most healthy women irrespective of their geographical location and time of delivery. However, different factors could influence the delivery of a normal live baby. Some of these factors include but not limited to environmental factors and socio-demographic factors of the mother.

2.5 Environmental Factors

The environment within which a mother lives could expose her to several factors such as smoking, video display terminals, and anaesthetic gases, antineoplastic Medicines as well as exposures to lead, selenium, and inorganic mercury and so on. Among all these factors, cigarette smoking during pregnancy has been found to be the leading environmental factor that has adverse pregnancy outcomes. For instance, Mothers who smoke during pregnancy are twice more likely to give birth to low-birth weight babies. In the same vein, air pollution, exposure to chemicals and stress also have an effect on low birth weight and preterm delivery (Hossain & Triche, 2009).

Antenatal education is a very important activity in primary health care given by midwives and other health staff. It requires a lot of time with other resources and is demanded by many pregnant women. However, there have been few studies evaluating its effectiveness, and nearly all of these studies have been carried out in North America, Australia, and Northern Europe. (Jaddoe, 2009). Another study in Kansay University found that antenatal

education result in higher birth weight than women who do receive antenatal education (Itziar & Bacigalupe, 2010; Mary et al, 2002) (Mary et al, 2002)((Itziar & Bacigalupe, 2010)).

Methodological Review

A cross-sectional evaluation study was done in 2013 in Tanzania on family oriented health education programme to improve maternal-infant birth outcomes. The study found that the intervention group had better outcomes than the control group. (Shimpuku et al, 2013). Also in Ghana, retrospective cohort study design was used to examine birth outcomes in Tema General Hospital by Patricia Bentle which found that there was no significant difference between the two groups. (Patricia Bentle, 2015). Similarly, in 2018 a systematic review of 40 articles was done in Ethiopia on the effects of antenatal education on skilled delivery showed that women who attended the antenatal education were more likely to deliver at the health facility (GedefawFekadu, 20118).

2.6 Summary of the Literature

The literature above show that pregnancy school or antenatal education generally results in improved pregnancy outcomes and skilled delivery. The study in United State of America showed that the prevalence of home delivery was higher among the control group(14%) compared to the intervention group(3). Another study in South Asia showed that women in the control group were five times more likely to deliver at home than those in the intervention group(Jacobs, 2010). Also, studies in Kenya and Malawi revealed that antenatal education is highly associated with skilled delivery in developing countries like Kenya, Malawi, and Ghana.

Moreover, a study in Denver City of United States discovered that the prevalence of LBW was lower (2.8%) among the intervention group compared to 7.7% in the control. Another study in India revealed that the prevalence of anaemia in pregnancy was lowered by 35% among the intervention group. Besides these, a retrospective records review in Hamadan City in 2012 show that antenatal education impacts positively in pregnancy outcome.

CHAPTER THREE

METHODS

3.0 Introduction

This section describes the design of the research, a description of how the research was performed from the start to the end. It defines the target population for this survey, the process of sampling, the sample size, the variables, the indicators for the research, the instruments for information collection, the data management and evaluation, and the study's ethical aspects.

3.1 Study Design

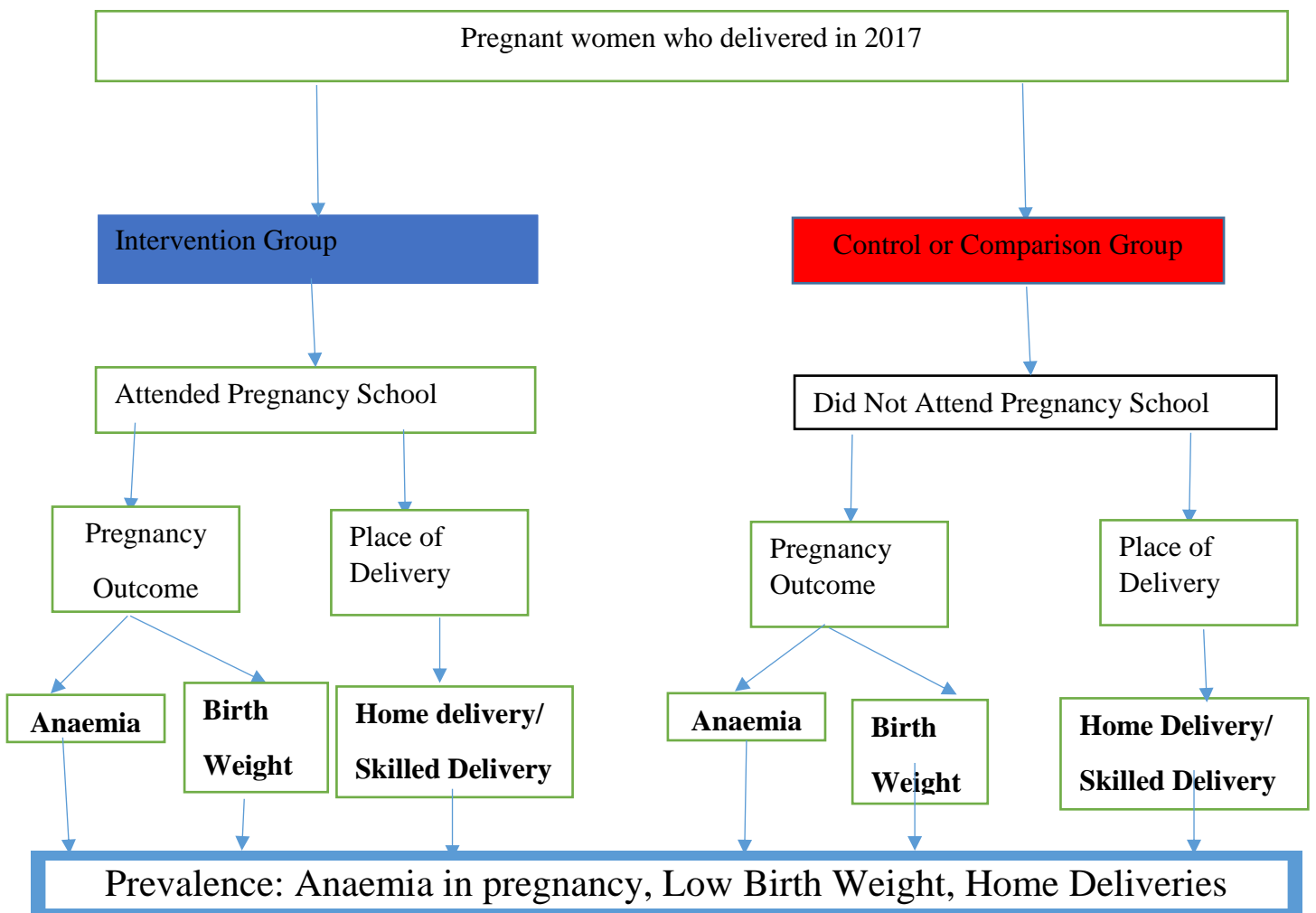


Figure 3: Study design for participants

Nabdam district were reviewed. The study compared pregnancy outcomes of women who attended pregnancy school with those who did not attend the pregnancy school. The main purpose was to find out whether there was any difference in the pregnancy outcomes among the two groups as well as the proportion of home deliveries between the two groups. The outcomes of interest in this study were anaemia in pregnancy, low birth weight and home deliveries among the intervention group and the control group.

3.2 Study Area

The study was carried out in all the nine health facilities in the Nabdam district that conducted deliveries in 2017. The facilities included the Nangodi Health Centre, Sakoti CHPS, Kotintaabig CHPS, Pelungu Health Centre, Zanlerigu CHPS, Loagre Health Centre, Pitanga CHPS, Dasobligo CHPS and Ayamfoya Clinic. However, there was no available data in Ayamfoya Clinic which was the only private health facility in the district. The Nabdam district has five sub districts, 21 health facilities out of which only 9 conduct deliveries within the study period. Nabdam District had 85 communities and population of 39,789(Nabdam District Health Directorate, 2017).

The Nabdam District Assembly was established in 2012 by L.I.2105. It was carved from Talensi-Nabdam District into the Nabdam District with Nangodi as its capital. The district is situated in Upper East region. It lies between latitudes 10° 47' adjacent and 10° 57' adjacent to the north of the equator; and longitudes 0° 31' adjacent and 10° 15' adjacent to the west Greenwich meridian. It is bounded to the north by the Bongo district, to the east by the Bawku West district to the south and to the west by the municipality of Bolgatanga. The district has 353 km² of territory.

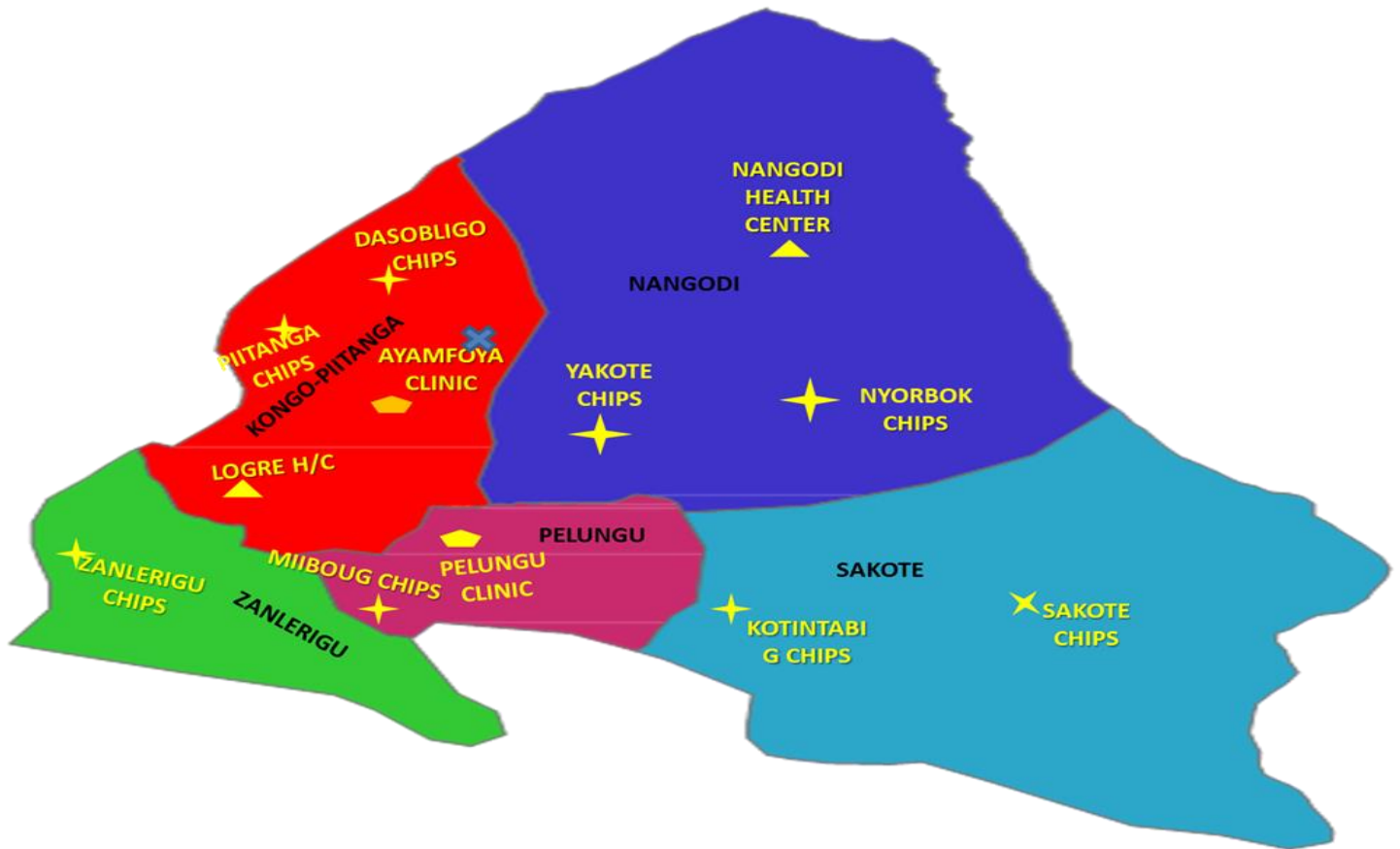


Figure 4: Map of Nabdam district showing health facilities by sub district

Source: Nabdam District Health Directorate

3.3 Study Population

In this study, the population targeted were groups of pregnant women who delivered in Nabdam district in 2017. It included a review of all available records of pregnant women who attended antenatal care in the Nabdam district and delivered in the district in 2017. A review of the district 2017 annual report showed that 945 pregnant women delivered during the study period. However 769 records were available for this study. Out of this, 398 were in the intervention group whilst 371 were in the in the control group.

3.4 Inclusion and Exclusion Criteria

Records of all pregnant women from the district who delivered in 2017 were included in the study. Pregnant Women who attended the pregnancy school and delivered in a facility outside the district but whose delivery records could be obtained were included.

3.5 The Exclusion Criteria

Participants with incomplete information on any of the outcome variables were excluded from the study. Also, pregnant women who did not attend ANC in the district but only came there to deliver were excluded from the study. Furthermore, pregnant women whose ANC and delivery records could not be traced at all did not form part of this study.

Table 1: Definition of Study variables

S/N	VARIABLE NAME	MEANING OF VARIABLE	TYPE OF VARIABLE	
1	Age	Age of mother	independent	Continuous but categorised
2	Educational level	Educational level of mother	independent	ordinal
3	Occupation	Occupation of the mother	independent	Nominal
4	Marital status	Marital status of the mother	independent	categorical
5	Community	The community or area where the woman stays	independent	Nominal
6	Facility	Health facility where the data was extracted	independent	Categorical
7	Sub district	The sub district of the health facility	independent	Categorical
8	ANC Registered Number	Antenatal Care registration number	independent	Count
9	Date of ANC Registration	Date of first ANC attendance for the pregnancy which the mother delivered 2017	independent	categorical
10	Gest. age at registration	Gestation age at ANC registration in weeks	independent	categorical
11	Hb at registration	Haemoglobin concentration at ANC registration	independent	Continuous
12	No. of ANC attendance	Number of visits by the woman went to the health facility for antenatal care	independent	Discrete
13	Pregnancy school enrolment	Whether the woman enrolled for the pregnancy school or not	independent	Binary
14	No of pregnancy school's attendance	Number of pregnancy school attendance of the mother	independent	Discrete
15	Hb at 36 weeks	Haemoglobin concentration of mother at 36 weeks	Dependent	Continuous
16	Birth weight	The weight of the baby at birth	independent	Continuous
17	Low birth Weight	Any birth weight less than 2.5 kg	Dependent	Binary
18	Place of Delivery	Skilled or unskilled (Home delivery)	Dependent	Categorical

Table 2: Definition of indicators and their measurement

INDICATOR	DEFINITION	NUMERATOR	DENOMINATOR	DATA SOURCE
Low birth weight	Birthweight < 2.5 kg	No. of live LBW	All live births	Delivery registers ANC register and pregnancy school register
Anaemia in Pregnancy at registration	Pregnant women with Hb < 11 g/dl at registration	No. of pregnant women whose HB <11 g/dl at registration	All pregnant women whose HB was tested at registration	ANC register, reports
Anaemia in Pregnancy at 36 weeks	Pregnant women with Hb < 11 g/dl at 36 weeks	No. of pregnant women whose HB < 11 g/dl at 36 weeks	All pregnant women whose HB was tested at 36 weeks	ANC register, DHIMS
Proportion of Home Deliveries	All deliveries conducted by unskilled personnel	No. of home deliveries	Total deliveries	Delivery register and pregnancy school register pregnancy school register

3.6 Sample Size Determination

A census was done for all 2017 deliveries in the Nabdram district. All available records of the study population within the study period were reviewed. Out of a total of nine hundred and forty-five (945) deliveries that were recorded in 2017 in the district, Seven hundred and sixty-nine (769) records were complete. Out of these number, three hundred and ninety-eight (398) were in the intervention group whilst 371 served as the control in the study.

3.7 Power Analysis

The sample size of 769 (398 intervention and 371 control) participants with complete information out of 945 deliveries resulted in a power of 99.26% after assuming a 0.2 reduction in anaemia among women who attended the pregnancy school using a type I

error of 5%. The 398: 371 gave a proportion of 0.48 control to 0.52 intervention which were put into STATA for the matching power calculation. This shows that the study was powered enough to detect a significant impact of pregnancy school on anaemia in pregnancy among the intervention group.

Note: Stata command for power; “power mcc 0.48, oratio (0.52) n (371)”

3.8 Data Collection

The data was collected from 8 health facilities namely Pitanga CHPS, Dasobligo CHPS, Loagre Health centre (ICM), Nangodi Health centre, Pelungu Clinic, Sakoti CHPS, Kotintaabig CHPS and Zanlerigu CHPS. An excel data extraction tool was used to compile the records of women who delivered in 2017 in the Nabdam district. The data was extracted from various registers such as pregnancy school register, ANC register, delivery register and where necessary, the Post-natal register.

3.9 Data Processing

The data was first extracted onto an excel sheet for proper cleaning, realignment before exporting to a Stata 15 software for recoding and analysis.

3.9.1 How missing data was handled

In every records review, the researcher is most likely to face the problem of missing data. As a result, measures were put in place to address this critical issue which could affect the findings of the study. Data elements that did not contain complete information on any of the three outcome variables were left out and therefore did not form part of the analysis.

3.10 Data analysis

Stata version 15 software was used in analysing the data where Chi-square test of association was used to determine whether there was association between the demographic characteristics of participants and categorised Hb levels, birth weight as well as home

delivery. Different statistical analysis tools were used for the various objectives in the study.

First of all, t-test for two sample population means was used to compare the differences in the mean haemoglobin concentration (Hb) among the intervention group and control group. This was done to determine the level of anaemia among the pregnant women before the pregnancy school intervention and after the pregnancy school. Thus, Hb at registration was used as anaemia before the pregnancy school intervention and Hb at 36 weeks was the level of anaemia after the intervention. This was to determine whether there was any difference in terms of the outcome variables between the beneficiaries of the pregnancy school and the control group. Also, two sample t-test was used to determine if there is any difference between the mean birth weight of pregnant women who attended the pregnancy school and those who did not.

3.11 Difference in differences analysis (DID)

The t-test of differences in two population mean was first used to obtain the mean difference in Hb at registration and at 36 weeks with their respective confidence intervals and p-values. The parallel trend assumption was then used in estimating the difference-in-differences analysis of Hb at 36 weeks. The parallel trend assumption in Difference in Differences (DID) means, in the absence of the program the change that would occur in both the control and intervention group will be constant and equal. This was unadjusted and basic differences in differences analysis that was done to see whether there was any difference in mean Hb concentration between the control and the intervention group before and after the intervention. However, the actual impact of the pregnancy school on anaemia was further determined using more rigorous methods such propensity score matching procedure. See Figure 5 for illustration on how they DID was done where:

$$\text{DID} = [(D-C)-(B-C)]$$

A= Hb of control group at registration

B= Hb of control group at 36 weeks

C= Hb of intervention group at registration,

D=Hb of intervention group at 36 weeks

Baseline= Hb at registration

End line= Hb at 36 weeks

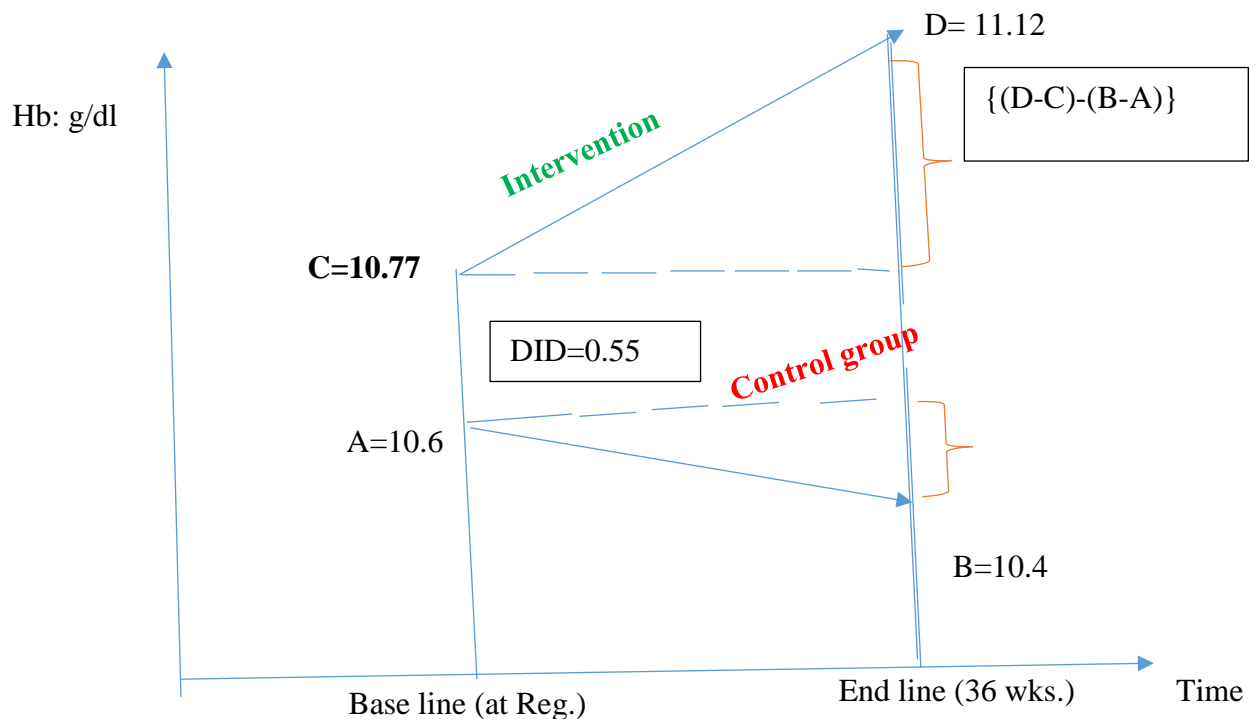


Figure 5: Difference analysis of Hb at 36 weeks between control and intervention group

3.12 Matching procedures

Matching is any method that equates or try to balance the distribution of covariates in the treated and control groups. Propensity score matching (PSM) and nearest neighbour matching procedures were used in several series of sensitivity analysis to decrease the covariate imbalance between the control group and the intervention group in the study.

Propensity score (PS) for an individual is the conditional probability of being treated given the individual covariates. That is $PS = \text{Estimated Pr}(T=1 | \text{covariates})$. The mean

propensity score for a pregnant woman benefitting from the intervention was 64.8%. This was done in STATA which minimised bias in the findings of this study. Propensity score matching with 1:1 and 1:2 nearest neighbour matching and bootstrapping with 50 replications were done to reduce random error in the estimate. The matching according to common support made the groups similar such that any estimated difference could then be attributed to the pregnancy school intervention. Hence the impact of the pregnancy school strategy on anaemia in pregnancy (at 36 weeks.). However, the kernel matching with Regression Adjusted results were reported because the adjustment made the model more robust in determining the actual impact of the intervention.

3.13 Quality control

In order to get quality data, only health staff such as Community Health Nurses and midwives who are very familiar with the data source registers were hired and trained to collect information. The data extraction instrument was also tested to guarantee that all corrections and adjustments were made before the actual data collection process began.

3.14 Expected outcome of the study

1. The impact of pregnancy school on anaemia in pregnancy among pregnant women who attended pregnancy school and those who did not attend the pregnancy school in the Nabdram district.
2. Proportion of low birth weight between the intervention and control groups
3. Proportion of skilled delivery among the two groups in Nabdram district.

3.15 Ethical consideration

Prior to the commencement of the study, ethical clearance was sought from the Ghana Health Service Ethics Review committee with approval number **GHS-ERC 068/04/19**. A formal permission was also obtained from the District Director of Health Services to pave

way for the study to be conducted. The data that were extracted from the records were solely used for the intended purpose and the identity of participants was concealed by using codes instead of names in order to maintain confidentiality. Last but not the least, the research team members were properly trained and advised to be respectful and responsive to all those concerned with the data required for this study. These techniques are all supported by a guide to field data collection that ensured successful data collection (Kathleen, Natasha Mack. Cynthia Woodson, 2011)

CHAPTER FOUR

RESULTS

The results from the data analysis in this study are presented in this chapter as follows:

4.0 Demographic characteristics of pregnant women

A total of 769 records of deliveries were reviewed during the study. Majority of the study participants in the intervention group 227 (57.64%) and comparison group 197 (53.8%) were between the ages 20-29 years with a mean age of 24.7 and 25.1 respectively. More than 90% of the participants were married (91.1% versus 93.6%). About 99% of the women in each group had an active NHIS card (Table 3).

Note: Each variable had its own denominator

Table 3: Association between Demographic Characteristics and pregnancy school attendance

Variable	Intervention Group, N (%)	Control Group N (%)	Total N (%)	χ^2 (p-value)
Age group (years)				40.15 (<0.01)
Mean \pmSD: 24.89\pm 0.2132	24.72	25.05		
10-19	86(21.60)	77(21.04)	188(21.41)	
20-29	227(57.64)	197(53.8)	512(58.21)	
30-34	49(12.31)	54(14.75)	168(19.13)	
35+	36(9.05)	38(10.38)	10(1.14)	
Total	398(100)	366(100)	764(100)	
Education				20.90 (<0.001)
No Education	178(45.52)	198(54.25)	376(49.74)	
Primary	61(15.60)	77(21.10)	138(18.25)	
JHS	94(24.04)	65(17.81)	159(21.03)	
SHS/TEC/VOC	42(10.74)	20(5.48)	62(8.20)	
Tertiary	16(4.09)	5(1.37)	21(2.78)	
Total	391(100)	391(100)	756(100)	
Occupation				25.08 (<0.001)
Farming	223(56.46)	204(56.04)	427(56.26)	
Hairdressing	13(3.29)	25(6.87)	38(5.01)	
House Wife	22(5.57)	33(9.07)	55(7.25)	
Salary Worker	19(4.81)	6(1.65)	25(3.29)	
Seamstress	29(7.34)	26(7.14)	55(7.25)	
Student	19(4.31)	24(6.59)	43(5.67)	
Trading	43(10.89)	39(10.71)	82(10.80)	
Weaving	27(6.84)	7(1.92)	34(4.48)	
Total	399(100)	364(100)	753(100)	
Marital Status				1.64 0.001
Married	337(91.08)	337(93.61)	647(92.33)	
Single/Separated	33(8.92)	23(6.39)	56(7.67)	
Total	370(100)	360(100)	730(100)	
NHIS Status				27.39 (<0.001)
Active	395(99.3)	339(91.4)	734(95.45)	
No Active	3(0.75)	32(8.6)	35(4.55)	
Total	398(100)	371(100)	769(100)	
Sub district				253.578 (<0.001)
Kongo/Pitanga	223(56.03)	50(13.48)	273(35.5)	
Nangodi	5(1.26)	26(7.01)	31(4.03)	
Pelungu	38(9.55)	167(45.01)	205(26.66)	
Sakoti	118((29.65)	59(15.9)	177(23.02)	
Zanlerigu	14(3.52)	69(18.6)	83(10.79)	
Total	398(100)	371(100)	769(100)	

4.1 Differences in mean Hemoglobin (Hb) Concentration between the two groups

The study found that there was a 0.71 g/d difference in mean Hb levels at 36 weeks between the intervention and control group.

The mean Hb concentration among the intervention group at 36 weeks was 11.12 g/dl whilst that of the comparison group was 10.41 g/dl. The mean Hb difference for the two groups at registration and 36 weeks was 0.71 g/dl as indicated in Table 4.

Table 4: Differences in mean Hb levels

Category	Mean (g/dl)	Hb 95% Confidence interval	P-value
Pregnancy school	11.12	10.98-11.26	
No pregnancy school	10.41	10.18-10.64	
Difference at 36 wks.	0.71	0.47-1.01	<0.001*
Differences at registration	0.11	0.13-0.35	0.3661

* *Difference in Hb concentration significant at 36 weeks*

Results from the study also showed significant difference in various grades of anaemia among the two groups. The intervention group did not record any case of severe anaemia but the comparison group recorded one case of severe anaemia. The prevalence of Moderate anaemia was 44.8% among the intervention group and 63.4% among the control group. The results also indicated that only 35.9 % of the control group were normal compared to 55.2% in the intervention group as shown in Table 5

Table 5: Grades of anaemia at 36 weeks among the two groups

Grades of Anaemia	Category		P-value
	Pregnancy school	No pregnancy school	
Normal (%)	207 (55.2)	47 (35.9)	<0.001
Moderate (%)	168(44.8)	83 (63.4)	
Severe (%)	0 (0)	1 (0.7)	
Total	375(100)	131(100)	

The study also found a wide variation in the prevalence of anaemia across the various five sub-districts in the Nabdram district with Nangodi recording as high as 70% prevalence of all grades of anaemia in pregnancy. The results revealed that the lowest prevalence (32%) of anaemia was recorded in Pelungu sub-district. However, all the other sub-districts recorded anaemia levels above 40%. The overall prevalence of anaemia in pregnancy in the Nabdram district in 2017 was as high as 51%. Details on the prevalence of anaemia at 36 weeks among the various five sub-districts can be seen in Figure 6.

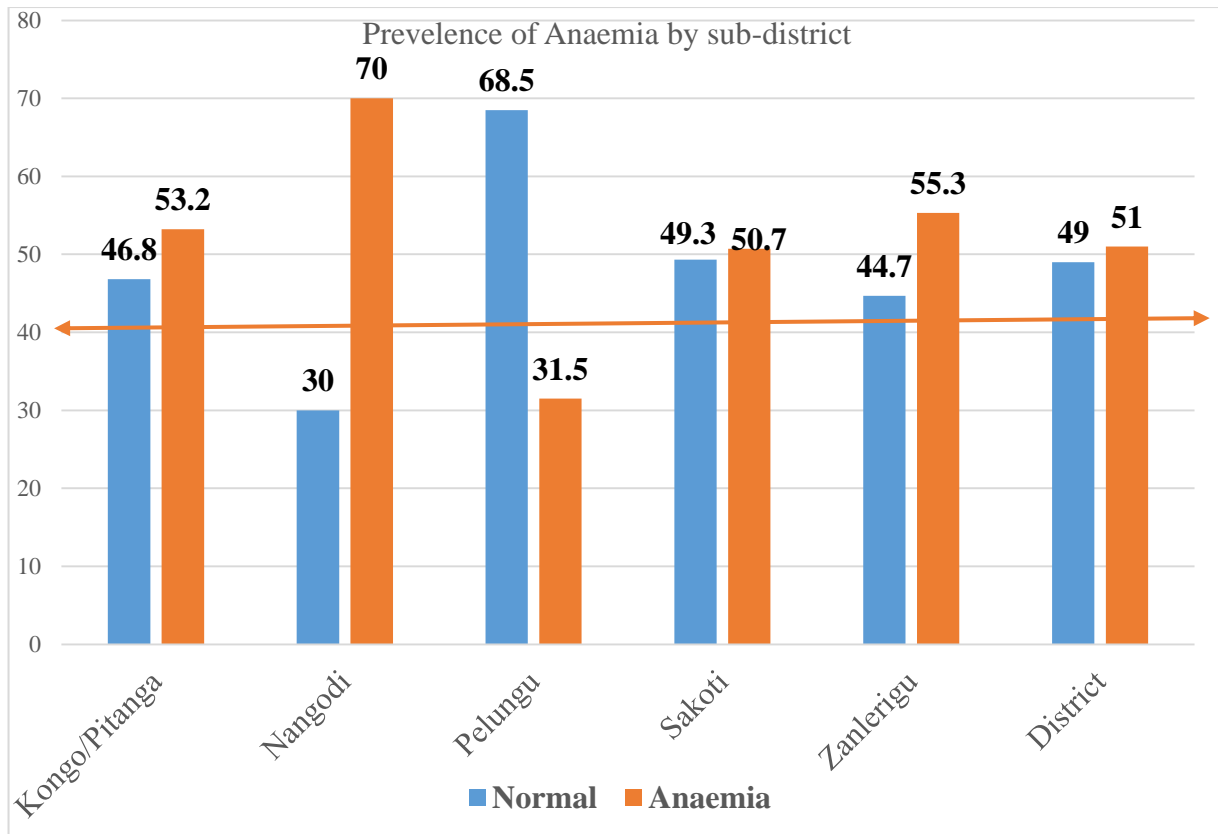


Figure 6: Prevalence of anaemia by sub-district

4.2 Differences in mean birth weight between the control and comparison groups

As in Table 6, the mean birth weight of the control was 2.834 kg while that of the intervention group was 2.950 kg. This resulted in a difference of 0.116 kg (**116 g**) which was statistically significant at p-value <0.001. Refer to section 4.4 for more details on the difference in mean birth weight between the two groups.

Table 6: Mean birth weight among the intervention and comparison group, Nabdram district in 2017

Category	Deliveries	Mean birth weight(kg)	95% CI	P-value
Pregnancy school	389	2.950	2.91-2.98	
No pregnancy school	354	2.834	2.79-2.88	
Differences	5	0.116	0.056-0.180	0.0002

4.2.1 Proportion of low birth weight

As shown in Figure 7, the prevalence of low birth weight in the intervention group was 5.2% while that of the comparison was 17.2%.

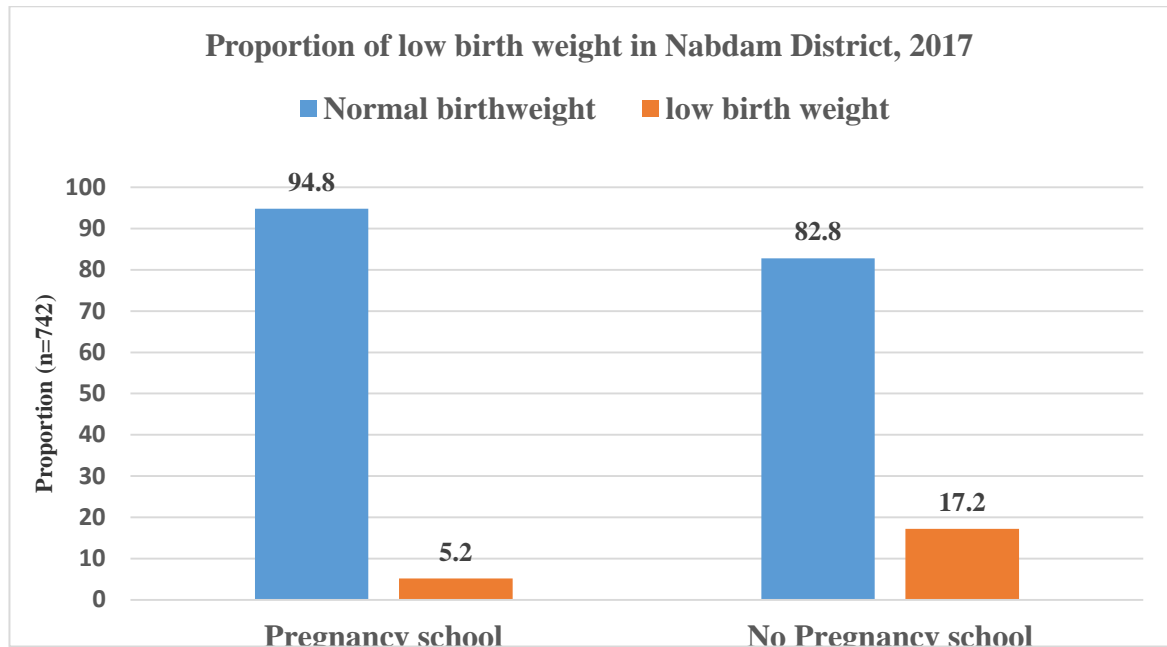


Figure 7: Proportion of low birth weight by pregnancy school

4.3 Proportion of Home deliveries

The results revealed that only one out of 398 in the intervention group delivered at home whilst the control group recorded 28 home deliveries out of 371 deliveries in the district (Table 7).

Table 7: Proportion of Home Deliveries among the two groups

Pregnancy school	Type of Delivery		Total	95% CI	P-value
	Skilled	Home			
Attended	397 (99.7)	1(0.3)		98.41-99.98	< 0.001
Pregnancy school		398(100)			
Did not attend	343 (92.5)	28	(7.5)	89.77-95.03	
pregnancy school		371(100)			
<i>Row Total</i>					

4.4 Difference in mean Hb concentration at 36 weeks

Results from t-test showed that the difference of 0.11g/dl in Hb at registration was not Significant (p=0.366). However at 36 weeks, the difference was 0.71g/dl which was statistically significant (p< 0.001). See Table 8 for details.

Table 8: T-test results on Difference in mean Hb levels before and after pregnancy school

Variable	Diff at Reg.	95% CI	P-value	Diff at 36 weeks	95% CI	P-value
Hb Conc.	0.11	0.13-0.35	0.3661	0.71	0.44-0.98	0<0.001*

**Difference after intervention (36 weeks) significant*

4.4.1 Impact estimates: Propensity Score Matching

Results from the regression adjusted propensity score matching techniques revealed that, the group of women who attended the pregnancy school had 34% reduced risk of anaemia (95% CI ; 21-42 p<0.01). Table 9 show the raw coefficients where the negative signifies reduction in risk of anaemia. This is the average treatment effect on the treated (ATET) which is the impact on the intervention group.

Table 9: Propensity score and Nearest Neighbour matching results (ATET/ATE)

Matching Type	ATE	95% CI	P-value	ATET	95% CI	P-value
PSM 1:1	-0.31	-0.64-0.23	<0.001	-0.33	-0.45-0.022	<0.001
PSM 1:2	-0.32	-0.44-0.20	<0.001	-0.32	-0.44-0.21	<0.001
NM 1:1	-0.35	-0.83-0.11	0.3661			
NM 1:2	-0.33	-0.43-0.217	<0.001			
PSM RA	-0.32	-0.46-0.21	<0.001	-0.34*	-0.46-0.21	<0.001

Note ATET: Average treatment effect on the treated effect

ATE: Average treatment effect

Note: PSMRA= Propensity Score Matching with Regression Adjustment model. ATET is Reported in this study.

4.5 Assessing quality of matching

The matching results showed that, the variance ratio between the control (untreated) and the intervention (treated) group after matching reduced closer to one as shown in Table 10. The closer the variance is to one, the better for comparison. According Donald Rubin, the difference in the variance ratio after matching should not be more than 25% to give a good match for better estimate.(Rubin, 2012).

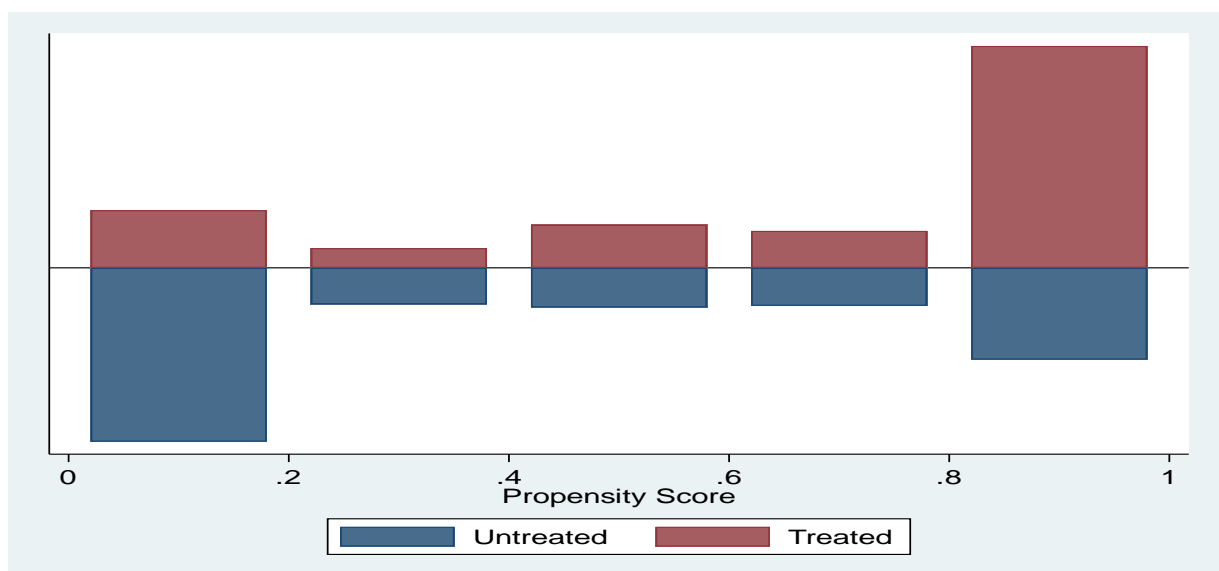
Table 10: Variance Ratios before and after matching

Variable	Raw Before Matching			After Matching (ATE)		
	Treated	Untreated	Variance Ratio	Treated	Untreated	Variance Ratio
Age	37.38	40.15	.093	37.15	36.45	1.01
Educational	1.17	0.74	1.58	1.07	0.85	1.25
Occupation	6.65	5.50	1.20	6.47	5.98	1.08
Marital status	0.081	0.12	0.618	0.084	0.086	0.98
Distance	0.081	0.13	0.623	0.084	0.083	1.01

Note: Variance ratio closed to one shows a good match and similarity

4.5.1 Results on Quality of Matching procedures

Results from the propensity score matching histogram showed that there was not much issue with the problem of lack of common support, which is usually associated with propensity score matching. This means the control group served as a good counterfactual



in estimating the impact of the pregnancy school. Figure 8 show a good match in the propensity score histogram.

Figure 8: Propensity Score Histogram

4.5.2 Results from Kernel density balancing plot

The kernel density balancing plot also showed that there was only a moderate overlap between the study group and the comparison group before matching. However, there was almost a complete overlap between the control and intervention groups after matching, there was almost a complete overlap or merge between the two groups. This means the groups became very similar after the matching thereby bringing the variations that initially existed due to covariates imbalance to almost zero after matching. Hence any difference in the estimation can be attributed to the pregnancy school strategy. Figure 9 indicates the matched and unmatched for the both the intervention and the comparison group.

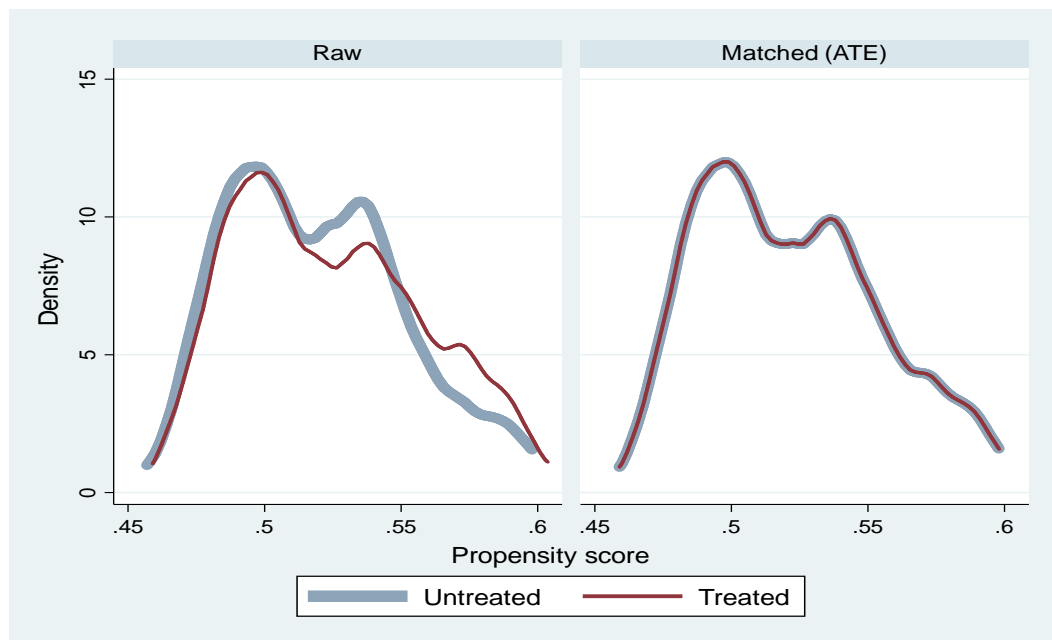
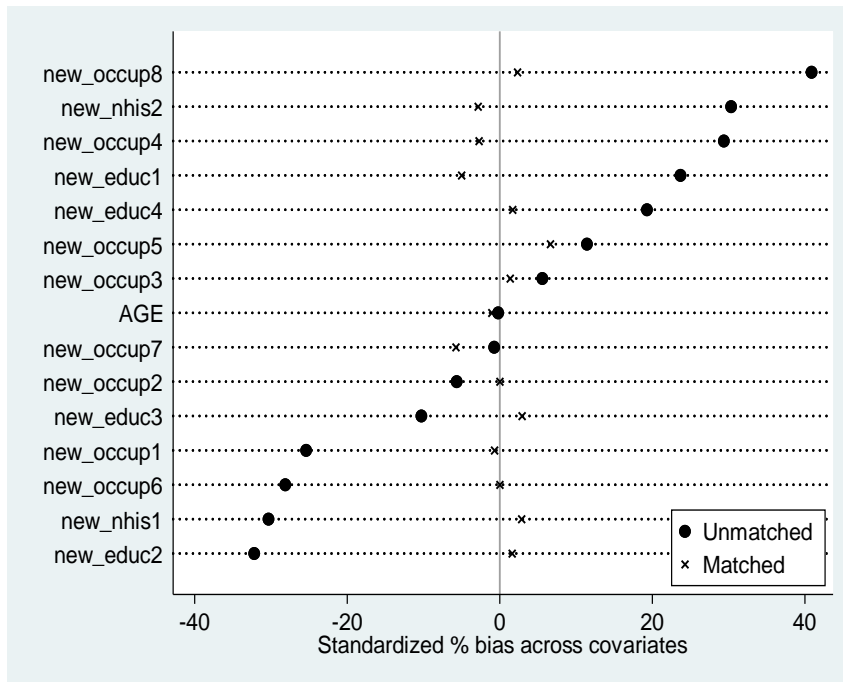


Figure 9: Kernel density balancing plot



Untreated represent those who did not attend the pregnancy school and treated are those pregnant women who attended the pregnancy school

Figure 10: Standardised cross covariate between the two groups

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Introduction

The main purpose of the pregnancy school project was to improve maternal and child health indicators such anaemia in pregnancy, low birth weight and home deliveries in the Nabdam district.

5.1 Summary of the study key findings

The study revealed that the pregnancy school intervention had a positive impact on pregnancy outcomes and skilled delivery in the Nabdam district. This include but not limited to the following:

- 1. Anaemia in pregnancy:** The pregnancy school strategy reduced the risk of anaemia at 36 weeks among the intervention group by 34%. This resulted from a difference of 0.71g/dl of Hb concentration between the two groups at 36 weeks
- 2. Birth weight:** There was a differences in mean birth weight between the intervention and control group (116g.)The proportion of low birth weight was also found to be higher among the control group (17.2%) compared to the intervention group (5.2%).
- 3. Home delivery:** The study also revealed that the proportion of home delivery was higher among the control group (7.5%) than the intervention group which was only 0.3%.

This chapter therefore gives a detailed discussion of the results from this study with references to the relevant reviewed literature as well as the researcher opinion and interpretation of the results.

5.1. Anemia in pregnancy at 36 weeks

The results from the difference in difference analysis revealed that there was a difference of 0.71 g/dl in mean hemoglobin concentration between the two groups. This means there was a positive impact of the pregnancy school intervention on anaemia in pregnancy. The 34% reduction in the risk of anaemia could be due to the fact that the intervention group had good nutrition education on how to preserve and consume iron rich foods which improved their Hb levels at thirty 36 weeks. It could also be due to the fact that the lessons from the pregnancy school might have increased their compliance in terms of taking iron supplements during their pregnancy. These findings are similar to a study in India which found that there was a 35% reduction in the risk of anemia in the intervention group in that study (Mishra et al., 2016). However, these findings contradict with a study which was conducted in Denmark on the effects of health education on pregnancy outcomes (Brixval et al., 2014)

According to the World Health Organization, any prevalence of anaemia greater than 40% (40-59%) in a population is a severe public problem. This means, apart from Pelungu sub-district, all the other sub-districts per the results recorded prevalence higher than the WHO recommend cut off point for anaemia. Though the intervention reduced the risk of anaemia by 34% in the intervention group, the overall district prevalence of anaemia was still high. This could be due to the fact that only about eight out of the 85 communities in the district organized the pregnant school. Nearly 52% of the pregnant women had anaemia which means by the WHO classification, the Nabdam district as a whole still has a public health problem in terms of anaemia in pregnancy. (Challa & Amirapu, 2016).

5.2 Low birth weight

The prevalence of low birth weight among the group of pregnant women who did not attend the pregnancy school was about 8% higher than the National prevalence of 9% and

also at the upper limit of the current World Health Organisation classification of low birth weight (Ghana Statistical Service/Ghana Health Service/ICF International, 2014; Weise, 2012a). The low birth weight rate of 5.2 percent among the intervention group was much smaller than the low birth weight incidence of 12 percent reported in the Nabdam District Health Directorate's 2018 annual report. This could be due to the fact that pregnant women who benefited from the pregnancy school had good maternal nutrition which improved the birth weight of their babies.

There was a difference of about 12% in the prevalence of low birth weight between pregnant women who attended the pregnancy and those who did not. Almost 95% of the women who attended the pregnancy school gave birth to normal weight babies against nearly 82% in the comparison group. These differences could be partly due to the pregnancy school intervention which had a positive impact on Low birth weight in the district. Also, the mean birth weight of women in the intervention group was 116 g higher than those in the comparison group. These results are consistent with a meta-analysis research conducted by (Grote et al., 2010) where the impact of antenatal care ranged from 1.02 to 4.75 times higher among beneficiaries.

These findings also means that, the impact of the pregnancy school was about five times more than what was found in a study by Lima and colleagues in 2016 which was only two 2.8% (50g) lower in the intervention group. Nearly 6% of women in the intervention group gave birth to low birth weight as compared to almost 18% in the control group. This means an increased risk of infant mortality since low birth weight babies are three times more likely to die than normal babies. The findings from this study however disagree with Thangaratinam study in 2012 which showed that there was no significant difference between the intervention and comparison group in terms of birth weight.(Thangaratinam, 2012) .

5.3 Home deliveries among the two groups

According to the 2017 Ghana Maternal Health survey, skilled delivery was 79% in the country and 91% in the Upper East Region .Though the results showed that the prevalence of home deliveries among both the intervention and control group were lower the national figure of about 20%, it was even much lower in the intervention group (0.3%) as compared to the control group (7.5%). This means the Nabdam district performed better in terms of home deliveries than the Upper East Regional figure of about 9%(Ghana Statistical Service/Ghana Health Service, 2017). The reduction in home deliveries to rates lower than both the regional and national figures could be due to the pregnancy school intervention. It could also be due to underreporting since some of the victims of home deliveries in the villages may fail to report to a health facility for fear of blame from health staff.

5.4 Impact of pregnancy school on anaemia in pregnancy at 36 weeks.

Results from the propensity score matching revealed that pregnant women who actually attended the pregnancy school had a 34% reduced risk of suffering from anaemia at 36 weeks in pregnancy. Therefore, the pregnancy school strategy was found to really have a positive impact on anaemia in pregnancy in the Nabdam district in 2017. These findings in the study were similar to a study in India which showed that the prevalence of anaemia was reduced by 35% among pregnant women who received a similar intervention during pregnancy (Mishra et al., 2016) .

5.5 Limitations of the Study

Despite the findings mentioned above, the study had some limitations. One had to do with unobserved factors which might not have been catered for in the model used in the impact estimates. For instance, a woman with undetected chronic condition could have developed anaemia or given birth to a low weight baby. Moreover, spillover effect could have affect

the estimates. Also, the parallel trend assumption that was used in the DID is very difficult to satisfy in real life situation and this was a limitation to the study.

One private health facility out of the nine facilities in the district that conducted deliveries in 2017 could not provide complete data for participants during the study. Hence, the researcher could not tell whether women who delivered in that private health facility had similar pregnancy outcomes or not.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion of the study

The main purpose of the study was to determine the differences in pregnancy outcomes and skilled delivery between pregnant women who attended pregnancy school in Nabdam district and those who did not attend the pregnancy school. The study specifically focused on comparing the differences in anaemia and mean birth weight as well as proportion of home deliveries among the control and intervention groups. Impact estimates of the pregnancy school on anaemia at 36 weeks was also determined among the intervention group.

Key Findings:

1. The mean Hb concentration at 36 is 0.71 g/dl higher among the intervention group than the control group.
2. There is 34% reduced risk of anaemia among those who attended the pregnancy school than in the control group.
3. The proportion of low birth weight among women who attended the pregnancy was 5.2% compared with 17.2% in the control group.
4. The mean birth weight of women in the intervention group was 116g higher than those in the control group.
5. Less than 1% of the pregnancy group delivered at home compared to 7.5% in the control group.

Following these findings from the study, I can conclude that the pregnancy school strategy really impacted positively on pregnancy outcomes and skilled deliveries in the Nabdam district.

6.2 Recommendations

Based on the findings above, the following recommendations are made:

1. The pregnancy school strategy should be scaled up to other communities in the Nabdam district.
2. Qualitative component of this study should be conducted to identify the lessons that were learnt during the implementation of the pregnancy school for informed decisions to be made on how to scale up and sustain the concept.
3. There should be Capacity building for health staff especially midwives and community health nurses on the pregnancy school concept to enhance universal health coverage.

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APPENDICES

Appendix I: Data extraction tool

PREGNANCY SCHOOL (C-PRESS) DATA
DIST.....
COLLECTION.....


FACILITY..... SUB-
CONTACT DATE OF DATA

S/N	ANC Reg No.	Active NHIS (Yes/No)	Age of mother	Edu Level	Marital status	Date of ANC Reg.	Gestation Age in months	Hb at Reg.	No of ANC Attendance	Pregnancy school attended: Yes/No	Trimester woman attended pregnancy school	Number of pregnancy school Attendance	Hb 36 wks.	Site of delivery (HF/Home)	Birth weight (kg)	Outcome of pregnancy Normal
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																

Appendix II: GHS Ethics Committee Approval letter

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

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



MyRef. GHS/RDD/ERC/Admin/App/19/292
Your Ref. No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
GPS Address: GA-050-3303
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com
8th July, 2019

Jonas Timbire Kolog
University of Ghana
School of Public Health
Legon

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

GHS-ERC Number	GHS-ERC 068/04/19
Project Title	Assessment of the Impact of Pregnancy School on Pregnancy outcomes and place of Delivery in the Nabdam District of Upper East Region of Ghana
Approval Date	8 th July, 2019
Expiry Date	7 th July, 2020
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly 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