KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI.

OBSTETRICS COMPLICATIONS: EFFECTS AND CONCERNS AT KOMFO ANOKYE TEACHING HOSPITAL (KATH)

By

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DECLARATION

I hereby declare that this submission is my own work towards the award of the M. Phil degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which had been accepted for the award of any other degree of the university, except where due acknowledgment had been made in the text.

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ABSTRACT

Obstetrics complication is an acute condition arising from indirect or direct causes of maternal death. Approximately 20 million of these claim the lives of 67,000 women. These deaths represent 11% of all pregnancy-related mortality in Ghana. A logistic regression was performed to ascertain the effects of age, marital status, education level, occupational status and place of delivery on the likelihood that women experienced obstetric complications. The study was based on 320 women between 15 – 49 years from May to August, 2015. Women who

were younger than 30, unemployed, single with low education and of low socio-economic status were thrice more likely to have abortion than those with eclampsia complications. Increasing levels of education was associated with increased likelihood of having eclampsia. Increasing in age was associated with increased likelihood of experiencing eclampsia complication but deccreasing in age was associated with reduction in the likelihood of having abortion. Also, a unit change in marital status (being married) was associated with a reduction in experiencing eclampsia. It was evident that only 107(33.4%) of the women used contraceptives after treatment indicating unmet need of family planning. It is recommended that women should use contraceptives in order to avert unintended pregnancies, unsafe abortion and eclampsia which ends in maternal morbidity and mortality.

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DEDICATION

This work is dedicated my son, Gideon Kwabena Lartey.

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Chapter 1

INTRODUCTION

1.1 Background Information

Obstetrics complication is an acute condition emerging from an indirect or direct cause of maternal death. Some of the direct causes are eclampsia, postpartum or antepartum haemorrahge, ruptured uterus, complications of abortion, obstructed labour, ectopic pregnancy and postpartum sepsis. Indirect causes include malaria, anaemia, fever and malnutrition (McGraw-Hill, 2014). According to the Guttmacher Institute and the World Health Organisation (WHO), about 35 million cases of abortion are reported annually in developing countries. Around 60% of the cases show unsafe abortions totaling 67000 women lives. World Health Organization (2010) and Jones et al. (2010) report that out of every 65 women chosen, one die of either childbirth or pregnancy related causes in developing countries comparative to one in 7300 women in developed countries. Conditions of abortion stem from the complexity of unsafe abortions (Roberts and Cooper, 2001).

Hypertensive Disorders of Pregnancy (HDP) suggest the conditions of proteinuria, pregnancy, high blood pressure and convulsions (ACOG Practice Bulletin, 2002). Eclampsia which is as a result of pre-eclampsia comprises the seizures resulting from the central nervous system if not treated or improperly treated leads to death. Eclampsia is the onset of convulsions in a woman with pre-eclampsia. Lambert et al. (2014) described pre-eclampsia as a pregnancy disorder where the blood pressure is high and either there is an organ dysfunction or large quantities of protein deposits are found in the urine. Complications include cerebral haemorrhage, aspiration pneumonia, cardiac arrest and kidney failure. Eclampsia and pre-eclampsia form components of a set

of conditions called the hypertensive pregnancy disorders (McGraw-Hill, 2014). In Ghana, addressing the problem of obstetric complications should significantly contribute to the achievement of Millennium Development Goal (target 5) on Improving Maternal Health. Induced abortions represents more than 1 in 10 maternal deaths (11%) in Ghana.

Also, a substantial proportion of women who survive obstetric complications die from the procedure or suffer severe disabilities (Sedgh et al., 2007). It is evident that contraception reduces unplanned pregnancies that is reducing the risk of maternal mortality or morbidity. Family planning interventions are not required only before a woman has become pregnant, but also after she has had complications. Unsafe abortion remains a major public health problem in Ghana despite apparent liberalisation of the abortion law over two decades. Morhee and Morhee (2006) concluded that the current abortion law makes enforcement difficult and leaves room for untrained and unskilled personnel to engage in dangerous and illegal abortion procedures. Therefore there is the need for the reform of the law. Cases of obstetric complications are common in Komfo Anokye Teaching Hospital (KATH-the study area) in the Ashanti Region of Ghana. KATH records revealed the rate of obstetric complications is similar to other parts of the developing world (two-thirds of the cases are complicated). Therefore, it is important to study some possible causes of obstetric complications (abortion and eclampsia) women face at delivery times and during pregnancy at KATH and deduce astute steps to improve their lives.

1.2 Problem Statement

Various measures have been put in place by the Ghanaian government to meet the Millennium Development Goals. These include the Free Child Delivery Program (FCDP) and National Health Insurance Scheme (NHIS). However, these

are underutilised services. There should be a progressive decrease in obstetric complications alongside emergency obstetric care (EMOC) with family planning in order to achieve the Millennium Development Goal 5. Most pregnant women seen at KATH with obstetric complications may have resorted to using methods such as herbs, misoprostol orally or vaginally, making delivery easy, concoctions with the aim of aborting the pregnancy or aiding it. This usually causes maternal morbidity and mortality.

1.3 Objectives of the Research

1.3.1 General Objective

Determine the characteristics of women with obstetric complications at KATH (beginning in May and ending in August, 2015) while on admission.

1.3.2 Specific Objectives

- To ascertain the use of contraceptives in emergency obstetric care (EMOC).
- To identify the characteristics of women with obstetric complications.
- To assess the causes of obstetric complications during pregnancy or delivery.

1.3.3 Research Questions

- Are obstetric complication patients given contraceptives?
- What are the characteristics of women with obstetric complications?
- What are the causes of obstetric complications?

1.4 Justification of the Research

Institute (1981) outlines that though in Ghana, some aspects of maternal health services such as antenatal care are covered by the National Health Insurance Scheme (NHIS), some women still go in for unsafe maternal health services because of ignorance and illiteracy. A greater number or women have less knowledge in the use contraceptives making after abortion care inefficient and raises alarm for the services to work.

Identifying the individual relationship of the characteristics of obstetric complications patients particularly those with abortion and eclampsia is a major step toward targeted policies and programs improving maternal health in Ghana. The study is expected to help provide information on characteristics of women with obstetric complications, assist the medical personnel to carry out effective health education and promote emergency obstetric care. This study will be beneficial in the education of women on the effects of smoking, self-medication, alcohol and malnutrition when published.

1.5 Limitations of the Research

The cross-sectional study design used for this study is limited in its ability to tell whether the exposure precede or followed the outcome or to draw valid conclusions. The total burden of health needs of the population which is useful in informing the planning and allocation of health resources may not be assessed properly. The data were collected by sampling means instead of a complete census. The results of the sample survey might differ from the complete census which could give more accurate picture of the characteristics of the population instead of using a few respondents to generalise for the entire population.

The study was conducted within half a year, from May to August and this was not enough to permit a detailed evaluation of the variables studied and

measured.Some of the detailed information about their family planning needs might have been difficult to recollect from long-term memory, making some respondents not to have given the true picture of the situation. All the possible cofounders might not be known from this study. Non-response could result in bias of measure of the outcome of the cross-sectional study design.

1.6 Structure of the Research

Chapter one gives the general background and introduction of the study.

Chapter two depicts literature review.

Chapter three examines the methodology and estimates of the variables using logistic regression to fit a model.

Chapter four is made up of the analysis of data.

Chapter five depicts conclusion.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

Various studies conducted on topics regarding child or maternal health world wide comprising maternal mortality, unsafe abortion, sepsis, post-abortion contraceptive uptake, ectopic pregnancy and their causes as well as recommendations have been made. This literature review therefore concentrates mainly on some of the studies done in this area and their significance to this study.

2.2 Characteristics of Women with Obstetric Com-

plication

Rang et al. (2014) and Bonevski and Adams (2001) outlined abortion as a major obstetric complications of maternal health. Research have shown that considerable percentage of Ghanaian women willfully end unwanted pregnancies. In Ghana, topics concerning abortion are perceived contrary to customary principles and respect. However, cases of morbidity and mortality develop from abortions. The survey conducted by the Ghana Maternal Health Survey (2007) records that 11% of maternal deaths is attributed to these obstetric complications . In spite of the fact that the abortion law is "broadly interpreted" in Ghana, abortion is a crime if not done by a professional practitioner in a hospital or a clinic under cases of defilement, rape fetal impairment, incest, mental risk or when the life the pregnant woman is at stake. Women aged from 20 to 24 years who reside in rural areas indulge in abortion more than their counterparts in the urban areas who are much educated and rich. The Ghana Maternal Health Survey (2007) accounts that 20% women who had experienced abortion in the last 5 years named financial restraints as the major reason for terminating the pregnancy for those living in both rural and urban areas (Ghana Maternal Health Survey, 2007). Accidental trauma can also cause a self-generated abortion. However, intentional trauma to cause miscarriage is considered an induced abortion institute (Institute, 1981).

In a French national sample of 12,432, women who had multiple births in a public or private maternity hospital during one week in 1995, women with single induced abortions were less likely to be unmarried, more likely to be unemployed during pregnancy, had a lower educational level, a lower incidence of inadequate antenatal care, were less likely to be smoking during pregnancy, and had a higher incidence of preterm birth compared to women with eclampsia Singh-Manoux et al. (2002). The 2008 Ghana Demographic and Health Survey (GDHS) confirmed a

rise in use of contraceptives between newly married females from 13.0% in 1988 to 19% in 2003 and 17% in 2008. Also, a rise in the use of contraceptives among unmarried women who are sexually active from 43.5% in 2003 to 50.4% in 2008 (GDHS, 2009). This is a positive impact though the Contraceptive Prevalence Ratio (CPR) in Ghana is minimum.

Research conducted by Ekane et al. (2005) reports high maternal mortality in developing and under-developed countries. For every 100,000 live births, 440 of them die in Sub-Sahara Africa. Over 30% of women give birth before reaching the age of 20. Mortality and morbidity associated with pregnancy is high among this group. Research shows that the use of contraceptives can prevent 90% abortion related, 20% of pregnancy related and 32% maternal morbidity and mortality. Financial constraints are the most dominant reason for seeking ingeminate abortions. Premarital exposure to pregnancy risk has risen, with a widening gap between age of marriage and sexual debut, and increased sexual activity prior to marriage, placing young women at increased risk when they are most economically and socially vulnerable. Reported sexual activity amongst adolescents in developing countries has generally increased, though there is a sizable variation between countries and data validity is often poor. In sub-Saharan Africa, 75 out of every 100 young women report having had sex by age 20 (Sedgh et al., 2007). It has been argued by Hatcher and Nelson (2007) that few adolescence who are sexually active in developing countries resort to the use of modern contraceptive methods such as condoms and oral contraceptives, and although there is considerable variation between countries, uptake is generally much lower than in developed countries. Previously identified limits to the use of contraceptive amongst adolescents in developing countries comprises sex education and access to services, inadequate knowledge, mis-perceptions, risks, and negative social norms around pregnancy and premarital sexual activity (Hatcher and Nelson, 2007).

Pre-eclampsia is a pregnancy disorder in which there is either large protein units in the urine or other organ dysfunction and high blood pressure (Lambert et al., 2014). It may begin before, along or after giving birth. Most at times, it is during the second quarter of pregnancy. The type of the seizures is thetonic-clonic and the duration is about 60 seconds. Mostly, confusion or coma follows the seizure. Complications comprises high blood pressure, seizures, cerebral haemorrhage, pneumonia, cardiac arrest and kidney failure. Eclampsia and pre-eclampsia form section of a bigger group known as the pregnancy disorders of hypertension. Prevention includes calcium supplementation in areas with low intake, aspirin in those at high risk and treatment of prior hypertension with medications (Rang et al., 2014). Pregnancy exercises can be helpful. The use of intramuscular magnesium sulphate or intravenous enhances results in eclampsia women and is safe (McDonald, 2014). This is the same both in the developed and developing world. Powers (2014) reported that other treatments for blood pressure consists of hydralazine and emergency delivery of the baby either by cesarean section or vaginally.

Hypertensive disorders of pregnancy are a combined significant determinant of pregnancy related mortality capturing 46900 mortality cases (Wang et al., 2016). Approximately, 1% of eclampsia women die. Most pregnant women typically develop proteinuria and hypertension before convulsions begins. Eclampsia is pre-eclampsia and seizures. Cerebral signs such as vomiting, nausea, cortical blindness and headaches may follow the the convulsion. Signs and symptoms such as the shortness of breath, stomachache, diminished urine output and jaundice may appear as the result of the multi-organ failure (Okech et al., 2011). Roberts and Cooper (2001) reported that placental hyper fusion which is associated to abnormal simulation of the interface of fetal-maternal placenta may be immunologically liaised. The intrusion of the trophoblast becomes incomplete (Zhou et al., 1997).

The USPSTF advocates steady measures to detect pre-eclampsia in pregnant women by checking their blood pressures. Pregnant women with convulsion that are not associated to pre-eclampsia are separated from those relating to eclampsia. Seizures and brain tumors are symptoms of severe pre-eclampsia. Women with pre-eclampsia are controlled using sulphate of magnesium to prevent convulsions. Convulsions are prevented or dealt with using sulphate of magnesium (Rosenberg et al., 2006). Pritchard and Wallace (2015) first published the research shoeing how to manage eclampsia using sulphate of magnesium.

In 1960, Ghana was amongst the pioneers in Africa to develop a policy on population. Accepting the family planning methods were slow but preponderance on the use of contemporary contraceptions accounted for only 5% 20 years later. However, it rose from 5% in 1988 to 13% in 1998 reducing the total rate of fertility from 6.4 to 4.5 at the same time (Stanback et al., 1997). In recent times, Ghana has set up the National Reproductive Unit to develop and distribute health service protocols to all units and service points of the family planning agenda in removing medical blocks and providing quality and uniform services.

A two-year study in Zimbabwe comparing two hospitals showed that when the intervention site provided on-site counseling and access to free contraceptives at the same location and at the same time as emergency treatment, women were significantly more likely than women treated at the control site to adopt highly effective methods of contraception than women treated at control site (96% versus 5%) and had less than half the unplanned pregnancies (42 against 96) during the year-long follow-up. The proportion of patients who had repeated abortion during follow-up was more than two times as high at the control site, where only emergency services were provided, as at the intervention site (53 out of 100 compared to 25 out of 100). The Mexico City study found that the

acceptance of the post-abortion contraceptive method was significantly associated with women with higher parity, prior contraceptive use, higher education and reported abortionrelated complications (Dixon-Mueller, 2007).

Barriers to use of contraception are mostly due to gender imbalance leading to inadequate education on family planning. About 200 million women around the globe say they want to delay or prevent pregnancy but are not using effective contraception. Either they will not get pregnant, they fear side effects or their families objects. Thousands of unintended pregnancies lead to ill health which results to maternal deaths. the Population growth between 1960 and 2000 of married women in developing regions using contraceptives increased from 0% to

60%. Population growth is highest in poor countries already struggling to meet their peoples needs for education, jobs, health care and services. Less than 20% of sexually active young people in Africa use contraception. Apart from lack of money, barriers include misconceptions and insufficint knowledge about family planning (Unicef, 2009).

2.3 Application of Logistic Regression Model

The odds ratio is used to consider the effect of the independent variables. The log of odds ratio provides a result on the extended real number line. Therefore, the central point 0 represents no effect. Selective methods are also available in the models of logistic regression but are not recommended for other regression methods. The selection methods can erase critical variables, provide wrong estimation of p-values and standard errors. Hence, it is always advisable to chose models based on their fit, reasonableness and their results.

Zhou et al. (2010) applied logistic regression in their study to credit risk analysis. With the appearance of listed companies' credit issues and frequent credit crisis, investors developed keen interest in credit risk analysis for listed companies. In view of the current development methods of credit risk analysis and the relevance of recognising corporate financial risk, Zhou et al. (2010) designed a more effective and comprehensive indicator system and established the models for credit evaluation of China's listed companies by taking advantage of the financial data gathered in 2009. Coupled with the reality of China's listed companies, they used the established models to discriminate and analyze.

Logistic regression methods have been globally embraced and used in numerous areas of research. The objective is to model the conditional success probability of an event as the logit function is the linear combination of covariates. However, some covariates may exist naturally as matrices with different meaning of its rows and columns. We may ignore important information if we regard X as a simple matrix and fit the model. The most important feature of this model is that, it retains the inherent covariate matrix structure. Another advantage is the closeness of the needed parameters. These features results to a high performance of MV-Logistic Regression in many situations. In 2010, Bayaga researched into the application of Polytomous Logistic Regression (PLR). After analysing risk data using PLR, he found out that the assumptions of equal variance and normality were not violated. The relationship between the dependent and the independent variables was addressed.

2.4 Strength and Weakness of Logistic Regression Model

LEE (1986) said polytomous logistic regression is a method used to assess the relationship between a quantitative result and the potential effects of antecedent

characteristics covariates. However, the PLR has some setbacks. Lee considered only the-main effect as the significant problem in the PLR model. The maineffect assumes that there is a linear relationship between the probability of the dependent variable and the sum of the covariates on the logistic scale. This assumption stipulates the odds ratio for every covariate to be constant and that the overall odds ratio of the model is the product of the odds ratio of the individual covariates.

However, if the odds ratio of the individual covariates do no follow the assumptions above, the model will not accurately fit the data and the overall odds ratio of the model will not reflect the odds ratio of the data. The expressed purpose of Lee's work makes explicit the potential problems encountered in logistic regression analysis. It is hoped that an awareness of these subtleties will encourage a more judicious use of this method in the analysis of epidemiological data.

Chapter 3

METHODOLGY

3.1 Introduction

This chapter comprises the methods and design, population, variables, sample size, ethical issues, limitations and assumptions of the study.

3.2 Study Population and Sample Design

It consists of every woman from 15 years of age to 49 years of age who has obstetric complications (abortion and eclampsia) at KATH from May to August, 2015. They were approached and requested to participate in a study on the topic:

obstetric complications (effects and concerns) at KATH. The study focused on 320 women with or without abortion and eclampsia complications.

3.2.1 Inclusion Criteria

Any woman aged 15 to 49 years at KATH who agreed to participate was included in the study. A cross-sectional design was used for the study. The study begun with a questionnaire for women with obstetric complications particularly, eclampsia and abortion at KATH.

3.3 Sample Size Consideration

Slovin (1960) proposed a technique for calculating the sample size of a distribution. Below are the guidelines;

Assume a to be the total enumeration of the independent variables (covariates) and b to be the minimum proportion of cases the population can have, then the least number of cases(sample size) is given by:

$$N = \frac{10b}{a}$$

Alternatively, using a guideline provided by Hosmer Jr et al. (2013), the minimum number of cases per independent variable is 10, with a preferred ratio of 20 to 1.

3.4 Data Collection and Tools

Patients presenting to KATH with abortion were approached and asked to participate after explaining the purpose of the study to them. After they had given their consent, the questionnaire was administered to them on daily basis. Its reliability and validity had been checked through the previous pilot survey. The

data was collected while participants were on admission and after discharge from KATH. Dummy tables were used to collect secondary data from the facility records. Interviews were conducted at KATH using a four-part questionnaire. The interviews were conducted in local languages particularly, Twi in order to ensure that the questions were fully understood by the clients. The first part of the questionnaire was on their socio-economic demographic and household information. The second part was information on the pregnancies each woman had experienced or fertility. The third part was assessment of provision of contraceptive after treatment of obstetric complications at the health facility.

3.5 Analysis for the Study

The study data was analysed using the Statistcal Package for the Social Scientist (SPSS) software. Cross-tabulations together with frequency distribution tables were used to examine variables. This provided values to be tested for association. For nominal variables, Chi-square and p-values were used. Logistic regression analysis was then used to estimate odds ratios (ORs) to assess the strength of association between variables with 95% confidence intervals (CIs) and $p < 0.05$ level of significance.

3.6 Assumptions For The Study

Since KATH is a tertiary referral centre and most complicated cases were referred there, it was assumed that: the sample population is a representative of Kumasi metropolis population of women with obstetrics complications (abortion and eclampsia), all the responses obtained from the respondents were true and accurate, women have been accessing health services at KATH. That is:

- The responses are true.

- The significant control measures were followed.
- The sample chosen clearly represents the population.

3.7 Ethical Consideration

The study protocol was given to the Committee on Human Research, Publications and Ethics (CHRPE) at the School of Medical Sciences, KNUST for ethical clearance before embarking on the study. A written letter of consent for the interview was signed by respondents. All information collected remained confidential and used for the purposes of the study only. Signed or thumb-printed consent letters were kept separately from completed questionnaires. The Kumasi Metropolitan Health Administration (KMHA) and the KATH administrations also provided the administrative clearance.

3.8 Model Description

The model used in this research is logistic regression.

3.8.1 Purpose of Logistic Regression (Logit Regression)

Linear regression deals with dependent variables that are quantitative in nature. However, the nature of the dependent in this study is categorical and cannot be modelled using linear regression. Since the dependent variable is also binary, there is the need for the Binary Logistic Regression. The logistic regression describes the systematic structure (the underlining probability distribution) and the stochastic structure (the link logit). The logistic regression relates the logarithm of the odds of the dependent variables to the covariates.

3.8.2 Assumptions of Logistic Regression

- The dependent variable must be categorical and binary in nature.

- The independent variables should be categorised into groups.
- The groups of the independent variables must be mutually exclusive and exhaustive.

3.8.3 Probability Distributions

Consider the probability of a generalized linear model where the dependent variable is dichotomous. A dichotomous variable can be defined as:

$$Y = \begin{cases} 1 \text{ if the dependent variable is true} \\ 0 \text{ if the dependent variable is false} \end{cases} \quad (3.1)$$

With probabilities: $P(Y = 1) = \alpha$ and $P(Y = 0) = 1 - \alpha$

Assuming $P(Z_j = 1) = \alpha_j$, this follows a Bernoulli distribution. However, if there are n of such variables the distribution tend to be binomial. Thus:

$$\prod_{j=1}^{n} \alpha_j^{Z_j}(1-\alpha_j)^{1-Z_j} = exp[\sum_{j=1}^{n} Z_j \log(\frac{\alpha_j}{(1-\alpha_j)}) + \sum_{j=1}^{n} \log(1-\alpha_j \quad)] \quad (3.2)$$

Y follows the binomial distribution with parameters (n, α):

$$Pr(Z = y) = \binom{n}{y}\alpha^y(1-\alpha)^{n-y}, y = 0, 1, 2, ..., n \quad (3.3)$$

Considering $Y_1, Y_2, Y_3, ..., Y_n$ corresponding to the number of 'trues' in distinct groups, the maximum likelihood function is given:

$$l(\alpha_1, ..., \alpha_n; y_1, ..., y_n) = \sum_{i=1}^{n} y_i \log(\frac{\alpha_i}{(1-\alpha_i)}) + n_i \log(1-\alpha_i) + \log\binom{n_i}{y_i} \quad (3.4)$$

The logistic model is one of the models that accommodates response variable that follows the binomial family. The probability distribution is

$$f(x) = \frac{exp(\beta_0 + \beta_1 x)}{[1 + exp(\beta_0 + \beta_1 x)]^2} \tag{3.5}$$

So integrating f(x), we obtain the logistic function

$$\alpha = \int_{-\infty}^{x} f(x)dx = \frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)} \tag{3.6}$$

Therefore, the odds is given by:

$$\frac{P(true)}{P(false)}$$

$$odds = \frac{P(true)}{Pr(false)} = \frac{\alpha}{1 - \alpha} \tag{3.7}$$

This can be obtained as follows

$$\frac{\alpha}{1 - \alpha} = (\frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)})/(1 - \frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)})$$

$$= (\frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)})/[(\frac{(1 + exp(\beta_0 + \beta_1 x) - exp(\beta_0 + \beta_1 x))}{1 + exp(\beta_0 + \beta_1 x)}]$$

$$= (\frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)})/(\frac{1}{1 + exp(\beta_0 + \beta_1 x)})$$

$$= (\frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)}) * (\frac{1 + exp(\beta_0 + \beta_1 x)}{1})$$

$$= exp(\beta_0 + \beta_1 x)$$

Therefore,

$$\frac{\alpha}{1 - \alpha} = exp(\beta_0 + \beta_1 x) \tag{3.8}$$

3.8.4 The Logit Model

The link function is given by:

$$\log(\frac{\alpha}{1 - \alpha}) = \beta_0 + \beta_1 x \tag{3.9}$$

The term $\log(\frac{\alpha}{1 - \alpha})$ is referred to as the log function. Hence the generalized form of the logistic regression model is given by:

$$\text{logit}(\alpha_i) = \log(\frac{\alpha}{1-\alpha}) = X_i^T\beta \tag{3.10}$$

3.8.5 Coefficients and Odds Ratios of Logit Model

The odd for Y=1 is:

$$\frac{\alpha(1)}{1-\alpha(1)} \tag{3.11}$$

The odd for Y=0 is:

$$\frac{\alpha(0)}{1-\alpha(0)} \tag{3.12}$$

The odds ratio (OR) is given by:

$$OR = \frac{\frac{\alpha(1)}{1-\alpha(1)}}{\frac{\alpha(0)}{1-\alpha(0)}} \tag{3.13}$$

$$OR = \frac{\exp(\beta_0 + \beta_1)}{\beta_0}$$

$$OR = \exp(\beta_0 + \beta_1 - \beta_0)$$

$$OR = \exp(\beta_1) \tag{3.14}$$

Hence, the odds ratios are the exponential functions of the coefficients in the logit model.

3.8.6 Maximum Likelihood Estimation Method (MLE)

The Bernoulli probability distribution is the primary distribution for the binary logistic regression. Therefore, we find the maximum likelihood estimator for the Bernoulli distribution.

$$f(\alpha,x) = \alpha^x(1-\alpha)^{1-x} \tag{3.15}$$

The likelihood function is given by

$$l(\alpha,x) = \prod_{i=1}^{n} \alpha^x(1-\alpha)^{1-x}$$

$$l(\alpha,x) = \alpha \sum_{i=1}^{n} x_i (1-\alpha)^{n-\sum_{i=1}^{n} x_i} \tag{3.16}$$

Solving for the log likelihood function, we have

$$\ln l(\alpha,x) = \ln[\alpha \prod_{i=1}^{n} x_i (1-\alpha)^{n-\sum_{i=1}^{n} x_i}]$$

$$\ln l(\alpha,x) = \sum_{i=1}^{n} x_i \ln\alpha + \ln(1-\alpha)^{n-\sum_{i=1}^{n} x_i}$$

$$\ln(\alpha,x) = \sum_{i=1}^{n} x_i \ln\alpha + (n - \sum_{i=1}^{n} x_i)\ln(1-\alpha) \tag{3.17}$$

The score function is given as:

$$S(\alpha,x) = \frac{d}{dx} l(\alpha,x_i)\, dx$$

$$S(\alpha,x) = \frac{d}{dx}[\sum_{i=1}^{n} x_i \ln\alpha + (n - \sum_{i=1}^{n} x_i)\ln(1-\alpha)]$$

$$S(\alpha,x) = [\frac{x}{\alpha} + \frac{x-n}{1-\alpha}] \tag{3.18}$$

The maximum likelihood(ML) estimator is given as:

$$S(\alpha,x) = 0$$

$$S(\alpha,x) = \frac{d}{dx} l(\alpha,x_i)\, dx$$

$$S(\alpha,x) = \frac{d}{dx}[\sum_{i=1}^{n} x_i \ln\alpha + (n - \sum_{i=1}^{n} x_i)\ln(1-\rho)]\, dx$$

$$S(\alpha, x) = [\frac{x}{\alpha} + \frac{x-n}{1-\alpha}]$$

$$\frac{x}{\alpha} + \frac{x-n}{1-\alpha} = 0$$

$$x(1-\alpha) + \alpha(x-n) = 0$$

$$x - x\alpha + x\alpha - n\alpha = 0$$

$$n\alpha = x$$

$$\alpha = \frac{x}{n} \tag{3.19}$$

3.8.7 The Wald Test

The Wald Test is given by:

$$W = (\frac{\beta_1}{S.E(\beta_1)})^2 \tag{3.20}$$

The SPSS computes the standard errors, the coefficients and the Wald test. Rejection decisions are based on the p- value and the level of significance.

3.8.8 Likelihood Test Criterion

Performing the likelihood test helps to know whether the dependent variable is explained well when another variable is added to the model or not. The test statistic of the likelihood ratio test is given by:

$$-2\log(\frac{L_0}{L_1}) = -2[\log(L_0) - \log(L_1)] = 2(L_0 - L_1) \tag{3.21}$$

where

L_1 = maximized value of the likelihood function for full model

L_0 = maximized value of the likelihood function for the reduced model

The SPSS computes the test statistic value.

3.8.9 Variance Explained Measure for Logit Model

The deviance for the observed model, null model and saturated model are useful quantities for exploring the fit of a logistic regression. One slightly controversial application of the deviance is to derive a pseudo-R square measure from it, known as the log-likelihood or Hosmer and Lemeshow R square Hosmer Jr et al. (2013). This is done by expressing the deviance of the model as a proportion of deviance for the null model. If the deviance for the model is D_M, log-likelihood pseudo-R square is:

$$R_L^2 = \frac{\ln(l_M) - \ln(l_0)}{\ln(l_s) - \ln(l_0)} = \frac{D_0 - D_M}{D_0} = 1 - \frac{D_M}{D_0} \tag{3.22}$$

This is termed as pseudo-R square measure because there is no agreed equivalent to R square in logistic regression (or other generalized linear models). The problem stems mostly from the fact that R square can be defined in several ways. One definition is the improvement in fit from adding predictors to a null model (which attempts to tackle). Another definition is in terms of the square of the correlation between predicted and observed values. A further definition is in terms of the proportion of explained variation in the data (e.g., R square can be calculated by subtracting the unexplained variance from one). For a normal generalized linear model with an identity link, these definitions coincide and lead to the same quantity, but they will not coincide for a generalized linear model. Applying the logic of the explained variance measure leads to the Cox and Snell pseudo-R square

$$R_{CS}^2 = 1 - (\frac{l_0}{l_M})^{\frac{2}{N}} = 1 - e^{-\frac{1}{2N[\ln(l_M) - \ln(l_0)]}} \tag{3.23}$$

Chapter 4

DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents the analysis of data collected on women who had obstetric complications at the Komfo Anokye Teaching Hospital, KATH from May to August 2015. The analysis centres on the characteristics of the individual women with more emphasis on the concerns and causes of abortion and eclampsia as obstetric complications.

4.2 Empirical Results

This section presents the descriptive statistics of women who have obstetric complications and social-economic factors that influences the type of obstetric complications under study.

Table 4.1: Age Distribution of Women

Age (years)	Frequency	Percentage
< 20	132	41.2
$20 - 34$	120	37.5
> 34	68	21.2
Total	320	100.0

Table 4.2: Marital Status of Women

Status	Frequency	Percentage
Married	90	28.1
Single	143	44.7
Divorced	25	7.8
Cohabiting	62	19.4
Total	320	100.0

Table 4.3: Educational Attainment of Respondents

Education level	Frequency	Percentage
None	77	24.1
Primary	161	50.03
Secondary	45	14.1
Tertiary	37	11.6
Total	320	100.0

Table 4.4: Economic Status of Women

Status	Frequency	Percentage
Poor	111	34.7
Middle class	153	47.5
Rich	41	12.8
Very rich	16	5.0
Total	320	100.0

Table 4.5: Occupation of Respondents

Status	Frequency	Percentage
Trader	132	41.2
Civil servant	120	37.5
Artisan	68	21.2
Total	320	100.0

Table 4.6: Plan of Index Pregnancy

Plan of index pregnancy	Frequency	Percentage
Yes	91	28.4
No	120	71.6
Total	320	100.0

Table 4.7: Age Distribution of Women

Age (years)	Type of Obstetric complications		Total
	Eclampsia	Abortion	
< 20	12	120	132
$20 - 34$	25	95	120
> 34	55	13	68
Total	92	228	320

Table 4.8: Chi-Square Tests

	Value	Df	Sig.(2-sided)
Pearson Chi-Square	1.188E2	2	.000
Likelihood Ratio	114.335	2	.000
Linear-by-Linear Association	98.005	1	.000
Number of Valid Cases	320		
Cramer's V	0.609		.000

The independence test between the type of obstetric complications and the age group of the women shows from the Chi Square value of $1.188E2$ with a corresponding p-value of 0.000. The Cramer's V value of 0.609 depicts that, the association identified is strong. That is with respect to the cross tabulation women below 20 years are more likely to have abortion than those between 20-34 years. Also, those below 34 years are less likely to have eclampsia than those who are above 34 years.

Table 4.9: Marital Status and Type of Obstetric Complications

Age (years)	Type of Obstetric	complications	Total
	Eclampsia	Abortion	
Married	60	30	90
Single	13	130	143
Divorced	2	23	25
Cohabiting	17	45	62
Total	92	228	320

The cross tabulation of marital status and obstetric complications type of women indicates that, 130(90%) out of 143 single women experienced abortion, for 90 married women only 30(33%) had abortion as compared to those cohabiting with their partners which is 45(72%) out of 62.

Table 4.10: Chi-Square Tests

	Value	Df	Sig.(2-sided)
Pearson Chi-Square	95.454[a]	3	.000
Likelihood Ratio	95.462	3	.000
Linear-by-Linear Association	23.199	1	.000
Number of Valid Cases	320		

The Chi-square statistic with a value of 95.454^{a} and a significance level of 0.000 shows a significant relationship between the type of obstetric complications and marital status of respondents. Therefore, women who are single or cohabiting are more likely to have abortion as compared to eclampsia.

Table 4.11: Symmetric Measures

	Value	Approximated Sig.
Nominal by Phi	.546	.000
Nominal Cramer's V	.546	.000
Number of Valid Cases	320	

Table 4.12: Level of Education and Type of Obstetric Complications

Age (years)	Type of Obstetric	complications	Total
Educational Level	Eclampsia	Abortion	
None	11	66	77
Primary	46	115	161
Secondary	10	35	45
Tertiary	25	12	37
Total	92	228	320

With respect to type of obstetric complications and the educational level of women, 12(5%), 35(15%), 115(50%) and 66(30%) of women with tertiary, secondary, primary and no formal education respectively had abortion over the period of study. It is evident that there is much distinction with particularly education level of women and the obstetric complications type they had during pregnancy.

Table 4.13: Chi-Square Tests

	Value	Df	Asymp. Sig.(2-sided)
Pearson Chi-Square	36.020	3	.000
Likelihood Ratio	33.834	3	.000
Linear-by-Linear Association	25.087	1	.000
Number of Valid Cases	320		

The chi- Square test yielded a value of 36.020 and the p-value of 0.000 further suggests a significant association between a woman's level of education and the type of obstetric complications. This therefore suggests that obstetric complications like abortion are possible irrespective of the woman's level of education.

Table 4.14: Symmetric Measures

	Value	Approximated Sig.
Nominal by Phi	.336	.000

Nominal Cramer's V	.336	.000
Number of Valid Cases	320	

Table 4.15: Level of Education and Type of Obstetric Complications

	Type of Obstetric	Complications	Total
Occupation	Eclampsia	Abortion	
Trader	12	120	132
Civil servant	25	95	120
Artisan	55	13	68
Total	92	228	320

On the issue of occupation and type of obstetric complications, the cross tabulation indicates that, among 228 women who had abortion 120(52%) were traders, 95(42%) were civil/public servants and 13(6.0%) were artisans.

Table 4.16: Chi-Square Tests

	Value	Df	Asymp. Sig.(2-sided)
Pearson Chi-Square	1.188*E*2	2	.000
Likelihood Ratio	114.335	2	.000
Linear-by-Linear Association	98.005	1	.000
Number of Valid Cases	320		

The Chi-Square test values in the table above with a test statistic of 1.188*E*2 and significance level of 0.000 indicates an association between a woman's type of obstetric complications and the occupation. However, the association identified is very significant as Cramer's V value of 0.609 depicts a strong relationship between the variables.

Table 4.17: Symmetric Measures

	Value	Approximated Sig.
Nominal by Phi	.609	.000
Nominal Cramer's V	.609	.000
Number of Valid Cases	320	

Table 4.18: Socioeconomic Status and Category of Index Pregnancy

Socio-economic Status	Type of Obstetric	Complications	Total
Occupation	Eclampsia	Abortion	
Poor	19	92	111

Middle Class	40	112	152
Rich	20	21	41
Very rich	13	3	16
Total	92	228	320

From the above cross tabulations, it is evident that only 92(40%) of the poor hard abortion whiles 112(49%) of middle class had abortion. Also, 20(21%) of the very rich and 13(14%) of the middle class had eclampsia. This suggests that, the middle class are more likely to have abortion.

Table 4.19: Chi-Square Tests

	Value	Df	Asymp. Sig.(2-sided)
Pearson Chi-Square	37.332	3	.000
Likelihood Ratio	34.855	3	.000
Linear-by-Linear Association	33.097	1	.000
Number of Valid Cases	320		

The Chi-Square test from the table above shows a significant relationship between socio-economic status of women and the sort of abortion complications they are likely to have. And this is confirmed by the Cramer's V value of 0.342 with a

corresponding significance level of 0.000.

4.3 Further Analysis

This section comprises the logistic regression modeling of data to determine factors that influence the type obsteric complications experienced. The variables that will influence the type obsteric complications by the women will be determined by their significant contribution to the model.

Table 4.20: Initial Classification

Step 0	Predicted Obstetric	Complications	Percentage
Type of Obstetric complications	Eclampsia	Abortion	Correct
Eclampsia	0	92	0
Abortion	0	228	100
Overall Percentage		2	71.2

From the beginning block, the proportion by chance accuracy is $0.7^2+0.3^2 = 0.58$ which is 58.0% of grouping and prediction.

Table 4.21: Constant term only

Step 0	Constant	β	S.E	Wald	Df	Sig.	Exp(β)
		0.908	0.124	53.991	1	0.000	2.478

From the table above, the model with only the constant term is found to be significant with significance level of 0.000 and a corresponding coefficient of 0.908.

Table 4.22: Omnibus Tests of Model Coefficients Chi-square

		Df	Sig.
Model	255.707	23	.000

4.3.1 Statistical Significance Level of the Overall Model

The Model Coefficients from the Omnibus Tests for the independent variables have a chi-square value (255.707) with a corresponding level of significance (0.000) less than 0.01. Hence the existence of a significant relationship between the response variable and independent variables and the null hypothesis that there is no difference between the model with only the constant and the model with the independent variables is rejected. Thus the hypothesis tested stated as follows:

$H_0 : \beta_i = 0$ vs $H_1 : \beta_i 6= 0$

Table 4.23: Hosmer and Lemeshow Test

Step 1	2log likelihood	Cox and Snell R Square	Nagelkerke R Square
	128.2277	0.550	.0.787

This is a reliable goodness of fit test of the final model. The model is a good- fit of the data when the significance value is greater than 0.05.

4.3.2 Statement of Hypothesis

H_0 = The model fits the data

H_1 = The model does not fit the data

Table 4.24: Hosmer and Lemeshow Test

Step 1	Chi-square	Df	Sig.
	3.249	8	.0.918

From the above table, the p-value of the Hosmer and Lemeshow is 0.918 which is comparatively greater than the α = 0.05. Therefore, we do not reject the null hypothesis and conclude that, the observed number of women who experience eclampsia is not significantly different from those predicted by the model and hence the overall model is a good fit of the data under study.

Table 4.25: Final Classification Table

Step 1		Predicted of Index Pregnancy	Category	Percentage Correct
		Eclampsia	Abortion	
Observed Category of Index Pregnancy	Eclampsia	77	15	83.7
	Abortion	8	220	96.5
Overall Percentage				92.8

From the beginning block, the percentage by chance was estimated to be 58.0% and for the overall accuracy rate, the final model classification should be at least 25% more than the proportion by chance. The final model overall accuracy of 92.8% is more than (1.25 × 0.58) = 0.725 which is 72.5%. Thus the final classification is accurate for the expected and observed cell frequencies.

Table 4.26: Constant term only

	β	S.E.	Wald	df	Sig.	Exp(β)	95.0% C.I. for EXP(B) Lower	Upper
Age			22.858	2	.000			
Age(1)	4.040	.910	19.703	1	.000	56.819	9.545	338.210
Age(2)	3.699	1.016	13.242	1	.000	40.391	5.510	296.098
Marital Status			15.010	3	.002			
Marital	-4.773	1.635	8.527	1	.003	.008	.000	.208

Status(1)								
Marital Status(2)	.371	.943	.155	1	.694	1.450	.228	9.204
Marital Status(3)	1.864	1.256	2.204	1	.138	6.452	.551	75.599
Education Level			12.344	3	.006			
Education Level(1)	5.142	1.522	11.418	1	.001	171.127	8.668	3.378E3
Education Level(2)	.441	1.010	.190	1	.663	1.554	.215	11.247
Education Level(3)	1.314	1.307	1.012	1	.315	3.721	.287	48.175
Wealth Index				.291	3	.962	7	
Place of Delivery(1)	-3.608	.973	13.743	1	.000	.027	.004	.183
Mothers Years of Schooling				1.805	2	.406		
Mothers Years of Schooling(1)	-1.090	1.131	.929	1	.335	.336	.037	3.085
Mothers Years of Schooling(2)	-1.205	1.089	1.225	1	.268	.300	.035	2.533
Type of Life Style				2.250	1	.134	7	
Type of Life Style(1)	2.447	1.631	2.250	1	.134	11.553	.472	282.676

Plan of Index Pregnancy(1)	-2.838	1.216	5.448	1	.020	.059	.005	.635
Place of Residence(1)	-.540	.891	.368	1	.544	.582	.102	3.337
Contraceptive use after complications(1)	2.950	1.012	8.501	1	.004	19.115	2.630	138.904
Sought Treatment for Pregnancy Complications(1)	.828	.792	1.092	1	.296	2.288	.484	10.811
Health Insurance Coverage(1)	-1.464	1.038	1.987	1	.159	.231	.030	1.771
Partner Desire to Keep the Index Pregnancy(1)	-5.191	1.518	11.690	1	.001	.006	.000	.109
Constant	3.617	1.877	3.712	1	.054	37.226		

From the table above with the variables in the equation, the final model for the prediction of the number of women who experience obstetric complication at KATH is given as: $\log(odds) = 3.617 + 4.04X_1 - 4.773X_2 + 5.142X_3 - 3.608$ And for predicting the probability of a particular case we can use

$$\pi = \frac{e^{3.617+4.04X_1-4.773X_2+5.142X_3-3.608X_4}}{1 - e^{3.617+4.04X_1-4.773X_2+5.142X_3-3.608X_4}}$$

where:

X_1 : Age Group 1

X_2 : Marital Status 1

X_3 : Education level 1

X_4 : Place of Delivery 1

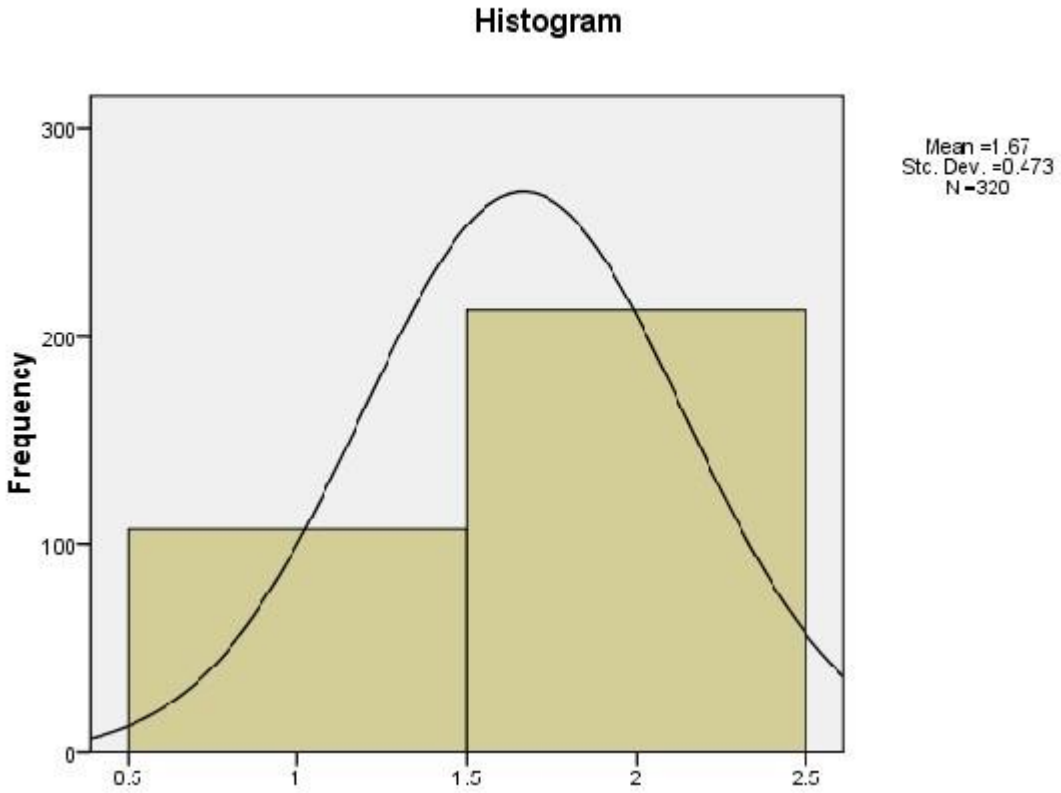
The selected variables in the logistic model are based on their significance levels which are comparatively less than 0.05. From the standard errors of the independent variables, the problem of multicollinearity to the model is checked. And since the standard errors are less than 2, there is no problem with multicollinearity in the model.

4.3.3 Summary of Model

A logistic regression analysis to predict the type of obstetric complications the 320 women understudy experienced used the independents variables such as age, marital status and the educational level as predictors for each woman. A test of the full model against the constant only term is statistically significant (0.000 < 0.05), indicating that, the predictor variables significantly distinguished between women who experienced eclampsia and abortion (*Chi–square* = 255.707, p = 0.000 with df = 23).

The Nagelkerke's R-square of indicates a moderately strong relationship between prediction and grouping. The overall success of prediction is observed to be 92.8% (83.7% for eclampsia and 96.5% for abortion).The Wald criterion for the selection of independent variables shows that age group, marital status, education level and place of delivery of women made significant contributions to the model with significance level less than each as in the table above.

Figure 4.1: Provided Contraceptives Before Discharge



From figure 4.1, it was evident that 107(33.4%) of the women used contraceptives whereas 213(66.6%) did not use contraceptives after obstetric complications signifying unmet need of family planning (FP). FP, an essential part of EMOC is ideal in spacing and improving maternal health by preventing further obstetric complications.

Chapter 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter explores the factors or characteristics predicting the type of obstetric complications women experience. It sums up the findings, conclusions and suggested recommendations.

5.2 Findings

In summary, 92 women had eclampsia complications as compared to 228 women had abortion complications. Of the 68 women who were above 34 years, 55 experienced eclampsia against 120 out of 132 women below 20 years who had abortion. The analysis revealed that those above 34 years with history of malnutrition were more likely to have eclampsia complications. Out of 37 women, 25 with tertiary education experienced eclampsia versus 115 out of 161 with low education who experienced abortion complications. In all, 110 sought treatment from private health facility whilst 210 women sought treatment from public health facility. The independent variables: education level, age, marital status and place of delivery were relevant predictors of eclampsia complications while others such as place of residence, parity, years of schooling, habits or life style and mother's occupation were dropped from the model. The final model was found to be: $\log(odds) = 3.617 + 4.04X_1 - 4.773X_2 + 5.142X_3 - 3.608X_4$

From the model, the highest predictive variable is education level which is more likely to estimate obstetric complications controlling all other factors.

5.3 Conclusions

It was estimated in Sub-Saharan Africa that 14 million unintended pregnancies occur yearly with almost 50% occurring among women aged 15–24 years (Ekane et al., 2005). This can be likened to the findings of the research where women above 30 years who were married with high socio-economic status were less likely to have abortions than those below the age 20 years. Women below 20 years were associated with single or cohabiting status, low education level and lower socioeconomic status with increased rate of abortion complications. Moreover, it was evident that those above 34 years and first-time pregnant women with history of high level of education, poor diet or malnutrition and high blood pressure were more likely to experience eclampsia complications. In

accordance to the results from chapter four, it is expected that the women would be given contraceptives as part of EMOC services to prevent further obstetric complications. Contraceptive uptake would interrupt the cycle of unplanned pregnancy, repeated abortion, maternal morbidity and maternal mortality.

5.4 Recommendations

The following recommendations were made:

- Further research could be done to better the findings and unveil other risk factors yet to be proven.
- Pregnant women should be educated on signs and symptoms of obstetrics complications in order to avoid delays in seeking assistance.
- Teenagers should be sensitize on the dangers of early sex so as to prevent obstetric complications like eclampsia and abortion.
- Ghana Health Service should educate women on the importance of using health facility and make Family Planning part of Emergency Obstetric Care.

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