KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

DETERMINANTS OF MATERNAL MORTALITY IN URBAN GHANA USING KORLE BU TEACHING HOSPISTAL AS A CASE STUDY

BY

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DECLARATION

I hereby declare that this submission is my own work towards the award of the M.SC. 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 acknowledgement had been made in the text.

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DEDICATION

I dedicate this thesis to my late father Samuel Ohene Danso and my sisters Mary Ohene Danso and Mrs Victoria Adjei Dickson.

ABSTRACT

Maternal mortality has been a challenge for developing countries. The objective of this research is to investigate the reasons for maternal death in the urban regions of Ghana. In this respect, Korlebu Teaching Hospital was selected as a case study. The study used demographic data of pregnant women who visit the hospital for prenatal and postnatal services. A random sample of delivery with maternal mortality and immortality was selected in proportions that will reflect the proportion in the total population. A chisquare test of association was performed to test for significance of relationship between demographics and maternal mortality. A binary logistic regression analysis was performed to estimate the probability of mortality of expectant mothers given their demographics. Demographics that indicated no significance or P-value more than 0.05 were excluded from the model to estimate the probability of mortality. A multiple logistic regression model was then used to examine various categories within the demographics. Occupation, parity, emergency referral, antenatal attendance and gestation age of pregnancy had a significant predictability for maternal mortality . It is recommended that more efforts should be made to equip hospitals with facilities that will enable delivery by cesarean section as early as possible and the support of the premature baby. Post-natal care for the newly born should also the included after delivery care for mothers. After delivery care for mothers should be at least forty-two days after delivery.

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CONTENTS

LIST OF ABBREVIATION

MMR .....Maternal Mortality Rate

MDG .....Millennium Development Goals

WHO .....World Health Organization UNICEF ..... United Nations International Children Emergency Fund

UNFPA .....United Nation Fund for Population Activities

TBA .....Traditional Birth Attendant NHIS .....National health insurance scheme

NMR ..... Neonatal Mortality Rate GDHS .....Ghana Demographic Health Survey

GSS ..... Ghana Statistical Service RCH ..... Reproductive and Child Health Unit Division MOH .....Ministry of Health

ANC ..... Antenatal Care IMMPACT .....Initiative for Martenal Mortality Programme Assessment

ICD ..... International Classification of Disease EmOC .....Emergency-Obstetric Care.

CHPS .....Community based planing service

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Everyday approximately 800 women die from preventable causes related to pregnancy and childbirth (Kyei *et al*.,2012). Ninety-nine percent of all maternal death occur in developing countries (Prata *et al*., 2009). Maternal mortality is higher in women living in rural areas and among poorer communities. Most nations have instituted programs and policies within their available resources to solve the problem of maternal mortality. In our modern world maternal mortality is considered as a violation of the right of women, and its rate is seen as critical measure of the of development of a country (Anarfi, 1986). Maternal mortality remains a major challenge to health systems worldwide. Reliable information about the rates and trends in maternal mortality is essential for resource mobilization and, for planning and assessment of progress towards Millennium Development Goal 5 (MDG 5), the target for which is a 75% reduction in the maternal mortality ratio (MMR) from 1990 to 2015. The health of women is a non-income indicator of poverty, therefore to reduce poverty is to improve the health of women hence the need for reducing maternal morality.

1.2 Background History

According to WHO globally some 585,000 women die yearly from pregnancy related complications. This estimates that 99 percent of these women are from the developing world mostly sub-Saharan Africa (WHO,1991). WHO/UNICEF(1991) estimates Ghana's rate of maternal mortality as 740 per 100000 live births. By the end of 2013, 289,000 women died during pregnancy and child birth world wide (WHO, 2013). Greater proportion of the death of pregnant women occurred in low resource settings and most of the death could have been avoided. Improving maternal health is one of the eight millennium development goals(MDGs)

adopted by the international community in the year 2000. Under MDG5, countries committed to reducing maternal mortality by threequarters between 1990 and 2015. At the end of 1990, maternal mortality death world wide have dropped by 45 percent (WHO).

In Sub-Saharan Africa a number of countries halved their level of maternal mortality since 1990. In other parts of the world including North Africa, Asia, the levels of improvement as much higher. Between 1990 and 2013, the global maternal mortality ratio(the number of death per 100,000 live birth)declined by only 2.6 percent (WHO). This is by far from the annual decline of 5.5 percent required to achieve MDG5. Maternal health and new born health are closely linked. Almost 3 million new babies die every year(WHO, 2013) and an additional 2.6 million babies are still born (Tunccalp *et al*.,2014;Lawn*et al*.,2014). While major improvement have been made in infant mortality, this is not so for maternal mortality and morbidity.Therefore in the late 1980's, maternal mortality and morbidity was drawn to the attention of the world with the publication of the article by Marine and Rosenfield (1985), maternal mortality a neglected tragedy-Where is the M in MCH(maternal and child health)? (WHO and UNICEF,1996), the International conference on population and Development in 1994 (DeJong, 2000), and the fourth world conference on women in 1995(Larson, 1996) all concluded to the achievement of maternal mortality by 50 percent by the year 2000. In 2000 United Nations at the Millennium summit committed the international community to reducing the 1990 maternal mortality ratio levels by 75 percent by the year 2015. In as much as the problem of maternal mortality has received great attention from the international health institutions, the challenge is the delivery of obstetric service to the parts of the communities that needed it most. Different interactive factors contribute to maternal morbidity and mortality. The range is wide and includes the behavior of families and communities, social status, education, income, nutritional status, age, parity, and availability of health services. It is important to note that non–health sector activities, such as education, water and sanitation, roads and communication, agriculture, and internal security, also influence maternal outcome. In Sub-Saharan Africa, some of the highest MMRs have been recorded in countries that are in conflict or have large refugee populations, such as Angola and Sierra Leone (Jamison, 2006).

Maternal mortality in resource-poor nations has been attributed to the "3 delays": delay in deciding to seek care, delay in reaching care in time, and delay in receiving adequate treatment (Ghebrehiwot, 2004). The first delay is on the part of the mother, family, or community not recognizing a life-threatening condition. Because most deaths occur during labor or in the first 24 hours postpartum, recognizing an emergency is not easy. Most births occur at home with unskilled attendants, and it takes skill to predict or prevent bad outcomes and the medical knowledge to diagnose and immediately act on complications. By the time the lay midwife or family realizes there is a problem, it is too late. The second delay is in reaching a health-care facility, and may be due to road conditions, lack of transportation, or location. Many villages do not have access to paved roads and many families do not have access to vehicles. Public transportation (or animals) may be the main transportation method. This means it may take hours or days to reach a health-care facility. Women with life-threatening conditions often do not make it to the facility in time. The third delay occurs at the health care facility. Upon arrival, women receive inadequate care or inefficient treatment. Resource-poor nations with fragile health-care facilities may not have the technology or services necessary to provide critical care to hemorrhaging, infected or seizing patients. Omissions in treatment, incorrect treatment, and a lack of supplies contribute to maternal mortality.

Evidence-based interventions for reducing maternal mortality strategically target the main causes of death. The consensus among international organizations is that quality care requires services throughout a woman's reproductive life. These organizations design programs that focus on improving outcome during the intrapartum/postpartum period, offering family planning services, providing safe abortions, and increasing antepartum care.

1.3 Problem Statement

Females of reproductive age are the susceptible group of maternal mortality. Over the past years there has been great reduction in maternal mortality in most developing countries including Ghana. But Ghana is yet to meet the millennium development goals(MDG5) by end of 2015. The maternal mortality ratio for Ghana is 350 death per 100,000 live births (Nketiah-

Amponsah *et al*., 2013). Hence the need to find the factors that has hindered Ghana from attaining MDG5 by the end of 2015.

1.4 objectives

The purpose of this research is to determine the factors that has hindered the attainment of MDG(5) in the mist of increased health facilities that are accessible to greater proportion of the citizens of developing countries such as Ghana.

1.5 Specific Objectives

1. To determine reasons why maternal mortality is still low in Ghana (not attained MDG5 by 2015).
2. To determine how well antenatal care is patronized in the urban parts of Ghana and its influence in predicting maternal mortality.
3. To predict whether a pregnant woman who visit the hospital given her socialdemographics and some measurable demographics, she will survive or not.

1.6 Justification

1. This thesis will provide a good insight into why Ghana has still not been able to achieve the WHO MDG5 on maternal mortality.
2. It will help in assessing the performance of the country in her quest to achieve a very low maternal mortality ratio(MMR) to save the female reproductive age.
3. It will enable Korlebu Teaching Hospital and other urban or referral hospitals to give more attention to the demographics which have higher probability in predicting maternal death.

1.7 Methodology

Maternal mortality has been studied mainly in the deprived parts of Ghana. This study, however, examines some socio-demographics in predicting maternal death in the urban parts of Ghana with Korlebu as a case study as this study may be a reflection of what pertains at urban and referral government hospitals in Ghana. Assessment of level of patronage of antenatal care by pregnant women who visit the hospital, social status, occupation etc, are some of the predictor variables that were used to determine the probability of a pregnant woman surviving or not, to substantiate the estimated maternal mortality rate at the hospital. This will be done by determining their predictive probabilities for maternal death at the hospital and also the prediction for the need for emergency health services. The model used is the multinomial logistic regression model to determine the estimated probabilities of categories within demographics.

Secondary data of demographics of maternal death and alive mothers were obtained from the Biostatistics section, Gynecology and Obstetric department of Korlebu Teaching Hospital considering the past three years since the department was established. Using statistical software SPSS to run the data, it gives the β-coefficient of each independent demographic of the data. Substituting the β values and the total number of it corresponding predictor variable, the probability of a pregnant woman surviving or not is calculated. Probability value less than 0.5 means the the pregnant woman is less likely to die. Probability value more than 0.5 indicates that the pregnant woman is highly likely to die. The same model was used to predict the probability of a pregnant woman's need for emergency referral at the hospital.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Maternal mortality remains a major challenge to health systems worldwide. Reliable information about the rates and trends in maternal mortality is essential for resource

mobilization, and for planning and assessment of progress towards Millennium Development Goal 5 (MDG 5), the target for which is a 75% reduction in the maternal mortality ratio (MMR) from 1990 to 2015. WHO assessed levels and trends in maternal mortality for 181 countries (Hogan *et al*., 2010)

Between 1990 and 2015, Millennium Development Goal (MDG) 4 calls for a reduction by 2/3 of the under-five mortality rate; and MDG 5 for a reduction by 3/4 of the maternal mortality ratio for 81 countries 2010. Progress towards achievement of MDG 4 and 5 has remained slower than desired in Ghana and other countries of sub-Saharan Africa(AbouZahr, 2003). Maternal and neonatal deaths are caused by a complex interaction of economic, financial, social, cultural and service access and quality factors. In Ghana, there is reasonable access to Antenatal Care (ANC) with about 95 % of women 15 – 49 years receiving ANC from a skilled provider (value is 95.7% in the Greater Accra region). Delivery by a skilled provider is lower with a national average of 59% (Chavkin, and Allen, 1993). 84.3% in the Greater Accra region (Chavkin and Allen, 1993).

A free maternal care policy was introduced in four regions of Ghana in 2003, and subsequently in 2005 to the whole country to reduce financial access barriers. Assessment suggested that though the policy had led to increases in institutional deliveries, institutional maternal mortality rates had not decreased (confidential inquiries ...., 2001;Chum *et al*., 2005;UNICEF, 2014;Matua, 2004). Quality of service within facilities remained problematic, and is considered to be partly responsible for the persisting high national average of maternal mortality rate (MMR) estimated at 451 per 100 000 live births and neonatal mortality rate (NMR) of 30 per 1,000 live (World Health Organization, and Unicef, 1996), (Weil, and Fernandez 1999). Gaps identified in the quality of care given to pregnant women when they use health facilities include decisions on management, as well as information given to women by frontline providers of maternal and perinatal health .

Maternal mortality is the vital indicator with the greatest disparity between developed and developing countries. The challenging nature of measuring maternal mortality has made it necessary to perform an action-oriented means of gathering information on where, how and why deaths are occurring; what kinds of action are needed and have been taken. A maternal

death review is an in-depth investigation of the causes and circumstances surrounding maternal deaths (Cham *et al*., 2005).

Investing in better maternal health not only improves a mother's health and that of her family, but also increases the number of women in the workforce and promotes the economic well-being of communities and countries. Untreated pregnancy and birth complications, mean that 10-20 million women become disabled every year,undermining their ability to support their families(Department of reproductive health and research WHO, 2010).

2.2 Definition of Maternal Mortality

Maternal mortality is defined by the tenth revision of the International Classification of Diseases (ICD-10) as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. The 42-day limit is somewhat arbitrary, and in recognition of the fact that modern life-sustaining procedures and technologies can prolong dying and delay death, ICD-10 introduced a new category, namely the late maternal death, which is defined as the death of a woman from direct or indirect obstetric causes more than 42 days but less than one year after termination of pregnancy.

According to ICD-10, maternal deaths should be divided into two groups: Direct obstetric deaths are those resulting from obstetric complications of the pregnant state(pregnancy, labour and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above (Department of Reproductive Health and Research WHO, 2002).

Reducing maternal mortality is the Millennium development goal 5. To attain this goal countries must have accurate data on the causes and levels of maternal death. Modern systematic view has shown that there are many inconsistencies in the way maternal deaths

are classified and there is lack if standard definitions for identifying severe maternal morbidity and maternal near miss cases(Patterson et al., 2009). Maternal morbidity can be described as continuum of adverse events which progresses from normal pregnancy to morbidity to severe morbidity to near miss(Patterson, 2004).

The study of maternal near miss in addition to maternal mortality evaluates the provision of obstetrical care and allow for enhancement of such services and with identification of deficiencies. The definition of maternal near miss by WHO states that a woman who nearly died but survived a complication during pregnancy, child birth or within 42 days termination of pregnancy. This definition settles the disparities observed with previous near miss and severe acute maternal morbidity definitions and it is also connected with the definition of maternal death in the International Statistical Classification of Diseases and related health problems 10th edition (ICD-10)

2.3 Measurement of Maternal Mortality

Maternal mortality is notoriously difficult to measure (Hogan *et al*., 2010). The most widely used measure, the Maternal Mortality Rate(MMR), expresses maternal deaths per 100 000 live births, but MMRatios rarely exceed 1000 or 1 per 100 live births. Maternal deaths are thus relatively rare events and they are also hard to identify precisely, both of which limit the applicability of sample survey measurement methods bulletin for the world health organization(Hill, AbouZahr, and Wardlaw, 2001). In countries with welldeveloped statistical services, the conventional source of information about maternal mortality is the civil registration system, which records both live births and deaths, by cause, on a continuous basis. Even in such settings, however, maternal deaths are invariably found to be under-recorded in official statistics owing to misclassification of the cause of death. In countries with less well developed statistical services, the outright omission of deaths contributes an additional source of error(WHO, 1995).

For countries having data directly relevant to the measurement of maternal mortality, a variety of adjustment procedures can be applied depending on the nature of the data used. Estimates for countries lacking relevant data may be made using a statistical model fitted to the information from countries that have data judged to be of good quality. Rather than estimate the Maternal Mortality Ratio (MMRatio) directly, this model estimates the proportion of deaths of women of reproductive age that are due to maternal causes. Estimates of the number of maternal deaths are then obtained by applying this proportion to the best available figure of the total number of deaths among women of the reproductive age.

Maternal mortality is difficult to measure for both conceptual and practical reasons. Maternal deaths are hard to identify precisely because this requires information about deaths among women of reproductive age, pregnancy status at or near the time of death, and the medical cause of death (WHO *et al*., 1992). All three components can be difficult to measure accurately, particularly in settings where deaths are not comprehensively reported through the vital registration system and where there is no medical certification of cause of death. Moreover, even where overall levels of maternal mortality are high, maternal deaths are nonetheless relatively rare events and thus prone to measurement error. As a result, all existing estimates of maternal mortality are subject to greater or lesser degrees of uncertainty(department of reproductive health and research WHO, 2002).

2.4 Antenatal Care

Whether antenatal care can prevent or contribute to the prevention of maternal mortality and serious morbidity is a serious question to answer definitely. Although systematic antenatal care was first introduced in the 1900's in Europe and North America and now almost universal in developing countries. Questions on its effectiveness have only began to be tackled comprehensively recently.

The role that pregnancy care, as distinct from delivery care, has played in this dramatic decline in maternal mortality in the developed world is not clear (Chavkin, and Allen, 1993). Estimate developed by reviews on improving the status of women, providing family planning pro grammes, provision of safe abortion services, strengthening antenatal care, improving emergency obstetric services, training traditional birth attendants (TBA) and community mobilization have provided optimistic maternal health in the community (Lettenmaier, 1988; Bourguignon *et al*., 2010) and pessimistic maternal and prenatal health in the community decline in maternal mortality in Bangladesh. There is, however, a notable lack of comprehensive and critical reviews of the effectiveness of antenatal care programs and/or of individual interventions during pregnancy to avert maternal death or severe morbidity.

In Ghana universal free policy was implemented access to delivery care in health facilities thereby improving access to skilled attendance and reducing maternal mortality. Between 1990 and 2015, Millennium Development Goal 5 (MDG5), targeted for a reduction by 3/4 of the maternal mortality ratio (WHO, 2010). Progress towards achievement of MDG 5 has remained slower than desired in Ghana and other countries of sub-Saharan Africa (WHO, 2012). Maternal and neonatal deaths are caused by a complex interaction of economic, financial, social, cultural and service access and quality factors (Ansong-Tornui, 2007).

In 2005 the whole country was lunched onto the free maternal health policy in the National Health Insurance Scheme(NHIS) to reduce financial access barriers. Assessment suggested that though the policy had led to increases in institutional deliveries however, institutional maternal mortality rates had not decreased (Ansong-Tornui, 2007). Quality of service within facilities remained problematic, and is considered to be partly responsible for the persisting high national average maternal mortality rate (MMR), estimated at 451 per 100,000 live births and neonatal mortality rate (NMR) of 30 per 1,000 live births. Gaps identified in the quality of care given to pregnant women when they use health facilities include decisions on management, as well as information given to women by front line providers (Deganus-Tornui, 2006).

The health of women is an important non-income indicator of poverty, hence to reduce poverty, the health of women must be improved to reduce maternal mortality. Ghana's

poverty reduction strategies emphasizes on improving the health of the poor is a crucial factor in the reduction of poverty given that ill health is both a consequence and cause of poverty. (Ghana demographic and health survey(GDHS)reports, Ghana maternal survey, 2007) indicates the health care a mother receives during the cause of pregnancy at the time of delivery, and soon after delivery is important for survival and well being of both mother and child. This therefore emphasizes the fact that achieving and improvement in the health of women is providing maternal health services such as antenatal care(ANC)during pregnancy. The fourth millennium development goal recognizes this and therefore aims at reducing maternal death by three-quarters by 2015(to achieve a maternal mortality ratio of 54 maternal deaths per 100000 live births)by improving preventive health care delivery to women during pregnancy.

From the Reproductive and Child Health Unit of the public health division RCH,MOH annual report 2007, maternal health service ratio in Ghana is 230/100,000 live births. It is also important to note that ANC alone is incapable of solving the high rate of maternal death. ANC needs to be accompanied by healthy lifestyle of the expected mother as directed by the health care provider. It serves as an indicator of accessibility in the patronage of maternal health care during pregnancy. ANC serves as point of contact between the health care provider and the expectant mother which has an impact on the pregnant woman's use of maternal health services delivery and post natal care. WHO defines antenatal care(ANC) as " care before birth" which includes education ,counseling screening and treatment to monitor and promote the well being of the mother and baby. The RCH/PHD-GHS annual report RCH,MOH annual report 2007 defines ANC as the health care and education given during pregnancy.The ministry of Health report on Frequency and timing of antenatal care in Kenya explains the variation between women of different communities. (Howe, 1999) states that the objective of ANC is to promote and maintaining the health of pregnant women. It aim to establish contact with the pregnant woman in order to detect and manage current health problems. During this period, pregnant women and their personal health care givers can develop a plan for delivery taking into account the needs, resources and circumstances. Significantly ANC can help identify and remedy risk factors in pregnancy.The failure to receive appropriate ANC during

pregnancy can lead to undesirable pregnancy outcomes such as maternal morbidity, low birth weight for baby or even maternal and prenatal mortality (Magadi, Madise, and Rodrigues., 2000).

To derive the maximum benefit from antenatal care, MOH(2006) stipulates that, it is essential for pregnant women to start utilizing ANC service early during pregnancy to be able to attain the minimum number of contacts with the health service provider. WHO recommends a minimum of four visits by expectant mothers if, the pregnant woman cannot make the number of visits requested by the physician. Recent empirical evidence has shown that four visits are only recommended for pregnant women with uncomplicated pregnancies (WHO, 2001). Most pregnant women in many developing countries lack such care, hence accounting for high rate of mortality which are as a result of pregnancy complication.

Antenatal care (ANC) coverage is defined as the percentage of women who use ANC services provided by skilled health personnel for reasons related to pregnancy at least once during pregnancy as a percentage of live births in a given period usually one year. The service provided include screening for health and socio-economic conditions which are likely to increase the possibilities of specific adverse pregnancy outcomes, provisions of therapeutic interventions known to be effective; and education of the pregnant woman concerning plans for safe birth, and dealing with emergencies during pregnancy.

Cost of ANC services are free in all government hospitals in Ghana and in some accredited private NGOs and religious hospitals. Some private and religious hospitals also provide ANC service but at a fee. The coverage is around 87% while adequate utilization is around 60% in the last four years according to Ministry of Health report(2006). This implies expectant mothers who are able to attend the minimum of four visited has become stagnant. The Initiative for Maternal Mortality Assessment(IMMPACT), implementation of free delivery policy in Ghana 2005 reported that some of the main causes of maternal death in Ghana are likely to be inaccessible and in-affordable health care services. As part of financial reforms of the economy in 1985, the user fee was introduced in the health facilities in Ghana commonly known as "cash and carry" system. As a result there was a reduction in the utilization of

services especially among the poor. The exemption of users from delivery fees policy was introduced in September 2003 in the four most deprived regions of the country ; Central, Upper-east, Upper-west and Northern Region . The aim was to reduce the financial barrier.In April 2005 the policy was extended to the remaining six regions of the country. The aim was to reduce the financial barriers in reducing maternal and prenatal mortality in the country. Maternal mortality is still high after the introduction of this policy.

2.5 Interventions to Reduce Maternal Mortality

Evidence-based interventions for reducing maternal mortality strategically target the main causes of death. The consensus among international organizations is that quality care requires services throughout a womans reproductive life. These organizations design programs that focus on improving outcome during the intrapartum/postpartum period, offering family planning services, providing safe abortions, and increasing antepartum care.

2.5.1 Intrapartum and Postpartum Period

Interventions focused on the intrapartum period have been implemented. For example, efforts to address or treat postpartum hemorrhage and infection at health-care facilities have been made by providing oxytocics and antibiotics, manual removal of the placenta, blood transfusion, and if needed, hysterectomy. Health-care facilities are more familiar with eclampsia prevention treatment using anticonvulsants. Instrumented vaginal deliveries are encouraged and basic surgical equipment for caesarean deliveries is required (Rosenfield, Min, and Freedman., 2007). Because most women in developing nations deliver at home, organizations such as the World Health Organization, Institute of Medicine, World Bank, and the Lancet's Maternal Survival Steering Group advocate for pregnant women to prioritize professional skilled birth attendance at delivery(Campbell and Graham, 2006). Studies have determined a direct relationship between having skilled birth attendants during labor and decreased maternal mortality ratios. Programs designed for home-based deliveries

recommend skilled birth attendants carry emergency first aid kits, and easy access to health facilities if labor becomes dysfunctional.

Donors, UN organizations, and governments have made great strides in promoting family planning and contraceptive use. Due to this effort, millions of maternal deaths have been prevented. However, contraceptive use in many resource-poor nations is still not at optimal levels. The overall lack of contraceptive access rate is 50% , with a low of 4% in Europe and high of 57% in countries in Africa.(Villar, Ba'aqeel, Piaggio,*et al*., 2001). This lack of access to contraception leads to unwanted pregnancies, increased demand for abortions, and deaths related to unsafe abortions. Measuring maternal mortality requires that the mother be pregnant, so prevention of pregnancy makes it difficult to quantify how many deaths have been prevented. Nevertheless, if unwanted pregnancies are prevented, data suggest that between 25% to 40% of maternal deaths could be eliminated (Ministry of health annual report, 2007).

2.5.2 Safe Abortions

Given the high rate of maternal death due to unwanted pregnancies, some countries, such as South Africa, Tunisia, and Cape Verde, are recognizing the importance of developing wider access to safe abortions. In countries such as Mali, Sudan, Benin, and Burkina Faso, where legally, politically, and culturally access to abortion creates internal dispute, governments have allowed women access to safe abortions under specific circumstances, such as in cases of rape or fatal malformation. There are still some countries where women's access to safe abortions is non-existent and medical communities face resistance when advocating policy change. Women who seek help may be ostracized.

2.5.3 Antepartum Care

Following the Safe Motherhood Conference, a key action point was improving antepartum care in order to identify high-risk pregnancies. Although it seems logical that it should be a

core component to maternal health, program evaluations demonstrate that antepartum care shows little impact on reducing maternal mortality (Magadi, 2000). Screening tests during the antenatal period were found to be inefficient and to overwhelm referral health centers(Ministry of health annual report 2007...Ghana). Also, women who were offered free antenatal care did not necessarily use it because they felt that they were well and did not need to see a health care provider(Abor *et al*., 2011). This does not disprove the need for antepartum care or its importance, but rather indicates that resources might be allocated elsewhere to make a greater impact on maternal mortality

2.6 Education Level

It was estimated that about 287,000 maternal death occurred in 2010. Most of these deaths occurred in middle and low income nations(WHO,UNICEF,UNFPA,the world bank trend in maternal mortality..., 2012). Since most of these deaths can be avoided, maternal mortality is now used as an indicator of differences between developed and developing countries (Ronsmans,and Graham., 2006). Education has proven to have positive effect on maternal health care usage (Govindasamy and Ramesh, 1997). A world-wide analysis of determinate of maternal mortality has shown that the level of female education or literacy is significantly associated with maternal death (McAlister and Baskett., 2006).).

The underlining factors for the strong association between educational level and maternal outcomes is that low level educated women experience longer and secondary delays in making their final decision to assess antenatal or maternal care respectively (Gabrysch and Campbell, 2009). Less educated women attend to maternal care with organ dysfunctions or death. However focusing on this fact may mask the fact that most developing countries have less skill heath personnel and under-resourced health facilities to effectively handle severe obstetric complications(Filippi *et al*., 2006). Countries with strong health system and are ready to provide integrated, continuous, high-quality care, both as routine and in an emergency are more likely to compensate for severe outcome experienced by women with low levels of

education (Knight, Self, and Kennedy, 2013) Since two decades ago, maternal mortality has reduced drastically by about 50 percent and education has risen considerably. This reduction may be attributed to increase in maternal education and or increased in the educational status of the pregnant woman (Bhalotra, 2013). In the last twenty years the number of women without formal education has fallen to 12 from 13 percent.This suggest that improvement in educational status over the past twenty year period can explain the observed decline in maternal mortality. Comparing this increase with attended birth suggest that educational of women has had a positive effect on the rate of pregnant women attending antenatal care and has made substantial and largely unrecognized contribution to the reduction of maternal mortality ratios world-wide (Bhalotra, 2013).

2.7 Marital status

When it comes to marriage, the power to decide on issues of reproductive health is mostly the power of the husband. Often permission is obtained by the wife from her husband before visiting the hospital for antenatal care. For many cultures husbands decide if their wives should seek antenatal care (Oxaal and Baden, 1996). Young married women may not seek antenatal care because they are not independent and have to depend on their husbands or mother-in-laws. This makes them prone to what they decide whether it is beneficial or not (WHO, 2010).

Unmarried young women are not likely to get social support either from their boyfriends who impregnate them or from in-laws as a form of punishment or lack of financial resources (Adamu and Salihu, 2002).

2.8 Maternal Health Knowledge

Maternal health refers to the health of women during pregnancy, childbirth and the postpartum period(WHO).

Knowledge of maternal health practices is very essential in determining whether to utilize the hospital or not. Prior to pregnancy most pregnant do not have such knowledge, Hence during

antenatal visits on particular days, health education programs are organized for pregnant women at the hospital.The pregnant women are educated on malaria, nutrition, reproductive health, pregnancy and childcare, sexual transmitted, family health care (Creel and Perry, 2003). Pregnant women who start visiting antenatal care early receive treatment from skillful professionals than those who start visiting late(ANC). Late visitation of of antenatal care may affect the type of treatment pregnant women receive which puts them at greater risk when it comes to delivery.

Frequent antenatal visits have been found to expose women to health education and counsellings. This leads to improved awareness of maternal care and the realization that antenatal care very is important (Stekelenburg, Kyanamina, Mukelabai,*et al*., 2004).

Pregnant women who attend antenatal care early will detect pregnant risk factors in time and will be educated on preventive measures and will be treated quickly to avoid possible complications.

2.9 Afford-ability of maternal health care

A higher percentage of pregnant women are not able to pay for maternal health care. Studies have shown that inability of pay for health care services has been a barrier for accessing antenatal, delivery and postnatal services when it come to women with low income earning(Adamu, and Salihu, 2002). Women with high income earnings are able to pay for maternal health services better than low income earners (Mngadi, Thembi*et al*., 2002). They also have easy access to maternal health knowledge (WHO and UNICEF, 2003). Women with white color job and civil servant tend to be able to access maternal health services better than unemployed. Hence employed women starts antenatal services earlier. Also women who are married to men with low income earning or no income tend to attend antenatal care less than women married to men with high income(Cicekliogl u, M.*et al*., 2005).

2.10 Cultural Perceptions of Maternal Health Care

The decision to assess maternal health care is not determined by the occurrence of decease only, but by cultural perception of sickness(Addai, 2000). Such cultural perceptions shape people understanding of how their body works, their health status and health care. This could be a negative factor to a maternal care. In some cultures, the believe that pregnancy is vulnerable to witchcraft prevents them from attending the antenatal care for the first trimester. Cultural believes encourage women to use various concoction during pregnancies and after pregnancy resulting in complication and sometimes death.

2.11 Quality of Maternal Health Services

The reluctance of women to attend maternal health care sometime is due to the quality of health care services they receive. Many young women are not willing to go for maternal health service and complain of rude, insensitive and sometimes threatening behavior meted out to them by health personnels. Factors affecting quality of health care includes a well functioning health system and the health personnel's professionalism with regard to skill, capacity and attitude to patients. In rural areas there is often the shortage of health personnel. This persuades women to seek traditional birth attendant delivery services. Moreover some health provider have little training and experience to handle maternal health related complications. The system problems also include difficulty in getting access to health care facilities due to deplorable roads, unavailable hospitals or clinics, unavailable medical equipment and or supplies, poor management of our health care facilities, overworked medical personnel because of abysmal doctor and nurse to patient ratios. There is also massive waste and inefficiency in the clinical care process. Because of a poor referral system and poor information transfer between hospitals and doctors, laboratory tests are wastefully repeated. There is delay in starting appropriate care and outcomes are compromised.

2.12 Unwanted Pregnancies

Unwanted pregnancy is associated with increased risk of maternal morbidity and mortality. Besides, it poses a burden to the utilization of health services(Gessessew, 2009). Ghana's abortion laws does not prevent many induced abortion from occurring.Few women who have unwanted pregnancy seek abortion from a physician. Most induce the abortion themselves with the collaboration of a pharmacist (Update, 2002). Traditional and cultural values, social perceptions, religious teachings and criminalization have facilitated stigmatization of abortion in Ghana.

Abortion is illegal in Ghana except in three instances. Though the law allows for performance of abortion in three circumstances, the Ghana reproductive health service policy did not have any induced legal abortion services component to cover the three exceptions until it was revised in 2003. The policy only had 'unsafe and post-abortion' care components, and abortions performed in health facilities operated by the Ghana Health Service were performed under this component. Though the policy has been revised, women and girls who need abortion services in Ghana more often resort to the backstreet dangerous methods and procedures. Criminalization of abortion and those who perform abortions has contributed to unsafe abortion, the second leading cause of maternal deaths in Ghana . Most of these are performed outside the formal health service structures. Traditionally, abortion is perceived as a shameful act and the community may shun and give a woman who has caused an abortion derogatory remarks(Weil, *et al*., 2003).

2.13 Causes of Maternal Mortality

About 60 percent of the maternal deaths occur during childbirth and the immediate postpartum period, with 50 percent of these deaths occurring within the first 24 hours of delivery. In a recent study in Eritrea, 16 percent of maternal deaths occurred during pregnancy, 48 percent during childbirth, and 36 percent postpartum(Sharan, M.*et al*., 2009). These findings imply that the causes of the deaths in this critical period are either the result of labor or worsened by labour and delivery. The causes of maternal mortality have

traditionally been classified as direct and indirect,although the distinction is not always easy to discern. Pathogenic causes are purely medical and therefore best determined by health professionals. Most of the information on pathogenic causes is derived from hospital studies; thus, data from health institutions will continue to be an important source of information for direct and indirect causes of maternal deaths. Implicit is the need to educate health professionals on the ICD and provide updates whenever the ICD definition changes. As an example, the 10th revision of ICD has introduced a much broader definition of maternal death and has expanded on the categorization of the causes(World Health Organization, 2011). This will make analysis of trends increasingly more difficult because past data will need to be adjusted to accommodate the new definition in order to make them comparable with more recent data.

Availability and accuracy of data sources influence the study of causes and correlates. For instance, data from hospitals or health institutions are limited in that medically certified deaths at these institutions involve only a small and selective fraction of total deaths. This limitation is greatest in Sub-Saharan Africa, where a large proportion of deliveries take place at home (WHO, 2011). The main direct causes of maternal deaths, accounting for up to 80 percent of cases in Africa, are obstetric hemorrhage, puerperal sepsis, pregnancy-induced hypertension (including eclampsia), obstructed labor and ruptured uterus, and complications of unsafe abortion . Three causes—hemorrhage, sepsis, and eclampsia—account for a vast majority of deaths, considering that even some cases of abortion or obstructed labor eventually succumb to either bleeding or sepsis.

2.14 Major Causes of Maternal Mortality in SubSaharan Africa

Source

Indirect causes account for 20 to 25 percent of maternal deaths and are attributable to illnesses aggravated by pregnancy (WHO, 2011). They include anemia; malaria; HIV/AIDS; diseases of the heart, lung, liver, or kidneys; and ectopic pregnancies. Physical violence and accidents are not included in this group.

As documented by several DHS surveys, many African women enter pregnancy in a state of nutritional deficit and therefore are unprepared to cope with the extra physiological demands of pregnancy. The nutritional deficit, macro- or micro nutrient, predisposes these women to anemia in pregnancy, among other problems. Anemia is highly prevalent in Africa, with up to three-fifths of pregnant women in Africa having some degree of anemia, and about one-third classified as having severe anemia (WHO 2011). Anemia may cause death on its own or predispose a woman to severe postpartum hemorrhage leading to death

The growing HIV/AIDS pandemic is also having a severe impact on women's health. It is estimated that there were 5 million new HIV infections in 2003, of which 40 percent were among women and 20 percent among children (Ngom, P., and Clark, S., 2003). In eastern and southern Africa, between 20 and 30 percent of pregnant women are infected with HIV, and available evidence indicates that HIV/AIDS currently accounts for at least 18 percent of maternal deaths. Death in this case results from opportunistic infections, puerperal sepsis, meningitis, tuberculosis, pneumonia, post abortion sepsis, encephalitis, and probably malaria (Pattinson, Say, *et al*., 2009)

Unsafe abortion deserves special mention in Africa,the only region where complications of abortion are the most common cause of maternal mortality. Globally, unsafe abortion accounts for about 13 percent of maternal deaths compared with 30 to 50 percent in Sub-Saharan Africa. The unsafe abortion conundrum in Africa begins with unprotected sex among teenagers who are ill-informed about their sexuality; an unwanted or ill-timed pregnancy follows. Living in countries where induced abortions are legally restricted, the young victims resort to back street abortionists or quacks. Crude methods used in the pregnancy termination, delay in seeking medical attention when and if there is a problem, and the poor quality of post abortion care lead to a significant proportion of the victims sustaining serious injuries with life-threatening complications, resulting in either death or disability. For survivors the psychological impact is immense and lifelong .

2.15 Determinants of Maternal Mortality and

Morbidity

Available evidence indicates that there are several factors that predispose a woman to greater risk of maternal death. The common biomedical approach to the determinants of maternal morbidity and mortality usually divides them into distal and proximal factors. The seminal work by McCarthy and Maine in 1992 is credited with the conceptual model of analyzing determinants of maternal mortality that could be applied to research as well as programs (Jamison, 2006). The concept grouped the determinants as:distant, or socio-economic, factors; intermediate factors (health behavior and status, access to services, and unknown factors);outcomes (pregnancy, morbidity, and mortality). The McCarthy and Maine concept has since been modified, most notably by UNICEF in 1999 (Jamison, 2006), to facilitate strategic programming for maternal health. From the pediatric perspective, the Mosley and Chen (1984) framework for the study of child survival in developing countries has also found, with various modifications, utility in the analysis of determinants of maternal morbidity and mortality (Mosley, and Chen, 1984). The original model proposed three levels of determinants of child mortality (socio-economic determinants, proximate and biological determinants, and outcomes expressed in terms of growth and death), but subsequent modifications have expanded the levels to five: household characteristics (behavioral), intermediate variables (behavioral and biological), risk factors (biological), (van Norren, and van Vianen, 1986). The Poverty Reduction Strategy approach developed by the World Bank and sector-wide approaches to the health sector have generated new interest for incorporating government policies and actions, within or outside the health sector, that focus on health outcomes (Edwards, Elwyn.,*et al*, 2001). By expanding on previous models, introduced the macroeconomic evaluation of non–health sector policies that influence health. These developments are relevant to maternal health and can be applied to generating a more comprehensive understanding of determinants and correlates of maternal health in Africa. The following modified framework is proposed as appropriate for discussing the correlates of maternal mortality in Africa: household and community characteristics (behavior, cultural-religious values, and income poverty) biological-demographic variables and risk factors malnutrition-infection syndrome (including protein-energy malnutrition [PEM], micro-

nutrient deficiencies, anemia, malaria, and HIV/AIDS) health systems national policies and related investments (health and non-health).

2.16 Household and Community Characteristics

Pregnancy outcome and maternal survival have strong correlations with household behavior and decision making. Enlightened communities value their mothers and seek prompt attention at the earliest indication of problems. Low status of women in the household and society as a whole, as exemplified by inequality in education, employment, property ownership, participation, and decision making, is another important correlate (Wall, 1998). Gender based violence is common situations in which the status of women is low and legal protection inadequate, and in turn it is correlated with high rates of maternal mortality.

Harmful traditional practices and religious beliefs also adversely affect maternal health. They vary from one ethnic group to another and cover a wide range of activities and practices; from the sexual or genitally linked ones, such as female genital cutting, to feeding and nutritional practices. In addition, a plethora of harmful beliefs and practices around pregnancy and childbirth affect health-seeking behavior during pregnancy and parturition. The disproportionately low use of health facilities for delivery care is testimony to the strength of these beliefs (Ghebrehiwot, 2004.) Household poverty, allocation of resources, and the control of those resources also influence maternal mortality. Delivery of infants is not free of charge in many African countries. Indeed, it was never without cost in traditional societies either. Even in countries where delivery is declared to be free in public facilities, the cost of accessing care, both direct and indirect, can be prohibitive, quality notwithstanding. The relationship to poverty is bi-directional; complications of pregnancy were cited as one of the most common causes of household poverty (Borghi*et al*., 2003).

2.17 Biological-Demographic Variables and Risk

Factors

Standard biological variables, such as age, height, and parity, apply to maternal mortality in Africa as elsewhere. In many countries of Sub-Saharan Africa, at least 50 percent or more of women will have started childbearing by age 19. Adolescents comprise about 20 percent of maternal deaths, most of which are due to complications of unsafe abortion. Early marriage and childbearing are associated with high parity and therefore higher risk of maternal death(Ghebrehiwot, M., 2004). Various indicators of maternal status during pregnancy and childbirth may also be predictors of maternal outcome, including edema, hypertension, and history of previous complications Socio demographic factors are correlates of maternal mortality. Marital status, first pregnancy, and level of education are commonly associated with maternal mortality(Garenne, and Mbaye*et al*., 1997).

2.17.1 Malnutrition-Infection Syndrome

Malaria remains a major killer of women in pregnancy and a leading indirect cause of maternal mortality. There are effective interventions, such as intermittent preventive treatment and insecticide-treated bed nets that are affordable but often not available where they are most needed. The changing complexities of malaria chemotherapy and the rising cost of newer, more effective combinations pose new challenges, including safety in pregnancy (Shulman, Dorman.*et al*., 1999). HIV/AIDS and its effect on maternal outcomes in Africa is grossly under reported. HIV is not regarded as a primary cause of death unless AIDS is diagnosed. A study in South Africa reported a 25 percent increase from 50 to 75 percent between 1997–99 and 2000, in maternal deaths due to non–pregnancy-related sepsis in Pretoria . HIV infection in pregnancy is also associated with anemia and severe malaria infections (Jamison, 2006).

Both PEM and micro-nutrient deficiencies are prevalent in African women. Pregnancy aggravates the situation and increases the vulnerability to any concurrent condition or opportunistic infection. Paul B.K.(1993),in analyzing maternal mortality in Africa from 1980 to 1987 found a strong correlation with calorie supply as a percentage of requirements. Maternal

anemia, however mild, also increases several-fold the risk of lifethreatening postpartum hemorrhage.

Inadequate financing and sustainability of the health sector in general and of reproductive health in particular, are other barriers. In most African countries, health expenditures have not increased substantially while major problems in allocation efficiency and inequities exist (World Bank, 2005). With various competing priorities for a dwindling financial resource base, the health sector needs to do a better job in reclaiming its rightful share. Moreover, given the inadequate investment, the number of health personnel trained is often small, and once trained, many open private clinics or emigrate to developed countries to earn a better living.

Malaysia and Sri Lanka have succeeded in reducing maternal mortality to levels comparable to those in industrial countries in the last few decades. Expanded female literacy in Sri Lanka and strong economic performance by Malaysia helped promote these gains. The World Bank analysis confirmed that maternal mortality can be halved in developing countries every 7 to 10 years and is affordable, regardless of income level and economic growth rate; steady, modest investment in poverty reduction and in maternal health services to improve access to and quality of emergency obstetric care are required. Removal of financial barriers to maternal care was an important step in both countries, as was increased access to skilled birth attendance and emergency obstetric care. Recording and reporting of maternal deaths was a prerequisite to addressing the challenges of reducing maternal mortality in both countries. Other important lessons were that governments can afford to provide the critical elements of maternal care free of charge to clients and that different tactics are needed at different stages of the development of health systems. The transition from high to low MMR passes through several phases characterized by the following: high MMR: low levels of skilled attendance and emergency obstetric care (EmOC) declining MMR: medium levels of skilled attendance and EmOC low MMR: high levels of skilled attendance and EmOC. Except for South Africa and Botswana, most of Sub-Saharan Africa falls in the first category, "high MMR—low levels of skilled attendance and EmOC." This status calls for establishing a solid foundation for effective maternity care, increasing access to care, and ensuring appropriate use of available services through community mobilization and improved quality. Elements of the foundation to support

effective maternal care in Malaysia and Sri Lanka included professionalization of midwifery, civil registration of births, compilation of data on maternal deaths, and replication of local success. These elements do not always need additional resources but require focused leadership and effective management.

2.18 Improving Emergency Obstetric Care: The Three Levels of Delay

It is clear from the foregoing that accelerating the decline of maternal mortality in Sub-Saharan Africa and realization of the Millennium Development Goals will require the provision of a synergistic package of health and social services that reaches everyone, especially deprived populations. The framework model of three delays has been applied to analyze the constraints, opportunities, and systems required at different levels of a safe motherhood program. This framework serves as a useful planning tool for the actions required at every level of health care while emphasizing the need to link these levels through transport and communication, supervision, and community outreaches. Thus, community awareness and trust and better access to and quality of emergency transport reinforce each other to improve maternal outcome. In an integrated essential health care package, this network enhances provision of other services, such as family planning and immunization, while promoting emphasis on skilled attendance (Jamison, 2006).

Model of Three Levels of Delay. Level 1 delay: decision making at community level examines decision-making process on pregnancy and childbirth at household and community level, including birth preparedness Level 2 delay: accessibility, transport, The model is advocated by the Regional Prevention of Maternal Mortality Network (PMMN 1995) and is rapidly gaining ground in Africa. Using a modified "Four Levels of Delay" approach to analyze maternal mortality in Eritrea, attributed the causes of death to the following processes:

Delay One: failure or delay in recognition of danger signs—33 percent of maternal deaths Delay Two: delay in deciding to seek care—40 percent of the cases Delay Three: delay in reaching appropriate care—19 percent of cases Delay Four: delay in receiving appropriate care—52 percent of cases.

This simple framework appears ideal for Sub-Saharan Africa. It works well and supports local partners in finding tailor-made solutions to challenges posed in each specific setting and making service more responsive to local community needs. It can also be used to improve data collection and use at the local level.

The first level involves a primary health care bottoms-up approach with active community involvement (men and women) and focused comprehensive development programs wherein reproductive health and safe motherhood are appropriately integrated into the district health system (Rogo, 1993). The second level entails expanding access to quality services, including functional linkages between communities and health facilities in regard to transport and communication. This leads to the final level, where appropriate quality of services is provided to clients on arrival at the health facility.

2.19 Government of Ghana Policies and Interventions

In 1920, the Ghana's maternal health service was established. In 2000, Ghana adopted the millennium development goal 5(MDG5) in an attempt to improve maternal health services.The MDG5 calls on all governments to improve maternal health care and reduce maternal mortality. In 1980 government of Ghana started the health sector reforms by implementing national policies, comprehensive plans and guidelines on maternal health services. This was in line with global trends in improving maternal health care and reduce maternal mortality. In September 2003, the Government of Ghana introduced the policy of exempting users of maternity services from delivery fees in the four most deprived regions of the country, which are Central, Northern, Upper West and Upper East Regions. The policy was later extended to the remaining six regions of Ghana in April 2005 with the aim of reducing financial barriers to using delivery services. The prospect was that it would lead to an increase in rate of skilled attendance at delivery and consequently to a reduction in maternal and perinatal mortality rates, and also contribute to poverty reduction. To make health care service easily assessable to pregnant women who must travel long distances to attend antenatal and postnatal care, the ministry of health established a number of community based

planing and services(CHPS) across the country. In addition the government of Ghana has increased the number of district health facilities. In 2004 the government suspended the exemption user fee of maternal services and established the National Health Insurance Scheme(NHIS). This is to provide affordable basic health care services to all citizens (WHO, 1991). Individual citizen must pay annual premium and get registered to access free basic health service when sick.This also include free antenatal care, delivery caesarean section, postnatal care, management of emergency obstetric conditions for pregnant women.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The objective of this study is to determine rate of maternal mortality in urban GhanaKolebu Teaching Hospital as case study. The study will determine whether antenatal care is well patronized by pregnant women from all socio-economic background and various demographic predictors of pregnant women who visit the hospital.

The target population was Korlebu and all the major hospitals and polyclinics in the urban regions in Ghana but was reduced to Korlebu Teaching Hospital. The sampled Hospital was chosen for reasons that it is a regional and referral hospital. A random of

2000 was randomly selected out of over 15,000 yielding a small margin of error of 0.005

$$s = \frac{z^2 \times p \times q}{e} \tag{3.1}$$

where s is

sample size

z is 95% confidence interval(reliability coefficient)

P is Probability of a woman dieing during pregnancy is 50% q is

Probability of women who did not die during pregnancy is 50% e is

error.

$$2000 = \frac{1.96^2 \times 0.5 \times 0.5}{e}$$

e = 0.0004802.

3.2 Data Analysis Procedure

In the binary response model of the data that will be used for this research, we equate the expected values of the linear combination of independent variable and their corresponding parameter in the linear regression

$$y = \beta x + \xi \tag{3.2}$$

y is expected response x is independent variable β is the parameter that refers to the effect of x on y (intercept of regression line) ξ is the error term. The expectation of y is

$$\xi(y) = \xi(x\beta) + \xi(\varepsilon) \tag{3.3}$$

$$\xi(y) = x\beta \tag{3.4}$$

The binary logistic model regression takes only two possible values, zero for failure and 1 for success. Unlike the normal regression line the independent variables and errors are continuous. Therefore

$$y = \beta x + \varepsilon \tag{3.5}$$

Since there is a gab between the probabilities of 0 and 1,there should be a link function between zero and one or yes and no responses. Considering the odds of the responses yes and no. The odds of yes is given by

$$\frac{\text{Probability of success}}{\text{Probability of failure}} = \frac{\pi_i}{1-\pi_i} \tag{3.6}$$

The regression model now becomes

$$\frac{\pi_i}{1-\pi_i} = \beta \quad x_i, \tag{3.7}$$

Taking the natural log of the odds and equating it to the matrix model, we have

$$\ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta \quad x_i \tag{3.8}$$

$$\frac{\pi_i}{1-\pi_i} = \exp(\beta \quad x_i) \tag{3.9}$$

$$\pi_i = \frac{\exp(\beta \quad x_i)}{1+\exp(\beta \quad x_i)} = \frac{1}{1+\exp(\beta \quad x_i)} \tag{3.10}$$

The expression

$$\pi_i = \frac{\exp(\beta \quad _i)}{1+\exp(\beta \quad _i)} \tag{3.11}$$

is referred to as the logistic regression model or logit. For multiple logistic model, let N represent the total number of population and n_i represent the number of observation in the i^{th} population,

$$M = \sum_{i=1}^{N}(n_i) \tag{3.12}$$

Let y be number of success in the i^{th} population and $\pi_i = p_i$. π_i is the probability in the i^{th} population.

$$\pi_i = \frac{1}{i} \quad i = 1, 2, \cdots, N$$

$$Y = \sum_{i}^{N} x_{ik}\beta \quad _k \tag{3.13}$$

where k is the k^{th} term.The logistic model is given by

$$\pi_i = \frac{\exp(\sum_{k=0}^{k} x_{ik}\beta \quad _k)}{1+\exp(\sum_{k=0}^{k} x_{ik}\beta \quad _k)} \tag{3.14}$$

Hence

$$\ln(\frac{\pi_i}{1-\pi_i}) = \sum_{k=0}^{k} x_{ik}\beta \quad _k \tag{3.15}$$

is the link function of the logistic model. When π_i is 1 link function

$$\ln(\frac{\pi_i}{1-\pi_i}) = \infty \tag{3.16}$$

when π_i is zero

$$\ln(\frac{\pi_i}{1-\pi_i}) = -\infty \tag{3.17}$$

hence

$$-\infty < \ln\frac{\pi_i}{1-\pi_i}) < \infty \tag{3.18}$$

This means the natural log of probability of success take real values which are the expected values of Y, $\xi(Y)$. The multiple logistic regression model becomes

$$ln(\frac{\pi_i}{1-\pi_i}) = \sum_{k=o}^{k} x_{ik}\beta_k = \beta_0 + x_{i1}\beta_1 + x_{i2}\beta_2 + ...x_{ik}\beta_k \tag{3.19}$$

The model is re-written to zero and solve for the β_k by running the data using SPSS software. For Logistic regression with a constantβ, the probability of success is given as

$$\pi_i(x) = \frac{\exp(\hat{\alpha} + \hat{\beta}x)}{1+\exp(\hat{\alpha} + \hat{\beta}x)} \tag{3.20}$$

where α is the constant β_0.It is the intercept of regression line.α indicated the initial point of the data. A 95% confident interval for the logit is thus $(\alpha + \beta x)$ 1.96*SE Substituting the end points of this interval in the exponents of the above model gives a corresponding interval for the predicted probability.The standard error(ASE) is estimated by

$$ASE = \sqrt{Var(\hat{\alpha} + \hat{\beta}x)} = \sqrt{Var(\hat{\alpha}) + 2xcov(\hat{\alpha},\hat{\beta}) + x^2 Var(\hat{\beta})} \tag{3.21}$$

This standard error is produce by R software.For multiple regression with a constant initial β-coefficient, probability of success is

$$\pi(x_i) = \frac{\exp(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... \beta_i x_{ik})}{1+\exp(-(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... \beta_i x_{ik}))} \tag{3.22}$$

$$\pi(x_i) = \frac{1}{1+\exp(-(\beta_0 + \beta_i x_{i1} + \beta_2 x_{i2} + ... \beta_i x_{ik}))} \tag{3.23}$$

ASSUMPTIONS OF LOGISTIC REGRESSION

- The true conditional probabilities are a logistic function of the independent variable.
- No important variable are omitted.
- The independent variable are measured without error.
- No extraneous variables are included.
- The independent variables are not linear combination of each other.
- The observations are independent

3.2.1 Log-likelihood statistic

This explains how much unexplained variation exist after the predictors have been entered into the model.

Large value from the estimated log likely hood can represent poor fitting model. Loglikelihood can be used to compare different models. The log-likelihood statistic

$(D) = -2log(A)$, where

$$A = \frac{\text{Maximun likelyhood when parameter staisfies H(null)}}{\text{Maximum likelyhood when unristricted}} \tag{3.24}$$

Since A cannot exceed 1. A far below 1 indicates that the maximum likelihood is much larger when parameters are not forced to satisfy H_0.

3.2.2 β-coefficients

These are coefficients values that can be used when reporting the prediction equation. From the data analysis by the R software or SPSS, the β- coefficient will be substituted into the multiple logistic equation. The data on patients can be collected as predictors. If the probability is above 0.5 then patient will be in the event group.

Negative β-coefficients indicates a reduction in probability of the event being predicted(that is a reduce probability of the event occurring). A positive β-coefficient indicates a higher probability value hence high probability of the event occurring.

3.2.3 Wald Statistic

Similar to the T-test, the Wald statistic is being used to determine whether or not the predictor are statistically significant to the model.

Consider a significant test of H_0:β=β_0 such as H_0:β = 0,for which β_0 = 0, and H_A:β6= β_0.

The test simplest statistic uses the large sample normality of the ML estimator $\hat{\beta}$. SE denotes standard error of $\hat{\beta}$evaluated by Maximum likelihood estimator(MLE) for the unknown parameter in the expression for the true standard error.When H_0 is true

$$Z = \frac{\beta(\hat{} - \beta_0)}{SE\beta(\hat{})} \sim N(0,1) df = 1 \tag{3.25}$$

or

$$W^2 = \frac{\beta(\hat{} - \beta_0)^2}{Var\beta(\hat{})} \sim x_1^2 df = 1 \tag{3.26}$$

The p-value is then the right-tail chi-square probability above the observed value.

3.2.4 Odds Ratio($\hat{OR}$)

The odds ratio enables us to predict that when an individual increases by one unit on that predictor, the odds of being placed in the event category will either increase or decrease. For dichotomous predictor, if group A odds ratio is 3 means group A's rate of survival is 3 fold. If group A's odds ratio is 0.3 means their chance of survival reduces by one- third.

In a simple logistic regression,if x is binary categorical variable,

$$\hat{OR} = \frac{\frac{P_m}{1-p_m}}{\frac{P_f}{1-Pf}} \tag{3.27}$$

$$\hat{OR} = \frac{\exp(\beta_0 + \beta_1)}{\exp\beta_0} = \exp(\beta_1)\exp = 2.71828 \tag{3.28}$$

P_m is probability of success

P_f is Probability of failure

If x is quantitative and continuous

$$\ln\frac{p}{1-p} = \beta_0 + \beta_x$$

$x = x_a, x = x_0$.

$$\hat{OR} = \frac{\frac{P_{xa}}{1-P_{xa}}}{\frac{P_{xo}}{1-Pxo}} \tag{3.29}$$

$$\hat{OR} = \frac{\exp(\beta_0 + \beta_1 x_a)}{\exp(\beta_0 + \beta_1 x_o)} = \exp(\beta_1(x_a - x_0)) \tag{3.30}$$

3.2.5 confidence interval for odd ratio

A 95% confidence interval for odds is given by

$$\ln\hat{OR} \pm 1.96 * SE\ln\hat{OR} \tag{3.31}$$

$$\exp(\ln\hat{OR} \pm 1.96 * SE\ln\hat{OR}) \tag{3.32}$$

$$SE = \sqrt{\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}} \tag{3.33}$$

a , b ,c, d are individual cells

3.2.6 The G-test of Independence

Just like the Pearson's chi-square test statistic

$$X^2 = \sum_{i}^{k} \frac{(O_{i-E_i})^2}{E_i} \tag{3.34}$$

which which is used to test for independence between categorical variable.

The G-test of independence statistic is used when $O_i > 2$.

$$T.S = 2\sum_{i=1}^{k} O_i \ln(\frac{O_i}{E_i}) \sim \chi^2 \tag{3.35}$$

(number of rows -1)(number of columns-1),α In the case where there are only two categorical data in a (2x2) contingency table Fishers exact test is used if an expected value in the cells is less than 5.

$$P_{(X=x)} = \frac{\binom{r}{x}\binom{w}{n-1}}{\binom{N}{n}} \tag{3.36}$$

where:

r is sum of row 1, N is Total sum of row or column, n is sum of col 1, w is sum of row 2, k is cell 1 or $a_(ij)$. We reject H if $p < \alpha$ If all the cells are more than 10, then we can either use chi-square test of independence or G-test of independence. If any expected counts are less than 10 but greater than or equal to 5 we use Y'ates correction for continuity for each cell. Y'ates correction version of Person's chi-square statistic

$$X^2_{yates} = \sum_{i=1}^{N} \frac{(|O_i - E_i| - 0.5)^2}{E_i} \tag{3.37}$$

where:

O_i is an ob severed frequency

E_i is an expected frequency

N is number of of distinct events.

$$MMR = \frac{\text{number of maternal death in a given period}}{\text{number of livebirth of the same period}} \times 100,000 \tag{3.38}$$

MMR is maternal mortality rate.

ASSUMPTIONS OF LOGISTIC REGRESSION

- The true conditional probabilities are a logistic function of the independent variable.
- No important variable are omitted.
- The independent variable are measured without error.
- No extraneous variables are included.
- The independent variables are not linear combination of each other.
- The observations are independent

CHAPTER 4

ANALYSIS OF DATA

4.1 Introduction

This chapter presents the results of the research.The first part presents the demographic characteristics of sampled pregnant women who delivered at Korlebu Teaching Hospital. The second part presents the association between the demographics and mortality of pregnant women. It also presents association between emergency referral and parity, antenatal attendance, gestation age group and occupation. The third part presents the result of multiple logistic output and the forth part shows classification output for the various binary and multiple logistic output.

Classification Tables are presented at the appendix. Classification Table 7, shows that overall percentage correct entries that were predicted when running the data was 86.9 % for the Binary logistic regression. The overall percentage correct prediction for Multiple logistic regression in Classification Table 8, was 89.90%. That for multiple logistic regression with significant P-value in Classification Table 9 is 89.10%. From the tables not all the maternal death entries were predicted however, if all were to be predicted, it would have made the significant demographics more significant in reference to pregnant women who survived after delivery.

Classification Table 10 for emergency referral(yes) against some relevant demographic gave overall predicted percentage of 71.20 %.That for emergency referral against significant demographics, gestation age and occupation in Classification table 11 is 65.10%.

4.2 Descriptive Analysis of Data

Table 4.1: Frequency of Demographics from the Sample

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age group of Preg Mother	2000	100.00%	0	0.00%	2000	100.00%
Marital status	2000	100.00%	0	0.00%	2000	100.00%
parity	1999	100.00%	1	0.00%	2000	100.00%
Religion	2000	100.00%	0	0.00%	2000	100.00%
Education	1999	100.00%	1	0.00%	2000	100.00%
GestAgeGroup	2000	100.00%	0	0.00%	2000	100.00%
Antenatal progress or Attendance	1998	99.90%	2	0.10%	2000	100.00%
occupation	2000	100.00%	0	0.00%	2000	100.00%
Emergency Ref	1998	99.90%	2	0.10%	2000	100.00%

Table 4.1 presents the frequencies and valid percentages of demographics from the sample.

Table 4.2 below provides the frequencies and valid percentages of the sub-groupings of the independent variables ie the demographics of pregnant women.

Table 4.2: Frequency of Sub-categories of Demographics

Case Processing Summary			
		N	Marginal Percentage
state of mother	death	285	14.30%
	alive	1709	85.70%
Age group of Preg Mother			
	15-19	442	22.20%
	20-24	1	0.10%
	24-29	598	30.00%
	30-34	545	27.30%
	35-39	315	15.80%
	40-44	80	4.00%
	45-49	7	0.40%

parity	P0	715	35.90%
	P1	548	27.50%
	P2	358	18.00%
	P3	200	10.00%
	P4	99	5.00%
	P5+	68	3.40%
	P6	6	0.30%
Marital status	single	342	17.20%
	married	1652	82.80%
Religion	moslem	197	9.90%
	christian	1797	90.10%
Education	none	182	9.10%
	primary	218	10.90%
	JHS	767	38.50%
	SHS	482	24.20%
	Tertiary	345	17.30%
Emergency Ref	No	1064	53.40%
	yes	930	46.60%

Table 4.3: Frequency of Sub-categories of Demographics

GestAgeGroup	under21	260	13.00%
	21-24	172	8.60%
	25-28	171	8.60%
	29-33	263	13.20%
	34-36	325	16.30%
	37-40	645	32.30%
	41+	158	7.90%
Antenatal progress or Attendance	0	27	1.40%

	1	174	8.70%
	2	177	8.90%
	3	193	9.70%
	4	214	10.70%
	5	217	10.90%
	6	212	10.60%
	7+	777	39.00%
	8	3	0.20%
occupation	unemployed	250	12.50%
	selfemployed	1447	72.60%
	civilservant	297	14.90%
Valid		1994	100.00%
Missing		6	
Total		2000	
Subpopulation		1656a	

Out of the 2000 pregnant women sample for the research 1713 (85.5%) delivered and were alive.There were 287(14.5 %) maternal mortalities.The highest age group of delivery is 25-29 with 600 deliveries (30 %). The number of new pregnant women who delivered at the hospital was the highest with 716(38.5%) deliveries under parity. With marital status of the women,there were 342(17.1%)single and 1658(82.9%)married. Religion mainly constituted Christians and Muslims with Christian have 1803(90.2%) and Muslims 197(9.8%). Education recorded most pregnant women having completed Junior high school with 760(38.4%). Emergency referral variable also had number of pregnant women who visited the hospital by referral as 931(46.3%),those who seek health care at the hospital without being referred are 1057(53.4%) Pregnant women in their third trimester within the age group 37-40 delivered at the hospital with 646(32.3 %). Pregnant women who attended antenatal care 7 times in the coarse of the pregnancy were 779(39%). Most of the women within the sample were self-employed,1451(72.6%).

4.3 Association between Maternal Mortality and Demographics

To test for association or relationship between the death of pregnant woman and the demographics, the Pearson chi-square was used. The study shows that there is no significant relationship between occupation and death of pregnant woman, p-value> 0.05. There is significant relation between death of pregnant woman and the marital status of the woman with p-value< 0.005. The same goes for religion, parity, antenatal attendance, emergency referral and education.

Table 4.4: Chi-square Test

1	demographic	chi-square value	sig (two sided)
	age of preg.woman	6.619	0.47
2	Marrital status	10.276	0.001
3	Parity	80.765	0
4	Religion	1.801	0.18
5	Education	18.854	0.001
6	Gest.AgeGroup	1.26E+02	0
7	Atenatal attendance	4.55E+02	0
8	Occupation	3.958	0.136
9	Emergency referral	78.716	0

Table 4.4 presents the strengths of association of the demographics with maternal mortality.The higher and chi-square value,the stronger the association. Age of pregnant woman, religion and occupation strength of association are not significant (P-value > 0.005).

4.4 Logistic Regression Model of Maternal Mortality

Table 4.5 presents the logistic regression output which indicates that age group, marital status, religion, education are not significant in predicting maternal mortality of a pregnant woman.

Table 4.5: Binary Logistic Regression Output

	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
AgeGroup	-0.011	0.061	0.035	1	0.851	0.989	0.877	1.114
Parity	-0.303	0.061	24.403	1	0	0.739	0.655	0.833
Marital.St	0.175	0.189	0.862	1	0.353	1.192	0.823	1.725
Religion	-0.236	0.268	0.774	1	0.379	0.79	0.467	1.336
Education.L	-0.092	0.071	1.676	1	0.195	0.912	0.794	1.048
Emergency.Ref	-0.575	0.167	11.89	1	0.001	0.563	0.406	0.78
GestAgeGroup	-0.144	0.045	10.337	1	0.001	0.866	0.793	0.945
AntenatalAtt	0.533	0.038	202.238	1	0	1.705	1.584	1.835
occupation	-0.389	0.157	6.158	1	0.013	0.677	0.498	0.921
Constant	1.822	0.414	19.406	1	0	6.186		

4.5 Discussion of Results

The study results presented no significant association between maternal mortality and occupation with P>0.05 from chi-square test. It indicates that maternal mortality is not determined by whether a pregnant woman is unemployed, self-employed or a civil-servant. However from logistic regression,p-values less than 0.05 for unemployed and self employed and odds ratio o.366 and CI=(0.19-0.703) and 0.509 CI(0.356-0.726)respectively. Although the study results showed a significant association between marital status and maternal mortality, the logistic regression proved it is not a good predictor of maternal mortality with P>0.05 with odds ratio of single mothers 1.091 and CI(0.716-1.662).

Religion showed significant association with maternal mortality P<0.05.It is however not a good predictor of maternal mortality in the logistic P>0.05 and odds ratio of pregnancy related death 0.660. Parity showed a significant association with maternal mortality with P<0.05. The study shows it is a significant predictor of maternal mortality with all categories of parity having P-value less than 0.05.The odds ratios of categories less than 1 indicates lower probabilities of maternal mortality. Odds ratio less than 1 between categories show no significant difference between the categories. The trend in the negative intercepts of parity indicates the lower the intercept, the lower probability of experiencing maternal death. There was a strong evidence of association between the number of weeks of pregnancy and maternal mortality, P< 0.05. However the logistic showed gestation group 5(34th-36th)weeks had P>0.05. Other groups had P<0.05. Odds ratio 0.885 indicating it has less probability of predicting maternal morality.

Emergency referral is significantly associated with maternal mortality.It is also a significant indicator of maternal mortality,P<0.05. From the study,odds ratio is 0.515 and negative intercept values. It has a less predictability of maternal mortality from the study sample. CI(0.359-0.740). Antenatal attendance or progress has a significant association with maternal mortality as presented by the study results. All other categories showed a strong or significant predictability with logistic regression on maternal mortality,with P<0.05 except pregnant women who did not assess antenatal care services P> 0.05. Negative intercept indicates lower probability of predicting maternal mortality.The smaller the intercept the lower the probability.Very low odds ratios values indicates no significant difference among the categories. Pregnant women with zero antenatal attendance showed very less probability for maternal mortality but it is highly not significant

The logistic model that predicted the death of pregnant woman who visits Korlebu Teaching Hospital as

$$\pi_{death} = \frac{1}{1 + \exp(-(41.122 - 20.041 \times 548 - 19.206 \times 174 - 1.686 \times 645 - 0.567 \times 250 - 0.676 \times 930)} \quad (4.2)$$

$$\pi_{death} = \frac{1}{1+\exp(-(\beta_0 + \beta_1(PT) + \beta_2(AA) + \beta_3(GAG/WKS) + \beta_4(OCC) + \beta_5(EMF))} \quad (4.1)$$

For a pregnant woman who delivers at the hospital with the demographics:parity=1 ,antenatal attendance=1, gestation age=1, occupation=unemployed, emergency referral=yes, the probability of death was calculated as

$$\frac{1}{1+inf} = 0 \quad (4.3)$$

Thus the pregnant woman is expected to die during of after labor.

4.6 Predicting Emergency Referral

The study showed that among all the predictors gestation age, antenatal attendance, occupation and parity,gestation age and are predictors of emergency referral.Gestation age showed significant predictability with P<0.05 except groups 5 and 6,(34-36)and (3740)weeks respectively. All the groups except group 6 presented odds ratio greater than 1 which indicates higher probability of requiring emergency referral. Occupation, from the regression results presented significant predictability of P<0.05. Odds ratio greater than 1 represent a higher probability for the need for emergency referral.Probability for emergency referral is

$$\pi_{\text{emergency referral}} = \frac{1}{1+\exp(-(\beta_0 + \beta_1(GAG/WKS) + \beta_2(0CC))} \quad (4.4)$$

The probability of a pregnant woman needing emergency referral with gestation age(37-40)weeks and with occupation self-employed is given as

$$\pi_{\text{emergency referral}} = \frac{1}{1+\exp-(-0.207 + 0.198 \times 645 + 0.783 \times 1447)} = \frac{1}{1+0} = 1 \quad (4.5)$$

Thus an expectant mother with such demographics is very likely to be in emergency care.

4.6.1 Multiple logistic Regression output

Tables 4.6 and Table 4.8 shows multiple logistic regression output between maternal mortality and demographics that showed significant p-values from the multiple logistic output with all the demographics(see appendix, Tables 1 - 4). Tables 4.8 and 4.9 multiple logistic output between emergency referral and and gestation age group and occupation.

Gestation age group and occupation being significant among selected demographics against the need for emergency referral(yes), (see appendix tables 5 and 6).

Table 4.6: Multiple logistic output between Maternal Mortality and significant (P < 0.005)Demographic

	Death of mother	B	Std. Error	Wald	df	
	Intercept	41.122	0.757	2.95E+03	1	
	[GestAgeGroup=1]	-1.16	0.361	10.331	1	
	[GestAgeGroup=2]	-2.011	0.406	24.545	1	
	[GestAgeGroup=3]	-2.286	0.431	28.166	1	
	[GestAgeGroup=4]	-0.872	0.315	7.681	1	
	[GestAgeGroup=5]	-0.132	0.291	0.206	1	
	[GestAgeGroup=6]	-1.686	0.299	31.878	1	
	[GestAgeGroup=7]	0b	.	.	0	
	[occupation=.00]	-1.006	0.333	9.102	1	
	[occupation=1.00]	-0.567	0.248	5.22	1	
	[occupation=2.00]	0b	.	.	0	
	[EmergencyReferral=0]	-0.676	0.182	13.806	1	
	[EmergencyReferral=1]	0b	.	.	0	
	[Parity=0]	-20.57	0.407	2.56E+03	1	
	[Parity=1]	-20.041	0.405	2.45E+03	1	
	[Parity=2]	-19.651	0.409	2.30E+03	1	
	[Parity=3]	-19.712	0.436	2.05E+03	1	
	[Parity=4]	-19.091	0.475	1.61E+03	1	
	[Parity=5]	-19.207	0	.	1	
	[Parity=6]	0b	.	.	0	
	[AntenatalProgress=0]	-36.236	907.914	0.002	1	
	[AntenatalProgress=1]	-19.206	0.609	992.948	1	

	[AntenatalProgress=2]	-19.729	0.611	1.04E+03	1	
	[AntenatalProgress=3]	-20.516	0.612	1.12E+03	1	
	[AntenatalProgress=4]	-21.796	0.637	1.17E+03	1	
	[AntenatalProgress=5]	-20.81	0.613	1.15E+03	1	
	[AntenatalProgress=6]	-21.713	0.638	1.16E+03	1	
	[AntenatalProgress=7]	-24.766	0	.	1	
	[AntenatalProgress=8]	0b	.	.	0	

Table 4.7: Multiple logistic output between Maternal Mortality and significant(P < 0.005)Demographic

Sig.	Exp(B)	95% Confidence Interval for Exp(B)		
		Lower Bound	Upper Bound	
0				
0.001	0.314	0.155	0.636	
0	0.134	0.06	0.296	
0	0.102	0.044	0.236	
0.006	0.418	0.226	0.775	
0.65	0.876	0.496	1.55	
0	0.185	0.103	0.333	
.	.	.	.	
0.003	0.366	0.19	0.703	
0.022	0.567	0.349	0.923	
.	.	.	.	
0	0.509	0.356	0.726	
.	.	.	.	
0	1.17E-09	5.25E-10	2.59E-09	
0	1.98E-09	8.95E-10	4.37E-09	

0	2.92E-09	1.31E-09	6.52E-09	
0	2.75E-09	1.17E-09	6.46E-09	
0	5.12E-09	2.02E-09	1.30E-08	
.	4.56E-09	4.56E-09	4.56E-09	
.	.	.	.	
0.968	1.83E-16	0	.c	
0	4.56E-09	1.38E-09	1.51E-08	
0	2.70E-09	8.17E-10	8.94E-09	
0	1.23E-09	3.71E-10	4.08E-09	
0	3.42E-10	9.81E-11	1.19E-09	
0	9.17E-10	2.76E-10	3.05E-09	
0	3.72E-10	1.06E-10	1.30E-09	
.	1.76E-11	1.76E-11	1.76E-11	
.	.	.	.	

Table 4.8: Logistic Regression between Emergency referral and Gestation Age group and occupation

	Emergency Referral(yes)	B	Std. Error	Wald	df	Sig.
	Intercept	-0.207	0.212	0.957	1	0.328
	[GestAgeGroup=1]	-2.129	0.24	78.768	1	0
	[GestAgeGroup=2]	-1.778	0.254	49.126	1	0
	[GestAgeGroup=3]	-0.86	0.228	14.211	1	0
	[GestAgeGroup=4]	-0.838	0.207	16.374	1	0
	[GestAgeGroup=5]	-0.446	0.199	5.029	1	0.025
	[GestAgeGroup=6]	0.198	0.184	1.156	1	0.282
	[GestAgeGroup=7]	0b	.	.	0	.
	[occupation=.00]	0.789	0.195	16.415	1	0

	[occupation=1.00]	0.738	0.15	24.12	1	0
	[occupation=2.00]	0b	.	.	0	

Table 4.9: Logistic Regression between Emergency referral and Gestation Age group and occupation

Exp(B)	95% Confidence Interval for Exp(B)	
	Lower Bound	Upper Bound
0.119	0.074	0.19
0.169	0.103	0.278
0.423	0.271	0.662
0.432	0.288	0.649
0.64	0.433	0.945
1.219	0.849	1.75
.	.	.
2.202	1.503	3.226
2.092	1.558	2.808
.	.	

CHAPTER 5

CONCLUSIONS and RECOMMENDATIONS

5.1 Conclusions

The study has examined the influence of various demographics characteristics in predicting maternal mortality with Korlebu Teaching Hospital as a case study. Some of the demographics showed significant level in predicting maternal mortality in the model(antenatal attendance, gestation age of pregnancy, occupation, emergency referral and parity). The study also shows that higher number of antenatal attendance by expectant mother indicates low probability of maternal mortality,however there is no positive correlation between the number of attendance and mortality as the β values are inconsistent(that is does not show increasing and

decreasing order). Hence the higher number of antenatal attendance is not a guarantee against maternal mortality. This may be due to other health factors (hallowell *et al.*,2009).

The type of occupation done by an expectant mother could be a cause of maternal mortality in term of significance. Pregnant women who are unemployed stands a higher chance of experiencing maternal death than self-employed expectant mothers at Korlebu. The death of self-employed pregnant mothers are significant at the hospital. Civil servants showed P-valve of 0.420 and confidence interval of (-0.35-0.83) in ruining a multivariate general linear model to determine the significance of civil servants on maternal mortality at the hospital.These there implies that every expectant mother should have some work doing to avoid complications that can lead to mortality during pregnancy. Self-employed shows significant on maternal mortality. Therefore the extent of work could have effect on the pregnancy.

Parity is a factor that can cause maternal mortality. Pregnant women with up to two children has lesser risk of maternal mortality. Those with more than two children already stands almost the some amount of risk of maternal mortality since their not much difference between their odds ratios or β values. Gestation age of pregnancies at the hospital showed low probabilities of causing maternal death though it is significantly related to maternal death The highest among them are groups(29-33) and (34-36) since they in the third trimester, the critical stage of pregnancy. Estimating the probability of a pregnant woman with the demographic values , parity 1,antenatal attendance 1, gestation age (37-40) weeks,occupation, unemployed and emergency referral , yes using their respective frequencies as predictor variables is zero(0). This indicates that a pregnant woman who attends Korlebu teaching hospital with such demographic conditions will not die. The study also revealed that some demographics showed significance in predicting the need for emergency referral. These are gestation age and occupation of pregnant woman. An estimate of the probability of a pregnant woman's need for emergency referral with demographic conditions, gestation age (37-40)weeks and occupation(self-employed) is one(1) indicating she will surely need emergency referral. This may also means too much work during the third trimester of pregnancy will cause

complications that will require emergency referral although complications during the third trimester could be due to ill health.

In summary, parity, gestation age,antenatal attendance ,emergency referral and occupation were the main factors maternal mortality.The results also indicates that antenatal attendance by pregnant women is very high ad that determines the probability of maternal mortality at Korlebu Teaching Hospital and the discussion,the probabilities are approximately zero (0).

5.2 Recommendations

- Antenatal attendance at Korlebu teaching hospital is very high. Almost all the women who delivered at Korlebu were referred to the hospital for specialist services. Pregnant women should be educated to attended antenatal care more than four times, the least number recommended for pregnant women by WHO. This is so because higher number of attendance ensure low chances of maternal death.

- Pregnant women at gestation age ages(33-36)weeks and (37-40) weeks should be given special attention. Were possible, caesarean section should be administered as soon as possible to prevent death of mother or complications after delivery which can also eventually lead to death of mother. Provision of more incubators at the hospitals are needed for caeserean section at gestation age that poses treat to the mothers life.

- Emergency referral has proven to be significant in predicting maternal death. Much as it essential to prevent death, efforts should be done on the part of government to develop emergency health care for pregnant women at government health facilities. This will ensure quick remedy to any anticipated problems associated with pregnancy. Women must be educated to embrace the concept of family planing and its methods to reduce the number of children, avoid unwanted pregnancies and save the life of the mother.

- To prevent the need for emergency referral, pregnant women should be educated to attend antenatal health care more than four times during the course of pregnancy. Post-natal check-ups or review should include the mother's health status after delivery within

forty-two days. During gestation age 36-40 weeks, the frequency of antenatal visits should increased (example once every week) for early diagnoses of difficulties with the pregnancy.