

**STATISTICAL ANALYSIS OF THE DETERMINANTS OF  
MATERNAL MORTALITY AND IMPACT OF VOUCHER FOR  
HEALTH IN KISUMU SUB-COUNTY, KENYA**

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*A thesis submitted in partial fulfillment of the requirements for the award of the degree of  
Master of Science (Biostatistics) in the school of Pure and applied Sciences, Kenyatta  
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## DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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## **DEDICATION**

I dedicate this work to my dear loving wife Julia and my sons Richard, Joseph and Geoffrey and my late father Pius for their financial, emotional, material and spiritual support. May the almighty God bless you and lift you up.

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**LIST OF ABBREVIATIONS AND ACRONYMS**

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
ANOVA	Analysis of variance
ANCOVA	Analysis of Covariance
BPL	Below Poverty Line
CBOs	Community Based Organizations
DFID	Department for International Development
DHMT	District Health Management Team
FP	Family Planning
GDP	Gross Domestic Product
GoK	Government of Kenya
HEFs	Health Equity Funds
HMT	Health Management Team
HSSF	Health Sector Services Fund
IMR	Infant Mortality rate
KDHS	Kenya Demographical Health Survey
KHPF	Kenya Health Policy Framework
KNBS	Kenya National Bureau of Statistics
Kshs	Kenya Shillings
M&E	Monitoring and Evaluation
MDGs	Millennium Development Goals
MMR	Maternal Mortality Ratio
MOMS	Ministry of Medical Services

MOPHS	Ministry of Public Health and Sanitation
NDHS	Nepal Demographic Health Survey
NGO	Non-Governmental Organizations
NHA	National Health Accounts
NHIF	National Hospital Insurance Fund
NHSSP	National Health Sector Strategic Plan
OBA	Output Based Approach
OOP	Out of Pocket Expenditure
OVC	Orphans of the Vulnerable Children
PPH	Postpartum Hemorrhage
RH	Reproductive Health
SBA	Skilled Birth Attendant
SM	Safe Motherhood
STI	Sexually Transmitted infections
TBA	Traditional Birth Attendant
TFR	Total Fertility Rates
THE	Total Health Expenditure
UNAIDS	United Nations Programme on HIV and AIDS
UNFPA	United Nations Population Fund Agency
UNICEF	United Nations Children's Fund
WB	World Bank
WHO	World Health Organization

## ABSTRACT

Globally in 2010, about 800 women died daily due to complications of pregnancy and child birth (WHO, 2010). Out of the 800 deaths, 440 deaths occurred in sub-Saharan Africa, 230 in Southern Asia and only five in high-income countries. In Kenya, maternal death is the leading cause of death amongst women of child bearing age, overall maternal mortality ratio in Kenya remain high at 488/100,000 and could even be higher in rural sub-counties. In response to the rising burden of MMR, the government of Kenya abolished user fees in all public health facilities. Consequently, targeted intervention for the poor pregnant mothers in the form of voucher for health meant to increase access to maternal health services is being piloted in few Counties. Based on this massive investment by the government to address maternal mortality, it is valuable to assess whether an impact is being realized. The purpose of this study was therefore to assess the determinants of maternal mortality, maternal service utilization and in particular find out whether the use of voucher for health has had an impact in reduction of maternal deaths as well as increasing utilization of maternal services in Kisumu Sub-County. A total of 293 pregnant women from 31 health facilities selected through purposive sampling were randomly interviewed while 210 maternal delivery outcomes were reviewed using questionnaires and structured checklist respectively. Data collected was analyzed using STATA version 11.0 Software and presented in tables and graphs. COX proportional Hazard regression model and Logistic regression model were used to estimate determinants of maternal mortality while general linear regression model was performed to predict the factors influencing maternal service utilization. The result of the study showed that overall women who attend maternal clinic and those who succumb to maternal related deaths are young. Utilization of maternal service is on the rise while maternal deaths are drastically decreasing. The factors that influence maternal service utilization in Kisumu Sub-County include level of education ( $\chi^2=20.52$ ,  $p=0.015$ ), voucher for health ( $\chi^2=30.69$ ,  $p=0.000$ ), payment for service ( $\chi^2=8.94$ ,  $p=0.030$ ) and knowledge on maternal visits ( $\chi^2=62.70$ ,  $p=0.000$ ), while the determinants of maternal mortality include age (Cox PH=1.039, OR=1.033), marital status (Cox ph = 1.063, OR=.977), Wealth index (Cox ph = 1.18, OR = 1.047), voucher for health (Cox ph = 3.075, OR=2.589) and presence of other diseases (Cox ph= 1.065, OR= 1.090). Maternal service utilization and maternal deaths in Kisumu Sub-County are determined by several factors that include background characteristics, socio-economic characteristics and institutional factors. Otherwise, voucher for health and women level of education stand out distinctively to influence the outcomes in both scenarios, therefore for maternal mortality ratio to come down, there is need to invest in women education and empower them economically which has desirable effects on decision making on maternal health.

## CHAPTER 1: INTRODUCTION

### 1.1 Study Background

Many promising interventions exist to reduce maternal mortality. However, families and communities often don't access care or practice preventive behavior for a variety of cultural, financial and societal reasons. According to the report by World Health Organization (2005), one of the reasons for slow progress in improving maternal and newborn health is the adoption of a single action response rather than a comprehensive approach.

Globally every day in 2010, about 800 women died due to complications of pregnancy and child birth, including severe bleeding after childbirth, infections, hypertensive disorders, and unsafe abortions (WHO, 2010). Out of the 800, 440 deaths occurred in sub-Saharan Africa and 230 in Southern Asia, compared to five in high-income countries.

Kenya continues to experience poor health outcomes attributed to a fast growing population, high fertility rate, emerging and reemerging diseases, high poverty levels, retrogressive cultural practices and social economic constraints among others.

The burden of high maternal mortality ratio that is not decreasing rapidly enough to meet the millennium development Goal 5 (MDG) is significantly evident in the KDHS (2010). Maternal deaths rose from 414/100,000 live births in 2003 to 488 per 100,000 live births in 2008, which translates to about 21 mothers dying daily.

While effective strategies to reduce maternal mortality are well known, different strategies and interventions on maternal mortality have either partially worked or not been effective due to either ineffective strategies or insufficient resources. Currently, attention is shifting to

interventions that address confounding factors in regard to maternal mortality. These factors revolve around societal, economic, education and cultural practices.

With a desire to achieve the MDG of reducing the MMR by three quarters by 2015, the Government of Kenya has been exploring different innovative ways that include; removal of user fees for pregnant mothers attending Ante natal clinic (ANC) in all public hospitals, intensifying health education on skilled deliveries, offering vulnerable mothers financial subsidies in the form of voucher for health in few Sub-Counties such as Kwale, Kisumu and the slums of Nairobi. However, mothers still pay some hidden costs when they deliver in the health facilities.

In the context of emergency preparedness, a clear referral strategy, improved institutional infrastructure development, trained skilled manpower and availability of medical products are critical in addressing maternal deaths at the community level (MOH, 2010). However, education of mothers is considered a key determinant to making informed decision. Education enhances women's ability to access existing health resources including skilled attendants for child birth, family planning and institutional deliveries and directly leads to a reduction in the risk of dying during pregnancy and child birth.

## **1.2 Statement of problem**

The World Health organization (WHO) estimates that about 536,000 women of reproductive age die each year from pregnancy related cases (WHO, 2008) of which 99% occur in developing countries with Africa alone accounting for 251,000 deaths (WHO, 2005). Furthermore, 20 million women suffer acute health conditions related to pregnancy annually (Souza *et al.*, 2007).

In Kenya, maternal death is the leading cause of death amongst women of child bearing age. Overall, maternal mortality ratio in Kenya remains high at 488/100,000 (KDHS, 2010). While

skilled deliveries have a significant effect on maternal deaths by 10 to 45% (MOH, 2010), the rate of women accessing deliveries from skilled birth attendant in Kenya is still low at 46.6% (KDHS, 2010). Similarly, despite the abundant evidence on strong association between MMR and child spacing (WHO, 2005), Contraceptive prevalence rate among married women in Kenya is low at 39% (RH strategy, 2009).

A study by Okumbe *et al.* (2009), revealed that, rural Sub-Counties in Kenya experience high maternal mortality approximated between 450 and 1,000 deaths per 100,000 live births. Kisumu Sub-County, is one such rural County with diverse socio- economic inequalities and cultural beliefs on pregnancy, maternal and child health, and also among the Counties with the highest poverty index of 65% (KNBS, 2010).

Maternal mortality ratio for Kisumu Sub-County is not stable and estimated between 456 and 405 deaths per 100,000 live births in 2008 and 2010 respectively while fertility level remain high at 5.4 and even much higher amongst the non educated at 6.7 (KDHS, 2010). Pregnant women in Kisumu are not completing the recommended four (4) antenatal care visits prior to delivery and a substantial number do not deliver in health facilities. According to the Kisumu East Development Plan for the period 2008 to 2012, 71% of women accessed antenatal care and only 33.3% births occurred in the health facility(GOK, 2009) which is lower than the national figure of 92% antenatal care visits and 44% health facilities deliveries (UNDP, 2010).

In response to the rising trend of MMR, the government of Kenya through the Ministry of health has been rolling out several health interventions in Kisumu Sub-County. One such intervention is voucher for health to the poor pregnant mothers. However, since the roll out of voucher for health in this Sub-county, no study has been done to find out whether the intervention has had an

impact in reducing maternal mortality and increasing maternal service utilization in this Sub-County.

It is expected that the findings will influence the programming of maternal survival programs in Kisumu County and at the same time guide the implementation of feasible intervention initiatives in an effort to reduce maternal mortality.

### **1.3 Research questions**

- i. Does socio-economic and institutional factors associated with maternal service utilization and maternal deaths in Kisumu Sub-County?
- ii. Does use of “voucher for health” have an effect on institutional deliveries in Kisumu Sub-County?
- iii. Does the use of “voucher for health” have an effect on maternal mortality in Kisumu Sub-County?

### **1.4 Hypotheses**

H<sub>01</sub>: Use of voucher for health does not significantly increase institutional deliveries in Kisumu Sub-County.

H<sub>02</sub>: Use of voucher for health does not have a significant effect on maternal mortality in Kisumu Sub-County.

H<sub>03</sub>: Utilization of services in health facilities by maternal mothers does not depend on level of education.

## **1.5 Objectives**

### **1.5.1 General Objective**

The aim of the study was to carry out a statistical analysis of the determinants of maternal mortality, maternal service utilization and assess whether voucher for health has an effect on maternal service utilization and mortality in Kisumu Sub-County.

### **1.5.2 Specific Objectives**

- i. To assess the socio-economic and institutional factors associated with maternal service utilization and maternal deaths in Kisumu Sub-County.
- ii. To determine the effects of voucher for health on utilization of maternal health services in Kisumu Sub-County.
- iii. To determine the effects of voucher for health on maternal mortality in Kisumu Sub-County.

## **1.6 Significance of the study**

The study sought to provide evidence on the effectiveness of the use of voucher for health in increasing maternal service utilization and reduction of maternal mortality. The results will be used as a basis in scaling up of the voucher for health project in other Counties and programming of maternal health services in the entire nation.

With a focus to reduce MMR by three quarters by 2015, (WHO, 2010), statistical modeling in key maternal interventions is a requirement. Statistical analysis provides feasible predictive models that may be applied in different case scenarios to maximize the available resources to achieve desired results. It is therefore expected that, these models would be generalized to provide best suited predictive model to tackle maternal mortality and maternal service utilization in the County and beyond.

### **1.7 Limitations of the study**

Some of the maternal deaths files reviewed had some information missing, however, by cross checking with the death register and death notification records in the facilities, all the missing data elements were fixed. In the assessment of the determinants of maternal service utilization, few recall bias noted during the interview were estimated after probing further with the client.

The study was narrowed to Kisumu Sub-County because of financial implication involved and due to the limited timeline of which the study was to be completed and submitted for academic purposes.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Introduction

This chapter reviews related work which has been undertaken by other researchers, it first gives the general overview of the problem area followed by the global perspectives and then the Kenyan context. Discussion on the risk factors, cause and barrier to maternal health services is also discussed.

### 2.2 Overview

The world Health Organization (WHO) defines a maternal death 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, its management but not from accidental or incidental causes. Skilled care refers to the care provided to a woman and her newborn during pregnancy, childbirth and immediately after birth by an accredited and competent health care provider who has at her/his disposal the necessary equipment and the support of a functioning health system, including transport and referral facilities for emergency obstetric care (WHO, 2004).

Maternal mortality is a health indicator that shows very wide gaps between the rich and the poor, both between countries and within them (WHO, 2010). Most of these deaths can be averted even where resources are limited but, in order to do so, the right kind of information is needed upon which to base actions.

Over the last 25 years, some countries, including some that have limited resources, have made striking progress in reducing maternal mortality, but many others still lag behind and are unlikely to achieve the country specific 2015 women’s health targets established in 2000 under the millennium Development goals (MDGs). Nieburg (2012), argues that Societies that have

achieved the lowest levels of maternal mortality have done so by preventing pregnancies, by reducing the incidence of certain (pregnancy) complications, and by having adequate facilities and well trained staff to treat the complications.

The world Health Organization has estimated that about 15 percent of pregnancies in all countries will have one or more complications that require “rapid and skilled obstetric care to prevent death or serious long term morbidity since globally around 80 percent of maternal deaths are due to obstetric complications, (pre-eclampsia and eclampsia, and prolonged or obstructed labour.), while complications of unsafe abortions accounts for 13 percent of maternal deaths worldwide (WHO, 2012)

The successful provision of the continuum of care requires a functioning health care system with the necessary infrastructure in place, including transport between the primary level of health care (health centers and dispensaries) and referral hospitals. It also needs effective, efficient and proactive collaboration between all those involved in the provision of care to pregnant women and newborns.

Baral *et al.* (2010), stated that, delivery by skilled birth attendant (SBA) serves as an indicator of achieving progress towards reducing maternal mortality worldwide, it is estimated that, if there were SBA at all deliveries, maternal mortality could be reduced by 13-33%. However, evidence from India (NFHS-3) indicates that institutional deliveries are not always a function of economic status; many non below poverty line (BPL) households choose to have their deliveries at home as well (Gupta *et al.*, 2010).

Yalem Tsegay *et al.* (2010), in his review to publications on skilled deliveries identified economic, health facility related and social cultural factors to be the most frequent contributors to low maternal health care utilization.

But according to WHO, UNICEF, UNFPA and The World Bank report of 1990-2010, in addition to improvement in health systems, other factors outside the health sector such as increased female education and increased physical accessibility to health facilities could be contributory factors to low institutional deliveries.

Culture on one hand has a significant influence on beliefs and practices of child birth. The ways in which an individual society views and manages childbirth are dependent on the beliefs, practices and values associated with reproductive health and the role and status of women (Lauderdale, 2003).

To address economic disparities and stimulate demand for services from underserved population groups, out-put based aid (OBA) or voucher for health strategy plays a critical role. Voucher for health exist in the context of a number of financing strategies aimed at rewarding both providers and beneficiaries for specific outcomes or outputs. Vouchers are a social health protection mechanism where subsidies from government or donor agencies are used to stimulate demand for priority goods or services (Reyners *et al.*, 2011), however Carrine *et al.* (2011), underscore voucher programmes appear successful in the intermediary goals of targeting specific groups or populations but are prone to counterfeiting.

## **2.3 The Kenyan Context**

On attaining independence (1963), the government committed itself to providing “free” health services as part of its development strategy to alleviate poverty and improve the welfare and productivity of the nation geared towards attaining the long term objectives of healthcare for all. However, in response to the declining economy, exponential population growth and emergence of AIDS epidemics, the government introduced modest cost sharing (payment by patient) in early 1980 to deliver health care (MSH, 2006).

Amid the worsening poverty situation in the Country, the policy on cost sharing was replaced with a “10/20” policy, in which dispensaries and health centers were not to charge user fees for curative care other than Kshs. 10 or 20 for client cards. Further review on health service delivery saw a policy directive exempting Pregnant mothers and under five years children from paying any user fees (MOH, 2008).

Access to maternal services has been an issue for a long time in Kenya, according to the UNDP report of 2011, the proportion of women making the recommended number of antenatal care visits of 4 and above declined from 64% in 1993 to 52% in 2003 and to 47% in 2008/09, while the proportion receiving skilled care during delivery declined from 45% in 1998 to 42% in 2003 (KDHS, 2010).

### **2.3.1 Causal analysis of maternal deaths in Kenya**

Maternal mortality is generally acknowledged to be a failure of the overall health system. In Kenya, as in most developing countries, the vast majority of maternal deaths take place during delivery and in the immediate 24 hours following delivery and most are attributable to just a few direct causes: hemorrhage, hypertension, sepsis and unsafe abortion. Virtually all of these

conditions can be prevented or managed by basic health care services, including quality antenatal care, safe and clean delivery practices, and access to emergency referral facilities when needed (WHO, 2010).

According to the KDHS 2008-09 adolescent mothers are more likely to experience complications during pregnancy and are less likely prepared to deal with them, which often lead to maternal deaths because of their early entry into childbearing. Children born to very young mothers are normally predisposed to higher risks of illness and death due to the limited exposure of the mothers to reproductive health services. Adolescent mothers are also more likely to experience complications during pregnancy and are less likely to be prepared to deal with them, which often leads to maternal deaths. The levels of teenage pregnancy and deliveries are highest in Nyanza (27%) and Coast (26%) provinces and lowest in Central province (10%).

Rural women are less likely than their urban counterparts to get antenatal care from a doctor, while women's level of education is highly associated with antenatal care coverage (KDHS, 2010).

### **2.3.2 Barriers to access to basic services during pregnancy and delivery**

**Human resources:** Kenya faces persistent shortages of critical health workers compounded by performance management issues and the inability to attract and retain health workers in the public sector and particularly in deprived and rural areas (KHRHC, 2011).

**Access to services:** Only one in three health facilities in Kenya offers basic maternity services and one in four is open at night; one in ten hospitals provide basic emergency obstetric care services and even fewer offer comprehensive emergency obstetric care (KSPA, 1999).

**Quality control:** Poor quality of services is cited more frequently than cost as the top barrier to care-seeking for maternal health in Kenya. Just thirty-nine percent of maternity facilities now conduct maternal death reviews and 38% of facilities perform basic monitoring of delivery coverage (KSPA, 2010).

**Cultural and behavioral factors** contribute to low coverage of life-saving maternal health interventions. Statistically, Kenyan households are less likely to seek care for pregnancy and delivery-related concerns than for a sick child (KDHS, 2010). Female genital cutting (FGC) and Gender based violence is a known risk factor for maternal complications. A woman is also much more likely to develop maternal health complications if she has an underlying illness, particularly HIV/AIDS, malaria and anemia. Other risk factors include age, parity and access to skilled birth attendant that predispose women to develop in complications during delivery.

## **CHAPTER 3: METHODOLOGY**

### **3.1 Introduction**

This chapter describes the methods used in the study, the study designs, dependent and independent variables, the data collection instruments and sampling technique. It further describes how data was collected and analyzed.

### **3.2 Research Design**

This study adopted both cross-sectional and retrospective study designs. Retrospective design was valuable in this study in assessing mortality trends and determining the socio-economic and institutional factors influencing maternal mortality. Cross-sectional design was used to assess health care seeking behavior for pregnant mothers and determinants that influence utilization of maternal health services.

The two components of the design used were, the quantitative and qualitative approaches. Maternal deaths and delivery outcome review was carried out using a designed checklist for all maternal deaths and proportionate delivery outcomes that occurred in sampled facilities in the study county to better understand factors that contributed to mortalities.

The qualitative process was through use of in depth interviews of randomly sampled ante natal mothers attending ANC at that time using a structured questionnaire. Cross-sectional design was used because it gives a quick snapshot of the behavior of the participant within the shortest time.

### **3.3 Variables**

#### **Independent variables**

Education, age, occupation, parity of the mother, marital status, distance from the health facility, Voucher for health and pregnant mothers accessing the services were taken as independent variables in this study.

#### **Dependent variables**

Maternal death, ante natal utilization, child survival and preference for health facilities were taken as the dependable variables in the study.

### **3.4 Study Location**

This study was conducted in the larger Kisumu Sub-County before split (i.e Kisumu West and East Sub-Counties) in Kisumu County, Western Kenya. The larger Kisumu Sub-County lies in a depression that is part of large lowland, on the Nyanza gulf, a protruding part of Lake Victoria at the head of which is Kisumu City.

The topography of the county is divided into two zones namely the Kano plains and the midland areas of Maseno and Kombewa. It has an estimated area of 1,695 KM<sup>2</sup> with a population of 743,946 people and a population growth rate of 2.9%. There are a total of 81 health facilities, one referral hospital, 2 County hospitals, 3 Sub-County hospitals, 7 other hospitals (non government), one nursing home, 49 Dispensaries and 18 Health centers.

### **3.5 Target Population**

The study targeted sampled facilities in the larger Kisumu Sub-County that offer maternal health services including deliveries. Pregnant mothers attending ANC clinic at the time of the study were interviewed randomly as they exited from the clinic to gauge the knowledge, attitude and practice on maternal health services.

### 3.6 Sampling Technique

A detailed sampling frame of all facilities offering ANC services was constructed for both Kisumu East and West Sub-Counties. The stratification method was used to group the facilities by type and ownership. The table below represents the frame;

**Table 3.1: Sampling frame for the study**

Type of the facility	Kisumu East Sub-County			Kisumu West Sub-County			Total
	GOK (No.)	Private (No.)	Local Authority (No.)	GOK (No.)	Private (No.)	Local Authority (No.)	
County Hospital	1	0	0	1	0	0	2
Sub- County Hosp	1	0	0	2	0	0	3
Other Hospital	1	5	0	0	1	0	7
Nursing Home	0	1	0	0	0	0	1
Health Center	5	1	4	8	0	0	18
Total	7	8	4	11	1	0	31

Using simple random sampling method, two (2) County hospitals and two (2) Sub-County hospitals each from the two Sub-Counties were selected. Two (2) other hospitals and two (2) nursing homes were also sampled from the two sub-counties. A total of six (6) health centers were selected for inclusion. And to avoid bias, the inclusion criteria considered the facility type, location and ownership.

A total of 293 respondents were interviewed from the facilities, the study employed proportional allocation to size sampling technique to determine the sample size; Where;

N: Population size (Total number of ANC – new visits) in the sampled facilities.

H: Number of Strata (Stratified by facility type e.g. Referral hospital, County hospital, health center e.tc)

With respect to  $h^{\text{th}}$  stratum  $h=1, 2, 3, \dots, H$ , size is  $N_h$  such that 
$$N = \sum_{h=1}^L N_h$$

So the proportional allocation for the stratum  $h$  is  $n_h = \frac{N_h}{N} n$

### **3.7 Research Instruments**

The research instrument used a mix of closed and open ended questionnaire for exit interview. A structured tool (checklist) was developed for retrospective study design to extract maternal deaths and delivery outcomes data from registers and any other relevant document from the hospitals.

### **3.8 Pilot Study**

This study was not piloted given the limited time frame for completion and submission for academic purposes, also due to financial constraints.

### **3.9 Data Collection Techniques**

This was done through administration of the questionnaire and extraction of the secondary data from existing books, registers and reports.

### **3.10 Data analysis**

Stata Version 11.0 was used to analyze data collected from the facilities. The analytical procedures performed include descriptive, univariate, bivariate and multivariate analysis. The bivariate and multivariate analysis was performed to predict the utilization of maternal health services and determinants of maternal deaths. The models used in the analysis included Cox regression model, logistic regression model and general linear regression model.

#### **3.10.1 General Linear Regression**

Describes a relation between some explanatory (predictor) variables and a variable of special

interest, called the response variable.

Example: **response variable:** Maternal service utilization

**Predictor variables:** Age, Distance of the facility, level of education of the respondent, marital status of the respondent, being able to pay, enrolled in voucher for health e.t.c.

### 3.10.1.1 Simple Linear Regression

This is a type of model that has only one predictor. The model:  $Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$ ,  $i=1 \dots n$ ,  $Y$  is the response variable; Where:  $X$  is the predictor variable,  $\beta_0$  and  $\beta_1$  are the regression coefficients,  $\varepsilon$  is an error term s.t.  $E(\varepsilon_i) = 0$  for all  $i$ ,  $\text{Var}(\varepsilon_i) = \sigma^2$  for all  $i$ ,  $\text{Cov}(\varepsilon_i, \varepsilon_j) = 0$  if  $i \neq j$ .

#### Parameter estimation

Estimates of  $\beta_0$  and  $\beta_1$  denoted by  $\hat{\beta}_0$  and  $\hat{\beta}_1$  and the Prediction is given by;  $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$  Each pair of the observation satisfy the relationship  $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x + e_i$   $i = 1, 2, \dots n$ . Where  $e_i = y_i - \hat{y}_i$  is called the residual. The residual describes the error in the fit of the model to the  $i^{\text{th}}$  observation.

### 3.10.1.2 Multiple Linear Regression Model

Multiple linear regression attempts to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to observed data. Every value of the independent variable  $x$  is associated with a value of the dependent variable  $y$ . The population regression line for  $p$  explanatory variables  $x_1, x_2, \dots, x_p$  is defined to be;

$$\mu_y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p$$

This line describes how the mean response  $\mu_y$  changes with the explanatory variables. The observed values for  $y$  vary about their means  $\mu_y$  and are assumed to have the same standard

deviation  $\sigma$ . The fitted values  $b_0, b_1, \dots, b_p$  estimate the parameters  $\beta_0, \beta_1, \dots, \beta_p$ , of the population regression line.

Since the observed values for  $y$  vary about their means  $\mu_y$  the multiple regression model includes a term for this variation. In words, the model is expressed as DATA = FIT + RESIDUAL, where the "FIT" term represents the expression  $\mu_y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p$ . The "RESIDUAL" term represents the deviations of the observed values  $y$  from their means  $\mu_y$ , which are normally distributed with mean 0 and variance  $\sigma$ . The notation for the model deviations is  $\epsilon$ .

**Formally, the model for multiple linear regression, given  $n$  observations, is**  
 $y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_p x_{ip} + \epsilon_i$  for  $i = 1, 2, \dots, n$ . In the least-squares model, the best-fitting line for the observed data is calculated by minimizing the sum of the squares of the vertical deviations from each data point to the line (if a point lies on the fitted line exactly, then its vertical deviation is 0). Because the deviations are first squared, then summed, there are no cancellations between positive and negative values. The values fit by the equation  $b_0 + b_1 x_{i1} + \dots + b_p x_{ip}$  are denoted by  $\hat{y}_i$ , and the residuals  $e_i$  are equal to  $y_i - \hat{y}_i$ , the difference between the observed and fitted values. The sum of the residuals is equal to zero. The variance  $\sigma^2$  may be estimated by  $s^2 = \frac{\sum e_i^2}{n-p-1}$ .

### 3.10.1.3 Checking Model Adequacy

The coefficient of multiple determination  $R^2$  is computed as the ratio of variation in  $y$  accounted for by the regression model and the total variation in  $y$ .  $R^2$  is therefore interpreted as the proportion of total variation of that can be explained by the regression is a number between 0 and 1. The larger  $R^2$ , the better fit the model has. If  $R^2=1$ , then the model has a perfect fit.

Define a residual  $\hat{\epsilon}$  as the difference between the observed  $y$  and fitted  $\hat{y}_i$ , that is  $\hat{\epsilon} = y - \hat{y}$

Residuals are interpreted as estimates of random errors  $\mathcal{E}$ s. Therefore to check if the model assumptions are met (Normality, mean zero and homoscedasticity), Residual analysis (also called model validation, model adequacy check or model diagnostic) will be performed.

### 3.10.2 Cox Proportional Hazard

The hazard model used was Cox proportional hazard model (Cox and Oakes 1984 and Cullet 1994). The hazard function for the Cox Proportional Hazard (Cox PH) model is;

$h(t, \mathbf{X}) = h_0(t) \exp(\sum_{i=1}^p \beta_i X_i)$ , where  $\mathbf{X} = (X_1, X_2, \dots, X_p)$  are the predictor variables and  $h_0(t)$  is called baseline hazard.

**Important characteristics of the Cox PH are that;**

- It is a product of a function in  $t$  and a function in  $\mathbf{X}$ ;
- $\mathbf{X}$  is time dependent;
- The baseline hazard is an unspecified function, making it a semi-parametric model.

### The Popularity of the Cox PH Model

Reasons for the popularity of the Cox Model:

- The Cox model is robust.
- The estimated hazards are always non-negative.
- The  $\beta$ 's can be estimated and the hazard ratio calculated.
- $h(t, \mathbf{X})$  and  $S(t, \mathbf{X})$  can be estimated.
- The Cox Model is preferred over the logistic model which ignores survival time and censoring information.

### 3.10.2.1 Computing the Hazard Ratio

The hazard ratio is defined as:  $\widehat{HT} = \frac{h(t, X^*)}{h(t, X)}$ , Where  $X^*$  is typically the group with the larger hazard (e.g. placebo group) while  $X$  is the group with the smaller hazard (e.g. treatment group). In the case of the Cox PH model this simplifies to  $\widehat{HT} = \exp\left(\sum_{i=1}^p \beta_i (X_i^* - X_i)\right)$  which can be easily computed once the  $\beta_i$  have been determined

### Cox PH Assumptions

The PH assumption requires that the hazard ratio is constant over time, or equivalently, that the hazard for one individual is proportional to the hazard for any other individual and the proportionality constant is dependant of time. Graphically this means that hazards for different individuals do not cross. The general rule is that if hazards cross, then the PH assumptions cannot be met, so that a Cox PH model is inappropriate. More on the evaluation of PH assumption is to follow in the next presentations.

### 3.10.2.2 ML Estimation of the Cox PH Model

The full likelihood can be used to derive a formula for the baseline hazard. The Cox model likelihood function  $L$  is called a "partial" likelihood function because it only considers probabilities for failed subjects explicitly. It can be shown that the Cox partial likelihood can be written as  $L(\beta) = \prod_{j=1}^K \frac{\exp\left(\sum_{i=1}^p \beta_i X_{ij} I_{ij}\right)}{\sum_{i \in R(t_{(j)})} \exp\left(\sum_{i=1}^p \beta_i X_{ii}\right)}$ , where;

- we assume  $k$  different failure times,  $t_{(1)} < t_{(2)} < \dots < t_{(k)}$  which exactly one failure at each time;
- $[i]$  denotes the subject with event at time  $t_{(i)}$ ;
- $R(t)$  is the risk set at time  $t$ .

### Properties of Cox likelihood

- The Cox likelihood is determined by the order of events and censoring and not by the distribution of the outcome variable.
- The baseline hazard cancels out in each term of the likelihood and does not play any role in estimation.
- It is still possible to derive a complete likelihood function.

#### 3.10.2.3 Illustration on application of Cox PH

Suppose there are two groups of pregnant mothers where pregnant mothers in the first group say (y) benefit from voucher for health while the other group (n) do not benefit. The Cox model assumes that the hazard of death at time “t” for the mothers who have benefited is proportional to the hazard of the mothers who have not by the same factor “ $\psi$ ” at every time “t”.

Thus;  $h_n(t) = \psi h_y(t)$ , where  $h_n$  and  $h_y$  are the hazards (probabilities of dying) for the two groups and “ $\psi$ ” is the hazard ratio. If  $\psi > 1$ , the hazard of death is larger for mothers who did not benefit from voucher for health relative to mothers who benefited, so that voucher for health has effect on maternal deaths. If  $\psi < 1$  or  $\psi = 1$ , the death hazard of the mothers with voucher for health would be higher or equal to the hazard of those mothers who are not beneficiary, in which case voucher for health would be of no effect or use.

The model can be extended and generalized to more than one explanatory variable. And it is practically useful to model the hazard ratio in logarithmic form as a function of a set of x variables, whose values are observed for “t” individuals;  $\log\left(\frac{h_j(t)}{h_0(t)}\right) = \sum_{ij} \beta_j x_{ij}$ , the j coefficients  $\beta_j$

represent the change in the logarithm of the hazard ratio, for a unit change in the explanatory variable  $x$ . The advantage of writing  $\beta$  as the logarithm of the hazard ratio is that the relative hazard ratio will always be positive: larger than 1 for  $\beta$  positive and less than one for  $\beta$  negative. The estimated hazard function for each individual becomes;  $h_i(t) = e^{(\sum \beta_j x_i)} h_0(t)$ .

### 3.10.3 Logistic regression Model

This is a statistical method for analyzing a dataset in which there are one or more independent variables that determine an outcome. The outcome is measured with a dichotomous variable (in which there are only two possible outcomes). In logistic regression, the dependent variable is binary or dichotomous, i.e. it only contains data coded as 1 (TRUE, success, pregnant, registered in voucher program etc.) or 0 (FALSE, failure, non-pregnant, not registered in voucher program).

The goal of logistic regression is to find the best fitting (yet biologically reasonable) model to describe the relationship between the dichotomous characteristic of interest (dependent variable = response or outcome variable) and a set of independent (predictor or explanatory) variables. Logistic regression generates the coefficients (and its standard errors and significance levels) of a formula to predict a *logit transformation* of the probability of presence of the characteristic of interest:  $logit(p) = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \dots + b_k X_k$ , where  $p$  is the probability of presence of the characteristic of interest, the logit transformation is defined as the logged odds:

$$Odds = \frac{p}{1-p} = \frac{\text{Probability of presence of Characteristics}}{\text{Probability of absence of characteristics}}, \quad logit(p) = \ln\left(\frac{p}{1-p}\right).$$

And; Rather than choosing parameters that minimize the sum of squared errors (like in ordinary regression), estimation in logistic regression chooses parameters that maximize the likelihood of observing the sample values.

### 3.10.3.1 Regression coefficients

The regression coefficients are the coefficients  $b_0, b_1, b_2, \dots, b_k$  of the regression equation:

$Logit(p) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_kX_k$ . An independent variable with a regression coefficient not significantly different from 0 ( $P > 0.05$ ) can be removed from the regression model. If  $P < 0.05$  then the variable contributes significantly to the prediction of the outcome variable.

The logistic regression coefficients show the change (increase when  $b_i > 0$ , decrease when  $b_i < 0$ ) in the predicted logged odds of having the characteristic of interest for a one-unit change in the independent variables.

When the independent variables  $X_a$  and  $X_b$  are dichotomous variables (e.g. Smoking, Sex) then the influence of these variables on the dependent variable can simply be compared by comparing their regression coefficients  $b_a$  and  $b_b$ .

### 3.10.3.2 Odds ratios with 95% CI

By taking the exponential of both sides of the regression equation as given above, the equation can be rewritten as:

$$odds = \frac{p}{1-p} = e^{b_0} x e^{b_1x_1} x e^{b_2x_2} x e^{b_3x_3} x \dots x e^{b_kx_k}$$

It is clear that when a variable  $X_i$  increases by 1 unit, with all other factors remaining unchanged, then the odds will increase by a factor  $e^{b_i}$ .

$$e^{b_i(1+X_i)} - e^{b_iX_i} = e^{b_i(1+X_i)-b_iX_i} = e^{b_i+b_iX_i-b_iX_i} = e^{b_i}$$

This factor  $e^b_i$  is the odds ratio (O.R.) for the independent variable  $X_i$  and it gives the *relative* amount by which the odds of the outcome increase (O.R. greater than 1) or decrease (O.R. less than 1) when the value of the independent variable is increased by 1 units.

### 3.10.4 Chi Squared tests of independence

Chi square test is used to assess two types of comparison: tests of goodness of fit and tests of independence. If we consider the null hypothesis that the cell probabilities equal certain fixed values  $\Pi_{ij}$ , then for a sample of size  $n$  with cell counts  $n_{ij}$ , the expected frequencies are  $\mu_{ij}=n \Pi_{ij}$ . They represents the values of the expectations  $E(n_{ij})$ , the notation refers to two way tables.

A test of **goodness of fit** establishes whether or not an observed frequency distribution differs from a theoretical distribution, while a **test of independence** assesses whether paired observations on two variables, expressed in a contingency table, are independent of each other.

#### Calculating the test-statistic

The value of the test-statistic is

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}$$

Where,

$\chi^2$  = Pearson's cumulative test statistics, which asymptotically approaches a  $\chi^2$  distribution.

$O_i$  = an observed frequency.

$E_i$  = an expected (theoretical) frequency, asserted by the null hypothesis.

$n$  = the number of the cell in the table.

The  $\chi^2$  statistic has approximately a chi-squared distribution, for large sample. For  $m$  rows and  $n$  columns the degrees of freedom is:  $df = (m-1)(n-1)$ .

### 3.10.5 Fisher's exact test

The Fisher's exact test is used when you want to conduct a chi-square test, but one or more of your cells has an expected frequency of five or less. The chi-square test assumes that each cell has an expected frequency of five or more, but the Fisher's exact test has no such assumption and can be used regardless of how small the expected frequency is.

Fisher exact follows a hypergeometric distribution in a 2x2 table with cell counts  $a, b, c, d$ . Assuming the marginal totals are fixed:  $M1 = a+b$ ,  $M2 = c+b$ ,  $N1 = a+c$ ,  $N2 = b+d$  and for convenience assume  $N1 < N2$ ,  $M1 < M2$ . The possible value of  $a$  are  $0, 1 \dots \min(M1, N1)$ . The probability of distribution of cell counts  $a$  follows hypergeometric distribution; where,  
 $N = a+b+c+d = N1 + N2 = M1 + M2$  ;  $\Pr(x=a) = \frac{N1!N2!M1!M2!}{(N!a!b!c!d!)$  ; Mean  $(x) = \frac{M1N1}{N}$   
 and  $\text{Var}(x) = \frac{M1M2N1N2}{(N^2(N-1))}$ .

#### 3.10.5.1 Assumption of Fisher's Exact

In Fisher's exact, it is assumed that the samples are drawn from the population by the process of random sampling. Secondly, in the Fisher's exact test, a directional hypothesis is assumed (for both negative and positive association). Lastly, the value of the unit of the items that are being sampled do not get affected by the value of the other unit of the item being sampled.

### 3.11 Logistical and Ethical Considerations

Approval of the study was sought from the university and authorization letter was given by the Director of medical services to visit health facilities in Kisumu Sub-County.

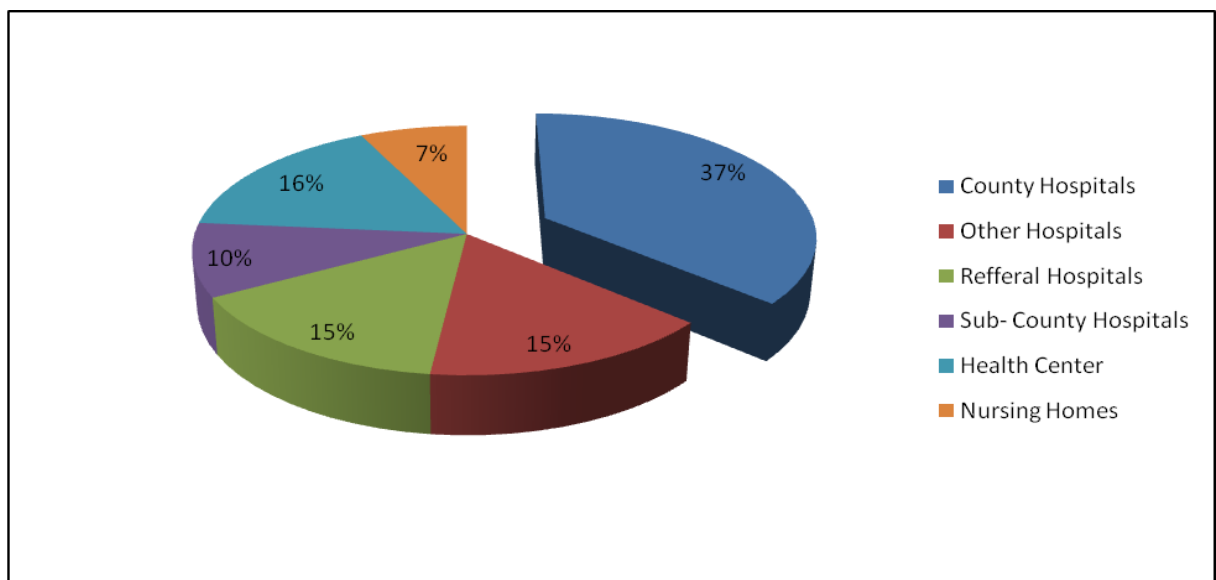
## CHAPTER 4: RESULTS AND DISCUSSION

### 4.1 Results

#### 4.1.1 Descriptive analysis - Maternal health service utilization

##### 4.1.1.1 Distribution of the Respondents by health facilities

A total of 293 respondents were interviewed. Figure 4.1 shows that, majority of clients 107 (36.52%) were from County hospitals, 45 (15.36%) were from other hospital hospitals, 44 (15.02%) were from referral hospital while 28 (9.56%) and 48 (16.38%) were from Sub County hospital and Health centers respectively. The least number 21 (7.17%) were from the Nursing homes.



**Figure 4.1: Distribution of Clients interviewed by health facilities**

##### 4.1.1.2 Socioeconomic and institutional Characteristics

Table 4.1 presents the socioeconomic and institutional characteristics of the study population. Majority of the facilities (84.64%) were owned by the government. Only 15.36% of the sampled facilities were private facilities. The mean age amongst the respondent was 23.9 years with a

standard deviation of 5.3. The ratio of married respondents to divorced, separated, single and widowed combined was 4:1.

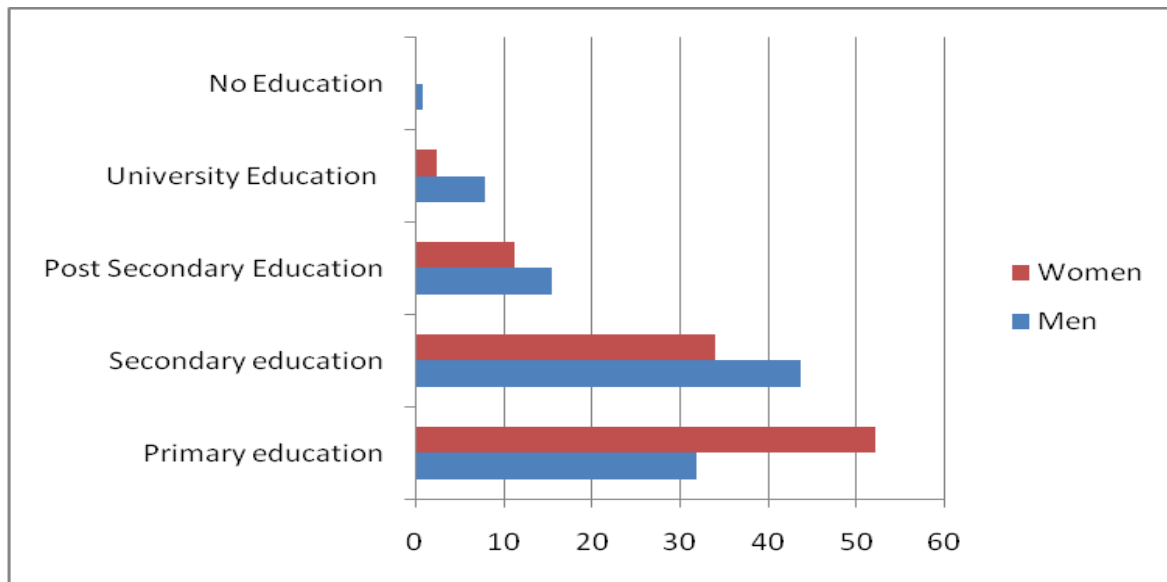
**Table 4.1: Percentage Distribution of sampled population by various characteristics**

Characteristics		Number	Percentage
Ownership of facility		n=293	
	Government	225	76.79
	Local Authority	23	7.85
	Private	45	15.36
Occupation of the mother		n=293	
	Salaried Worker	26	8.87
	Business lady	90	30.72
	Not working	164	55.97
	Farmer	13	4.44
Level of Education		n=293	
	Primary education	153	52.22
	Secondary education	100	34.13
	Post Secondary Education	33	11.26
	University Education	7	2.39
Religion		n=293	
	Christian	285	97.27
	Islamic	6	2.05
	No religion	2	0.68
Husband Occupation		n=238	
	Salaried Worker	89	37.39
	Business man	98	41.18
	Not working	21	8.82
	Farmer	30	12.61
Level of Education of husband		n=238	
	Primary education	76	31.93
	Secondary education	104	43.7
	Post Secondary Education	37	15.55
	University Education	19	7.98
	No education	2	0.84
Facility Distance		n=293	
	1 kilometer	55	18.77
	1 to 3 kilometers	124	42.32
	3 to 5 kilometers	75	25.6
	over 5 kilometers	39	13.31

#### 4.1.1.3 Level of education

Education is a basic right and one of the major stimuli of development. Education is commonly seen as an indicator of socioeconomic development. The basic level of education in Kenya is

primary education. In figure 4.2, all the respondents had the basic level of education except for a few men reported to be illiterate. The most achieved level of education (52.22%) was primary level which showed women outnumbering their male counterpart. However, this pattern changed from secondary school to university level of education.

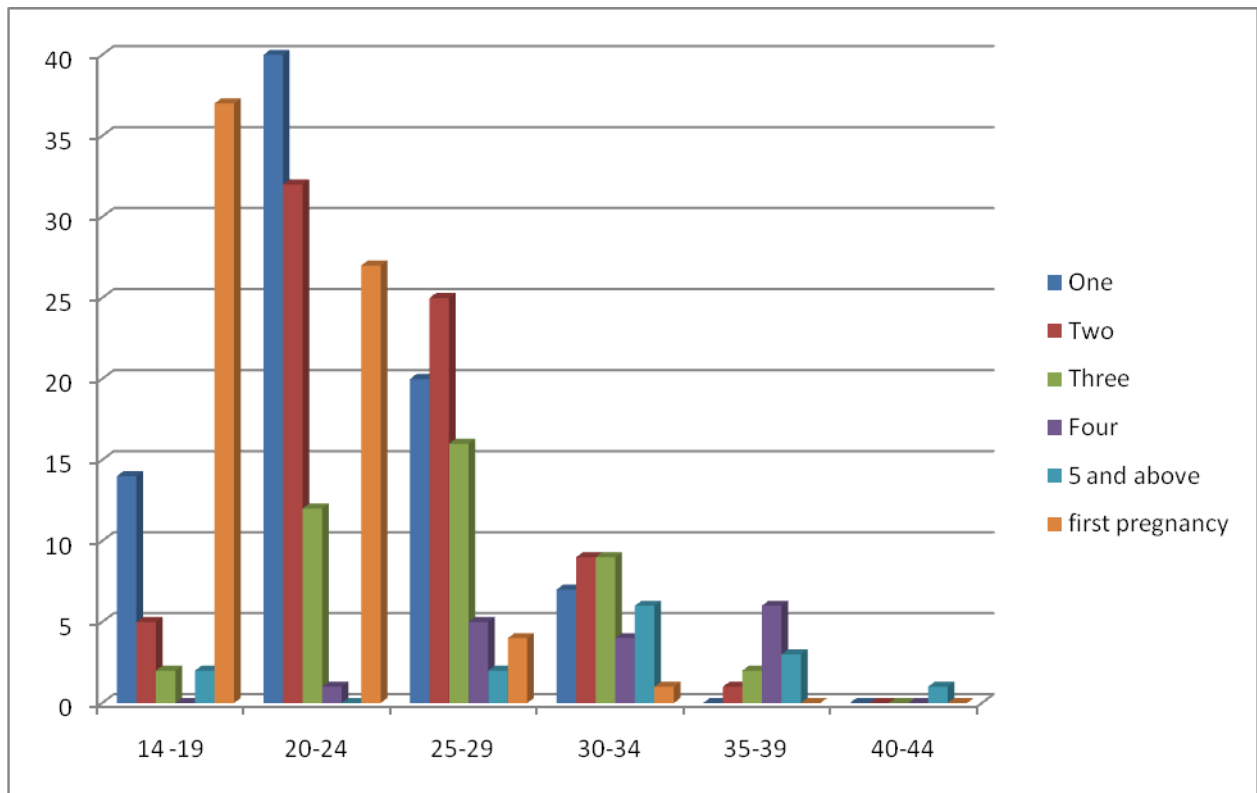


**Figure 4.2: Comparison of level of education of Women and Men level of education**

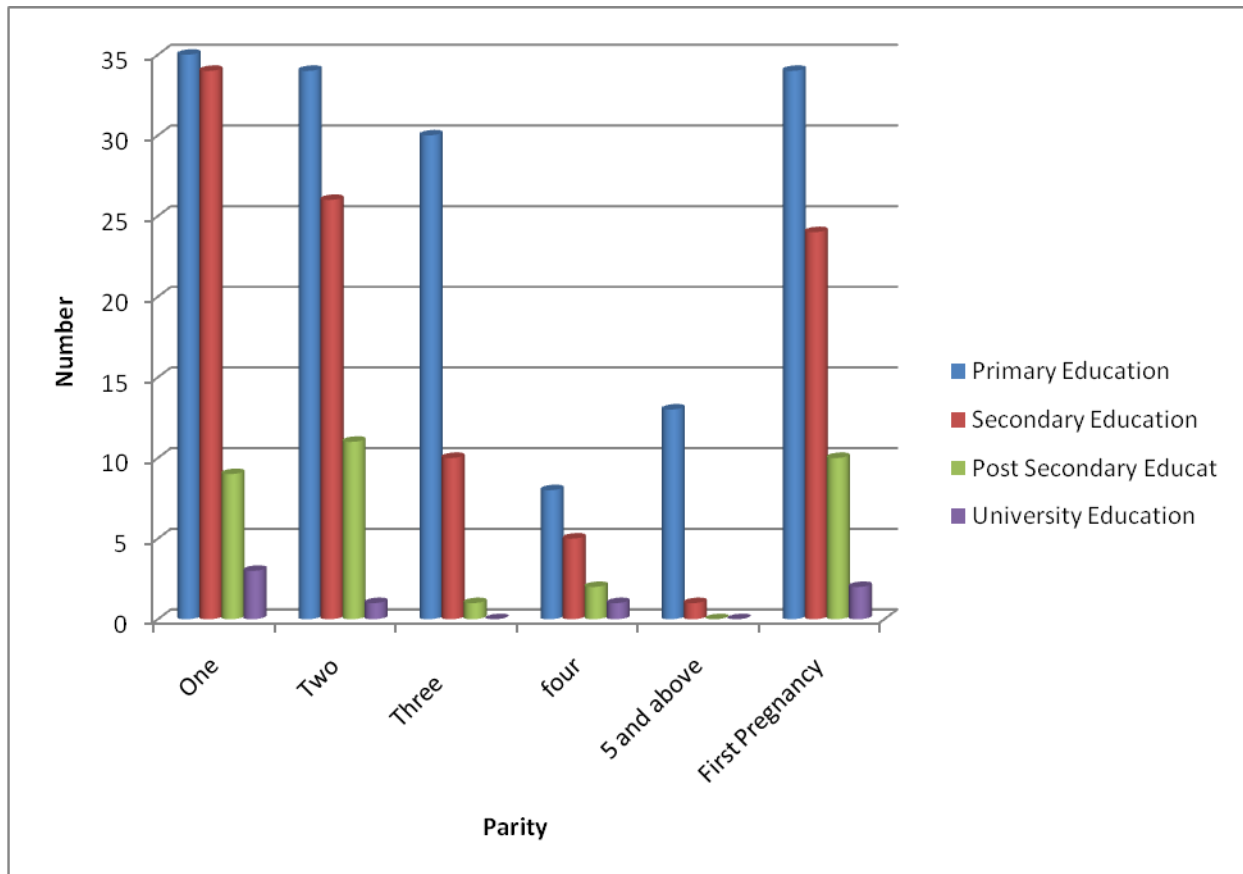
#### 4.1.1.4 Parity (Number of Children ever delivered)

Examining parity of the mother was vital for this study. Parity is important in monitoring the progress of maternal mortality and child survival as well as influencing decision on health care service delivery on maternal and child survival interventions. The respondents who reported first pregnancy and one child were approximately 51 percent. Those with one child were 81 (27.65%), first pregnancy 69 (23.55%), two children 72 (24.57%), three children 41 (13.99%), four children 16 (5.46%) and five children 14 (23.55%). Figure 4.3 shows that, women in Kisumu sub-county starts bearing children at an early age i.e 14 years. The graph showed that,

there is high fertility amongst the young mothers which is a risk factor to maternal mortality and child survival.



**Figure 4.3: Distribution of Pregnant Women by Age and Parity**



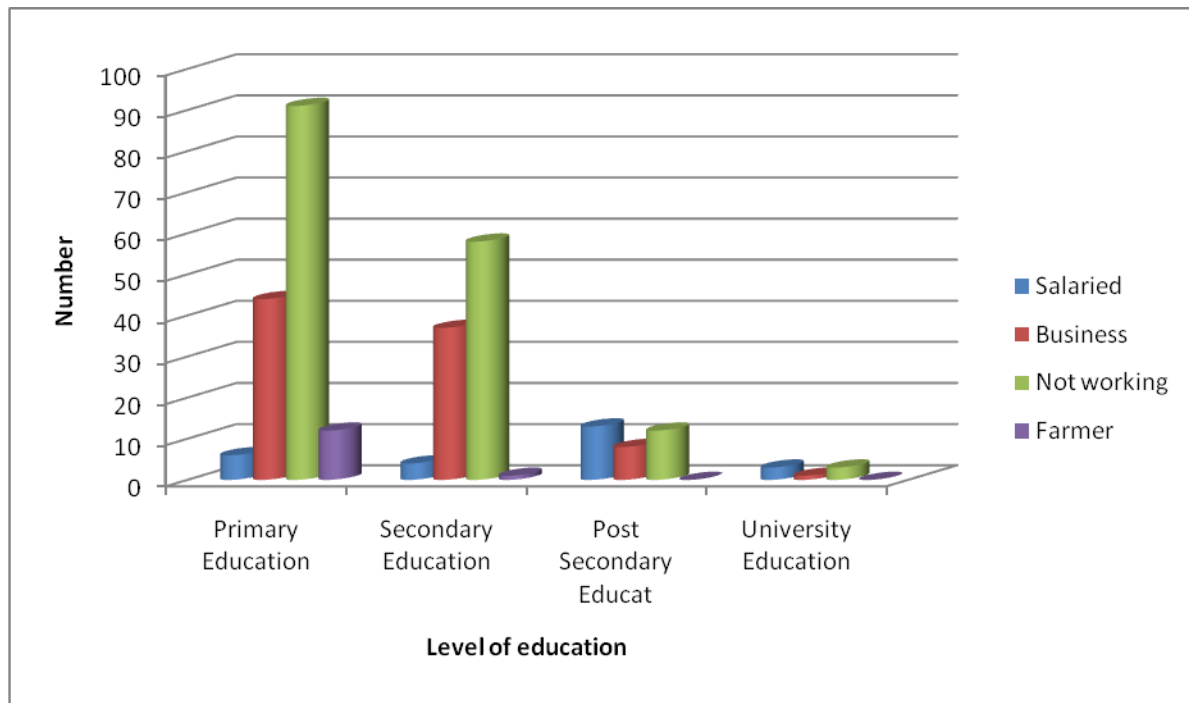
**Figure 4.4: The distribution of children by level of Education and Parity**

Figure 4.4 shows that women who had primary level of education dominated all the parity sub category and had the highest number of children in the distribution. Those who reported university and post secondary education had the minimum number children in all sub categories. Low level of education (Primary level) is seen to be associated with high parity.

#### **4.1.1.5 Occupation and level of education**

Figure 4.5 shows that majority of women who were not in any gainful employment attained primary level of education. Most of the salaried workers were women who attained post secondary education. Those who had university education had insignificant appearance in all the

occupation segments. Salaried and farming segments of occupation recorded the least number of respondents.



**Figure 4.5: The distribution of children level of education and Occupation**

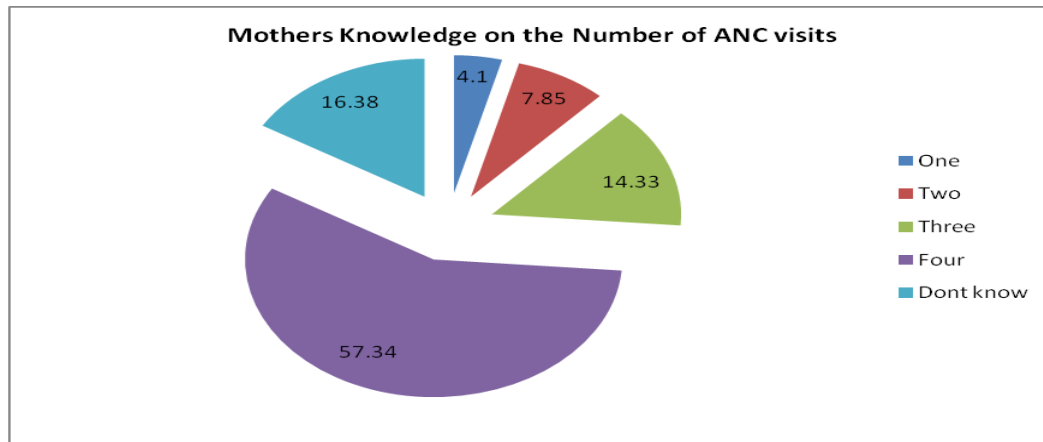
Table 4.2 further describes other aspects of social and economic characteristics of the respondents. The widely used source of maternal services information was health providers (82.95%). Health facility was preferred by 74.11% for delivery, while majority (75%) preferred health providers for assistance during delivery. Most respondents (90.04%) preferred health facility for delivery because it saves mother and child. The ratio of health facility delivery to home delivery during the previous delivery was 3:1.

**Table 4.2: Percentage Distribution of Sampled population by various Characteristics**

<b>Characteristics</b>		<b>Number</b>	<b>Percentage</b>
Health education on maternal health		n=293	
	yes	168	57.34
	No	125	42.66
Source of maternal health education		n=217	
	Parents	17	7.83
	TBA	1	0.46
	Health provider	180	82.95
	Media	19	8.76
ANC visit so far made		n=293	
	One	78	26.62
	Two	90	30.72
	Three	49	16.72
	Four	76	25.94
Reasons for not attending ANC		n=293	
	Not able to pay	12	4.1
	facility far	95	32.42
	provider cruel	8	2.73
	other	93	31.74
	on schedule	85	29.01
Previous Delivery		n=224	
	Home	58	25.89
	Health facility	166	74.11
Delivery Assistance		n=224	
	My mother	5	2.23
	TBA	38	16.96
	Health Provider	168	75
	Relative	13	5.8
Preference of home delivery		n=224	
	No transport	10	4.46
	No payment	12	5.36
	provider cruel	6	2.68
	Privacy	1	0.45
	facility far	11	4.91
	facility delivery	168	75
	Others	16	7.14
Difference in facility and home delivery		n=293	
	yes	281	95.9
	No	12	4.1
Reasons for health facility preference		n=281	
	Clean	20	7.12
	Save mother and child	253	90.04
	Able to pay for my self	8	2.85
Voucher for health (OBA) enrolment		n=293	
	yes	178	60.75
	No	115	39.25
What the Voucher covers		n=178	
	Clinic visits	3	1.69
	Clinic visits and delivery	62	34.83
	Pre and post natal care	113	63.48
payment of service		n=293	
	yes	226	77.13
	No	67	22.87

#### 4.1.1.6 Knowledge on Number of ANC visits to make

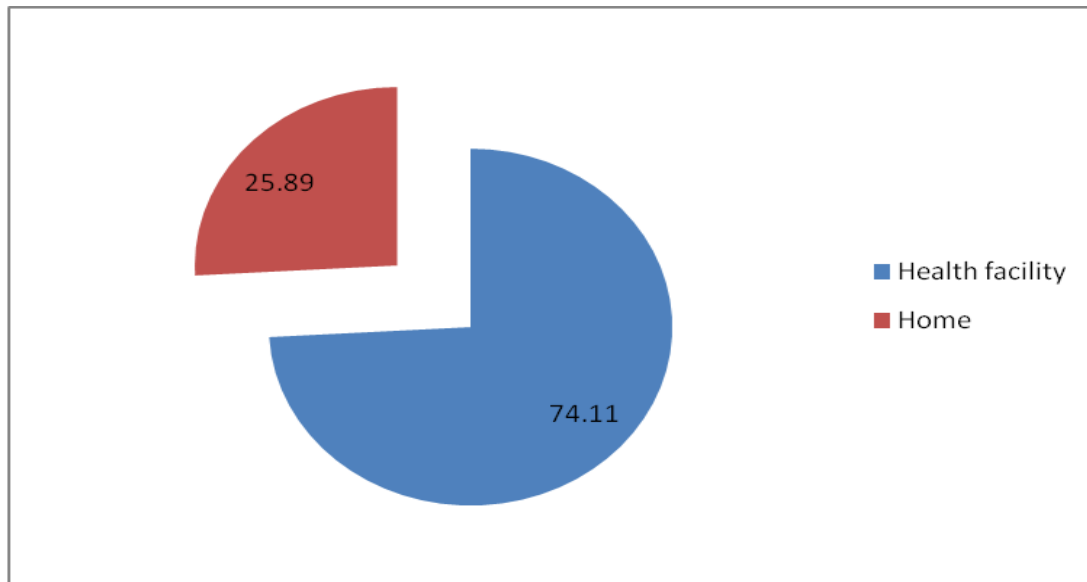
Figure 4.6 shows that over 50% of the respondents had the knowledge on the minimum number of clinic visits they are supposed to make when pregnant. Adolescent and reproductive health policy document (MoH, 2013) puts a minimum of four (4) clinic visits during the life of pregnancy. However, those who said they don't know the exact number of visits were (16.38%), one visit (4.1%), two visits (7.85) and three visits (14.33%) combined were also significant given the importance of antenatal clinic visits.



**Figure 4.6: Knowledge on Number of ANC visits to make**

#### 4.1.1.7 Knowledge on Maternal deliveries

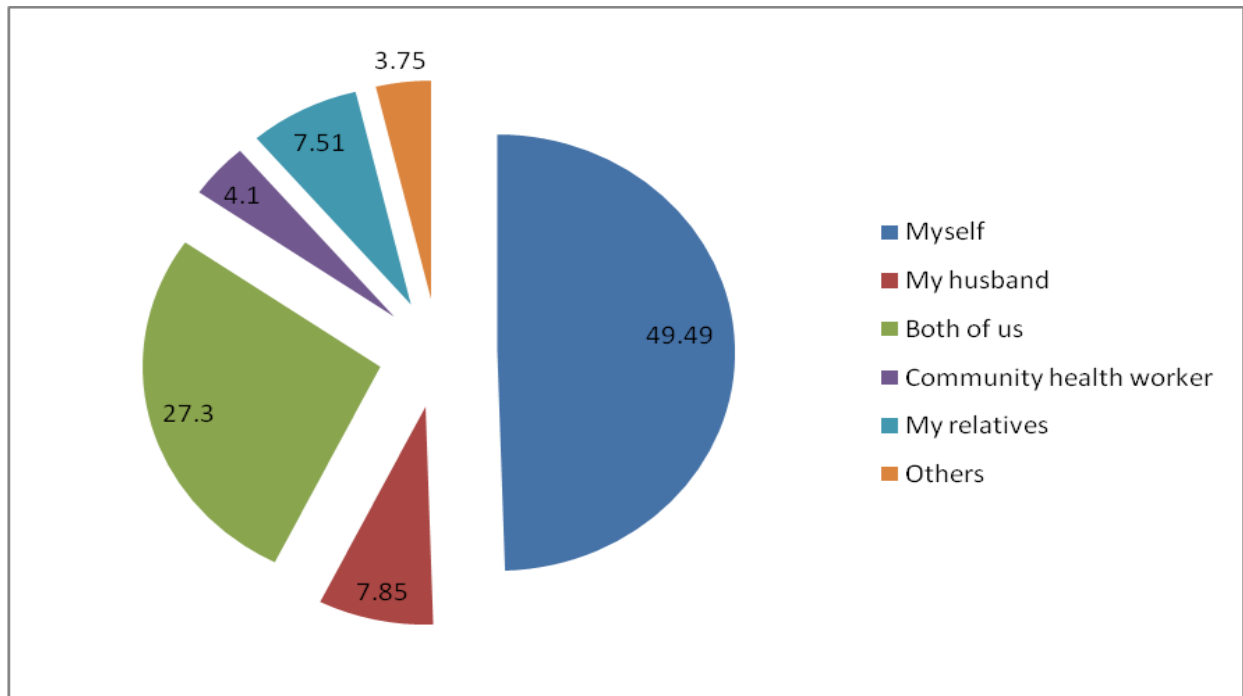
Increasing the proportion of babies that are delivered in the health facilities is an important factor in reducing the health risks to both the mother and the baby (KDHS, 2010). Proper medical attention and hygienic conditions during delivery can reduce the risks of complications and infection that can cause morbidity and mortality. Figure 4.7 shows that 74.11% of mother delivered in the health facility during their previous pregnancy. This percentage correlates with the preference of mothers on where to deliver (75%) and who to assist them during delivery (75%) in table 4.2, page 32.



**Figure 4.7: Previous delivery**

#### **4.1.1.8 Decision on where to deliver**

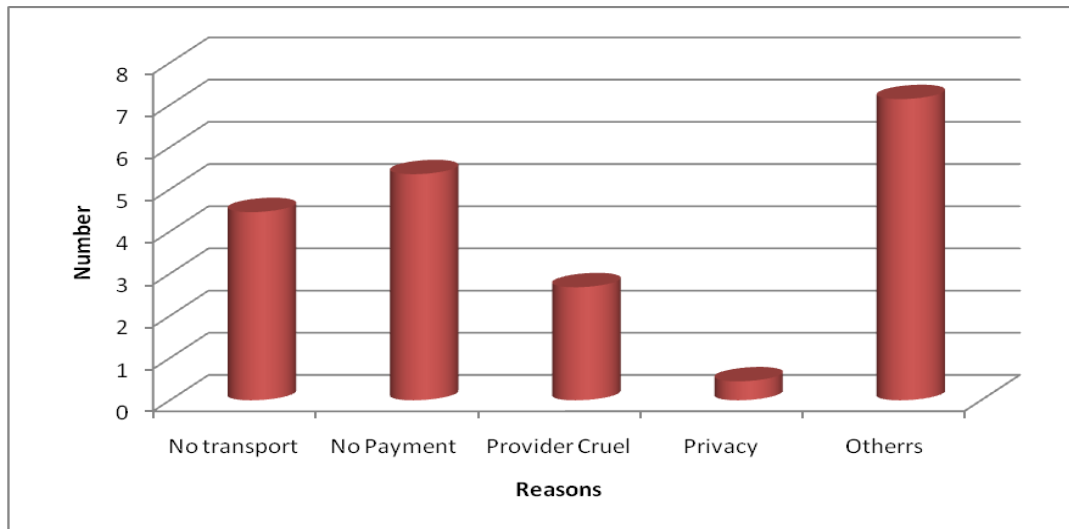
Figure 4.8 shows that nearly half of the decisions (49.90%) on where to deliver when pregnant were made by pregnant women themselves. The proportion of collective decision making process between women and their partners accounted for only 27 % of the total response. The pattern displayed in the graph showed that there is minimal male involvement in maternal issues.



**Figure 4.8: Decision on where to deliver**

#### **4.1.1.9 Reasons why Mothers do not deliver in the Health facility (Skilled delivery)**

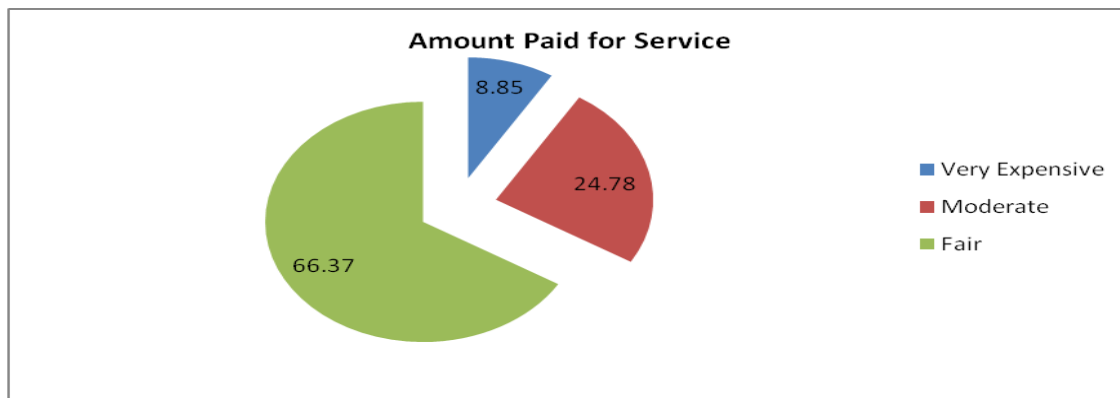
In table 4.1, most of the respondents (86.69%) reported that they travelled between one kilometer and five kilometers, however, according to figure 4.9 facility being far was one of the main reasons for not delivering in the hospital. This is a contrast and can be attributed to either wrong estimation by the respondent. Other reasons reported for not delivering in the health facility included lack of cash to pay for services at the facility (4.46%) and other reasons (7.14%). However, the high preference rating on health facility delivery (74%) and high rating on facility for saving mother and child (90%) by the respondents in table 4.2 is a good move towards tackling maternal mortality and child survival challenges.



**Figure 4.9: Reasons why Mothers do not deliver in the Health facility (Skilled delivery)**

#### 4.1.1.10 Amount Paid for ANC Services

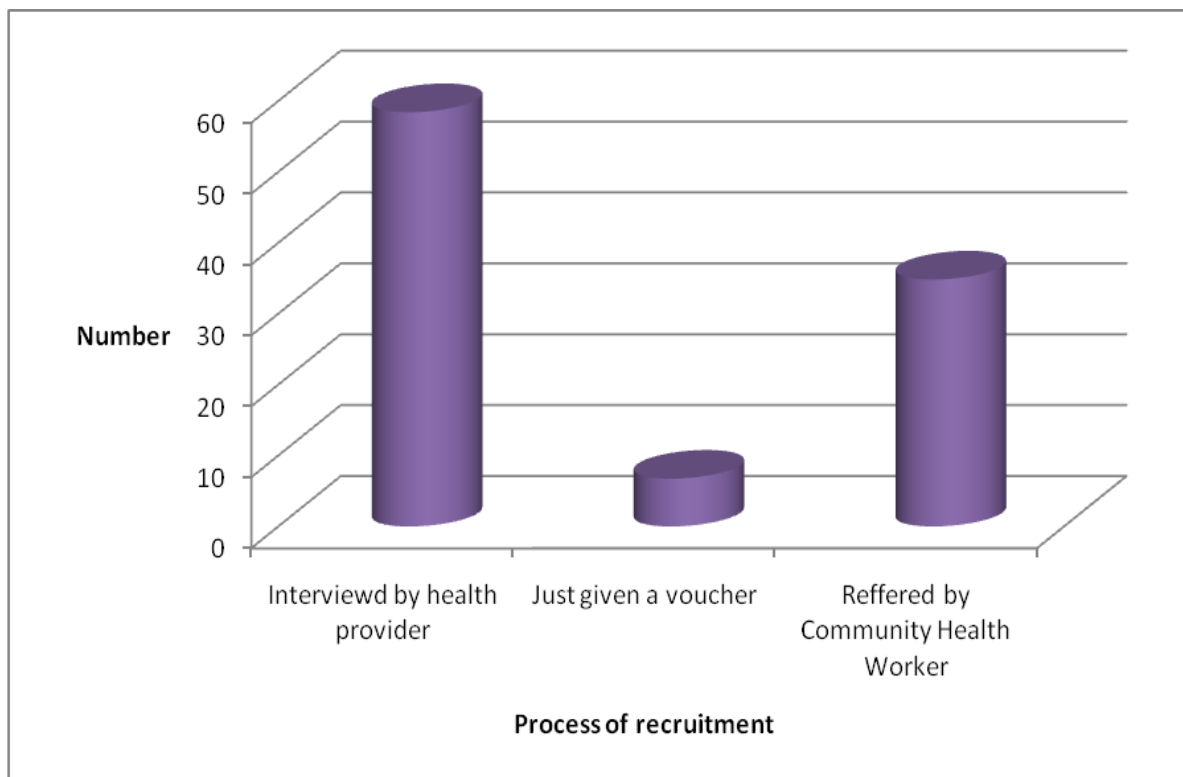
Figure 4.10 shows that all the respondents paid some money (out of pocket) for service delivery, however, the amount paid was reported to be fair by the respondents. Only 8.85% reported that the amount paid was very expensive. Voucher for health subsidizes the cost of maternal health care services for the poor and vulnerable.



**Figure 4.10 Amount Paid for ANC Services**

#### 4.1.1.11 Recruitment of Mothers into OBA Program (Vouchers for health)

As shown in figure 4.11, the process of recruiting mothers into OBA program was largely done through interview by the health provider (58.43%). Referral by Community health workers accounted for only 35% of the beneficiary, while those who were just given vouchers recorded low number. The process of recruitment through interview is aimed at identifying the rightful beneficiary of the program.



**Figure 4.11: Recruitment of mothers into OBA Program (Voucher for Health)**

#### 4.1.2 Analysis

**Table 4.3: T-test on service utilization and Voucher for Health enrolment**

Sub-County	Service utilization			OBA( Voucher for health) enrolment		
	Mean Score	95% CI	P-value	Mean score	95% CI	P-value
Kisumu East	2.398	2.221- 2.576	0.7329	1.462	1.383 –1.540	0.0083
Kisumu West	2.444	2.247 - 2.641		1.311	1.232 - 1.390	

Table 4.3 presents a t-test to determine whether there is a difference in service utilization between the two Sub-Counties that form the larger Kisumu Sub-County. The results revealed that there is no significant difference on service utilization ( $p=0.7329$ ) however, there was significance difference in the enrolment to output based approach (voucher for health) between the two Sub-counties ( $p=0.0083$ ).

**Table 4.4: Relationship between Maternal service utilization and background, socio-economic and institutional factors**

Variable	$\chi^2$	P values		df
		Pearson	Fisher Exact	
Level of Education of the respondent	20.52	0.015	0.057	9
Voucher for Health	30.6979	0.000		3
Health education on maternal Health	19.7412	0.000	0.000	3
Knowledge on the number of visits to make	62.7080	0.000	0.000	12
Parity	19.7903	0.180		15
Payment for service	8.9476	0.030		3
Distance of facility	9.972	0.353		3
Decision on maternal	16.67	0.339	0.339	15
What the voucher covers	5.4872	0.483	0.373	6
Previous Delivery	5.4571		0.141	3

Table 4.4 presents relationship between maternal service utilization of selected background, socioeconomic and institutional factors. A  $\chi^2$  test on level of education and service utilization by respondents revealed statistical significance ( $\chi^2=20.52$ ,  $p=0.015$ ,  $df=9$ ) meaning level of

education of the mother influences utilization of maternal health services and therefore we reject the null hypothesis “ $H_{03}$ ” (page 4) and conclude that service utilization depended on the level of education of mothers. Knowledge on how many ANC visits a mother is supposed to make while pregnant also had a strong association with maternal service utilization ( $\chi^2=62.7080$ ,  $p=0.000$ ,  $df=12$ ), mothers who knew exactly the number of visits they were supposed to make when pregnant had a good utilization rate compared to those who did not know the number of visits. Another association also existed between health education on maternal health and service utilization ( $\chi^2=19.74$ ,  $p=0.000$ ,  $df=3$ ), meaning that mothers who are educated on maternal health services are likely to utilize maternal services more than those who are not educated. However, parity of the mother did not have any association with maternal service utilization ( $\chi^2=19.79$ ,  $p=0.180$ ,  $df=15$ ).

Another strong significant difference is noted on service utilization and voucher for health ( $\chi^2=30.6979$ ,  $p=0.000$ ,  $df=3$ ). However, what the voucher covers does not in any way associated with the utilization of services ( $\chi^2=5.48$ ,  $p=0.483$ ,  $df=6$ ). Payment for service and service utilization presents a statistical significance difference ( $\chi^2= 8.94$ ,  $p=0.030$ ,  $df=3$ ), this means access to maternal services is strongly hampered by payment. Mothers who are not able to pay for the services shy of or just utilize services when there is dire need.

Distance of facility and maternal utilization service was not in any way associated ( $\chi^2=9.972$ ,  $p=0.353$ ,  $df=3$ ), this is further demonstrated where nearly a half of the respondent reported that they only travelled one to three kilometers to sought for care which is below the government policy of less than 5 kilometers. Where mothers sought care during their previous delivery had no influence to the current utilization of maternal service ( $\chi^2=5.45$ ,  $p=0.131$ ,  $df=3$ ).

**Table 4.5: Predictors of Maternal Service Utilization (General linear Regression Model)**

Variable	Coef	Std Error	P> t	[95% Conf. Interval]
Level of education	0.2333	0.0836184	0.006	0.0692117, .3983975
Marital status	-.01948	.1123667	0.862	-.2406635, .2016976
Occupation of respondent	.1488962	.092435	0.108	-.0330511, .3308436
Distance of the facility	.0038763	.0665558	0.954	-.1271309, .1348836
Education on maternal health	-.514424	.1457825	0.000	-.8013795, -.2274684
Knowledge on ANC visits	.2178902	.0639331	0.001	.0920455, .3437349
Parity	-.026573	.0335659	0.429	-.0926434, -.3896831
Voucher for health	-.662137	.138415	0.000	-.9345904, -.3896831
Payment for service	.0515888	.161663	0.750	-.2666258, .3698034
_Cons	2.443302	.5690304	0.000	1.323233, 3.563372

From table 4.5 we see that, the model was significant ( $p=0.000$ ,  $R^2=0.2061$ ). The predictors of maternal service utilization are level education ( $p=0.006$ ), health education on maternal health ( $p=0.000$ ), voucher for health ( $p=0.000$ ) and knowledge on the number of visits to make ( $p=0.001$ ). These p-values indicates that as the level of education of mothers goes up, utilization of services increases by 0.23, at the same time as enrolment on voucher for health goes down, utilization of services decreases by - 0.6621 while as health education on maternal health services goes down, utilization of services decreases by - 0.5144 and as the knowledge on the number of visits goes up, utilization of services increases by 0.217.

From Table 4.5.1, the fitted model after controlling for the confounders in the model can be summarized as:  $y=f(k,l,m, n)$ , with  $k$  being level of education,  $l$  being knowledge on the number of visits,  $m$  being health education on maternal health and  $n$  being voucher for health.

**Maternal Service utilization (y) = (2.8966 + 0.197 (Level of mothers education) + 0.22088 (Knowledge on the number of visits to make) – 0.5144 (health education on maternal health) – 0.702 (Beneficiary of voucher).**

**Table 4.5.1: Predictors of Maternal Service utilization after controlling for confounders**

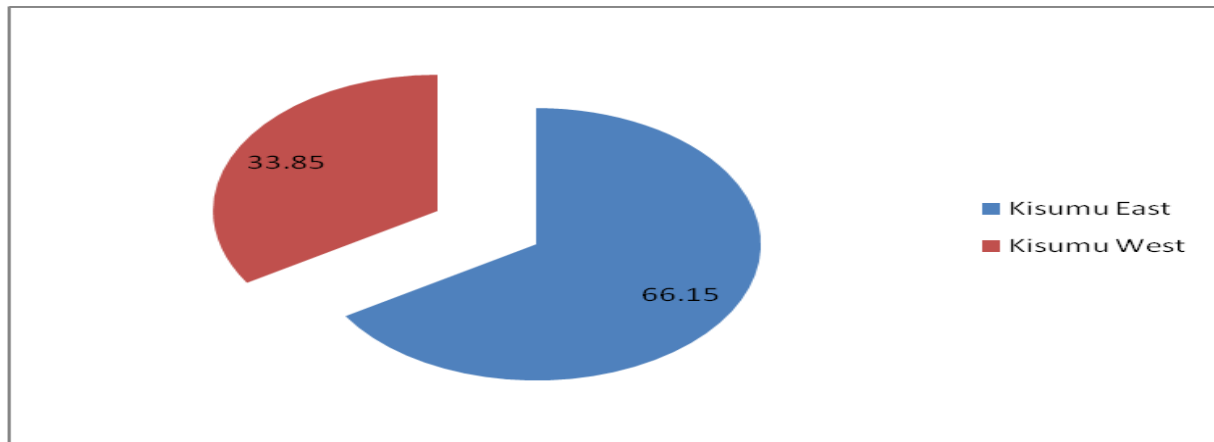
Variable	Coef	Std Error	P> t	[95% Conf. Interval]
Education level of the respondent	0.1973542	0.0799298	0.014	0.0400335, .3546749
Education on maternal health	-.5144004	.1393521	0.000	-.788678, -.2401227
Knowledge on ANC visits	.2208833	.0629333	0.001	.0920455, .3437349
Voucher for health	-.7027605	.1246992	0.000	-.9481978, -.4573231
_Cons	2.896662	.3674893	0.000	2.173356, 3.619967

### 4.1.3 Maternal Death Review

The years 2010, 2011 and 2012 were reviewed to determine the factors that are associated with facility based maternal deaths. All maternal deaths that occurred in the sample facilities were reviewed and to compare the results, proportionate sample of maternal deliveries to maternal deaths in those facilities were randomly reviewed. In total 210 maternal delivery outcomes were reviewed, the characteristics which were reviewed include socio-economic history, clinical history and institutional background factors.

A total of 65 maternal deaths occurred during the period 2010 and 2012 in the sampled facilities. The mean age of the women who died was 24 years while the youngest woman who died was aged 16 years. In figure 4.12, more deaths occurred in Kisumu east Sub-County (66.15%) than Kisumu west Sub-County (33.85%).

Further descriptive analysis on social, economic and background characteristics of those who died are summarized and presented in table 4.6.



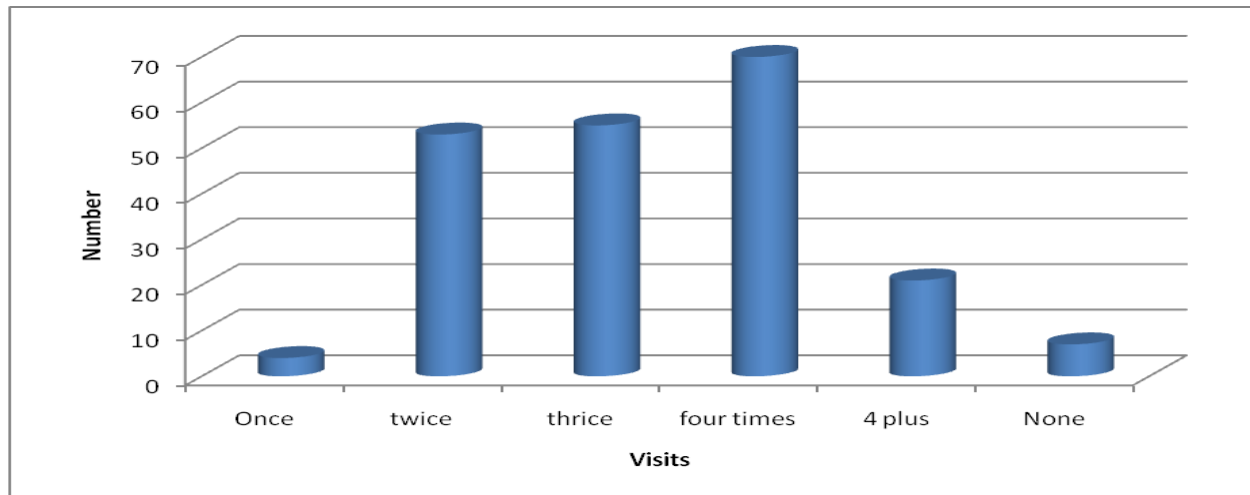
**Figure 4.12: Facility Based Maternal deaths (2010 -2012)**

**Table 4.6: Socio-economic characteristics of women who died**

Variable	General	Maternal Outcome	
		0=alive (Percentages)	1=Death (Percentages)
<b>Education</b>			
Primary level	78 (37.14%)	47 (32.41%)	31 (47.69%)
Secondary level	101 (48.10%)	76 (52.41%)	25 (38.46%)
College level	31 (14.76%)	22 (15.17%)	9 (13.85%)
<b>Parity</b>			
One (1)	24 (11.43%)	9 (6.21%)	15 (23.08%)
Two (2)	44 (20.95%)	29 (20.00%)	15 (23.08%)
Three(3)	64 (30.48%)	48 (33.10%)	16 (24.62%)
Four (4)	50 (23.81%)	40 (27.59%)	10 (15.38%)
Prime	28 (13.33%)	19 (13.10%)	9 (13.85%)
<b>ANC attendance</b>			
One (1)	4 (1.9%)	0 (0.00%)	4 (6.15%)
Two (2)	53 (25.24%)	30 (20.69%)	23 (35.38%)
Three(3)	55 (26.19%)	35 (24.14%)	20 (30.77%)
Four (4)	70 (33.33%)	62 (42.76%)	8 (12.31%)
Four Plus	21 (10.00%)	18 (12.41%)	3 (4.62%)
None	7 (3.33%)	10.00%	7 (10.77%)
<b>Occupation</b>			
Salaried worker	73 (34.76%)	50 (34.48%)	23 (35.38%)
Farmer	9 (4.29%)	6 (4.14%)	3 (4.62%)
Not working	118 (56.19%)	82 (52.55%)	36 (55.38%)
Others	10(4.76%)	7 (4.83%)	3 (4.62%)

#### 4. 1.3.1 Ante natal Clinic (ANC) attendance by Mothers who died

The results from figure 4.13, indicates that majority of women who died did not complete the required (at least four visits) antenatal visits. Majority (72.31%) attended either once, twice or thrice. Those who completed at least four plus visits accounted for only 16.93% while a significant number (10.77%) did not attend ANC visits.



**Figure 4.13: Ante natal Clinic (ANC) attendance by Mothers who died**

#### 4. 1.3.2 Distribution of other diseases apart from delivery

As shown in Figure 4.14, HIV/AIDS presence was prominent in both case scenarios. Amongst the women whose children survived, 24.32% were HIV positive while those whose children died 28.57% were positive. The ratio of children who survived to those who died was almost 1:1.



maternal deaths ( $\chi^2=0.9484$ ,  $p=0.475$ ,  $df=2$ ). Ante natal visits (ANC) attendance was associated with maternal deaths ( $\chi^2=44.34$ ,  $p=0.000$ ,  $df=5$ ), the study revealed that mothers who made the required number of ante natal visits had a lower risk of dying compared to those who did not make the required number of visits.

**Table 4.8: Relationship between Voucher for health and Antenatal Visits**

Beneficiary of voucher	ANC attendance						Total
	Once	twice	thrice	four time	4 plus	None	
Yes	2	7	2	54	16	0	81
No	2	46	53	16	5	7	129
Total	4	53	55	70	21	7	210
Pearson chi2(5) = 103.8328    Pr = 0.000 Fisher's exact =                    0.000							

From table 4.8, voucher for health influences utilization of maternal health services ( $\chi^2=103.832$ ,  $p= 0.000$ ), this therefore means, mothers who benefit from voucher are more likely to make the required ANC visits and deliver in the health facility and have lower risk of dying. The prediction of hospital delivery by mothers with voucher for health was much better than those without ( $p=0.000$ , page 32).

**Table 4.9: Determinants of maternal mortality**

Variable	COX Proportional Hazard Ratio		Logistic Regression	
	Hazard Ratio	95% conf. Interval	Odds Ratio	(95% conf. Interval)
Age	1.039256	.9617137 - 1.123051	1.0335096	.9473808 - 1.130933
Marital status	1.063344	.6501445 - 1.739153	.977221	.5400215 - 1.768376
Occupation	1.185569	.9075641 - 1.548733	1.047171	.7407765 - 1.480294
Education	.6318055	.4275561 - .9336277	.5200644	.3087946 - .87588
Parity	.7391494	.5515025 - .9906426	.6469188	.4562765 - .9172157
Voucher for health	3.07591	1.540055 - 6.143432	2.589957	1.184835 - 5.661443
ANC attendance	.8009338	.6050984 - 1.06015	.8309808	.6131332 - 1.12623
Other Diseases	1.065417	.8888146 - 1.277109	1.090596	.8720995 - 1.363834

From table 4.9, we see that, voucher for health presented the highest hazard ratio (Cox  $ph=3.07591$ ), this indicate that poor mothers who are not covered by voucher for health has the highest risk of dying when pregnant. Voucher for health is issued to facilitate the poor women to access maternal health services including facility delivery. In the context under which voucher for health is issued, wealth index of the mothers plays a role in determining maternal deaths in Kisumu Sub-County with occupation hazard ratio of (Cox  $ph= 1.185$ ) meaning that poor women who are not covered, risk dying more than their counter part who are covered. The hazard ratio for mothers who presented with other diseases was also significant, hazard ratio of (Cox  $ph=1.065$ ) meaning, mothers who present with other diseases during pregnancy have a higher risk of dying than those who do not have other diseases during pregnancy. Age of the women was also found to be a risk factor (Cox  $ph=1.039$ ), meaning young inexperienced mothers stand a high chance of dying when pregnant than older women. Marital status even though did not show any association with maternal death ( $\chi^2=0.9484$ ,  $p=0.622$ , page 36), it proved to be a risk factor

(Cox  $ph=1.063$ ). Cox PH for education, parity and ANC were less than one (1) meaning they had no effects on maternal deaths.

Similarly, analysis using logistic regression model indicates mothers who do not benefit from voucher for health are 2.5 times more at risk of dying than those who are covered (OR=2.5899, 95% CI= 1.18 – 5.66), this therefore leads us to reject the null hypothesis ( $H_{02}$ , page 4) and conclude that voucher for health has an impact in reducing maternal mortality in Kisumu Sub-County. Mothers having other diseases (OR =1.090, 95% CI =0.872 – 1.36) are also at a high risk of dying than those without other diseases, Age was also noted to be a factor (OR=1.033, 95% CI =0.9473 – 1.1309), meaning that young mothers were twice likely to die during pregnancy than the older mothers. Likewise, mothers who are not in any gainful employment and are not covered with voucher for health have a high risk of dying during delivery compared to those salaried or those benefitting from voucher (OR=1.0471, 95% CI = 0.74077 – 1.4802).

**Table 4.10: Child Survival relationship with background and socio-economic factors**

Variables	$\chi^2$	P values		df
		Pearson	Fisher Exact	
Education	2.6307	0.268	0.277	2
Age	22.95	0.151		17
voucher for health	7.3211	0.009	0.007	1
Occupation	2.6253	0.453	0.465	2
Antenatal attendance	20.2560	0.001	0.001	5
Other diseases	13.7306	0.008	0.008	4
Parity (Number of children ever delivered)	0.918	0.922	0.904	4

As shown in table 4.10, voucher for health ( $\chi^2=7.32$ ,  $df= 1$ ,  $p=0.007$ ) had a strong association with survival of children during delivery. ANC visits during pregnancy ( $\chi^2=20.25$ ,  $df= 5$ ,  $p=0.001$ ) was also found to be associated with child survival. Likewise presence of other

diseases during pregnancy ( $\chi^2=13.73$ ,  $df=4$ ,  $p=0.008$ ) also showed a statistical association with child survival. These results suggest that, children born from mothers who benefitted from voucher for health and those who attended the required ante-natal clinic had a high chance of surviving in the event of maternal death. However, education, parity of the mother and occupation did not show any association with child survival.

**Table 4.11: Predictors of Child Survival**

	Odds Ratio	Std Error	P> z	[95% Conf. Interval]
Age	1.035376	0.0765941	0.638	0.8956301, 1.196927
Education of the mother	1.057283	0.4675256	0.900	0.4444206, 2.515293
Occupation	1.257411	0.4116999	0.484	0.661878, 2.388782
Parity	0.832361	0.2143917	0.476	0.5024203, 1.378974
Voucher for health	0.089609	0.0788666	0.006	0.0159658, 0.502934
Antenatal attendance	1.139814	0.2319303	0.520	0.7649459, 1.698389
Presence of other diseases	0.735381	0.1456851	0.121	0.4987494, 1.084283

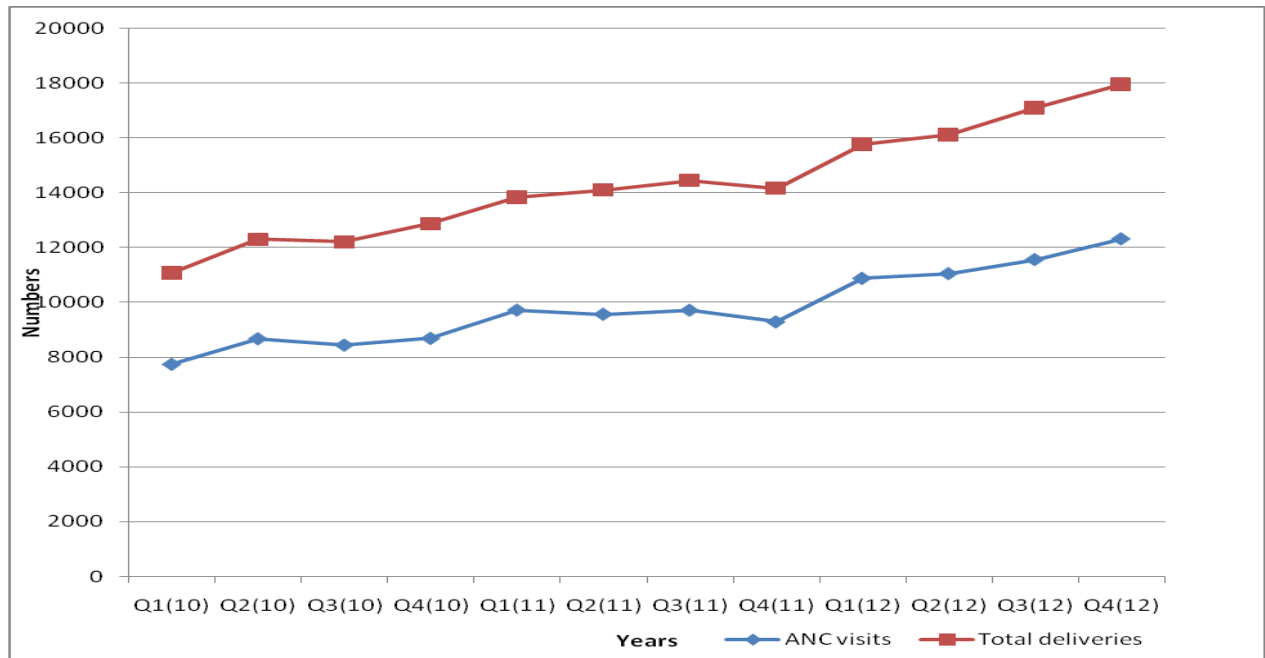
From table 4.11, the predictors of child survival include age (OR=1.03, CI=0.895 -1.19), education (OR=1.057, CI=0.44-2.515), occupation (OR=1.25, CI=0.66-2.388) and ANC attendance (OR1.13, CI=0.764-1.698).

**Table 4.12: Prediction and risk factors between beneficiary of voucher and non beneficiaries on institutional deliveries years 2010 – 2012**

General Linear regression Model				
Variable	Coef	Std error	P> t	[95% Conf. Interval]
Beneficiary of Voucher (antenatal attendance)	.6159868	.060582	0.000	.4789408, .7530329
Non voucher ((antenatal attendance)	.0640362	.3684895	0.866	-.7695448, .8976173
_cons	855.7079	1655.842	0.618	-.2890.066, 4601.482
Cox Proportional Hazard Ratio				
Variable	Haz. Ratio	Std error	P> z	[95% Conf. Interval]
Beneficiary of Voucher (antenatal attendance)	.9699383			
Non voucher ((antenatal attendance)	1.006562	.0508391	0.897	.9116925, 1.111304

Tables 4.12 demonstrate that, mothers who are supported by voucher for health significantly have high prediction in institutional deliveries ( $p=0.000$ ) by 0.61 than those who are not supported, and therefore we reject the null hypothesis “ $H_{01}$ ” (page 4) and conclude that use of voucher for health increases utilization of institutional deliveries. This is further demonstrated by a correlation between skilled delivery and voucher for health ( $r=0.96$ ). Skilled deliveries is recognized to lower maternal deaths. From table 4.11 Cox regression revealed that, the likelihood hazard ratio for those mothers who are not covered by voucher are higher than those covered (Cox PH =3.07591, 95 CI = 1.540055 – 6.14343), this therefore means, women who were not covered by voucher were unlikely to attend ANC clinics and had less chance of delivering in the health facility.

However, from figure 4.15, the general trend on antenatal visit and institutional deliveries has been on the rise since the year 2010, however those making the minimum four (4) ANC visit are low in both segment of the maternal health services i.e voucher for health program and the normal intergrated maternal health program.



**Figure 4.15: Trend in Antenatal Clinic visits and institutional deliveries**

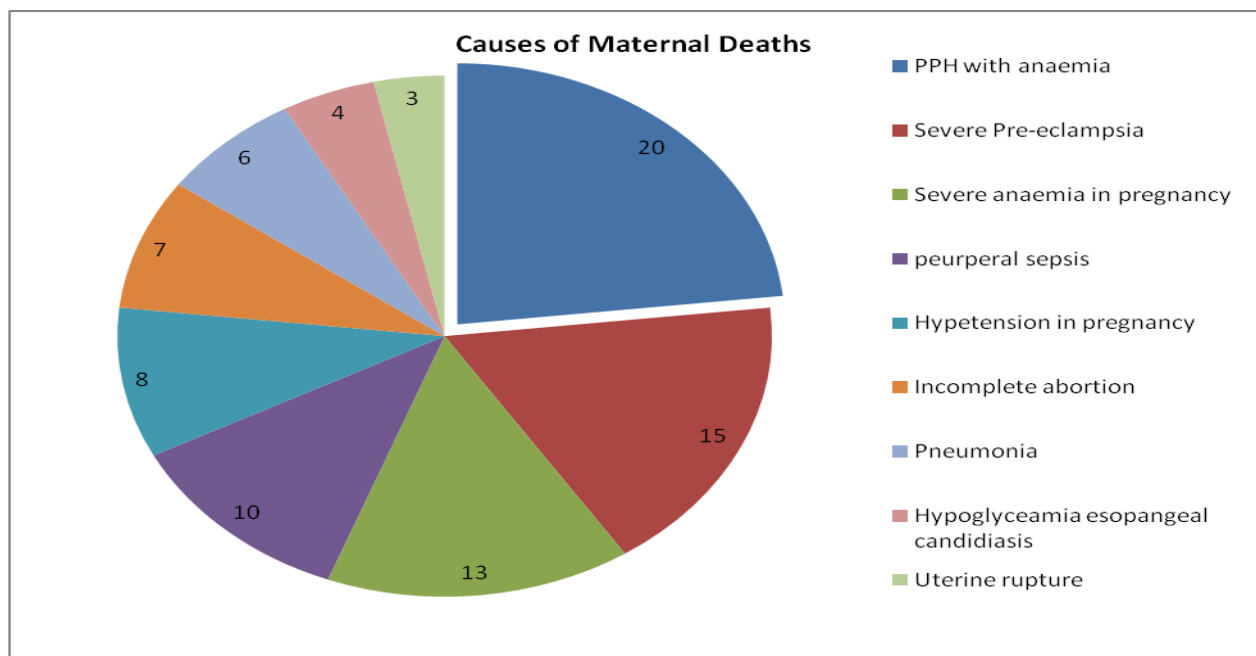
**Table 4.13: Trend in maternal deaths in Kisumu Sub-County**

Year	Deliveries (live births)	Deaths	Mortality /100,000
2010	24456	52	213
2011	30390	58	191
2012	30986	39	126

Table 4.13 demonstrates that there has been a significant increase in facility based delivery from the year 2010 all through to the year 2012. Despite the increase in the number of facility maternal deaths in the year 2011 (58), analysis on facility based mortality ratio revealed that maternal mortality ratio (MMR) is significantly coming down in the whole Sub-County. This trend demonstrate that interventions aimed at addressing maternal mortality in Kisumu are working. Such interventions include removal of user fees for pregnant mothers and voucher for health for the poor women, which aimed at removing barriers on access to maternal services.

Even though this trend is promising, analysis only captured maternal deaths that occurred in the health facilities, all the deliveries and maternal deaths that occurred outside the facilities were not included in the analysis.

From figure 4.16, PPH with anaemia accounted for the highest proportion (23%) of causes of maternal deaths in Kisumu Sub-County. The compounding factor of anaemia in pregnancy and PPH with anaemia means, anaemia is a predisposing factor to maternal deaths in Kisumu Sub-County.



**Figure 4.16: Cause of Maternal deaths in Kisumu Sub-County**

## 4.2 Discussion

### 4.2.1 Background characteristics that influences maternal service utilization and maternal deaths

The finding of this study revealed that Kisumu Sub-County is mostly dominated by young mothers. This was revealed in both cross-sectional and maternal review studies, the average age in

both studies was 24 years. Age is found to be a risk factor in this study, young mothers aged between 16 years to 23 years are more at risk of dying compared to the older mothers. This case scenario is attributed to several factors including biological, socio-economic that predisposes young women to early marriages and pregnancies. According to WHO (2012) young age coupled with limited access to health information, cultural pressures and little control for decision making leads to high risk pregnancies. These pregnancies, especially first time pregnancies are associated with high rate of mortality. Kathryn Graczyk (2007), stated that adolescent age 15 through 19 years are as twice likely to die during pregnancy or child birth as those over age 20 ; girls under age 15 are 5 times more likely to die. The study also found that utilization of ANC services and parity of the mother were risk factors to birth outcome. Clinic visits influences the service utilization and skilled delivery. It is also a potential for early diagnosis of the risk factors associated with maternal death and child survival. Similarly, even though this study did not explore child spacing, Sonneveldt *et al.*(2013) reported that, higher parity with short birth order predisposes mothers to the risk of dying.

Education and parity was found to be associated and influences health seeking on maternal utilization and death. Mothers with high parity and less educated make fewer visits during pregnancy and are unlikely to deliver in the health facility and therefore stand a high risk of dying compared to the other group of women. In both approaches, mothers who had post secondary education level of education had a higher utilization rate and higher predictive level of skilled delivery than those who had no education or primary level education.

Similarly, limited access to maternal education amongst mothers contributed to low maternal utilization and was associated with risk of dying in the study. According to Mats Malqvist *et al.*

(2012), maternal education has long been considered an important determinant for maternal and child health. Education has an effect on health on many levels, either directly through increased knowledge about danger signs and disease patterns or indirectly through a deeper understanding of health system structures and a higher ability to adapt to change. In addition to individual education level of the mother, it has been argued that level of educational of the whole family and even the general level of education of the community has an effect on health.

Parity of the mother did not have any influence on maternal service utilization, however, it had a strong influence on maternal deaths. Mothers with high and narrowed birth spacing are more likely to die than those with fewer spaced children. Level of education and ANC attendance was also found to be closely associated and had effects on maternal utilization and deaths.

According to a study by Ann *et al.* (2006), marital status, distance and age was found not to have any influence on maternal service utilization, likewise this study did not find any association between service utilization and maternal deaths.

#### **4.2.2 Socio- economic factors influencing maternal service utilization and maternal deaths**

According to Maxwell *et al.* (2013), the high unit costs reflect under utilization of the existing capacities of health facilities. The financial barrier includes costs incurred at the health facility for treatment, transport costs; expenses of those accompanying the woman and opportunity costs for income earning. Nanjala and Wamalwa (2013), reported that lack of knowledge by male partners of complications associated with delivery, cultural beliefs, high fees charged for delivery at health facilities are major contributing factors to low male partner involvement in maternal and child survival issues.

Affordability was still a major barrier to accessing care, particularly among the poor. Wealth index signifies the economic power of an individual, in this study wealth was equated to occupation of the mother and financial subsidy.

Eric Arthur (2012), stated that wealth influences the use of health services positively; wealthier mothers have more chance of attending a first and additional visits than poorer mother in Columbia. The study found out that wealth index had an effect on the utilization of ANC services and maternal deaths. Salaried mothers and those who benefited from vouchers for health had higher utilization compared to the other groups. Likewise mothers who reported to be salaried workers had a lower risk to maternal mortality than their colleagues who are not working (COX ph =1.185). Maternal deaths that occurred to salaried mother was insignificant compared to the rest of the group. This therefore means, poverty is a barrier to access to maternal services and accelerate maternal deaths amongst the poor segment of the population.

Rouselle *et al.* (2008), reported that the differences of women who are assisted by skilled attendants during delivery are stark across wealth quantile. Those in the riches quantile were five times more likely than the poorest to have births attended by health professional. Skilled delivery is consider to reduce maternal deaths by 45 percent, and the proportion of babies that are delivered in health facilities is an important indicator in reducing the health risks to both the mother and the baby (KDHS, 2009).

#### **4.2.3 Institutional factors that influences maternal services utilization and maternal deaths**

Distance to the facility can be an obstacle to reaching the facility, or it can act as a discentive to try seeking care. However, in this study distance to facility was not associated with maternal utilization nor maternal deaths.

The study revealed that most of the mothers travelled between 1 and 3 kilometers. The government policy on access to health facility put a radius of 5 kilometers to be the minimum. However, despite the fact that most mothers reported to have travelled less than 5 kilometers, most mothers still complained that facilities are far and that is why they do not utilize ANC services.

In order to improve the MDGs indicators, access to reproductive health services needs to be expanded rapidly, particularly for the poor and under served. In view of this, the government abolished user fees except for 10/20 registration fee for pregnant women and explored other initiatives such as voucher for health for the poor and vulnerable mothers. Carrine *et al.* (2011), indicated that voucher for health exist in the context of targeting specific group to accelerate the uptake of services.

Recent analysis by Nguyen *et al.* (2012), reported that a pilot program that provided vouchers to pregnant women in Bangladesh was effective in increasing use of maternal health services. After initiation of the program, which provided free access to antenatal care, institutional delivery and other services, women in the voucher areas who had recently given birth were more likely than their counterparts in comparison areas to have had three antenatal visits (55% vs. 34%), a qualified provider at their delivery (64% vs. 27%), an institutional delivery (38% vs. 19%) and at least one postnatal care visit with a qualified provider (30% vs. 15%).

Overall, voucher for health has significant effect on maternal mortality and utilization rate in Kisumu Sub-County. This study found out that access to maternal health increased significantly, mothers who attended ANC services increased steadily upwards for the three years. Most important, mothers who benefitted from voucher for health showed remarkable utilization rate

upto four (4) ANC plus attendance ( $p=0.009$ ) than those who did not. The prediction to institutional delivery also revealed that mothers who benefit from vouchers has a higher prediction of delivering in the hospital than those who do not have voucher for health. Maternal mortality also showed a downward trend on those mothers who were cushioned by voucher for health.

#### **4.2.4 Predictors of Maternal service utilization and maternal deaths**

The major predictors of maternal utilization in this study remain level of education of the mother, voucher for health which is equivalent to wealth index of the mother or household. Mothers with post secondary education have a better utilization rate than those with no education or primary level education. Education is also associated with occupation meaning mothers who are well educated are likely to be employed and stand a better chance of making their own decision on child conception and the facility to visit.

According to WHO (2011), women who are working and earning money may be able to save and decide to spend it on a facility delivery. However, in many settings women either do not earn money for their work or do not control what they earn.

Health education on maternal health also played a role in influencing maternal utilization. Information is power and if mothers are educated on the importance of clinic visits and the danger signs of pregnancy, then they are likely to utilize the facility during pregnancy and delivery. Poverty or catastrophic health spending by mothers or households deter mothers from accessing services leading to either late diagnosis of the risk factor to the pregnancy. Voucher for health that subsidizes spending by mothers motivates mothers to seek care during pregnancy and delivery.

Major risk factors to maternal death remain age, occupation, voucher for health and other diseases. Young mothers are at high risk of dying during pregnancy compared to the middle aged mothers. Young mothers are inexperienced, shy of due to either being single or cultural ties on pregnancy before marriage and do not attend the ANC clinic where risk factors are identified. Occupation of the mother and voucher for health go together since they aim at addressing financial risks, equity and access issues. Mothers who are not empowered economically either through their own wealth or voucher for health cannot make their own decision on maternal services or if they do then those decision are not consistent to the requirement of the pregnancy and therefore are at a risk of maternal morbidity and mortality.

Other diseases which come together with pregnancy are seen to be accelerating factors to maternal mortality in this study.

#### **4.2.5 Predictors of child survival**

This study explored the chances of the child surviving when maternal death occurs, results proved that wealth index of the mother, education of the mother, age of the mother and ANC attendance of the mother were the risk factors. The findings were synonymous with the risk factors to maternal death.

Children from young mothers were more at risk of dying than those from middle aged mothers, also children from mothers with post secondary education had high chances of surviving than those from the lower level of education. Another factor that influenced child survival is ANC attendance, mothers who attended atleast three visits had their children surviving compared to those who did not attend ANC clinic or below two visits. Wealth also played a role in child survival, mothers who reported to be salaried workers had their children surviving than those

who reported they don't do any gainful work. Occupation is associated with utilization of maternal services and influences decision making process.

#### **4.2.6 Major causes of deaths**

According to WHO (2005), the main direct causes of maternal deaths in sub Saharan region account up to 80 percent of cases and include obstetric hemorrhage, puerperal sepsis, pregnancy induced hypertension (including eclampsia), obstructed labor and ruptured uterus and complication of unsafe abortion. Indirect causes account for 20 to 25 percent of maternal deaths and are attributed to illnesses aggravated by pregnancy which include anaemia, malaria, HIV/AIDS, diseases of the heart, lung, kidney and ectopic pregnancy.

The same causes of maternal deaths that are found globally are seen in Kisumu Sub-County. Postpartum Hemorrhage (PPH), severe pre-eclampsia, anaemia, puerperal sepsis, hypertension incomplete abortion, pneumonia and uterine rupture are the main causes of maternal deaths amongst women in Kisumu Sub-County.

## **CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Introduction**

This chapter presents a summary of the determinants of maternal mortality and the impacts of voucher for health in Kisumu Sub-County.

### **5.2 Summary of findings**

#### **5.2.1 Overview**

Maternal service utilization in Kisumu Sub-County is on the rise, the general trend showed a steady increase year by year. However, women making the required minimum number of clinic visits (4 visits) remain low in both segments (i.e those covered by voucher and those not covered). On average many women make 2.5 visits, and those covered by voucher make an average of 3.5 visits during the life of a pregnancy.

Maternal mortality in Kisumu Sub-County is declining, a fact that can be attributed to the effects of voucher for health, removal of user fees and the intensity of maternal health education. Most Maternal deaths occurred in the government owned facilities. More deaths occurred in the referral facilities, County hospital and sub-county hospitals, however no death was reported in the private and health center facilities.

#### **5.2.2 Background characteristics influencing maternal service utilization and deaths**

Overall, on average women who sought care for maternal services in Kisumu Sub-County were young. Young mothers or adolescent mothers fear attending reproductive health clinic while early child bearing is a high risk factor to maternal mortality. The study found out that the level of education and knowledge on maternal health services influenced high uptake of maternal

health services in the Sub-County. The risk factors of maternal deaths were age , level of education, parity, presence of other diseases and number of ante natal care visits.

### **5.2.3 Socio- economic factors influencing maternal service utilization and maternal deaths**

There is a strong link between economic factors (voucher for health and occupation) maternal service utilization and maternal deaths. Antenatal care is very critical in determining the birth outcome and not being able to pay for services impede utilization of services. Salaried mothers were ranked high in utilization and were less likely to die during delivery. Poor women who benefited from voucher for health had high utilization rate and low risk to maternal death. Therefore, emphasis should be put on strategies and interventions that reduce poverty and barriers to maternal service utilization.

### **5.2.4 Institutional factors influencing maternal services utilization and maternal deaths**

Generally, most women in Kisumu Sub-County prefer government owned health facilities. Majority of women preferred delivering in the government facility. Staff to client relationship was reported to be good and could be a motivating factor for preference to government facility.

### **5.2.5 Predictors of Maternal service utilization and maternal deaths**

Predictors of maternal utilization are level of education, wealth or economic subsidy of the household and health education on maternal health services. However, maternal death was strongly predicted by age of the mother, wealth or economic subsidy, parity and presence of other diseases.

### **5.2.6 Predictors of child survival**

Child survival dependent on the level of education of the mother, age of the mother, ANC attendance, wealth or economic subsidy of the household and presence of other diseases.

### **5.2.7 Causes of Maternal Deaths**

Association between other diseases and pregnancy is a predisposing factor to maternal death in Kisumu Sub-County.

## **5.3 Conclusion**

The study provides important information on community perception on maternal health services in Kisumu County. Maternal deaths and poor utilization of maternal services in Kisumu County are fuelled by social and economic factors. As Kenya pushes for reduction of Maternal Mortality by three quarters by 2015, it is important to invest in women education as well as improving their economic power. In this study, voucher for health proved to have a significant effects on maternal deaths and service utilization and therefore, scale up of the intervention in the under served communities and other segment of the population in the County is viable in addressing the rising burden of maternal mortality in Kisumu County. Other areas of focus should be access to education and reproductive health information that stimulate decision making amongst the girl child and women on reproductive health issues.

## **5.4 Recommendations**

Considering the above findings, this study therefore recommends the following;

- i. Eliminate barriers that prevent mothers from seeking maternal health care services.
- ii. Intensify health education on maternal health services so that mothers and household members can make informed decisions on the benefits of maternal health services.

- iii. Intensify investment in girls' education and youth friendly programs to enable them plan for their future and make critical decision on reproductive health issues.
- iv. Pregancy is not a disease and requires collective responsibility therefore, Male involvement in decision making should be enhanced.
- v. Poverty reduction strategies and economic empowerment of women will help them make their own decision on maternal health.
- vi. Improving on family planing strategies to address issues of parity.

### **5.5 Areas of further Research**

The government of Kenya recently launched a country wide free maternity and delivery services in all public health institutions. The objective of this initiative is to improve on access to maternal health service to address high maternal mortality in the Country. This initiative significantly ties with the initial idea of voucher for health program. It would therefore be valuable to do a comparative effect analysis study on maternal service utilization and maternal deaths over time in the whole country.

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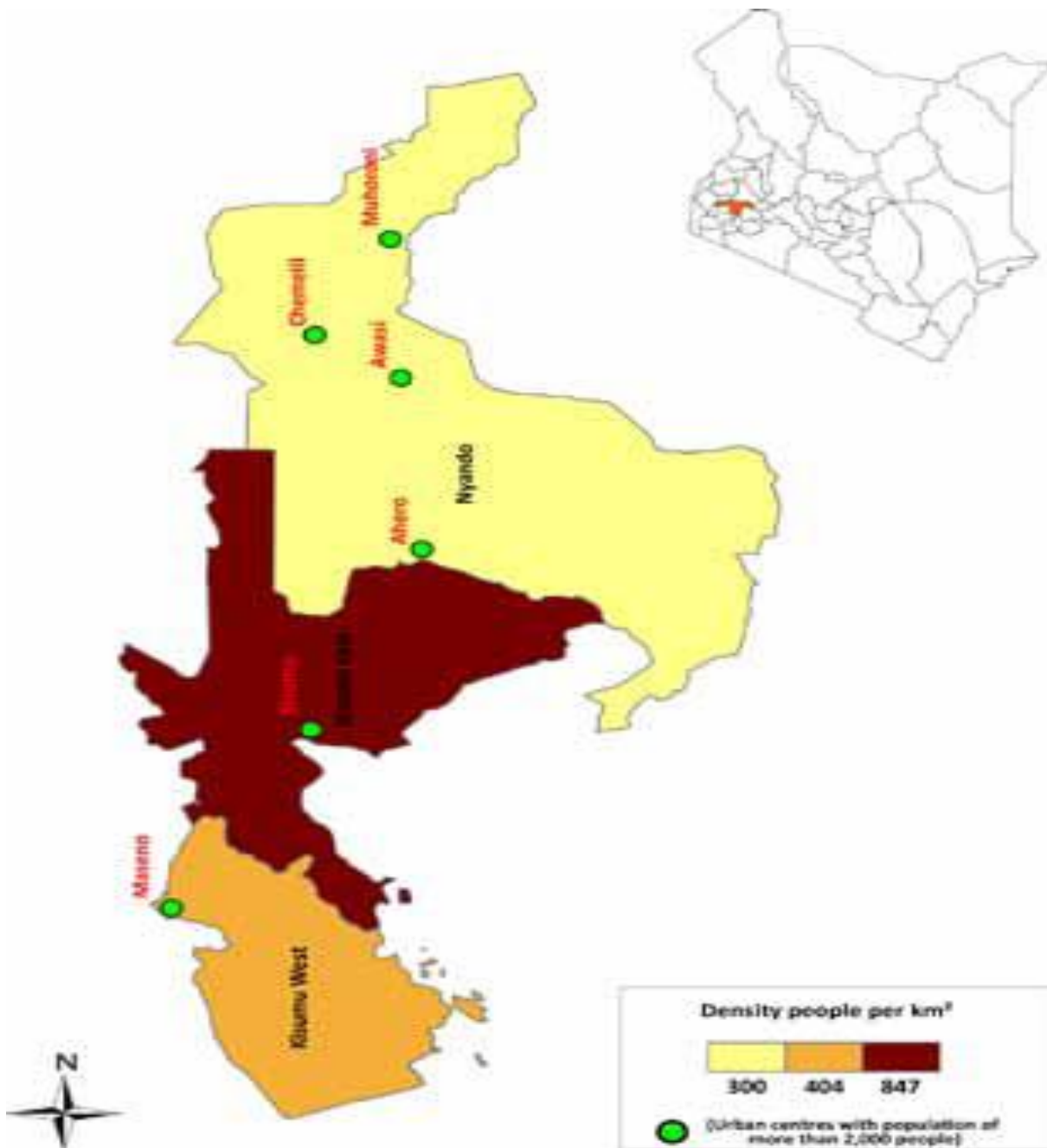
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**APPENDIX I MAP OF KISUMU COUNTY (KISUMU EAST AND WEST IN LOWER END)**



## APPENDIX II CLIENT QUESTIONNAIRE

### ANALYSIS OF THE DETERMINANTS OF MATERNAL MORTALITY: A CASE STUDY OF KISUMU SUB-COUNTY

#### Social Demographic Information

1. Name of Health facility.....
2. Sub-County .....
3. Category of the facility
  - a. District hospital [ ]
  - b. Sub – District hospital [ ]
  - c. Other Hospital [ ]
  - d. Nursing Home [ ]
  - e. Health Center [ ]
4. Ownership of the facility
  - a. Government [ ]
  - b. Local Authority [ ]
  - c. Private [ ]
5. Age of the Respondent.....
6. Marital status
  - a. Married [ ]
  - b. Single [ ]
  - c. Divorced [ ]
  - d. Widowed [ ]
  - e. Separated [ ]
7. What is your Occupation.....
  - a. Salaried Worker [ ]
  - b. Business lady [ ]
  - c. Not working [ ]
  - d. Farmer [ ]
8. What level of education have you attained
  - a. Primary Education [ ]
  - b. Secondary Education [ ]
  - c. Post Secondary Education [ ]
  - d. University Education [ ]
  - e. No education [ ]
9. What is your Religion.....

- a. Christian [ ]
- b. Islamic [ ]
- c. No religion [ ]
10. If Married, what is the occupation of your husband.....
- a. Salaried Worker [ ]
- b. Business lady [ ]
- c. Not working [ ]
- d. Farmer [ ]
11. What level of education has your husband attained.....
- a. Primary Education [ ]
- b. Secondary Education [ ]
- c. Post Secondary Education [ ]
- d. University Education [ ]
- e. No education [ ]
12. Do you have any of your relative who has a basic education.....
- a. Yes [ ]
- b. No [ ]
13. How far is the nearest health facility from your home.....
- a. One kilometer [ ]
- b. 1 to 3 km [ ]
- c. 3 to 5 km [ ]
- d. Over 5 km [ ]

### Questions on Clinic Visits and delivery

14. Do you have any health education on maternal Health.....
- a. Yes [ ]
- b. No [ ]
15. If Yes in above, by whom did you get health education from.....
- a. My Parents [ ]
- b. TBA [ ]
- c. Health Provider [ ]
- d. Media [ ]
16. How many ANC visits are you suppose to make.....
- a. One [ ]
- b. Two (2) [ ]
- c. Three (3) [ ]
- d. Four (4) [ ]

17. How many visits have you made so far.....
- a. One [ ]
  - b. Two (2) [ ]
  - c. Three (3) [ ]
  - d. Four (4) [ ]
18. What is your current parity.....
- a. One [ ]
  - b. Two [ ]
  - c. Three [ ]
  - d. Four [ ]
  - e. Five and above [ ]
19. Where did you deliver during the previous pregnancy.....
- a. Home [ ]
  - b. Health facility [ ]
20. Who assisted you during the delivery.....
- a. My Mother [ ]
  - b. TBA [ ]
  - c. Health Provider [ ]
  - d. Relative [ ]
21. If home, why did you prefer where you delivered (Home) .....
- a. No transport [ ]
  - b. No payment [ ]
  - c. Privacy [ ]
  - d. Able to retain placenta [ ]
  - e. Others..... [ ]
22. Do you think there is a difference in giving birth at home and health facility.....
- a. Yes [ ]
  - b. No [ ]
23. If yes, why is health facility preferred.....
- a. Clean [ ]
  - b. Safe(save the mother) [ ]
  - c. Save the child. [ ]
  - d. Able to pay for myself. [ ]
  - e. Able to be paid for (Voucher). [ ]
24. Who decide where you give birth and by whom.....
- a. Myself [ ]
  - b. My husband [ ]
  - c. Both of us [ ]
  - d. Community health worker. [ ]
  - e. My relatives. [ ]

- f. Others..... [ ]
25. What is your reason for not attending ANC .....
- a. Not able to pay [ ]
- b. The facility is far [ ]
- c. Health providers are cruel [ ]
- d. Not allowed to cross river [ ]
- e. Others specify.....
26. What is your reason for not delivering in health facility .....
- a. Not able to pay [ ]
- b. The facility is far [ ]
- c. Health providers are cruel [ ]
- d. Not allowed to cross river [ ]
- e. Others specify.....

### Questions on financial subsidies

27. Have you had of OBA programme .....
- a. Yes [ ]
- b. No [ ]
28. Are you enrolled in OBA programme.....
- a. Yes [ ]
- b. No [ ] jump to question
29. If yes in above how were you recruited to the programme.....
- a. Interviewed by the health provider. [ ]
- b. Was just given a voucher [ ]
- c. Identify and referred by the community health worker [ ]
30. What does the voucher covers.....
- a. Clinic visits. [ ]
- b. Clinic visits plus health facility delivery. [ ]
- c. Pre and post natal care. [ ]
- d. Comprehensive safe motherhood. [ ]
- e. Family planning. [ ]
- f. Others specify..... [ ]
31. Did you pay for the service.....
- a. Yes [ ]
- b. No [ ]
32. Can you rate the amount you have paid.....
- a. Very Expensive
- b. Moderate
- c. Fair
- d. Exorbitant

## APPENDIX III MATERNAL DEATH REVIEW DATA COLLECTION CHECKLIST

### Demographic information

1. Facility Name.....
2. Year.....
3. Facility Type.....
  - a. District hospital
  - b. Sub district Hospital
  - c. Other Hospital
  - d. Nursing Home
  - e. Health Center
4. Location of the facility .....
  - a. Kisumu East
  - b. Kisumu West
5. Age.....
6. Marital status.....
  - a. Married
  - b. Single
  - c. Divorced
  - d. Separated
  - e. Widowed
7. Occupation .....
  - a. Salaried worker
  - b. Farmer
  - c. Not working
  - d. Other specify.....
8. Education level.....
  - a. Primary level
  - b. Secondary Level
  - c. College level
  - d. No education
9. Mode of transport to the facility.....
  - a. Public transport
  - b. Ambulance (Referral)
  - c. Walked
  - d. Others specify .....

**Clinical history****10.** Date of admission.....**11.** Reason for admission

- a.** Delivery
- b.** Sick pending delivery
- c.** Other specify.....

**12.** Parity .....

- a.** One
- b.** Two
- c.** Three
- d.** Four plus

**13.** Beneficiary of voucher for health .....

- a.** Yes
- b.** No

**14.** ANC attendance.....

Once	Twice	Thrice	Four times	Four plus

**15.** Outcome.....1 (for Death) and 0 (for Alive)**16.** Immediate cause of death.....**17.** Subsequent cause of death.....**18.** History of other diseases.....

- a.** Malaria
- b.** HIV/AIDS
- c.** Anaemia
- d.** Others specify.....

**19.** Child survival .....1 (for Dead) 0 for (alive)



MINISTRY OF MEDICAL SERVICES  
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Ref. No. MPHS/ADM/22/2

Date 10/03/2013

To

*Authority granted to  
carry out the research as  
per director's instructions*

Provincial Director of Medical Services - Nyanza  
All Medical Superintendent  
All facilities in charges

Dear,

RE: STUDY ON A MULTI TOOL ANALYSIS OF DETERMINANTS OF MATERNAL MORTALITY:  
A CASE STUDY OF KISUMU EAST AND WEST DISTRICTS: (MIRASI TOM - P/NO1995041978).

This is to guarantee the above named officer who is an employee of the Ministry of Health to undertake the mentioned study in your institution in partial fulfilment of thesis for Master in Bio-Statistics, Kenyatta University.

Attached overleaf are the names of the sampled facilities for both Kisumu east and West Districts.

Please accord him the necessary support.

Dr. Francis Kimani  
Director of Medical Services

*SH*

Dr. S. K. Sharif MBS, MBChB, MIMED, DLSHTM, MSc  
Director of Public Health and Sanitation

*Noted 30.04.2013  
authority granted.  
A Omwiga WGH  
@mmp*

*Noted  
29/4/13  
12:30pm*

*Noted - supported  
After meeting /11/04/13 /11/04/13*

*Noted Approved 29/4/13*