DEMAND FOR CAESAREAN DELIVERY IN KENYA. THE CASE OF FREE MATERNAL HEALTH CARE POLICY

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DECLARATION

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This Proposal is my Original Work and has not been presented for the award of a Degree in any other University.

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ABBREVIATIONS AND ACRONYMS

ANC	Ante-natal Clinic
BMI	Body Mass Index
CS	Caesarean Section
EmOc	Emergency Obstetric care
MOH	Ministry of health
Log.	Logarithm
PPH	Post Partum Haemorrhage
Pr.	Probability
WHO	World Health Organization

ABSTRACT

Background. Caesarean delivery is a method of child birth whereby an incision is made through the abdominal muscles and uterine wall to remove the baby. Historically, it was done only if the mother had died before delivery. However, today, it is conducted either in emergency cases or if a mother chooses to. In 2013, the government of Kenya introduced a free maternal health policy aimed at increasing access to maternal health services, delivery included. This was therefore expected to increase the number of women delivering by Caesarean section in public hospitals in the country. It is however not well understood whether abolition of delivery fees alone is sufficient to cause such a policy outcome. This is the knowledge gap that this study seeks to fill.

Objectives. The general objective of this study is to compare trends and predictors of Caesarian delivery between government owned and privately owned hospitals in Kenya. The specific objectives were to analyze the comparative trends of recorded Caesarian deliveries between public and private hospitals in Kenya since implementation of free maternal care policy, to determine the association between sociodemographic characteristics and likelihood of Caesarean delivery, to investigate the relationship between method of payment and choice of site for Caesarean delivery, to establish the influence of health facility characteristics on choice of site of Caesarean delivery and to determine contributors to Caesarean section deliveries in public hospitals as compared to private hospitals in Kenya using the modified Robson criteria

Methodology. Mutivariable logistic regression analysis of **s**econdary data from KDHS 2014 will be analysed on stata version 13. The independent variables of Age of Mother at Birth, Parity, Previous CS, Income, Mother's level of education, Person assisting in the delivery, Distance to the nearest public health facility, Number of ANC visits, Method of payment, Residence (Urban, Rural), Region and Religion will be regressed in a logit model against the choice of site of Caesarean delivery as the dependent variable. A logit model equation will then be developed from the regression coefficients.

CHAPTER ONE
INTRODUCTION

1.1Background to the study

This chapter consists of a summary of theoretical aspects of the study themes such as modes of delivery, indications, risk factors, consequences of caesarean section as and health systems factors that inform the decision to perform caesarian deliveries including the free maternal health policy in Kenya.

1.1.1 Global trends of Caesarian delivery

Globally, more than 20 million deliveries are performed by Caesarean section every year (Molina et al, 2015). In the year 1985, the World health Organization (WHO) gave a statement against the rise of caesarean section delivery rates globally. It recommended that births by caesarean section should be maintained at rates between 5 and 15% (WHO, 1985). Initially, access to caesarean delivery was considered an indicator of improved readiness for emergency management of obstetric complications (EmOc). For example, in Bangladesh, lack of preparedness for emergency obstetric care was shown to be responsible for high rates of maternal deaths (Wichaidit et al, 2016). EmOc, including access to Caesarean delivery, has been prioritized and advocated for in several parts of the world, including the south of Sahara (Holmer et al, 2015, Abegunde et al, 2015). The reasoning is that if women can increasingly access emergency obstetric care services, the rate of maternal deaths can be drastically reduced. However, in the recent past, Caesarean births have increased globally (Betran et al, 2016). This has led to questioning of whether all these deliveries are warranted or whether there is an aspect of supplier induced demand for Caesarean delivery. It has for example been shown that Caesarean section deliveries are more likely to be conducted in for profit health facilities than in those not for profit (Hoxha I, et al, 2017). In Africa, there has been a steady increase in C-section rates without evidence of benefits in terms of reduction of maternal mortality (Chu et al, 2012). Despite empirical evidence that interventions can significantly reduce the unwarranted caesarean section deliveries (Kaboré et al, 2019), there are still many cases of CS sections that may not be warranted. This may be explained by several health systems and individual patient factors. For example, despite lower costs of vaginal delivery compared to C-section delivery, vaginal delivery comes with a number of personal care processes thus demanding fine interpersonal

skills from the birth attendants. In Tehran, for instance, results from a qualitative study showed that women felt they received low quality of obstetric services (Shirzad et al., 2019).

A study in Bangladesh showed that up to 34% of deliveries conducted were caesarean (Begum et al, 2017). Nepal however had 14.1% deliveries being Caesarean (Khanal et al, 2016) which is within the WHO recommended range of 5-15% (WHO, 1994). However, in the same Nepalese study, it was reported that there were rural urban differences in Caesarean delivery rates with rural women having 5% of deliveries by Caesarean section and their urban counterparts having 23%.

Very high caesarean delivery rates have been reported from Iran in a meta analysis study. They reported a 48% prevalence of C-section deliveries with Tehran, the capital city, at 66.5%. (Azami-Aghdash et al, 2014)

The United States had a 33% rate of Caesarean delivery. The individual risk factors for C-section delivery were identified as insurance, age of the mother, race/ethnicity and medical conditions related to pregnancy and delivery. They also reported that there were inter-hospital hospital diferrences in caesarean delivery rates that were not directly attributable to differences in case mix scenarios (Kozhimannil et al, 2014). China also has reported rates similar to those of the USA at 32.7 (Li et al, 2017) and some reports indicate very high CS rates such as in a study which was conducted in Shanghai (Ji et al, 2015)

1.1.2 Trends of Caesarian delivery in Africa

In Africa, Caesarean delivery has for a long time been poorly accessed. However, the recent trends indicate a sharp increase in the rates of such deliveries. For example, in sub Saharan Africa, up to 8.8% of all births were conducted by C-section by as early as the year 2009 (Shah et al, 2009). More recent studies indicate increase in C-section rates. For instance, Rwanda has been reported to have caesarean delivery rates above the continental average at 64 %. In the same study, C-section rates in Sao Tome and Principe was recorded as 0% (Yaya et al, 2018). In Morocco, up to 17.8 % of all deliveries were through caesarean section in the year 2016 (Soukayna et al, 2016). In Ethiopia, C-Section rates rose from 2.3% in 1995 to 24.4% in 2010. In

this research, education, parity and income were shown to increase demand for CS (Gebremedhin, 2014). The rates in Mali and Senegal were found to be 19% with 14% being intrapartum C-Section, 3% emergency C-Section and 2% elective C-Section (Briand et al, 2012). In Muhimbili hospital Tanzania, a study found out that between the year 2000 and 2011, Caesarian section births rose from 19% to 49%. This increase was not matched with improvements in obstetric outcomes as both peri-natal and maternal mortality increased during the same period. Moreover, the observed increase in C-section rates was in low risk groups (Litorp et al, 2013). A few countries like Ghana at 6.5%, (Manyeh et al, 2018) have reported Caesarean section rates within the WHO recommended range of 5-15%. In the Ghana study, age above 30 years, higher level of maternal education, employment, marriage, late onset of ante-natal clinic (ANC) visits, higher income, higher birth weight babies, male babies, higher education levels of the household head and low parity were shown to increase the odds of Caesarean section delivery.

1.1.3 Indications for Caesarean section delivery

In Africa, the most common indications for Caesarean delivery have been reported as labour with obstruction (31%), breach presentation (18%), having a previous Cesarean section delivery (14%), foetal distress (10%), rupture of the uterine membranes (9%) and ante-partum hemorrhage (8%) (Chu et al, 2012).

According to the Association of the Scientific Medical Societies in Germany, indications for Caesarean section can be categorized as being relative or absolute. Absolute indications are those that necessitate immediate delivery by CS and include absolute disproportion: small maternal pelvis, chorioamnionitis, deformation of maternal pelvis, eclampsia, foetal acidosis or foetal asphyxia, placenta previa: wrong positioning of the placenta, hindering vaginal delivery, breach presentation and rupture of the uterine membranes.

Relative indications, however, are those that may require CS delivery or other methods of emergency delivery such as suction or use of forceps. Such indications include pathological cardiotocography which often results in acute hypoxia or foetal asphyxia, poor progression of labour.

1.1.4 Health and health systems consequences of Caesarian section delivery

Delivery by Caesarean section has been shown to lead to longer hospital stay and greater likelihood of utilization of critical care (Glowicz, 2018). It has also been associated with more human resource inputs hence higher cost of care (Zhifei et al, 2016).

Global estimates of post Caesarean neonatal mortality indicate that it is approximately three times more likely than post vaginal delivery neonatal mortality (McDorman et al, 2006). A study in Rwanda indicated that even where there are no maternal deaths, Caesarean section deliveries still lead to undesirable health outcomes such as puerperal sepsis, postpartum hemorrhage and rupture of the uterine membranes (Kalisa et al, 2017). In South Africa, maternal deaths following Caesarean section delivery have been on the rise in the past decade and what is astonishing is that as many as 71% of such deaths are preventable (Fawcus et al, 2016, Maswime and Buchmann, 2016).

1.1.5 Differences in demand for Caesarian delivery between private and public health facilities

A survey of rates of Caesarean section deliveries in sub-Saharan African hospitals revealed that private health care facilities conduct more Caesarean deliveries (12.3%) compared to public health facilities at 7.9% (Yaya et al, 2018). In a study done in Bangladesh, it was found out that as much as 80% of all Caesarean deliveries conducted were in private facilities (Begum et al, 2017). Another Bangladeshi study also indicated that private hospitals have higher likelihood of performing a Caesarean section in a similar circumstance compared to public hospitals. In that study, it was actually noted that private hospitals had a C-section delivery rate of 90.47% whereas public hospitals had a rate of 30.28% (Rahman et al, 2015).

Lebanon however had 35% CS rates but with public health facilities having higher rates than public health facilities. This was attributed to influx of Syrian refugees who often did not prefer C-section to vaginal delivery but had no awareness about its complications and rarely had adequate ante natal care if at all (Huster et al, 2014)

A study conducted in Ethiopia also showed that private health facilities conducted Caesarean deliveries more frequently (41.7%) than public health facilities (20.6%) indicating a likelihood of profit considerations hence supplier induced demand (Gebremedhin, 2014) A similar trend was reported from Brazil where the caesarean delivery rates in private hospitals at 86.2% were almost triple those in public health facilities at 29.9%. They also reported association between C-section in public hospitals and maternal age equal to or above 20 years, primiparity, twinning, ante-natal care in private health facilities, delivering in a high level facility and attending more than six ANC visits (Vieira et al, 2015).

1.1.6 Free Maternal Health policy in Kenya

Reducing or abolishing fees for delivery is commendable but sometimes does not translate to absolutely free delivery. This was shown in the Morocco study where the researchers reported that despite fee exemption for Caesarean delivery intended to make it accessible, the cost incurred by women to purchase pharmaceutical products before or after the surgery made the total cost of the procedure to remain prohibitive to poor patients (Bennis and De Brouwere, 2013).

In June 2013, Kenya officially abolished user fees for delivery f in all public hospitals via a presidential decree [MoH, 2013]. The policy directive intended to reimburse government health facilities for costs of delivery services by way of a capitation fund availed through the Ministry of Health. The policy stipulates equal reimbursement whether the delivery is via Caesarean section or vaginal method. The amount of money reimbursed is based on the health facility service level with levels II and III hospitals given 2500 Kenya shillings, levels IV and V hospitals, 5000 Kenya shillings and level VI (National Referral Hospitals) receiving 17,500 Kenya shillings for every delivery [Ministry of Health of Kenya, 2013].

Since the time of inception, the implementation of the policy has experienced a number of challenges as well as successes. For example, due to rapid implementation devoid of adequate planning, there has been inadequate stakeholder involvement and lack of clarity about the policy details such as the specific services which were meant to be free (Tama et al., 2018)

Other challenges documented empirically so far include delayed health facility reimbursement by the government, stock outs of essential medicines and commodities, increased workload worsened by shortage of qualified staff (Lang'at and Mwanri, 2015). These challenges are basically as a result of rushed implementation that was not matched with capacity expansion for the hospitals. Concurrent devolution of health services at around the same time also meant that there were more challenges due to a very steep learning curve for the policy implementers (Pyone t al., 2017)

1.2 Statement of the problem

It is estimated that more than 20 million Caesarian deliveries are conducted every year globally. Approximately 8.8% of all deliveries in sub-Saharan Africa are Caesarian [Shah et al, 2009]. This rate is within the WHO recommendations of 5–15% [Harrison MS, Goldenberg, 2016]. It is however noteworthy that intrapartum neonatal death rates in Africa, south of Sahara, still accounts for more than 70% of global intrapartum neonatal deaths [Cavallaro, 2013]. It is also here where post-cesarean neonatal death rate in is above the global average [Shah et al. 2009]. Caesarian section is often more costly compared to other methods of delivery (Petrou et al, 2017). In resource strained settings, it is therefore usually conducted to save the life of the foetus and the mother (Mac Dorman et al, 2006).

Initially, Caesarian delivery was only common in the developed world, but recent literature indicates an increasing trend in the developing world too (Harrison et al, 2016). Caesarian deliveries that are not properly necessitated by medical reasons unjustifiably put poor households at the risk of catastrophic health expenditure. In 2003, Buckens et al noted that rates of Caesarean section deliveries were low in all sub-Saharan African countries except in Kenya. In Africa, the ratio of citizens to obstetricians is way below the WHO recommendation. This may partly explain why many Caesarean Sections (CSs) in Africa have been associated with poor outcomes such as post partum haemorrhage (PPH), maternal deaths and post-operative surgical site infections since the operations are often conducted by less qualified and less experienced health care providers (Mac Dorman et al, 2006, Molina et al, 2015,).

In rural areas, poor maternal and neonatal outcomes post caesarian delivery is often associated with long distances to health facilities (Nyirahabimana et al, 2017). It is therefore important that any caesarian delivery that can be avoided should not take place. This is because non-justified CSs are not just of medical but also of economic concerns.

Despite observed increase in the number of ANC visits, health facility births, and live births, there is still no observed change in caesarean delivery rate in Kenya after implementing the policy on free maternal health (Njuguna et al, 2017, Langat et al, 2019). This indicates that the demand for Caesarean deliveries may depend on other factors than cost alone. These other factors may even include provider induced demand for CS.

1.3 Knowledge Gap

The main knowledge gap that this study sought to fill was whether the free maternity policy introduced in Kenya in the year 2013 has led to a shift in patterns of demand for Caesarian section deliveries or not.

1.4 Study justification and rationale

In the year 2013, Kenya rolled out a policy on free maternal health services. The policy aimed to improve access to care by all mothers in Kenya hence reduce maternal deaths and improve perinatal health outcomes. It was therefore expected from sheer logic that deliveries in public hospitals, including caesarian deliveries would increase, in comparison to private hospitals. This would only be true if cost is the main consideration by women who seek these services and their families. On the other hand caesarian deliveries would still be higher in private facilities if the health providers in such facilities are considered more competent to conduct such deliveries. The findings of this study will therefore indicate the impact of this policy on patterns of demand for Caesarian section deliveries. Many studies have focused on choice of place of delivery; home or facility but no study that reviewed in this study focused on comparing private versus public Caesarian delivery.

1.5 Research Questions

1. Have trends for demand for Caesarean section delivery change after free maternal health policy was launched in Kenya?
2. What factors influence the trends for demand for Caesarean section delivery in Kenya
3. Is there a better alternative to free maternal health policy for optimizing demand for Caesarean section delivery in Kenya?

1.6 Research Objectives

The study was premised of the following objectives

1.6.1 General Objective

To determine the demand for Caesarian section delivery in Kenya

1.6.2 Specific Objectives

1. To establish the patterns of demand or Caesarean section delivery among women in Kenya after implementation of free maternal care policy
2. To determine the factors affecting the trends of demand for Caesarean delivery observed
3. To come up with a policy alternative for optimizing Caesarean section delivery rates in Kenya

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents both theoretical and empirical literature related to trends and predictors of caesarean delivery. In the theoretical literature section, the Grossman model of demand for health and the neoclassical utility theory are presented. In the section of empirical literature, a review of studies conducted globally, regionally and locally on determinants of Caesarean delivery is presented. At the end, an overview of the literature reviewed is also presented.

2.2 Theoretical Literature

The theoretical basis of this study is the economic theory of demand for health, Wagstaff Adam, (1986a). This theory attempts to link human behavior, available resources, and health as a consumer good.

2.2.1 Grossman's model of demand for health

The health of an individual is dependent on not only biological factors but also level of income, education, cultural factors, childhood experiences, social status, work conditions, the physical and social environment, gender, health systems, social support, population dynamics and lifestyle among other factors. Demand for Health Care is a function of education, perceived severity of illness, income, client's available time, age , health facilities, insurance, quality of care, employment status, location and housing conditions among other factors.

The demand for health is therefore more sophisticated compared to demand for other economic goods. The concept of Grossman model is based on the premise that and individual directly demands health, not health-care. It is therefore, a derived demand. Therefore, to measure the amount of health care demanded, one needs to measure the total sum of the quantity of services used, such as number of days spent in the health facility or medicines consumed (Ringel et al., 2002).

The focal concept behind Grossman's model is the postulation of how social factors like education, age, income and health status influence the production of health through the demand for health capital. According to him, health is a consumption good as well as a production good. This is because health is consumed directly; people always want to be healthier. Secondly, health is an investment because good health enables individuals to carry out other economically useful activities (Becker, 1965). The individual is therefore both the producer and consumer of the economic good called health.

Health is seen as a capital good inherited at birth at an original stock level that depreciates as one ages and is depleted at death. He argued that an individual is responsible for the length of their life since they can prolong it by investing in their health through medical care, exercise, appropriate diet etc.

Demand for healthcare is unique because the consumer's choice is often determined by the clinician (supplier) due to information asymmetry. Also, the consumer has little or no capability to make a rational choice before purchasing health because he/she is ill and the clinicians often do not inform the consumer. Health is also a good that is produced as it is consumed.

2.2.2 Integrated Grossman's 4 Quadrant Model

This composite model of Michael Grossman is summarized in the following statement: In trying to maximize utility, depending on available time and money within a particular period, an individual needs to appropriate time and money between leisure and work for a better present and future. Using this concept, Grossman noted that an individual will strive to best organize his/her health expenditure and consumption to attain the highest possible level of wellbeing (Grossman M., 1972b). The assumptions may be depicted by demonstrating the relationship between the indifference curves, the budget constraint and the production functions which constraint individual's health behaviour (Wagstaff Adam, 1986b). The main objective of an individual is therefore to attain the highest possible welfare contour subject to the technological and financial constraints he/she faces (Wagstaff Adam, 1986b).

The thought that builds this synthesis can be constructed based on the following illustration:

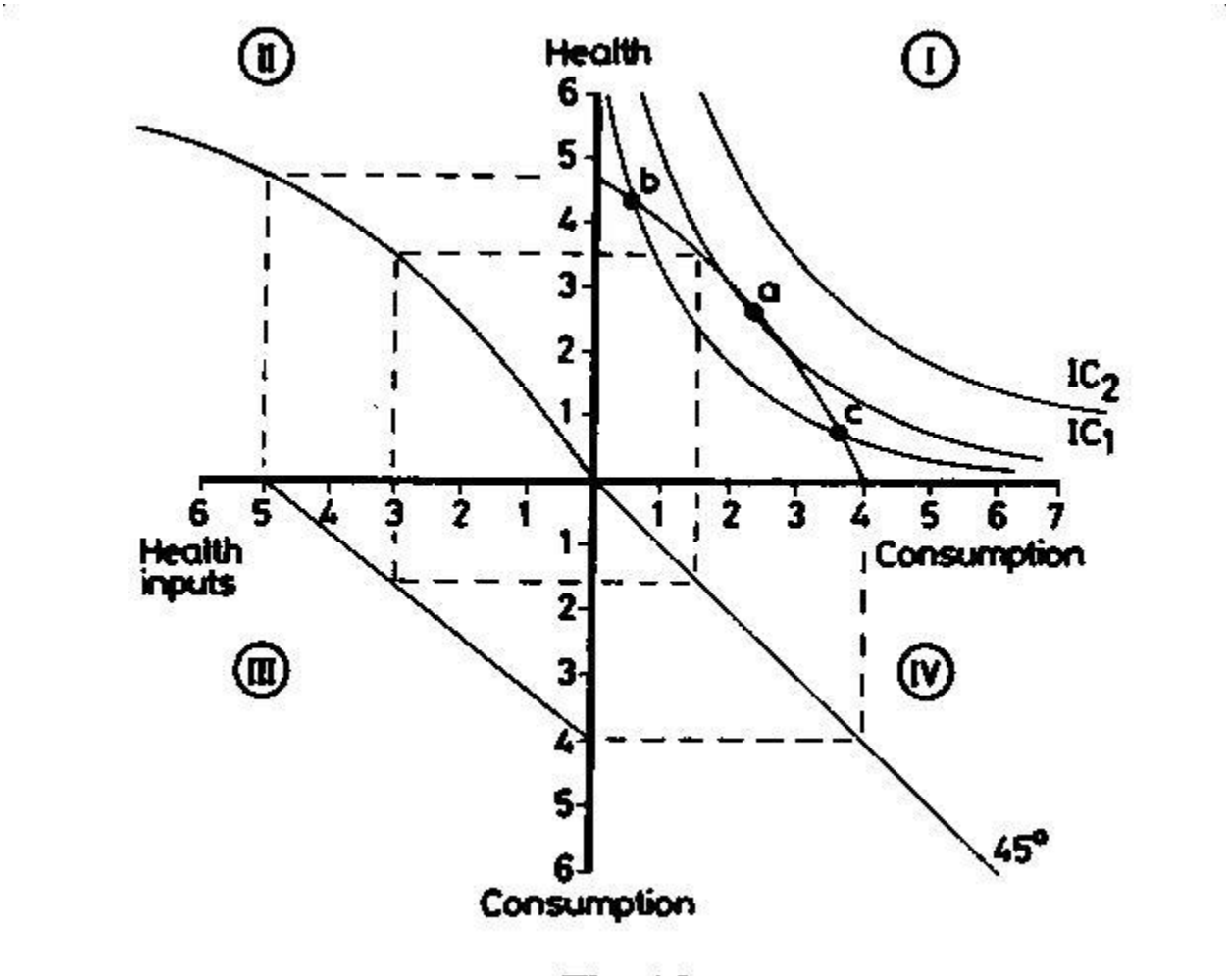


Figure 1: Michael Grossman's four quadrant model

Source: Wagstaff (1986a)

2.2.3 The neoclassical Utility Theory

Utility theory is founded on the preferences of individuals. It attempts to explain the observed behaviour of individuals based on the assumption that people's ranking of choices can be consistently based on their preferences. The preferences of each individual are intrinsic and often difficult to change. The utility theory is therefore abstract and relies on some assumptions.

Utility theory is based on the concept that when individuals make decisions, they first assign some abstract utility values called 'utils' to the initial monetary values of the goods or services

they wish to purchase. The individual sees various levels of monetary values, translates them into units of utility; 'utils', makes a choice in terms of 'utils' and translates the result back to monetary terms. Since utility indicates level of satisfaction, individuals therefore behave in a manner such as to maximize the utility, not monetary gains.

The utility theory is a positive rather than normative theory since it attempts to explain the observed choosing behaviour of an individual by drawing inferences from the preferences of the individual. Under certain conditionalities, we can represent the preferences of an individual mathematically using a utility function that orders the preferences of an individual on the basis of satisfaction derived from the consumption bundles. We therefore assume that people make choices based on a utility function upon which they decide.

The assumptions of the utility theory include the following; completeness: That individuals can rank all possible consumption bundles based on preferences no matter how many they are. The second assumption is that more is better, meaning that a bundle with more utility will always be ranked higher. It is known as the monotonicity assumption on preferences. The third assumption is that mix is better meaning that a mix of the two, separate choices will be preferred to both stand-alone choices. It is known as the "convexity" assumption on preferences. The last and most important and controversial assumption is that of rationality. It is assumed that individuals' preferences avoid any form of circularity.

Whenever the above assumptions are satisfied, the individual's preferences may be represented by a well-behaved utility function. Well-behaved utility functions show why a comparison of individual people's utility functions is not useful and that cardinal utility is not attainable. However, utility functions are useful for representing the preferences of one individual, under the assumptions stated.

2.3 Empirical Literature

This section presents global, regional and local empirical literature from research performed in the recent past concerning demand for Caesarean section deliveries.

2.3.1 Factors influencing Demand for Caesarian delivery

Some of the individual factors that influence demand for Caesarean section delivery have been empirically identified to be maternal age, maternal education, place of residence, income, parity, and antenatal care (ANC) attendance.

For example, Janoudi et al (2015) using multivariable logistic regression showed that increase in maternal age affected demand for Caesarean delivery positively. This study was done in Canada. Similar associations were observed by Zhifei et al (2016) in China who used multiple linear regression to demonstrate that increase in mother's age at birth increases the demand for Caesarean delivery.

In Bangladesh, in the year 2015, Mostafizur et al used logistic regression and Cox proportional hazards models to show that having a previous Caesarean section affects demand for Caesarean delivery positively. Similarly, Will et al in 2015 in the United States of America (USA) reported concurring findings. They used multivariable multinomial logistic regression analysis to demonstrate that having a previous Caesarean section delivery increased demand for Caesarean delivery.

In 2014, Gebremedhin, in Ethiopia, used simple linear regression analysis to show that increase in the level of education of the mother increases the demand for Caesarean section delivery. Similar positive relationship between education of the mother and demand for Caesarean section delivery were reported by Beena et al in Colorado, United States of America in the year 2009. In their study, Beena et al used multivariable logistic regression models. Manyeh et al in 2018 also showed similar positive relationship between level of maternal education and demand for Caesarean section delivery in Ghana. They used multinominal logistic regression models.

Khanal et al in Nepal demonstrated in 2016 using multivariable logistic regression that women residing in urban neighbourhoods have higher demand for Caesarean section delivery than their rural counterparts. Another factor that has been shown to increase demand for Caesarean section delivery is income. This was shown by Zahra et al in 2016 from a study in Iran where they used bivariate regression analysis. This was positive relationship between income and demand for

Caesarean section delivery was also shown by Manyeh et al in a study in Ghana in 2018 where they used multinominal logistic regression analysis. Manyeh also identified age, and parity as other factors that had a positive relationship with demand for Caesarean section delivery.

In 2014, Akinola et al reported from the findings of a study in Nigeria that increase in parity increases demand for Caesarean section delivery. They used multivariable logistic regression analysis. Vanahor et al in a Kenyan study in 2018 also found out that increase in age and parity of the mother increased demand for Caesarean section delivery. They used multinominal logistic regression analysis.

Using random intercept logistic regression modeling, Padmadas and ZoeMathews in 2008, showed that increase in ANC attendance as well as increase in income of the mother increased demand for Caesarean section delivery. In Tanzania, Nielsen et al in 2014 used multivariable logistic regression modeling to demonstrate that increase in age and maternal education as well as urban residence increased demand for Caesarean section delivery.

Honglei et al, in the year 2015 in China demonstrated that presence of doctors increased the demand for caesarean delivery using multinominal logistic regression analysis. Using simple linear regression, Gebremedhin (2014) in Ethiopia showed that higher parity and delivering in a private hospital both increased the demand for caesarean delivery.

In 2017, Al Rifai et al also showed from a study in Egypt that women with higher parity and those delivering in private health facilities have higher demand for Caesarean section delivery than those with lower parity and those delivering in public health facilities respectively. Using generalized linear models in Uganda, Atuheire et al in 2019 showed that in Uganda, increase in distance to nearest health facility affected demand for Caesarean section delivery negatively.

2.3.2 Overview of literature

From the above literature, the factors that were identified as predictors of demand for Caesarean section delivery were age, income, education level of the mother, parity, ANC visits, distance to the nearest hospital, place of delivery(public or private hospital), having a previous Caesarean section and urban or rural residence. These factors form the set of variables that will be fit into a multivariable regression model to estimate how each of them influences demand for Caesarean section delivery in Kenya.

2.3.3 Value addition

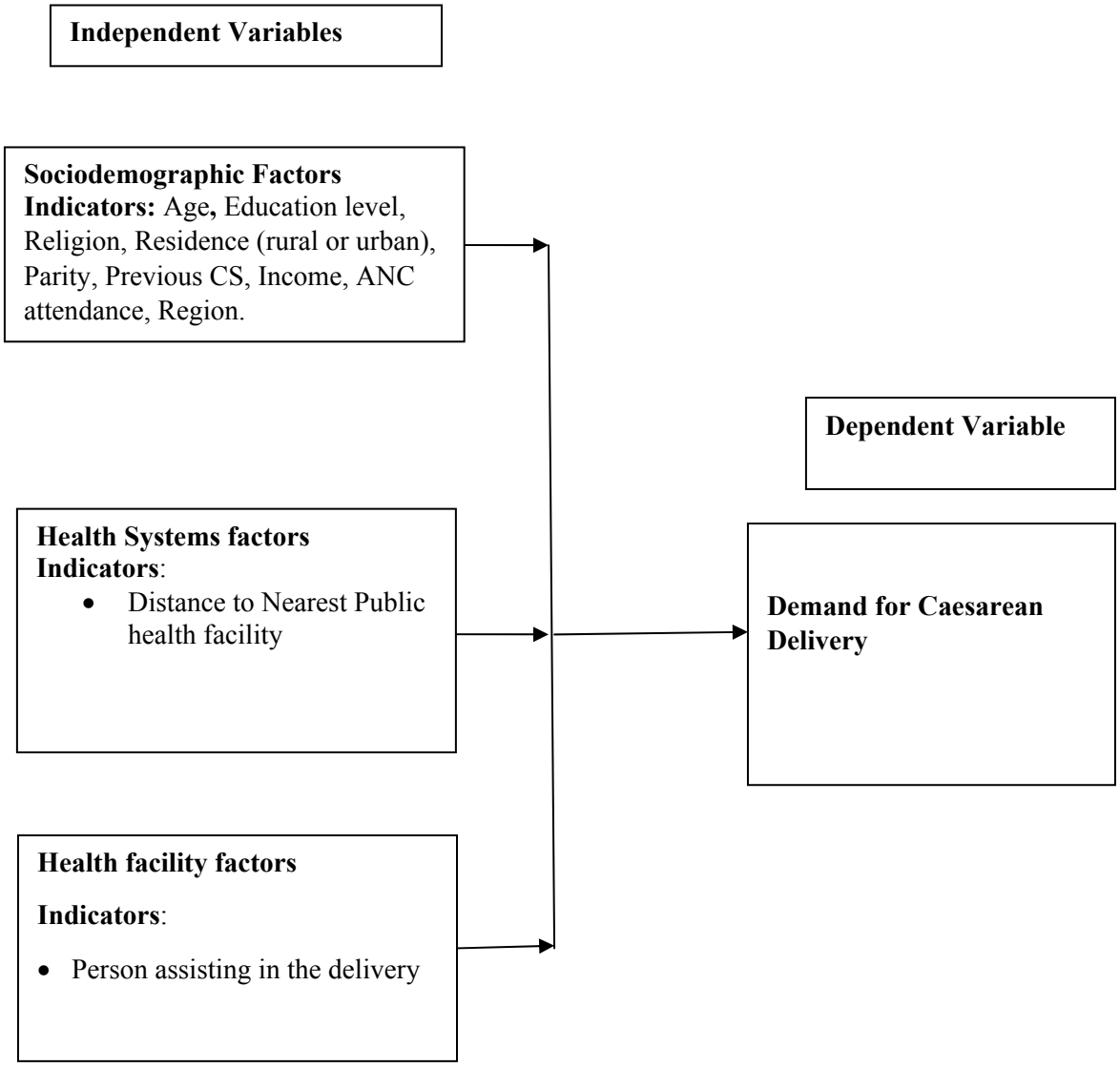
Most of the studies reviewed looked at Caesarean delivery in contexts of clients paying for the caesarean delivery. In this study, the policy context is different in that maternal health care is free in Kenya. Very few of the studies were done in Sub-Saharan Africa and so this study will add to the much scanty literature demand for Caesarean section delivery and its correlates in this part of the world.

CHAPTER THREE
METHODOLOGY

3.1Introduction

This chapter summarizes the conceptual framework and an econometric model for choice of place of Caesarean delivery, whether private or public health facility. It also describes study variables, their definitions, measurements and expected signs and finally the data sources and data issues.

3.2 Conceptual framework of choice of place of caesarean delivery



Source (Author)

3.3 Econometric Model Specification and Estimation

3.3.1 Probit Regression model

This data analytical framework of this study is the probit regression model. Probit regression makes the outcome variable to take a binary form (0 or 1). It is presented in the Yes or No format hence suitable for modeling binary dependent variables like in the case of this study, whether one delivers by other methods of (0) or by Caesarean section (1).

What the probit model does is to estimates the probability that the dependent variable is 1 **(Y=1)**. This is the probability that a given event occurs. In this study, the event is taken as the choice to deliver by Caesarean section in a public health facility. The model uses the maximum likelihood estimation method. This means that an increase of an independent variable (**X**), say age or income, leads to a decrease or increase of likelihood to deliver by Caesarean section method in a public health facility. The probit analysis gives statistically significant results for which independent variables $\mathbf{X_1, X_2, X_3.....X_k}$ increase or decrease the likelihood of choosing a public health facility for caesarean section delivery.

We state the binary outcome variable as follows:

$\mathbf{Y_i = f(X_i)}$**.....(1)**

Where;

$\mathbf{Y_i}$= 1 if the individual chooses to deliver via Caesarean Section, given that $Y_i > 0$

$\mathbf{Y_i}$= 0 if the individual chooses other methods of delivery, given that $Y_i \leq 0$

$\mathbf{X_i}$= a set of explanatory variables

We can therefore define binary response model by transforming Xβ into a probability of the form given below:

$\mathbf{Prob\ (y_i=1)=F(X_i\ \beta)}$**.....(2)**

Where β refers to the parameters to be maximized.

3.3.2 Model estimation

The model was estimated by use of the binary probit model described in 3.2.1. above, where delivery by Caesarean section in a public health facility is a function of:
(Age of Mother at Birth, Income (Poorer, Middle, Richer and Richest), Mother's level of education (Primary, Secondary and Tertiary), Number of ANC visits and place of delivery.

This relationship can be expressed as:

$$\mathbf{CSD=f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10})}\text{.....(1)}$$

$$\mathbf{CSD= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \square}\text{.....(2)}$$

Where

CSD = Delivery by Caesarean section

$\mathbf{X_1}$ = Age of the mother at birth

$\mathbf{X_2}$ = Primary education

$\mathbf{X_3}$ = Secondary education

$\mathbf{X_4}$ = Tertiary education

$\mathbf{X_5}$ = Poorer

$\mathbf{X_6}$ = Middle income

$\mathbf{X_7}$ = Richer

$\mathbf{X_8}$ = Richest

$\mathbf{X_9}$ = Number of ANC visits

$\mathbf{X_{10}}$ = Place of delivery (Public or private hospital)

$\square$ = error term

3.4 Data analysis

Summary descriptive statistics will be run on R statistical software. Chi square statistics will then be used to compare the distribution of caesarian delivery between the government owned hospital and the privately-owned hospitals. Multiple linear regression and stepwise multiple logistic regression will also be used to analyze the predictors of site caesarian delivery (Public or private hospital).

3.5 Definition of study variables, measurements and expected sign

This section presents the various independent variables and the dependent variable to be measured in the study.

3.5.1 Independent variables

The independent variables in this study are categorized into patient factors, socioeconomic factors and health systems factors. The actual independent variables to be measured are Age of Mother at Birth, Parity, Previous CS, Income, Mother's level of education, Person assisting in the delivery, Distance to the nearest public health facility, Number of ANC visits, Method of payment, Residence (Urban, Rural), Region and Religion

3.5.2 Dependent variable

The dependent variable in this study is the Site of Caesarian Delivery (0=Public Health facility, 1=Private Health facility)

Table 3.1. Variable measurement and expected sign

Variable	Measurement	Expected outcome/sign	Reference	Method of Analysis used
Dependent Variable				
Demand for Caesarian Delivery	1 if Caesarean, 0 if otherwise			
Independent Variable				
Age of the mother	Number of completed years	Positive	Janoudi et al, 2015, Zhifei et al, 2017	Logistic regression and multiple linear regression
Income	A continuous variable measured in K.Shs	Positive	Gebremedhin, 2014, Zahra et al, 2016	Simple linear regression and Bivariate logistic regression
Number of ANC attendances	Categorical variable measured as 1 if attended 3 or less and 0 if attended >3	Positive	Padmadas et al, 2008, Manyeh et al, 2018	Random intercept logistic regression, Multiple logistic regression

Person assisting in the delivery	1 if Medical officer, 0 if otherwise	Positive	Honglei et al, 2015, Zahra et al, 2016	Multinominal logistic regression
Education of the mother	A categorical ordinal variable measured as 1 if Primary, 2 if Secondary and 3 if College and above	Positive	Manyeh et al, 2018 Gebremedhin et al, 2014	Multiple logistic regression, Simple linear regression
Residence	A categorical variable measured as rural or urban (1 if rural, 0 if urban)	Positive	Khanal et al, 2016	Multivariate logistic regression
Parity	A continuous variable	Positive	Akinola et al, 2014, Manyeh et al, 2018	Multivariate logistic regression
Previous CS	1 if yes, 0 if no		Will et al, 2015, Mostafizur et al, 2015	Multinominal logistic regression, and Cox proportional hazard model
Nearest public health facility	Continuous variable measured in Kilometres	Negative	Nyirahabimana et al, 2017, Atuheire et al, 2019	Multivariate logistic regression model and Generalized linear models
Choice of place of delivery	A categorical variable measured as 1 if public, 0 if private	Negative	Al Rifea et al, 2017, Gebremedhin et al, 2014	Binary logistic regression and simple linear regression

3.6 Data Sources

The study will involve analyzing data from the Kenya KDHS 2014. The dataset will be obtained from the Kenya National Bureau of statistics through their website. This edition of the KDHS contains information on marriage and sexual activity, family planning, fertility, fertility preferences and maternal health. On maternal health, it has details such as assistance during delivery, antenatal care, place of delivery and access to health care.

3.7 Data Diagnostic Issues

Data diagnostics were carried out to ensure that the data used in the study did not

3.7.1 Normality

Normality was tested using The Shapiro-Wilk W test for normal. The null hypothesis was that the data used in this study was drawn from a normally distributed population hence was also normally distributed.

3.7.2 Multicollinearity

Multicolinearity is a problem with data that occurs if the exposure variables in a regression equation are correlated with each other. It is a problem because it causes noise in the analysis of the relationship between the exposure variable and the outcome variable. The extent of co-linearity needs to be as low as possible for the regression relationship to hold. In this study, the variance inflation factor will be used to test the extent of co-linearity among the exposure variables and if the value of the factor is below 10, it will interpreted to mean that there is no multicolinearity among the variables

3.7.3 Heteroskedasticity

This is a phenomenon the variance of the error term is not constant as would ordinarily be expected. The standard error, in such a case, may therefore be biased. In this study, the error term variance will be diagnosed by the Breusch Pagan Lagrange multiplier.

CHAPTER FOUR

PRESENTATION, INTEPRETATION AND DISCUSSION OF STUDY FINDINGS

4.1 Sociodemographic characteristics of the respondents

The total number of observations made in the survey was 7,155 women. Their ages raged between ten years and 44 years. 7.77% of them delivered by Caesarean section with most of them (50%) having primary level education. Income seemed to be fairly evenly distributed in the study population and majority (62.63%) lived in rural areas. Most of the respondents (73.61%) stated that distance to the nearest health facility was not a major barrier to their access to delivery services. Attendance of ante natal clinics (ANC) was impressive with up to 78.1% reporting having made three or more such visits during pregnancy. Less than half of the respondents (46.21%) delivered in public health facilities. The sociodemographic characteristics of the respondents were as summarized in table 4.1.

Table 4.1: Sociodemographic characteristics of the respondents

	Freq.	Percent
Age of respondent at birth		
10-15	2662	11.45
16-20	12984	55..86
21-25	6134	26.39
26-30	1249	5.37
31-35	187	0.28
36-40	22	0.80
41-44	6	0.03
Mode of Delivery by		
Other modes	13778	92.23
CS	1161	7.77
Highest educational level		
No education	4183	13.46
Primary	15613	50.24

Secondary	8595	27.66
Higher	2688	8.65
Wealth index (proxy for income)		
Poorest	7262	23.37
Poorer	5970	19.21
Middle	5946	19.13
Richer	5958	19.17
Richest	5943	19.12
Place of residence		
Rural	19465	62.63
Urban	11614	37.37
Distance to nearest health facility		
Not a big problem	10846	73.61
Big problem	3889	26.39
Ante-natal clinic visits		
Less than 4 visits	6805	21.90
Four or more visits	24274	78.10
Place of delivery		
Other places	8025	53.79
Government hospital	6895	46.21

4.2 Descriptive summary statistics

Table 4.2 provides a summary descriptive statistics of frequency, mean, standard deviation, minimum and maximum values for the variables in the Caesarean section delivery model.

Table 4.2: Summary statistics for the Caesarean section delivery model

Variables	Obs	Mean	Std. Dev.	Min	Max
Mode of delivery	14939	.078	.268	0	1
Age	23245	19.423	3.656	10	44
Income	31079	2.915	1.441	1	5
ANC visits	31079	.781	.414	0	1
Mothers education	31079	1.315	.811	0	3
Place of residence	31079	.374	.484	0	1
Parity	655	.656	1.377	0	4
Previous CS	14939	.078	.268	0	1
Distance to nearest facility	14735	.264	.441	0	1
Delivery at gov hosp	14920	.462	.499	0	1

The findings presented in table 4.2 indicate that 7.8% the mothers sampled delivered by Caesarean section, mean age of women sampled was 19.42 with a minimum age of 10 years and a maximum of 44 years. On the average, the sampled women were in the middle wealth quintile. More than 78% of the women attended more than the WHO recommended minimum of four antenatal clinic (ANC) visits during pregnancy. Majority of the women had primary school education and up to 62% resided in rural neighbourhoods. The mean parity was less than one child and upto 7.8% had a previous Caesarean section delivery. Upto 26.4% stated that distance to the nearest health facility was not a problem in their access to hospital delivery services and 46.2% delivered in a government hospital facility.

4.3 Diagnostic tests results

A number of data diagnostic tests were carried out before full data analysis to ascertain that there were no issues with the data that would lead to biased conclusions from the results of the analysis. These included tests for normality, multicollinearity and heteroskedasticity. The outcomes of the tests are presented in subsequent sections.

4.3.1 Test for Normality

The Shapiro-Wilk W test for normal data was used to test if the data used in this study was drawn from a population that was normally distributed. The null hypothesis was that data is normally distributed. The test returned significant p values as shown in table 4.3 with the level of significance set at 0.05. We therefore failed to reject the null hypothesis that the data was from a normally distributed population hence is normally distributed.

Table 4.3: Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
Resid	7,155	0.51841	1791.538	19.867	<0.001

4.3.2 Multicollinearity

Multicollinearity is a problem with data that arises if two or more variables are dependent on each other, i.e., change in one leads to change in the other. If ignored, it can lead to spurious conclusions from a study. The following tests were carried out to rule out multicollinearity in this study.

4.3.3 Variance inflation factor

Multicollinearity was ruled out using the variance inflation factor. If the variance inflation factor is 10 or more, it indicates that there is multicollinearity in the data. However, if it is less than 10, as is the case with our data, then one can conclude that there is no multicollinearity in the data variables. Given that the mean variance inflation factor in our data is 1.68, we fail to reject the null hypothesis that the data has no multicollinearity.

Table 4.4: Variance inflation factor analysis

Variable	VIF	1/VIF
Secondary education	2.46	0.407250
Primary education	2.39	0.417969
Richest	2.33	0.428554
Ricer	1.85	0.539521
Tertiary education	1.85	0.541345
Middle income	1.67	0.598070
Poorer	1.66	0.603863
Urban residence	1.40	0.715886
Age	1.21	0.824247
Delivery in government hosp	1.14	0.875030
Distance not a barrier	1.11	0.899644
Four or more ANC visits	1.07	0.931388
Mean VIF	**1.68**	

4.3.4 Correlation Analysis

To further interrogate if there would be multicollinearity among the independent variables, we performed a correlation analysis by inspecting the correlation coefficients of the independent variables. A correlation coefficient of zero implies absolute lack of correlation. A coefficient of 1 denotes perfect positive autocorrelation whereas negative 1 denotes perfect negative autocorrelation. As evident from table 4.5 where the correlation matrix of the variables is summarized, the independent variables have low correlation with each other enabling us to conclude that there is no multicollinearity in the variables.

Table 4.5: Pairwise correlation analysis of the independent variables

	Age	Dist	Pri.	Sec.	Ter.	Poorr	Mddle	Richer	Richst	Resid	Deliv	ANC
Age	1											
Dist.	-.05	1										
Pri.	-.24	.03	1									
Sec.	.14	-.09	-.62	1								
Ter.	.30	-.11	-.31	-.19	1							
Poorer	-.09	.05	.19	-.05	-.12	1						
Middle	-.05	-.02	.09	.05	-.07	-.24	1					
Richer	.05	-.10	-.05	.13	.04	-.24	-.24	1				
Richst	.22	-.19	-.22	.14	.33	-.24	-.24	-.24	1			
Resid	.10	-.18	-.13	.11	.18	-.16	-.14	.10	.48	1		
Deliv	.07	-.15	.02	.18	.05	.01	.07	.15	.10	.16	1	
ANC	.07	-.10	-.05	.12	.11	-.04	.03	.07	.14	.10	.15	1

4.3.5 Heteroskedasticity

Heteroskedasticity test is carried out to ascertain that the variance of the error term is constant so that the standard error is not biased. In this study, we used the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity and the findings were as summarized in table 4.6.

Table 4.6: Results of Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Mode of delivery	Coef.	Robust S. E.	*t*-values	P>|t|	[95% Conf. Int]	
Age	0.0084523	0 .0009346	9.04	<0.001	0.00662	.0102844
Distance	0.00022	.0069466	0.03	0.975	-0.01340	0.01384
Education level						
Primary educ	0.01404	.0093426	1.50	0.133	-0.00427	0.03236
Secondary educ	.0127461	.011507	1.11	0.268	-0.00981	.0353032
Tertiary educ	.0689085	.0159419	4.32	<0.001	0.03766	.1001594
Wealth quintile						
Poorer	.0143648	.0096574	1.49	0.137	-0.00457	.0332961
Middle	.0148378	.0102356	1.45	0.147	-0.00523	.0349026
Richer	.0376243	.0109652	3.43	0.001	.0161292	.0591194
Richest	.0498353	.0128073	3.89	<0.001	.0247291	.0749415
Residence	.0109793	.007468	1.47	0.142	-0.00366	.0256188
Place of delivery	.050395	.0064629	7.80	<0.001	.0377258	.0630642
ANC visits	.0209989	.0062815	3.34	0.001	.0086853	.0333125
Cons	-0.1631258	.019484 -	8.37	<0.001	-0.20132	-0.12493

Given that our null hypothesis is that the error term exhibits constant variance, and that the results of the test presented in table 4,6 indicate that all the variables have p values that are significant at the set level of 0.05, we have a reason to conclude that the data has no heteroskedasticity.

4.4 Inferential statistics

After confirming statistically that the data had no issues, we went ahead and carried out inferential analysis by use of probit modeling to establish the predictors of demand for Caesarean section delivery in Kenya after implementation of the free maternal health policy in the year 2013.

4.4.1 Probit regression results

This section provides a summary of the probit regression of factors influencing demand for Caesarean section delivery in public hospitals after the implementation of free maternal health care policy in Kenya.

Table 4.7: Probit regression of factors influencing demand for CS delivery

Mode of delivery	Coef.	St.Err.	*t*-value	[95%CI]	p-value	Sig
Age	**0.056**	0.007	8.25	0.043, 0.069	**<0.001**	***
Distance	**-0.020**	0.058	-0.35	-0.135, 0.094	**0.730**	
Primary edu	**0.245**	0.096	2.55 2.24	0.057, 0.433	**0.011**	**
Secondary edu	**0.234**	0.104	3.55	0.029, 0.438	**0.025**	**
Tertiary edu	**0.428**	0.121	2.46 2.60	0.192, 0.665	**<0.001**	***
Poorer	**0.217**	0.088	4.17	0.044, 0.390	**0.014**	**
Middle	**0.233**	0.090	3.99 1.67	0.058, 0.409	**0.009**	***
Richer	**0.375**	0.090	8.59	0.199, 0.551	**<0.001**	***
Richest	**0.398**	0.100	3.43 -20.80	0.203, 0.590	**<0.001**	***
Urban residence	**0.093**	0.056		-0.016, 0.203	**0.095**	*
Delivery in govt.	**0.433**	0.050		0.334, 0.531	**<0.001**	***
ANC visits	**0.176**	0.051		0.075, 0.276	**<0.001**	***
Constant	**-3.445**	0.166		-3.770, 3.120	**<0.001**	***

Mean dependent var	0.074	SD dependent var	0.263
Pseudo r-squared	0.109	Number of obs	7155.000
Chi-square	413.316	Prob> chi2	<0.001
Akaike crit. (AIC)	3406.405	Bayesian crit. (BIC)	3495.787

**** p<0.01, ** p<0.05, * p<0.1*

From the findings of the regression analysis presented in table 4.7, all the independent variables other than place of residence (**p=0.095**) and distance to nearest health facility (**p=0.73**) showed statistically significantly association with demand for Caesarean section delivery. The two variables were therefore dropped from the demand model.

Every additional year of age led to increase in demand for Caesarean delivery by 5.6% (95% CI= 0.043, 0.069; **p<0.001**). Women with primary level education had 2.5% higher demand for Caesarean section delivery than their counterparts without any formal education (95% CI= 0.057, 0.433; **p=0.011**). Those with secondary level education also had 2.3% higher demand compared to those without formal education (95% CI=0.029, 0.438; **p=0.025**) while those with tertiary level education had 4.3% higher demand for Caesarean section delivery than women without formal education (95% CI= 0.192, 0.665; **p<0.001**).

Increase in wealth quintile also led to an increase in demand for Caesarean section delivery. For example, those who were poorer had 2.1% higher demand for Caesarean section delivery that the poorest (95% CI=0.044, 0.390; **p=0.014**). Those in the middle wealth quintile had 2.3% higher demand for Caesarean section delivery than the poorest (95% CI=0.058, 0.409; p=**0.009**). Those who belonged to the richer category had 3.8 % higher demand for Caesarean section delivery than the poorest (95% CI=0.199, 0.551 ; **p<0.001**) while the richest had the highest demand for Caesarean section delivery with their demand levels being 4.0% higher than that of the poorest (95% CI=0.203, 0.590 ; **p<0.001**).

Delivery in a government hospital decreased demand for Caesarean section by 43% in comparison to delivery in a private hospital (95% CI=0.334, 0.531; **p<0.001**). On the other hand, attending the recommended number of antenatal clinic increased demand by 17.6% (95% CI= 0.075, 0.276; **p<0.001**).

4.4.2 The Econometric Model

The econometric model was estimated as follows:

$$\mathbf{CSD = \beta_0 + X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \square \ldots\ldots\ldots\ldots\ldots (1)}$$

Where

CSD=Demand for Caesarean section

β_0= A constant

X_1=Age of the mother at birth

X_2=Primary education

$\mathbf{X_3}$=Secondary education

$\mathbf{X_4}$=Tertiary education

$\mathbf{X_5}$= Poorest

$\mathbf{X_6}$= Middle income

$\mathbf{X_7}$=Richer

$\mathbf{X_8}$= Richest

$\mathbf{X_9}$= Number of ANC visits

$\mathbf{X_{10}}$= Place of delivery (Public or private hospital)

□= error term

Thus,

Y= -3.45 + 0.056 Age + **0.245** EduPri + **0.234** EduSec + **0.428** EduTer + **0.217** Poorer + **0.233** Middle + **0.375** Richer + **0.388** Richest + **0.176** ANC visits **- 0.433** Delivery govt + □**..... (2)**

Marginal effects after probit regression

Table 4.8 summarizes the marginal effects of the independent variables on the dependent variable after probit regression.

Table 4.8: Marginal effects after probit regression

Y =Pr (mode of delivery) (predict) = .0535581

Variable	dy/dx	Std.Err.	Z	P>z	[95%CI]	
Age	0.006	0.001	8.210	<0.001	[0.005	0.008]
Distance	-0.002	0.006	-0.350	0.728	[0.014	0.010]
Primary *	0.026	0.010	2.590	0.010	[0.006	0.047]
Secondary *	0.028	0.014	2.040	0.042	[0.001	0.056]
Tertiary*	0.062	0.022	2.810	0.005	[0.019	0.106]
Poorer*	0.026	0.012	2.250	0.025	[0.003	0.049]
Middle*	0.029	0.012	2.340	0.019	[0.005	0.053]
Richer*	0.050	0.014	3.530	<0.001	[0.022	0.078]
Richest*	0.054	0.016	3.310	0.001	[0.022	0.086]
Residence*	0.010	0.006	1.630	0.102	[0.002	0.023]
Delivery in gov hosp*	0.049	0.006	8.440	<0.001	[0.038	0.060]
ANC visits*	0.019	0.005	3.480	<0.001	[0.008	0.030]

(*) dy/dx is for discrete change of dummy variable from 0 to 1

4.4.3 Interpretation of marginal effects

The marginal effects on table 4.8 indicate that every additional year of age increases demand for Caesarean delivery in a public hospital by 0.6%. On distance, the findings indicate that those that stated that distance is not a big problem have reduced demand for delivering by Caesarean section in a government health facility by 0.2% compared to those that stated that distance is a big problem. Every additional year of primary education confers a 2.6% increase in demand for delivery by CS in a public hospital, every additional year of secondary and of tertiary education confers 2.8% and 6.2% increase in demand for delivery by CS in a public hospital respectively. On wealth index, those that are poorer have a 2.6% higher chance of delivering via CS than those that are poorest. Those in middle income, richer or richest quintiles have 2.9%, 5% and 5.4% higher demand for delivery via CS respectively, indicating that increase in income increases demand for delivery via CS. Delivering in a government hospital reduced demand for CS by 4.9% indicating either reduced access or lower chances of unindicated CS delivery in a government health facility. The results also indicate that every additional ANC visit increases demand for CS delivery by 1.9%.

4.5 Discussion of study findings

The overall rate of delivery by CS was 7.7%. This is well within the WHO recommended rate of 5-15% (WHO, 2015) and below the sub-Saharan African average which is 8.8% (Shah et al, 2009). In comparison to most other African countries, Kenya seems to be doing better since countries such as Rwanda have a very high CS rate of 64% (Yaya et al, 2018), Morocco 17.8% in 2016 (Soukayna et al, 2016), Mali and Senegal 19% (Briand et al, 2012). Tanzania increased from 19 to 49 between the year 2000 and 2011 (Litorp et al, 2013) while Ethiopian rates increased from 2.3% to 30.3% between 1995 and 2013 (Gebremedhin, 2014). Other African countries which have met the WHO targeted rate of CS deliveries include Ghana at 6.5% (Manyeh et al, 2018). Sao Tome and Principe however reported a rate of 0% which is below the recommended range (Yaya et al, 2018)

From the findings of this study, all the independent variables other than place of residence (**p=0.095**) and distance to nearest health facility (**p=0.73**) showed statistically significantly association with demand for Caesarean section delivery. This indicated that demand for

Caesarean delivery is not statistically significantly influenced by the factors of whether a woman resides in a rural or urban setting nor by the distance to the nearest health facility. These findings contradict those of Khanal et al who demonstrated in 2016 using multivariable logistic regression that women residing in urban neighbourhoods have higher demand for Caesarean section delivery than their rural counterparts. Distance also did not have statistically significant association with demand for Caesarean section delivery. This finding contradicts that of researchers in Uganda, Atuheire et al, who in 2019, by use of generalized linear models showed that in Uganda, increase in distance to nearest health facility affected demand for Caesarean section delivery negatively. This may indicate that the nationwide free maternal health policy is being implemented well across the country hence distance rural-urban differences in demand for Caesarean section delivery are no longer significant.

Increase in the age of the mother at birth was however found to increase demand for Caesarean section delivery. Every additional year of age led to increase in demand for Caesarean delivery by 5.6% (95% CI= 0.043, 0.069; **p<0.001**). These findings concur with those of Janoudi et al (2015) who used multivariable logistic regression to show that increase in maternal age affected demand for Caesarean delivery positively. Similar associations were observed by Zhifei et al (2016) in China who used multiple linear regression to demonstrate that increase in mother's age at birth increases the demand for Caesarean delivery. Vanahor et al in a Kenyan study in 2018 also found out that increase in age and parity of the mother increased demand for Caesarean section delivery. They used multinomial logistic regression analysis.

The more women age, the more likely they are to experience difficulties with normal vaginal delivery. Higher age also confers higher likelihood of a previous CS scar which has been associated with higher demand for CS delivery.

The level of education of the mother was also shown to have positive effect on the demand for Caesarean section delivery. Women with primary level education had 2.5% higher demand for Caesarean section delivery than their counterparts without any formal education (95% CI= 0.057, 0.433; **p=0.011**). Those with secondary level education also had 2.3% higher demand compared to those without formal education (95% CI=0.029, 0.438; **p=0.025**) while those with tertiary level education had 4.3% higher demand for Caesarean section delivery than women without

formal education (95% CI= 0.192, 0.665; **p<0.001**). These findings concur with those of Gebremedhin (2014) in Ethiopia, who used simple linear regression analysis to show that increase in the level of education of the mother increases the demand for Caesarean section delivery. Similar positive relationship between education of the mother and demand for Caesarean section delivery were reported by Beena et al in Colorado, United States of America in the year 2009. In their study, Beena et al used multivariable logistic regression models. Manyeh et al in 2018 also showed similar positive relationship between level of maternal education and demand for Caesarean section delivery in Ghana. They used multinominal logistic regression models.

It is expected that a woman with more education will most likely be able to make informed reproductive health choices for herself and is more able financially to procure Caesarean section delivery. The more educated woman is also more likely to be in formal employment hence own medical insurance cover that may increase demand for CS.

Increase in wealth income also led to an increase in demand for Caesarean section delivery. For example, those who were poorer had 2.1% higher demand for Caesarean section delivery that the poorest (95% CI=0.044, 0.390; **p=0.014**). Those in the middle income had 2.3% higher demand for Caesarean section delivery than the poorest (95% CI=0.058, 0.409; p=**0.009**). Those who belonged to the richer category had 3.8 % higher demand for Caesarean section delivery than the poorest (95% CI=0.199, 0.551 ; **p<0.001**) while the richest had the highest demand for Caesarean section delivery with their demand levels being 4.0% higher than that of the poorest (95% CI=0.203, 0.590 ; **p<0.001**).

Increase in income has been severally shown to increase demand for Caesarean delivery. Such a relationship was shown by Zahra et al in 2016 from a study in Iran where they used bivariate regression analysis. This positive relationship between income and demand for Caesarean section delivery was also shown by Manyeh et al in a study in Ghana in 2018 where they used multinomial logistic regression analysis

It is logically expected that a woman with higher income has a greater leverage to make key decisions on her reproductive health such as whether to take up Caesarean section delivery or not. They are also more likely to be better informed on health matters than those with less income.

We also found that attending the minimum four WHO recommended antenatal clinics increased demand for Caesarean section significantly. These findings are congruent to those of Padmadas and ZoeMathews in 2008 who used random intercept logistic regression modeling to show that increase in ANC attendance as well as increase in income of the mother increased demand for Caesarean section delivery. This trend may be attributed to the fact that information received in these clinics may demystify reproductive health and childbirth in general and even CS in particular, thereby empowering the women to make their choices on reproductive health freely.

In our study, we found out that delivering in a government health facility increased demand for Caesarean section delivery by 43. 3%. This finding contradicts most other studies which have previously shown higher demand for CS in private than public health facilities. For example, a survey of rates of Caesarean section deliveries in sub-Saharan African hospitals revealed that private health care facilities conduct more Caesarean deliveries (12.3%) compared to public health facilities at 7.9% (Yaya et al, 2018). In a study done in Bangladesh, it was found out that as much as 80% of all Caesarean deliveries conducted were in private facilities (Begum et al, 2017). Another Bangladeshi study also indicated that private hospitals have higher likelihood of performing a Caesarean section in a similar circumstance compared to public hospitals. In that study, it was actually noted that private hospitals had a C-section delivery rate of 90.47% whereas public hospitals had a rate of 30.28% (Rahman et al, 2015).

A study conducted in Ethiopia also showed that private health facilities conducted Caesarean deliveries more frequently (41.7%) than public health facilities (20.6%) indicating a likelihood of profit considerations hence supplier induced demand (Gebremedhin, 2014) A similar trend was reported from Brazil where the caesarean delivery rates in private hospitals at 86.2% were almost triple those in public health facilities at 29.9%. They also reported association between C-section in public hospitals and maternal age equal to or above 20 years, primiparity, twinning, ante-natal

care in private health facilities, delivering in a high level facility and attending more than six ANC visits (Vieira et al, 2015).

However, from our literature search, the only study which had similar findings to ours was one conducted in Lebanon where government health facilities had higher CS rates than private health facilities. This was attributed to influx of Syrian refugees who often did not prefer C-section to vaginal delivery but had no awareness about its complications and rarely had adequate ante natal care if at all (Huster et al, 2014)

CHAPTER FIVE
SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This section summarizes the findings of this study and proceeds to give conclusions and recommendations emanating from the study findings. It ends by stating the policy implications of the study findings.

5.2 Summary of findings

From the findings of this study, place of residence and distance to nearest health facility did not show statistically significantly association with demand for Caesarean section delivery. Education increased demand for CS; every additional year of age led to increase in demand for Caesarean delivery by 5.6%.

Increase in wealth quintile also led to an increase in demand for Caesarean section delivery. The demand increased from poorer through to middle and richer quintiles with the richest quintile having the highest demand for CS. Delivery in a government hospital increased demand for Caesarean section by 43% in comparison to delivery in a private hospital Similarly, attending the recommended minimum of four of antenatal clinics increased demand by 17.6%.

5.3 Conclusions

Kenya has Caesarean section rates within the WHO recommended range of 5-15%. Key predictors of demand for Caesarean section delivery in Kenya are maternal age, income, delivery in a government hospital and attending the recommended four ANC visits. The free maternal health policy seems to be succeeding since more delivering in government health facilities now seems to increase demand for CS.

5.4 Recommendations for further research

From the study findings, we recommend that a study should be carried out to analyze the policy implementation environment in order to identify the strong points that seem to make the policy succeed with respect to Caesarean section delivery. Further research on other aspects of maternal

health than CS should also be conducted in order to draw broader conclusions in the success of the policy.

5.5 Policy implications

The free maternal health policy seems to be doing well with respect to controlling the demand for CS within the WHO recommended range and in attracting more women to deliver via CS in government hospitals instead of private hospitals. It should therefore be accorded due support as this will eventually improve our key health indicators.

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6/12/2019

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by Maurice Kodhiambo

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