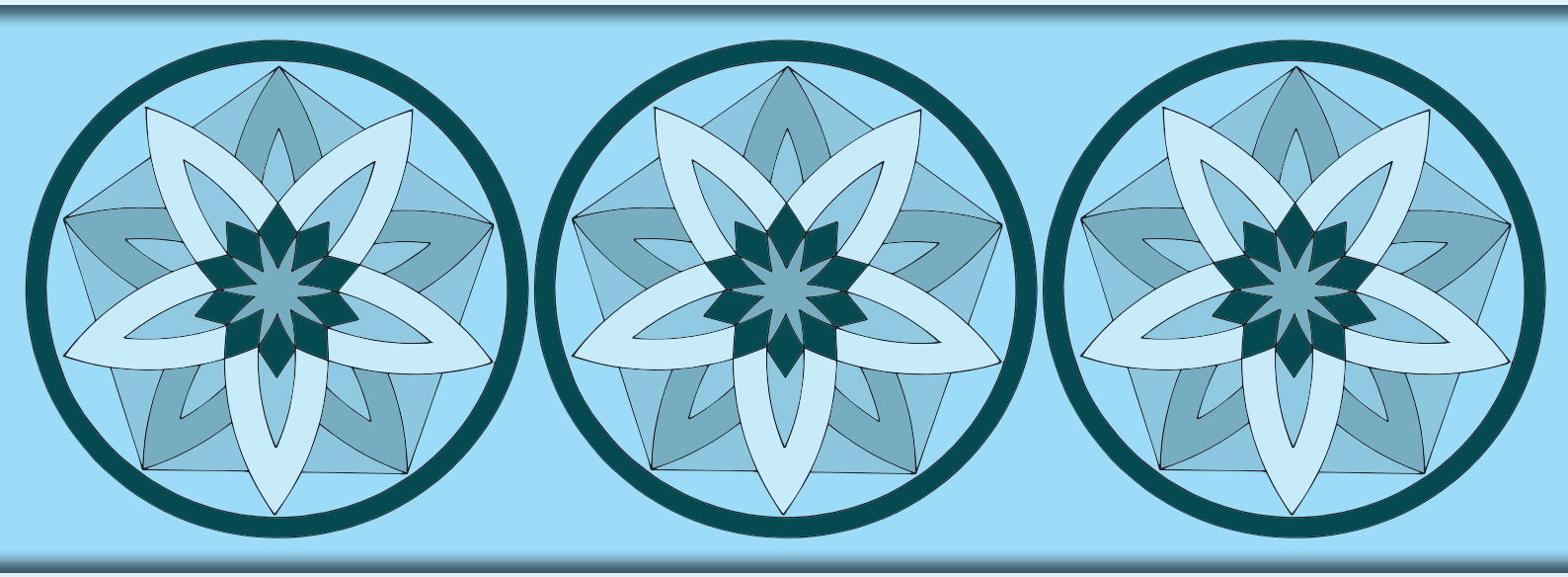
Determinants of Maternal Care Seeking in Kenya



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Determinants of Maternal Care Seeking in Kenya

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Additional information about the 2014 KDHS may be obtained from the Kenya National Bureau of Statistics (KNBS), P.O. Box 30266-00100 GPO, Nairobi, Kenya; telephone (Nairobi): 3317586/8, 3317612/22, 3317623, 3317651; fax: 3315977; e-mail: directorgeneral@knbs.or.ke, info@knbs.or.ke; website: www.knbs.or.ke.

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ABSTRACT

This study is a theory-driven analysis of the socio-demographic determinants of maternal care seeking in Kenya. Specifically, it examines predisposing, enabling, and need factors potentially associated with use of antenatal care (ANC), health facility delivery, and timely postnatal care (PNC).

This study uses data from the 2014 Kenya Demographic and Health Survey (KDHS) conducted among women age 15-49 with a live birth in the five years preceding the survey. It includes data from all 47 counties of Kenya, grouped contiguously into 12 regions. We apply Andersen's Behavioral Model of Health Services Use to examine socio-demographic predictors of health service use. We estimate logistic regression models for adequate use of ANC (defined as attending at least four ANC visits, starting in the first three months of pregnancy), delivery in a health facility, and PNC within 48 hours of delivery.

The odds of adequate ANC are significantly higher for women with a secondary or higher level of education, women in the richer and richest wealth quintiles, and women with low parity. Compared with the Nairobi region, women in the Mid Rift region and Nyanza North region have significantly higher odds of obtaining adequate ANC.

Delivery in a health facility is significantly more common among women with secondary or higher education, women in the richest wealth quintile, women in urban areas, women with only one child, women having no fertility risk, and women who received adequate ANC. Compared with the Nairobi region, women's odds of delivery in a facility are higher in the Central region and Upper Eastern region. Significantly lower odds are found in the Lower Eastern, Upper Rift, Mid Rift, and Western regions.

Receiving timely PNC—within 48 hours of delivery—is significantly associated with women's level of education. Similarly, women in the richest wealth quintile have higher odds of receiving timely PNC. Compared with the Nairobi region, only Upper Eastern region and Nyanza North region have significantly higher odds for PNC within 48 hours. Three other regions have significantly lower odds compared with Nairobi: the North Eastern, Upper Rift, and Western regions. Primiparous women have higher odds of timely PNC than women with two or more children. Higher odds of PNC are also found among women with no fertility risk compared with those with fertility risk. Women who received at least four ANC visits and women who delivered at a health facility also are significantly more likely to receive PNC in the 48 hours after childbirth.

A common set of factors examined in the study is associated with use of ANC, health facility delivery, and timely PNC. These include women's education (predisposing factor), wealth quintile and region (enabling factors), and parity and fertility risk (need factors). Results also suggest that need factors, including experience with prior stages of care, are more prominent than predisposing and enabling factors in their influence on maternal care-seeking behavior.

1 BACKGROUND

1.1 Introduction

The world has witnessed a global decline in maternal mortality in recent years, from 380 maternal deaths per 100,000 live births in 2000 to 210 per 100,000 in 2013 (WHO and USAID 2015). The maternal mortality ratio, however, has not improved significantly for some regions. Sub-Saharan Africa, for example, with 13% of the world's population, accounts for 52% of all maternal deaths, especially among the poor, uneducated, and marginalized rural groups (Warren 2015). In Kenya maternal mortality declined from 687 to 510 deaths per 100,000 live births between 1990 and 2015—still far above the global average. In order to address the problem of maternal mortality, improvements in the quality and coverage of antenatal care (ANC), hospital delivery, and postnatal care (PNC) are required.

ANC is considered part of the continuum of care needed in order to improve maternal health and survival. ANC presents several opportunities to reach pregnant women and provide information and education on pregnancy care and safe delivery. The effectiveness of ANC interventions to improve fetal outcomes—such as tetanus vaccination, malaria treatment and prevention, anemia and STI management, and adequate nutrition—depends both on the number of ANC visits and timing during pregnancy at which ANC visits begin (Bua et al. 2015). Minimum standards for adequate use of ANC are considered to be met when women attend at least four ANC visits during the course of the pregnancy, with the first visit within the first trimester. In sub-Saharan Africa, even though 69% of pregnant women attend ANC at least once in a pregnancy, few start in the first trimester and make the four minimum recommended visits (Lincetto et al. 2006).

Given the challenges facing health care resources in most developing countries, health facility delivery provides an opportunity for women to receive assistance from a skilled birth attendant. Health facility delivery ensures timely and proper care during delivery, since many deaths occur around labor and during delivery; hence the need for skilled birth attendants (Bua et al. 2015). In 2013 the government of Kenya rolled out a program offering free maternal services within public health facilities, with the aim to promote access to facility delivery across the county (Bournannais 2013). The 2014 Kenya Demographic and Health Survey (2014 KDHS) reported that 61% of women with a recent birth delivered in a health facility (KNBS et al. 2015).

Timely postnatal care as defined in this study covers the first two days after delivery. A checkup within the critical first 48 hours after delivery is essential for a woman, as this period is one of the high risk moments which, when ignored, leads to high mortality rates. Analysis of DHS data among 23 countries in sub-Saharan Africa found that only 13% of women who deliver at home receive PNC within 48 hours (Lawn and Kreber 2006). The 2014 KDHS national average was 53% for PNC within the first two days, and just 39% among women not delivering at a hospital (KNBS et al. 2015).

The present study is an examination of the determinants of these three critical aspects—antenatal care, facility delivery, and postnatal care—of maternal care seeking in Kenya, using nationally representative data from the 2014 KDHS.

1.2 Analytical Framework

The literature on poor use of ANC identifies parity, age of the woman, wealth, and education among individual socio-demographic factors affecting ANC attendance (Rurangwira et al. 2017; Mungai and

Oleche 2016). Other studies have cited user fees, distance to a health facility, waiting times, inadequate ANC communication and knowledge, dehumanizing care at a facility, and social and cultural barriers to ANC use (Pell et al. 2013; LeGrand and Adjiwanor 2013).

Studies of health facility delivery show different factors that influence use. A review of the literature indicates socio-demographic factors associated with low levels of health facility delivery include women's lack of education, rural residence, low wealth status, and religion, as well as insufficient ANC visits (Mazalale et al. 2015; Samson 2012). Low levels of use of health facility delivery have also been attributed to unpredictable timing of labor and availability transport, cost of facility-based delivery care, husband's preferences, health facility staff attitudes, and women's previous experiences and habits (Mason et al. 2015). Omollo (2016) cites distance, travel cost, medicine cost, poor roads, lack of nighttime travel services, verbal abuse and negative attitude from some health workers, and long waiting hours.

The literature on use of postnatal care indicates factors that include women's age, education, income, use of ANC, proximity to a health facility, and cultural practices (Gitumu et al. 2015; Belachew, Taye, and Belachew 2016; Magango 2013).

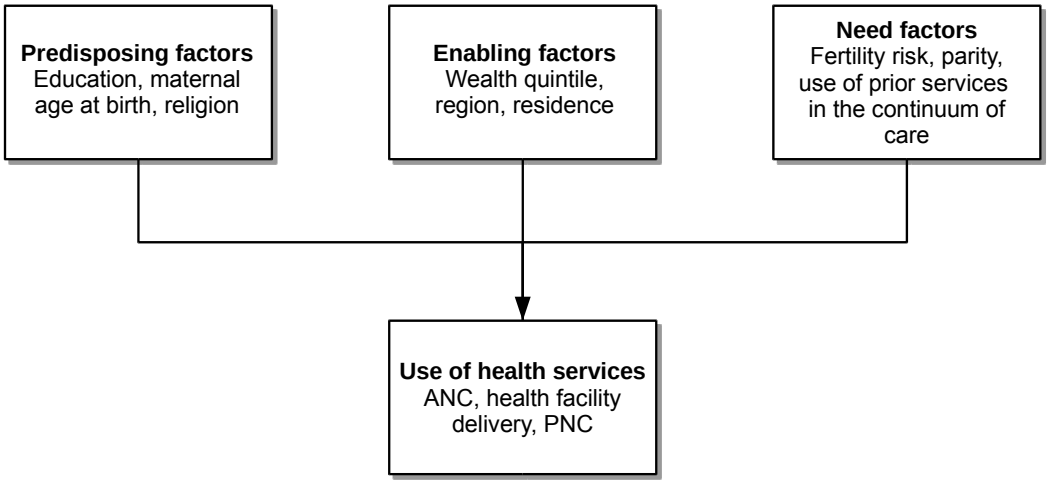
The analytical framework selected for this study is the Andersen Behavioral Model of Health Services Use (Andersen and Newman 2005). The Andersen model centers on the individual as the unit of analysis and examines differences in use of health services from a socio-demographic perspective. An advantage of this model is that it easily incorporates information on women's background characteristics available in the KDHS and other Demographic and Health Surveys. The model postulates that decisions on use of health services (outcome factors) are largely influenced by a number of determinant factors, which are grouped as: predisposing factors, enabling factors, and need factors.

Predisposing factors are the social and cultural characteristics among individuals prior to the need for care that characterize their propensity to use health services. In Andersen's model, predisposing factors consist of demographic characteristics such as age, sex, marital status, and prior illness, as well as factors capturing social structure like education, ethnicity, occupation, family size, and religion, and health attitudes and beliefs (Andersen and Newman 2005).

Enabling factors refer to characteristics, generally related to the family or community, that contextualize an individual's ability to secure services. Variables corresponding to this component of the model refer to an individual's means to seek health care, including wealth or income, health insurance coverage, distance to and accessibility of services, price structure of services, provider-to-population ratio, rural or urban residence, or region of the country (Andersen and Newman 2005).

Need factors consist of both perceived needs and evaluated needs (Andersen and Newman 2005). Perceived needs are self-judgments of the urgency and magnitude of the health concern or of the probability that its occurrence is sufficient to warrant seeking care. They can be operationalized through self-reported symptoms, perception of disability, or a self-report of one's general state of health. Evaluated needs are those based on a physical exam, clinical diagnosis, or external, objective criteria of the need for medical care.

Figure 1 Analytical framework



Note: Modified from the Andersen Behavioral Model of Health Services Use (Andersen and Newman 2005).

We adopt and modify the Andersen model based on the 2005 revised framework (Figure 1). We apply this framework to understand factors that facilitate three maternal care-seeking outcomes: ANC use, facility delivery, and timely receipt of PNC.

As Figure 1 shows, our analysis uses data from the 2014 KDHS on education level of the respondent, religion, and maternal age at birth as direct predisposing factors. Enabling factors in this study are household wealth, region, and residence. Household wealth quintile is a close proxy for financial-related access to health services, while region and residence are good proxies for the physical accessibility of health services, given the inequalities in health provision that exist between urban and rural communities, where urban areas are endowed with more services and urban residents are closer to good-quality health care. Similarly, in Kenya variation exists among the regions in the distribution and availability of maternal health services (Mbugua and MacQuarrie 2018).

Finally, we use fertility risk and parity as reflective of need factors, given the fact that they explain previous experiences with maternal health issues or the anxiety for younger or older women of risk of pregnancy and its outcome. Women with heightened fertility risk, according to external criteria, have greater need of and may be more likely to use maternal health services. Primiparous women may also have greater need of maternal health services than women with previous childbearing experience because they have greater educational needs; may benefit more from the professional advice and guidance of skilled providers through this novice experience; and may be more likely to experience complications during pregnancy and delivery (Letamo and Rakgoasi 2003; Kaur and Kaur 2012; Jordan et al. 2014).

We also consider use of a prior service in the continuum of maternal health care among need factors (ANC affecting facility delivery; ANC or facility delivery affecting PNC). We do so because counseling on the need for facility delivery is one explicit component in the protocol for quality ANC, and because ANC and facility delivery provide opportunities to identify additional health concerns and thus may serve as proxies for clinical diagnosis.

This study examines these predisposing, enabling, and need factors in association with adequate ANC use (at least four ANC visits with the first visit within the first three months), health facility delivery, and timely PNC (within 48 hours after delivery), through both unadjusted and adjusted odds ratio analysis.

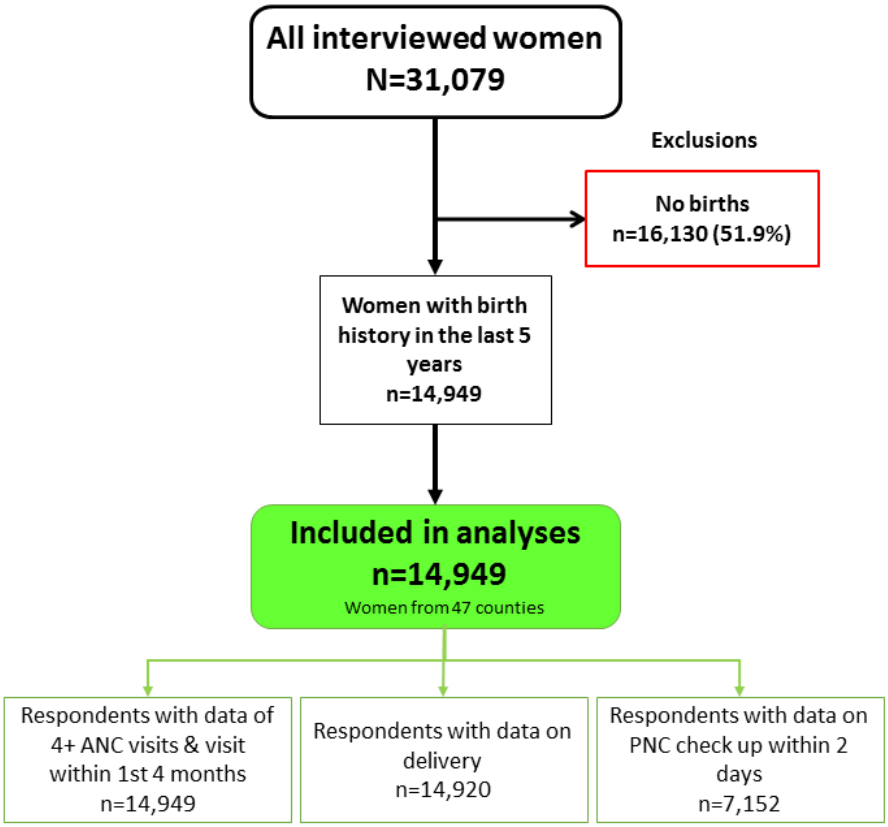
2 METHODS

2.1 Data and Study Design

This study uses data from the 2014 Kenya DHS (KDHS) survey. DHS surveys employ a standardized questionnaire, based on a multistage cluster sampling design to acquire nationally representative data. More specific information on the sampling design is available in the KDHS final report (KNBS et al. 2015).

Figure 2 shows the sample selection criteria used. The respondents for this study are 14,949 women age 15-49 with a live birth in the five years preceding the survey, including 7,152 women who were interviewed with questions related to PNC for live births in the last three years. The 2014 KDHS consists of two subsamples. In one in every two households, eligible women were administered the long questionnaire, producing indicators designed to be representative at the national, regional, and urban-rural levels. In the other half, eligible women were administered the short questionnaire—a subset of questions from the long questionnaire designed to produce indicators representative not only at the national, regional, and urban-rural levels but also at the county level (KNBS et al. 2015). While questions on antenatal and delivery care were included in both the long and short questionnaires, and therefore available for the full sample, questions on postnatal care were included only in the full questionnaire, and therefore available only for about one half of all women interviewed.

Figure 2 Sample selection flow diagram



2.2 Variables

The outcome variables for this study are adequate ANC use, delivery at a health facility, and timely PNC. Table 1 presents the operational definition of the outcome variables and the corresponding population base.

Table 1 Definition of outcome variables

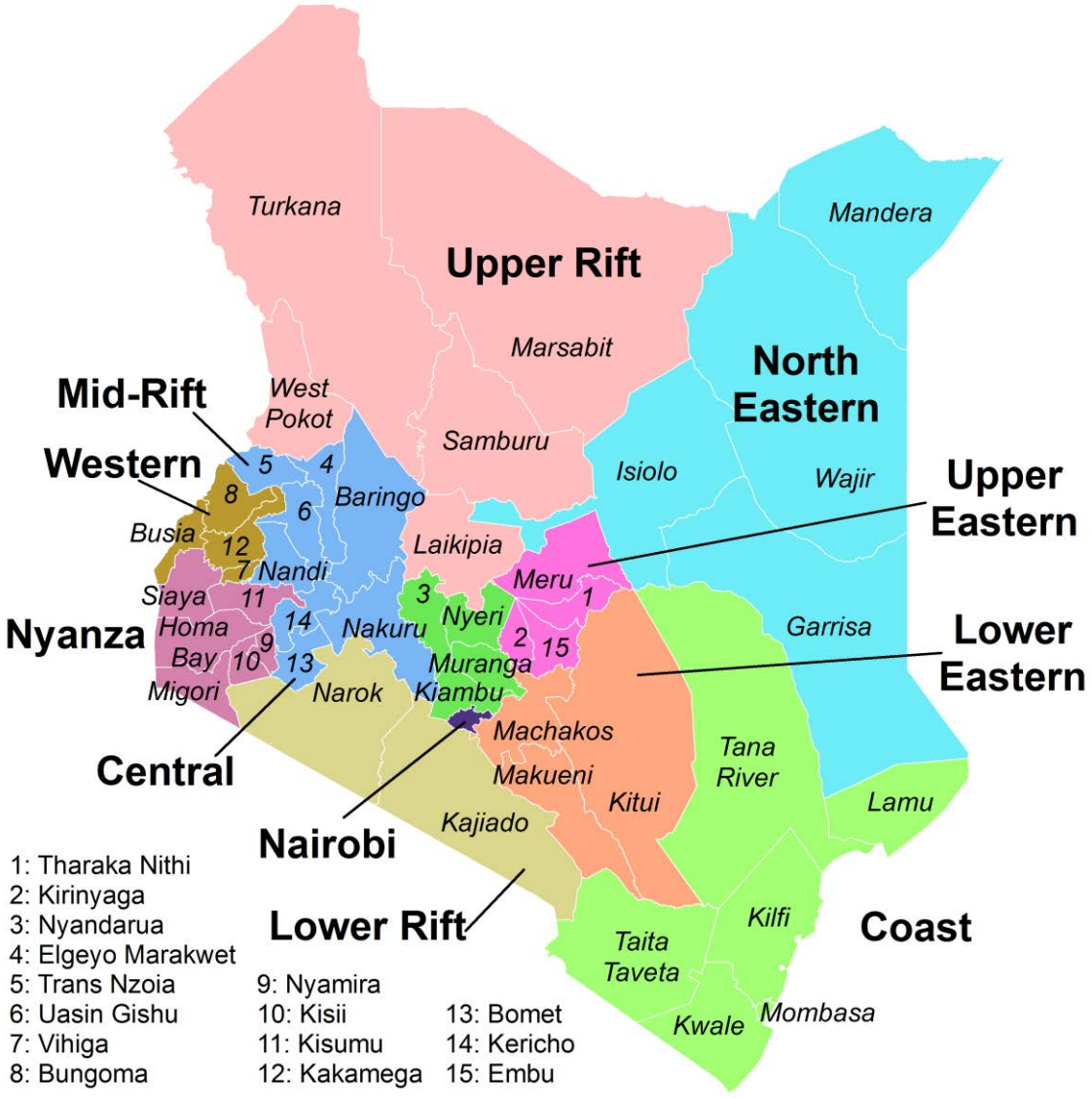
Indicator	Definition	Population base
ANC use	Percentage of women who have at least four ANC visits, including a visit in the first three months of pregnancy for their most recent pregnancy	Women age 15-49 with a live birth in the five years preceding the survey
Health facility delivery	Percentage of women who deliver at a health facility for their most recent pregnancy	Women age 15-49 with a live birth in the five years preceding the survey
Timely PNC	Percentage of women who receive a PNC checkup within 48 hours of delivering their most recent birth	Women age 15-49 (from one in every two households) with a live birth in the five years preceding the survey

Variables for predisposing factors include maternal age at birth, the woman's education level, and religion. Maternal age at birth is computed in completed years and then categorized as younger than age 20, age 20-29, age 30-39, and age 40-49. Women are categorized as having completed no education, primary education, or secondary or higher education. The religious categories used are Catholic, Protestant, or other.

Variables for enabling factors include household wealth quintile, residence, and region (based on the contiguous grouping of 47 Kenyan counties into 12 regions that are climatically and ethnically homogenous). The wealth variable is a pre-calculated variable included in standard DHS recode datafiles and is based on a set of assets owned by the household (Rutstein 2008; Rutstein and Johnson 2004). Residence is defined as either rural or urban in the master sampling frame used by the 2014 KDHS, which is the Fifth National Sample Survey and Evaluation Programme (NASSEP V) (KNBS et al. 2015).

As mentioned, we group the 47 counties in the KDHS into 12 regions (see Figure 3). The 12 regions are Nairobi, Central (Nyandarua, Nyeri, Kiambu, and Muranga), North Eastern (Isiolo, Garrisa, Wajir, and Mandera), Lower Eastern (Kitui, Machakos, and Makueni), Lower Rift (Kajiado and Narok), Mid Rift (Baringo, Nandi, Uasin Gishu, Nakuru, Kericho, Trans Nzoia, Elgeyo Marakwet, and Bomet), Upper Rift (West Pokot, Laikipia, Turkana, Samburu, and Marsabit s), Western (Bungoma, Kakamega, Vihiga, and Busia), Nyanza (Kisii, Nyamira, Siaya, Homa Bay, Kisumu, and Migori), Coast (Lamu, Mombasa, Kwale, Kilfi, Tana River, and Taita Taveta), Upper Eastern (Meru, Embu, Kirinyaga, and Tharaka Nithi).

Figure 3 Map of Kenya with 47 counties in 12 regional groups



Note: Names of 15 of the 47 counties were too small to list on the map and are designated here by number instead.

Variables related to need factors include fertility risk and parity (number of births). Women with fertility risk are defined as meeting one of the following criteria: women either younger than age 18 at time of birth, or age 35 or older at time of birth, women with a short birth interval (<24 months), or women with four or more births prior to the index pregnancy. Parity is the number of births inclusive of the index pregnancy and is categorized as primiparous (one birth) or multiparous (two or more births). In addition to these variables, which can affect all three care-seeking outcomes, use of ANC services can affect use of facility delivery and PNC, while facility delivery can affect use of PNC.

2.3 Data Analysis

Data are analyzed using Stata SE 12 (StataCorp 2011). Descriptive statistics are presented mainly as frequency and percentages because most of the variables are categorical, alongside 95% confidence intervals.

We fit an unadjusted logistic regression model to assess whether there are any associations between each of the three outcomes (ANC use, facility delivery, and PNC within 48 hours after delivery) and the independent/determinant variables. In the multivariate analysis we fit an adjusted binary logistic regression model while controlling for each factor. The models for each outcome specify a common set of predisposing factors (maternal age at birth, education, religion), enabling factors (wealth, residence, region), and need factors (parity, fertility risk).

Also, our models for the three outcomes are additive in that the model for facility delivery includes a measure for experience with ANC use and the model for timely PNC includes measures for ANC use and for facility delivery. This sequence of models allows us to assess the role of experience with a previous stage in the continuum of care—itself conceptualized as a need-factor variable—but also to implicitly assess the extent to which the outcomes have a common set of socio-demographic determinants or the extent to which those determinants act indirectly through their influence on the previous step in care seeking.

In our analysis we use the *svyset* suite of commands in Stata to adjust for the complex sampling design used in the DHS (KNBS et al. 2015). We use the weights provided in the women's dataset in the 2014 KDHS, which account for sampling probability and non-response. All statistical testing is performed at the 95% significance level.

3 RESULTS

3.1 Sample Characteristics

Table 2 shows the characteristics of the respondents, grouped by predisposing factors, enabling factors, and need factors. Among predisposing factors, over three-quarters (78%) of respondents are age 20-39,

Table 2 Sample Profile: Percent distribution of socio-demographic characteristics of respondents (n=14,949)

Characteristics	N	Percent
Predisposing factors		
Maternal age at birth		
<20	2,664	17.8
20-29	7,573	50.7
30-39	4,128	27.6
40+	584	3.9
Education		
None	2,790	18.7
Primary	7,843	52.5
Secondary or higher	4,316	28.8
Religion [1]		
Catholic	2,873	19.2
Protestant	9,474	63.5
Other	2,576	17.3
Enabling factors		
Household wealth quintile		
Poorest	4,517	30.2
Poorer	3,045	20.4
Middle	2,628	17.6
Richer	2,465	16.5
Richest	2,294	15.3
Residence		
Urban	5,164	34.5
Rural	9,785	65.5
Regions		
Nairobi	428	2.9
Central	1,197	8.0
North Eastern	925	6.2
Upper Eastern	1,377	9.2
Low er Eastern	922	6.2
Upper Rift	1,054	7.1
Mid Rift	1,893	12.6
Low er Rift	1,813	12.1
Nyanza North	1,025	6.9
Nyanza South	1,060	7.1
Western	1,398	9.4
Coast	1,857	12.3
Need factors		
Parity		
1 child	3,235	21.6
2+ children	11,714	78.4
Fertility risk [2]		
No risk	7,056	47.2
High risk	7,893	52.8

[1] Missing data on religion for 26 cases (n=14,923).

[2] Fertility risk is defined as meeting one of the follow ing criteria: younger than age 18 at time of birth, age 35 or older at time of birth, birth interval <24 months, or four or more births.

and about half (53%) have a primary level of education. About two-thirds (64%) are of the Protestant religion. Among enabling factors, about half of the respondents are in the poorest and poorer wealth quintiles, while the other half are distributed fairly evenly among the top three wealth quintiles. Two-thirds of the women are rural (66%). Among the need factors, 78% of respondents have two or more children, and a slight majority of women are from the Mid Rift, Lower Rift, and Coast regions. Respondents are divided about equally between the no-risk and high-risk fertility categories (47% versus 53%).

3.2 Use of Antenatal Care

Table 3 shows the percentage of women who obtained adequate ANC, grouped by predisposing, enabling, and need factors. Overall, only 18% of the respondents have obtained at least four ANC visits with their first visit in the first three months. By predisposing characteristics, ANC use is highest among women age 20-29 (20%), women with secondary or higher education (26%), and Catholics (20%). Regarding enabling factors, women in the richest wealth quintile (30%), women in urban areas (24%), and residents of Nairobi (28%) are more likely to use ANC compared with their counterparts elsewhere. According to need factors, primiparous women (24%) and women with no fertility risk (22%) are more likely to use ANC than women with two more children or women with high fertility risk.

Table 3 Distribution of antenatal care use across predisposing, enabling, and need factors, 2014 KDHS (n=14,949)

Characteristics	N	Percent	95% CI
Total	14,949	18.1	(17.2-19.1)
Predisposing factors			
Maternal age at birth			
<20	2,664	16.9	(14.9-19.2)
20-29	7,573	19.7	(18.3-21.2)
30-39	4,128	16.3	(14.7-18.1)
40+	584	14.2	(10.8-18.3)
Education			
None	2,790	10.7	(8.9-12.9)
Primary	7,843	14.4	(13.4-15.5)
Secondary or higher	4,316	25.7	(23.9-27.7)
Religion [1]			
Catholic	2,873	19.6	(17.6-21.7)
Protestant	9,474	18.4	(17.2-19.6)
Other	2,576	13.5	(11.0-16.4)
Enabling factors			
Household wealth quintile			
Poorest	4,517	11.2	(9.9-12.7)
Poorer	3,045	14.4	(12.8-16.1)
Middle	2,628	15.0	(13.4-16.8)
Richer	2,465	18.5	(16.3-20.9)
Richest	2,294	29.7	(27.3-32.2)
Residence			
Urban	5,164	23.8	(22.1-25.7)
Rural	9,785	14.5	(13.6-15.5)
Regions			
Nairobi	428	27.6	(23.5-32.3)
Central	1,197	20.9	(17.8-24.4)
North Eastern	925	8.8	(6.3-12.2)
Upper Eastern	1,377	13.2	(10.4-16.6)
Low er Eastern	922	18.4	(15.6-21.6)
Upper Rift	1,054	13.0	(9.6-17.4)
Mid Rift	1,893	13.8	(11.7-16.2)
Low er Rift	1,813	16.1	(14.0-18.5)
Nyanza North	1,025	24.3	(20.9-28.0)
Nyanza South	1,060	14.7	(12.5-17.2)
Western	1,398	17.3	(15.0-19.9)
Coast	1,857	16.7	(14.8-18.8)
Need factors			
Parity			
1 child	3,235	24.0	(22.0-26.2)
2+ children	11,714	16.2	(15.2-17.2)
Fertility risk [2]			
No risk	7,056	21.8	(20.3-23.3)
High risk	7,893	14.1	(13.1-15.2)

Note: At least four ANC visits w ith first visit in the first three months

[1] Missing data on religion for 26 cases (n=14,923).

[2] Fertility risk is defined as meeting one of the follow ing criteria: younger than age 18 at time of birth, age 35 or older at time of birth, birth interval <24 months, or four or more births.

3.2.1 Factors associated with antenatal care use

The predisposing, enabling, and need factors are used as determinant variables in unadjusted and adjusted odd ratio analysis, as Table 4 shows. Overall, the unadjusted odds indicate that multiple predisposing, enabling, and need factors are associated with ANC use.

3.2.2 Bivariate logistic regression analysis (unadjusted)

The unadjusted odds ratio analysis for determinant variables echoes the findings of bivariate distributional analysis. Age at birth, education, and religion are each predisposing factors significantly associated with ANC use in separate bivariate models. Women age 20-29 have 1.5 greater odds of adequate ANC use (OR 1.5, CI 1.1-2.1) compared with women age 40-49. Women younger than age 20 and women age 30-39 are not significantly different from women age 40-49 in their ANC care-seeking behavior.

Among enabling factors, level of education is significantly positively associated with ANC use: Both women with primary education (OR1.4, CI 1.1-1.8) and those with secondary or higher education (OR 2.9, CI 2.3-3.6) have greater odds compared with women with no education. Both Catholics (OR 1.6, CI 1.2-2.0) and Protestants (OR 1.4, OR 1.1-1.8) have significantly higher odds compared with other religions.

Women in the poorer, middle, richer, and richest wealth quintiles have significantly higher odds of adequate ANC, ranging from 1.3 to 3.3 times the odds of the poorest wealth quintile. Rural residents have lower odds of adequate ANC compared with urban residents (OR 1.8, CI 1.6-2.1). Compared with Nairobi region, all other regions show significantly lower odds of adequate ANC use.

Having only one child is also significantly associated with ANC use (OR 1.6, CI 1.4-1.9) compared with women with higher parity. Meanwhile, women without fertility risk have higher odds of adequate ANC (OR 1.7, CI 1.5-1.9) compared with women with high fertility risk.

3.2.3 Multivariate logistic regression analysis (adjusted)

Table 4 also shows that, after adjusting for other factors, among the predisposing factors women's education remains statistically significant in its association with ANC use, while among the enabling factors wealth and region remain statistically significant, and both need factors—parity and fertility risk—remain statistically significantly associated with ANC use.

Table 4 Unadjusted and adjusted odds ratios for antenatal care use: Results from binary logistic regressions, 2014 KDHS (n=14,920)

Characteristics	Unadjusted OR	95% CI	Adjusted OR	95% CI
Predisposing factors				
Maternal age at birth				
<20	1.2	(0.9-1.8)	0.8	(0.5-1.1)
20-29	1.5 *	(1.1-2.1)	0.9	(0.7-1.3)
30-39	1.2	(0.9-1.6)	0.9	(0.7-1.3)
40+	ref.		ref.	
Education				
None	ref.		ref.	
Primary	1.4 **	(1.1-1.8)	1.0	(0.8-1.3)
Secondary or higher	2.9 ***	(2.3-3.6)	1.5 *	(1.1-2)
Religion				
Catholic	1.6 ***	(1.2-2)	1.0	(0.7-1.4)
Protestant	1.4 *	(1.1-1.8)	1.0	(0.7-1.4)
Other	ref.		ref.	
Enabling factors				
Household wealth quintile				
Poorest	ref.		ref.	
Poorer	1.3 **	(1.1-1.6)	1.2	(0.9-1.4)
Middle	1.4 ***	(1.2-1.7)	1.1	(0.9-1.4)
Richer	1.8 ***	(1.5-2.2)	1.3 *	(1.1-1.6)
Richest	3.3 ***	(2.8-4)	2.1 ***	(1.7-2.8)
Residence				
Urban	1.8 ***	(1.6-2.1)	1.0	(0.9-1.2)
Rural	ref.		ref.	
Regions				
Nairobi	ref.		ref.	
Central	0.7 *	(0.5-0.9)	0.9	(0.6-1.2)
North Eastern	0.3 ***	(0.2-0.4)	0.6	(0.4-1.1)
Upper Eastern	0.4 ***	(0.3-0.6)	0.7	(0.5-1)
Lower Eastern	0.6 ***	(0.4-0.8)	1.1	(0.8-1.5)
Upper Rift	0.4 ***	(0.3-0.6)	1.0	(0.6-1.5)
Mid Rift	0.4 ***	(0.3-0.6)	0.7	(0.5-1)
Lower Rift	0.5 ***	(0.4-0.7)	0.8	(0.6-1.1)
Nyanza North	0.8	(0.6-1.1)	1.6 **	(1.2-2.2)
Nyanza South	0.5 ***	(0.3-0.6)	0.9	(0.6-1.2)
Western	0.5 ***	(0.4-0.7)	1.1	(0.8-1.5)
Coast	0.5 ***	(0.4-0.7)	0.9	(0.7-1.2)
Need factors				
Parity				
1 child	1.6 ***	(1.4-1.9)	1.3 **	(1.1-1.5)
2+ children	ref.		ref.	
Fertility risk [1]				
No risk	1.7 ***	(1.5-1.9)	1.2 **	(1.1-1.4)
High risk	ref.		ref.	

* p≤0.05; ** p≤0.01; *** p≤0.001
Note: At least four ANC visits with first visit in the first three months
[1] Fertility risk is defined as meeting one of the following criteria: younger than age 18 at time of birth, age 35 or older at time of birth, birth interval <24 months, or four or more births.

Compared with women with no education, women with secondary and higher level of education have significantly higher odds of adequate ANC (AOR 1.5, 1.1-2.0). No significant difference is detected for women with primary education, after controlling for other factors.

Women in the richer wealth quintile (AOR 1.3, 1.1-1.6) and in the richest quintile (AOR 2.1, 1.7-2.8) have significantly higher odds of adequate ANC compared with women in the poorest wealth quintile, while odds for women in the middle and poorer wealth quintiles are similar to women in the poorest quintile.

Compared with Nairobi region, only women in Nyanza North region (AOR 1.6, CI 1.2-2.2) have significantly higher odds of adequate ANC, a reversal in direction when controlling for other factors. No other regional differences are significant, although the results for women in Upper Eastern and Mid Rift regions appear to be borderline non-significant.

The adjusted odds of adequate ANC are significantly higher for women with low parity (AOR 1.3, CI 1.1-1.5) compared with those with higher parity, and higher for women with no fertility risk (AOR 12 CI 1.1-1.4) compared with women with high fertility risk, results which are robust to the inclusion of other factors in the model. The predisposing factors of maternal age at birth and religion and the enabling factor of residence are no longer statistically significant in the multivariate model.

3.3 Facility Delivery

Overall, two-thirds of women in Kenya delivered their most recent birth in a health facility, according to the 2014 KDHS (Table 5). Among predisposing factors, women older than age 40 at childbirth have the lowest rates of facility delivery (48%) compared with all other age groups, while women age 20-29 have the highest rates (69%). Women with a secondary or higher level of education are more likely to give birth in a health facility (86%) compared with the other education categories, as are Catholics (70%) and Protestants (68%).

For the enabling factors, wide regional disparities exist, with high rates of facility delivery in Nairobi and Central regions (each 91%), and lowest in Upper Rift (29%) and North Eastern regions (31%). A higher percentage of women in the richer wealth quintile (82%) or richest quintile (93%) deliver in a health facility compared with the poorer quintiles, as is also true for women in urban areas (84%) compared with rural areas (55%). For need factors, women with no fertility risk (78%) and women with low parity (84%) are more likely to deliver in a health facility than women with high fertility risk (53%) and women with two or more children (60%). Women who obtain adequate ANC also have a higher proportion (80%) delivering at a health facility compared with other women.

Table 5 Distribution of facility delivery across predisposing, enabling, and need factors, 2014 KDHS (n=14,949)

Characteristics	N	Percent	95% CI
Total	14,949	66.1	(64.7-67.4)
Predisposing factors			
Maternal age at birth			
<20	2,664	68.5	(66.0-71.0)
20-29	7,573	69.2	(67.4-70.9)
30-39	4,128	60.5	(58.2-62.8)
40+	584	48.0	(42.7-53.4)
Education			
None	2,790	27.7	(24.3-31.3)
Primary	7,843	59.6	(57.8-61.3)
Secondary or higher	4,316	86.4	(85.1-87.7)
Religion [1]			
Catholic	2,873	69.7	(67.3-72.0)
Protestant	9,474	67.6	(66.1-69.2)
Other	2,576	47.1	(42.9-51.4)
Enabling factors			
Household wealth quintile			
Poorest	4,517	33.6	(31.1-36.2)
Poorer	3,045	53.3	(50.8-55.7)
Middle	2,628	65.4	(62.9-67.8)
Richer	2,465	82.1	(79.9-84.1)
Richest	2,294	93.0	(91.5-94.3)
Residence			
Urban	5,164	84.3	(82.6-85.8)
Rural	9,785	54.7	(52.8-56.5)
Regions			
Nairobi	428	90.5	(86.6-93.3)
Central	1,197	91.0	(88.8-92.8)
North Eastern	925	30.7	(24.9-37.2)
Upper Eastern	1,377	76.7	(73.0-80.0)
Low er Eastern	922	57.5	(51.8-63.0)
Upper Rift	1,054	29.2	(22.3-37.2)
Mid Rift	1,893	54.7	(50.4-58.8)
Low er Rift	1,813	61.3	(57.2-65.3)
Nyanza North	1,025	69.7	(64.5-74.4)
Nyanza South	1,060	68.0	(63.3-72.5)
Western	1,398	51.6	(47.5-55.7)
Coast	1,857	62.8	(58.7-66.8)
Need factors			
Parity			
1 child	3,235	83.8	(82.0-85.4)
2+ children	11,714	60.1	(58.6-61.7)
Fertility risk [2]			
No risk	7,056	78.0	(76.6-79.4)
High risk	7,893	52.9	(51.0-54.7)
ANC use [3]			
No	12,579	63.0	(61.6-64.5)
Yes	2,341	79.7	(77.5-81.8)

[1] Missing data on religion for 26 cases (n=14,923).

[2] Fertility risk is defined as meeting one of the follow ing criteria: younger than age 18 at time of birth, age 35 or older at time of birth, birth interval <24 months, or four or more births.

[3] At least four ANC visits w ith first visit in the first three months

3.3.1 Factors associated with health facility delivery

Table 6 shows results of bivariate and multivariate analysis with facility delivery as the outcome variable and predisposing, enabling, and need factors as possible determinants. The results of the

unadjusted (bivariate) odds ratio analysis indicate that all variables in each of the three factors are significantly related to facility delivery.

3.3.2 Bivariate logistic regression analysis (unadjusted)

For the predisposing factors, younger women have higher odds of facility delivery than older women, with the odds decreasing as women's age increases. Women under age 20 and women age 20-29 have 2.4 greater odds of facility delivery, and women age 30-39 have 1.7 greater odds compared with women age 40 and over. The odds of facility delivery increase consistently with education level; women with secondary or higher education have the highest odds (OR 16.7, CI 13.5-20.6). Catholic and Protestant women have approximately two and a half times the odds of facility delivery compared with other religions.

With regard to the three enabling factors, women in urban communities have four times higher odds of facility delivery (OR 4.4, CI 3.9-5.1) compared with rural residents. The odds of facility delivery increase substantially with greater household wealth. Women in the richest wealth quintile have 26 times the odds of women in the poorest wealth quintile (OR 26.4, CI 20.4-33.7). Region is similarly associated with facility delivery. Compared with Nairobi region, which has the highest proportion of women delivering at a health facility, all regions except Central region have significantly lower odds of facility delivery.

Primiparous women have 3.4 higher odds of delivering in a health facility (OR 3.4, CI 3.0-3.9) compared with women with two or more children. Women with no fertility risk have higher odds (OR 3.2, CI 2.9-3.5) compared to those with fertility risk. Women who obtain adequate ANC during pregnancy have higher odds of facility delivery (OR 2.3, CI 2.0-2.6) compared with those who do not.

Table 6 Unadjusted and adjusted odds ratios for health facility delivery: Results from binary logistic regressions, 2014 KDHS (n=14,920)

Characteristics	Unadjusted OR	95% CI	Adjusted OR	95% CI
Predisposing factors				
Maternal age at birth				
<20	2.4 ***	(1.9-3.0)	0.9	(0.7-1.2)
20-29	2.4 ***	(1.9 -3.1)	1.2	(0.9-1.5)
30-39	1.7 ***	(1.31-2.1)	1.2	(0.9-1.5)
40+	ref.		ref.	
Education				
None	ref.		ref.	
Primary	3.8 ***	(3.2-4.6)	2.1 ***	(1.6-2.6)
Secondary or higher	16.7 ***	(13.5-20.6)	4.0 ***	(3.1-5.1)
Religion				
Catholic	2.6 ***	(2.1-3.2)	1.2	(0.9-1.5)
Protestant	2.3 ***	(2.0-2.8)	1.1	(0.9-1.4)
Other	ref.		ref.	
Enabling factors				
Household wealth quintile				
Poorest	ref.		ref.	
Poorer	2.3 ***	(2.0-2.6)	1.5 ***	(1.3-1.8)
Middle	3.7 ***	(3.2-4.4)	2.2 ***	(1.9-2.6)
Richer	9.1 ***	(7.5-10.9)	3.8 ***	(3.1-4.7)
Richest	26.4 ***	(20.7-33.7)	7.3 ***	(5.4-9.8)
Residence				
Urban	4.4 ***	(3.9-5.1)	1.4 ***	(1.2-1.7)
Rural	ref.		ref.	
Regions				
Nairobi	ref.		ref.	
Central	0.0	(0.03-0.08)	2.8 ***	(1.8-4.2)
North Eastern	0.3 ***	(0.22-0.53)	0.9	(0.6-1.5)
Upper Eastern	0.1 ***	(0.09-0.22)	2.2 ***	(1.4-3.2)
Lower Eastern	0.0 ***	(0.03-0.07)	0.6 *	(0.4-0.9)
Upper Rift	0.1 ***	(0.08-0.19)	0.6 *	(0.4-1)
Mid Rift	0.2 ***	(0.11-0.26)	0.5 ***	(0.4-0.8)
Lower Rift	0.2 ***	(0.15-0.38)	0.8	(0.5-1.1)
Nyanza North	0.2 ***	(0.15-0.35)	1.3	(0.8-2)
Nyanza South	0.1 ***	(0.07-0.17)	1.2	(0.8-1.8)
Western	0.2 ***	(0.12-0.27)	0.6 **	(0.4-0.9)
Coast	1.1 ***	(0.67-1.67)	1.2	(0.8-1.8)
Need factors				
Parity				
1 child	3.4 ***	(3.0-3.9)	2.2 ***	(1.8-2.6)
2+ children	ref.		ref.	
Fertility risk [2]				
No risk	3.2 ***	(2.9-3.5)	1.5 ***	(1.4-1.7)
High risk	ref.		ref.	
ANC use [3]				
No	ref.		ref.	
Yes	2.3 ***	(2.0-2.6)	1.6 ***	(1.4-1.9)

* p≤0.05; ** p≤0.01; *** p≤0.001
[1] At least four ANC visits with first visit in the first three months
[2] Fertility risk is defined as meeting one of the following criteria: younger than age 18 at time of birth, age 35 or older at time of birth, birth interval <24 months, or four or more births.
[3] At least four ANC visits with first visit in the first three months

3.3.3 Multivariate logistic regression analysis (adjusted)

After adjusting for other factors in multivariate analysis, the predisposing factors of age at birth and religion are no longer significantly associated with facility delivery, while more educated women continue to have higher adjusted odds of facility delivery, albeit with smaller odds ratios than in unadjusted regression analysis. Women with primary education have double the odds (AOR 2.1, CI 1.6-2.6), and those with secondary or higher education have quadruple the odds (AOR 4, CI 3.1-5.1) of facility delivery compared to those without education (Table 6).

Among the enabling factors, wealth and residence as well as certain regions remain significantly associated with facility delivery after adjusting for other factors. The odds of facility delivery increase

systematically with increasing levels of wealth. Women in the richest wealth quintile have the highest odds (AOR 7.3, CI 5.4-9.8) compared with the poorest wealth quintile. Urban residence is also positively associated with facility delivery (AOR 1.4, CI 1.2-1.7) compared with rural residence. With Nairobi region as the referent category, the only regions with significantly higher odds for facility delivery are Central region (AOR 2.8, CI 1.8-4.2) and Upper Eastern region (AOR 2.2, CI 1.4-3.2). Four other regions have significantly lower odds of facility delivery compared with Nairobi: Lower Eastern (AOR 0.6, CI 0.4-0.9), Upper Rift (AOR 0.6, CI 0.4-1.0), Mid Rift (AOR 0.5, CI 0.4-0.8), and Western (AOR 0.6, CI 0.4-0.9). Five other regions are no longer significantly associated with facility delivery after controlling for other factors.

All three need factors remain associated with facility delivery after controlling for other factors. Primiparous women (AOR 2.2, CI 1.8-2.6), women with no fertility risk (AOR 1.5, CI 1.4-1.7), and women who obtain adequate ANC (AOR 1.6, CI 1.4-1.9) all have higher adjusted odds of facility delivery compared with their referent groups (multiparous women, women with high fertility risk, and women without adequate ANC).

3.4 Postnatal Care

Table 7 presents results of bivariate analysis of the distribution of postnatal care within the first 48 hours across predisposing, enabling, and need factors. Overall, 55% of women received PNC from a health care worker within 48 hours after delivery. Regarding predisposing factors, higher proportions of younger women (53-57%) received timely PNC compared with women age 40 and older (42%). PNC is also highest among the women with the highest level of education (71%), while Protestants (57%) and Catholics (56%) are nearly equal in receiving timely PNC.

Among enabling factors, PNC is highest among the wealthiest quintile (74%) and decreases as wealth decreases. Urban residents (67%) have higher use of PNC than rural residents. Among the 12 regions, high proportions of women receiving PNC are found in Nyanza North (73%), Nairobi (72%), and Upper Eastern (71%) regions. The lowest are recorded in North Eastern (17%), Upper Rift (20%), and Western (36%) regions.

Among need factors, bivariate analysis reveals that PNC is more common among women with no fertility risk (62%), primiparous women (66%), women with adequate ANC (64%), and women who delivered at a health facility (74%).

Table 7 Distribution of postnatal care within 48 hours of delivery across predisposing, enabling, and need factors, 2014 KDHS (n=7,152)

Characteristics	N	Percent	[95% CI]
Total	7,152	54.9	(53.1-56.7)
Predisposing factors			
Maternal age at birth			
<20	1,237	57.0	(53.3-60.5)
20-29	3,629	56.2	(53.6-58.7)
30-39	2,007	52.9	(49.8-56.0)
40+	279	41.7	(34.3-49.5)
Education			
None	1,327	24.4	(20.9-28.2)
Primary	3,779	50.5	(48.2-52.8)
Secondary or higher	2,046	70.1	(67.2-72.8)
Religion			
Catholic	1,400	55.9	(51.9-59.8)
Protestant	4,501	56.7	(54.7-58.8)
Other	1,249	39.7	(35.3-44.3)
Enabling factors			
Household wealth quintile			
Poorest	2,143	32.1	(29.4-35.0)
Poorer	1,451	49.9	(46.6-53.2)
Middle	1,257	52.1	(48.6-55.6)
Richer	1,208	63.6	(59.5-67.5)
Richest	1,093	74.2	(70.5-77.6)
Residence			
Urban	2,507	67.0	(63.9-70.0)
Rural	4,645	47.2	(45.2-49.3)
Region			
Nairobi	199	71.6	(63.2-78.7)
Central	562	65.7	(59.8-71.1)
North Eastern	451	16.5	(12.4-21.7)
Upper Eastern	667	71.4	(66.6-75.7)
Low er Eastern	446	52.5	(46.1-58.8)
Upper Rift	522	20.4	(15.4-26.6)
Mid Rift	898	53.1	(48.7-57.4)
Low er Rift	880	54.3	(49.7-58.8)
Nyanza North	476	73.0	(68.1-77.5)
Nyanza South	497	51.0	(45.3-56.6)
Western	684	36.4	(32.3-40.6)
Coast	870	51.4	(45.8-56.9)
Need factors			
Parity			
1 child	1,535	66.4	(63.0-69.6)
2+ children	5,617	51.2	(49.2-53.3)
Fertility risk [1]			
No risk	3,362	62.3	(60.0-64.6)
High risk	3,790	46.9	(44.5-49.2)
ANC use [2]			
No	6,005	52.9	(51.0-54.7)
Yes	1,147	63.9	(59.8-67.8)
Place of delivery			
Other	1,249	39.7	(35.3-44.3)
Facility	4,209	73.5	(71.4-75.5)

[1] Fertility risk is defined as meeting one of the follow ing criteria: younger than age 18 at time of birth, age 35 or older at time of birth, birth interval <24 months, or four or more births.
[2] At least four ANC visits w ith first visit in the first three months

3.4.1 Factors associated with postnatal care within 48 hours after delivery

Table 8 shows the results of bivariate analysis with PNC as the outcome variable. The determinant variables include the predisposing, enabling, and need factors, as well as ANC use and facility delivery in odds ratio analysis in both unadjusted (bivariate) and adjusted multivariate forms.

3.4.2 Bivariate logistic regression analysis (unadjusted)

Analysis of the unadjusted odds for receiving PNC within the first 48 hours after delivery shows significant associations with all three of the predisposing factors. Women in the youngest age group have the highest odds (OR 1.9, CI 1.3-2.6) of receiving timely PNC compared with those age 40 and older. Educated women have higher odds than women without education. Women with secondary or higher education have the highest odds (OR 7.3, CI 5.7-9.3) of timely PNC compared with women with no education. Women who are Catholic (OR 1.9, CI 1.5-2.5) or Protestant (OR 2, CI 1.6-2.4) have higher odds of receiving timely PNC compared with other religions.

In bivariate analysis PNC is also associated with the enabling factors of wealth, residence, and most regions. There is a significant pattern of increasing odds of receiving PNC across the wealth quintiles, with women in the richest wealth quintile having the highest odds (OR 6.1, CI 4.8-7.6) compared with the poorest quintile. Women in urban areas have higher odds (OR 2.3, CI 1.9-2.7) of receiving PNC compared with rural areas. Compared with Nairobi region, seven regions have significantly lower odds of timely PNC use: North Eastern (OR 0.1, CI 0-0.1), Lower Eastern (OR 0.4, CI 0.3-0.7), Upper Rift (OR 0.1, CI 0.1-0.2), Mid Rift (OR 0.5, CI 0.3-0.7), Nyanza South (OR 0.4, CI 0.3-0.6), Western (OR 0.2, CI 0.1-0.3), and Coast (OR 0.4, CI 0.3-0.7). No regions have significantly higher odds of timely PNC compared with Nairobi.

Regarding need factors, women with no fertility risk have higher odds (OR 1.9, CI 1.7-2.1) of receiving timely PNC compared with those with high fertility risk. Primiparous women have higher odds (OR 1.9, CI 1.6-2.2) of PNC compared with women with two or more children. Women who obtain adequate ANC have higher odds of receiving timely PNC (OR 1.6, CI 1.3-1.9) compared with women who did not. Women who delivered at a health facility (OR 12.4, CI 10.5-14.5) also are more likely to receive PNC within 48 hours after delivery.

Table 8 Unadjusted and adjusted odds ratios for postnatal care use: Results from binary logistic regressions, 2014 KDHS (n=7,152)

Characteristics	Unadjusted OR	95% CI	Adjusted OR	95% CI
Predisposing factors				
Maternal age at birth				
<20	1.9 ***	(1.3,2.6)	1.1	(0.7,1.6)
20-29	1.8 ***	(1.3,2.5)	1.1	(0.7,1.6)
30-39	1.6 **	(1.1,2.2)	1.3	(0.8,1.8)
40+	ref.		ref.	
Education				
None	ref.		ref.	
Primary	3.2 ***	(2.6,3.9)	1.7 ***	(1.3,2.3)
Secondary or higher	7.3 ***	(5.7,9.3)	2.7 ***	(2.0,3.6)
Religion				
Catholic	1.9 ***	(1.5,2.5)	0.8	(0.6,1.2)
Protestant	2.0 ***	(1.6,2.4)	0.9	(0.7,1.2)
Other	ref.		ref.	
Enabling factors				
Household wealth quintile				
Poorest	ref.		ref.	
Poorer	2.1 ***	(1.8,2.5)	1.5 ***	(1.2,1.8)
Middle	2.3 ***	(1.9,2.8)	1.6 ***	(1.3,1.9)
Richer	3.7 ***	(3,4.6)	2.1 ***	(1.6,2.6)
Richest	6.1 ***	(4.8,7.6)	2.7 ***	(2.0,3.6)
Residence				
Urban	2.3 ***	(1.9,2.7)	1.2	(2.0,1.4)
Rural	ref.		ref.	
Regions				
Nairobi	ref.		ref.	
Central	0.8	(0.5,1.2)	1.0	(0.6,1.6)
North Eastern	0.1 ***	(0,0.1)	0.3 ***	(0.2,0.6)
Upper Eastern	1.0	(0.6,1.5)	2.3 ***	(1.4,3.6)
Lower Eastern	0.4 ***	(0.3,0.7)	0.9	(0.6,1.5)
Upper Rift	0.1 ***	(0.1,0.2)	0.4 **	(0.2,0.7)
Mid Rift	0.5 ***	(0.3,0.7)	0.9	(0.6,1.3)
Lower Rift	0.5 ***	(0.3,0.7)	0.9	(0.6,1.4)
Nyanza North	1.1	(0.7,1.7)	2.3 ***	(1.4,3.7)
Nyanza South	0.4 ***	(0.3,0.6)	0.9	(0.5,1.4)
Western	0.2 ***	(0.1,0.3)	0.5 ***	(0.3,0.7)
Coast	0.4 ***	(0.3,0.7)	0.9	(0.6,1.5)
Need factors				
Parity				
1 child	1.9 ***	(1.6,2.2)	1.3 *	(1.0,1.6)
2+ children	ref.		ref.	
Fertility risk				
No risk	1.9 ***	(1.7,2.1)	1.2 *	(1.0,1.4)
High risk	ref.		ref.	
ANC use [2]				
No	ref.		ref.	
Yes	1.6 ***	(1.3,1.9)	1.2	(1.0,1.4)
Place of delivery				
Other	ref.		ref.	
Facility	12.4 ***	(10.5, 4.5)	10.2 ***	(8.5,12.4)

* p≤0.05; ** p≤0.01; *** p≤0.001

[1] Fertility risk is defined as meeting one of the following criteria: younger than age 18 at time of birth, age 35 or older at time of birth, birth interval <24 months, or four or more births.

[2] At least four ANC visits with first visit in the first three months

3.4.3 Multivariate logistic regression analysis (adjusted)

Table 8 shows that after adjusting for other factors in the multivariate model, only one of the three predisposing factors, a minority of the enabling factors, and three of four need factors remain significantly associated with receiving PNC within 48 hours of delivery.

After adjusting for other factors, women with primary education (AOR 1.7, CI 1.3-2.3) or secondary/higher education (AOR 2.7, CI 2.0-3.6) continue to have increased odds of timely PNC

relative to women with no education. Maternal age at birth and religion are no longer associated with PNC when controlling for other variables.

Women in wealthier households have higher odds compared with those in the poorest wealth quintile. This pattern holds across all wealth quintiles, with women in the richest wealth quintile having the highest odds (AOR 2.7, CI 2.0-3.6) of receiving PNC within 48 hours of delivery.

Most regions show no association after controlling for other factors. However, in two regions—Upper Eastern (AOR 2.3, CI 1.4-3.6) and Nyanza North (AOR 2.3, CI 1.4-3.7)—women have significantly higher odds of timely PNC compared with Nairobi, while three other regions have significantly lower odds compared with Nairobi: North Eastern (AOR 0.3, CI 0.2-0.6), Upper Rift (AOR 0.4, CI 0.2-0.7), and Western (AOR 0.5, CI 0.3-0.7). Urban-rural residence shows no association with PNC after controlling for other factors.

Primiparous women have higher odds of timely PNC (AOR 1.3, CI 1.0-1.6) compared with women with two or more children. Women with no fertility risk (AOR 1.2, CI 1.0-1.4) have significantly higher odds compared with those with high fertility risk. Women who delivered at a health facility (AOR 11.2, CI 8.5-12.4) have higher odds of timely PNC compared with those who delivered elsewhere.

4 DISCUSSION

Full antenatal care, delivery in a health facility, and timely postnatal care are components of the continuum of care essential for maternal and newborn survival. Yet in Kenya use of maternal care remains below desired levels. Our study examined predisposing, enabling, and need factors among women surveyed in the 2014 KDHS to measure their relationship to each of these components of maternal care.

Among the predisposing, enabling, and need factors in the framework used in this study, variables at all three levels are associated with use of maternal health care in Kenya. Among the predisposing factors, women's education is found to be a strong predictor of ANC, facility delivery, and PNC. This is particularly the case for facility delivery and PNC, where women of multiple education levels are positively associated with these outcomes. Nsibu and colleagues (2016) argue that educated women are more likely to understand and follow health recommendations. Education has been found to influence use of ANC (Babalola 2014) and facility delivery (Samson 2012; Gitonga and Muiruri 2016; Mazalale et al. 2015; Dickson, Adde, and Amu 2016) in a variety of settings, while a mixed methods study in Ethiopia found education among other factors to be a significant determinant of receiving PNC within 48 hours after delivery (Belachew, Taye, and Belachew 2016).

Several studies have cited religion (Babalola 2014; Mazalale et al. 2015; Dickson, Adde, and Amu 2016), and at least one Nigerian study identified age (Babalola 2014) as key determinants of ANC use or facility delivery. Our study, however, found neither maternal age at birth nor religion to be predisposing factors for adequate use of ANC. Both variables lost statistical significance in multivariate models for each of the three care-seeking outcomes studied here.

Residence as an enabling factor has been found to be a predictor of maternal health service use in studies in Nigeria (e.g. Babalola 2014), Malawi (Mazalale et al. 2015), and Ghana (Dickson, Adde, and Amu 2016). In Kenya the rural-urban differential also is a factor, given that better health care is concentrated in county and sub-county hospitals, which are located within the urban areas, while rural households are disadvantaged, and in some regions people have to travel long distances to access these facilities. In this study, urban residence is found to be positively associated only with facility delivery, but not with ANC or PNC. Similarly, while there are regional differences in maternal care seeking in Kenya, these differences are significant only for facility delivery and PNC in about half of the regions after controlling for other factors.

Among the enabling factors included in this study, household wealth is most consistently and strongly associated with the three maternal care-seeking outcomes. Wealth differences as an explanation for use of health services are most pronounced with regard to facility delivery. These findings are consistent with numerous studies examining use of ANC (Babalola 2014), facility delivery (Gitonga and Muiruir 2016; Mazalale et al. 2015; Dickson, Adde, and Amu 2016; Gitonga and Muiruri 2016), and PNC (Belachew, Taye, and Belachew 2016) in a range of African settings. Conversely, Omollo (2016) cites distance, travel cost, and medicine cost as barriers to health facility visits, which could explain why low-wealth groups are less likely to access care.

Our study shows need factors—considered here as parity, fertility risk, and experience with previous steps in the continuum of care—to be major determinants of the use of maternal health services. Fertility risk is consistent in its association across all three outcomes after controlling for other factors. However, it operates in a direction opposite to that posited by the Andersen Behavioral Model of Health Services

Use. While the Andersen model would indicate that women with high fertility risk—and therefore by definition, greater need—should be more likely to access maternal health services, we found that women with high fertility risk are consistently less likely to access adequate ANC, to have a facility delivery, or to receive timely PNC compared with women without fertility risk.

It has been argued that stigma exists among younger, older, or lactating women attending ANC, reflecting a cultural norm, which coincides with the need factor of high fertility risk women (Nsibu et al. 2016). Such stigma and quarantine of puerperium women for a period of time after birth have also been cited in other studies (Pell et al. 2013; LeGrand and Adjiwanor 2013). Belachew and colleagues (2016) found the cultural practice of a 42 day quarantine period to be a significant determinant of receiving PNC within 48 hours of delivery in Ethiopia, alongside a number of socio-demographic characteristics. A study from Nigeria (Adegbola 2008) reinforces the cultural perceptions of women's age (too young or too old) and ANC visits, reporting the fear of wizards and jealousy from others if one attends ANC early. Magoma and colleagues (2010) argue that other socio-cultural factors, such as the belief in normal pregnancy requiring home delivery, suppress facility delivery with only complicated deliveries taken to hospital as common practice.

Regional differences in all three outcomes are evident from the study. The counties/regions selected in this study are from diverse parts of Kenya (see Figure 1) and are inhabited by different communities, each with their own unique cultural beliefs. Nairobi is more metropolitan, as the capital city, but has unequal distribution of quality services, due to congestion in public health facilities located far from the highly populated low income areas and existence of unregistered health service providers, especially in the low income areas (APHRC 2009). Other cultural practices such as puerperium quarantine for a specified period of time to avoid an evil eye could explain some of the variations by region or county as a determinant of receiving timely PNC, especially among pastoral communities in the Coast, Upper Rift, and North Eastern regions of Kenya (Caulfield et al. 2016).

Although Andersen contends that cultural beliefs and social structure are encapsulated in predisposing factors (Andersen and Newman 2005), a common criticism of the Andersen model is that it directs insufficient attention to socio-cultural barriers to care. A systematic review found few studies of cultural norms and traditional health beliefs among applications of the Andersen model, perhaps due to the difficulty operationalizing such variables (Babitsch et al. 2012). It is possible that our study's inability to adequately account for cultural beliefs and their interactions with fertility risk explains the negative association found between high fertility risk and maternal care seeking.

Parity is also consistently negatively associated with each of the three maternal care-seeking outcomes. In contrast to our measure of fertility risk, our results regarding parity are consistent with the direction suggested by the Andersen model: In all three models, primiparous women have increased odds of ANC, facility delivery, and PNC compared with women with two or more children. This finding is consistent with empirical literature, including studies of ANC in rural Kenya (Gabrysch and Campbell 2009; Gitonga and Muiruri 2016). Also, in a Rwandan study Rurangwira and colleagues report that older women with high parity will have gained confidence and experience from earlier pregnancies, and therefore be more likely to forego ANC (Rurangwira et al. 2017) as well as facility delivery and PNC. Other studies have argued that among women with high parity available resources need to be divided among competing needs and thus women are less likely to seek health services unless the pregnancy poses a specific risk requiring hospital care (Mungai and Oleche 2016). Previous experiences with delivery and facility service and habits of women have also been found to influence facility delivery and thus to help explain the variation among parity groups (Mason et al. 2015).

Independent of the other factors from the framework (including other need factors), use of ANC is a direct determinant of facility delivery, and facility delivery is a direct determinant of timely PNC. This finding of our study aligns with other studies in Kenya and many other African countries that have found ANC attendance to influence subsequent stages in the continuum of care (Obago 2013; Mazalale et al. 2015; Belachew, Taye, and Belachew 2016; Dickson, Adde, and Amu 2016; Gitonga and Muiruri 2016; Owili et al. 2016).

Taken together, the strength and consistency of parity and fertility risk variables and experience with prior stages of care suggest that need factors outweigh predisposing and enabling factors in their influence on maternal care-seeking outcomes.

4.1 Study Limitations

Because the study is based on a cross-sectional survey, our results cannot establish causality but rather show associations between the variables in the analysis. Additionally, our analysis is limited to the variables available in the 2014 KDHS dataset. A strength of DHS surveys, including the 2014 KDHS, is the range and representativeness of the socio-demographic characteristics measured. We applied a conceptual framework that centers on such socio-demographic characteristics. However, our choice of conceptual frameworks and availability of variables may result in omitted variable bias.

We identified variables in the 2014 KDHS with which we could operationalize each factor (predisposing, enabling, and need) in the Andersen behavioral model. However, it can be argued that our application of the model is weak in its ability to capture the health beliefs and attitudes component of the predisposing factor and the need factor, as many of the variables are proxy measures.

We do not have available to us direct measures of clinical diagnoses or perceived susceptibility or seriousness of illness as postulated in the Andersen model. The need factor is represented by external criteria of need, such as fertility risk.

In this study, we conceptualize parity as a variable representing the need factor. We do so under the assumption that women experiencing pregnancy and childbirth for the first time have greater need of maternal health services than do multiparous women (Letamo and Rakgoasi 2003; Kaur and Kaur 2012; Jordan et al. 2014). However, it is possible that we have miscategorized parity in the Andersen model. A review conducted by Holtz (2014) found that women with children are likely to have difficulty arranging for childcare for multiple children, thereby reducing encounters with health services. When considering the opportunity cost between childcare and use of health services, parity may better represent an enabling factor than a need factor.

Finally, we could not explore in detail socio-cultural practices and beliefs that may act as a barrier to care seeking but that lie outside of this model. For example, we are unable to explore the role that fear of mistreatment, women's empowerment, men's involvement, or other community contextual norms may play in limiting use of facility delivery (Stephenson et al. 2006; Mageni et al. 2013; Warren et al. 2017). Such socio-cultural barriers to care may best be assessed through qualitative or mixed methods of inquiry, as they are not easily captured in a structured, pre-coded questionnaire such as the KDHS.

4.2 Conclusion and Recommendations

Our study has shown that a pathway exists linking the three outcomes through a set of common factors (from multivariate analysis) based on the modified Andersen model. The common predisposing factor in all outcomes is women's education. The enabling factors are wealth and region, and need factors are

parity and fertility risk. Also worth noting is the direct link between ANC use as a determinant of facility delivery, and of facility delivery as a direct link to receiving PNC within 48 hours of delivery. Thus investing in the above factors is likely to have a substantial impact on improving maternal health care.

Education is a strong predictor of care seeking, having been highly significant in all three outcomes, suggesting a need for health promotion and education intervention approaches, especially in regions where literacy levels are low, with messaging in the local language and context. Empowerment programs to fight poverty are also likely to have a direct impact on use of maternal health services since relative poverty emerged as a strong predictor of (not using) maternal health services across the three outcomes. Comprehensive health insurance programs to cover the poor may help to counteract the extent to which cost acts as a barrier to maternal health care seeking and could be an intermediate consideration. Providing family planning services and addressing the factors that lead to early pregnancies should continue to address parity and age risk at first pregnancy. As well as need for county-specific program interventions to address specific regional needs, inequities in health service infrastructure should be addressed through the counties, so as to ensure access to services within communities, in rural and other remote areas.

That high fertility risk is found to be associated with less maternal care seeking in our study should be a concern for maternal health policies and programs. The study results indicate a need to reach women who have high fertility risk with information about the need for and utility of ANC, facility delivery, and timely PNC, as well as the need to investigate the barriers that prevent women with high fertility risk from seeking care and measures that could support their access to maternal care.

Given the fact that counties in Kenya are to a large extent drawn along ethnic boundaries, there is a need to undertake qualitative or ethnographic studies to understand the role of culture in maternal health services uptake and target the factors in county-specific programs.

REFERENCES

Adegbola, O. A. 2008. "Gestational Age at Antenatal Booking at Lagos University Teaching hospital." *Nigerian Quarterly Journal of Hospital Medicine* 18(2):79-82.

Andersen, R., and J. F. Newman. 2005. "Societal and Individual Determinants of Medical Care Utilization in the United States." *The Milbank Quarterly* 83(4):1-28.

African Public Health Research Center (APHRC). 2009. *The Maternal Health Challenges in Poor Urban Communities in Kenya*. Policy Brief No.12.

Babalola, B. I. 2014. "Determinants of Rural-Urban Differentials of Antenatal Care Utilization in Nigeria." *African Population Studies* 28(3):1263-1273.

Babitsch, B., D. Gohl, and T. von Lengerke. 2012. "Re-revisiting Andersen's Behavioral Model of Health Services Use: A Systematic Review of Studies from 1998-2011." *GMS Psycho-Social-Medicine* 9(11):1-15. doi: 10.3205/psm000089.

Belachew, T., A. Taye, and T. Belachew. 2016. "Postnatal Care Services Utilization and Associated Factors among Mothers in Lemo Woreda, Ethiopia." *Journal of Women's Health Care* 5(3):1-7.

Bourbannais, N. 2013. "Implementing Free Maternal Health Care in Kenya: Challenges, Strategies and Recommendations." Nairobi: Kenya National Commission on Human Rights (KNCHR).

Bua, J., L. Paina, E. E. Kiracho, T. Mukaba, A. Binanga, S. Fohl, J. T. Bertrand, N. Muinga, B. Sen, P. Ayieko, and J. Todd. 2015. "Postnatal Care for Mothers and Newborns: Highlights from the World Health Organization 2013 Guidelines." *Implementation Science* 10(2):108.

Caulfield, T., P. Onyo, A. Byrne, J. Nduba, J. Nyagero, A. Morgan, and M. Kermode. 2016. "Factors Influencing Place of Delivery for Pastoralist Women in Kenya: A Qualitative Study." *BMC Women's Health* 16:52.

Dickson, K. S., L. S. Adde, and H. Amu. 2016. "What Influences Where They Give Birth? Determinants of Place of Delivery among Women in Rural Ghana." *International Journal of Reproductive Medicine* 2016 (7203980):1-8.

Gabrysch, S., and O. M. Campbell. 2009. "Still Too Far to Walk: Literature Review of the Determinants of Delivery Service Use." *BMC Pregnancy and Childbirth* 9(1):34.

Gitonga, E., and F. Muiruri. 2016. "Determinants of Health Facility Delivery among Women in Tharaka-Nithi County, Kenya." *Pan African Medical Journal* 25(suppl 2)(November):1-4. doi: 10.11604/pamj.

Gitumu, A., C. Herr, H. Oruko, E. Karijo, R. Gichuki, P. Ofware, A. Lakati, and J. Nyagero. 2015. "Determinants of Use of Skilled Birth Attendants at Delivery in Makueni, Kenya: A Cross-Sectional Study." *BMC Pregnancy and Childbirth* 15(9):1-7.

Holtz, C. 2014. *Primary Health Service Use by Mothers and Children from London-Middlesex, Ontario*, London, Ontario, Canada: University of Western Ontario.

Jordan, R. G., C. L. Farley, and K. Trister Grace. 2014. *Prenatal and Postnatal Care: A Woman-Centered Approach.* 2nd ed. Hoboken, NJ, USA, and West Sussex, UK: John Wiley and Sons.

Kaur, J., and K. Kaur. 2012. "Obstetric Complications: Primiparity vs. Multiparity." *European Journal of Experimental Biology 2*(5):1462-1468.

Kenya National Bureau of Statistics [KNBS], Ministry of Health/Kenya, National AIDS Control Council/Kenya, Kenya Medical Research Institute, National Council for Population and Development/Kenya, and ICF International. 2015. *Kenya Demographic and Health Survey 2014*. Rockville, MD, USA: Kenya National Bureau of Statistics, Ministry of Health/Kenya, National AIDS Control Council/Kenya, Kenya Medical Research Institute, National Council for Population and Development/Kenya, and ICF International.

Lawn, J., and K. Kreber. 2006. *Opportunity for Africa Newborns: Practical Data, Policy and Programmatic Support for New Born Care Africa*. Cape Town, South Africa: Partnership for Maternal, Newborn and Child Health (PMNCH).

LeGrand, T., and V. Adjiwanor. 2013. "Does Antenatal Care Matter in Use of Skilled Birth Attendance in Rural Africa; A Multi-Country Analysis." *Social Science and Medicine* 86:26-34.

Letamo, G., and S. D. Rakgoasi. 2003. Factors Associated with Non-use of Maternal Health Services in Botswana. *Journal of Health, Population and Nutrition* 21(1):40-47.

Lincetto, O., S. Mothebesoane-Anoh, P. Gomez, and S. P. Munjanja. 2006. "Antenatal Care." Chapter 2 in *Opportunities for Africa's Newborns: Practical Data, Policy and Programmatic Support for Newborn Care in Africa*, eds. Joy Lawn and Kate Kreber. pp. 52-61. Geneva, Switzerland: The Partnership for Maternal, Newborn and Child Health (PMNCH).

Magango, D. O. 2013. *Factors Influencing Deliveries under Traditional Birth Attendants in Kaloleni and Rabai Districts of Kilifi County, Kenya*. M.A. Dissertation, University of Nairobi, Kenya.

Mageni, J. N., A. Mwagni, S. Mbugua, and V. Mukthar. 2013. *Male Involvement in Maternal Health Care as a Determinant of Utilization of Skilled Birth Attendants in Kenya*. DHS Working Papers No. 93. Calverton, Maryland, USA: ICF International.

Magoma, M., J. Requejo, M. R. Dona, C. Simon, and V. Filippi. 2010. "High ANC Coverage and Low Skilled Attendance in a Rural Tanzania District: A Case for Implementing a Birth Plan Intervention." *BMC Pregnancy and Childbirth* 10(13):1-12.

Mason, L., S. Dellicour, F. T. Kuile, P. Ouma, P. Phillips-Howard, F. Were, K. Laserson, and M. Desai. 2015. "Barriers and Facilitators to Antenatal and Delivery care in Western Kenya; A Qualitative Study." *BMC Pregnancies and Childbirth* 15(26):1-10.

Mazalale, J., C. Kambala, S. Brenner, J. Chinkhumba, et al. 2015. "Factors Associated with Delivery Outside a Health Facility: Cross-Sectional Study in Rural Malawi." *Tropical Medicine and International Health* 20(5):617-626.

Mbugua, S., and K. L. D. MacQuarrie. 2018. *Maternal Health Indicators in High-Priority Counties of Kenya*. DHS Further Analysis Reports No. 110. Rockville, Maryland, USA: ICF.

Mungai, S., and M. O. Oleche. 2016. “The Determinants of Maternal Healthcare Services in Kenya.” *International Journal of Novel Research in Healthcare and Nursing* 3(2):162-172.

Nsibu, C. N., C. Manianga, S. Kapanga, E. Mona, P. Pululu, and N. M. Aloni. 2016. “Determinants of Antenatal Care Attendance among Pregnant Women Living in Endemic Malaria Settings; Experience from the Democratic Republic of Congo.” *Obstetrics and Gynaecology International* 2016 (542341):1-8. *Http://dx.doi.org/10.1155/2016/5423413*.

Obago, I. T. 2013. *The Role of Antenatal Care in Predicting Health Facility Delivery among Women in Kenya: Further Analysis of Data from the 2008-09 KDHS*. DHS Working Papers No. 86. Calverton, Maryland, USA: ICF International.

Omollo, J. V. 2016. “Factors and Challenges Influencing Mother’s Choice of Birth Attendance in Bunyala Sub-County, Kenya.” *International Journal of Scientific & Technology Research* 5(7):101-105.

Owili, P. O., M. A. Muga, Y. Chou, Y. E. Hsu, N. Huang, and L. Chien. 2016. “Associations in the Continuum of Care for Maternal, Newborn and Child Health: A Population-Based Study of 12 Sub-Saharan Africa Countries.” *BMC Public Health* 16(1):414.

Pell, C., A. Menaca, F. Were, N. A. Afrah, S. Chatio, L. Manda-Taylor, M. J. Hamel, et al. 2013. “Factors Affecting ANC Attendance; Results from Qualitative Studies in Ghana, Kenya and Malawi.” *PLOS One* 8(1):e53747.

Rurangirwa, A. A., I. Mogren, L. Nyiranzinyoye, J. Ntaganira, and G. Krantz. 2017. “Determinants of Poor Utilization of Antenatal Care Services among Recently Delivered Women in Rwanda; A Population Based Study.” *BMC Pregnancy and Childbirth* 17(142):1-10.

Rutstein, S. O. 2008. *The DHS Wealth Index: Approaches for Rural and Urban Areas*. DHS Working Papers No. 60. Calverton, MD: Macro International.

Rutstein, S. O., and K. Johnson. 2004. *The DHS Wealth Index*. DHS Comparative Reports No. 6. Calverton, MD: ORC Macro.

Samson, G. 2012. “Utilization and Factors Affecting Delivery in Health Facility among Recently Delivered Women in Nkasi District.” MPH diss., Muhimbili University of Health and Allied Sciences, Tanzania.

StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP.

Stephenson, R., A. Baschieri, S. Clements, M. Hennink, and N. Madise. 2006. “Contextual Influences on the Use of Health Facilities for Childbirth in Africa.” *American Journal of Public Health* 96(1):84-93.

Warren, C. E. 2015. “Exploring the Quality and Effect of Comprehensive Post-natal Care Models in East and Southern Africa.” PhD Diss., University of Ghent, Belgium.

Warren, C. E., R. Njue, C. Ndwiga, and T. Abuya. 2017. “Manifestations and Drivers of Mistreatment of Women During Childbirth in Kenya: Implications for Measurement and Developing Interventions.” *BMC Pregnancy and Childbirth* 17(1):102.

World Health Organization [WHO] and United Nations Children's Fund (UNICEF). 2015. *Trends in Maternal Mortality: 1990-2015: Estimates from WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division*. Geneva, Switzerland: WHO.