

Gender Relations and Maternal Healthcare Utilization in sub-Saharan Africa: A Bayesian Multilevel Analysis

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Abstract

Maternal health care utilization still remains crucial in ensuring good pregnancy outcomes and a reduction in maternal and child mortality especially in developing countries. Although several studies have been conducted investigate determinants of maternal health care utilization, cross-national comparative and multilevel studies on use of maternal healthcare have received little attention. This paper sets out to examine the relationship between gender relations and maternal healthcare utilization in sub-Saharan Africa. The analysis pools sample data of 245,955 respondents from the most recent Demographic and Health Surveys (DHS) and World Development Indicators of 35 sub-Saharan African countries. Separate Bayesian multilevel logistic regression models are fitted for adequate antenatal care and institutional delivery in relation to several factors indicating gender relations at three levels. Fixed and random effects were produced. At the individual level, adjusted results indicate that women who have attained at least primary education, are in the second and higher wealth quintile, are employed, exercise sexual autonomy and have insurance coverage are more like to use maternal health care. Urban residence, living in areas that are proximal to health facilities, have more educated women, have more women with decision-making authority and less polygynous marriages enhances the propensity to consistently use maternal health care. These results help to underscore the importance of contextual factors in understanding women's utilization of maternal healthcare and how critical they are in the implementation of policy strategies aimed at bolstering maternal healthcare uptake in low resource countries.

Introduction

About 302,000 women die due to maternal-related causes in developing countries, accounting for 99% of the global maternal deaths estimates. An estimated 546 (66%) Maternal Mortality Rates (MMR) are registered within sub-Saharan Africa (sSA) (Alkema et al., 2016). Lack of adequate maternal healthcare services such as antenatalcare and skilled delivery are some the most important factors exacerbate maternal and child mortality (Filippi et al., 2006; Onah et al., 2006; Zureick-Brown et al., 2013). Access to maternal healthcare services helps provide health information that is necessary for healthy pregnancy outcomes (Birmeta et al., 2013) and ensures timely management and treatment of pregnancy complications to minimize maternal deaths (Tey and Lai, 2013). Despite the importance of maternal healthcare in ensuring the safety of both the mother and child, many women in disadvantaged populations still face challenges using these key services. In low-income countries for example, an estimated 52% of women benefit from skilled care during childbirth compared to high-income countries where almost all women have adequate antenatal care and are attended to by skilled health professionals (Alkema et al., 2016).

Factors accounting for inadequate utilization of maternal healthcare services are complex and range

from micro to macro-level structures within society. Underlying social, cultural and economic conditions in which a women and her family live are significant determinants of maternal healthcare utilization (Cresswell et al., 2020; Lange et al., 2019; Simona, 2020). Among these conditions, gender relations has in the recent past emerged to be an important theme in maternal, sexual and reproductive health discourses (Adjiwanou and LeGrand, 2014; Kane et al., n.d.). Conceptualizing gender in relational terms is a contemporary approach that seeks to problematize the assumed equivalence between ‘sex’ and ‘gender’ and emphasize the embeddedness of gender performance in the social structure. Systems of social stratification within the social structure define and shape the relationships between men and women, that tends to privilege men with power, status and better access to resources (Springer et al., 2012). Women experience their reproductive and maternal healthcare within the frames of gendered social relations that occur at different levels including with intimate partners, household, community, nation and the broader society (Kane et al., n.d.). All of which have implication on the nature and quality of care which they receive.

The relational conceptualization considers gender not as a stand alone concept but one that intersects with several other categories of inequalities in a complex and interactional manner (Connell, 2012; Springer et al., 2012). In other words, gender is part of social, institutional, and structural dimensions of human lives (Öhman et al., 2015). Often subordination in one dimension is not only related to, but also aids subordination in another. For example, the gender division of labour in most sub-Saharan African societies is such that women have the exclusive responsibility for maternal roles and childbirth. These social formulations and norms are reinforced by sanctions embedded within social institutions to ensure conformity (Blanc, 2001). However, women occupy subordinate positions and that means being of low socio-economic status and having limited access to economic resources (Ahmed et al., 2010; Blanc, 2001). In this regard, women would have challenges in terms of use of maternal healthcare and also be vulnerable to other societal vices including intimate partner violence (Simona et al., 2018) and HIV/AIDS (Igulot and Magadi, 2018).

Gender relations are also shaped by agency, which reflects a person’s freedom to pursue and achieve goals important to them (Kabeer, 1999; Sen, 1985). Women’s agency is negotiated within societal power structures in specific spheres of life. Agency leads to women empowerment when it’s exercise undermines and challenges power structures which perpetuate the subordinate of women (Hanmer and Klugman, 2016; Kabeer, 1999). Lack of agency leads to sustained denial of equality and self-determination (Sen, 1985). An operational definition of agency is difficult to achieve for research and measurement purposes but in line with international commitments to gender equality, agency is often studied in terms of observed behaviour and self-reported attitudes (Alkire, 2008). In this regard, researchers posit certain ‘domains of capability’ to represent agency and empowerment and these include sexuality, marriage, childbearing, and the exercise of reproductive rights making decisions in the family and labour force participation (Alkire, 2008). Sen (1999) would add economic opportunities, clean water, basic education, gainful employment and access to health care. The assumption is that the presence of these domains will undermine structural influence on women and thus improve well-being.

The contribution of this study is to integrate different conceptualizations of gender relations and other intersecting categories. In line with Springer et al. (2012)’s call for gender and health researchers to investigate numerous intersecting variables at both individual and structural levels, I do so in the context of maternal healthcare utilization in sub-Saharan Africa. I seek to study the relationship between gender relations and maternal healthcare utilisation. I also examine the relative importance of structural level factors in contributing to maternal healthcare utilization relative to individual level factors. Structural level factors are delineated at community and country-levels.

To my knowledge, no study has examined the relationship between gender relations and maternal healthcare utilization using three-level multilevel cross-country analysis. Many studies use multilevel models to investigate the association between several factors and different indicators of maternal healthcare in sub-Saharan Africa. Most of these however, are two level studies and focusing on a single country (Ndao-Brumblay et al., 2013; Ononokpono et al., 2013; Yebyo et al., 2015). Adjiwanou et al. (2018) studied gender inequality and use of maternal healthcare in rural areas of selected sub-Saharan Africa and found that gender norms that are relatively tolerant of violence against women inhibit use of maternal healthcare. Most studies that address maternal healthcare utilization, have examined the effects of broader contextual factors which mostly include poverty, ethnic origin and area of residence among others (Ononokpono et al., 2013; Stephenson et al., 2006). Indeed, they have shown that social and community level factors influence maternal healthcare utilization. Women's inferior status, characterized by lack of social independence and autonomy, lack of freedom of movement, no or little participation in household decision making and negative attitudes towards woman's rights is also associated with low uptake of health services and poor health outcomes (Schuler et al., 1997; Steele et al., 2001; Steele and Goldstein, 2006).

However, social conditions in which constructions of gender relations are embedded, are complex and determining their effects on maternal healthcare may not be adequate without representing broader social contexts within which they occur. In this study, I seek to extends previous multilevel studies that have only focused on two level models by including country-level factors and by interpreting both measures of associations and measures of variance among variables. In doing so, I seek to delineate the variance of the social conditions in which women are located to identify which among the individual, community and country-level factors have the greatest effects on maternal healthcare utilization. If the social conditions are important in explaining maternal healthcare utilization, it is expected that a meaningful share of total individual variation should be located at the contextual level (Dundas et al., 2014). This is important because it allows for an understanding of the patterns and distribution of contextual factors that influence maternal healthcare to bolster context-based interventions aimed at enhancing maternal healthcare. This is especially so given the 2015 shift to the Sustainable Development Goals (SDGs) target of 70 maternal mortality cases or less per 100,000 live births by 2030.

Methods

The Data

The individual and community-level analysis (level 1 and 2) pools data from 35 Demographic and Health Surveys (DHS) conducted between 2006 and 2015 in sub-Saharan Africa. Countries included are Angola, Benin, Burkina Faso, Burundi, Cameroon, Chad, Congo, Congo DR, Cote d'Ivoire, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe. The inclusion criterion for countries was availability of comparable DHS data on maternal healthcare variables (antenatal care visits, delivery care and postnatal care for mothers and newborn babies). The country-level (level 3) data are drawn from World Development Indicators (WDI) of the World Bank Databank. The sample was restricted to selected DHS countries.

The Demographic and Health Surveys (DHS) are nationally representative population-based cross sectional surveys for men and women designed to provide information on several measures including fertility, family planning, mortality, nutrition, maternal and child health, HIV/AIDS, domestic

violence and other health indicators. This study utilizes data for 245,955 women in the reproductive age group of 15-49 years. The DHS sample is typically representative at national level, for urban and rural areas, the regional level and sometimes at state/provincial or district level. The surveys have large sample sizes (usually between 5,000 and 30,000 households) and are typically conducted about every 5 years. The DHS respondents are selected using probabilistic two-stage cluster sampling techniques using the most recent population census as a sampling frame in each participating country (Falic et al., 2012; Fisher and Way, 1988).

World Development Indicators (WDI) are the primary World Bank collection of development indicators, compiled from officially-recognized international sources. These are the most current and accurate global development data available and they provide national, regional and global estimates (The World Bank, 2018). For the purposes of this study, data series from 35 out of 48 sub-Saharan African countries, are selected corresponding to countries with available DHS data. Three Country-level variables were selected from the World Bank Databank including the countries' human development index (HDI), gender inequality index and national female literacy rate.

Outcome variables

Two separate dichotomous outcome variables of antenatal care (ANC) visits and institutional delivery care were used to measure maternal healthcare utilization. Both outcome variables were derived from the DHS data. Antenatal care in the DHS was measured by the question which asks women how many times they received antenatal care during pregnancy for their most recent birth. The variable was recoded into a binary, based on the World Health Organisation (WHO) recommendations of at least four ANC visits. Thus, no to three antenatal care visits was recoded as "0", and at least four antenatal care visits was recoded as "1". For delivery care, women were asked about their place of delivery for the most recent birth. The variable was recoded to either home "0" or institutional delivery "1". Only the most recent birth was considered and all previous births were excluded. The preference for the most recent birth was because information on maternal health care tends to be more accurate for most recent births compared to that given for other previous births (Kistiana, 2009)

Individual-level explanatory factors

Gender relations in this study are represented by several intersecting variables reflecting gender inequalities, agency and women empowerment and they include sexual autonomy, the ability to negotiate sex and whether they condone violence perpetrated by partners (Nankinga et al., 2016). Others are Maternal age, educational status, household wealth and employment status.

Sexual autonomy is drawn from a question in the DHS which asks women whether they can refuse sexual demands from their partners. The ability to negotiate sex was derived from a question asking women if they are able to ask their partners to use a condom during a sexual encounter and condoning violence is computed from a series of questions to women on whether wife beating is justifiable if a wife a) goes out without telling her husband b) neglects children c) argues with the husband d) refuses to have sex with the husband and e) burns the food. A composite binary variable was constructed with "yes" if she responded in affirmative to any of the five questions and "no" if the response was negative.

Maternal age was defined as mother's age at the most recent birth. Maternal age was categorized in three intervals <20, 20–34 and 35–49 years. Educational status was defined as a highest level of education attained by respondents and was recoded as no education, primary education and

secondary or higher education. Employment status in the DHS ranges from unskilled to professional. In this study the responses were recoded into unemployed, self-employed (agricultural employment) and formally employment. Household wealth is a wealth index variable in the DHS which is a composite measure of a household's cumulative living standard. The index is calculated using principal component analysis (PCA) based on ownership of selected household assets such as television, radio, refrigerator and bicycles; materials used for house construction and types of water and sanitation facilities. The index places individuals on a continuous scale of relative wealth which is divided into five quintiles: poorest, poor, middle, rich and richest. I renamed the quintiles in this study as first, second, middle, fourth and fifth quintile.

Community-level explanatory factors

The DHS does not capture variables that can describe the characteristics of the communities. The primary sampling units (PSU) in the surveys are clusters and these were used to assess the community/neighborhood context in this study. Community factors have been calculated by aggregating individual women's characteristics within their clusters. PSUs are used to represent communities and neighborhoods because they are the most consistent measure of communities across all DHS surveys and many previous studies have defined communities in a similar manner (Adjiwanou et al., 2018; Ononokpono et al., 2013; Wiysonge et al., 2012; Yebo et al., 2015). Just like at the individual level, community level factors were defined to reflect the gender relations, agency and the extent of woman's empowerment within communities. The variables include community education, community employment, community distance problems, community money problems, community decision-making authority, community female headed households, community media exposure, community female autonomy, community Polygamy prevalence and area of residence.

Community education is the aggregate value of the educational levels of women based on the average of proportions of educational levels in the community. The aggregate shows the overall female educational attainment in the community. The variable was categorized into three categories: lower, medium, and high attainment. Community distance problems was defined as the proportion of women in the community who consider distance to health facilities as a problem. The variable was categorized as low and high. Community money problems was the proportion of women who regarded money as a problem which hinders them from accessing health care. It was divided into binary category of low and high. Community Polygyny is constructed as a binary variable and clusters are classified as having either a lower proportion of polygamous marriages or a higher proportion, based on cluster distribution of the type of marriage. Community female headed household was defined as a proportion of female-headed household in a PSU and categorized as low and high. Community media exposure was the proportion of women exposed to the mass media (radio, television and newspaper) in the PSU. Community decision making authority was the proportion women with the authority to participate in household decisions and have a final say regarding their health. It was divided into low and high. Residence was pre-categorized as rural and urban areas.

Country-level explanatory factors

The country level variables also indicate gender relations and are the country's gender inequality index, female literacy rate and the human development indicator. Gender inequality index is measured on a scale of 1 to 6, 1 being the most equal country and 6 being the worst. Female literacy rate is the percentage of female literacy levels relative to the female population aged 15 and above in a country. The human development index is the composite indicator of life expectancy, education

and per capital income. Countries are ranked on a scale of 0 to 1, 0 being the lowest HDI and 1 being the highest. All country-level measurements are for the year 2015 and this was for the purposes of corresponding appropriately with the DHS data which ended in the same year.

Statistical analysis

The distribution of respondents by independent and outcome variables was assessed and expressed in percentage form before the analysis was done. In view of the hierarchical structure of the DHS data, whereby individuals are nested within clusters which are in turn nested within countries and my aim to examine the relative variance of use of maternal healthcare at different levels, I used multilevel modelling techniques for the main analysis. Multilevel techniques are suited for this purpose because, in addition to capacity to assess the fixed associations between variables, they recognize the existence of data hierarchies by allowing for residual components at each level in the hierarchy. In this regard, the residual variance is divided into the variance of the group-level residuals and that of the individual-level residuals. The group residuals represent unobserved group characteristics that affect individual-level outcomes. It is these unobserved variables which lead to correlation between outcomes for individuals from the same group (Bryk and Raudenbush, 1992; Goldstein, 2011; Kreft and De Leeuw, 1998; Snijders and Bosker, 2011).

Multilevel logistic regression models are used in this study to examine the probability p_{ijk} of a woman i in the community j and country k having adequate maternal healthcare utilization. This analysis is represented as:

$$\text{logit}(p_{ijk}) = \beta_0 + \beta \mathbf{X}_{ijk} + u_{jk} + v_k$$

where \mathbf{X}_{ijk} is the vector of explanatory variables at individual, community and country levels, u_{jk} is normally distributed with variance σ_u^2 ; v_k is normally distributed with σ_v^2 .

In terms of variances used to understand the relative importance of the general contextual factors of community and country-level characteristics, I used the median odds ratios (MOR) and the variance partition coefficients (VPC). The MOR is on the same scale as the odds ratios and is interpreted as the median value of the odds ratios between individuals from units at high or low risk when randomly choosing 2 individuals from different units. In this study, that would be the odds of having inadequate utilisation of maternal healthcare that are determined by unexplained factors at the community and country levels.

The VPC provides information on the share of the variance at each level of operation. The VPC at each level was calculated using the latent method. It assumes a threshold model and approximating the level-1 (individual) variance by $\pi^2/3$ (≈ 3.29) (Dundas et al., 2014; Goldstein, 2011; Merlo et al., 2005; Rodriguez and Goldman, 2001).

$$VPC_{Country} = \frac{\sigma_{u(3)}^2}{\sigma_{u(3)}^2 + \sigma_{u(2)}^2 + \pi^2/3}$$

and

$$VPC_{Community} = \frac{\sigma_{u(2)}^2}{\sigma_{u(3)}^2 + \sigma_{u(2)}^2 + \pi^2/3}$$

A three-level multilevel model for each of the two outcome variables (ANC visits and delivery care) was specified with the three-level structure. Estimates for parameters were obtained using the Bayesian Markov chain Monte Carlo (MCMC) Methods in MLwiN through the R2MLwiN package

(Zhang et al., 2016) in R. MLwiN uses a combination of Gibbs sampling and Metropolis-Hastings sampling to extract samples from the posterior distribution of unknown parameters. McMC methods allow for specification of the prior distribution which is then combined with the likelihood function produced by the data to create the posterior distribution. McMC methods do not aim to find simple point estimates for the parameters of interest as in frequentist likelihood methods. Instead, they make a large number of simulated random draws from the joint posterior distribution of all parameters and use the draws to make a summary of the underlying distributions (Browne, 2015; Gill, 2014). From these random draws, it is then possible to calculate the posterior mean and standard deviation (SD), as well as density plots of the complete posterior distribution and quantiles of this distribution allowing for the construction of credible intervals. The Bayesian inference with McMC methods are preferred for this analysis because they produce unbiased estimates according to Browne (2015).

Because of limited background information and lack of related previous studies, this study uses non-informative uniform prior distributions with large variances (mean = 0, variance = 106) for regression parameters and inverse gamma (0.001, 0.001) for precision parameters. One chain was specified running for 55,000 iterations with a burn-in length of 5,000 iterations in order to achieve convergence. The convergence of chains was assessed by inspection of trace and auto-correlation plots as shown in the appendix. The Bayesian Deviance Information Criterion (DIC) was used to evaluate the goodness of fit of the models (Browne, 2015; Gelman and Hill, 2007; Lynch, 2007).

Ethical consideration

This study is based on existing DHS data and publicly available world development indicators. Both have fewer ethical implications because they do not include any identifier information. The DHS surveys are approved by the Institutional Review Board of the ICF International in Calverton, Maryland, USA and specific ethics committees in participating countries. The surveys are conducted by well-trained research assistants who administer informed consent before respondents are interviewed and information is obtained anonymously and confidentially. The data is stored by the DHS Program based in Maryland United States and are publically available for research purposes upon approval from the program.

Results

Sample characteristics

Table 1 presents sampled countries, year of completion of data collection, final sample per country, number of communities in a country, median number of respondents per community and range of respondents in a community. As indicated above, the surveys were conducted between 2006 and 2015. The total number of respondents per country ranged between 1,445 Sao Tome and Principe and 20,192 Nigeria. The number of communities in the sample ranged from 104 for Sao Tome and Principe and 1612 for Kenya. The median number of respondents per community is between 7 and 21. Table 2 presents descriptive statistics for the pooled sample data of 245,955 respondents in SSA at individual level.

Table 2 shows summary statistics of the explanatory variables included in the analysis. The results show that most of the respondents were aged between 20 and 34 (67.39%), had no education (39.46%) and were in the poorest quintile of the population (23.75). One-third of women were unemployed while 39.61% were in formal employment with 26.88% being employed in the agricultural sector. As expected, the larger majority had no health insurance coverage (95.08%). In terms of sexual

Table 1: Description of
DHS data

Country	Year	N	Communities	Median N	Range
Angola	2015-16	8947	625	15	1-26
Benin	2011-12	9111	750	12	2-31
Burkina Faso	2010	3960	210	17	2-49
Burundi	2010	4916	376	13	4-21
Cameroon	2011	7655	580	13	4-21
Chad	2014-15	11104	626	18	3-40
Comoros	2012	2016	252	08	1-16
Congo	2011-12	6463	384	17	4-39
Congo DR	2013-14	11293	540	21	9-38
Cote d'Ivoire	2011-12	5431	352	14	4-37
Ethiopia	2011	7764	650	13	1-26
Gabon	2012	4143	336	12	1-34
Gambia	2013	5385	281	17	2-72
Ghana	2014	4294	427	09	1-33
Guinea	2012	4999	300	16	6-41
Kenya	2014	14949	1612	09	1-25
Lesotho	2014	2596	400	06	1-17
Liberia	2013	5348	322	16	5-32
Madagascar	2008-09	8569	600	14	4-31
Namibia	2013	3974	600	07	1-18
Niger	2012	7680	480	16	3-39
Nigeria	2013	20192	904	20	3-55
Rwanda	2014-15	5955	492	12	3-23
Sao Tome	2008-09	1445	104	12	3-48
Senegal	2010-11	8151	392	20	5-47
Sierra Leone	2013	8524	435	19	5-43
Swaziland	2006-07	2136	275	07	1-18
Tanzania	2015-16	7050	608	11	1-18
Togo	2013-14	5016	330	14	2-34
Uganda	2011	4909	712	12	1-25
Zambia	2013-14	9353	722	12	1-26
Zimbabwe	2015	4833	400	12	1-25

autonomy, most of the respondents (59.07%), reported that they were able to refuse sex while a slight majority (50.08) were comfortable to ask their partners to use a condom during a sexual encounter. Slightly over half reported that the use of violence against women is justifiable under certain circumstances.

The community level factors indicate that the proportion of women living in rural areas in sSA is more (68%) than those residing in urban areas. Community education seems to be evenly distributed as the communities with low, medium and higher education are all approximately 33%. The table also indicates that the proportion of women in communities saying that the distance to health facilities is a problem is more (61.25%) than those don't find it problematic. Similarly, the proportion of those who find money to be a problem in access to health facilities are more (55.36%) than those who don't. The proportion of women living in communities with high polygamous marriages is more than (51.38%) those living in communities without polygamous marriages and the proportion of women living in communities with low female-headed households is almost equal to that of women living in communities with high female-headed household holds. In both media exposure and decision-making authority, there is almost an equal proportion of women residing in both categories of each variable.

Table 2 also shows the summary statistics of factors measured at the country level in terms of standardised means and standard deviations. Standardization of continuous variables is important to aid the interpretation of relationships in the regression analysis. The results show that the gender inequality index and human development index have means approaching and standard deviations closer to 1, resembling that of standardised normal distribution. Country female employment rate has a standardised mean of 0.13 and standard deviation of 0.83.

Table 2: Descriptive statistics for analysis pooled sample (N = 245, 955)

Characteristics	Category	%	Mean(SD)
Individual-level			
Maternal age	<20	15.79	
	20-34	67.39	
	35-49	16.82	
Educational status	No education	39.46	
	Primary	34.81	
	Secondary/higher	25.71	
Household wealth	First	23.75	
	Second	21.02	
	Middle	19.23	
	Fourth	17.95	
	Fifth	16.43	
Employment status	Unemployment	33.52	
	Self employed	26.88	
	Formally employed	39.61	
Insurance coverage	No	95.08	
	Yes	5.92	

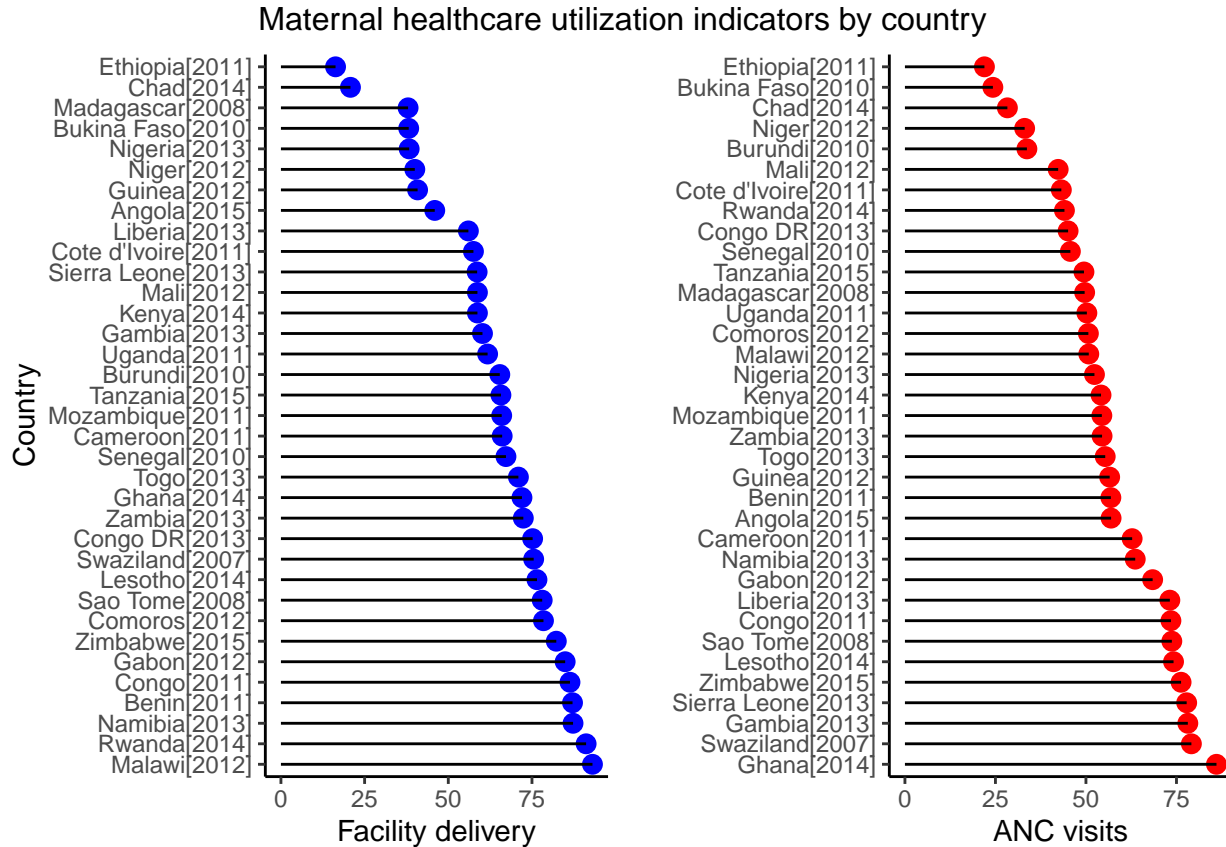
Table 2 – *Continued from previous page*

Characteristics	Category	%	Mean(SD)
Sexual autonomy	No	40.93	
	Yes	59.07	
Negotiate sex	No	40.93	
	Yes	50.08	
Condoms violence	No	54.02	
	Yes	45.92	
Community-level			
Community education	Low	33.30	
	Medium	33.70	
	High	33.01	
Community distance problem	Low	38.75	
	High	61.25	
Community money problem	Low	44.64	
	High	55.36	
Community polygynous marriage	Low	48.80	
	High	51.20	
Community female-headed households	Low	50.45	
	High	49.51	
Community media exposure	Low	49.69	
	High	50.31	
Community decision-making authority	Low	50.29	
	High	49.71	
Country-level			
Gender inequality index			0.00(1.00)
Female literacy rate			0.13(0.83)
Human development index			0.00(0.99)

Figure 1 reports the distribution of the two outcome variables by country. The results indicate the prevalence of institutional delivery in sSA range between approximately 16% to about 84% while that of ANC visits is between 22% and 86%. The variability in the outcome factors is about the

same.

The figure shows that the performance of sSA countries in the use maternal healthcare depends on the specific indicator of maternal healthcare. For antenatal care, Ghana is the best performing country where more than 80% of pregnant women attended antenatal care in their most recent pregnancy. Ghana is followed by Swaziland, Sierra Leone and the Gambia averaging between 77% and 80%. For institutional delivery, we see that Malawi, Rwanda and Namibia are the best performing countries. In terms of least performing countries, Ethiopia, Burkina Faso and Chad seem to be consistently recording low level of maternal healthcare utilisation across the continuum of antenatal care and institutional delivery.



Multilevel analysis

Four models were specified for each of the outcome variables and are reported in table 3 and 4. Model 1 is the null or empty model which contains only the intercept and outcome variable. Model 2 includes the individual level variables (maternal age, educational status, household wealth, employment, sexual autonomy, insurance coverage and condoning violence). Model 3 includes community-level variables (community education, community autonomy, community distance to health facility problem, community polygamous marriages, community female-headed households, community money problem and area of residence) and Model 4 has the country-level variables (gender inequality index, national female literacy rate and human development index).

I report the posterior odds ratios and 95% Bayesian credible intervals (CrI) for each of the variables in all models except for the null. Statistical significance is determined by non-inclusion of “1” in the 95% (CrI). Both the fixed and random effects are reported. Fixed effects are the average

associations of individual, community and country-level variables on maternal health care and these are represented as odds ratios and 95% credible intervals. Random effects are measures of variations in maternal health care use across communities and countries. To measure random effects, I used the variance partition coefficient (VPC) which measures the proportion of variation in the outcome variable that occurs between groups versus the total variation present. Higher VPC values show that a greater share of total variation in the outcome variables is attributable to higher level membership (Finch et al., 2019).

Gender relations and antenatal care

Table 3 presents the results of 4 models analyzing the odds of having adequate antenatal care visits during pregnancy. Model 2 which represents individual-level variables, indicates that maternal age, educational status, employment status, sexual autonomy, insurance coverage and condoning violence are all associated with having adequate antenatal care visits. Women aged 20 years and above, those who are educated up to primary level or higher, who are in employment, are able to refuse or negotiate sex and have health coverage are more likely to have 4 or more antenatal care visits to health facilities during pregnancy. It has also been established that women who condone violence are significantly less likely to have adequate antenatal care. Model 3 includes contextual factors at the community level. Community education, community media exposure and community decision-making authority are associated with 4 or more antenatal care visits. This means that women living in communities where a higher proportion of women have an education and those living in communities where a higher proportion have media exposure are more likely to use antenatal care services. The same is true for communities with a high proportion of women having decision-making authorities within their families.

As expected, distance and money-related barriers to access health facilities are negatively associated with ANC visits. Women residing in clusters in which a high proportion of women consider the lack of money and distance to be major problems in accessing healthcare facilities were less likely to use antenatal care services. Inequalities in gender relations variables including the proportion of female-headed households and polygynous marriages in a community show interesting results. Women who live in communities with high proportions of polygynous marriages are less likely to have adequate antenatal care while those who live in communities with high proportions of female-headed households are more likely to have adequate antenatal care use. All the individual level variables that were associated with antenatal care use in the second model remained so even after controlling for the effects of community-level variables.

Model 4 includes contextual factors at both country and community levels. It shows that only maternal age at the individual level, community polygynous marriages and residence at the community level lose significance when country-level variables are factored in. However, apart from the female literacy rate, the other country-level variables are not significantly associated with antenatal care use. For female literacy, the results show that a one unit increase in female employment, increases the odds of antenatal care use by a factor of 1.46.

Table 3 also reports the variance partition coefficients (VPCs), which show that the proportion of unexplained variation in antenatal care attributable to the community and country level factors is significantly large, 19.0% and 15.4% respectively. Antenatal care variations across communities and countries remained significant even in model 4 which controls for all the factors. The median odds ratio (MOR) for the unadjusted model at both community and country-levels are substantial, 2.52 and 2.31 respectively. These values confirm the importance contextual factors in explaining the

odds of having adequate antenatal care visits.

Model comparison denoted by the values of the DIC shows an improvement in model fit as the variables at different levels are being added. This means a complete three-level model is a considerably better predictor of adequate antenatal care compared to other models.

Table 3: Gender relations and antenatal care analysis of pooled sample (N = 245, 955)

Variable	Model 1	Model 2	Model 3	Model 4
Individual-level				
Intercept	0.85	0.49	0.34	0.31
<i>Maternal age</i>				
<20		1.00	1.00	1.00
20-24		1.06(1.01,1.09)	1.04(1.00,1.08)	1.01(0.79,1.06)
35-49		1.05(1.01,1.10)	1.04(1.00,1.09)	1.05(0.96,1.12)
<i>Educational status</i>				
No education		1.00	1.00	1.00
Primary		1.43(1.17,1.26)	1.30(1.26,1.35)	1.41(1.34,1.49)
Secondary/higher		1.95(1.87,2.03)	1.72(1.64,1.79)	1.83(1.71,1.96)
<i>Household wealth</i>				
First		1.00	1.00	1.00
Second		1.22(1.17,1.26)	1.16(1.12,1.20)	1.12(1.06,1.19)
Middle		1.49(1.43,1.55)	1.33(1.28,1.39)	1.40(1.31,1.49)
Fourth		1.84(1.76,1.92)	1.52(1.45,1.59)	1.70(1.57,1.84)
Fifth		2.82(2.67,2.96)	2.06(1.94,2.18)	2.41(2.18,2.65)
<i>Employment</i>				
Unemployed		1.00	1.00	1.00
Self-employed(agric)		0.99(0.94,1.02)	1.02(0.98,1.06)	1.03(0.97,1.10)
Formally employed		1.20(1.17,1.24)	1.18(1.14,1.21)	1.24(1.18,1.29)
<i>Insurance coverage</i>				
No		1.00	1.00	1.00
Yes		1.30(1.21,1.38)	1.27(1.19,1.36)	1.63(1.47,1.82)
<i>Sexual autonomy</i>				
No		1.00	1.00	1.00
Yes		1.07(1.04,1.10)	1.05(1.02,1.08)	1.10(1.04,1.15)
<i>Negotiating sex</i>				
No		1.00	1.00	1.00
Yes		1.26(1.22,1.29)	1.23(1.19,1.26)	1.23(1.18,1.29)
<i>Condone violence</i>				
No		1.00	1.00	1.00
Yes		0.93(0.91,0.97)	0.95(0.92,0.98)	0.93(0.86,0.98)
Community-level				
<i>Community education</i>				
Low			1.00	1.00
Mediam			1.49(1.41,1.57)	1.75(1.58,1.93)
High			1.60(1.49,1.72)	1.21(1.61,2.01)
<i>Community distance problem</i>				
Low			1.00	1.00
High			0.91(0.87,0.95)	0.84(0.78,0.90)

Table 3 – *Continued from previous page*

Variable	Model 1	Model 2	Model 3	Model 4
<i>Community money problem</i>				
Low			1.00	1.00
High			0.85(0.83,0.88)	0.80(0.77,0.84)
<i>Community polygynous marriage</i>				
Low			1.00	1.00
High			0.95(0.91,0.99)	0.99(0.92,1.06)
<i>Community female-headed households</i>				
Low			1.00	1.00
High			1.16(1.11,1.20)	1.21(1.14,1.29)
<i>Community media exposure</i>				
Low			1.00	1.00
High			1.25(1.19,1.31)	1.17(1.08,1.25)
<i>Community decision-making authority</i>				
Low			1.00	1.00
High			1.20(1.15,1.25)	1.27(1.19,1.36)
<i>Residence</i>				
Urban			1.00	1.00
Rural			0.94(0.90,0.99)	1.01(0.94,1.09)
Country level				
Gender inequality index				1.23(0.90,1.75)
National female literacy				1.46(1.11,1.81)
Human development index				1.36(0.84,1.81)
Random effects				
Country-level				
Variance(SE)	0.773(0.192)	0.613(0.166)	0.527(0.136)	0.497(0.162)
VPC(%)	15.4	12.0	11.9	11.3
MOR	2.31	2.11	2.00	1.96
Community-level				
Variance(SE)	0.950(0.018)	0.653(0.014)	0.628(0.015)	0.629(0.016)
VPC(%)	19.0	14.3	14.1	14.0
MOR(2.53)	2.53	2.16	2.13	2.13
DIC	288,175.95	218,025.83	217,563.73	194,711.81

Gender relations and institutional delivery

Table 4 presents analyses of the odds of having institutional delivery among women in sub-Saharan Africa. The results show similar patterns as the antenatal care uptake. All individual level variables are consistently associated with institutional delivery even after controlling for community and country-level variables. However, it is interesting to note that for maternal age, women who are more than 20 years are less likely to deliver in health facilities when the opposite was the case for antenatal

care visits. Additionally, women who are employed in agriculture have consistently reduced odds of delivering in institutional facilities compared to those who are unemployed. All community-level variables are associated with institutional delivery including community polygamous marriages and place of residence which unlike in the antenatal care model, they are consistently negatively associated with institutional delivery. The country-level variables are all not significantly associated with facility delivery.

The VPC indicates that unlike antenatal care, the variations in the odds of institutional delivery are explained by the contextual factors more than individual factors. This is the case even after controlling for all the factors. The MOR from the variances are also very high for both the country level (MOR = 3.79) and the community level (MOR = 5.65) indicating greater contextual-level variations in institutional delivery.

The DIC which reports model comparison shows an improvement in model fit as the variables are different levels are being added. This means a complete three-level model is a considerably better predictor of institutional delivery compared to other models.

Table 4: Gender relations and institutional delivery analysis pooled sample (N = 245, 955)

Variable	Model 1	Model 2	Model 3	Model 4
Individual-level				
Intercept	1.30	0.00	0.21	0.57
<i>Maternal age</i>				
<20		1.00	1.00	1.00
20-24		0.81(0.78,0.85)	0.80(0.76,0.83)	0.80(0.76,0.84)
35-49		0.78(0.74,0.83)	0.76(0.72,0.80)	0.76(0.72,0.81)
<i>Educational status</i>				
No education		1.00	1.00	1.00
Primary		1.60(1.54,1.66)	1.40(1.35,1.46)	1.41(1.35,1.46)
Secondary/higher		3.09(2.94,3.26)	2.48(2.35,2.62)	2.43(2.31,2.57)
<i>Household wealth</i>				
First		1.00	1.00	1.00
Second		1.44(1.38,1.51)	1.32(1.26,1.37)	1.30(1.24,1.35)
Middle		1.96(1.87,2.06)	1.56(1.49,1.64)	1.52(1.45,1.60)
Fourth		3.33(3.15,3.52)	2.11(1.99,2.24)	2.07(1.95,2.19)
Fifth		8.50(7.89,9.16)	3.70(3.41,4.00)	3.62(3.35,3.91)
<i>Employment</i>				
Unemployment		1.00	1.00	1.00
Self employment(agric)		0.75(0.71,0.78)	0.82(0.78,0.86)	0.82(0.78,0.86)
Formally employed		1.09(1.05,1.14)	1.05(1.01,1.09)	1.04(1.00,1.09)
<i>Insurance coverage</i>				
No		1.00	1.00	1.00
Yes		1.68(1.54,1.84)	1.66(1.52,1.82)	1.78(1.62,1.96)
<i>Sexual autonomy</i>				
No		1.00	1.00	1.00
Yes		1.11(1.07,1.15)	1.08(1.04,1.12)	1.08(1.04,1.16)
<i>Negotiate sex</i>				
No		1.00	1.00	1.00
Yes		1.34(1.29,1.39)	1.28(1.24,1.34)	1.27(1.23,1.32)

Table 4 – *Continued from previous page*

Variable	Model 1	Model 2	Model 3	Model 4
<i>Condone violence</i>				
No		1.00	1.00	1.00
Yes		0.89(0.85,0.91)	0.90(0.87,0.93)	0.89(0.86,0.92)
Community-level				
<i>Community education</i>				
Low			1.00	1.00
Medium			2.14(1.98,2.32)	2.19(2.02,2.37)
High			3.06(2.76,3.41)	3.09(2.79,3.44)
<i>Community distance problem</i>				
Low			1.00	1.00
High			0.54(0.51,0.58)	0.53(0.50,0.57)
<i>Community money problem</i>				
Low			1.00	1.00
High			0.86(0.83,0.89)	0.87(0.84,0.89)
<i>Community polygynous marriage</i>				
Low			1.00	1.00
High			0.84(0.79,0.90)	0.83(0.78,0.89)
<i>Community female-headed households</i>				
Low			1.00	1.00
high			1.18(1.12,1.24)	1.16(1.09,1.24)
<i>Community media exposure</i>				
Low			1.00	1.00
High			1.51(1.41,1.61)	1.52(1.42,1.63)
<i>Community decision-making authority</i>				
Low			1.00	1.00
High			1.20(1.13,1.28)	1.22(1.14,1.29)
<i>Residence</i>				
Urban			1.00	1.00
Rural			0.54(0.50,0.59)	0.56(0.52,0.60)
Country-level				
Gender inequality index				1.24(0.81,1.85)
National female literacy				0.65(0.35,1.31)
Human development index				0.94(0.64,1.26)
(Random effects)				
<i>Country-level</i>				
Variance(SE)	1.95(0.50)	1.68(0.45)	1.39(0.39)	1.59(0.50)
VPC(%)	22.90	25.80	22.90	25.20
MOR	3.79	3.44	3.08	3.33
<i>Community-level</i>				
Variance(SE)	3.30(0.05)	1.56(0.03)	1.38(0.03)	1.41(0.03)
VPC(%)	38.60	23.90	22.70	22.40
MOR	5.65	3.29	3.07	3.11

Table 4 – *Continued from previous page*

Variable	Model 1	Model 2	Model 3	Model 4
DIC	210,306.11	155,932.28	154,131.68	136,879.32

Discussion

This study sought to examine the relationship between gender relations on maternal health care utilization and the role played by structural factors in this relationship. Gender relations and female empowerment are formulations that are influenced by social, cultural and economic factors (Sado et al., 2014) and are in turn reflected mainly by women’s interactions with intimate partners, households, community and society at large (Kane et al., n.d.). Maternal health care in developing countries is akin to sexual and reproductive health which as [Organization and others (2007)] describes is shaped by the nature of intimate relationships, family structures, community institutions and relations within a particular society. To adequately explain variations in maternal healthcare utilization, it is important to capture this complexity in the analysis. I used three-level multilevel logistic regression models to represent individual, community and country level measures of gender relations and other intersectional categories. The findings of this study provides evidence of direct linkages between these measures and the two most basic indicators of maternal health care uptake, antenatal care and institutional delivery. The study deepens our understanding of the importance of contextual gendered factors in maternal healthcare utilization. In particular, the study found that women who live in communities where there are more women with primary or higher education, decision making authority, exposure to the media and minimal distance to health facilities are more likely to consistently use maternal health care, from antenatal to postnatal care.

The study finds evidence of substantial clustering at both the community and country levels. Both the VPC and MOR confirm that contextual level factors are responsible for more variations in institutional delivery and postnatal care than individual-level variables. Individual-level factors still explains greater variation in antenatal care coverage albeit with significant contextual-level variance. Clustering evidence indicates the presence of homogeneity among women from the same communities and countries, suggesting that they are shaped by common sociocultural fundamentals.

At the individual level, education, employment, media exposure, autonomy and being from a female-headed household are predictors of consistent use of maternal health care in SSA. There are many studies that have reported significant relationships between several gender-related factors and use of maternal health care in SSA, some of which corroborate our results albeit in different contexts (Adjiwanou and LeGrand, 2014; Gage, 2007; Onah et al., 2006; Ononokpono et al., 2013; Stephenson et al., 2006). These studies either use individual countries, a few selected countries or or do not focus on broader contextual influences of gender-related factors on maternal health care.

The results are also corroborated by (Ahmed et al., 2010) who use multiple countries and found empowerment, education and empowerment to be significantly associated with maternal health care, measured as contraceptive use, skilled birth attendance and attending at least four antenatal care visits in developing countries. Adjiwanou et al. (2018) equally finds a significant relationship between education and maternal health care utilization.

Maternal health, throughout the continuum of pregnancy care, including attending a recommended number of antenatal visits, having skilled delivery care and postnatal checkups is central to woman’s

health which leads to reduced maternal mortality and have positive implications for society as a whole. The results raise important implications across the SSA society as to the social mechanisms that contribute to the observed associations. It shows that health care disparities are embedded within the social and cultural fabric and is based on gender relations and socio-economic status. The pathways between high socio-economic status and healthcare utilization are obvious as the person who has wealth and is educated is most likely to reside in places which are proximal to health facilities and is also most likely to have health insurance or afford out-of-pocket payments for healthcare (Baum et al., 1999; Cutler et al., 2008; Leive and Xu, 2008; Myburgh et al., 2005). Gender relations in the form of lack of decision-making authority among women, affects levels of emotional, sexual and physical well-being as well as mobility to healthcare facilities and hence poor health outcome (Krug et al., 2002; Matthews et al., 1999; Steele et al., 2001; Steele and Goldstein, 2006).

The community and country level factors that are found to be significantly associated with maternal health care buttresses notions of the impact of up-stream factors in individual level decision-making processes. This would be the result of structural factors embedded within local communities and broader social institutions existing at the country and international level. In fact, individual level determinants of maternal healthcare utilization may just be symptoms of structural factors within local communities and broader social institutions. For example, the influence of decision-making authority on maternal healthcare operationalized at an individual level have often been discussed within the framework of dominant and broader masculinity ideologies or cultural beliefs in particular spaces (Say and Raine, 2007). The same may be true with health systems whose dysfunctionality may be a direct consequence of political and governance systems far removed from their level of operation. Indeed some studies have found evidence of the significant role played by structural factors in influencing maternal healthcare utilization in sSA.

Limitations of the study include the use of pooled analysis which combined the 35 countries of sSA. It is probable that effect sizes resulting from the pooled analysis may not represent what pertains within individual countries included. Also, the constitution of community level variables which was done by aggregating individual level variables using the PSUs may potentially have created atomistic fallacy (Diez, 2002) whereby inferences at the high level are made using lower level data. Recall bias is also one of the potential problems although it was minimized by the focus on exclusively the most recent birth of the five years prior to the survey.

The strengths of this study lies in the use of several factors to measure gender relations at three-levels, providing a cross-national evidence of the magnitude of their associations with use maternal health care. It is also worth noting that unlike some previous studies (Ononokpono et al., 2013) that have relied on one variable to represent maternal healthcare utilization, this study uses the whole continuum beginning with antenatal care up to postnatal check-ups for mothers and newborn children. The use of Bayesian MCMC estimation which minimizes bias to estimation especially in multilevel models with countries occupying the highest level in the analysis (Bryan and Jenkins, 2016; Stegmuller, 2013). This provides a better separations of the effects of individual and contextual factors on women's utilization of MHC, which is critical for the implementation of policy strategies aimed at bolstering the use of MHC services especially in low resource countries. Isolating the effects of contextual conditions provides a better platform for theoretical developments that are crucial for understanding the relationships between the broader social structure and health outcomes. This may ultimately help us explain why there are protracted disparities in health and healthcare outcomes in sSA.

Conclusion

This paper addressed the impact of gender relations on maternal healthcare utilization in sub-Saharan Africa. I used several variables at the individual, community and country-level to represent gender relations agency and women empowerment. The results show that in addition to several individual level factors, community education, community decision- making authority, community exposure to the media and community distance to health facilities are important predictors of maternal healthcare utilization. In other words, women living in communities in which most women have primary or higher education, decision making authority, exposure to the media, live closer to health facilities are more likely to use maternal healthcare services. At the country level, education in form of higher literacy rates among women was found to be positively associated with use of maternal healthcare.

The findings from this study also generally attributes cross-national variations in maternal healthcare to contextual factors. This means that apart from specific individual, community and country levels factors that are found to be associated with indicators of maternal healthcare, the findings in this paper help to re(emphasise) the importance of contextual factors in terms of understanding as well as bolstering maternal healthcare utilisation in sub-Saharan Africa.

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