

Gender Relations, Female Empowerment and Use of Maternal Health care in sub-Saharan Africa: A Multilevel Modelling Study

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Abstract

Maternal health care utilisation still remains crucial in ensuring good pregnancy outcomes and a reduction in maternal mortality and child mortality especially in developing countries. Although several studies have been conducted investigate determinants of maternal health care utilisation, the multi-country and multi-level influence of socio-cultural factors on use of maternal health care has received little attention. This paper sets out to examine the influence of gender relations and female empowerment on maternal healthcare utilisation in sub-Saharan Africa. The analysis pools sample data of 245,955 respondents from the most recent Demographic and Health Surveys and World Development Indicators of 35 sub-Saharan African countries. Separate Bayesian multilevel logistic regression models are fitted for adequate antenatal care, institutional delivery and postnatal care in relation to several factors indicating gender relations and female empowerment as 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 polygamous marriages enhances the propensity to consistently use maternal health care. These results help to underscore the importance of contextual factors in understanding women's utilisation of maternal healthcare and how critical they are in the implementation of policy strategies aimed at bolstering maternal healthcare uptake in low resource countries.

1 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)—the highest among the regions of the world (Alkema et al., 2016). The lifetime risk of maternal mortality is approximately 1 in 36 in SSA, which contrasts sharply with that of developed countries, which stands at 1 in 4,900. Although there was a sustained decline of 45% in MMR between 1990 and 2015, SSA is one of the regions which registered the least progress in terms of meeting the 2015 United Nations Millennium Development Goal target of a 75% reduction (Alkema et al., 2016). Given this backdrop, a great effort needs to be made towards reducing MMR if the prospects of meeting an even more ambitious target of 70 maternal mortality cases or less per 100,000 live births by 2030 are to be realised.

Maternal healthcare (MHC) services such as antenatal, skilled delivery and postnatal care are some the most important drivers of maternal and child mortality in the world (Zureick-Brown et al., 2013; Onah et al., 2006; Filippi et al., 2006). MHC helps provide health information that is necessary for healthy pregnancy outcomes (Birmeta et al., 2013). It also ensures timely management and treatment of complications to minimise maternal deaths (Tey and Lai, 2013). Despite the importance of MHC 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 virtually all women have adequate antenatal care and are attended to by skilled health professionals during childbirth (Alkema et al., 2016). Moreover, women from disadvantaged societies are less health and in more need for maternal healthcare services than those in better-off places. Additionally, they are usually of low socio-economic status making them disadvantaged within already disadvantaged societies (Ahmed et al., 2010) and vulnerable to other societal vices including intimate partner violence (Simona et al., 2018) and HIV/AIDS (Igulot and Magadi, 2018).

Inequalities in gender relations and female empowerment have, in the recent past emerged as important themes in discourses of maternal healthcare utilisation in SSA and other developing countries. Socially constructed sexual division of labour as well as intrinsic social norms define role expectations, obligations and relationships between men and women (Nankinga et al., 2016). These social formulations and norms are reinforced by sanctions embedded within social institutions to ensure conformity and dissuade deviance (Blanc, 2001). Inequalities in gender relations are often detrimental to maternal healthcare utilisation because society assigns women with exclusive responsibility to nurture maternal roles and yet they occupy subordinate positions and have limited access to economic resources (Yamin et al., 2015). As explained by Sen and Batliwala (2000:24), the control of women and girls' sexuality and reproduction is at the core of unequal gender relations and is central to the denial of equality and self-determination of women. "Female empowerment has often been conceptualised as a consequence of agency. It reflects a person's freedom to pursue and achieve goals important to them (Sen, 1985). It invokes woman's ability to participate in making decisions that affect the outcomes of their families and society (Hanmer and Klugman, 2016). Intrinsic to both agency

and empowerment is the domain of capability and among the areas that represent agency and empowerment include sexuality, marriage, childbearing, and the exercise of reproductive rights; making decisions in the family; participation in labor, land, and financial markets; and, engagement with collective action and politics (Alkire, 2008).

Although most research in SSA and other developing countries conceptualise gender relations and the status of women within a broader narrative of patriarchal superstructure which privileges men with power (Nankinga et al., 2016; Balk, 1994), fewer studies examine the relationship between gender relations and maternal healthcare. Adjiwanou and LeGrand (2014) looked at 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 utilisation, have examined the effects of broader contextual factors which mostly include poverty, ethnic origin and area of residence among others (Stephenson et al., 2006; Ononokpono et al., 2013). Indeed, they have shown that social and community level factors influence maternal healthcare utilisation. Women's inferior status, characterised 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 and other social vices are embedded, are complex and determining their effects on maternal healthcare may not be appropriate without representing broader social contexts within which they occur. In this study, I seek to utilise three-level multilevel models to examine the influence of gender relations and female empowerment on maternal healthcare utilisation in SSA. This extends previous multilevel studies that have only focused on two level models by including and controlling for country-level variables and by interpreting both measures of variance and measures of associations 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 utilisation. If the social conditions are important in explaining maternal healthcare utilisation, 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.

I use data from the Demographic and Health Surveys (DHS) and the World Bank's World Development Indicators in this study. Bayesian inference using Markov chain Monte Carlo (MCMC) is applied for parameter estimation.

2 Methods

2.1 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’voire, 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 of women and men of reproductive age (15-49 year for women and 15-59 years for men) designed to provide information on a number of measures including fertility, family planning, mortality, nutrition, maternal and child health, HIV/AIDS, domestic violence and other health indicators, at national level for both rural and urban areas of DHS countries. The main purpose of the DHS is to provide policy-makers, programme planners and researchers in DHS participating countries with a database sufficient to allow them to make informed policy and program choices; to expand the international health and population databases; to advance survey research methodology for the collection and processing of demographic and health data; and to help participating countries develop the technical skills and resources necessary for conducting their own demographic and health surveys ([Fabric et al., 2012](#); [Fisher and Way, 1988](#)). 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.

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.

2.2 Outcome variables

Three separate dichotomous outcome variables were used to measure maternal healthcare utilisation including antenatal care (ANC), institutional delivery care and postnatal checkups for mothers and newborn babies, measured at an individual level. All the dependent 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 the pregnancy for their most recent birth. The variable was recoded into a binary variable taking into account the World Health Organisation (WHO) recommendations of four or more ANC visits and thus if they received no antenatal care or made one to three visits, this was recoded as “0”, and if they made four or more antenatal care visits, this was recoded as “1”. For delivery care, women were asked where they delivered their babies for the most recent birth. Many options were given which included public hospital, private hospital, public clinic, private clinic or home among others. The variable was recoded to either home “0” or institutional delivery “1”. With regard to postnatal care, women were asked whether they and their babies were checked within the first one month of birth and their responses were also recoded into a binary variable taking the value of “0” if they were not checked and the value of “1” if they were checked. 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](#))

2.3 Explanatory variables

2.3.1 Individual level variables

Inequalities in gender relations and female empowerment in this study are represented by variables depicting both the absolute and relative nature of the status of women. Gender-based inequalities at the individual level are assessed by sexual autonomy, the ability to negotiate sex and whether they condone violence perpetrated by spouses ([Nankinga et al., 2016](#)). All the three variables were dichotomised into “yes” and “no” responses. 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 she provided a negative response.

Female empowerment was conceptualised in terms of socioeconomic status and decision-making processes. Socioeconomic status include woman’s educational status, household wealth, employment status and access to healthcare facilities. 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 formal employment (professional/technical/managerial/clerical/sales/services/skilled manual workers), agricultural employment and unemployed. 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. We renamed the quintiles in this study as first, second, middle, fourth and fifth quintile.

Maternal age was included as the control variable. It was defined as mother's age at the most recent birth. Maternal age was calculated by subtracting the century month code (CMC) of the date of birth of the child from the CMC of the date of birth of the respondent. Maternal age was categorised in three intervals <20, 20–34 and 35–49 years.

2.3.2 Community level 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/neighbourhood 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 neighbourhoods because they are the most consistent measure of communities across all DHS surveys and many previous studies have defined communities in a similar manner ([Ononokpono et al., 2013](#); [Wiysonge et al., 2012](#); [Adjiwanou and LeGrand, 2014](#); [Yebyo et al., 2015](#)). Just like at the individual level, community level factors were defined to reflect the gender relations 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 categorised into three categories: lower educational attainment, medium educational attainment and high attainment. Community distance problems was defined as the proportion of women who considers distance to health facilities as problem. The variable was divided into categorised as less problems and more problems. 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 more problems and less problems. Community Polygamy prevalence 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 categorised 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 pre-categorised as rural and urban areas.

I computed aggregates for clusters using the means of the proportions of women in each category of a given variable and then categorised the aggregate of a cluster into 2 groups based on the national median values. I used quintile for the community education to deliniat it into three tertiles.

2.3.3 Country level factors

The country level variables as indicated above are the country’s gender inequality index, female employment rate and the human development indicator is used as a control variable. Gender inequality index is measured on a scale of 1 to 6, 1 being the most equal country and 6 being the worst. Female employment rate is the percentage of female employment 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 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.

2.4 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 data structure whereby individuals are nested within clusters which are in turn nested within countries and our aim to examine the relative variance of use of maternal healthcare at different levels, we used multilevel modelling techniques. They are suited for this purpose because in addition to capacity to assess the fixed associations between variables, they recognise 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 (Goldstein and Leckie, 2011; Kreft et al., 1998; Snijders and Bosker, 2012; Raudenbush and Bryk, 2002).

A three-level multilevel model for each of the three outcome variables (ANC visits, delivery care and postnatal care for mothers and new born babies) was specified with the three-level structure. Estimates for parameters were obtained using the Markov chain Monte Carlo (McMC) Methods in MLwiN through the R2MLwiN package (Zhang et al., 2016) in the R environment. 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 uninformative uniform prior distribution with large variances (mean = 0, variance = 10^6) 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 (Gelman and Hill, 2007; Lynch, 2007; Browne, 2015).

Four models were specified for each of the outcome variables and are reported in table 3 to 5. Model 1 is the null or empty model which contains only the 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 log odds ratios and 95% confidence 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., 2014).

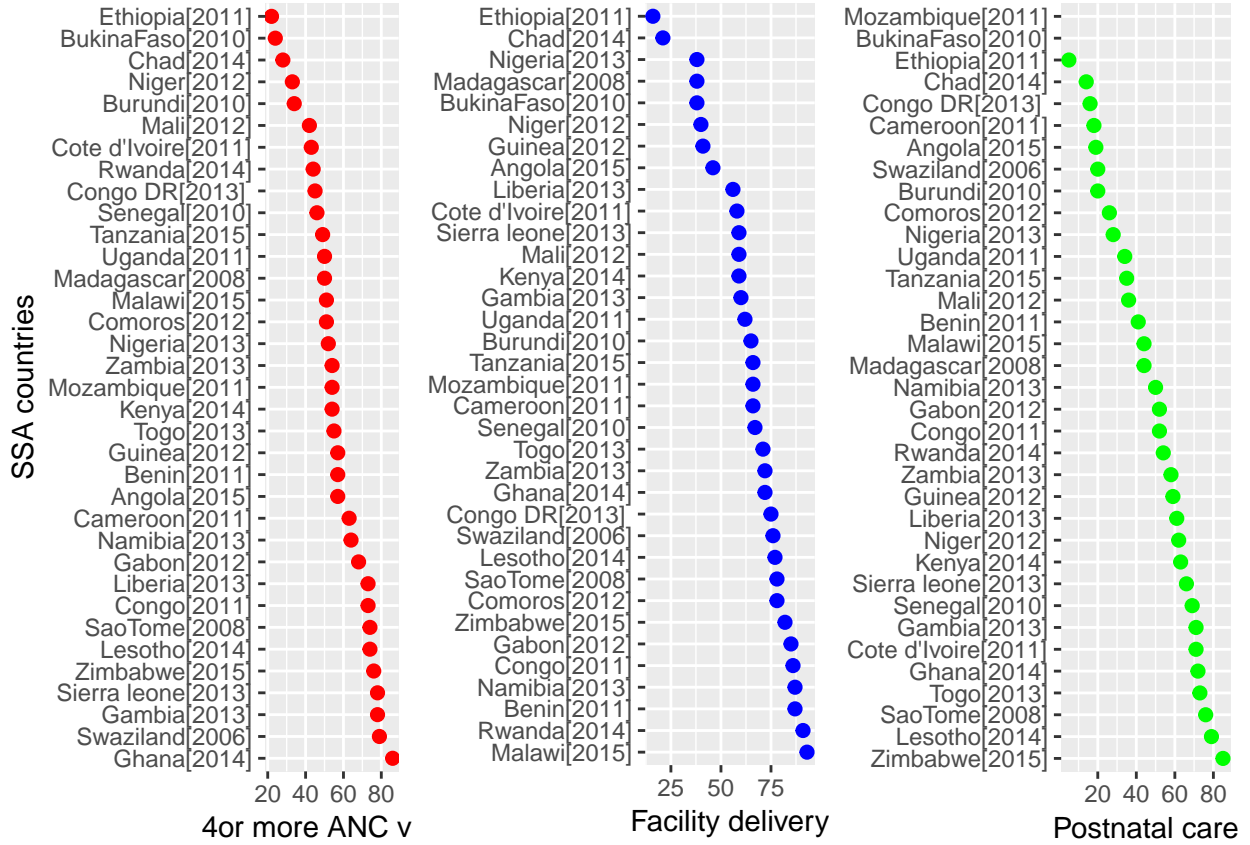


Figure 1: Maternal healthcare utilisation in SSA by country

2.5 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 procedures to acquire and use the data are documented on their website. Permission to use the DHS data was granted without conditions. The data set for Uganda required additional request to be made to the Statistics Bureau of that country. A request was made through email and permission to use the data was subsequently granted.

3 Results

3.1 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. 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 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. Standardisation 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 1: Description of Sample Data of DHS 2006-2015 in sub-Saharan Africa

Country	Survey year	Sample size	Number of Communities	Median of respondents per community	Range of respondents in community
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
Malawi	2015-16	13448	850	16	4-27
Mali	2012-13	6723	585	16	2-30
Mozambique	2011	7623	611	12	2-33
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

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 or	25.71	
	Higher		
Household wealth	First	23.75	
	Second	21.02	
	Middle	19.23	
	Fourth	17.95	
	Fifth	16.43	
Employment status	Unemployed	33.52	
	Self em- ployed(agric)	26.88	
	Formally employed	39.61	
Insurance coverage	No	95.08	
	Yes	5.92	
Sexual autonomy	No	40.93	
	Yes	59.07	
Negotiate sex	No	49.92	
	Yes	50.08	
Condomes violence	No	54.02	
	Yes	45.92	
Community-level			
Community education	Low	33.30	
	Medium	33.70	
	High	33.01	
Community distance problem	Less problems	38.75	
	More problems	61.25	
Community money problems	Less problems	44.64	
	More problems	55.36	
Community polygamous marriage	Low	48.80	
	High	51.20	

Table 2 – continued from previous page

Characteristics	Category	%	Mean(SD)
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	
Residence	Urban	31.74	
	Rural	68.26	
Country-level			
Gender inequality index			0.00(1.00)
Female employment rate			0.13(0.83)
Human development index			0.00(0.99)

3.2 Multilevel analysis

Fixed and random effects of individual-level, community and country-level variables are presented in tables 3-6, each representing one of the indicators of maternal health care as outcome variables (ANC visits, institutional delivery and postnatal care). Table 3 presents the results of 4 models analysing 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, those who are in employment, are able to refuse or negotiate sex and have health coverage are more like to have adequate care of 4 or more 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. Female empowerment indicators including community education, community media coverage and community decision-making authority are related to use of antenatal care. 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 economic and distance barriers related to service use are negatively associated

with ANC visits. Women residing in clusters in which a high proportion of women considered the lack of money and distance to be a major problem in healthcare access were less likely to use antenatal care services. Inequalities in gender relations variables including the proportion of female-headed households and polygamous marriages in a community show interesting results whereby women who live in communities with high proportions of polygamous marriages and 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 first model remained so even after controlling for the effects of community-level variables.

Model 3 includes contextual factors at both country and community levels. It shows that only maternal age at the individual level, community polygamous marriages lose significance when country-level variables are introduced. Place of residence shows a surprising notion: women who live in rural areas are less likely to use adequate antenatal care but after controlling for country-level factors, it is found that those who live in rural areas are more likely to attend at least 4 antenatal care visits. However, apart from the female employment rate, the other country-level variables are not significantly associated with antenatal care use. For female employment, 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.

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 = 5.650) indicating greater contextual-level variations in institutional delivery.

Table 5 reports the analyses of the odds of postnatal care for both mothers and newly-

born children in sub-Saharan Africa. For the individual-level factors, maternal age is not significantly associated with postnatal care in all the models while justification of violence against women is only associated with postnatal care after country-level variables are controlled for. It shows that women who justify violence against women in certain circumstances are less likely to have postnatal check-ups for themselves and their babies. All the other variables are positively associated with postnatal care. All community level factors are associated with postnatal care apart from place of residence and community female-headed households and they remain so even after country-level variables are introduced. Country-level variables hold no significance apart from employment rate whereby a unit increase in female employment increases the odds of having postnatal care by a factor of 1.36.

The VPC results from table 5 also indicate greater variation in the odds of postnatal care being attributed to community level (VPC = 24.2%) and country level factors (VPC = 28.2%). The large values of MOR are equally indicative of the significance of community and country level factors in explaining the odds of having postnatal care.

Table 3: Posterior odds ratios for multilevel logistic regression for Gender relations , female empowerment and antenatal care in sub-Saharan Africa with 95% credible intervals

Variable	Model 1	Model 2	Model 3	Model 4
Individual-level				
<i>Maternal age(years)</i>				
<20		1.00	1.00	1.00
20-34		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>Negotiate 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
Medium			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>				
Less problems			1.00	1.00
More problems			0.91(0.87,0.95)	0.84(0.78,0.90)
<i>Community money problem</i>				
Less problems			1.00	1.00
More problems			0.85(0.83,0.88)	0.80(0.77,0.84)
<i>Community polygamous 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
Higher			1.16(1.11,1.20)	1.21(1.14,1.29)
<i>Community media exposure</i>				

Table 3 – continued from previous page

Variable	Model 1	Model 2	Model 3	Model 4
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				
<i>Country-level</i>				
Variance(SE)	0.773(0.192)	0.613(0.166)	0.527(0.136)	0.497(0.162)
VPC(%)	15.4	11.0	11.9	11.3
MOR	2.31	2.11	2.00	1.96
<i>Community-level</i>				
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	14.2
MOR	2.53	2.16	2.13	2.13
DIC	288,175.95	218,025.83	217,563.73	194,711.81

Table 4: Posterior odds ratios for multilevel logistic regression for Gender relations, female empowerment and institutional delivery in sub-Saharan Africa with 95% credible intervals

Variable	Model 1	Model 2	Model 3	Model 4
Individual-level				
<i>Maternal age(years)</i>				
<20		1.00	1.00	1.00
20-34		0.81(0.78,0.85)	0.88(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>				
Unemployed		1.00	1.00	1.00
Self employed(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)
<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>				
Less problems			1.00	1.00
More problems			0.54(0.51,0.58)	0.53(0.50,0.57)
<i>Community money problem</i>				
Less problems			1.00	1.00
More problems			0.86(0.83,0.89)	0.87(0.84,0.89)
<i>Community polygamous 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
Higher			1.18(1.12,1.24)	1.16(1.09,1.24)
<i>Community media exposure</i>				

Table 4 – continued from previous page

Variable	Model 1	Model 2	Model 3	Model 4
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)	1.953(0.501)	1.682(0.453)	1.388(0.386)	1.589(0.496)
VPC(%)	22.9	25.8	22.9	25.2
MOR	3.79	3.44	3.08	3.33
<i>Community-level</i>				
Variance(SE)	3.294(0.054)	1.559(0.033)	1.379(0.029)	1.412(0.033)
VPC(%)	38.6	23.9	22.7	22.4
MOR	5.65	3.29	3.07	3.11
DIC	210,306.11	155,932.28	154,131.68	136,879.32

Table 5: Posterior odds ratios for multilevel logistic regression for Gender relations, female empowerment and postnatal care in sub-Saharan Africa with 95% credible intervals

Variable	Model 1	Model 2	Model 3	Model 4
Individual-level				
<i>Maternal age(years)</i>				
<20		1.00	1.00	1.00
20-34		1.03(0.99,1.08)	1.03(0.99,1.08)	1.00(0.94,1.06)
35-49		1.01(0.96,1.07)	1.01(0.96,1.06)	0.98(0.90,1.06)
<i>Educational status</i>				
No education		1.00	1.00	1.00
Primary		1.27(1.22,1.33)	1.20(1.16,1.26)	1.33(1.25,1.42)
Secondary/higher		1.53(1.45,1.60)	1.40(1.34,1.47)	1.52(1.41,1.64)
<i>Household wealth</i>				
First		1.00	1.00	1.00
Second		1.18(1.13,1.23)	1.13(1.09,1.18)	1.10(1.02,1.17)
Middle		1.33(1.27,1.39)	1.22(1.16,1.28)	1.21(1.12,1.31)
Fourth		1.53(1.45,1.61)	1.31(1.24,1.39)	1.30(1.20,1.43)
Fifth		1.90(1.79,2.02)	1.50(1.40,1.60)	1.52(1.37,1.70)
<i>Employment</i>				
Unemployed		1.00	1.00	1.00
Self employed(agric)		1.52(1.45,1.60)	1.02(0.98,1.06)	1.50(1.40,1.61)
Formally employed		1.30(1.26,1.35)	1.27(1.23,1.32)	1.26(1.20,1.33)
<i>Insurance coverage</i>				
No		1.00	(ref)	1.00
Yes		1.32(1.23,1.41)	1.29(1.20,1.39)	1.25(1.13,1.39)
<i>Sexual autonomy</i>				
No		1.00	1.00	1.00
Yes		1.16(1.12,1.20)	1.15(1.11,1.19)	1.19(1.13,1.25)
<i>Negotiate sex</i>				
No		1.00	1.00	1.00
Yes		1.14(1.10,1.18)	1.12(1.09,1.16)	1.11(1.06,1.17)
<i>Condone violence</i>				
No		1.00	1.00	1.00
Yes		0.98(0.95,1.02)	0.99(0.95,1.03)	0.90(0.85,0.95)
Community-level				
<i>Community education</i>				
Low			1.00	1.00
Medium			1.31(1.20,1.44)	1.56(1.37,1.77)
High			1.42(1.26,1.60)	1.49(1.28,1.72)
<i>Community distance problem</i>				
Less problems			1.00	1.00
More problems			0.78(0.73,0.83)	0.69(0.63,0.76)
<i>Community money problem</i>				
Less problems			1.00	1.00
More problems			0.85(0.82,0.87)	0.82(0.78,0.86)
<i>Community polygamous marriage</i>				
Low			1.00	1.00
High			1.01(0.95,1.08)	0.92(0.84,1.01)
<i>Community female-headed households</i>				
Low			1.00	1.00
Higher			1.05(0.99,1.11)	1.00(0.92,1.08)
<i>Community media exposure</i>				

Table 5 – continued from previous page

Variable	Model 1	Model 2	Model 3	Model 4
Low			1.00	1.00
High			1.34(1.25,1.43)	1.39(1.27,1.53)
<i>Community decision-making authority</i>				
Low			1.00	1.00
High			1.24(1.16,1.31)	1.23(1.12,1.34)
<i>Residence</i>				
Urban			1.00	1.00
Rural			1.00(0.94,1.08)	1.02(0.93,1.14)
Country-level				
Gender inequality index				1.59(0.87,2.77)
National female literacy				1.36(1.03,1.69)
Human development index				1.13(0.71,1.49)
Random effects				
<i>Country-level</i>				
Variance(SE)	1.952(0.541)	1.927(0.497)	1.856(0.470)	1.951(0.620)
VPC(%)	28.2	28.6	28.0	28.8
MOR	3.79	3.76	3.67	3.79
<i>Community-level</i>				
Variance(SE)	1.670(0.029)	1.511(0.031)	1.494(0.030)	1.534(0.035)
VPC(%)	24.2	22.5	22.5	22.6
MOR	3.43	3.23	3.21	3.26
DIC	205,673.38	168,224.21	168,029.25	153,391.18

4 Discussion and Conclusion

This study sought to examine the influence of gender relations and female empowerment on maternal health care utilisation and the role played by contextual 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., 2016). Maternal health care in developing countries is akin to sexual and reproductive health which as De Francisco et al. (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 utilisation, 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 female empowerment. The findings of this study provides evidence of direct linkages between these measures and the three most basic indicators of maternal health care uptake, antenatal care, institutional delivery and postnatal care. The study deepens our understanding of the importance of contextual gender and empowerment factors on maternal healthcare utilisation. 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 explain 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 ([Ononokpono et al., 2013](#); [Onah et al., 2006](#); [Gage, 2007](#); [Adjiwanou and LeGrand, 2014](#); [Stephenson et al., 2006](#)). These studies either use individual countries, a few selected countries 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 utilisation.

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 utilisation 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 ([Leive and Xu, 2008](#); [Myburgh et al., 2005](#); [Cutler et al., 2008](#); [Baum et al., 1999](#)). Gender inequality in the form of lack of autonomy among women, affects levels of emotional, sexual and physical well-being as well as mobility to healthcare facilities and hence poor health outcome ([Matthews et al., 1999](#); [Krug et al., 2002](#); [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 utilisation may just be symptoms of structural factors embedded within local communities and broader social

institutions. For example, the influence of female empowerment and decision-making powers on maternal healthcare operationalised 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 utilisation in SSA.

Limitations of the study include the use of pooled analysis which combined the 34 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 ([Roux, 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 minimised by the focuss 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 and female empowerment 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 healthcae utilisation, 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 minimises bias to estimation especially in multilevel models with countries occupying the highest level in the analysis ([Stegmueller, 2013](#); [Bryan and Jenkins, 2015](#)). This provides a better separations of the effects of individual and contextual factors on women's utilisation 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.

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