Patterns of access to reproductive health services in Ghana and Nigeria: results of a cluster analysis

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Research article

Keywords: reproductive services, maternal care, family planning, access, Nigeria, Ghana

Posted Date: January 2nd, 2020

DOI: <https://doi.org/10.21203/rs.2.17114/v2>

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Version of Record: A version of this preprint was published at BMC Public Health on April 23rd, 2020. See the published version at <https://doi.org/10.1186/s12889-020-08724-3>.

Abstract

Background To understand differences in access to reproductive healthcare services, the use of family planning and maternal care by women in Ghana and Nigeria is examined. **Methods** We used population-level data from the Ghana and Nigeria Demographic Health Surveys of 2014 and 2013 in two-step cluster analysis followed by multinomial logistic regression analysis. **Results** The initial two-step cluster analyses on family planning identify three groups of women in Ghana and Nigeria: women with high, medium and poor access to family planning services. The subsequent two-step cluster analyses identify five distinct groups: higher, high, medium, low and poor access to maternal health services in Ghana and Nigeria. The multinomial logistic regression shows that education and occupation are associated with access to family planning and maternal health services. Women without education often have poor access to reproductive health services in both countries. In Nigeria, household wealth is strongly associated with access to maternal health services but household wealth does not explain access in Ghana. Not having insurance in Ghana is associated with low access to family planning service, while this is not the case in Nigeria. **Conclusions** These differences confirm the importance of a focused context-specific approach towards reproductive health services, particularly to reduce inequality in access resulting from socioeconomic status.

Background

Inequalities in access to healthcare can result in health differences between social groups. Interventions to create universal access to healthcare and to improve health outcomes do not always consider these inequalities. Women are most exposed to unequal access to healthcare services globally [1]. This is particularly the case for reproductive healthcare services [2], which include contraceptives, maternal health services, and services related to sexual health [3] [4, 5]. Targets have been set to improve these services. For example, the Sustainable Development Goal 3 aims to ensure universal access to reproductive healthcare services [6].

Factors that determine access to reproductive health services are related to both demand and supply and can be divided into social and economic factors [7]. Education, occupation, wealth and possession of insurance among others are significant predictors of inequality in access to reproductive health services in Sub Saharan Africa [8-13]. However, previous studies have mostly focused on determinants of service use in a country or region [11, 14, 15]. There is a need of cross-country comparisons to shed light on similarities and/or dissimilarities between groups of users of reproductive health services in Sub-Saharan African countries.

This study examines access to reproductive healthcare services among women of reproductive age in Ghana and Nigeria. We use data from the Demographic Health Surveys (DHS) of Ghana in 2014 and Nigeria in 2013. The two countries are selected for this study based on the similarities in trends, health outcomes as well as data availability. At the same time, the countries' healthcare systems are different. For example, Ghana has an established national health insurance system, while there is no such well-

established system in Nigeria [16]. Ghana and Nigeria introduced a minimal user fee in the early 1970s which was later abandoned in both countries due to cash crunches [17]. Ghana offers free-of-charge maternal care and the health insurance scheme in the country is reported to cover 65% of the population which reduces the out-of-pocket health expenditure (66% of total health spending) [18]. One study using the cluster analysis method, has shown that there are differences in adequacy of maternal care available in Ghana and there are disparities in the socio-demographic characteristics that determine access [8]. Insurance coverage in Nigeria is 3.5% of the population with out-of-pocket health expenditure of over 90% of total health spending [17, 18]. These differences are expected to result in differences in access to reproductive health services, which we investigate in this paper.

Methods

The DHS are nationally representative cross-sectional surveys carried out in low- and middle-income countries periodically [19, 20]. The DHS adopts a multi-stage cluster design. Samples selected for enumeration are ensured to be representative and comparative across countries. The DHS for both countries included in this study involves a two-stage cluster and systematic sampling design where households per cluster were randomly selected [19, 20]. Respondents were selected by gender for the different questionnaire types and based on whether the respondent was a usual member of the household or having spent the night prior to the survey in the household.

We only used the data provided by women of reproductive age (15-49 years) in Ghana and Nigeria who had given birth during the last 5 years before the survey and were able to provide information on the use of reproductive health services. The study included 4,142 women in Ghana and 7,725 women in Nigeria.

We first performed two-step cluster analyses, which provided insight into the patterns of reproductive health services use among women of reproductive ages in both countries. Cluster analysis is a method to quantify similarities or dissimilarities based on respondents' data and to classify respondents into groups based on similarities [21]. Four cluster analyses were carried out, one for family planning services and another for maternal health services per country. We did not predefine the number of clusters. The clusters were generated by the cluster analysis procedure based on the indicators of reproductive care use that we included in the analysis. In particular, the two-step clustering procedure uses the Schwarz's Bayesian Information Criterion (BIC) method to determine the number clusters. Different clustering solutions are compared and the clustering solution with the lowest BIC is selected by the procedure. Thus, the cluster analysis suggested 3 cluster solutions for family planning services and 5 for maternal health care services. We inspected this clustering solution and accept it as adequate. The stability and reliability of the cluster analyses were ensured when the clustering procedure produced the best quality cluster quality in repeated analyses. The two-step cluster analysis procedure specifies the clustering quality based on the Silhouette Index (SI). The SI indicates how well each subject/object lies within its cluster, and thus, it validates the clustering outcomes. SI ranges from -1 to 1. SI greater or equal to 0.5 indicates good clustering quality.

We titled the clusters based on the quality and adequacy of medical care used by women in each cluster compared to what is usually provided in government-licensed medical facilities. Thus, in the poor access cluster, on average, women reported using less and lower quality care than the care usually provided at government licensed facilities, and, in the high access cluster, women reported using more and better care. Details about the cluster composition variables, patterns and quality are presented in Appendix A in the supplementary file.

Regression analyses provided an understanding of factors that are associated with the differences between the clusters generated in the cluster analyses. Multinomial logistic regression was used for the analysis of factors associated with the cluster membership identified during the cluster analyses. A total of four regression analyses were conducted. The cluster membership generated in each cluster analysis was the dependent variable in the multinomial logistic regression analyses. The explanatory variables consisted of women's background characteristics that were found to be associated with the use of family planning services and maternal health services in previous studies and were available in our dataset. Sample weights were applied for the multinomial logistic regression. SPSS version 23 was used for all data analyses.

Results

Descriptive statistics on the socioeconomic characteristics of the two samples and primary results of the two-steps cluster analyses can be found in the appendices (supplementary files). Below, we present the key findings of the cluster analyses as well as the results of the regression analyses.

Cluster analysis

In the two-step cluster analyses for Ghana and Nigeria (Table 1) regarding family planning services, three distinct clusters are identified for access to these services in each country. The clusters are labeled as high, medium, and poor access to family planning services based on the services used by women in each cluster. The cluster with high-access to family planning services captures 19.1% and 21.4% of women in the Nigeria sample and Ghana sample respectively. The other extreme is the third cluster that consists of women whose access can be described as poor; 71.5% of women in Nigeria belong to this cluster and 64.2% in Ghana.

Both two-step cluster analyses for access to maternal health services result in five clusters of women of reproductive ages in Nigeria and Ghana categorized as higher, high, medium, low and poor access to maternal health services based on the type of services used by the women. The higher-access cluster captures 29.6% of women in the Nigeria sample and 26.3% of the women in the Ghana sample. Relative to the other four clusters, a larger proportion of members of this cluster report that they accessed government hospitals for antenatal care and used institutional maternal care more. The high-access cluster consists of 21.6% of women in Nigeria and 23.0 % in Ghana. For both countries, this cluster has a lower proportion of women who accessed government health centers for antenatal care or got assistance from physicians during childbirth. Members of the medium-access cluster in both countries accessed

private facilities for antenatal care as well as for childbirth. This cluster of women makes up 25.9% of the Nigeria sample and 18.2% of the Ghana sample. Members of the low-access cluster in both countries are women who report that they accessed government health posts/dispensaries for antenatal care but did not have skilled assistance during childbirth. In the Nigeria sample, 4.4% of women fall into this cluster and in the Ghana sample, this share is 7.1%. Lastly, 18.5% and 25.4% of women from the Nigeria and Ghana sample respectively are members of the poor-access cluster who did not receive institutionalized maternal care. For both countries, the poor-access cluster has a high proportion of members who had home childbirth and used traditional birth attendants during childbirth.

Regression analysis

The dependent variables in the four multinomial logistic regressions were the four cluster membership variables generated in the cluster analyses. Tables 2 and 3 present the odds ratios for the four regressions, information about the independent variables used and the full results of the regression analyses can be found in Appendix B of the supplementary file.

For family planning services, the results in Table 2 show that in both countries, women with no education, compared to women with secondary or higher education, are more likely to have poor-access to family planning in Nigeria (OR=2.544, 95% CI:1.907- 3.395, $p \leq 0.01$) and in Ghana (OR=1.527, 95% CI: 1.173- 1.988, $p \leq 0.01$). Increased odds of having poor-access to family planning services also apply to women in Ghana who do not belong to white-collar workers, who belong to the bottom two wealth quintiles, but not women who live in rural areas. The same higher odds of poor-access apply to women in Nigeria belong to the services occupational category (OR=1.283, 95% CI: 1.002- 1.642, $p \leq 0.05$), compared with white-collar workers; as much as 3 times among the poorest quintile than the richest quintile (95% CI: 1.825- 6.396, $p \leq 0.01$); and who have no insurance (OR=1.374, 95% CI: 1.011- 1.867, $p \leq 0.05$) compared to those with insurance.

Table 3 shows the regression results of access to maternal health services in Nigeria and Ghana. In Nigeria, women with primary or no education are more likely to have poor- (OR= 1.387, 95% CI: 1.140- 1.687, $p \leq 0.01$) or low-access to maternal health services (OR= 1.786, 95% CI: 1.247- 2.557, $p \leq 0.01$); women who are not working have only poor-access maternal health services in Nigeria (OR= 1.579, 95% CI 1.081- 2.307, $p \leq 0.01$); women in all household wealth quintile are more likely to have high- or poor-access to maternal health services; and women without insurance are more likely to have high or poor-access to maternal health services. Ghana data show that women with primary (OR= 1.38, 95% CI: 1.036- 1.838, $p \leq 0.05$) or no education (OR= 1.542, 95% CI: 1.115- 2.132, $p \leq 0.01$) have higher odds of poor-access to maternal health services; only women in agriculture occupational group have high-access to maternal health services compared to women in white-collar sector (OR= 1.781, 95% CI: 1.022- 3.104, $p \leq 0.05$); and women without health insurance have higher odds of access to maternal health care service.

Discussion

As shown by our results, access to reproductive health services varies among women of reproductive ages. A large proportion of women in Ghana and Nigeria have poor access to family planning services. Most women do not have access to modern contraceptives. They use traditional birth control methods or do not have the means for needed services. These differences in access to maternal health services in both countries reflect a broader gap between women who access antenatal care at government hospitals, government facilities for childbirth with a physician present, and the low access group of women limited to services such as government health posts without skilled assistance during childbirth, or antenatal care private vendors. This confirms that among women of reproductive ages in Ghana and Nigeria, there exists unequal access to reproductive health services.

According to M Gulliford, J Figueroa-Munoz, M Morgan, D Hughes, B Gibson, R Beech and M Hudson [7], sub-population-specific needs of care arise when unmet needs lead to unequal healthcare utilization or access. This suggests a dysfunctional organization structure that creates constraints to preventive and medical procedures provided by well-trained professionals [4, 18, 22].

Our results show that educational attainment is associated with access to family planning and maternal health services. Low educational attainment reduces the ability to overcome access barriers, particularly to maternal health services. This finding supports similar results in other studies on the importance of education in improving access to reproductive health services [10-12, 23]. Our results indicate that among women with low education, some intend to use contraceptives later while others use traditional contraceptive methods of family planning. Notably, the group with poor access to family planning services for a large part consists of women who have no future intention of contraceptive use. This could be due to lower-educated women being less able to act on their intentions due to difficulty in overcoming access barriers or limited knowledge about the benefits of family planning [24]. The connection between education and socioeconomic status could also explain this observation; low education attainment, usually implies less access to resources [10, 25, 26]. The result further confirms what is known about the social stratification and its relationship fostering inequalities [9].

Results suggest that wealth/finance related inequality in access to reproductive health services is prominent in Nigeria and Ghana. Considering finance -related inequality between the two countries, we find that women without insurance coverage in Ghana are less likely to access family planning services. This is dissimilar to their counterparts without insurance in Nigeria; women in Nigeria who have poor-access to family planning opt for services such as traditional methods of contraception. These findings are consistent with other research on the use of family planning services in the countries and other parts of Africa [10]. This can be partially attributed to the inaccessibility of family planning services through a cost-reducing scheme inadvertently increasing the financial burden on household's preference for traditional contraceptives among some women [27]. Other research also found a situation similar to Ghana among women in Burkina Faso and concluded that affordability of insurance premium varies by household income [13]. The poor access to reproductive health services in any of the wealth quintiles in Nigeria is expected considering the lack of insurance. The low coverage of insurance schemes such as

the NHIS, particularly among informal workers or uneducated women, magnifies the effect of household wealth [17, 18].

There is an association between maternal occupation and access to maternal health services in both countries. Other studies have reported various associations [14, 22, 23]. However, where associations between maternal occupation and access to reproductive health services are observable, disparity by type is not unusual [22]. The results suggest that women in Nigeria are predisposed to any type of maternal health services compared with Ghana: access among Ghana women was only observed within the higher-access and low-access clusters.

It is possible that the cost of maternal health services available to women in Ghana (through the free maternal care policy) can be (or has to be) endured by women themselves in Nigeria [28, 29]. In the five maternal health services access groups observed, women of all occupational types belong to at least one of five maternal health services access -group available. Conversely, women in Ghana (except sales) either belong to two of five - the high- or low-access group. Women in the agriculture sector are only likely to access maternal health services in the high access group. Out-of-pocket payments for health have been consistently high in Nigeria compared with Ghana while insurance coverage is better in Ghana, particularly in the informal sector [27, 30].

This study has some limitations that need to be acknowledged. There was not much variation in some response variables and they had to be excluded from the analysis. The inclusion of country-specific variables helps to better reflect the women's situation but this also creates some dissimilarities in the country's analytical models.

Conclusion

This study evidenced inequalities in access to reproductive health services within Ghana and Nigeria, and also between these two countries. A key observation is the varied composition of services available for use at different access levels. But there are several imperative factors contributing to inequality in access to these services. After controlling for the effects of maternal-related variables, findings showed significant inequalities by differences in educational attainment, household wealth, insurance status and woman's occupational type. Much of the inequality in access to family planning services that are seen in Nigeria and Ghana is related to education. The contribution of household wealth and insurance status in creating unequal access was also evidenced in the study. Health programs, which seek to stimulate the use of reproductive health services in Ghana and Nigeria could take into account the variation in access reported in this study to assure the user-centeredness of these programs. It is important to identify and prioritize services for the needs of vulnerable groups.

Declarations

Abbreviations: Not applicable

Ethics approval and consent to participate: The Demographic & Health Survey has approval from by ICF Institutional Review Board (IRB). Procedures and questionnaires for standard DHS surveys have been reviewed and approved by ICF Institutional Review Board (IRB). Additionally, country-specific DHS survey protocols are reviewed by the ICF IRB and typically by an IRB in the host country. ICF IRB ensures that the survey complies with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46), while the host country IRB ensures that the survey complies with laws and norms of the nation. Informed consent was obtained from respondents during the survey while formal approval to use the data was obtained from the DHS program. It was determined that this study is not human subject's research by the Research Integrity & Ethics Office of the University. Administrative permissions were required and obtained from the DHS program to access the data used in this study.

Consent for publication: Not applicable

Availability of data and material: The data used for this study can be accessed through the following link: https://dhsprogram.com/data/dataset_admin/login_main.cfm?CFID=15554769&CFTOKEN=6d6c1572de0c435a-5BA70A19-BD9F-EDBD-DBC0BB52339CAF30

Competing interests: The authors declare that they have no competing interests.

Funding: Not applicable

Authors' contributions: JO and MP designed the study. JO analysed the data and drafted the manuscript. JO, MP and WG subsequently revised the manuscript and approved the final draft for submission.

Acknowledgements: Not applicable

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Tables

Table 1: Frequency distribution of cluster membership

Cluster group	Family planning services			
	Ghana		Nigeria	
	Obs	%	Obs	%
Poor-access	2755	64.2	5638	71.5
Medium Access	918	14.4	1507	9.3
High-Access	619	21.4	736	19.1
	Maternal health service			
	Ghana		Nigeria	
	Obs	%	Obs	%
Low-access	293	7.1	346	4.4
Poor -Access	1053	25.5	1452	18.5
Medium-Access	756	18.2	2027	25.9
High-Access	952	23.0	1693	21.6
Higher-access	1092	26.3	2315	29.6

Table 2: Odds ratio family planning services. Nigeria and Ghana (multinomial logistic regression)

Background characteristics	Medium access (high access ref)	Poor access (high access ref)	Medium access (high access ref)	Poor access (high access ref)
	Nigeria		Ghana	
	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)
Maternal age	1.018 (0.998- 1.038)	1.015 (1.001- 1.029)	1.047 (1.023- 1.072)	1.037 (1.019- 1.055)
Number of children alive	0.940 (0.878- 1.007)	0.774 (0.738- 0.813)	0.851 (0.777- 0.931)	0.849 (0.795- 0.908)
Marital status				
Married (ref)	1.00	1.00	1.00	1.00
Never married	0.338 (0.185- 0.619)	0.550 (0.395- 0.767)	1.068 (0.705- 1.617)	1.359 (1.008- 1.833)
Widowed/separated/divorced	1.038 (0.606- 1.777)	1.531 (1.052- 2.228)	1.004 (0.656- 1.535)	0.935 (0.695- 1.258)
Maternal Education				
Secondary/ Higher (ref)	1.00	1.00	1.00	1.00
No education	1.257 (0.776- 2.037)	2.544 (1.907- 3.395)	1.35 (0.941- 1.938)	1.527 (1.173- 1.988)
Primary	0.825 (0.642- 1.061)	1.111 (0.939- 1.314)	0.817 (0.601- 1.112)	0.961 (0.774- 1.192)
Maternal Occupation				
White collar (ref)	1.00	1.00	1.00	1.00
Not working	1.006 (0.706- 1.435)	1.135 (0.882- 1.459)	1.732 (1.027- 2.921)	2.194 (1.447- 3.325)
Services and manual	1.134 (0.806- 1.594)	1.283 (1.002- 1.642)	1.227 (0.723- 2.081)	1.727 (1.137- 2.622)
Sales	0.930 (0.687- 1.258)	0.987 (0.793- 1.228)	1.238 (0.771- 1.987)	1.686 (1.152- 2.466)
Agriculture	0.805 (0.503- 1.291)	1.194 (0.867- 1.646)	1.378 (0.785- 2.421)	1.801 (1.164- 2.786)
Household Wealth				
Richest (ref)	1.00	1.00	1.00	1.00
Poorest	0.762 (0.220- 2.633)	3.417 (1.825- 6.396)	0.947 (0.519- 1.731)	1.403 (0.895- 2.200)
Poorer	1.026 (0.621- 1.694)	2.282 (1.669- 3.120)	0.781 (0.469- 1.302)	1.148 (0.786- 1.677)
Middle	1.241 (0.899- 1.714)	1.979 (1.583- 2.475)	0.775 (0.508- 1.183)	0.997 (0.723- 1.375)
Richer	1.232 (0.977- 1.553)	1.704 (1.448- 2.006)	0.928 (0.652- 1.32)	0.968 (0.734- 1.277)
Residence				
Urban (ref)	1.00	1.00	1.00	1.00
Rural	1.092 (0.864- 1.381)	0.927 (0.785- 1.093)	0.748 (0.556- 1.006)	0.779 (0.624- 0.974)
Has health insurance				
Yes (ref)	1.00	1.00	1.00	1.00
No	0.909 (0.602- 1.373)	1.374 (1.011- 1.867)	0.320 (0.246- 0.417)	0.829 (0.699- 0.983)
Religion				
Other Christian (ref)	1.00	1.00	1.00	1.00
Catholic	1.078 (0.811- 1.433)	1.048 (0.849- 1.295)	0.824 (0.57- 1.19)	0.891 (0.676- 1.173)
Traditionalist/ none	1.324 (0.254- 6.898)	2.043 (0.625- 6.678)	1.128 (0.75- 1.695)	1.137 (0.840- 1.538)
Islam	1.188 (0.915- 1.542)	1.474 (1.240- 1.753)	0.527 (0.297- 0.932)	1.109 (0.781- 1.575)
Need permission for medical help				
Not a big problem (ref)	1.00	1.00	1.00	1.00
Big problem	1.247 (0.771- 2.016)	1.130 (0.792- 1.611)	1.036 (0.64- 1.678)	1.015 (0.705- 1.462)
Need money for medical help				
Not a big problem (ref)	1.00	1.00	1.00	1.00
Big problem	1.041 (0.835- 1.297)	0.812 (0.697- 0.947)	1.297 (0.999- 1.682)	1.051 (0.868- 1.273)
Distance to health facility				
Not a big problem (ref)	1.00	1.00	1.00	1.00
Big problem	0.771 (0.571- 1.042)	1.109 (0.904- 1.360)	1.237 (0.908- 1.685)	1.164 (0.923- 1.466)
Do not want to visit health facility alone				
Not a big problem (ref)	1.00	1.00	1.00	1.00
Big problem	1.728 (1.112- 2.685)	1.407 (1.012- 1.958)	1.017 (0.705- 1.465)	1.020 (0.771- 1.349)
Heard family planning on radio last few months				
Yes (ref)	1.00	1.00	1.00	1.00
No	0.885 (0.648- 1.208)	0.800 (0.643- 0.997)	1.099 (0.848- 1.424)	1.023 (0.846- 1.236)

Table 2 (continued): Odds ratio family planning services. Nigeria and Ghana (multinomial logistic regression)

Background characteristics	Medium access (high access ref)	Poor access (high access ref)	Medium access (high access ref)	Poor access (high access ref)
	Nigeria		Ghana	
	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)
Heard family planning on TV last few months				
Yes (ref)	1.00	1.00	1.00	1.00
No	0.790 (0.624- 1.001)	1.090 (0.926- 1.283)	0.827 (0.623- 1.098)	1.012 (0.819- 1.249)
Heard family planning in print last few months				
Yes (ref)	1.00	1.00	1.00	1.00
No	1.354 (1.066- 1.720)	1.105 (0.934- 1.308)	0.552 (0.327-0.933)	0.710 (0.458- 1.103)
Region (Nigeria)				
South West (ref)	1.00	1.00	-	-
North Central	0.462 (0.320- 0.666)	0.962 (0.765- 1.209)	-	-
North East	0.162 (0.070- 0.376)	1.574 (1.101- 2.250)	-	-
North West	0.038 (0.016- 0.086)	0.425 (0.321- 0.563)	-	-
South East	1.523 (1.022- 2.270)	1.390 (1.01-0 1.913)	-	-
South South	1.100 (0.780- 1.550)	0.965 (0.755- 1.233)	-	-
Region				
Greater Accra (ref)	-	-	1.00	1.00
Western	-	-	1.742 (1.097- 2.765)	0.868 (0.610- 1.234)
Central	-	-	0.754 (0.463- 1.229)	0.691 (0.494- 0.966)
Volta	-	-	3.191 (1.890- 5.389)	0.499 (0.326- 0.764)
Eastern	-	-	0.474 (0.273- 0.825)	0.868 (0.617- 1.223)
Ashanti	-	-	1.912 (1.264- 2.893)	1.103 (0.808- 1.505)
Brong Ahafo	-	-	1.826 (1.123- 2.969)	0.658 (0.451- 0.960)
Northern	-	-	1.623 (0.835- 3.155)	1.805 (1.083- 3.006)
Upper East	-	-	0.146 (0.045- 0.473)	0.709 (0.424- 1.185)
Upper West	-	-	0.262 (0.090- 0.769)	0.728 (0.398- 1.332)
Ethnicity (Nigeria)				
Yoruba (ref)	1.00	1.00	-	-
Other minorities	1.338 (0.961- 1.864)	1.953 (1.566- 2.436)	-	-
Fulani	1.961 (0.436- 8.812)	3.352 (1.699- 6.612)	-	-
Igbo	2.134 (1.471- 3.096)	1.922 (1.448- 2.551)	-	-
Hausa	4.820 (2.139- 10.861)	11.842 (7.766- 18.059)	-	-
Ethnicity (Ghana)				
Akan (ref)	-	-	1.00	1.00
Ga/Dangme	-	-	1.294 (0.775- 2.159)	1.142 (0.790- 1.650)
Ewe	-	-	1.044 (0.687- 1.584)	1.059 (0.780- 1.437)
Guan	-	-	1.631 (0.783- 3.396)	0.883 (0.469- 1.664)
Mole-Dagbani	-	-	1.184 (0.754- 1.860)	1.061 (0.754- 1.493)
Grusi	-	-	0.942 (0.490- 1.811)	0.682 (0.422- 1.103)
Gurma	-	-	0.948 (0.523- 1.720)	0.883 (0.563- 1.385)
Mande	-	-	0.561 (0.266- 1.181)	0.741 (0.446- 1.230)
Attitude of the health workers				
Not a big problem (ref)			-	-
Big problem	0.900 (0.684- 1.184)	1.147 (0.940- 1.401)	-	-

Table 3: Odds ratio maternal health service: Nigeria and Ghana: Ref: Higher access (multinomial logistic regression)

Background characteristics	High-access	Medium-access	Low-access	Poor-access	High-access	Medium-access	Low-access	Poor-access
	(higher access ref)				(higher access ref)			
	Nigeria				Ghana			
	Exp B	Exp B	Exp B	Exp B	Exp B	Exp B	Exp B	Exp B
	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)
Maternal age	0.977 (0.963-0.992)	0.980 (0.967-0.994)	0.956 (0.930-0.982)	0.965 (0.950-0.980)	0.977 (0.957-0.997)	0.984 (0.963-1.005)	1.020 (0.995-1.047)	0.961 (0.940-0.983)
Number of children alive	1.101 (1.045-1.16)	1.087 (1.033-1.145)	1.113 (1.016-1.220)	1.126 (1.067-1.188)	1.105 (1.016-1.201)	1.088 (0.998-1.185)	1.000 (0.899-1.113)	1.239 (1.134-1.353)
Marital status								
Married (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Never married	1.081 (0.722-1.619)	0.894 (0.600-1.332)	1.550 (0.676-3.551)	1.382 (0.922-2.072)	0.981 (0.699-1.377)	0.713 (0.495-1.026)	0.970 (0.628-1.498)	0.880 (0.604-1.281)
Widowed/separated/divorced	1.252 (0.871-1.800)	1.055 (0.729-1.527)	1.248 (0.634-2.459)	1.084 (0.740-1.588)	0.978 (0.676-1.413)	0.869 (0.59-1.278)	0.803 (0.477-1.350)	0.880 (0.591-1.310)
Maternal Education								
Secondary/ Higher (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No education	1.145 (0.902-1.454)	0.690 (0.524-0.909)	1.849 (1.247-2.742)	1.431 (1.132-1.809)	0.961 (0.702-1.316)	0.962 (0.691-1.341)	0.680 (0.430-1.076)	1.542 (1.115-2.132)
Primary	1.034 (0.855-1.251)	0.921 (0.763-1.111)	1.786 (1.247-2.557)	1.387 (1.140-1.687)	0.975 (0.742-1.28)	1.202 (0.914-1.580)	0.594 (0.398-0.886)	1.380 (1.036-1.838)
Maternal Occupation								
White collar (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Not working	1.052 (0.779-1.421)	1.097 (0.847-1.422)	1.754 (0.752-4.093)	1.579 (1.081-2.307)	1.074 (0.644-1.79)	0.771 (0.474-1.254)	0.889 (0.535-1.476)	1.076 (0.500-2.313)
Services and manual	1.492 (1.109-2.006)	1.215 (0.940-1.570)	2.422 (1.032-5.686)	1.719 (1.172-2.522)	1.168 (0.699-1.952)	0.782 (0.479-1.276)	0.437 (0.252-0.757)	1.141 (0.527-2.468)
Sales	1.289 (0.979-1.698)	1.300 (1.032-1.638)	2.729 (1.198-6.219)	2.001 (1.395-2.871)	0.824 (0.511-1.329)	0.576 (0.368-0.903)	0.628 (0.400-0.987)	0.779 (0.371-1.636)
Agriculture	1.697 (1.187-2.428)	1.298 (0.922-1.826)	4.253 (1.741-10.392)	1.667 (1.076-2.584)	1.781 (1.022-3.104)	0.735 (0.426-1.266)	0.539 (0.277-1.050)	1.226 (0.561-2.682)
Household Wealth								
Richest (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Poorest	4.726 (2.982-7.489)	1.531 (0.855-2.740)	3.230 (1.668-6.255)	6.592 (4.247-10.233)	3.732 (2.171-6.415)	3.826 (2.16-6.775)	1.889 (0.863-4.135)	20.631 (10.086-42.199)
Poorer	2.750 (2.018-3.748)	1.104 (0.796-1.533)	1.580 (0.921-2.711)	2.408 (1.750-3.312)	2.514 (1.605-3.938)	2.351 (1.479-3.737)	1.679 (0.949-2.97)	10.228 (5.352-19.544)
Middle	1.829 (1.433-2.334)	0.832 (0.657-1.054)	1.268 (0.795-2.023)	1.810 (1.401-2.338)	1.967 (1.363-2.838)	1.684 (1.153-2.459)	1.077 (0.705-1.645)	6.376 (3.508-11.587)
Richer	1.476 (1.221-1.785)	0.733 (0.616-0.873)	0.665 (0.433-1.022)	1.237 (1.006-1.522)	1.263 (0.926-1.723)	1.354 (0.991-1.851)	0.627 (0.447-0.881)	1.328 (0.713-2.474)
Residence								

Urban (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Rural	0.654 (0.550- 0.779)	1.086 (0.914- 1.290)	0.539 (0.384- 0.757)	0.817 (0.678- 0.985)	1.149 (0.889- 1.483)	1.303 (0.999- 1.699)	0.646 (0.453- 0.921)	2.139 (1.600- 2.86)
Has health insurance								
Yes (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No	1.167 (0.770- 1.770)	0.789 (0.574- 1.085)	0.563 (0.274- 1.156)	1.570 (0.926- 2.661)	1.146 (0.923- 1.422)	1.260 (1.009- 1.573)	1.209 (0.919- 1.59)	1.888 (1.500- 2.376)
Religion								
Other Christian (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Catholic	1.244 (0.970- 1.595)	1.582 (1.269- 1.973)	1.355 (0.847- 2.166)	0.952 (0.709- 1.278)	0.710 (0.505- 0.998)	0.698 (0.492- 0.99)	0.496 (0.300- 0.820)	0.679 (0.470- 0.980)
Traditionalist/ none	0.643 (0.249- 1.661)	0.470 (0.165- 1.340)	0.379 (0.034- 4.263)	0.470 (0.154- 1.432)	1.031 (0.719- 1.478)	0.763 (0.524- 1.113)	0.825 (0.500- 1.363)	0.781 (0.528- 1.154)
Islam	0.992 (0.810- 1.214)	0.916 (0.760- 1.104)	1.429 (0.971- 2.105)	0.976 (0.783- 1.215)	1.112 (0.644- 1.921)	1.294 (0.724- 2.314)	2.472 (1.263- 4.837)	2.244 (1.351- 3.726)

Table 3 (continued): Odds ratio maternal health service: Nigeria and Ghana: Ref: Higher access (multinomial logistic regression)

Background characteristics	High-access	Medium-access	Low-access	Poor-access	High-access	Medium-access	Low-access	Poor-access
	(higher access ref)				(higher access ref)			
	Nigeria				Ghana			
	Exp B	Exp B	Exp B	Exp B	Exp B	Exp B	Exp B	Exp B
	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)
Need permission for medical help								
Not a big problem (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Big problem	0.990 (0.709-1.384)	0.781 (0.540-1.128)	0.620 (0.312-1.232)	1.016 (0.730-1.415)	1.097 (0.711-1.691)	0.816 (0.525-1.267)	0.478 (0.23-0.993)	0.840 (0.532-1.328)
Need money for medical help								
Not a big problem (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Big problem	0.996 (0.843-1.178)	0.879 (0.744-1.037)	1.033 (0.768-1.389)	1.304 (1.100-1.547)	0.999 (0.794-1.256)	1.239 (0.977-1.572)	0.668 (0.487-0.916)	0.889 (0.693-1.14)
Distance to health facility								
Not a big problem (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Big problem	1.211 (0.974-1.506)	1.652 (1.327-2.057)	1.109 (0.760-1.620)	1.510 (1.216-1.876)	0.756 (0.569-1.005)	0.971 (0.729-1.292)	1.315 (0.899-1.924)	1.099 (0.827-1.461)
Do not want to visit health facility alone								
Not a big problem (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Big problem	0.869 (0.632-1.196)	0.982 (0.714-1.351)	0.859 (0.471-1.565)	0.791 (0.566-1.106)	1.020 (0.728-1.427)	0.932 (0.658-1.321)	0.93 (0.592-1.462)	1.431 (1.02-2.008)
Heard family planning on radio last few months								
Yes (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No	1.008 (0.797-1.275)	0.776 (0.612-0.983)	0.418 (0.240-0.730)	0.546 (0.419-0.712)	1.180 (0.937-1.487)	1.515 (1.193-1.925)	1.314 (0.968-1.784)	1.212 (0.946-1.554)
Heard family planning on TV last few months								
Yes (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No	0.917 (0.768-1.095)	0.934 (0.785-1.112)	0.928 (0.670-1.286)	1.075 (0.896-1.290)	1.090 (0.848-1.399)	0.852 (0.656-1.105)	0.773 (0.554-1.077)	0.923 (0.704-1.21)
Heard family planning in print last few months								
Yes (ref)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No	0.861 (0.708-1.047)	0.877 (0.729-1.053)	1.384 (0.885-2.165)	1.068 (0.861-1.324)	1.733 (1.042-2.883)	0.930 (0.588-1.473)	1.526 (0.909-2.562)	1.195 (0.614-2.324)
Region (Nigeria)								
South West (ref)	1.00	1.00	1.00	1.00	-	-	-	-
North Central	0.377 (0.286-	0.335 (0.264-	0.666 (0.381-	0.343 (0.250-	-	-	-	-

	0.499)	0.425)	1.166)	0.470)				
North East	0.427 (0.302- 0.603)	0.061 (0.039- 0.096)	1.162 (0.632- 2.136)	0.596 (0.418- 0.850)	-	-	-	-
North West	0.206 (0.145- 0.292)	0.030 (0.020- 0.046)	0.344 (0.178- 0.665)	0.346 (0.242- 0.492)	-	-	-	-
South East	1.112 (0.736- 1.681)	0.771 (0.554- 1.073)	1.712 (0.635- 4.618)	0.961 (0.567- 1.629)	-	-	-	-
South South	1.031 (0.767- 1.387)	0.319 (0.244- 0.417)	0.248 (0.107- 0.577)	1.401 (1.019- 1.928)	-	-	-	-
Region								
Greater Accra (ref)	-	-	-	-	1.00	1.00	1.00	1.00
Western	-	-	-	-	0.369 (0.237- 0.576)	1.444 (0.948- 2.198)	1.013 (0.625- 1.64)	1.340 (0.767- 2.342)
Central	-	-	-	-	0.994 (0.666- 1.483)	1.596 (1.036- 2.459)	1.171 (0.721- 1.904)	2.101 (1.211- 3.648)
Volta	-	-	-	-	1.133 (0.695- 1.849)	0.480 (0.274- 0.841)	0.411 (0.208- 0.811)	0.834 (0.452- 1.539)

Table 3 (continued): Odds ratio maternal health service: Nigeria and Ghana: Ref: Higher access (multinomial logistic regression)

Background characteristics	High-access		Medium-access	Low-access	Poor-access	High-access		Medium-access	Low-access	Poor-access
	(higher access ref)					(higher access ref)				
	Nigeria					Ghana				
	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)	Exp B (95% CI)
Region (continued)										
Eastern	-	-	-	-		0.444 (0.288-0.684)	1.228 (0.804-1.874)	0.570 (0.333-0.977)	1.253 (0.733-2.142)	
Ashanti	-	-	-	-		0.900 (0.633-1.279)	2.429 (1.681-3.511)	1.660 (1.131-2.435)	1.093 (0.633-1.888)	
Brong Ahafo	-	-	-	-		0.648 (0.415-1.01)	1.705 (1.075-2.705)	1.690 (1.014-2.818)	0.871 (0.478-1.587)	
Northern	-	-	-	-		2.036 (1.163-3.564)	0.753 (0.382-1.484)	0.225 (0.071-0.711)	2.962 (1.489-5.891)	
Upper East	-	-	-	-		3.661 (1.92-6.98)	1.161 (0.542-2.486)	0.762 (0.249-2.329)	0.665 (0.287-1.541)	
Upper West	-	-	-	-		1.789 (0.713-4.489)	7.466 (3.195-17.443)	0.348 (0.033-3.654)	2.861 (1.079-7.586)	
Ethnicity (Nigeria)										
Yoruba (ref)	1.00	1.00	1.00	1.00		-	-	-	-	
Other minorities	0.541 (0.412-0.71)	0.987 (0.780-1.249)	1.223 (0.677-2.208)	0.816 (0.603-1.105)		-	-	-	-	
Fulani	0.681 (0.405-1.143)	0.868 (0.400-1.883)	0.897 (0.376-2.139)	0.881 (0.529-1.466)		-	-	-	-	
Igbo	0.759 (0.519-1.109)	1.808 (1.336-2.447)	1.014 (0.378-2.722)	0.495 (0.305-0.803)		-	-	-	-	
Hausa	0.862 (0.59-1.259)	1.177 (0.760-1.822)	2.231 (1.122-4.438)	1.416 (0.965-2.078)		-	-	-	-	
Ethnicity (Ghana)										
Akan (ref)	-	-	-	-		1.00	1.00	1.00	1.00	
Ga/Dangme	-	-	-	-		1.592 (1.068-2.374)	1.286 (0.813-2.035)	1.456 (0.892-2.376)	1.319 (0.776-2.243)	
Ewe	-	-	-	-		0.647 (0.438-0.957)	1.469 (1.019-2.119)	1.633 (1.076-2.477)	1.154 (0.764-1.743)	
Guan	-	-	-	-		1.544 (0.676-3.525)	3.760 (1.678-8.424)	7.107 (3.037-16.632)	1.639 (0.674-3.988)	
Mole-Dagbani	-	-	-	-		0.754 (0.494-1.15)	1.391 (0.927-2.088)	1.605 (0.955-2.698)	1.056 (0.676-1.649)	
Grusi	-	-	-	-		0.850	1.102 (0.587-	1.056 (0.441-	1.113	

					(0.463- 1.561)	2.07)	2.527)	(0.564- 2.199)
Gurma	-	-	-	-	0.795 (0.438- 1.443)	1.249 (0.658- 2.373)	0.929 (0.33- 2.615)	1.438 (0.792- 2.613)
Mande	-	-	-	-	0.604 (0.318- 1.149)	1.257 (0.651- 2.425)	0.840 (0.34- 2.071)	1.252 (0.627- 2.497)
Attitude of the health workers								
Not a big problem (ref)	1.00	1.00	1.00	1.00	-	-	-	-
Big problem	1.707 (1.314- 2.217)	1.361 (1.098- 1.686)	0.809 (0.450- 1.455)	2.495 (1.748- 3.56)	-	-	-	-

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