Effect of internal migration, individual and contextual factors on contraceptive use among Nigerian women

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Paper Presented at the 7th African Population Conference, Pretoria, South Africa: Nov 30- Dec 4, 2015

Abstract
The role of contextual factors in the relationship between internal migration and contraceptive use is not clear. This study describes the internal migration pattern and its association with modern contraceptive use in Nigeria while controlling for individual and contextual or community) characteristics. Multilevel logistic regression models were fitted to nationally representative data on 28, 876 women in 884 communities. Rural non-migrants have the least likelihood of using modern contraceptives. The effect of internal migration on modern contraceptive use was fully explained by individual and community characteristics of women. Programmes aimed at increasing contraceptive prevalence in Nigeria should address contextual challenges.

Keywords: Internal female migration, contraceptive use, regional differentials, contextual factors, community characteristics, Nigeria

Introduction

Even though, there has been global improvement in contraceptive use, western and central Africa regions are in the lowest rung of the ladder with less than 20% of men and women of reproductive using any method of contraception (Alkema et al., 2013). In Nigeria, despite near universal knowledge about contraceptive method, only 10% of sexually active women reported using a modern method (National Population Commission [Nigeria], 2014). Meanwhile, contraceptive use has been shown to prevent unintended and unwanted pregnancies thereby reducing the incidence of unsafe abortion, maternal mortality and morbidity (Smith et al., 2009). It also helps in reducing fertility and population growth, thereby contributing to poverty reduction, better health, education, women empowerment and environmental sustainability (Cleland et al., 2006).

Nigeria alongside India and China are projected to contribute 37% of the increase in urban population and the largest absolute increase in rural population between 2014 and 2050 (United Nations, 2015). With this alarming picture, population movement and internal migration is bound to increase with its attendant impact on health indices. The reproductive health challenges associated with internal migration as a consequence of population growth is a major concern (World Health Organisation, 2010). At the centre of this discourse is the interplay between internal migration and contraceptive use which is one of the proximate determinants of fertility.

The inter-relationship between internal migration and reproductive health outcomes have been hinged on three hypotheses - migrants selection, migrants disruption and migrant adaptation(Brockerhoff, 1995, Chattopadhyay et al., 2006). Selection hypothesis argues that migrants are pre-selected by demographic variables such as age, education and socio-economic status in such a way that these variables promote lower fertility. For instance,

studies have shown that female rural-urban migrants are more likely to be educated, in their mid 20's and seeking for better economic opportunities (Brockerhoff, 1995). The disruption perspective opined that the migration process itself interfere with fertility in the short term after migration because there would be fewer episodes of sexual intercourse and thereby lowering fertility. Adaptation hypothesis is targeted at the post-migration period during which fertility attitudes and behaviour of migrants are likely to have been modified. The modification is viewed as a reflection of adaptation to the new environment, for example contraceptive use may increase as a result of better awareness and access to reproductive health services in the urban destinations (Chattopadhyay et al., 2006).

Most of the previous studies on internal migration in Nigeria have approached the subject from the economical angle (Ajaero and Onokala, 2013, Okhankhuele and Opafunso, 2013), health consequences are rarely investigated. Internal migration and contraceptive use has not been widely investigated in sub-Saharan Africa unlike fertility and child survival. The available evidence in this regard were from Peru and Bolivia (Tam, 1994), Guatemala (Lindstrom and Hernandez, 2006), and Kenya (Omondi, 2003, Omondi and Ayiemba, 2003). The findings from these studies showed that rural-urban migrants were more likely to use contraceptive than rural non-migrants and urban-rural migrants. This agreed with the adaption hypothesis explained earlier. Further regional analysis in the Kenya study however revealed that the relationship between contraceptive use and internal migration varied across cultures and groups and it depend on the socio-cultural and economic context (Omondi and Ayiemba, 2003).

Inffluence of context or community characteristics has been demonstrated for child survival (Adedini et al., 2014, Antai et al., 2010), contraceptive use ((Kaggawa et al., 2008, McGuire and Stephenson, 2015, Stephenson et al., 2007, Stephenson et al., 2008)) and utilisation of other maternal health services (Babalola and Fatusi, 2009, Ononokpono and Odimegwu,

2014). Incidentally, most of the studies emphasize the importance of contextual factors while controlling for individual-level factors. However, there were variations across study settings to further underscore the fact that the context matters.

Studies on contraceptive use in Nigeria have mostly been facility-based or community studies conducted in few states (Odimegwu, 1999, Oye-Adeniran et al., 2006) and focused on individual-level variables. Meanwhile, when people migrate or move from one place to another, it implies a change in context. These two entities- migration and context definitely act together to affect contraceptive use. How context and internal migration affect contraceptive use has not been investigated previously in Nigeria. Therefore, this study attempts to fill this knowledge gap. Specifically, it addressed three research questions: (1) what are the patterns and factors associated with internal migration in Nigeria? (2) what is the relationship between internal migration and contraceptive use? and (3) what individual and contextual factors explain the relationship between internal migration and contraceptive use?

Data and Methods

Data source

The data analysed in this study were extracted from the individual women recode file of the 2008 Nigeria Demographic and Health Survey (NDHS). NDHS 2008 was the fourth round of the nationally representative survey under the DHS program and the first to be designed to provide estimates at national, regional and state levels. Women aged 15-49 years and a sub-sample of men aged 15-59 years were usually selected through a stratified two-stage cluster sampling technique. Data were then collected from household head, eligible men and women through questionnaires administered by trained interviewers. Detailed information on the survey methodology are available in the published report (National Population Commission

[Nigeria], 2009). For this study, analysis was restricted to women who reported to have ever had sex and were not currently pregnant at the time of the survey.

Variables and measurement

The dependent variable was modern contraceptive use which was coded yes (1) or no (0). It was derived from the question "are you currently doing something or using any method to delay or avoid getting pregnant? (Yes/No)" Those who answered yes were further asked " which method are you using?" Modern contraceptive users were women using any of the following: female sterilisation, male sterilisation, pill, IUD, injectables, implants, male condom, female condom, diaphragm, foam/jelly, lactational amenorrhea and emergency contraception.

The main independent variable was migration status which was categorised as rural-urban, urban-rural, rural non-migrants and urban non-migrants. Migration data are not routinely collected in the NDHS. Therefore, migration status was derived from three other variables on which data were available.These were (1) duration (years) of stay in place of current residence (responses recorded as years, always or visitor), (2) type of place of previous residence (city, town or village) and (3) place of current residence (urban or rural). A respondent whose previous place of residence was village and current residence was reported as urban was categorised as a rural-urban migrant. An urban-rural migrant is a respondent whose current residence is rural but previous residence was city or town. Rural non-migrants were those who reported to have always lived in rural location or moved in from a village. Urban non-migrants refers to those who have always lived in urban location or moved in from a city or a town. Visitors (588 respondents) and those whose place of previous residence were missing (488) were excluded from the analysis.

Other explanatory variables were categorised as individual-level and contextual (community-level) factors. The individual-level factors included age, highest educational attainment, wealth quintile, religion, marital status, number of living children and exposure to family planning messages (radio, television and newspaper) in the last six months.

The contextual variables included in this study were: (i) region of residence (North central, North east, North west, South east, South west and South south, (ii) community fertility norm which was measured by the percentage of wome reporting ideal family size as being less than or equal to four; (iii) community family planning awareness – percentage of women exposed to family planning messages in the past six months; (iv) community-level of education was estimated as the percentage of women with at least a secondary education in the community and (v) community poverty determined from the percentage of women in the poorest or poorer wealth quintile in the community. The greater the proportions the greater is the level of these contextual variables. A community in this study refers to an enumeration area which was the primary sampling unit (cluster) in the NDHS. The contextual variables were derived by aggregating responses from individual women at the cluster (community) level.

Statistical analysis

Univariate, bivariate and multivariate analyses were conducted to address the objectives of this study. In the univariate analysis, frequency and percentage distributions of the study sample according to selected explanatory variables were generated. Secondly, in the bivariate analysis, we produced a cross tabulation for the migration status according to backgound charactertics. The significance of the association between these variables was ascertained using the Chi square test. Univariate logistic regression analysis was conducted to explore the relationship between modern contraceptive use and each of the individual-level variables. In

the multivariate analysis, two-level random intercept logistic regression models were fitted in stages to investigate the independent effects of the explanatory variables on the outcome. This multilevel technique was employed to account for the hierachical structure of the data of which 28,876 women (level 1) were nested in 884 clusters (level 2). Apart from adjusting for dependency within clusters, the multilevel technique also provide estimate of the random effects at the cluster level which capture the influence of unobserved or unmeasured community characteristics. The influence of the individual-level variables are known as fixed effects and measured in terms of Odds Ratio (OR) with their 95% confidence interval (CI). A variable with Odds Ratio greater than 1.00 implied that the variable increases the likelihood of the outcome while it is the opposite when the OR is less than 1.00. Random effects were represented using intra-cluster correlation (ICC) and proportional change in variance (PCV).

The model is of the form:

$$Y_{ij} = \beta_0 + \beta_{1k} X_{1kij} + \beta_{2k} X_{2kj} + u_j + e_{ij}$$

Where:

Y_{ij}	=	log-odds of modern contraceptive by woman i in cluster (community) j
β_0	=	intercept (average likelihood of modern contraceptive use)
β_{1k}	=	coefficients for the individual-level variables
X_{kij}	=	individual level covariates (migration status, education, age group, wealth index etc) for woman i in community j
β_{2k}	=	coefficients for the community-level variables
X_{2kj}	=	community- level covariates (region, community fertility norm etc)
u_j	=	community level random effect
e_{ij}	=	error terms for the individual-level

Error terms were assumed to be normally distributed with zero mean and constant variance at both individual (σ_e^2) and community (σ_u^2) levels. The ICC captures the extent to which contraceptive use is correlated in the community or the extent to which women in the same community shared the same characteristics associated with the dependent variable. ICC was estimated as $\frac{\sigma_u^2}{3.29+\sigma_u^2}$ (Twisk, 2006).

A null model (with no covariate) was first fitted to estimate the total variance in modern contraceptive use between the clusters. This null model also provide the reference value for estimating the proportional change in variance for the subsequent models. Model 1 included only migration status as the explanatory variable while model 2 contained migration status, age, education and wealth quintile. Model 2 was actually speficically fitted to investigate the selection hypothesis in the effect of migration on modern contraceptive use. In model 3, all other individual-level factors were added to model 2. Model 4 contained only contextual factors while model 5 included both individual-level and community-level variables. The models were fitted using the random-effects logistic regression module in Stata version 12.0.

Analyses were guided by the selection and adaptation hypothesis on the effect of internal migration. For the adaption perspective, we hypothesized that rural-urban migrants would have rates of contraceptive use very close to that of urban non-migrants but higher than those of rural non-migrants. This was tested in Model 1. We used models 2 and 3 for the selection hypothesis. The hypothesis is deemed confirmed if adjusting for individual level variables partly or completely explain the migration differentials in contraceptive use.

Ethical considerations

Formal approval to use this data was obtained from the DHS program. The survey itself was approved by the National Health Research Ethics Committee in Nigeria (Approval no: NHREC/01/01/2007). Informed consent was obtained from survey participants before data collection.The extracted data did not contain any identifying information. As such, privacy and confidentiality of respondents was guaranteed.

Results

Characteristics of the study sample and migration pattern

The selected background characteristics of the study sample according to their migration status are summarised in Table 1. The regional distribution shows that the largest proportion of women in the sample were from the Northwest region (21.2%) while the Southeast (11.0%) had the least. Women aged 20-29 years were in the majority (35.3%). About four out of every ten women in the study sample had no formal education (39.4%) while one third attained only secondary education. There were similar proportions of other christians (41.6%) and muslims (45.4%) with very few adherents of traditional religion (2.2%). About 70.0% of all subjects were currently married or in a relationship.

The migration status of the women were: rural-urban (4.7%), urban-rural (11.7%), rural non-migrants (56.2%) and urban non-migrants (27.3%). There were significant variations in the migration status across all the background variables (See Table 1). For instance, the South south (2.3%) and North west (2.7%) had the lowest proportion of rural-urban migrants while the South east had the highest (8.6%). On the other hand, the South west (17.4%) and South south (21.3%) regions had a preponderance of urban-rural movements. Women aged 20-29 years were more likely to move from rural to urban location. As expected, women without formal education (75.5%) and those with higher education (63.7%) consituted the majority among rural non-migrants and urban non-migrants respectively. The proportion of rural-urban migrants and urban non-migrants increased with wealth quintile. Lastly, urban non-migrants were more likely to have been exposed to family planning messages in the last six months before the survey.

Contextual (community-level) variables

The summary of the contextual variables (Table 2) also shows that these vary according to migration status. The percentage of women in each community reporting ideal family size as being less than four ranged from 17% among rural non-migrants to 48% among urban non-migrants with a similar proportions for rural-urban (29.0%) and urban-rural (30.0%) migrants. The lowest community-level education and highest community poverty were recorded among rural non-migrants.

Modern contraceptive use

Out of all women, only 10.4% were currently using a modern contraceptive. The proportion of modern contraceptive users in the migrants groups were: rural-urban (12.5%), urban-rural (13.8%), rural non-migrants (6.2%) and urban non-migrants (17.1%). The North west (2.7%) and South south (19.9%) regions respectively had the lowest and highest percentage of women using modern contraceptive (see Table 3). There was a significant positive association between educational attainment, wealth quintile and modern contraceptive use. Women who were not in a union were less likely to be users while those with three or more living children had higher odds of being users. Use of modern contraceptive was significantly higher among women who have heard family planning messages in the last six months.

Relationship between modern contraceptive use, migration status, individual and contextual variables

The results of multilevel models fitted to investigate the relationship between modern contraceptive use and migration status adjusted for individual and contextual factors are summarised in Table 4. Model 1 showed that rural-urban migrants (OR=0.81, CI: 0.67-0.98), urban-rural migrants (OR=0.52, CI:42-0.64) and rural non-migrants (OR=0.30, CI: 0.25-0.36) were less likely than urban non-migrants to use modern contraceptive. Addition of age, education and wealth quintile to model 1 (model 2) showed that these variables partly explain the migration differentials in modern contraceptive use. Rural non-migrants were less likely than their urban counterparts to use modern contraceptive (OR=0.74, CI: 0.63-0.86). The odds of contraceptive use increased with educational level and wealth quintiles. Further control for other individual-level variables (model 3) did not alter the direction of the effects of the socio-demographic variables and migration status on the outcome (modern contraceptive use).

Model 3 also shows that exposure to family planning messages (OR=1.83, CI:1.66-2.02) and number of living children were positively associated with contraceptive use. In model 4, rural non-migrants were less likely than urban non-migrants to use modern contraceptive (OR=0.84, CI: 0.72-0.98). In addition, there were significant differentials in contraceptive use between North east (OR=0.58, CI: 0.46-0.72), North west (OR=0.32, CI: 0.25-0.41), South east (OR=0.54, CI: 0.42-0.68), South south (OR=0.79, CI:0.63-0.98) and the North central region. All the other contextual variables were also statistically significant with community education and community fertility fertility norm having the greatest effect.

Model 5 showed that contextual factors explained the effects of migration status as the significant association observed in previous models completely disappeared. Even though the magnitude of the effects of individual-level factors were reduced, their direction remained the same. Regional differentials were however not completely explained by the variables in the final model. Women in North east (OR=0.66, CI: 0.52-0.83), North West (OR=0.37, CI: 0.29-0.48), and South east (OR=0.48, CI: 0.37-0.61) regions had lower odds of modern contraceptive use compared to their North central counterparts. The final model also showed that three of the contextual factors were significant predictors of modern contraceptive use. Women who live in communities in which higher proportion believe that ideal family size should be less than or equal to four had higher odds of using modern contraceptives. Similarly, the greater the level of community education, the more the likelihood of contraceptive use. However, community poverty exerts a negative influence on contraceptive use as the results showed that women from communities with a greater proportion in the poor wealth quintile were less likely to use modern contraceptive.

Random effects

The intra-cluster correlation (ICC) from the null model (not shown) was 30.44 % which implied that 30.44% of the variance in modern contraceptive use is explained by within

cluster (community) variation. Even though the ICC decreased from model 1 (24.31%) to model 4 (7.2%), the intra-cluster correlation remained statistically significant all through. In model 1, the proportional change in variance (PCV) shows that 48.55% of the variance in modern contraceptive use across communities was explained by migration status. The random effect in model 3 indicate that individual level factors explained 68.35% of the total variance in contraceptive use while the contextual factors (model 4) accounted for 57.84%. Model 5 showed that migration status, individual and community-level variables explained 74.69% of the variation in modern contraceptive use across communities.

Discussion

The findings in this study provide evidence on population mobility and migration patterns in Nigeria. The proportion of rural-urban migrants is very close to that found by Bocquier et al (2011) using NDHS 1999 data. The migration patterns show that rural-urban migrants were more likely to have at least a secondary education, resident in south west and south east regions and belong to the richer or richest wealth quintile. This agreed with findings from other studies which has reported that rural-urban migrants mostly comprise of young men and women who travel to urban areas in pursuit of higher education and never return back because they secure opportunities for better livelihood in the urban areas (Ajaero and Onokala, 2013, Aworemi and Adegoke, 2011, Okhankhuele and Opafunso, 2013). Generally, the distribution of migration streams according to socio-demographic characteristics reveal that the concept of migrant selectivity operate differently across Nigeria geo-political regions. For instance, percentage of rural non-migrants are higher in the northern regions while urban non-migrants were more common in the south.

Apart from the very low prevalence of modern contraceptive use, there was significant differential by migration status. Rural non-migrants were the least users while urban non-

migrants recorded the highest proportion of contraceptive users. Rural-urban and urban-rural migrants were closer and better than rural non-migrants in terms of modern contraceptive use. This is consistent with existing knowledge that urban non-migrants have higher odds of contraceptive use (Lindstrom and Hernandez, 2006, Omondi and Ayiemba, 2003, Tam, 1994). Controlling for age, education, wealth index and other individual characteristics drastically reduced the disparity in contraceptive between the migrant groups. This suggests that the differences observed were due to these individual-level variables and further confirmed the migrant selection hypothesis.

In the full multilevel model, the difference in contraceptive use across migration status was no longer significant. This implied that the individual and contextual variables some of which were statistically significant in the final model completely explained the relationship between migration status and contraceptive use. The results also show that regional differences between the northern and southern regions remained statistically significant despite controlling for other covariates. This implies that there are other variables responsible for the difference but which were not included in the models. These variables may be related to individual or community characteristics or health systems.

The significant effect of community and individual level of education meant that beyond individual educational attainment, the prevailing level of education in the community where a woman lives plays significant roles in use of modern contraceptive. Education is also associated with socio-economic development and both have been shown to be positively associated with contraceptive use(McGuire and Stephenson, 2015). The results also showed that higher likelihood of contraceptive use among women living in a community with a higher proportion of women who believe that the ideal number of children should not be greater than four. When a woman know that there is a subtle disapproval for large number of children, she

would want to adopt modern practices to limit children bearing and this implied increased use of contraception.

The level of urban-rural movement reported from the 1999 NDHS sample (25.8%) is more than the 11.7% reported in this study. Urban-rural movements have declined between 1999 and 2008 and this could be a reflection of the lack of basic infrastructure and economic opportunities which ought to serve as incentive for living in rural areas.The results on contextual variables result is slightly different from findings in other countries where contextual variables have been analysed. For instance, previous studies in East and West Africa (Kaggawa et al., 2008, Stephenson et al., 2007) and South Africa (Stephenson et al., 2008) have shown inconsistent results especially in regard to effect of contextual variables. Our findings suggest that the Nigeria context is different compared to these other countries and this further justify the need for context-specific studiesin different countries (Diez Roux, 2008). We found significant effect of community fertilty norm, education and poverty on contraceptive use. Community education for instance may itself influenced community norms and also increase the awareness about contraception methods and sources.

The national representativeness of the data analysed is a strength of this study. Another strength is the inclusion of community level variables in the analyses. These variables permit the exploration of the influence of the characteristics of place of domicile on reproductive health behaviours. It thus lends support to the argument on the relevance of context in health issues (Diez Roux, 2008). The fact that data from another round of NDHS conducted after 2008 is available may be seen as a limitation. However, the latest round (2013 NDHS) did not collect data on type of place of previous residence and duration of stay in current residence. However, this is not likely to bias the findings because contraceptive use only differ by 2% between the two surveys (National Population Commission [Nigeria], 2014). Other contextual

factors especially those that deal with norms, values and practices could not be included in the analysis because they were not collected in the cross-sectional DHS. These were represented by the random effects and thus properly controlled through the analytical techniques used in the study.

These results have implications for programmes aimed at improving contraceptive use in Nigeria. Population movement and migration do not matter for contraceptive use but the individual characteristics and the context in which women live. These call for short and long term strategies. Improvement in female education is a long term issue. In the short term, family planning programmes should be designed to be context-specific in order to reach the rural and poor populace so that contraceptive uptake can be increased.

Some issues that require further research emerge from the findings of this study. First, the reasons or barriers to contraceptive use are not very clear. Future research need to unearth the motivators and disincentives so that programs can be designed to address them. Despite adjustement for all covariates, differences in modern contraceptive use between the northern and southern regions remained. Coupled with the significant intra-community correlation, these points to the fact that there are factors influencing contraceptive use in Nigeria which have not beeing accounted for. Identification of these unmeasured characteristics and other factors that affect contraceptive use is an important research problem.

Conclusion

This study has shown that rural-urban and urban-rural migration is common among reproductive age women in Nigeria. The migration pattern varies across the geo-political regions, age, education and wealth quintile. There were differentials in contraceptive use across migrant groups with rural non-migrants having the least likelihood and urban non-migrants constituting the greatest proportion of contraceptive users. The relationship between

contraceptive use and migration status was fully explained by individual and contextual characteristics of women.

Acknowledgements

We appreciate the University of Witwatersrand, for providing a research-friendly environment to conduct this study. Also acknowledged is ICF Macro International, USAID and other NDHS implementing partners.

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Table 1: Background characteristics of women according to migration status, Nigeria

Variables	All women	Migration status: n(%)				P-value
	n (%)	Rural-urban	Urban-rural	Rural non-migrants	Urban non-migrants	
Total	**28876**	**1363 (4.7)**	**3392 (11.7)**	**16232 (56.2)**	**7889 (27.3)**	
Region						
North Central	5548 (19.2)	285 (5.1)	486 (8.8)	3330 (60.0)	1447 (26.1)	
North East	5304 (18.4)	282 (5.3)	386 (7.3)	3669 (69.2)	967 (18.2)	
North West	6136 (21.2)	165 (2.7)	565 (9.2)	4401 (71.7)	1005 (16.4)	<0.001*
South East	3181 (11.0)	275 (8.6)	266 (8.4)	1711 (53.8)	929 (29.2)	
South West	4221 (14.6)	252 (6.0)	735 (17.4)	2190 (51.9)	1044 (24.7)	
South South	4486 (15.5)	104 (2.3)	954 (21.3)	931 (20.8)	2497 (55.7)	
Age (years)						
15-19	5849 (20.3)	229 (3.9)	556 (9.5)	3416 (58.4)	1648 (28.2)	
20-29	10180 (35.3)	500 (4.9)	1224 (12.0)	5528 (54.3)	2928 (28.8)	<0.001*
30-39	7246 (25.1)	337 (4.7)	973 (13.4)	3956 (54.6)	1980 (27.3)	
40-49	5601 (19.4)	297 (5.3)	639 (11.4)	3332 (59.5)	1333 (23.8)	
Education						
None	11264 (39.4)	446 (4.0)	965 (8.6)	8503 (75.5)	1350 (12.0)	
Primary	5651 (19.6)	306 (5.4)	767 (13.6)	3299 (58.4)	1279 (22.6)	
Secondary	9623 (33.3)	517 (5.4)	1311 (13.6)	4024 (41.8)	3771 (39.2)	<0.001*
Higher	2338 (8.1)	94 (4.0)	349 (14.9)	406 (17.4)	1489 (63.7)	
Wealth Quintile						
Poorest	6136 (21.2)	112 (1.8)	455 (7.4)	5431 (88.5)	138 (2.2)	
Poorer	5848 (20.3)	172 (2.9)	683 (11.7)	4648 (79.5)	345 (5.9)	
Middle	5679 (19.7)	300 (5.3)	721 (12.7)	3529 (62.1)	1129 (19.9)	<0.001*
Richer	5780 (20.0)	396 (6.9)	832 (14.4)	2081 (36.0)	2471 (42.8)	
Richest	5433 (18.8)	383 (7.0)	701 (20.7)	543 (3.3)	3806 (48.2)	
Religion						
Catholic	3115 (10.8)	226 (7.3)	333 (10.7)	1690 (54.3)	866 (27.8)	
Protestants	12005 (41.6)	583 (4.9)	1621 (13.5)	5972 (49.7)	3829 (31.9)	<0.001*
Islam	13114 (45.4)	528 (4.0)	1391 (10.6)	8109 (61.8)	3086 (23.5)	
Others	642 (2.2)	26 (4.0)	47 (7.3)	461 (71.8)	108 (16.8)	
Marital status						
Not currently in union	8931 (30.9)	387 (4.3)	904 (10.1)	4317 (48.3)	3323 (37.2)	
currently in union	19945 (69.1)	976 (4.9)	2488 (12.5)	11915 (59.7)	4566 (22.9)	<0.001*
Number of living children						
0	8838 (30.6)	380 (4.3)	920 (10.4)	4377 (49.5)	3161 (35.8)	
1 -2	6839 (23.7)	324 (4.7)	869 (12.7)	3917 (57.3)	1729 (25.3)	<0.001*
3 -4	6560 (22.7)	317 (4.8)	853 (13.0)	3731 (56.9)	1659 (25.3)	
5+	6639 (23.7)	342 (5.2)	750 (11.3)	4207 (63.4)	1340 (20.2)	
Heard of family planning message in last 6 months	10628 (36.8)	515 (37.8)	1646 (48.5)	3917 (24.1)	4550 (57.7)	<0.001*
Use modern contraceptive	3002 (10.4)	171 (12.5)	469 (13.8)	1014 (6.2)	1348 (17.1)	<0.001*

* $p<0.05$

Table 2: Descriptive statistics of contextual variables

Community-level (contextual) variables	Migration status: Median (Min-Max)			
	Rural-urban	**Urban-rural**	**Rural non-migrants**	**Urban non-migrants**
Nigeria				
community fertility norm: % of women reporting ideal family size as <= 4	0.29 (0.0-0.85)	0.30 (0.0-0.84)	0.17 (0.0-0.84)	0.48 (0.0-0.88)
community FP awareness: % of women exposed to family planning messages in the past 6 months	0.44 (0.0-0.97)	0.46 (0.0-0.93)	0.19 (0.0-0.93)	0.60 (0.0-1.00)
community education: % of women with at least a secondary education	0.58 (0.0-1.00)	0.52 (0.0-0.98)	0.17 (0.0-0.98)	0.74 (0.0-1.00)
community poverty : % of women in the poor wealth quintile	0.03 (0.0-1.00)	0.21 (0.0-1.00)	0.72 (0.0-1.00)	0.00 (0.0-1.00)

Table 3: Modern contraceptive use among Nigerian women according to migration status and selected background characteristics

Variables	All women	Modern contraceptive use	
	n	n (%)	unadjusted OR (95% CI)
Migration status			
Rural-urban	1363	171 (12.5)	0.70 (0.59 - 0.83)*
Urban-rural	3392	469 (13.8)	0.78 (0.70 - 0.87)*
Rural non-migrants	16232	1014 (6.2)	0.32 (0.29 - 0.35)*
Urban non-migrants	7889	1348 (17.1)	1.00
Region			
North Central	5548	650 (11.7)	1.00
North East	5304	211 (4.0)	0.31 (0.27 - 0.37)*
North West	6136	165 (2.7)	0.21 (0.18 - 0.25)*
South East	3181	316 (9.9)	0.83 (0.72 - 0.96)*
South West	4221	766 (18.1)	1.67 (1.49 - 1.87)*
South South	4486	894 (19.9)	1.88 (1.68 - 2.09)*
Age (years)			
15-19	5849	247 (4.2)	1.00
20-29	10180	1297 (12.7)	3.31 (2.88 - 3.81)*
30-39	7246	972 (13.4)	3.51 (3.04 - 4.06)*
40-49	5601	486 (8.7)	2.16 (1.84 - 2.52)*
Education			
None	11264	330 (2.9)	1.00
Primary	5651	622 (11.0)	4.09 (3.57 - 4.70)*
Secondary	9623	1419 (14.7)	5.73 (5.07 - 6.48)*
Higher	2338	631 (27.0)	12.25 (10.62 - 14.13)*
Wealth Quintile			
Poorest	6136	172 (2.8)	1.00
Poorer	5848	299 (5.1)	1.87 (1.54 - 2.26)
Middle	5679	511 (9.0)	4.43 (2.87 - 4.09)*
Richer	5780	864 (14.9)	6.09 (5.15 - 7.21)*
Richest	5433	1156 (21.3)	9.37 (7.95 - 11.05)*
Religion			
Catholic	3115	416 (13.4)	1.79 (1.32 - 2.42)*
Protestants	12005	1889 (15.7)	2.16 (1.62 - 2.89)*
Islam	13114	646 (4.9)	0.60 (0.45 - 0.81)*
Others	642	51 (7.9)	1.00
Marital status			
Not currently in union	8931	996 (11.2)	1.00
currently in union	19945	2006 (10.1)	0.89 (0.82 - 0.97)*
Number of living children			
0	8838	857 (9.7)	1.00
1 -2	6839	626 (9.2)	0.94 (0.84 - 1.05)
3 -4	6560	821 (12.5)	1.33 (1.20 - 1.48)*
5+	6639	698 (10.5)	1.09 (0.99 - 1.22)
Heard of family planning message in last 6 months			
Yes	10628	1942 (18.3)	3.63 (3.35 - 3.92)*
No	18248	1060 (5.8)	1.00

* $p<0.05$

Table 4: Results of multilevel analysis showing the effect of migration status on modern contraceptive use adjusted for individual and contextual factors among Nigerian women

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Migration status					
Rural-urban	0.81 (0.67-0.98)*	0.94 (0.78-1.14)	0.92 (0.76-1.12)	0.91 (0.76-1.10)	0.98 (0.81-1.19)
Urban-rural	0.52 (0.42-0.64)*	0.94 0.78-1.11)	0.86 (0.72-1.02)	1.17 (0.99-1.38)	1.02 (0.86-1.21)
Rural non-migrants	0.30 (0.25-0.36)*	0.74 (0.63-0.86)*	0.69 (0.59-0.80)*	0.84 (0.72-0.98)*	0.88 (0.75-1.03)
Urban non-migrants	1.00	1.00	1.00	1.00	1.00
Region					
North Central	-	-	-	1.00	1.00
North East	-	-	-	0.58 (0.46-0.72)*	0.66 (0.52-0.83)*
North West	-	-	-	0.32 (0.25-0.41)*	0.37 (0.29-0..48)*
South East	-	-	-	0.54 (0.42-0.68)*	0.48 (0.37-0.61)*
South West	-	-	-	1.09 (0.89-1.33)	0.99 (0.81-1.21)
South South	-	-	-	0.79 (0.63-0.98)*	0.82 (0.65-1.02)
Age (years)					
15-19	-	1.00	1.00	-	1.00
20-29	-	3.71 (3.20-4.30)*	2.82 (2.40-3.31)*	-	2.82 (2.40-3.31)*
30-39	-	4.52 (3.87-5.28)*	2.29 (1.89-2.77)*	-	2.22 (1.83-2.70)*
40-49	-	3.37 (2.84-4.01)*	1.40 (1.13-1.75)*	-	1.33 (1.06-1.65)*
Education					
None	-	1.00	1.00	-	1.00
Primary	-	2.66 (1.25-1.89)*	2.09 (1.78-2.46)*	-	1.69 (1.44-1.99)*
Secondary	-	3.55 (3.03-4.16)*	2.81 (2.38-3.33)*	-	2.20 (1.85-2.62)*
Higher	-	4.58 (3.81-5.00)*	3.69 (3.02-4.51)*	-	2.88 (2.35-3.53)*
Wealth Quintile					
Poorest	-	1.00	1.00	-	1.00
Poorer	-	1.53 (1.24-1.89)*	1.42 (1.15-1.75)*	-	1.27 (1.02-1.57)*
Middle	-	2.10 (1.71-2.59)*	1.81 (1.47-2.23)*	-	1.43 (1.12-1.81)*
Richer	-	2.82 (2.27-3.49)*	2.30 (1.85-2.86)*	-	1.60 (1.23-2.07)*
Richest	-	3.07 (2.43-3.87)*	2.36 (1.86-2.98)*	-	1.49 (1.13-1.97)*
Religion					
Catholic	-	-	0.88 (0.62-1.24)	-	0.87 (0.61-1.22)
Protestants	-	-	0.98 (0.71-1.36)	-	0.87 (0.63-1.21)
Islam	-	-	0.50 (0.36-0.70)*	-	0.60 (0.43-0.84)*
Others	-	-	1.00	-	1.00

Marital status					
Not currently in union	-	-	1.00	-	1.00
currently in union	-	-	0.69 (0.56-0.86)*	-	0.69 (0.55-0.85)*
Number of living children					
0	-	-	1.00	-	1.00
1 -2	-	-	1.12 (0.98-1.28)	-	1.13 (0.99-1.29)
3 -4	-	-	1.95 (1.69-2.25)*	-	1.99 (1.72-2.29)*
5+	-	-	2.72 (2.29-3.24)*	-	2.86 (2.41-3.40)*
Family planning message					
Yes	-	-	1.83 (1.66-2.02)*	-	1.85 (1.67-2.06)*
No	-	-	1.00	-	1.00
Contextual factors					
community fertility norm	-	-	-	2.56 (1.66-3.92)*	2.65 (1.70-4.13)*
community FP awareness	-	-	-	1.75 (1.22-2.50)*	1.04 (0.71-1.51)
community education	-	-	-	3.35 (2.24-5.02)*	1.64 (1.06-2.54)*
community poverty	-	-	-	0.72 (0.54-0.95)*	0.88 (0.62-1.24)*
Random effects					
Variance (SE)	1.0279(0.0440)	0.6551(0.1099)	0.6324(0.0354)	0.5058(0.0343)	0.5055(0.0352)
ICC (%)	24.31	11.54	10.83	7.21	7.2
Proportional Change in Variance (PCV) (%)	48.55%	67.21%	68.35%	57.84%	74.69%
Log likelihood	-8808.6349	-8282.8307	-8066.4264	-8465.6336	-7957.2623
ICC	0.2431 (0.0158)*	0.1154(0.0112)*	0.1083(0.0108)*	0.07214(0.00908)*	0.07209(0.00931)*

* $p<0.05$