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ABSTRACT

Background: Despite the acknowledged health and socioeconomic benefits of use of modern contraceptives, their use in Nigeria remains persistently low, with wide variations in pattern of use. Given Nigeria's commitment to doubling her contraceptive prevalence within four years, it is imperative to investigate the mediating role of contextual factors in influencing contraceptive behavior, for more responsive programming. This study therefore aims to assess the role of contextual factors in determining use of modern contraceptives in Nigeria.

Methods: A multilevel modelling was carried out using data from the 2013 Nigeria Demographic and Health Survey (NDHS) among women age 15-49. The weighted sample used in the analysis comprised 13,835 women of reproductive age who were married, fecund and did not desire a child within two years of the study, drawn from 904 clusters (enumeration areas) across the country. The clusters were taken as representative of communities. The outcome variable used in the modelling was current use of modern contraceptives.

Results: Overall, individual and community level variables accounted for 82% of the variations in contraceptive use in Nigeria. Positive community-level predictors of contraceptive use level were the level of female autonomy, female education and access to health facilities within the community. Conversely, communities with higher proportions of Muslim and higher proportions of polygynous marriages negatively predicted use of modern contraceptives. Also, compared with the South West Zone, all the other zones of the country except the South Zone had significant lower odds of contraceptive use. Poverty and rural residence had no significant effect on use of modern contraceptives.

Conclusion: Individual and community characteristics were significant predictors of use of modern contraceptives in Nigeria and thus these factors should be taken into account in programming for family planning in the country.

Keywords: Nigeria, modern contraceptive use, contextual factors, multilevel models

INTRODUCTION

This study focuses on determining the community-level factors that influence modern contraceptive use in Nigeria, using multilevel analysis of the 2013 Nigeria Demographic and Health Survey (NDHS) data sets. Nigeria is committed to raising her current contraceptive prevalence rate to 36% by 2018. There is thus an urgent need to determine factors responsible for the persistent low coverage and the observed wide variations across the country. Recognizing that uptake of modern contraceptives tends to be socially and culturally nested, the findings of this study will be useful for retooling interventions to make them context specific, to achieve better results.

Background

Nigeria, the seventh most populous nation in the world, has a current estimated population of 183 million, which is projected to reach 285 million by 2050 (United Nations 2013). There are an estimated 35 million women of reproductive age in the country, with an annual number of births of approximately 7 million and annual population growth of 3.2% per annum. The country's rapid population growth is attributable to a high total fertility rate (TFR) of 5.5 children per woman (National Population Commission and ICF International and 2014). Family planning—the ability of individuals and couples to attain their desired number and spacing of their children through contraceptive use—is one of the most cost-effective public health interventions and is pivotal to reducing the country's fertility(Graff, 2014).

Fertility decline is a means of achieving a demographic dividend, with the consequent potential of reducing poverty, boosting economic growth and contributing to the overall well-being of families and societies (Cleland et al. 2006; Graff and Bremner 2014; Gribble and Bremner 2012). It has been estimated that in Nigeria a reduction in fertility by one child per woman would lead to a 13% increase in GDP per capita within 20 years (Ashraf, Weil, and Wilde 2013). While family planning impacts all the MDG goals, it is most directly associated with MDG 5, improving maternal health (Ezeh, Bongaarts, and Mberu 2012; UNFPA and PATH 2008).

Contraceptive use reduces the pregnancy rate, the number of unintended pregnancies and associated induced abortions and the proportion of high-risk pregnancies, therefore causing a reduction in maternal mortality and an improvement in maternal and child health. Studies have

estimated that 30% to 40% of maternal deaths (Ahmed et al. 2012; Cleland, Ndugwa, and Zulu 2011; Collumbien, Gerressu, and Cleland 2004; Singh et al. 2009) and 90% of induced abortion-related maternal deaths (Cleland et al. 2006) could be averted if all women who desired to use contraceptives had access to them. In addition, contraception makes significant contributions to reducing levels of infant, neonatal and under-five mortality (Tsui and ACreanga 2009). It is estimated that in developing countries as many as 1.8 million child deaths could be averted if all pregnancies were spaced by at least three years (Rutstein 2008).

In the past few decades investments in family planning programs have raised the level of contraceptive use from 19% to 62% in the developing world and contributed to an estimated 75% decline in fertility (Greanga et al. 2011). However, despite the increase in supply of and demand for family planning services, gross inequities exist both between and within countries in the use of contraceptives, posing challenges to health policy and programming. Use of modern contraceptives in developing countries remains comparatively low, with West Africa having the lowest rates. In many countries the demand for contraceptives is still not being fulfilled. Worldwide, in 2010 12% of women currently married or in union who do not want any more children or want to postpone their next pregnancies for at least two years are not using any form of contraception—that is, they have an unmet need for family planning (Alkema et al. 2013). In developing countries an estimated 222 million women have an unmet need for modern contraception (Singh and Darroch 2012). The proportion of married women with unmet need for modern contraception is 18% in the developing world as a whole, but is much higher than average (30–37%) in Western Africa, Middle Africa, Eastern Africa and Western Asia, and is somewhat higher than average (22–24%) in South Asia and the Caribbean (Singh and Darroch 2012).

Nigeria is yet to derive significant benefits of family planning, as her use of contraceptives has remained persistently low, prevalence of modern contraceptive use stagnating at 10% among currently married women (National Population Commission and ICF International and 2014), much lower than the African average. The resultant high fertility is a significant contributor to high maternal mortality in Nigeria. Even though Nigeria has only 2% of the global population, it contributes a disproportionate 14% to the global burden of 289,000 annual maternal deaths (World Health Organization 2014).

The context of family planning in Nigeria

Nigeria's family planning program began in 1964 with the National Family Planning Council of Nigeria (Oyediran 1969). Before the 1980s, however, family planning programs were not a priority for the government of Nigeria and consequently were driven by development partners and nongovernmental organizations. Following analysis of the consequences of unregulated population growth on health and development in Nigeria, starting in the late 1980s the country began formulating various policies aimed at improving reproductive health outcomes and reducing fertility levels through family planning. These include Nigeria's national population policy, first enunciated in 1988 and revised in 2004. These policies focused on increasing uptake of modern contraceptives for health and national demographic goals (Federal Republic of Nigeria 1988). Targets of the first national population policy included increasing contraceptive prevalence to 80% and limiting the TFR to an average of four children per woman by 2000. The revised population policy calls for a reduction of maternal mortality by 75% by 2015, reduction of the fertility rate by 0.6 children per woman every five years and a 2% annual increase in the proportion of women using contraceptives. More recently, following the 2012 London Summit on Family Planning, Nigeria developed a blueprint for accelerating uptake of family planning with a target of increasing the national contraceptive prevalence rate to 36% by 2018(Federal Republic of Nigeria 2014).

Currently, family planning services are provided by both the public and private sectors, with the commodities provided free in public sector facilities. In spite of the various investments in family planning programs in the country, contraceptive prevalence has not shown any sign of increasing. According to the 2013 NDHS, while knowledge of contraceptives is generally high, uptake is low; only 15% of married women of reproductive age are using any contraceptive method and, as mentioned, only 10% are using a modern family planning method, while unmet need for contraception is 16% (National Population Commission and ICF 2014). The national rates have shown little change since 1990. Motivation to use contraceptives is low in the country, as pro-natalism is one of the reasons for high fertility and low contraceptive prevalence (Federal Ministry of Health 2008).

These national aggregate indicators mask wide variations in the uptake of contraceptives across the country. The southern zones of the country have higher contraceptive prevalence compared with the northern zones. The northern part of Nigeria has one of the lowest rates of

contraceptive use in the world. Across the states of the country, contraceptive prevalence ranges from 26% in Lagos State in South-western Nigeria to less than 1% in Jigawa and Kano States, North-western Nigeria. The 2013 NDHS data aggregated by zones showed wide variations in fertility intentions and contraceptive use. While the national total fertility rate is 5.5 children per woman, it ranges from 4.3 children per woman in the South Zone to 6.7 children per woman in the North West Zone. Use of modern contraceptives ranges from 3% in the North East Zone to 25% in the South West Zone. Also, the 2013NDHS showed variation in the method mix. For example while contraceptive prevalence was comparatively high in some of the eastern states of the country, contraceptive use includes more natural and traditional contraceptive methods. There are also variations in contraceptive use by religion, education, place of residence and socioeconomic status (National Population Commission and ICF International and 2014).

In addition to the many socio-cultural drivers of high fertility, poor investment in strategic behavior change communication has contributed to low demand for family planning. The main sources of information on family planning in the country are friends or siblings, media, formal education and health workers (Ankomah, Anyanti, and Oladosu 2011; Monjok et al. 2010; Oye-Adeniran et al. 2006). Additionally, a number of supply-related factors limit contraceptive use. These include erratic supply of modern contraceptives, gaps in logistics supply chain, donor dependence, poor-quality services and dearth of skilled health personnel to provide family planning services (Federal Government of Nigeria 2014).

Variations in contraceptive use

Wide variations exist in the pattern of contraceptive use between regions and countries of the world, and also at sub-national levels (Alkema et al. 2013; Dynes et al. 2012). Studies on reasons for the observed variations have tended to concentrate on individual and household factors. The findings show that a number of demographic, biological, socioeconomic and behavioral variables are associated with contraceptive use.

Demographic factors influencing use of contraceptives include age, parity, marital status and marriage type. Women's age has a curvilinear effect on contraceptive use, with lower levels of use at younger and at older ages (Njogu 1991). In Africa, sexually active single women are more likely to use contraceptives than married women (Adebayo et al. 2012; Caldwell, Orubukoye, and

Pat 1992). Marriage type has a mixed effect on uptake of contraceptives, which is made more complex by spousal age differences and inequalities between co-wives (Hertrich 2005). Polygamy has been associated with lower levels of contraceptive use (Johnson and Elmi 1989; Peterson 1999). A study from Northeast Nigeria reported that women in polygamous unions are less likely to use contraceptives compared with women in monogamous unions (Audu et al. 2008). Polygamy, when coupled with youthful age at marriage and with a wide differences in age between spouses, may inhibit husband-wife interactions and perpetuate male dominance within the marriage (Ezeh 1997).

The demographic factors may be mitigated by biological and behavioral factors, such as fecundity, sexual activity and desire for children. African societies are pro-natalist and believe that children are a gift from God and are also social and economic investments; this has negative implications on use of contraceptives (Caldwell and Caldwell 2000). Couples and women who desire more children are less likely to use contraceptives (Mahmood and Ringheim 1999). Studies have found that an inverse relationship exists between the number of living children and use of modern contraceptives (Stephenson et al. 2007; Uchindi 2001; Yihunie et al. 2013). Evidence from a number of countries has pointed towards the partner's disapproval and his desire for more children as key factors for non-use of contraception (Bongaarts and Bruce 1995).

A strong relationship has been found between women's education, especially completed primary education and entry into secondary level, and fertility reduction. Several studies have reported that women's education has a strong positive impact on contraceptive use (Bawah 2002; Burgard 2004; Guilkey and Susan 1997; Kradval 2002). In Nigeria, education has been found to increase contraceptive use (Oye-Adeniran et al. 2006). Nigerian women with tertiary level education are one-and-a-half times more likely to have ever used contraception than women with secondary education (Asekun-Olarinmoye et al. 2013). Partner's level of education is equally important, as it may operate through many of the same pathways (childbearing preferences) as the woman's own education, given that education levels of husbands and wives are positively correlated (Malwade 2002). A study from Nigeria showed that the likelihood that a woman and her partner were using contraception was higher if at least one partner had a primary or higher education than if both had no education (Ibisomi 2014). However, women who are more educated than their husbands tend to use contraceptives more than women who are not as educated as their

husbands (Stephen and Enoch 2014). Level of education is a predictor of socioeconomic status, which correlates with contraceptive use. Thus, women of lower socioeconomic status have lower uptake rates of contraceptives (Acharya 1998; (Ibisomi 2014; Shah, Shah, and Radovanovic 1998; Stephenson and Tsui 2003).

Independent of socioeconomic factors, knowledge of contraceptives is a determinant of contraceptive use. Exposure to mass media has strong effects on attitudes towards family planning through ideation, which has been found to contribute to observed fertility decline (Cleland and Christopher 1987). Evidence from a number of studies reveals that exposure to mass media messages promoting family planning may affect contraceptive behavior (Jato et al. 1999; Kane et al. 1998; Storey et al. 1999).In Nigeria, use of modern contraceptives, the intention to use them and desire for fewer children were found to be associated with exposure to media message about family planning (Bankole, Rodriguez, and Westoff 1996).

Contextual factors and contraceptive use

After accounting for the effects of individual and household factors, variations in contraceptive use still persist. There is thus an increasing call for health researchers to begin to focus on examination of how individual-level variables interact with group-level variables to cause health and disease (Diez-Roux 1998). Since individuals live in communities, communities evidently influence personal health behavior, as there are usually intersections between personal beliefs and attitudes and community norms. With regard to contraceptive use, women must navigate community norms to fulfill their ideals in terms of fertility and contraceptive decision-making (Colleran and Mace 2015). The community influences an individual's use of contraceptives through multiple pathways: socioeconomic characteristics of the community, presence of health facilities and infrastructure and prevailing attitudes and behavior. Consequently, within the reproductive health field attention is now shifting to examining the role of contextual factors in explaining the observed variations in contraceptive use, with increasing attention being given to the role of the community in shaping reproductive health behavior of individuals, including contraception behavior (Dynes et al. 2012).

In recent times, a number of studies have attempted to investigate the role of contextual factors in contraceptive use in African countries (Bogale et al. 2011; Dynes et al. 2012; Elfstrom

and Stephneson 2012; Kaggwa, Diop, and Storey 2008; Wang et al. 2013). The growing body of knowledge has identified a number of contextual factors that influence contraceptive use; they include presence and quality of reproductive health services, macroeconomic factors, community fertility norms, female autonomy, and availability of physical infrastructure.

These studies suggest that considerable gains in understanding determinants of contraceptive use could be made from studying contextual influences, as they have demonstrated that, beyond individual and family factors; the context in which women live also influences their contraceptive decisions. They posit that a greater understanding of the contextual factors associated with modern contraceptive use has the potential to inform the development of community-level programs aimed at increasing contraceptive use and to allow for better targeting of programs to align with communities (Elfstrom and Stephneson 2012).

In Nigeria, not much is known about how community characteristics affect contraceptive use among married women and about the causes of the observed variations by various characteristics across the zones of the country. There is a dearth of literature on contextual factors influencing contraceptive use in Nigeria. Few studies using multilevel modeling techniques identified contextual factors associated with contraceptive use but they are limited in the number of factors investigated. The study by Aremu was limited to determining contextual factors influencing choice of family planning provider and method choice (Aremu 2013). In a study by Omotola the contextual factors were limited to comparison of contraceptive uptake between the northern and southern parts of the country across a number of variables (Omotola 2013). We do know that wide variations exist in socioeconomic and cultural characteristics even within the two broad zones of the country, and grouping them as homogenous entities may mask these differences. A study by Ibisomi was limited to examining the effect of spousal age difference on contraceptive use (Ibisomi 2014), while Adebayo et al. examined variation in use of contraceptives with a focus on marital status (Adebayo et al. 2012).

Research Questions and Hypothesis

The **research question** is, beyond individual and household factors, what community factors shape use of modern contraceptives in Nigeria?

The main **hypothesis** is there is an association between community factors and use of modern contraceptives in Nigeria.

The other hypothesis is that significant differences exist in contraceptive modern use across communities in Nigeria.

Significance of the Study

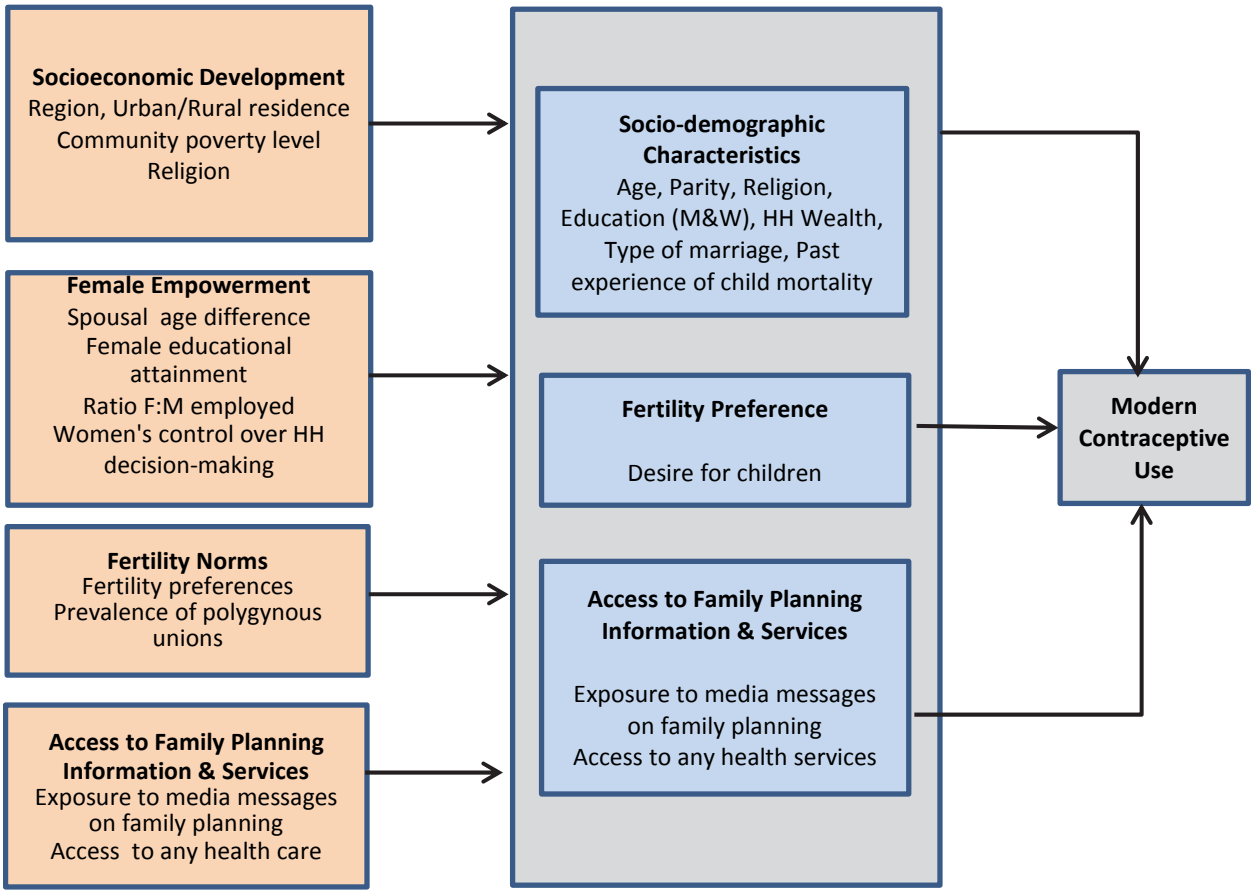
Nigeria has an ambitious target of more than doubling her contraceptive prevalence rate with four years (2014 – 2018), from 15% to 36%. This is against a backdrop of persistently low and stagnating contraceptive use. For effective policy implementation, the need to determine factors responsible for low coverage and the observed wide variations across the country is not only imperative but urgent if better results are to be achieved.

In terms of policy and programming implications of the proposed study, we believe that presence of community-level effects on contraceptive uptake, if identified, will indicate the need for changes in family planning programming that will factor in community and service delivery characteristics (e.g., health campaigns, number and type of services), with positive influences on program and maternal health outcomes for whole communities.

Conceptual Framework

Figure 1 shows the conceptual framework for this study. The contextual factors indirectly influence fertility by acting on the proximate or intermediate (individual and household) determinants at different levels to influence a woman's use of contraception. All the contextual factors either function independently or through their influences on the individual factors selected to influence use of modern contraceptives.

Figure 1. Conceptual framework



Socioeconomic development

The contextual regions used in this study were based on geo-political zones of the country, which was used by NDHS 2013. They are categorized into North West, North Central, North East, South West, South East and South zones based on the premise that they may have a strong relationship with contraceptive use since there are wide differentials in poverty levels, education, religion and infrastructural development across the zones. Place of residence is associated with contraceptive use. The DHS surveys have consistently showed that use of contraceptives is higher among women living in urban areas compared with women in rural areas. This is because urban areas in sub-Saharan Africa are associated with higher infrastructural development, better education and easier access to public and private medical care and services. However, while some contextual studies have found an association between residence and use of contraceptives (Yihunie et al. 2013), others have found no significant association (McNay, Arokiasamy, and Cassen 2003).

Household socioeconomic status and the community's overall level of economic prosperity could impact women's contraceptive use through several pathways. DeGraff et al reported that the presence of family planning services and community labour-market conditions and infrastructural development were strong influences on contraceptive use in the Philippines (Degraff, Bilsborrow, and Guilkey 1997). Other studies have examined the influence of community economic development (Diez-Roux 1998; Nazzar et al. 1995; Stephenson and Tsui 2002; Stephenson, Beke, and Tshibangu 2008) and of levels of school participation (Degraff, Bilsborrow, and Guilkey 1997) on contraceptive use. Other community-level measures of socioeconomic development have included the percentage of women with access to piped water (Kaggwa, Diop, and Storey 2008) and habitat type (Stephenson et al, 2007). However, these factors were not found to be determinants of contraceptive use. Others have used the community level of poverty, household amenity index as a proxy for level of economic development of a community and found an association (Clements et al. 2003, Elfstrom and Stephenson 2012).

The impact of religion on contraceptive use is mixed. One perspective is that, irrespective of religious affiliation, people with the same socioeconomic and demographic characteristics should have similar fertility limitations and practices (Goldsheider and Mosher 1998) while others emphasize the independent effect of religion on contraceptive use (Heaton 2011). Generally, studies have demonstrated lower contraceptive use and higher fertility among Muslims compared with Christians (Heaton 2011). Studies in Nigeria have also demonstrated lower use of contraceptives among Muslims (Obasahon 2015; Wusu 2014).

Female empowerment

Women's education, a key measure of female empowerment, is a powerful correlate of contraceptive use (Larsson and Stanffors 2014). Studies have shown that the average community level of women's education or literacy is associated with reproductive behaviour, including family planning, beyond contributions of individual level of education (Kravdal 2000, 2002). However, female empowerment is more than just education. It fundamentally has to do with agency and control over decision-making and choices. The DHS surveys collect information on various aspects of decision-making: economic decision-making, household decision-making and female mobility. Using these dimensions, higher levels of contraceptive use have been found to be associated with joint decision-making in these areas (Bogale et al. 2011; Do and Kurimoto 2012;

Elfstrom and Stephneson 2012; Feyisetan 2000; Hameed et al. 2014; Wang et al. 2013). A study among the Yorubas in Nigeria found a positive association between female empowerment and contraceptive use among older women (OlaOlorun and Hindin 2014). However, another study in Ethiopia found that, even though women make joint decisions with their husbands, they defer to them for the final verdict (Bogale et al. 2011). This may reflect lack of empowerment in other areas of their lives. A study of contextual influences on contraceptive use in 20 African countries found no association between contraceptive use and female empowerment (Elfstrom and Stephenson 2012). Another measure of empowerment is economic independence. Women who work for cash have been found to more significantly communicate with their spouses about family planning, thus increasing the likelihood of contraceptive use (Gage 1995).

Spousal age difference is taken as a measure of gender inequality (Barbieri and Hertrich 2002). Large age differences are often accompanied by differences in maturity, life experiences, social position and financial resources, which may make spousal relationships inherently unequal and a source of risk for women's health (Darroch, Landry, and Oslak 1999; Luke 2005). The younger the wife is compared with her husband, the less her autonomy, limiting her ability to communicate with her spouse, challenge gender norms and adopt new practices (Barbieri and Hertrich 2002). This has implications for contraceptive use. However, research has provided mixed results; some studies have found an inverse relationship between spousal age difference and use of contraceptives (Barbieri and Hertrich 2002), while others have shown a lack of association (Ibisomi 2014).

Fertility norms

At the individual level, decisions are generally shaped by perceived prevailing attitudes and behaviours of other members of the community (Rimal and Real 2003; Colleran and Mace 2015). Thus, community norms regarding the family and family planning are likely to impact women's own attitudes, and ultimately influence their family planning behaviours (Bongaarts and Bruce 1995; Nazzar et al. 1995). Men and women can be influenced even more by their perception of community norms than by their personal preferences concerning their ideal number of children and contraceptive use. However, some studies have reported mixed findings. Kaggwa et al. reported that in Mali, after controlling for individual-level factors, they found no evidence that women's use of modern contraceptives was impacted by community norms and desired family

size (Kaggwa, Diop, and Storey 2008; Nazzar et al. 1995). In contrast, Stephenson et al., after controlling for individual and other community factors, found that in four of six countries studied the percentage of women in the community who approved of family planning was positively associated with women's own use of modern contraceptives (Stephenson et al. 2007). Also, a study in Kenya found that women whose number of living sons was lower than their perceived community norms were less likely to use contraceptives (Dynes et al. 2012).

Also, family size preferences—an indicator of the demand for children—has been shown to be a measure of motivation to consciously limit fertility through use of contraceptives (Mahmood and Ringheim 1999). Husband's demand for children is significantly related to the wife's desired fertility and the couple's fertility outcome. In Nigeria, women whose spouses desire more children have been found less likely to use contraceptives (Bankole and Singh 1998). Among the Yoruba in Nigeria, the fertility desires of both partners are important predictors of the couples' fertility. Whereas the husband's preferences are dominant in predicting the couple's behaviour when the number of children is small, the wife's becomes more important as the number of living children grows (Uchindi 2001).

Access to family planning information and services

Access to family planning information can enhance uptake of services. Most studies have shown that community-level exposure to family planning media messages increases the odds of contraceptive use (Bankole, Rodriguez, and Westoff 1996; McNay, Arokiasamy, and Cassen 2003; Stephenson et al. 2007; Wang et al. 2013). However, in a study of contextual factors influencing contraceptive use in 21 African countries, Elfstrom et al. found that exposure to media messages was positively associated with contraceptive use in only two countries, while the effect was negative in one country (Elfstrom and Stephenson 2012).

Expanding access to effective, accessible, acceptable and good-quality family planning services is critical to its uptake, especially clinical contraception. The majority of research on access to health care services has tended to focus on one dimension of access, geographical access. This refers to either the distance to service delivery points, which is measured by either the density of service delivery points in a given area or the time it takes to get to the service delivery point. Studies have found that access to family planning services increases the likelihood of contraceptive use, so also availability of family planning commodities (Wang et al. 2013). Stephenson et al.

(2007) reported that the presence of family planning services and community labour-market conditions and infrastructural development were strong influences on contraceptive use in the Philippines (Degraff, Bilsborrow, and Guilkey 1997). Other studies have examined the influence of community economic development (Diez-Roux 1998; Nazzar et al. 1995; Stephenson and Tsui 2002; Stephenson, Beke, and Tshibangu 2008) of levels of school participation (Degraff, Bilsborrow, and Guilkey 1997) on contraceptive use. Other community-level measures of socioeconomic development have included the percentage of women with access to piped water (Kaggwa, Diop, and Storey 2008) and habitat type (Stephenson et al. 2007). However, these factors were not found to be determinants of contraceptive use. Others have used the community level of poverty, household amenity index as a proxy for level of economic development of a community and found an association (Clements et al. 2003; Elfstrom and Stephneson 2012).

DATA AND METHODS

Study Setting

Nigeria's population of 183 million people is spread across 774 Local Government Areas, which are grouped into 36 States plus the Federal Capital Territory. These states are further grouped into six geopolitical zones, the North West, North East, North Central, South East, South West and South zones. More than half (54%) of the population resides in the rural areas. The population is made up of 50% Muslims, 40% Christians and 10% traditional religionists. An estimated 57% of females are enrolled in school (primary, secondary or tertiary) compared with 71% males. Even though Nigeria is said to have the largest economy in the Africa, with a per capita GDP of $2,710, the poverty level is high and an estimated 62% of Nigerians live below the poverty line

Wide differences exist between the northern and the southern parts of the country and across the zones of the country in terms of levels of socioeconomic development, cultural practices, availability and access to health care services and use of contraceptives. The southern population is made up of mainly Yoruba in the South West and Ibo in the South East as the predominant Christian ethnic groups, while the majority of the North consists of Hausa/Fulani Muslims. As one moves from the more affluent and educated southern parts of the country to the

northern parts, the level of education declines and poverty levels deepen, so also availability of health services and their use.

Data Source

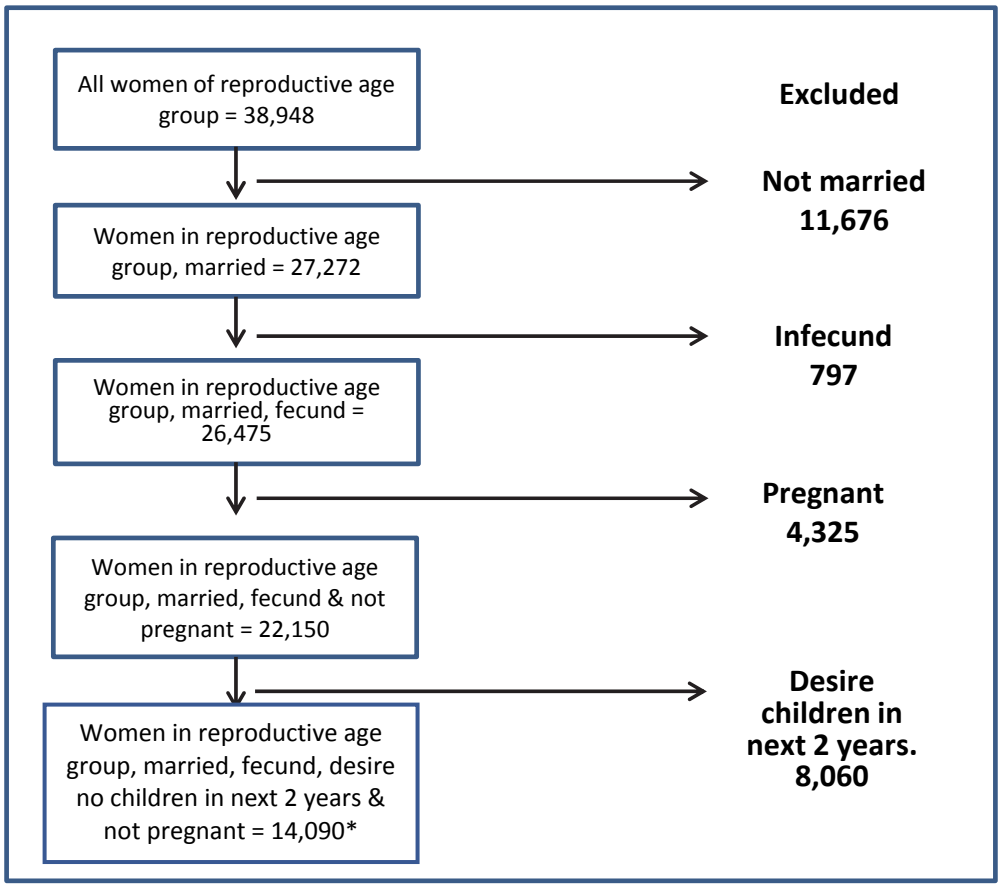
The data for this study come from the 2013 Nigeria DHS. The 2013 NDHS was the fifth in the series of surveys that have collected demographic and health information for program planning, implementation and monitoring. The survey used a three-stage cluster sampling design and covered all the states in the country. The sampling design was based on the 2006 census, where the enumeration areas served as the primary sampling unit (PSU). A total of 904 clusters (PSU) were sampled during the 2013 NDHS: 372 in urban areas and 532 in rural areas. About 20-30 households were randomly selected in each cluster, yielding a representative sample of 40,680 households. All women age 15-49present either as a permanent resident or as visitor in the household the night before the survey were eligible for the interview. The survey used basically three types of structured questionnaires: the Household Questionnaire, Woman's Questionnaire and Man's Questionnaire. The Household Questionnaire listed all usual household members and visitors to the sampled households; additional basic information collected was on the characteristics of each person listed, including age, sex, marital status, education and relationship to the head of the household. The Woman's Questionnaire collected information on background characteristics, reproductive history, childhood mortality, knowledge and use family planning methods, fertility preferences, antenatal, delivery and postnatal care, female empowerment and a host of other health issues relating to specific diseases and disease-prevention programs/interventions. The Man's Questionnaire is similar to the Woman's Questionnaire except that it is shorter. At the end of the exercise, 99%, 98% and 95% response rates were recorded, respectively, for households, women and men [National Population Commission and ICF 2014]. Similar to its predecessors, the 2013 NDHS collected information on knowledge and current use of contraceptives among 38,948 eligible women.

Sample derivation

For the purpose of this analysis only married women considered to have a need for contraceptives were included in the sample—that is, the eligible respondents comprised only

married, fecund women who did not desire any children in the next two years. The final weighted sample size comprised 13,835 women. The sample size derivation is shown in Figure 2.

Figure 2. Sample derivation flow chart



Key Variables and Measurements

Dependent variable: The dependent variable is current use of any modern contraceptive among the sub-sample of women. This is a binary variable and women were categorized into those using a modern contraceptive method (oral pills, injectables, male or female condoms, intrauterine devices, male or female sterilization, lactational amenorrhea) and those not using any contraceptive method or using periodic abstinence, withdrawal, or other traditional family planning methods.

Independent variables: The individual-level and community-level explanatory variables selected for this analysis were drawn from DHS data, based on the literature review; they are outlined in our conceptual framework. The independent variables are broadly classified into two

main groups in line with our multilevel analytic approach: individual-level variables and community-level variables.

Individual-level variables

The individual-level variables are: age of woman at time of survey, household wealth index, highest level of educational attainment of the woman and that of her partner, parity, type of marriage, and exposure to media messages on family planning. Table 1 provides an operational definition and coding of these variables.

Community-level factors

The 2013 NDHS data had identifiers for the primary sampling units (PSU) where each respondent resided. Each PSU had between 20 and 30 households. For the purpose of this study, the PSU were considered to be representative of the community, and contextual factors were assessed at community level, derived from the DHS data by averaging individual-level values for each cluster.

The community-level factors are considered as the contextual factors operating within the communities in which individuals (women) live, determining community norms, which may in part shape women's knowledge, attitudes and contraceptive use beyond individual traits and family composition. In this analysis we first calculated the community-level value for each variable and compared it with the national median value to categorize communities into high-level and low-level groups. In aggregating the individual values, we constructed a non-self-average by excluding the reference woman, since she cannot influence her own behavior and practice but could be influenced by others in her community. This procedure was applied for all the nine community-level factors except residence and geopolitical zone, which were directly collected in the survey. These community-level variables (from aggregation of individual characteristics) are :the community-level proportion of women with secondary education or more; the proportion of women in the communities who are involved in decision-making with respect to their own health care, household goods purchases and visitation to family; the proportion of women who were exposed to family planning messages in the media; the proportion of women who have access to health facilities in the community; the proportion of Muslims in the community; the proportion of women in the community who are in the middle or lower wealth quintiles; the proportion of women

in the community in polygynous marriages and the ratio of females-to-males working. We used the work of Yebyo and colleagues to guide the construction of the majority of these community-level variables (Yebyo, Gebreselassie, and Kahsay 2014).

Community-level education: This is the average educational attainment of women in the community. From the survey data, number of years of formal education was obtained for each woman. The median years of formal education was computed for all women sampled; this was taken as the national aggregate. From the 2013 NDHS, the median years of female education was 5.6 years. Clusters were classified as having lower or high levels of female education if their median level of female education was lower or higher than the national value, respectively.

Community-level poverty: The survey classified households into five categories of wealth index. The composite median wealth index was computed for each community (cluster), and also a national value was derived. The median national wealth index was 3.1. Communities were classified as having lower or high poverty in relation to the national median value.

Community-level prevalence of Muslims: This is a binary variable at the individual level but aggregated at the community level as follows: from national distributions of Muslims in clusters or communities, a benchmark ratio of 0.5 of cluster distribution of the Muslim population was taken as our cut-off point. Communities or clusters with less than 0.5 population of Muslims were classified ‘lower Muslim cluster’ while those with more than 0.5 were classified as ‘higher Muslim cluster’.

Community-level prevalence of polygyny: This is also a binary variable at the individual level, and clusters are classified as having either a lower proportion of polygynous marriages or a higher proportion, based on cluster distribution of the type of marriage. Communities or clusters with 4% or less were classified ‘lower polygyny cluster’ while those with more than 4% or more were classified as ‘higher polygyny cluster’.

Community-level of women’s autonomy: This is also a composite variable measuring women’s involvement in three dimensions of decision-making ability in their households: involvement in decision-making on her own health care, on large household purchases and on visitation to family and relatives. A woman is considered to have some level of autonomy if she alone or jointly with her partner makes decision on these three dimensions of autonomy; otherwise

she is considered to have no autonomy. A single index of autonomy was therefore generated using the proportion of women with high autonomy as the reference category compared with those with lower autonomy.

Community-level ratio of women-to-men employed: Adopting a similar approach as for community-level proportion of Muslims, a ratio of women-to-men employed at the community level was also derived. Communities with a ratio of less than 0.5 were classified as 'lower work ratio', while those with work ratio of more than 0.5 were classified as 'high work ratio'. However, this benchmark figure is arbitrary.

Community-level access to health facility: In the absence of service delivery points in the DHS survey data, and recognizing the limitations of linking service delivery data with demographic survey data (Wang et al. 2014), we used visit to a health facility within 12 months of the NDHS survey as a proxy for service availability. Use of a health facility by a woman in the 12 months preceding the NDHS survey was taken as a proxy for access to health services, including family planning. It is assumed that there is a health facility in the neighborhood/cluster that will warrant use. We also assumed that there are no barriers or only limited barriers to use of health facilities by the women and that women residing in a cluster or neighborhood will make use of the health facility. Thus, community-level access was constructed based on the use of health facility in the previous 12 months, classified as having access or no access.

Table 1. Definition of individual and community variables used in the analysis

Variables	Definition and Coding
Individual and household variables	
Age of respondent	Self-reported age of respondent at time survey coded as 1=15-19; 2=20-29; 3=30-39; 4= 40-49
Maternal educational attainment	Highest educational level attained (none=0; primary=1; secondary and more =2)
Husband's educational attainment	Highest educational level attained (none=0; primary=1; secondary and more =2)
Parity	Number of children given birth (None=0; 1-2=1;3-4=2;5+=3)
Marriage type	Monogamy =1, polygyny=2
Wealth index	Household wealth index (poorest =1; poorer =2; middle =3; richer=4 richest =5.
Media Exposure to FP messages	Media exposure were radio, television and newspaper. Exposed to none =0; exposed to at least one =1; exposed to at least 2 = 2; exposed to all 3=3
Desire for children	Partner wants same number of children as woman =1; partner wants more children than woman =2; partner wants fewer children than woman =3; don't know =4
Age difference between partner and woman	woman older or same age =0; man older<10years = 1; man older≥ 10 years = 2
Community-Level Variables	
Geopolitical zone	Geopolitical zone of residence (North Central=1, North East=2, NorthWest=3, South East=4, SouthSouth=5, SouthWest=6)
Place of residence	Current place of residence (rural=2, urban=1)
Community level of female autonomy	Coded as low=0, high=1
Community level of poverty	Coded as low=0, high=1
Community level of education	Coded as low=0, high=1
Community level of women in polygynous marriages	Code as low =0; high =1
Community level of access to health facilities	Coded as low=0, high=1
Community level of exposure to media messages on contraceptives	Coded as low=0, high=1
Community level of monogamous marriage	Coded as low=0, high=1
Community level of Muslims	Coded as low=0, high=1
Community level of ratio of female-to-men employment	Coded as low=0, high=1

Statistical Analysis

Data analyses were performed at univariate, bivariate and multivariate levels. At the univariate level, frequencies and percentages of background characteristics were generated. At the bivariate level, background characteristics were cross-tabulated with use/non-use of contraceptives and associations tested using Chi square tests. At the multivariate level of analysis, a two-level multivariate logistic regression was fitted to examine, first, the relationship between the individual attributes and contraceptive use and, secondly, the effects of community-level aggregate factors on contraceptive use. The structure of the 2013 NDHS data allows for the application of multilevel

logistic regression, since the respondents (women) are nested within households that are further nested within clusters (or communities). Therefore, to assess the effects of both women's individual characteristics and cluster (or community) characteristics on contraceptive use, a two-level mixed logistic regression model is most appropriate and was thus fitted.

Multilevel mixed effects logistic model has two parts: fixed and random. In a simplified model, the equation is of the form (Goldstein 2003).

$$\text{Log}\left[\frac{\pi_{ij}}{1-\pi_{ij}}\right] = \beta_0 + \beta_1 X_{1ij} + \ldots . \beta_n X_{nij} + u_{0j}$$

Where,

π_{ij} is the proportion of women who currently using modern contraceptive
$(1-\pi_{ij})$ is the proportion not using modern contraceptive
β_0 is the intercept coefficient
$\beta_1, \ldots \beta_n$ are the coefficients of individual and community-level factors
$X_{1ij} \ldots X_{nij}$ are independent variables of individuals and communities
u_{0j} are random errors at cluster levels

The effects of the fixed part of the model were measured by the odds ratio; while the contribution of the random part of the model (u_{0j}) was assessed using intra-cluster correlation coefficient (or ICC). The odds ratios were derived by running logistic regression controlling for confounders. ICC is defined as the ratio of the between-cluster variance to the total variance (both between and within clusters), and therefore has a value between 0 and 1. It measures the relatedness of elements within the clusters, and an ICC of '0' indicates that individuals within clusters are no more similar to each other than individuals from different clusters (there is no between-cluster variability), while an ICC of 1 indicates that individuals within the same cluster all have identical outcomes (there is no within-cluster variability or the individuals are homogenous (Killip, Mahfoud, and Pearce 2004). Mathematically, it is the ratio between cluster variability and total cluster variability (i.e., between-cluster and within-cluster variability). Thus, it is represented by rho (ρ):

$$\rho = \frac{s_b^2}{\left(s_b^2 + s_w^2\right)}.$$

Where S_b^2 is variance between clusters and S_w^2 is variance within clusters. This equation can also be represented as follows:

$$\rho = \frac{\sigma u^2}{\left(\sigma u^2 + \pi^2/3\right)}$$

Where σu^2 is the variance between clusters and $\pi^2/3$ is the variance within clusters. It is assumed that within-cluster variability (that is, variation among the women within the cluster) is constant, estimated at $\pi^2/3$ or 3.29. Proportional change in variance (PCV) is a measure of the contribution of cluster effect on women's contraceptive use—that is, how much influence the cluster characteristics have on women's contraceptive use. It is calculated using the 'empty' or 'null' model as a reference model. It is mathematically computed as:

$$PCV = \left(\frac{V_e - V_{mi}}{V_e}\right)$$

Where,

V_e is the variance in woman's use of contraceptives in empty model
V_{mi} is the variance in woman's use of contraceptives in model mi (or the subsequent model)

To assess the effects of cluster variability on current use of contraceptives, we used Stata multilevel analysis command merqlogit. Four models were fitted as follows:

Null model (Model 0): This is also called the empty model, since no factors were included in the model. It is aimed at testing the random effect of between-cluster variability.

Model I: This model has only the individual-level variables included, thus it measures only the effect of individual characteristics on contraceptive use

Model II: This model contains the community-level factors. It thus assessed the effects of community factors as they influence contraceptive use.

Model III: This model has both the individual-level variables and community-level factors concurrently to determine their combined fixed and random effects on the use of contraceptives. This model was built sequentially by adding one community-level variable at a time in order to

avoid potentiality of collinearity with other variables and to see if addition of community-level variables improves the model. (With these, community-level access to media messages on contraceptives was dropped in the final model because of collinearity.) Also, variance inflation factors were estimated to assess risk of multicollinearity between variables. All analyses were conducted using Stata version 13 (StataCorp).

RESULTS

Background Characteristics of Individuals and Clusters

Individual level

We analyzed data from the 2013 NDHS on a subset of 13,835 fecund women of reproductive age who do not desire children in the two years following the survey. Table 2 presents the background characteristics of the sample analyzed. Except for age 15-19, the population appeared evenly distributed across other groups, with 72% below age 40. A majority of women had formal education (57%), were in monogamous marriages (69%) and were Islam by religion (54%). The population is characterized by high parity, with 48% of the women having more than five children. A third of the husbands (36%) had no formal education, and 39% of the women were in the lowest two household wealth quintiles. All but 1.5% of the women had spouses who were older than themselves, with 46% having a spousal age difference of more than 10 years. About a third (36%) of the women and their husbands desired the same number of children, while 36% of the husbands wanted more children than their wives. Almost two-thirds of the women (63%) reported no exposure to family planning messages from television, radio or newspapers within a few months of the survey.

Table 2. Percent distribution of currently married women age 15-49 who were fecund but desiring no children in next two years by background characteristics, Nigeria 2013 DHS

Background characteristics	Percent	Number of women
Age		
15-19	4.7	657
20-29	32.8	4541
30-39	34.2	4730
40-49	28.2	3907
Education of woman		
No education	43.0	5954
Primary	21.7	3006
Secondary and higher	35.2	4875
Education of man*		
No education	35.5	4910
Primary	19.9	2756
Secondary and higher	44.6	6168
Wealth index		
Poorest	19.9	2758
Poor	19.3	2674
Middle	18.7	2586
Rich	20.5	2838
Richest	21.5	2979
Marriage type		
Monogamy	68.7	9504
Polygyny	31.3	4330
Religion		
Christianity	44.6	6176
Islam	53.8	7447
Traditional/others	1.5	211
Age difference		
Woman same age or older than man	1.5	338
Man older by < 10years	51.6	7143
Man older by ≥10years	45.9	6354
Parity		
None	1.3	172
1-2	22.1	3052
3-4	28.2	3908
5+	48.4	6702
Exposure to media messages on FP		
Not exposed	63.3	8759
Exposed to at least one media	17.0	2359
Exposed to at least two media	14.3	1975
Exposed to all	5.4	743
Desire for children		
Both desire same number	36.2	5014
Husband desires more	35.6	4923
Husband desires fewer	4.4	612
Don't know	22.3	3081
Missing	1.5	206
Total	**100.0**	**13835**

*Missing and don't know values merged

The cluster was the unit of analysis at this level and there were a total of 904 clusters sampled for the 2013 NDHS. Table 3 gives a distribution of the community-level characteristics. About two-thirds of the clusters were rural. There was an almost even distribution of proportions of clusters with higher and lower levels of education, wealth, level of female autonomy, access to health services and female-male work ratio. Slightly more than half of the clusters (53%) had a higher than national average proportion of Muslims and the same proportion had access to health facilities (53%). However, marked disparity was found in the proportional distribution of clusters with higher levels of polygamy (88%).

Table 3. Percent distribution of clusters by community-level characteristics, Nigeria 2013 DHS

Community-level variables	Percentage
Place of Residence	
Urban	37.5
Rural	62.5
Region	
North Central	17.6
North East	18.0
North West	23.7
South East	8.9
South	14.4
South West	17.5
Education	
Lower	52.6
Higher	47.4
Wealth index	
Lower	50.0
Higher	50.0
Religion (% of Muslims)	
Lower	46.9
Higher	53.1
Access to health facilities	
No access	47.0
Have access	53.0
Type of marriage (% Polygamy)	
Lower polygamy	12.0
Higher polygamy	88.0
Level of female autonomy	
Low	52.2
High	47.8
Work ratio (Female-to-Male)	
Low	49.9
High	50.1

Modern Contraceptive Use by Individual and Community Factors

Overall, 26% of the women were using any method of contraception, with 17% using a modern method and 9% using traditional means (Figure 3).

Figure 3. Contraceptive prevalence rate by method type, Nigeria 2013 DHS

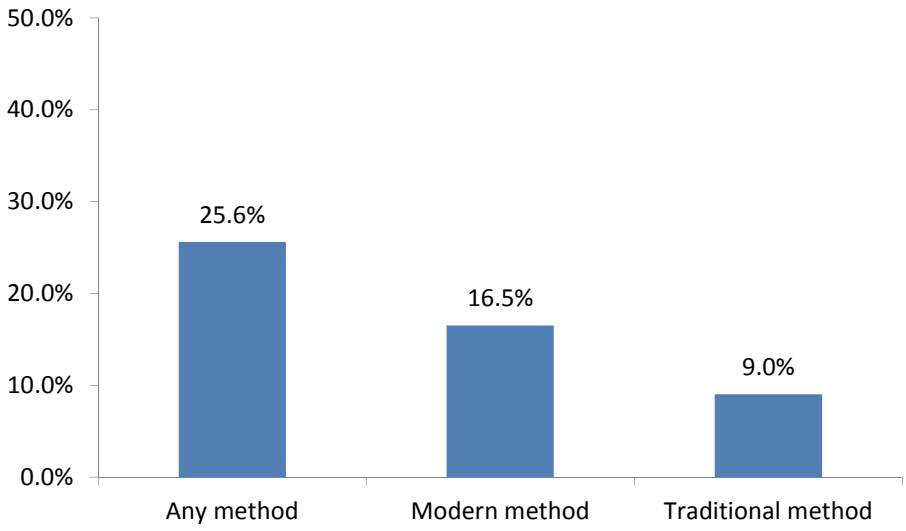
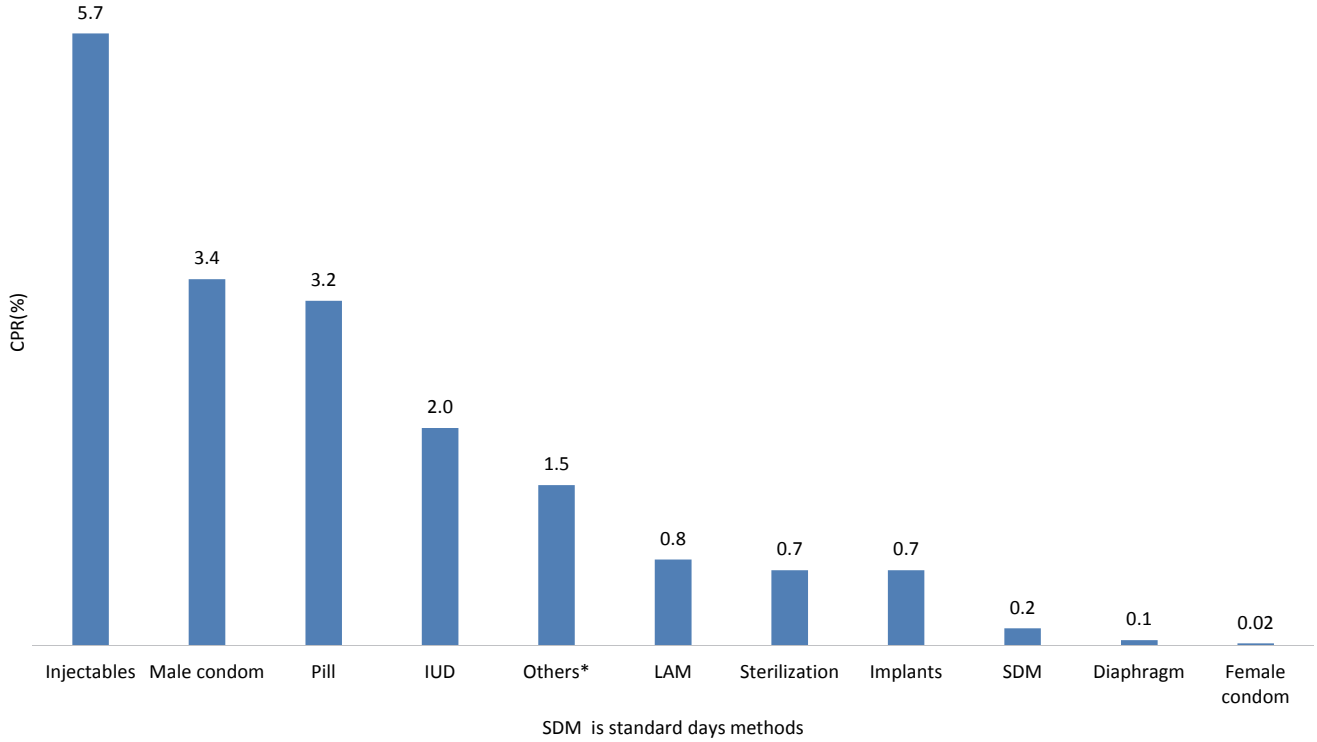


Figure 4 depicts the method mix of modern contraceptives; injectable contraceptives appear to be the most popular, used by 6% of the women, followed by condoms and oral pills, at 3% each. Use of permanent methods, notably sterilization, was negligible.

Figure 4. Percentage of women who used different types of contraceptive method, Nigeria 2013 DHS



At the individual level, socio-demographic differentials in use of modern contraceptives were evident, and the degree of association for these background characteristics was tested using X^2 tests. All of the socio-demographic characteristics tested were found to be statistically significantly associated with use of modern contraceptives, at p <0.000 (Table 4).

As Table 4 shows, use of modern contraceptives increases with women's age, from 4% at age 15-9 to 17% at age 40-49. Being Christian, being in a monogamous relationship and having two to four children were all significantly associated with higher rates of use of modern contraceptives (p <0000). Education of the woman and her spouse were all found to be significantly associated with use of modern contraceptives (p <0.000). The prevalence of contraceptive use increased with increase in the level of education of women and their husbands. Women and men with secondary school and above level of education were eight and six times, respectively, more likely to use contraceptives compared with women and men with no formal education. The wealth index was also found to be significantly associated with use of modern contraceptives; as wealth quintile increased, use of modern contraceptives increased (p <0.000) Women in the highest wealth quintile were 17 times more likely to use modern contraceptives

compared with women in the lowest wealth quintile, from 2% for women in the lowest quintile to 35% for women in the highest quintile.

There was an inverse association between spousal age differences and the level of contraceptive use: the wider the age gap between the woman and her partner, the lower the rates of modern contraceptive use. Women who were older than or the same age as their spouses had significantly higher rates of modern contraceptive use, with the lowest level of use among women whose husbands were older by more than 10 years. ($p < 0.000$). Also, the level of convergence of desire for children between spouses was significantly associated with use of modern contraceptives ($p < 0.000$). Where the husband wanted fewer children than the wife, or wanted the same number of children, the level of modern contraceptive use was higher than when the husband wanted more children than the wife.

The level of exposure to media messages on family planning was significantly associated with use of modern contraceptives ($p < 0.000$). Use of modern contraceptives increases from 10% for women not exposed to any media messages on family planning to 34% for women exposed to messages from at least two media sources and 38% for women exposed to messages from all three types of media sources.

Table 4. Percent distribution of currently married, fecund women age 15-49 not desiring children by contraceptive method currently using, according to individual characteristics, Nigeria 2013 DHS

	Type of contraceptives used		Chi-squared test	
Individual characteristics	**None/traditional/ folkloric method**	**Modern method**	**X^2 value**	**p value**
Age			177.6	0.000***
15-19	96.1	3.9		
20-29	86.4	13.6		
30-39	78.7	21.3		
40-49	83.1	16.9		
Education, woman			1300.0	0.000***
No Formal Education	96.4	3.6		
Primary Education	79.8	20.2		
Secondary and Above	70.5	29.5		
Education, Man			967.0	0.000***
No Formal Education	96.4	3.7		
Primary Education	82.2	17.8		
Secondary and Above	74.1	26.0		
Missing/DK	89.8	10.2		
Wealth			1300.0	0.000***
Poorest	97.9	2.1		
Poorer	93.1	6.9		
Middle	84.3	15.7		
Richer	77.4	22.6		
Richest	65.2	34.8		
Type of Marriage			172.8	0.000***
Monogamous	80.4	19.6		
Polygynous	89.3	10.7		
Religion				
Christianity	72.3	25.7	756.5	0.000***
Islam	91.5	8.5		
Traditional/others	93.5	6.5		
Age Difference			145.9	0.000***
Woman same age/older than man	74.3	25.7		
Same age	77.3	22.7		
Man older <10yrs	80.0	20.1		
Man older 10yrs+	87.3	12.7		
Parity			64.1	0.000***
None	85.5	14.5		
1-2	84.9	15.1		
3-4	79.2	20.9		
5+	84.7	15.3		
Exposure to messages on FP			1000.0	0.000***
Not exposed	90.2	9.8		
Exposed to at least one	79.1	20.9		
Exposed at least to two	66.1	33.9		
Exposed to all	61.4	38.6		
Desire for children			890.4	0.000***
Both want same	77.4	22.6		
Husband wants more	90.1	9.9		
Husband wants fewer	72.5	27.5		
Don't know	87.7	12.3		
Missing	24.4	75.6		

There was a wide variability in contraceptive use by contextual variables (Table 5). All these differences were statistically significant at p <0.000. In urban clusters the level of modern contraceptive use, at 26%, was more than twice as high as in rural clusters, at 11%. In clusters located in the southern zones of the country use of modern contraceptives was more common than in clusters in the northern zones, from 6% in the North East and North West zones to 33% in the South West zone. Women living in communities with comparatively higher levels of female education were five times more likely to use modern contraceptives compared with women in communities with lower proportions of educated women (28% versus 6%). Also, rates of modern contraceptive use were higher in communities with lower levels of poverty, lower proportions of Moslem populations, lower levels of polygyny and greater access to health facilities.

Table 5. Percent distribution of currently married, fecund women age 15-49 not desiring children by contraceptive method currently using, according to community characteristics, Nigeria 2013 DHS

	Types of Contraceptives Used		*X2 Test*	
Community characteristic	**None/traditional/ folkloric method**	**Modern method**	***X2***	**p value**
Place of residence			531.4	0.000***
Urban	73.9	26.1		
Rural	88.9	11.1		
Contextual region			1100.0	0.000***
North Central	77.9	22.1		
North East	93.7	6.3		
North West	94.4	5.6		
South East	83.8	16.3		
South	77.7	22.3		
South West	67.0	33.0		
Community Education			1300.0	0.000***
Low	94.4	5.6		
High	72.1	27.9		
Community poverty			948.3	0.000***
Low	92.9	7.1		
High	73.6	26.5		
Community religion			900.7	0.000***
Low Muslims	73.8	26.2		
High Muslims	92.7	7.3		
Community female-male work ratio			354.3	0.000***
Low women-to-men ratio	89.2	10.8		
High women-to-men work ratio	77.3	22.7		
Community access to facility			425.6	0.000***
Have no access to facility	89.7	10.3		
Have access to facility	76.7	23.3		
Community female autonomy index			967.4	0.000***
Low female autonomy	93.0	7.0		
High female autonomy	73.4	26.6		
Level of polygyny			232.9	0.000***
Lower	70.2	29.8		
Higher	85.0	15.0		

Multilevel Analysis of Predictors of Women's Current Use of Modern Contraceptive

Table 6 shows results of the multilevel analyses. We examined how variability in modern contraceptive use could be attributed to different sets of variables, with a focus on determining the contribution of community-level variables in accounting for the differences. The strength of association between the explanatory variables and contraceptive use was measured using the odds ratio. Odds ratios greater than one show a positive association, while there is a negative association when the odds ratio is less than one. The intra-cluster correlation coefficient (rho) was used to determine the proportion of differences in contraceptive use that could be due to intra-cluster variation. The impact of community-level factors was also assessed using the proportional change in variance (PCV). Four models were generated to assess the impact of individual and community variables on use of modern contraceptives.

Model 0, the empty or null model, has no individual and contextual level variables added. It examines the random variable and intercept. The result shows a variance partition coefficient or intra-cluster correlation coefficient (ICC) of 38.5% (95%CI: 0.28-0.50) implying that as much as 38.5% of the variations observed in the use of modern contraceptive could be explained by community-level variables.

Table 6. Multilevel regression results assessing effects of individual and community characteristics on contraceptive use among women in Nigeria, 2013 DHS

	Null Model	Model I		Model II		Model III	
		Individual characteristics		Community-level variables		Individual and community-level variables	
Characteristics	**Empty model**	**Odds Ratio**	**95% CI**	**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
Fixed effects							
Age (ref.=30-39)							
15 - 19		0.44	0.28-0.70***			0.54	0.34-0.86**
20 - 29		0.75	0.64-0.87***			0.80	0.69-0.93**
40 - 49		0.70	0.62-0.80***			0.68	0.60-0.78***
Educational attainment (ref.=no formal)							
Primary		2.84	2.32-3.49***			2.24	1.82-2.75***
Secondary and above		3.21	2.59-3.98***			2.53	2.04-3.14***
Education, husband (ref.=no formal)							
Primary		1.47	1.17-1.84***			1.25	1.00-1.57¶
Secondary and above		1.49	1.19-1.86***			1.26	1.01-1.58*
Type of Marriage (ref.=monogamy)							
Polygynous		0.99	0.87-1.15			1,01	0.87-1.15
Parity (3-4)							
None		1.41	0.81-2.45			1.47	0.84-2.57
1 - 2		0.78	0.66-0.91**			0.77	0.65-0.90**
>5		1.22	1.07-1.40**			1.32	1.15-1.51**
Household wealth (ref.=middle quintile)							
Poorest		0.29	0.21-0.41***			0.48	0.34-0.71***
Poorer		0.60	0.49-0.74***			0.70	0.56-0.87**
Richer		1.24	1.06-1.46**			1.15	0.98-1.36
Richest		1.67	1.40-2.00***			1.44	1.19-1.75***
Media exposure (ref.=exposure to none)							
Exposure to at least one		1.44	1.23-1.67***			1.39	1.20-1.61***
Exposure to two		1.75	1.52-2.03***			1.63	1.41-1.89***
Exposure to 3		1.89	1.55-2.30***			1.82	1.50-2.22***
Age difference (ref.=woman older or same age)							
Partner older by < 10 years		1.00	0.74 - 1.37			0.99	0.73 - 1.35
Partner older by more than 10 years		0.87	0.64 - 1.19			0.90	0.66 - 1.23
Desire for children (ref.=both wants same number)							
Husband wants more		0.72	0.63-0.83***			0.76	0.66-0.88***
Husband wants fewer		1.07	0.88-1.33			1.07	0.86-1.32
Don't know		0.72	0.62-0.83***			0.68	0.59-0.78***
Community level variables							
Geopolitical zone (ref.=South West)							
North Central				1.15	0.92-1.44	0.62	0.47-0.84**
North East				0.63	0.46-0.88**	0.65	0.49-0.87**
North West				0.52	0.37-0.72***	0.33	0.25-0.44***
South East				0.40	0.30-0.52***	0.60	0.47-0.76***
South				0.75	0.59-0.94**	1.03	0.82-1.28
Place of residence (ref.=urban)							
Rural				0.71	0.59-0.84***	0.96	0.81-1.14
Community-level female autonomy (ref.=low)							
High				1.60	1.33-1.92***	1.67	1.40-1.99***
Community-level female education (ref.=low level)							
High				1.79	1.43-2.23***	2.70	1.79-4.07***

(Continued)

Table 6. − *Continued*

	Null Model	Model I		Model II		Model III	
		Individual characteristics		Community-level variables		Individual & Community-level variables	
Characteristics	**Empty model**	**Odds Ratio**	**95% CI**	**Odds ratio**	**95% CI**	**Odds ratio**	**95% CI**
Community-level poverty (ref.=high poverty)							
Low poverty				1.67	1.35-2.07***	0.99	0.76-1.29
Community-level religion (ref.=low proportion Muslim)							
High				0.50	0.41-0.61***	0.72	0.58-0.87**
Community-level access to facility (ref.=no access)							
High access				1.39	1.20-1.61***	1.28	1.09-1.49**
Community-level female women-men employment ratio (ref.=low)							
High				1.02	0.86-1.21	0.92	0.78-1.08
Community-level proportion of polygyny (ref.=low)							
High				0.72	0.59-0.88**	0.78	0.64-0.95*
Random effects							
ICC (%)	38.5	13.9		12.8		9.6	
PCV (%)	Reference	74.2		77.0		82.9	

p <0.05 *, P <0.01**, p<0.001***

Model I includes individual-level variables only. This model accounted for 74.2 % of the variation in contraceptive use. Statistically significant positive predictors of current use of modern contraceptives were age of the woman, educational levels of the woman and her partner, household wealth level and media exposure to family planning messages. Compared with women age 30–39, the odds of using modern contraceptives were significantly lower in both the younger and older age groups. Education significantly increased the odds of contraceptive use. The likelihood of using modern contraceptives progressively increased with a woman's level of education, with women having secondary-level education or above more than three times more likely to use modern contraceptives compared with women with no education (OR = 3.2, 95% CI: 2.59-3.98). Non-use of modern contraceptives was significantly associated with poverty. Compared with women in the middle wealth quintile, women in the lowest wealth and lower wealth quintile were 81% and 40% less likely to use contraceptives, respectively, while women in the higher and highest wealth quintile were 1.2 times and 1.7 times more likely to use modern contraceptives; these associations were significant. Compared with women with three or four children, having no children was not significantly associated with increased use of contraceptives, while having more than five children significantly increased the odds of modern contraceptive use, and having one or two children significantly reduced the odds of modern contraceptive use. Exposure to media

messages on family planning was significantly associated with increased use of modern contraception.

Being in a polygynous union reduced the odds of modern contraceptive use, as did having a husband who wanted more children. Also, the odds of using modern contraception increased for women whose partners were the same age or less than 10 years older than them. These differences were not significant, however.

Model II examined the contextual factors of interest, excluding individual factors. Looking at zonal variation in contraceptive use, women the North Central zone were 1.2 times more likely to use modern contraceptives compared with the women in the South West zone, but the difference was not significant. However, comparatively, the odds of women using modern contraceptives were reduced by 51% in the South East, 60% in the North West, 37% in North East and 25% in South zones; these reduced odds were all significant. Low community levels of poverty, exposure to media messages on contraception, high community-level access to health facilities and high community levels of female autonomy also significantly increased the odds of use of modern contraceptives. The odds of contraceptive use were significantly reduced in communities with high levels of Moslem populations, poverty, polygyny and residence in rural areas.

In the final model, Model III, when individual-level variables were added to the community-level variables, certain community-level variables lost their significance: rural residence and community poverty level. At the regional level, while the odds of contraceptive use were not significant for the North Central Zone when community level variables only were considered, in the final model they became significant, while the South Zone they became non-significant. Compared with the South West Zone, all the zones of the country had significantly reduced odds of modern contraceptive use, except the South Zone, with odds of 1.03 (CI 0.82 - 1.28), which was non-significant. High community levels of the female-to-male employment ratio now had non-significant reduced odds of modern contraceptive use (OR 0.92; CI 0.78 – 1.08). Religion remained an important significant predictor of use of modern contraceptives, with communities with higher proportion of Muslims having reduced odds (OR 72, CI 0.58 – 0.87). Other significant positive predictors of modern contraceptive use at the community level that remained in the final model were community level of female education (OR 2.27, CI 1.79 - 4.07), female autonomy (OR 1.67, CI 1.40 -1.99) and access to health facilities (OR 1.28, CI 1.09 - 1.49).

The direction in the associations between individual-level variables and contraceptive use remained the same, albeit with some variations in the strength of the association and levels of significance.

Examining the ICC, there was a progressive decrease from 38.5% in the empty model to 13.9% in Model I (individual-level variables only), to 12.8% in Model II (cluster-level factors) and to 9.6% in Model III (combined individual and cluster-level factors).The variance partition coefficient (VPC), which shows the contribution each of individual and community-level variables as they determine contraceptive use, progressively increased from 76.4% in Model I to 77.0% in Model II and 82.9% in Model III. This indicates that 82.9% of all the variations related to use of modern contraceptives in Nigeria are attributable to both individual characteristics and community factors. However, 17.1% of the factors responsible for the variation in contraceptive use could not be accounted for by individual and community factors.

DISCUSSION AND CONCLUSIONS

The study investigated contextual determinants of modern contraceptive use among married, fecund women in Nigeria who do not desire to have a child in the next two years. This group is the key target of family planning programs. Our hypotheses were that there is an association between community-level factors and use of modern contraceptives and that wide differences exist across communities in the country. In summary, the contextual factors found to be positively associated with use of modern contraceptives were female education, female autonomy and access to health facilities.

Our study found lower odds of use of modern contraceptives in the northern zones of country, which is similar to findings from other studies (Adebayo et al. 2012; Hailu 2015; Omotola 2013; Oye-Adeniran et al. 2006). These findings persisted after individual-level factors were controlled, tending to suggest the role of contextual community factors in shaping contraceptive behavior in these regions. The northern regions are populated predominantly by Muslims, who have a more conservative culture. The religion may be acting in synergy with other areal factors to negatively influence uptake of contraceptives. This study confirmed previous findings of the negative association between predominantly Muslim communities and modern contraceptive use.

The study showed, for the first time, that the South East and South zones have lower odds of modern contraceptive use, though the odds were not statistically significant. Perhaps the greater preference for traditional/folkloric methods of contraception (National Population Commission and ICF 2014), which are of lower efficacy than modern methods, may be responsible for the lower odds of modern contraceptive use in these two southern states. These have important policy implications, as interventions aimed at scaling up family planning use in the country will have to be holistic in their approach, going beyond descriptive zonal variables.

This study found that, when individual-variables were controlled, rural residence and level of community poverty were no longer significantly associated with lower odds of contraceptive use. This is contrary to previous studies (Ibisomi 2014; Stephenson et al. 2007). It would appear that other mediating factors have mitigated the effects of place of residence; several studies have shown that urban residence is associated with increased use of modern contraceptives because of improved infrastructure and greater access to health services. It is unlikely that the modification of this association in this study is because of the recent increase in investments in family planning and free provision of the commodities. Surprisingly, community level of poverty was not significantly associated with use of modern contraceptives.

We also found that female education was positively associated with use of modern contraceptives. Improvements in women's educational attainment increase the likelihood of use of modern contraceptives. This may be associated with the role of female education in empowering women through enhancing their autonomy and participation in decision-making, positively modifying health-seeking behavior and building social capital through expansion of social networks. The positive association found between female education and contraceptive use is consistent with several studies conducted in developing countries (Ainsworth, Beegle, and Nyamete 1996; Arokiasamy, and Cassen 2003; Hailu 2015; McNay, Kaggwa, Diop, and Storey 2008). Education also increases women's employment opportunities, which can result in increased economic independence and expanded autonomy in decision-making. This is expected to be associated with increased use of modern contraceptives. This association was not established by this study, however. To the contrary, we found that female employment reduced the odds of modern contraceptive use, though the association was not statistically significant. The reason for this is not clear and requires further investigation. Studies have suggested that in Africa paid female employment outside the home may be related to poverty, with the women employed in menial

jobs, and this would likely have a negative effect on use of maternal health services, including contraception.

Female empowerment expands women's choices and ability to make decisions, including reproductive health decisions, and it also leads to improved health-seeking behavior. It is believed that empowerment of women will lead to increased use of modern contraceptives. We examined three dimensions of female empowerment in relation to decision-making regarding mobility, financial decisions and decisions on use of contraceptives. Similar to other studies, we found that women who participate in decision-making along these dimensions were significantly more likely to use contraceptives.

At the individual level, high parity, female education, husband's education and household wealth were associated with increased likelihood of using modern contraceptives. This is consistent with previous studies (Gage 1995; Hogan, Betemariam, and Assefa 1999; White and Speizer 2007). Also, women in monogamous unions and women who were Christian had significantly higher odds of modern contraceptive use than women in polygynous unions and women who were Muslims. Younger and older ages were negatively associated with modern contraceptive use, while spousal age difference and polygyny had no significant association with use of modern contraceptives. This study confirms Ibisomi's findings from Nigeria that did not demonstrate any association between spousal age difference and use of contraceptives (Ibisomi 2014). However, this finding is in contrast to many other studies that established such an association (Darroch, Landry, and Oslak 1999; Longfield et al. 2004). After controlling for all other individual and community-level factors, we found that 83% of all variations related to use of modern contraceptives in Nigeria were attributable to both individual characteristics and community factors.

Policy implications

Because female education is positively associated with modern contraceptive use, it is evident that investment in female education should command the attention of health and development policy-makers in Nigeria. To this end, greater investment in the education of girls should be pursued beyond 2015, as it has multiplier effects in increasing uptake of modern contraceptives. In the spirit of inter-sectoral collaboration, the health sector should continually

engage with the education sector to advocate for girl-child education, for the reproductive health and empowerment benefits it offers for women.

The largest religion in Nigeria is Islam. Given the negative association between Muslim faith and contraceptive use, there is a need to develop innovative and appropriate strategies to increase family planning demand among this population. Recognizing that Islam is not averse to contraceptives, but religious opposition has always been cited as the reasons for non-use of contraceptives, there is a need to involve the Islamic religious leaders in developing and implementing the communication plan.

Additional research is needed to determine how best to meet women's information needs efficiently on a sustainable basis and how to provide a continuous flow of information that is lively, interesting and culturally appropriate.

In Nigeria there are wide zonal variations in contraceptive use. The study findings showed that the South East and South South Zones have significantly lower odds of use of modern contraceptives. This part of the country has the largest population of Catholics, who are averse to the use of modern contraceptives andwho promote natural family planning methods only. This may be one of the reasons for this finding, as the use of traditional/folkloric methods is comparatively higher than in other zones. There is a need for further investigation of this finding, as we did not investigate the influence of Catholic religion on contraceptive use. This couldform the basis of context-specific interventions.

Strengths and limitations

One of the important strengths of this research is that the data were collected based on a nationally representative sample of women. Therefore, a national average of contraceptive prevalence could be estimated. Further, because of its large sample size it was possible to estimate contraceptive prevalence rate at the sub-national zonal level. The hierarchical nature of the data allowed us to explore factors operating beyond the individual level to look at such variables at the community level. Employing this type of analysis has brought to the fore some factors which hitherto have not been explored to explain the persistent low levels of modern contraceptive use in Nigeria. Use of this analytic method has a policy implication of making programming examine

contextual factors affecting contraceptive use, rather than placing disproportionate emphasis on the individual.

There are limitations to this study. Some women were excluded from the couple data set because their husbands were over age 49, and thus not surveyed. A survey that does not restrict data collection based on age of male partners might provide more information on modern contraceptive use. The fact that the data were collected using a cross-sectional survey constrained us from making causal inferences between the exposure variables (individual and community variables) and the outcome variable, current use of modern contraceptive. We were only able to estimate the strength of the association between the exposure variables and the outcome variable; identifying a definitive causal relationship is not possible with this type of study design. In particular, rather than predicting contraceptive use, discussion between spouses about family planning may actually have taken place after contraceptive acceptance.

In addition, access to a health facility and exposure to media messages on family planning could not be adequately accounted for as far as the extent of access or exposure is concerned. Related to measurement error is the association between Islam and contraceptive use. This study did not explore respondents' knowledge and perception of contraceptives based on their religious point of view. Finally, there is the issue of endogeneity, as the value of some independent variables might be determined or influenced by other covariates. For instance, exposure to family planning messages might be correlated with development of the community, which itself might be associated with contraceptive use.

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