Trends in Reproductive Behavior in Nigeria, 2003–2013

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Trends in Reproductive Behavior in Nigeria, 2003–2013

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Abstract

This study is based on three Demographic and Health Surveys conducted in Nigeria, in 2003, 2008, and 2013. The study was undertaken against the background of a persistently high rate of population growth in Nigeria, caused primarily by a high fertility rate that has shown few signs of decline. The United Nations medium population projection for Nigeria shows an increase from 282 million in 2015 to about 400 million by 2050, even with an assumed substantial decline in fertility. The present analysis explores the components and some of the covariates of fertility in Nigeria, recent trends, and potential future changes. One objective is to assess the extent to which various components of reproduction and their changes in Nigeria since 2003 can be explained at the macro level of the country's 37 states as well as at the individual level. Trends in age at marriage, reproductive preferences, contraceptive use, teenage fertility, child mortality, and total fertility are described. The covariates of these reproductive components highlight the importance of women's education, child mortality, monogamy, religion, and exposure to television and radio. Residence in the South of Nigeria is consistently associated with lower fertility. The most important determinants of fertility decline in Nigeria are increases in women's education and decreases in child mortality. However, while declines in child mortality in recent years have been considerable, they have not yet translated into substantial declines in fertility, and increases in women's education have been very slow.

Executive Summary

This report focuses initially on the demographic characteristics of the 37 states of Nigeria, based on three national Demographic and Health Surveys (DHS) conducted in 2003, 2008, and 2013. The analysis then shifts to DHS sampling clusters, which are relatively homogeneous census enumeration areas, and to DHS data for individuals, partly in order to evaluate consistency with the findings from the aggregate analyses and to develop a series of fertility simulations. The primary interest of the study is on reproductive behavior, including total fertility, teenage fertility, reproductive preferences, nuptiality, child mortality, and family planning, and association with socioeconomic characteristics. The statistical analysis emphasizes both cross-sectional associations in 2013 and the correlation of changes since 2008 and 2003. It differs from the more familiar analyses of samples of individual women in that it examines the predictability of fertility and related measures based mainly on data aggregated for states.

There are wide variations across states in demographic and socioeconomic measures. A principal finding is the repeated importance of women's education, which, frequently alone, explains large proportions of variation in age at marriage, ideal number of children, demand for family planning, child mortality, teenage fertility, and total fertility. In the analysis of the covariates of change over time, increases in age at marriage are related to declines in teenage childbearing, a decline in polygyny, and increased electrification, which is a component of economic development. Declines in polygyny are associated with declines in child mortality, smaller proportions of Muslims, and increases in schooling. Declines in the ideal number of children relate to increases in literacy, declines in teenage childbearing, and greater participation of women in household decision-making. Increases in the proportion of women who want no more children are related to increases in television exposure, the use of contraception to limit fertility, and the intention to use contraception. Contraceptive use increases with urbanization, radio exposure, and higher proportions married. Declines in teenage fertility are connected with increases in the age at marriage, lower proportions married, and a reduction in the ideal number of children. Declines in total fertility are related to declines in child mortality and increases in education. Similar findings emerge from the analysis of the state characteristics of men in the 2008 and 2013 surveys. In general, the analysis of individuals and clusters is consistent with the analysis of states. An analysis of Nigerian fertility based on both individual women and men in the 2003 and 2008 DHS surveys likewise found that education is a strong predictor of fertility outcomes (Mberu and Reed 2014).

Simulations of the number of children ever born indicate the potential future impact of further reductions in child mortality, increases in age at marriage, and increases in the education of women. Continuing increases in the education of women along with reductions in both child mortality and polygyny are likely to contribute most to the future decline of fertility in Nigeria.

1. Introduction

1.1. Population Growth in Nigeria

The total population of Nigeria in 2015 was 182 million, about half of the population of Western Africa and by far the largest of all countries in Africa. The Nigerian birthrate in 2015 was 39 births per 1,000 population. With a death rate of 14 per 1,000 population, the rate of natural increase is the difference of 25 per 1,000, or 2.5% per year. If continued unchanged, this rate of growth implies a doubling of the population in 28 years, to 364 million by the year 2043. The 2015 UN projections assume in their medium variant a declining fertility rate, from a total fertility rate (TFR) of 5.7 in 2010-15 to 3.6 by 2045-50, with a population then of just under 400 million, a substantial increase from 2015. Even with the assumption of a TFR that declines to 2.3 by 2095-2100, the Nigerian population at the end of the century is projected at 752 million (Figure A). The potential growth of the population is due in part to the momentum created by Nigeria's youthful age structure, with nearly two-thirds (64%) of the current population below age 25 (Corteza et al. 2016).

The problems associated with this rapid rate of population growth were recognized by the Nigerian government in 2004 as "having an adverse impact on living conditions, health, nutrition and wellbeing especially of mothers and children." It was noted that "such population growth will put pressure on the health, education, housing and public services – water supply, roads etc. resulting in declining quality. Per capita food production will decline resulting in food shortages, unemployment and insecurity will increase as well as the level of urbanization with resultant increases in urban slums, poverty and crime. For living standards to rise, the rate of economic growth and social development must exceed the rate of population growth" (Federal Government of Nigeria, 2004).

One of the targets mentioned in 2004 was to reduce the annual rate of population growth to 2% by 2015, a goal that has not been reached. This is the only policy that explicitly addresses concerns relating to population growth. Governmental concerns about increasing contraceptive prevalence, obviously relevant to such growth, have been expressed in more recent times mostly in a reproductive health context. In 2012, at the London Summit on Family Planning the Gates Foundation made a substantial financial commitment to make contraception freely available in the poorest countries, including Nigeria. It remains to be seen whether the expectation of making family planning significantly more available will be realized. A recent essay by Elisha Renne (in Solinger and Nakachi 2016) is pessimistic that such goals in Nigeria could be implemented without substantial reductions in poverty. Her analysis rests on the premise that a prerequisite for increases in contraceptive prevalence is a change in reproductive norms from a preference for large families to a preference for small families, which in turn suggests the need for declines in poverty and increases in education.

Figure A. Projected population growth (in millions) in Nigeria 2015–2100

Millions
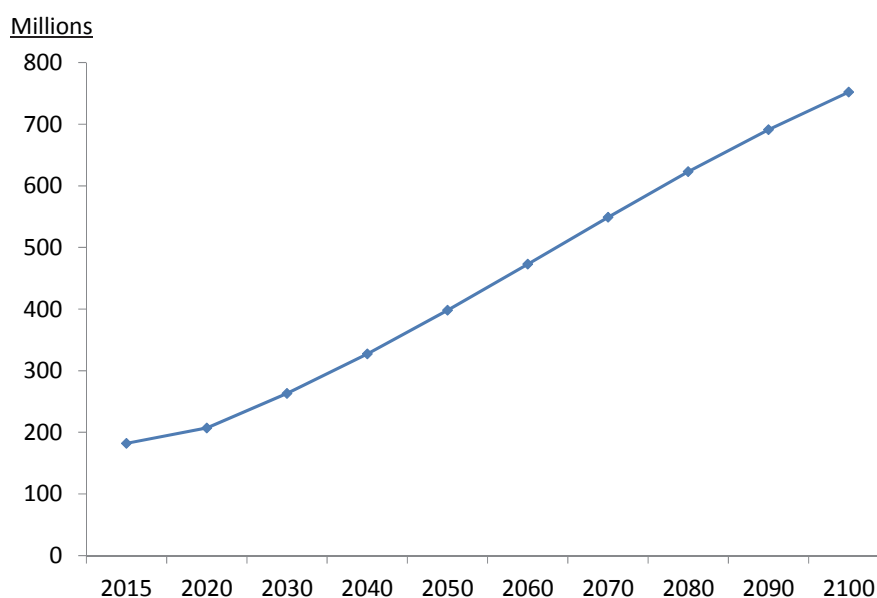
Source: United Nations, Department of Economic and Social Affairs, Population Division (2015), World Population Prospects: The 2015 Revision Based on the Medium Fertility Variant

1.2. Plan of Analysis

This analysis is based on data from three national Demographic and Health Surveys (DHS) conducted in 2003, 2008, and 2013. One objective of the study is to assess the extent to which various components of fertility and their changes in Nigeria since 2003 can be explained at the macro level, with characteristics of the country's 37 states and 896 DHS sampling clusters, as well as at the individual level. For this analysis the Federal Capital Territory is treated as a state. Initially, these 37 states are the principal units of analysis, weighted equally. The ultimate interest is in fertility, measured here mainly by the total fertility rate (TFR) based on the three years preceding the DHS and also, in our analyses at the individual and cluster levels, measured by the number of children ever born. The 2003 DHS survey included 7,620 women and 2,346 men. In the 2008 sample there were 33,385 women and 15,486 men. And in the 2013 survey a total of 38,948 women and 17,359 men were interviewed.

The analysis focuses initially at the state level on the primary components of the TFR, including nuptiality, reproductive preferences, family planning, teenage fertility, and child mortality. The general strategy is first to evaluate at the state level the current cross-sectional association of these components with each other, with several socioeconomic characteristics, and with the TFR. The second objective is to focus on the association between changes in fertility and changes between the surveys in such characteristics as education, media exposure, urban-rural residence, and the proportions of Muslims in the state populations.

In the regression analyses that include more than one independent variable, the standardized partial regression coefficients (beta weights) are shown in parentheses (as "b") in order to evaluate their comparative statistical importance in the regression equations. All coefficients with numerical values specified are statistically significant at the .05 level or better (with standard errors adjusted for the survey design).

2.   Components of Fertility

2.1.   Marriage

Marriage, either cohabitation or formal unions, is an important determinant of fertility, as it determines exposure to the risk of pregnancy through regular sexual activity. In 2013, across all 37 states of Nigeria, the proportion of women currently married ranged from 47% in Akwa Ibom to 93% in Jigwa, with an average of 69% (Table 1). Two factors—the amount of schooling (b= -.49) and the proportion Muslim (b= .49)—are equally strong and together account for 88% of the variation in the proportions of women currently married. Map 1 shows the proportions of women age 15-49 with no formal schooling, by state of residence, which in 2013 ranged from 1% to 89%, with an average of 32%. Women in the northern states are the least educated, with more than half having no schooling. At the opposite extreme, less than 10% of women in the South have no schooling. The proportions of women identifying as Muslim are shown by state in Map 2, which resembles Map 1 in its pattern. The highest proportions of Muslims—90% and higher—are in the North, and the lowest proportions—less than 10%—are in the South.

Table 1. Summary of demographic and social characteristics of the 37 states based on data for women, Nigeria 2013, 2008, 2003

	Range in 2013	Mean		
		2013	2008	2003
Percent currently married	47 – 93	69	70	68
Percent polygynous	5 – 53	29	32	34
Mean age at marriage	14.5 – 22.4	18.5	18.2	17.5
Percent teenage childbearing	1 – 53	20	24	23
Total fertility rate	3.8 – 8.4	5.4	5.7	5.6
Mean number of living children	1.8 – 3.3	2.5	2.5	2.5
Number of children ever born	2.0 – 4.4	3.0	3.1	3.0
Percent with child death	9 – 55	24	28	31
Mean ideal number of children	4.1 – 9.1	6.2	6.2	6.7
Percent non-numeric response	0 – 36	7	12	13
Percent want next child later	21 – 53	33	32	27
Percent want no more children	4 – 44	23	21	16
Percent using contraception	1 – 48	19	15	14
Percent using to space births	1 – 26	10	9	10
Percent using to limit births	0 – 22	9	6	4
Percent intend to use	3 – 43	23	20	26
Percent unmet need	6 – 31	18	20	17
Percent unmet need for spacing	4 – 24	12	14	12
Percent unmet need for limiting	1 – 13	5	6	5
Demand for family planning	9 – 54	36	35	30
Percent urban	7 – 100	42	33	34
Percent Muslim	0 – 99	44	43	45
Mean years of schooling	1 – 11	7	6	5
Percent no school	1 – 89	32	36	38
Percent illiterate	6 – 89	41	47	45
Percent listen to radio at least once a week	9 – 71	40	52	58
Percent watch TV at least once a week	2 – 74	38	38	37
Percent recently heard FP radio message	3 – 75	34	37	42
Percent recently saw FP message on TV	0 – 62	22	22	23

Map 1. Percentage of women with no schooling

Map 2. Percentage of women who are Muslim
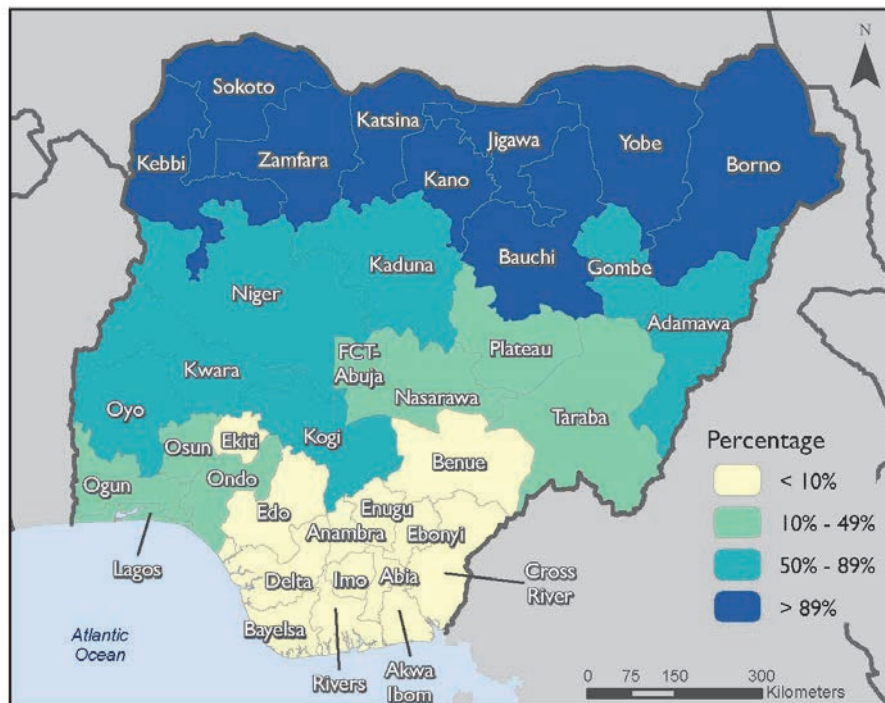
The mean age at first marriage (including informal cohabitation) for ever-married women in the 2013 survey was 18.5, up slightly from 18.2 in 2008 and from 17.5 in 2003 (Table 1). An estimated 43% of women marry before age 18 (and 11% before age 15). There is a strong regional association with the average age of marriage, as Map 3 shows. FCT-Abuja, the capital of Nigeria, is closer to the southern states than to the northern states in age at marriage and most of the other demographic characteristics

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described in the later maps. The number of years of schooling is a strong covariate of age at marriage (Figure 1), with a correlation of .95 across states.

Map 3. Mean age at marriage of ever-married women
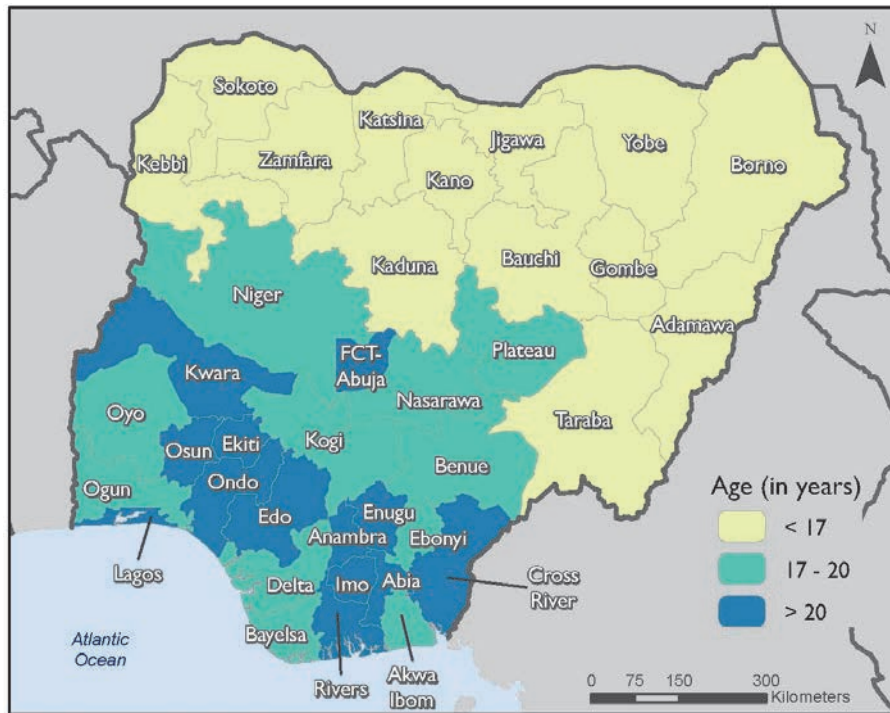
Polygny is fairly common in Nigeria. The average proportion of married women in a polygynous union across the 37 states in 2013 was 29%, down from 32% in 2008 and from 34% in 2003. Imo state currently has the lowest prevalence of polygynous marriages (5%), while Zimfara has the highest (53%). The strongest single covariate of polygyny is the proportion of Muslims in the population, with a correlation of .84. Including the TFR (b= .51) along with the proportion Muslim (b= .45) increases the explained variation in polygyny across states to 81%.

Figure 1. Association between women's age at marriage and years of schooling for the states
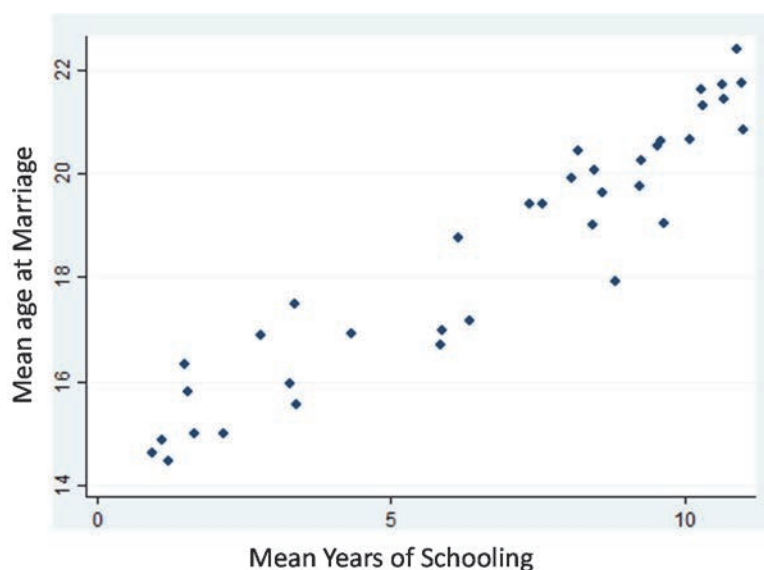
2.2.   Reproductive Preferences

The number of children desired reflects the reproductive norms of a society and the demand for children (Westoff 1991). A change in reproductive norms from a preference for large families to a preference for small families is a prerequisite for sustained fertility declines. Three measures of the desired number of children are used here: ideal number of children, intention to postpone the next birth, and desire to cease childbearing.

In the 2013 DHS, the average ideal number of children desired among married women ranged from 4.1 to 9.1 across the states of Nigeria, with an overall mean of 6.2—unchanged at the national level since 2008 but showing a decline from 6.7 in 2003 (Table 1). The most important covariate is the number of years of schooling, which alone accounts for 89% of the inter-state variation (Figure 2). Women in the northern states desire more children—more than seven on average—than women in the South, who prefer fewer than five children (Map 4).

Map 4. Mean number of children desired

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Figure 2. Association between women's ideal number of children and years of schooling for the states
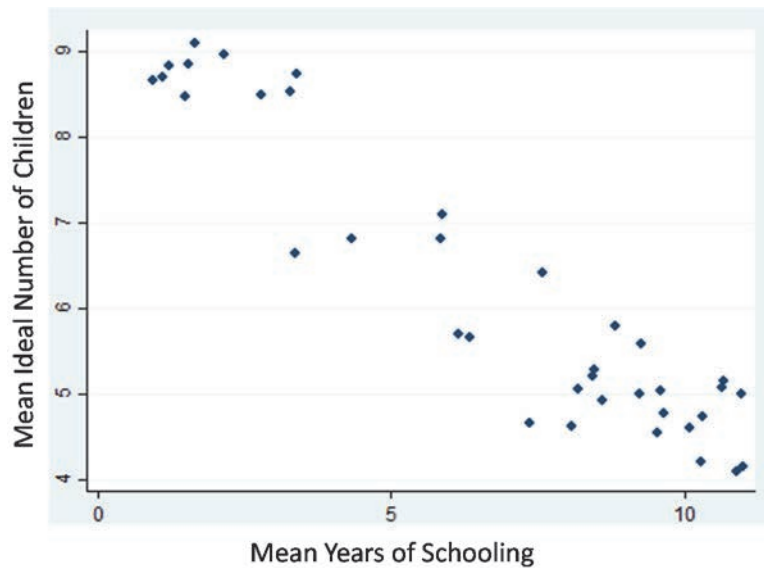
A non-negligible proportion of women do not respond with a number to the DHS question about the ideal number of children, stating instead that "It's up to God" or "However many children come." The results here are based on the numerical responses only. In the 2013 survey, the average proportion of non-numeric responses was 7%, down from 12% in 2008. The range across states in 2013 is from 0% to 36% (Table 1). The main correlate of the frequency of non-numeric responses is women's education.

The other measures of reproductive preferences are the proportion of women who want to have more children but want to wait until "later" (two years or longer) and the proportion who want no more children at all. The preference to delay childbearing ranges across the states from 21% to 53%, with an average of 33%, and shows no overall change since 2008 but an increase from 27% in 2003. The desire to postpone having the next child is associated with having had a teenage birth (b= .45), with intention to use a contraceptive method (b= .39), and with a higher TFR (b= .51). These three measures collectively account for 52% of the total inter-state variation in the desire to postpone fertility.

In 2013, among married women the desire to have no more children ranged across states from 4% to 44%, with an average of 23%, up slightly from 21% in 2008 but up more substantially from 16% in 2003. States with higher proportions of women who want no more children tend to be those with higher proportions using a contraceptive method (b= .55) or having an unmet need for family planning, as well as states with lower rates of teenage fertility (b= -.39) (Figure 3), and states with more schooling (Figure 4). Together, these associated characteristics explain 82% of the variation across states in the proportions of women wanting no more children.

Figure 3. Association between the percentage of women who want no more children and teenage fertility for the states
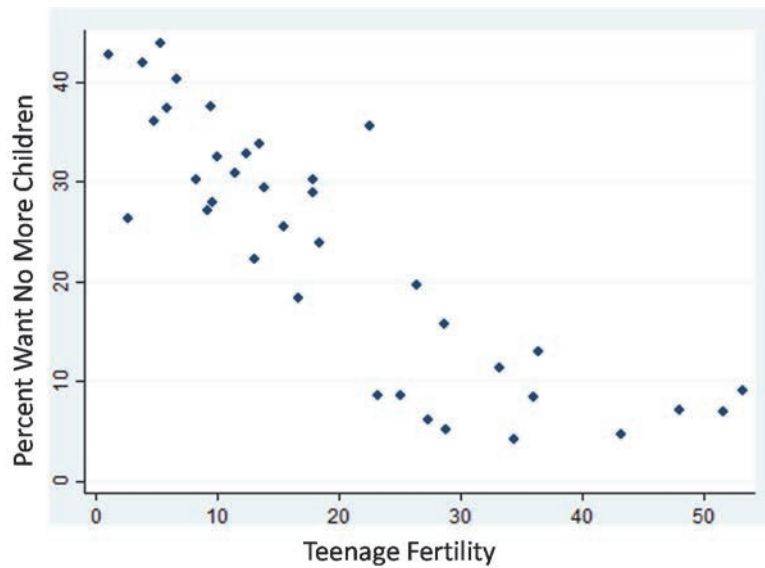
Figure 4. Association between the proportion of women who want no more children and women's years of schooling for the states
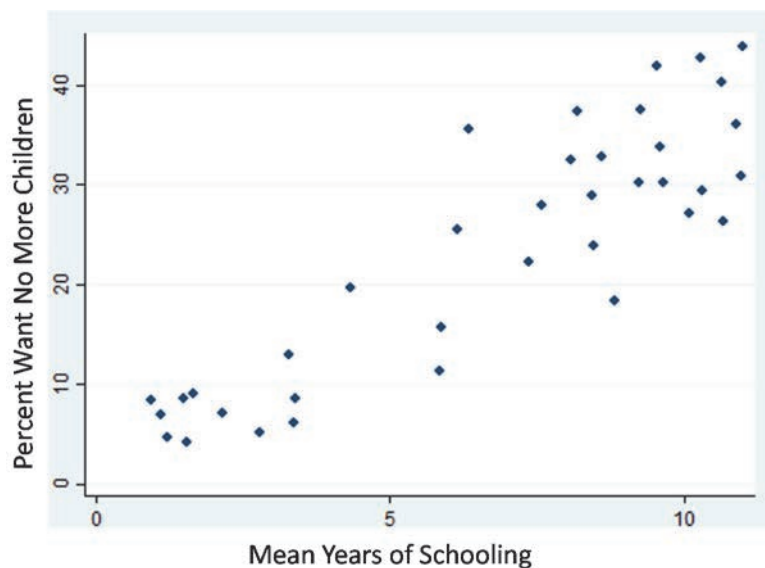
2.3. Use of Contraception

Overall in the 37 states, the average proportion of married women currently using any contraceptive method was 19% in 2013, up from 15% in 2008 and 14% in 2003 (Table 1). The level of contraceptive use differs substantially across sub-populations in Nigeria. The range across states in 2013 is from 1% in Kano to 48% in Lagos. Some of the states in the North have the lowest levels of contraceptive use anywhere in the world. At the state level, there has been little change in the proportion using a contraceptive method. States with absolute increases of at least 10% include Abia, Ebonyi, Ekiti, Enugu, Imo, Kaduna, Kwara, Ondo, and Oyo. In general, the familiar pattern of increasing contraceptive prevalence from North to South prevails (Map 5). The considerable geographic variation in contraceptive use in earlier years has been well documented (Adebayo et al. 2013).

Map 5. Percentage of women currently using contraception
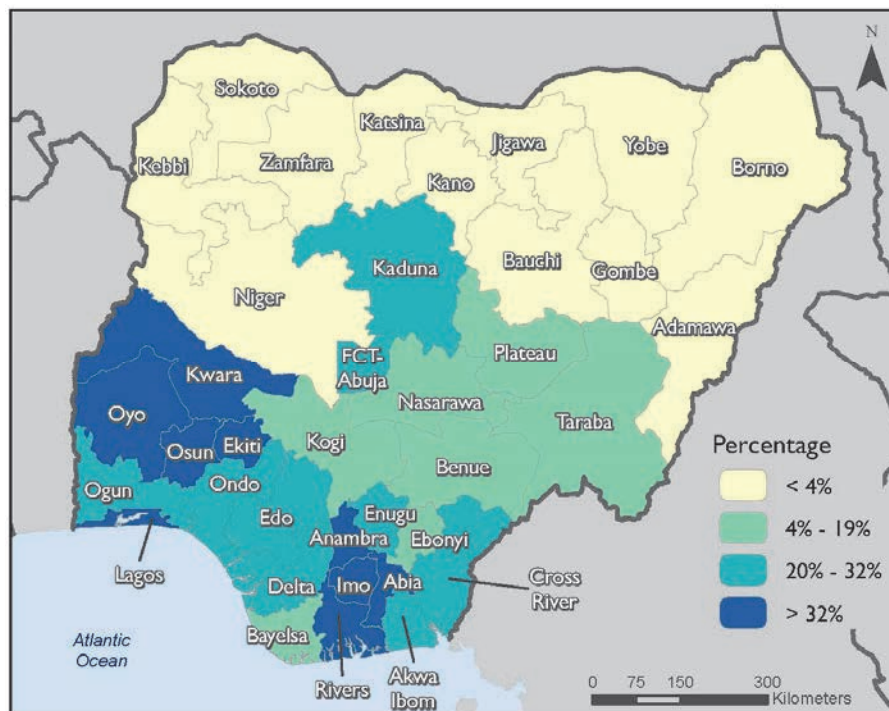
The separation of contraceptive prevalence into use for spacing and use for limiting births shows a similar level, although use for limiting births doubled between 2003 and 2013. The two use patterns are highly correlated with each other across states (.86).

Current use of contraception is highly correlated with women's education (Figure 5) and with later ages at marriage (Figure 6). A related recent study of married, fecund Nigerian women who do not desire a child in the next two years (Ejembi, Dahiru, and Aliyu 2015) shows strong associations between modern contraceptive use and women's education, female autonomy, and access to health facilities, as well as husband's education and household wealth. There is also some evidence that exposure to family planning messages on radio or television is directly associated with current use of contraception. Appendix A describes this evidence.

One of the consequences of low contraceptive prevalence in Nigeria is a significant number of unintended pregnancies and a substantial abortion rate. In 2012, an estimated 56% of such pregnancies were aborted. A total of 1.25 million induced abortions, an annual rate of 33 abortions per 1,000 women age 15-49, are estimated to have occurred in 2012 (Bankole et al. 2015).

Figure 5. Association between women's contraceptive use and years of schooling for the states
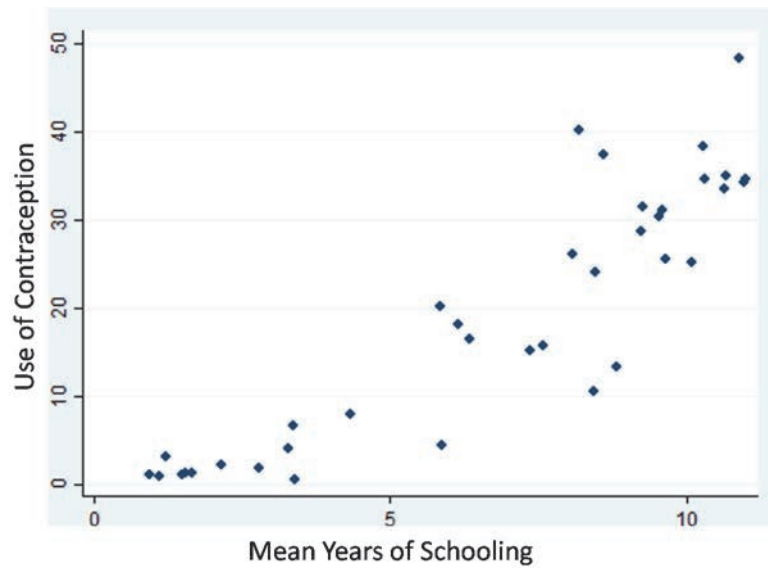
Figure 6. Association between women's contraceptive use and age at marriage for the states
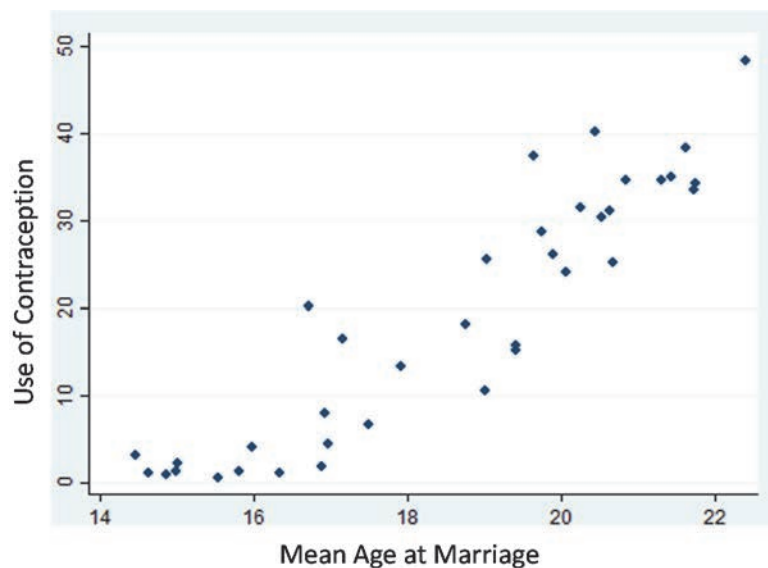
2.4.   Intention to Use Contraception

In the 2013 DHS an average of 23% of nonusers responded that they intended to use a contraceptive method. The main covariate in both the 2013 and 2008 surveys is the proportion of Muslims in the state populations, which is negatively associated with intention to use family planning (Wusu 2014). Having heard family planning messages on the radio is also associated with intention to use contraception. Together, these two variables—the proportion Muslim and having heard family planning messages on the radio—account for 65% of the variation across states in the intention to use a method.

2.5.   Unmet Need

Unmet need for family planning is defined as the proportion of married women currently exposed to the risk of conception who do not want any more children or who want to delay the next birth by at least two years but who are not using any method of contraception. It points to the apparent gap between reproductive intentions and contraceptive behavior. In 2013, the mean level of unmet need across the 37 states of Nigeria was 18%, with a range from 6% to 31% (Table 1). The main covariates are rural residence and lack of any schooling, which are both directly related to the unmet need for spacing and for limiting. Over time, at the state level, only increases in educational attainment seem to play a role in reducing unmet need for limiting births. Differences in the proportion urban and in the proportion married also affect changes in unmet need for spacing. In Nigeria most unmet need is for spacing rather than limiting births.

2.6.   Demand for Family Planning

Together, the proportions of women having an unmet need along with the proportions currently using a method comprise the total demand for family planning. The average total demand in 2013 was 36%, with no change since 2008, at 35%, but up from 30% in 2003 (Austin 2015). In 2013, the range in total demand for family planning was from a high of 59% in Lagos to a low of 9% in Sokoto (Map 6). The state of Kwara had the greatest increase in demand, at 13 percentage points, while Kano experienced the greatest decrease, at 19 percentage points. The demand for family planning is uniformly strongest in the South and lowest in the North (Map 6). Among states, the principal covariates of higher demand for family planning are older ages at marriage (b= .59), higher levels of intention to use a contraceptive method (b= .39), and a higher percentage of households with electricity (b= .31), which together account for 89% of the variation. Another equation featuring the average years of schooling alone accounts for 84% of the variation in total demand for family planning (Figure 7).

Map 6. Demand for family planning
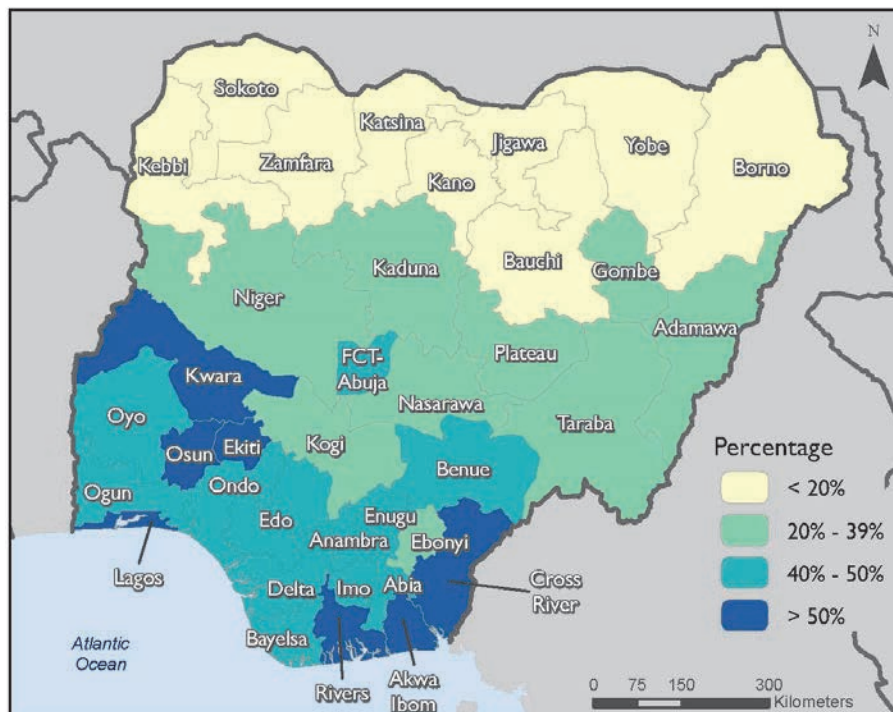
Figure 7. Association between total demand for family planning and women's years of schooling for the states
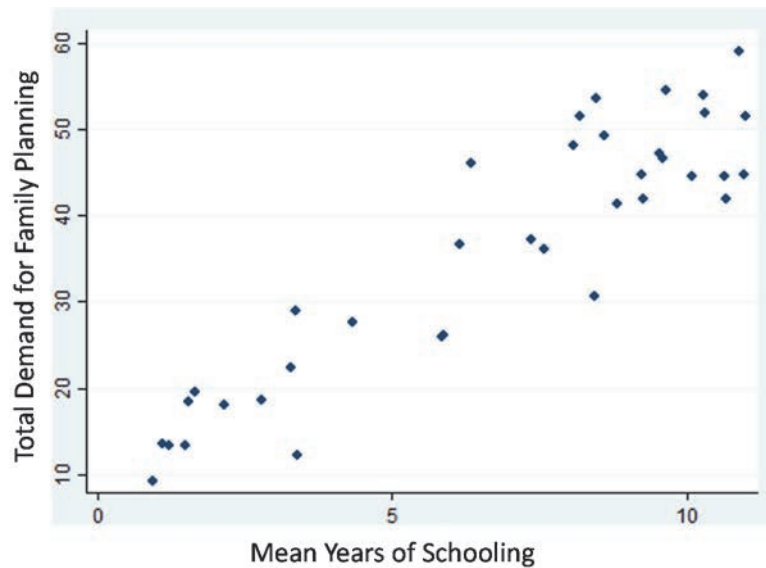
2.7.   Teenage Fertility

The fertility of adolescents is of special interest both because of its importance for the health and education of young women and because of its relationship to total fertility. The proportion of women age 15-19 who are either pregnant or who have already given birth averaged 20% across the 37 states in 2013, from 1% in Osun to 53% in Katsina (Map 7). The proportion is down from 24% in 2008. Two regression equations account equally for the inter-state variation in adolescent fertility. One includes the proportion with no schooling (b= .47), the level of child mortality (b= .30), and rural residence (b= .27). An alternative model includes mean age at first marriage (b= -.73) and child mortality (b= .23). Each model explains 85% of the state variation in teenage fertility. The mean age at marriage alone is highly correlated with the rate of teenage fertility (Figure 8).

Map 7. Teenage childbearing
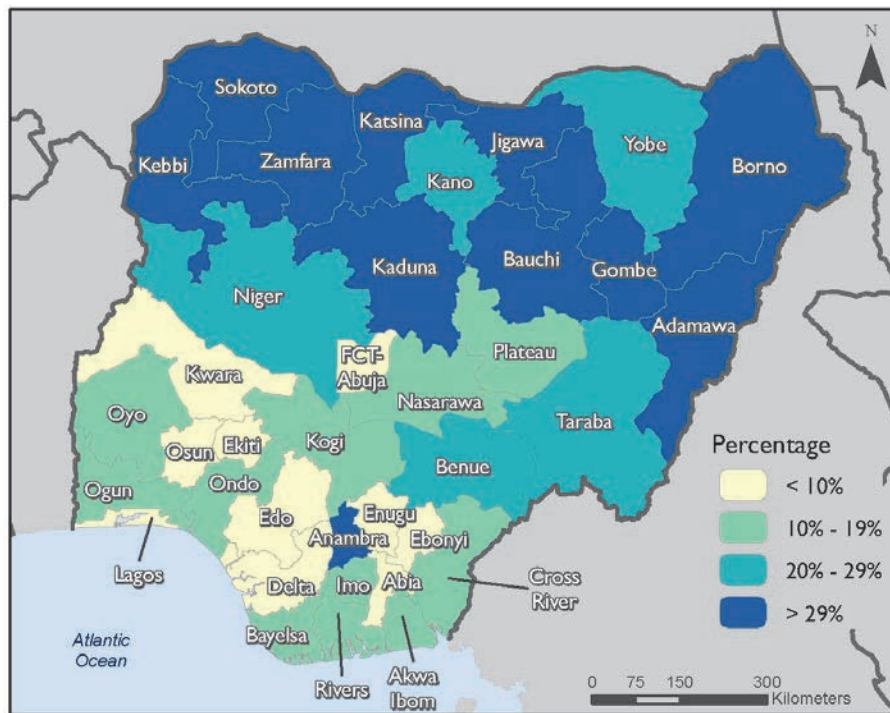
Figure 8. Association between teenage fertility and women's age at marriage for the states
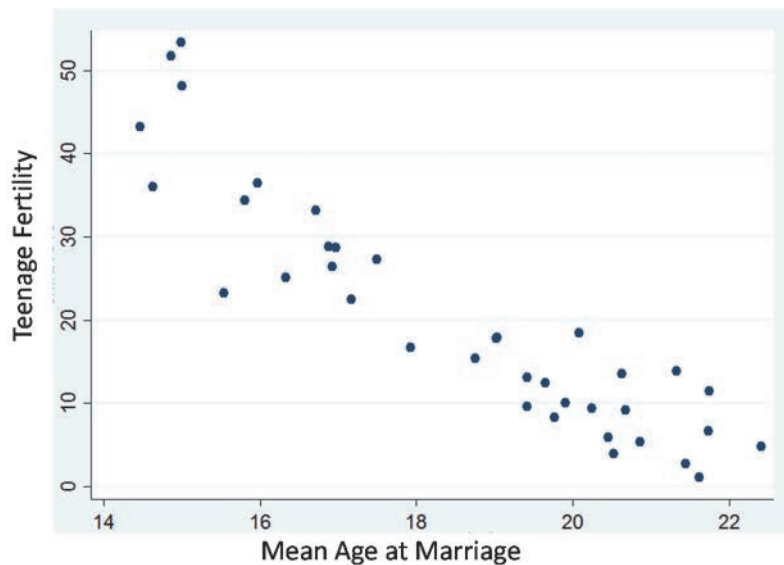
2.8. Child Mortality

Child survival has a strong association with fertility. Higher fertility is associated with higher child mortality (Figure 9). There is a positive association between the reduction of child mortality and the decline of fertility. Child survival reduces the demand for children and increases the cost of childbearing. However, there can be a long interval of time before this association materializes. In Nigeria the child mortality rate dropped by around a third from 1999-2003 to 2009-2013 with little

change in fertility. The latest UN projection shows an additional 50% drop in child mortality by 2045-2050.

Child mortality is measured here by the percentage of women who report that at least one child had died. The average across the states in 2013 was 24%, with a range from 9% in Osun to 55% in Zamfara. The average has declined from 31% in 2003. It is more highly correlated with the TFR than any other variable measured here (r= .94). Much of this association is endogenous—that is, the more births, the greater the risk of child deaths. There is also a possible reverse effect: some women may have an additional birth to replace a child who died.

Figure 9. Association between the total fertility rate and child mortality for the states
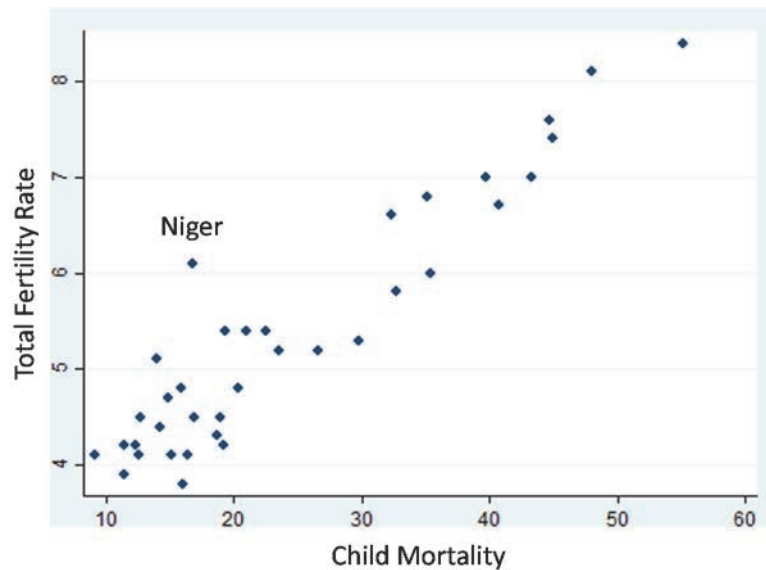
2.9. Total Fertility

The average number of children ever born, at 3.0 births per woman in 2013, did not change over the 10 years between surveys (Table 1). The average TFR across the 37 states in the three years preceding the 2013 survey was 5.4 births per woman (Table 1, Map 8), slightly lower than in the earlier surveys. It ranges from 3.8 in Rivers to 8.4 in Zamfara. Two anomalies in Map 8 are in Kaduna and in Borno, which show much lower TFRs than neighboring states in the North. In Borno the most recent rate is 4.7, but the corresponding rate from the 2008 survey is a more credible TFR of 7.1. A similar situation appears in Kaduna, with TFR of 4.1 in the 2013 survey but a TFR of 6.3 five years earlier. The likely explanation is omission of births in the 2013 survey. In Kaduna, contraceptive prevalence increased from 10% to 20% between 2008 and 2013, but a prevalence of 20% would imply a TFR much higher than 4.1.

Map 8. Total fertility rate
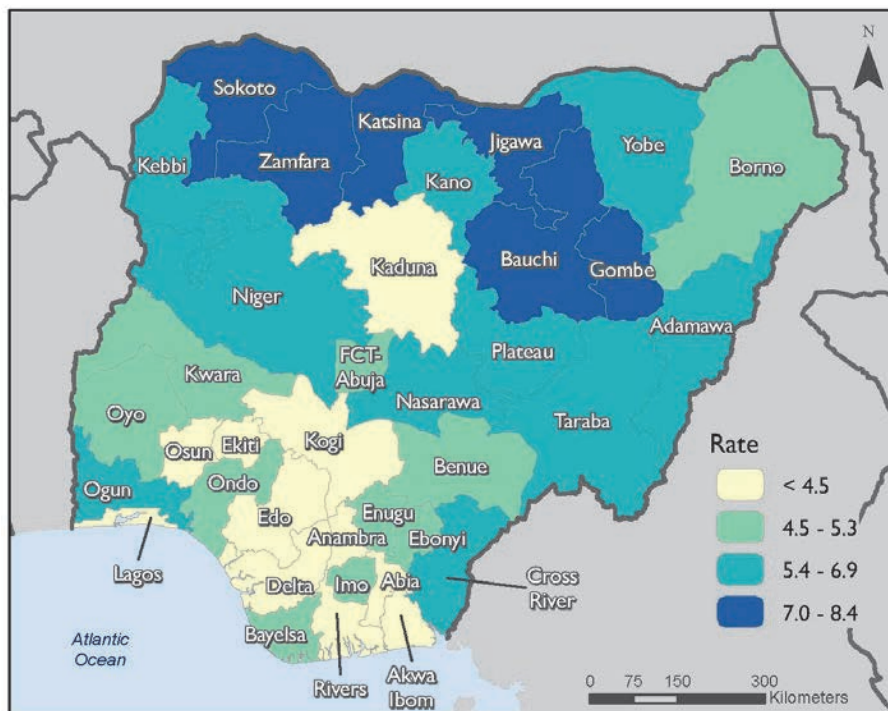
One regression model includes child deaths (b= .68) and the mean years of schooling (b= -.32), which together explain 92% of the variation in fertility (Figures 9 and 10). In general, child mortality is negatively related to amount of schooling, with a correlation of -.82.

Figure 10. Association between the total fertility rate and women's years of schooling for the states
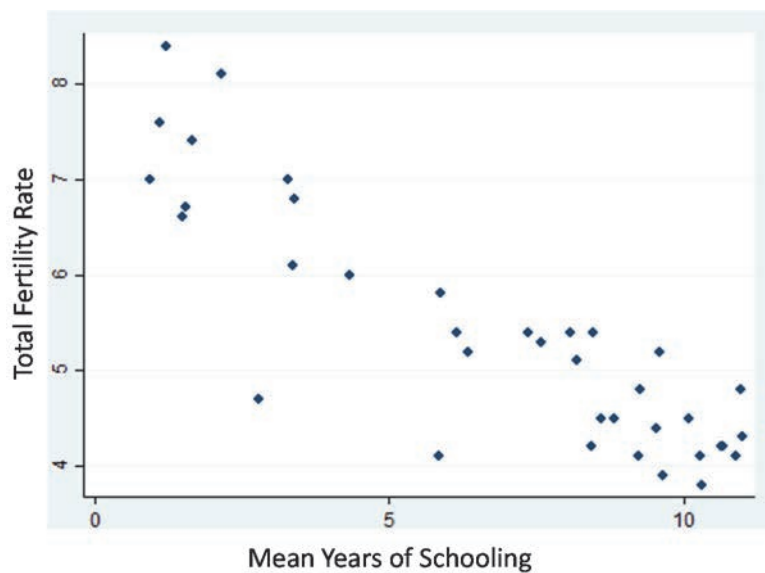
3. Components of Fertility Change

3.1. Changes over Time

The analysis above has concentrated on cross-sectional covariations. We focus now on the more predictive question: how well can we account for changes or differences in the fertility and family planning variables over time by observing changes in other measures, such as education? As in the cross-sectional analysis, our analysis of changes over time is based on the characteristics of the 37 states of Nigeria.

3.2. Changes in Nuptiality

Changes in three variables between 2008 and 2013 are associated with increases in age at marriage: a decline in teenage childbearing (b= -.42), a decline of polygyny (b= .31), and increases in electrification, which is a component of economic development (b= .33). Collectively, the three account for 45% of the state variations of changes in age at marriage and are about equally important statistically. The covariates of the increase in age at marriage between 2003 and 2013 include the increase in monogamy (b= .40) and an increase in schooling (b= .32), accounting for 51% of the increase in age at marriage. Declines in teenage childbearing are not included because the quality of data in 2003 on teenage childbearing does not permit its inclusion (zero teenage fertility is reported in the states of Abia and Kwara).

As noted earlier, the prevalence of polygyny has declined slightly. Changes in three variables between 2008 and 2013 explain 56% of the state declines in the proportion of polygynous unions: the proportion of Muslim women (b= -.27), increases in schooling (b= .21), and declines in child mortality (b= -.62).

3.3. Changes in Reproductive Preferences

Changes over time related to declines in the ideal number of children since 2008 include increases in literacy (b= .38), declines in teenage childbearing (b= -.36), and a decline in polygyny (b= -.32). Collectively, changes in these three variables account for 40% of the variation in the mean number of children desired. Such declines over the full decade since 2003 are related to increases in schooling (b= -.62) and declines in polygyny (b= -.30), which together account for 71% of the variance.

The three strongest predictors of increases in the proportion of women who want no more children are increases in television exposure (b= .34), increases in the use of contraception to limit fertility (b= .48), and increases in the intention to use a family planning method (b= .24). Together, these three variables account for 50% of the state variations in the change in the proportions of women who want no more children. A state-by-state comparison of the proportion of women who want no more children shows little change between 2008 and 2013. Changes in the same three covariates are observed in the 2003 to 2013 comparisons, accounting for 83% of the variation across states.

3.4. Changes in Family Planning

The main covariates of contraceptive use in both 2013 and 2008 are the rising level of education and a later age at marriage. However, a focus on differences in contraceptive use between the two periods does not show the same covariates but rather highlights changes in the proportions of people living in cities (b= .52), in radio exposure (b= .36), and in the proportions married (b= .21), collectively accounting for 52% of the variance of state changes in contraceptive use. If we combine contraceptive use and unmet need for family planning to create a measure of total demand, the correlation of changes in demand for family planning with changes in education alone explains 38% of the variance (Figure 11). With the declines in child mortality (b= .51) and in polygyny (b= .39) included along with changes in education (b= .57), the total explained variance among the states increases to 53%. Over the ten-year span, the only significant covariate of increased contraceptive use is the proportion of women who want no more children, which accounts for 50% of the variation.

Figure 11. Association between changes in the demand for family planning and women's years of schooling between 2008 and 2013 for the states
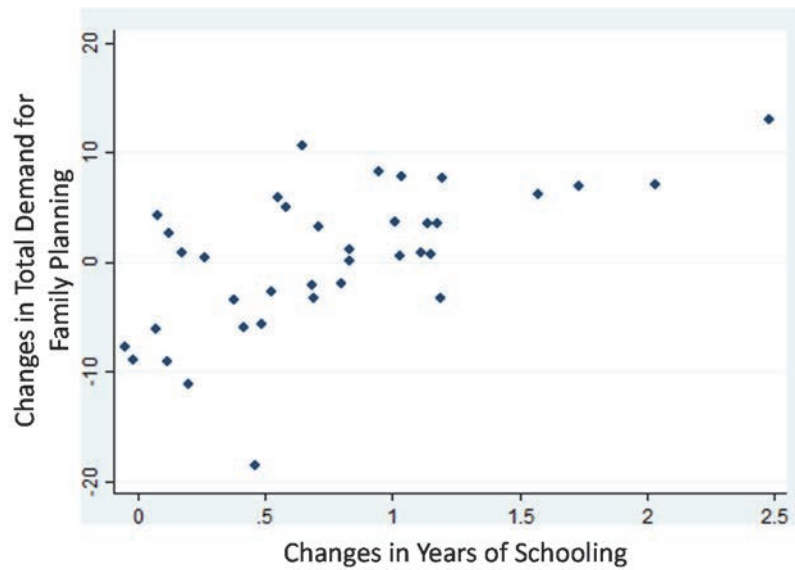
3.5. Changes in Fertility

Declines among the states in the TFR between 2008 and 2013 are associated with reductions in child mortality (Figure 12) (b= .77) and with increased schooling (b= .19), which together account for 60% of the variance of change in the TFR. A similar analysis of the determinants of fertility based on 640 districts in India shows results very much like those in our Nigerian study. One of the main conclusions in the India study is that "increased educational attainment and improved child survival continue to be major drivers of fertility reduction" (Mohanty et al. 2015).

The changes in the TFR among the Nigerian states between 2003 and 2013 are associated mainly with declines in child mortality (b= .69) and with declines in the proportion of Muslims (b= .23), with a total of 59% of the variance explained.

Declines in teenage fertility in Nigeria's states between 2008 and 2013 are correlated with lower proportions married (b= .50), with declines in the mean ideal number of children (b= -.27), and with increases in age at marriage (b= -.43). Together, changes in these variables explain 61% of the changes in teenage fertility.

Figure 12. Association between changes in the total fertility rate and changes in child mortality between 2008 and 2013 for the states
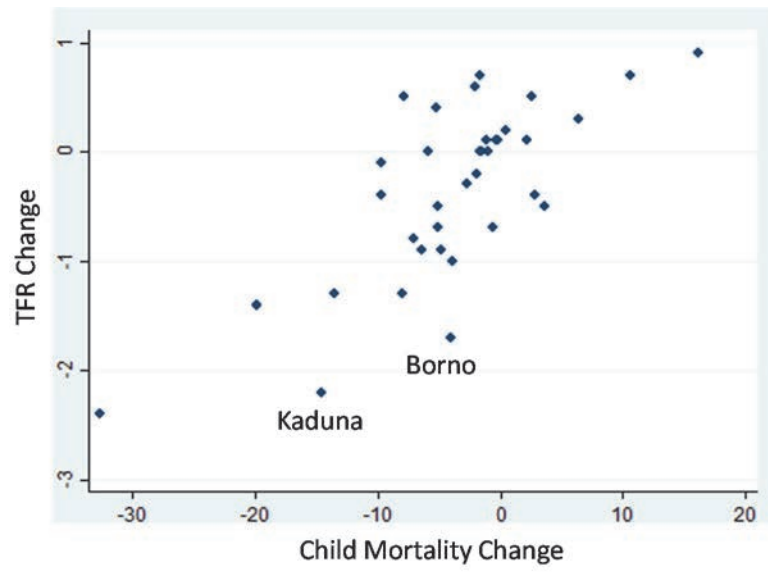
4.   Men and Fertility

4.1.   Males

The analyses above are all based on data collected from women. In the three latest Nigeria DHS surveys, samples of men were also included. Table 2 shows some summary descriptive statistics for men. The highlights of the analysis of male reproductive behavior follow.

The proportion of men currently married has declined from an average of 56% across the 37 states in 2008 to 49% in 2013. Age at marriage increased by an average of one year in each of the three surveys. The proportion of men in polygynous marriages declined from 23% in 2008 to 15% in 2013.

Reproductive preferences among men have declined somewhat but remain high, at 7.3 children, considered ideal in 2013 (compared with an ideal of 6.2 children that women prefer). The percentage of men currently using any method of contraception increased from 17% to 22% between 2008 and 2013. Men's average educational achievement has not changed much, although the percentage of men with no schooling dropped from 22% in 2008 to 18% in 2013.

Table 2. Selected characteristics of the 37 states based on data for men, 2013, 2008, and 2003

		Mean		
	Range 2013	2013	2008	2003
Percent currently married	32 - 65	49	56	52
Percent polygynous	0 - 36	15	19	23
Mean age at marriage	22 - 30	26	25	24
Mean total fertility rate	3.8 - 8.4	5.4	5.7	5.6
Mean ideal number of children	4.2 - 13.9	7.3	8.1	8.6
Percent want no more children	0 - 18	7	10	NA
Percent want next child later	1 - 38	20	19	NA
Percent using contraception	0 - 47	22	17	NA
Mean years of schooling	2 - 12	9	8	7
Percent no schooling	0 - 79	18	22	22
Listen to radio at least weekly	7 - 93	57	81	86
Watch TV at least weekly	4 - 88	42	50	46
Percent recently heard FP radio message	7 - 91	51	59	56
Percent recently saw FP message on TV	2 - 78	29	31	32

4.2.   Male Covariates of Fertility and Its Proximate Determinants

The TFR is strongly correlated (.89) with the state proportions of men in polygynous marriages in 2013 (Figure 13 and Table 3), and is also highly correlated inversely with the average number of years of schooling (-.83) as well as the proportion of child deaths in each state (.87). Among men, the number of children desired is strongly associated negatively with years of schooling (-.94). Figure 14 shows this association. The main outlier in Figure 14 is the state of Borno, where both the number of children desired as well as the TFR appear seriously underreported (a comparison with the 2008 estimates of the number desired shows a decline of 5.4 for Borno and a drop of 2.4 in the TFR by 2013). The use of contraception is highly correlated with the years of schooling (.86).

Figure 13. Association between the total fertility rate and proportions of men in polygynous marriages for the states
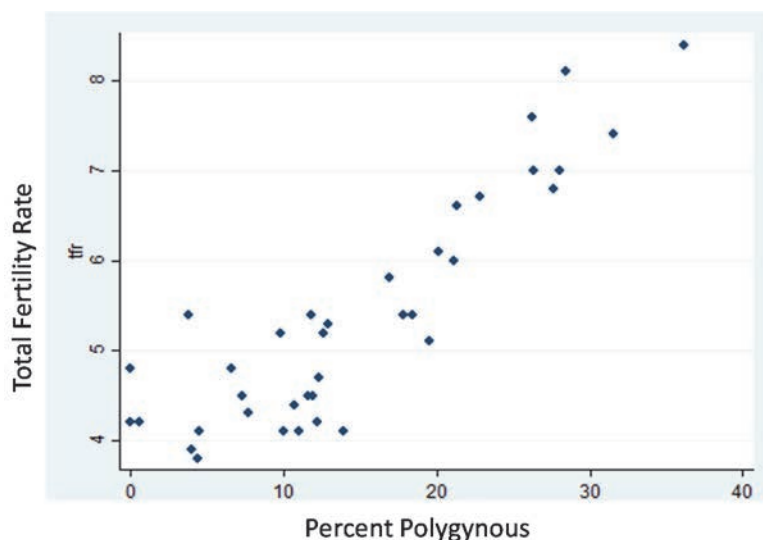
Table 3. Bivariate correlations of leading indicators of fertility for male characteristics in the 37 states

	Total Fertility Rate	Desired Number of Children	Use of Contraception	Age at Marriage
Polygyny	.89	.84	.73	—.84
Years of schooling	—.83	—.94	.86	.74
Child deaths	.87	.73	—.64	—.80

Figure 14. Association between men's ideal number of children and men's years of schooling for the states
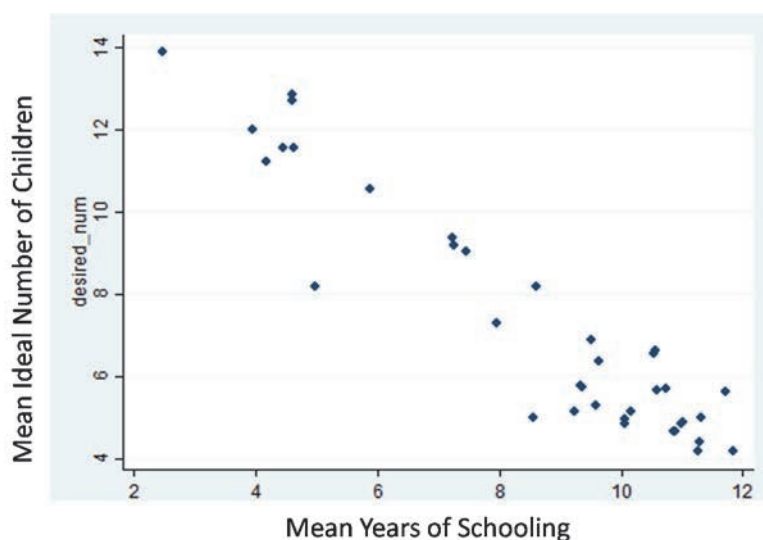
Four multivariate models using the 2013 DHS survey of men are described in Table 4. The state-level dependent variables in these regressions are age at marriage, number of children desired, use of contraception, and the TFR. Age at marriage is correlated mainly with lower polygyny proportions and with lower child mortality. The desired number of children is associated primarily with fewer years of

schooling and with polygyny, which jointly account for 91% of the variance. A total of 80% of the variance of contraceptive prevalence is statistically explained by the amount of schooling and radio exposure. Higher total fertility rates are explained (88% of the variance) by less schooling, more polygyny, and higher child mortality.

Analyses were also explored with covariates of changes across the 5-year interval between the two most recent DHS male surveys, but the results are disappointing. Changes in the TFR are related to declines in child death rates and in polygyny and increases in schooling, but only 41% of the variance is explained.

Table 4. Multivariate analyses based on data for men in the 37 states

	Standardized Partial Regression Coefficients			
	Total Fertility Rate	Desired Number of Children	Use of Contraception	Age at Marriage
Years of schooling	—.30	—.74	.65	—
Polygyny	.31	.25	—	—.56
Proportion child deaths	.41	—	—	—.33
Listens to radio	—	—	.32	—
R^2	.88	.91	.80	.74

5.   Individual and Cluster Levels of Analysis

5.1.   Cluster-Level Analysis

The preceding analysis has been based on summary data for the 37 states of Nigeria. Much of the same data for 2013 can be examined for 896 sampling clusters, with an average of 48 women in each cluster. In Table 5, a set of multiple regressions shows the associations of the covariates of fertility with summary measures based on currently married women in each cluster. For example, in the first column of Table 5, we show the association of the mean number of children ever born to married women in each cluster with the mean years of schooling, whether Muslim or not, with residence in the South or elsewhere, and so on. In this table, five dependent variables are given in the columns. The estimates are the standardized partial regression coefficients (beta coefficients), which permit comparisons of the relative strengths of the different covariates. Column 1 shows that the mean number of child deaths in the clusters is the strongest predictor of the mean number of children ever born in the clusters, with b= .65. The number of years of schooling is the next strongest, with the b coefficient of -.39.

An interesting result is the negative effect on fertility of more Muslims in the cluster populations and the positive effect of average wealth. By themselves in bivariate analyses, the signs are the opposite: the more Muslim the population, the higher the fertility rate, and the wealthier the cluster, the lower the fertility rate. The main explanation lies in the education and child mortality variables, which are highly connected with the Muslim variable, with less schooling, and with higher child mortality.

Table 5. Multiple regression analysis of 896 sampling clusters based on summary characteristics of currently married women, Nigeria 2013

Covariate	Children Ever Born	Desired Number of Children	Wants No More Children	Demand for Family Planning	Age at Marriage
Years of schooling	−.39	−.45	.28	.22	.56
Muslim	−.27	.27	−.36	−.28	(−.02)
South	(.02)	−.07	.15	.12	.15
Polygyny	(.05)	−.07	.14	.08	−.06
Number child deaths	.65	.23	(−.02)	−.09	−.14
Listens to radio	.09	−.08	.23	.09	(.00)
Watches TV	−.15	−.07	(−.06)	(.07)	(.02)
Wealth	.22	(.05)	(.00)	.13	(.05)
R²	.55	.80	.49	.60	.78

( ) Not statistically significant at .05 level
 Note: Standardized partial regression coefficients

The mean number of children desired (Column 2 in Table 5) shows a negative association with the mean years of schooling (b= -.45), and here the Muslim effect is positive (b= .27). A total of 80% of the variance of the desired number of children is explained mainly by these two covariates, along with the number of child deaths (b= .23).

The average cluster proportion of married women who want no more children (Column 3 in Table 5) is similarly related to more schooling, to lower proportions of Muslims in the population, and to more radio exposure.

The demand for family planning (Column 4 in Table 5) is positively related to education (b= .22) and negatively related to the extent of Muslims in the population (b= -.28). It is also positively related to wealth and to residence in the South.

Later age at marriage (Column 5 in Table 5) is strongly associated with more schooling (b= .56) and has a lower but positive relation to residence in the South (b= .14), and a negative relationship with child mortality (b= -.14).

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In sum, this multivariate analysis of clusters in 2013 shows a dominant relationship of fertility with education and with child mortality, and a mixed effect of Muslim composition. Residence in the South shows a more modest association with several components of fertility, but polygyny shows a direct association with wanting no more children, which is related to a joint association between the proportion of Muslim populations and polygyny. Media exposure shows different directions of the relationship of television and radio with fertility—with television exposure more associated with lower fertility compared with radio exposure.

5.2. Comparison with Individual Data

The associations described earlier in this report are based either on the 37 states or on the 896 clusters. As a partial check on the validity of these associations, Table 6 presents multivariate analyses of the primary variables in 2013 for 27,274 individual currently married women, and in Table 7 for 8,557 currently married men. Logistic regressions are used to compare the associations across the covariates.

Table 6. Multivariate logistic regression (odds ratios) of factors affecting fertility, number of children desired, reproductive intention, contraceptive use, and age at marriage among 27,274 currently married women, Nigeria 2013

Covariate	Children Ever Born[1]	Desired Number of Children[3]	Wants No More Children[4]	Contraceptive Use[5]	Age at Marriage[2]
No schooling	1.00	1.00	1.00	1.00	1.00
Some schooling	0.69	0.45	1.38	2.92	2.19
Not Muslim	1.00	1.00	1.00	1.00	1.00
Muslim	1.34	2.61	0.48	0.59	0.52
North	1.00	1.00	1.00	1.00	1.00
South	0.86	0.56	1.55	1.73	1.65
Monogamous	1.00	1.00	1.00	1.00	1.00
Polygynous	1.09	1.13	(1.00)	0.76	0.82
No child deaths	1.00	1.00	1.00	1.00	1.00
Child death(s)	5.45	1.72	(1.00)	0.86	0.46
No radio exposure	1.00	1.00	1.00	1.00	1.00
Listens to radio	(0.94)	0.79	1.15	1.25	(1.02)
No TV exposure	1.00	1.00	1.00	1.00	1.00
Watches TV	0.88	0.71	1.17	1.10	1.29
Low wealth	1.00	1.00	1.00	1.00	1.00
High wealth	0.64	0.53	1.14	1.97	1.74
Age	1.22	1.03	1.19	1.03	1.03
R[2]	0.40	0.25	0.30	0.19	0.21

( ) Not significant at the .05 level
[1] Fewer than 4 vs. 4 or more children ever born
[2] Married under age 18 vs. age 18 or older
[3] Ideal number fewer than 6 vs. 6 or more children
[4] Wants more vs. no more children
[5] Not currently using contraception vs. using any method

Table 7. Multivariate logistic regression (odds ratios) of factors affecting fertility, number of children desired, reproductive intention, contraceptive use, and age at marriage among 8,557 currently married men, Nigeria 2013

Covariate	Fertility[1]	Desired Number of Children[3]	Wants No More Children[4]	Contraceptive Use[5]	Age at Marriage[2]
Less than six years of schooling	1.00	1.00	1.00	1.00	1.00
More than five years of schooling	(0.95)	0.53	1.48	1.96	1.38
Not Muslim	1.00	1.00	1.00	1.00	1.00
Muslim	1.16	3.59	0.38	0.78	(0.94)
North	1.00	1.00	1.00	1.00	1.00
South	0.86	0.49	1.76	1.18	(1.01)
One wife	1.00	1.00	1.00	1.00	1.00
More than one wife	6.56	3.61	0.54	0.78	0.45
No child deaths	1.00	1.00	1.00	1.00	1.00
Child death(s)	7.92	1.77	1.19	(0.99)	0.39
No radio exposure	1.00	1.00	1.00	1.00	1.00
Listens to radio	(1.17)	(1.01)	(0.93)	1.90	0.85
No TV exposure	1.00	1.00	1.00	1.00	1.00
Watches TV	(0.88)	0.70	1.49	1.48	1.18
Low wealth	1.00	1.00	1.00	1.00	1.00
High wealth	0.55	0.45	1.50	1.85	1.85
Age	1.21	1.02	1.13	(1.01)	1.11
R^2	.40	.31	.22	.10	.15

( ) Not significant at the .05 level
[1] Fewer than four vs. four or more children ever born
[2] Married under age 25 vs. age 25 or older
[3] Ideal number fewer than seven vs. seven or more children
[4] Wants more vs. no more children
[5] Not currently using contraception vs. using any method

Education is significantly related to all five reproductive measures for both women and men, most strongly with contraceptive use. Women with some schooling are nearly three times more likely than women with no schooling to be using contraception, while men with more than five years of schooling are twice as likely to be using a contraceptive method compared with men with less education. Education is also strongly linked with later ages at marriage, with causal connections in both directions. Both measures of reproductive preferences are also strongly associated with education, a finding substantiated in a recent analysis of DHS data in three other sub-Saharan African countries (Behrman, 2015). The fertility index included in these analyses is the number of children ever born and shows a level 31% lower for the more educated women, but not for men. Muslim women are more likely to have higher fertility and earlier ages at marriage, but this connection does not reach statistical significance for men. However, reproductive preferences are higher for Muslims, and contraceptive prevalence is lower.

Residence in the South of Nigeria is consistently associated with lower fertility and its components for both women and men. Although this connection is certainly related to the location of the Muslim population in the North, the associations in the multivariate analyses show regional influences beyond religion.

Polygyny is associated with higher fertility, especially among men. Men with more than one wife (17% of married men) are nearly seven times more likely to have more than three children and nearly four times more likely to want more than three children compared with monogamous men. Polygynous men are also more likely to have married at younger ages. These relationships are in the same direction but much weaker for women, one-third of whom have co-wives.

Child mortality is strongly associated with higher fertility, with the number of children desired, and with earlier ages at marriage. As noted before, there is undoubtedly some endogeneity involved in this particular complex of relationships.

Mass media exposure, mainly to television, is significantly related to all of the reproductive measures here. Men and women who watch television tend to marry at later ages, want fewer children, are more likely to want no more children, are more likely to use contraception, and have fewer children. Radio exposure relates mainly to the use of contraception.

Altogether, these analyses at the individual and cluster levels show the same general picture as the state-level associations.

5.3.   Individual and Cluster-Level Covariates

The final multivariate analysis of fertility and its components includes both the individual and cluster-level relationships simultaneously. The main objective of examining the associations of both the individual and cluster level with fertility and its components (Table 8) is to determine whether there might be some group effects beyond the individual. Column 1 in Table 8 shows the associations for married women with the number of children ever born. The directions of the relationship with wealth and with Muslim affiliation are different at the individual and at the cluster levels. For individual women, wealth is negatively related to fertility but positively related to the wealth of their residential cluster. Muslim women show higher fertility individually but lower fertility at the cluster level. Child mortality is strongly associated with higher fertility but only at the individual level (b= .37).

The number of children desired (Column 2 in Table 8) is negatively associated with schooling at both individual and cluster levels (Kravdal 2002), but wealth shows the same pattern as with the fertility measures. However, the Muslim covariate shows larger family size preferences with both measures. There is some evidence of an inverse association with the number of children desired and with media exposure at both individual and cluster levels.

The proportion of married women who want no more children (Column 3 in Table 8) is positively correlated with higher proportions of women with more schooling (the cluster-level measure) but at the individual level is negatively associated with the amount of schooling. Without the cluster variable, the association of the individual level of schooling with wanting no more children is positive, consistent with the finding shown in Column 3 in Table 6. Both measures of wanting no more children are negatively related to child mortality.

Contraceptive use (Column 4 in Table 8) is positively related to schooling at the cluster level (b= .22) and is directly associated with individual wealth but negatively with the level of wealth in the cluster. Muslim women are less likely to use a contraceptive method but clusters with more Muslims appear more likely to use contraception. Residents in the South are more likely to use contraception. Women in polygynous marriages show a weak negative relationship with contraceptive use at both individual and cluster levels.

Age at marriage (Column 5 in Table 8) is higher for more educated women and lower for Muslim women and for those in polygynous marriages. It is also inversely associated with experience with child mortality and directly related to residence in the South.

Table 8. Multiple regression analysis of individual married women and cluster measures (Cℓ) of fertility and its components, Nigeria 2013

Covariate	Children Ever Born	Desired Number of Children	Wants No More Children	Currently Using Contraception	Age at Marriage
Years of schooling	−.13	−.11	−.09	.06	.28
Cℓ Years of schooling	−.07	−.19	.16	.22	.07
Wealth	−.04	−.06	(.01)	.07	.04
Cℓ Wealth	.08	.09	−.06	−.06	(−.01)
Muslim	.05	.11	−.03	−.04	−.09
Cℓ Muslim	−.08	.08	−.07	.04	.06
Polygynous	(−.00)	.01	−.02	−.02	−.03
Cℓ Polygynous	(.01)	−.03	.04	−.02	−.02
Number of child deaths	.37	.10	−.04	−.01	−.14
Cℓ Number of child deaths	.02	.10	−.04	−.02	−.06
South	−.03	−.05	.03	.09	.09
Age	.55	.13	.44	.06	.18
R^2	.64	.34	.27	.17	.35

( ) Not significant at .05 level
Note: Standardized partial regression coefficients

The mass media exposure variables (not included in Table 8) do not show any clear picture of association with the various measures of fertility and its components in the individual-level analysis. The only significant results are for clusters exposed to both radio and television media, where women are more likely to want fewer children. A different approach with a focus on the significance of having heard or seen media messages specifically on the subject of family planning is explored in Appendix A.

6.   Simulations of Fertility Decline and Conclusions

6.1.   Fertility Simulations

The central concern in this study is to delineate the major determinants of fertility in Nigeria and to evaluate the role they may play in the future level of reproduction. Recent national trends in fertility have not shown strong indications of a decline. Over the 10 years leading up to the 2013 DHS survey, the three latest surveys indicate virtually no change in fertility. The TFR was 5.7 in both 2003 and 2008 and 5.5 in 2013. The average number of children ever born to married women also shows virtually no change, from 4.1 in 2003 to 4.0 in both 2008 and 2013. Measures of reproductive preferences—the desired number of children and the proportion of women who want no more children—show no change. Current contraceptive use increased from 13% to 15% among married women over the decade. A decline in postpartum insusceptibility, from a median of 13.8 months in 2008 to 12.6 months in 2013, tended to offset the increase in contraceptive prevalence. This pattern is described in a review of sub-Saharan African countries, not including Nigeria (Johnson, Abderrahim, and Rutstein 2011).

Some measures, however, appear to be moving in a direction that implies future declines in fertility. The mean age at marriage, among married women, has increased over the decade, from 16.6 in 2003 to 17.7 in 2013, and shows a two-year increase in mean age at marriage among men, from 24 in 2003 to 26 in 2013. A specification of 18 as the minimum age at marriage is in the Nigeria Child's Rights Act but does not seem to have been observed in many of the states. The law does not align with most systems of customary law and Islamic law on marriage.

The proportion of women in polygynous unions declined between 2003 and 2013, from 36% to 33% among women and from 23% to 15% among men. The average number of years of schooling increased from 3.8 to 4.9 among women and from 6.2 to 7.2 among married men. The percentage of married women with the experience of a child death declined from 44% in 2003 to 34% in 2013.

The following simulations estimate the hypothetical average number of children ever born to married women implied by different assumptions about the future values of four variables. Age at marriage is assumed to rise universally to over age 17, a level that in 2013 included only 42% of married women. Child mortality, currently experienced by 34% of married women, is set at zero. The percentage of married women who are in polygynous unions, currently 34%, is set at zero. And the future number of years of schooling is assumed to be more than five for all married women, versus only 46% of women in 2013.

These are all extreme values that are intended to capture the potential impact of these four different components of change on the number of children ever born to married women (Figure 14). To illustrate: The mean number of children ever born (CEB) to married women with no child death in their history (two-thirds of married women) is 2.9 children in contrast to 4.8 CEB to women who have experienced at least one child death. Since the mean CEB for all married women in 2013 is 4.0, the potential impact on fertility of reducing child mortality (in this example, eliminating it entirely) is considerable, from 4.0 to 2.9.

Following the same logic, the potential impact on fertility of increasing the age at marriage is also significant. If we assume age at marriage to be older than 17, the result is an estimated CEB of 3.3. The combined "effect" of this assumption along with zero child mortality would be a CEB of 2.6.

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Figure 15. Estimated reductions in the number of children ever born to currently married women if polygyny were zero, or if schooling exceeded five years, or if age at marriage exceeded 17, or if child mortality were zero

	Percent in 2013	Mean Number Children Ever Born
All currently married women	100	4.0
Percent not polygynous	67	3.6
Percent with more than 5 years school	46	3.4
Percent marry after age 17	42	3.3
Percent with no child deaths	66	2.9
Percent with all four assumptions	22	2.4
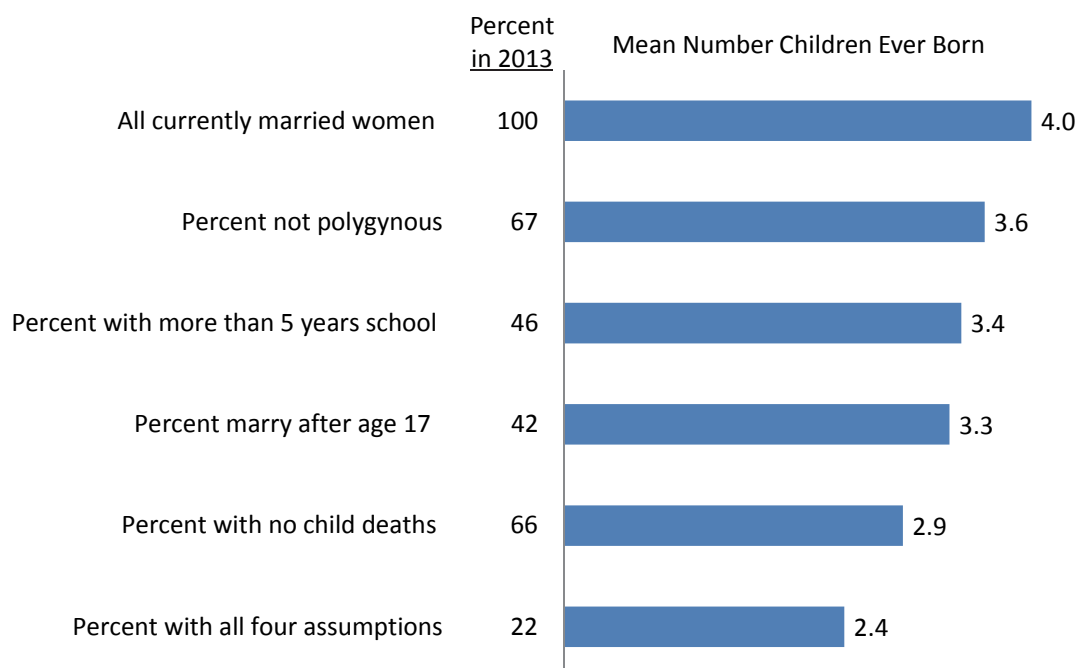
Alone, the assumption of universal monogamy would imply a CEB of 3.6. Women with co-wives have an average CEB of 4.7. When combined with the later age at marriage, the CEB would be 3.0, and would be 2.5 with zero child mortality also included.

The remaining variable in this exercise is education, measured by the total number of years of schooling. A recent study of childbearing dynamics among married women in Nigeria reaffirmed the role of education in the length of birth intervals and the number of children ever born (Adebowale et al. 2014). The assumption here is that all married women would have more than five years of schooling. Alone, this implies a reduction of the CEB from 4.0 to 3.4[1]. When combined with the later age at marriage assumption, the CEB is reduced to 2.9, and with zero child mortality, to 2.5. The further inclusion of the assumption of universal monogamy—the full picture for all four variables considered together—implies a CEB of 2.4.

The same simulations were undertaken for the 8,723 currently married men in the 2013 Nigeria DHS and show a similar picture. The hypothetical age at marriage is set higher for men than for women, at a minimum of 24 years, which is currently the median age at marriage for men, and the minimum amount of schooling is set at six years, a year more than for women (a criterion that excludes illiterate men). When all four variables are included, the CEB drops from 4.2 to 2.3. The only difference from the analysis of women involves polygyny, which plays a more significant role for men than for women. If the only hypothetical change is the assumption that all marriages would be monogamous, the estimated CEB for men would be 3.4 compared with 3.6 for women.

For both women and men, these variables are all interrelated. Returning to the model for women, taking these associations into account suggests a more parsimonious picture including only three of the four assumptions, while excluding the monogamy condition. The three assumptions of zero child mortality, marriage ages older than 17, and a minimum of five years of schooling collectively imply a CEB of 2.5 births for married women. In 2013, women with these three characteristics were 25% of the married population. A recent analysis of the demographic significance of polygyny is that it makes "a substantial

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[1] If universal literacy is substituted for more than five years of schooling, it alone would imply a CEB of 3.3.

contribution to demographic growth in sub-Saharan Africa, and can be seen as a partial explanation for the delayed demographic transition" (Cahu, Fall, and Pongou 2014). Our estimate of the polygyny effect for Nigeria is more modest, and its impact is clearly moderated by its relationships with the other three measures in the simulation exercise. Other variables, such as wealth and urban residence, also relate to fertility and its components, but education is the dominant factor.

6.2.   Conclusion

This report used data from DHS surveys conducted in Nigeria in 2013, 2008, and 2003 to examine fertility and related measures based mainly on data aggregated for states. It thus differs from the more familiar analysis of data from samples of individual women. The study demonstrates the importance of women's education, which explains large proportions of the variance among Nigeria's states in age at marriage, ideal number of children, demand for family planning, child mortality, teenage fertility, and total fertility. An analysis of Nigerian fertility based on both individual women and men in the 2003 and 2008 DHS surveys also found that education is a strong predictor of fertility outcomes (Mberu and Reed 2014).

Our analysis of fertility trends found that increases in age at marriage are related to declines in teenage childbearing and in polygyny, as well as to increased electrification. Declines in polygyny are associated with declines in child mortality and in the proportions of Muslims, and with increases in schooling. Declines in the ideal number of children are related to increases in literacy, declines in teenage childbearing, and greater participation of women in household decision-making. Increases in the proportion of women who want no more children are related to increases in television exposure, use of contraception to limit fertility, and intention to use contraception. Contraceptive use increases with urbanization, radio exposure, and an increase in the proportions married. Declines in teenage fertility are related to lower proportions married, a reduction in the ideal number of children, and increases in the age at marriage. Declines in total fertility are related to declines in child mortality and to increases in women's education.

The stated goal of the national population policy in 2004, to reduce the national rate of population growth to 2.0% by 2015, has not been achieved. The growth rate is currently about 2.5%. The fertility rate has remained essentially unchanged at 5.5 births per woman, despite a target that would have reduced the TFR to about 4.0 currently. The use of modern contraception has not increased by two percentage points per year as recommended. Reductions of infant and child mortality have been realized but the rates remain about twice as high as the specified targets. The recommended achievement of universal basic education is still to be realized, with about a third of women and a fifth of men having no schooling at all. Close to half of women and a quarter of men are illiterate.

Continuing increases in the education of women along with reductions in both child mortality and polygyny are likely to contribute to the future decline of fertility in Nigeria. The study's simulations indicate the importance, for lower levels of fertility, of further reductions in child mortality, increases in age at marriage, and increases in the education of women. Essential ingredients for such changes are the support of the central government and the continuation of international donor support for family planning programs, as highlighted in a recent review of fertility policies throughout sub-Saharan Africa (May 2016).

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Appendix A: Media Messages on Family Planning

The DHS includes a standard question on media messages about family planning. We show here the most recent picture for Nigeria in 2013 at the state level for both radio and television messages (Maps 9 and 10). Overall, in the 2013 DHS one-third (33%) of women reported having heard family planning messages on the radio, and one-fifth (19%) reported having seen such messages on television. As these two maps show, the states with the most frequently reported family planning messages are in the South, especially the South West. Table A-1 shows regional trends since 2003 for both women and men. There is a general decline in the proportions reporting having received such messages on both radio and television, but somewhat greater exposure for men than for women. The decline is consistent with declines in radio listening generally, while overall television exposure seems to have increased among women but not among men (not shown here).

Map 9. Percentage of women who recently heard radio messages on family planning
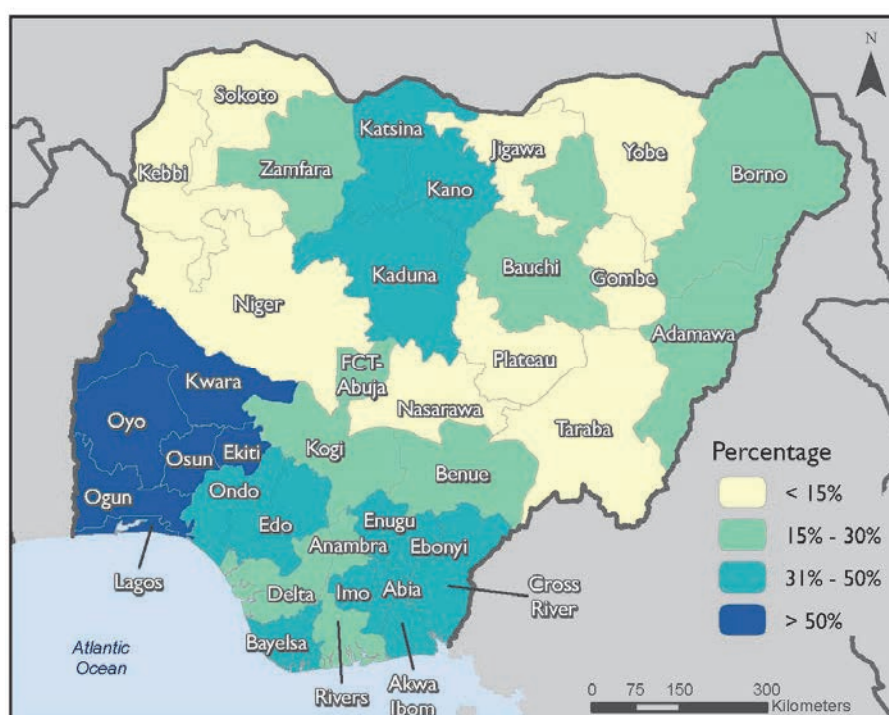
Map 10. Percentage of women who recently saw television messages on family planning
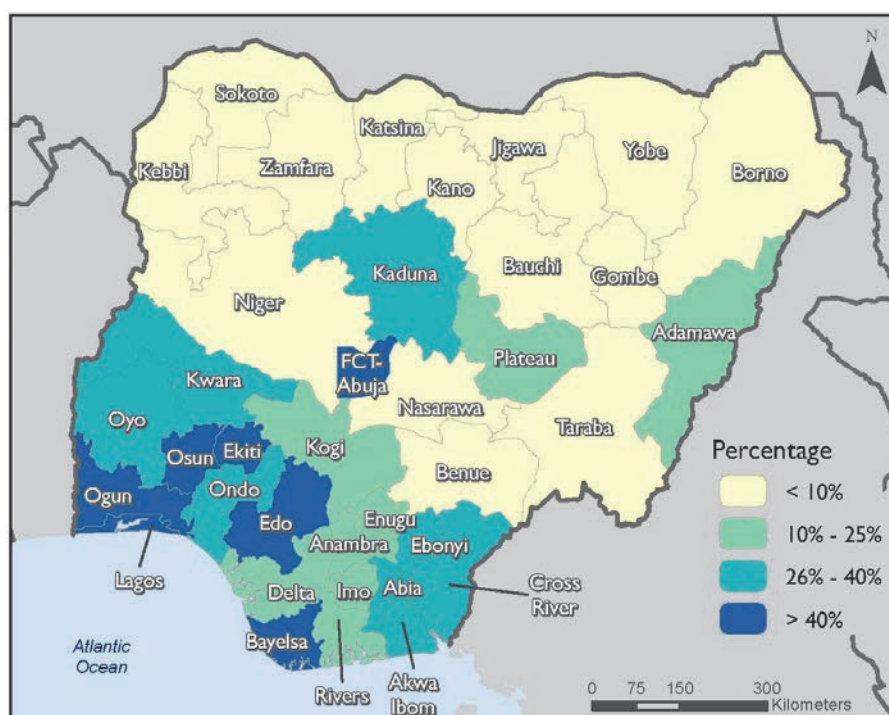

Table A-1. Regional trends in the percentages of men and women who received radio and television messages on family planning in the past few months, 2013, 2008, 2003, Nigeria

	WOMEN					
	Radio			Television		
	2003	2008	2013	2003	2008	2013
North Central	26	19	25	14	13	15
North East	21	15	15	8	6	7
North West	39	30	24	11	6	6
South East	54	55	38	28	35	24
South South	49	44	38	36	35	30
South West	64	67	65	47	51	49
Nigeria total	40	40	33	21	24	19
	MEN					
	Radio			Television		
	2003	2008	2013	2003	2008	2013
North Central	54	55	49	32	32	25
North East	49	44	33	24	12	13
North West	49	52	34	17	13	7
South East	43	72	49	28	49	31
South South	61	63	70	40	46	54
South West	80	66	64	61	45	45
Nigeria total	56	59	53	32	32	26

Table A-2 shows the covariates of exposure to media messages on family planning. This analysis is based on average women's characteristics in the 896 clusters in 2013. The picture is the same for both radio and television exposure. The strongest association shows greater media exposure in wealthier clusters. Other cluster covariates with lower but significant associations are higher levels of schooling, lower proportions in rural areas, and higher proportions in the South.

Table A-2. Multiple regression analysis of factors affecting having received media messages on family planning in the last few months before the survey, based on the average women's characteristics in 896 clusters, Nigeria 2013

Women's Characteristics	Radio Messages on Family Planning	Television Messages on Family Planning
Mean years of schooling	.13	.18
Proportion rural	—.12	—.11
Proportion in South	.17	.16
Mean wealth percentile	.44	.47
R^2	.54	.65

Note: Standardized partial regression coefficients

The important question is the extent to which exposure to family planning messages results in greater use of contraception, or perhaps in desire for fewer children. The DHS surveys are cross-sectional, not longitudinal in design, so the "effects" of media exposure on family planning behavior cannot be assessed with a "before" and "after" time sequence of exposure and behavior. The only evidence that can be assembled is the association between media exposure and reproductive behavior, not clearly whether exposure to messages on radio or television causes or leads to certain behavior. If there were no causal connections there would be no association, but the reverse is not true. For example, women who are currently using a contraceptive method may be more sensitive to radio or television messages on family planning after having started use of a method at an earlier time. So, the presence of an association between such media exposure and the use of contraception does not "prove" a causal connection, though the absence of any association would imply the absence of such a connection. The same logic applies to any connection with the number of children desired. Women who want fewer children may be more sensitive to media messages on family planning, or women exposed to such messages may want fewer children as a result.

Table A-3 shows the associations of current method use and of the number of children desired by women with reports of having heard radio or seen television messages on family planning simultaneously with covariates of schooling, Muslim religion, residence in the South, and wealth. The statistics are based on the 896 clusters. With all four covariates included, there are still significant positive associations with media exposure and current contraceptive use, and negative associations with the number of children desired, both stronger for television. The variable "years of schooling" shows the strongest association, for both radio and television.

Table A-3. Multiple regression of factors associated with current use of contraception and with number of children desired, based on women's characteristics in 896 clusters, Nigeria 2013

Covariates	Current Use of Contraception	Number of Children Desired
Heard radio messages	.13	—.09
Years of schooling	.36	—.46
Muslim	—.11	.31
South	.23	(—.01)
Wealth	.13	—.13
R^2	.69	.81
Saw television messages	.17	—.17
Years of schooling	.37	—.46
Muslim	—.09	.31
South	.23	(—.00)
Wealth	.09	—.08
R^2	.69	.82

( ) Not significant at the .05 level