BIRTH SPACING AND PARITY PROGRESSION IN NIGERIA

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Abstract

High fertility and close birth spacing are associated with poorer child and maternal health outcomes, reduced quality of maternal care for both the newborn and older siblings, and high completed fertility rates among women. While previous research exists which shows the sociodemographic correlates of birth spacing, so far, there has been little research into parity progression among women in Nigeria. Therefore, we examined parity progression among Nigerian women, as well as the prevalence of, and factors influencing birth spacing in Nigeria between 2008 and 2018. Data from the 2008-2018 Nigeria Demographic and Health Surveys were used. Parity progression ratios, frequency distributions, chi square analysis and logistic regressions were conducted. This study concludes that Nigerian women have a high probability of progressing to higher parities, and this differs by educational level, wealth status and ethnicity. Women's probability of progressing to higher parities reduced with increasing education and wealth status, while the highest parity progression ratios were found among Hausa/Fulani and minority tribe women. Additionally, while we found that a relatively high number of women of childbearing age had birth intervals in agreement with the minimum WHO's standard (24-36 months) during the three years under review, a sizable number of Nigerian women still had short birth intervals. It is also concluded that the length of birth intervals among women of childbearing age are associated with socio-demographic factors such as women's age, education, wealth status, marital status, religion, age at first cohabitation, son preference, daughter preference, number of children ever born, contraceptive use, duration of breastfeeding and child survival.

Keywords: parity progression, birth spacing, women, Nigeria.

Introduction

Nigeria is one of the greatest contributors to maternal mortality globally, with 814 maternal deaths per 100,000 live births (World Health Organization, 2015). Nigeria also has an under-five mortality rate of 117 per 1,000 live births; infant mortality rate of 74 per 1,000 live births, and neonatal mortality rate of 37 per 1,000 live births (United Nations Children Education Fund, 2015). Research has however discovered that short birth spacing is one of the major factors responsible for adverse outcomes, including mortality, for both mothers and children (Aleni et al., 2020; Damtie et al., 2021; Fotso et al., 2013).

Birth spacing, commonly referred to as birth interval, is the practice of delaying pregnancies. A minimum of 2-3 years between births is advised by the World Health Organization (WHO) and other international organizations to lessen the risk of detrimental effects on mother and child health (World Health Organization, 2006). It however appears that a good number of women in Nigeria and across Africa do not adhere to the minimum waiting period recommended by the World Health Organization (Afolabi et al., 2021; Dim et al., 2013; Fayehun et al., 2011; Moultrie et al., 2012).

In examining birth intervals as a marker of fertility decline in Africa, it was discovered that lower-order birth intervals have increased in all countries, with the largest increases observed in Southern Africa (Moultrie et al., 2012). A similar study found out that birth intervals in Africa were longer compared to those in Asia and Latin America, though Africa has a TFR stall (Bongaarts & Casterline, 2014).

A higher probability of transition to higher parities among African women is a major contributor to the continuously high fertility regime on the continent. For instance, by 2055, the number of children in Africa will reach 1 billion, making it the continent with the highest proportion of children worldwide (United Nations Children Education Fund, 2019). Furthermore, according to data, Nigeria and other Sub-Saharan African nations will continue to have the highest birth rates for the remainder of this century (United Nations Children Education Fund, 2019). In examining the fertility transition in sub-Saharan Africa, it was discovered that transition to higher parities remained at about 90% and above in the majority of countries, while in Southern Africa it was around 80%. In countries where fertility transition was just beginning, progression to higher parities was relatively stable. West Africa showed a very limited reduction in fertility. The initial stage of fertility transition mainly resulted from the increase in age at first birth among women in sub-Saharan Africa (Lerch & Spoorenberg, 2017).

Shorter birth intervals also contribute to an increase in the total fertility rate (Afolabi et al., 2021). Birth intervals have been getting longer in Ethiopia, Kenya, Tanzania and Zimbabwe since the 1970s and are between 35 and 51 months in length (Towriss & Timæus, 2018). In another study examining time to second birth in selected sub-Saharan countries, the time to second birth was shorter than optimal in the Democratic Republic of Congo and Nigeria, long in South Africa and optimal in Ethiopia (Afolabi et al., 2021). Prior studies have identified some of the causes of short birth intervals, and consequently, rising parity among women between the ages of 15 and 49 who are capable of delivering children. Among them are sex preferences, mothers' nutrition, the length of breastfeeding, not using contemporary contraceptives, and religious beliefs, among others (Adebowale et al., 2011; Dim et al., 2013; Fayehun et al., 2011). It is crucial to note that if drastic measures and policy intervention programs are not implemented to address short birth intervals among women of childbearing age, there is a tendency for women to experience short and long-term health complications, including an increased risk of having a poor birth outcome, threats to the health of the child and the mother, as well as a high risk of infant mortality, among other risks (Adebowale et al., 2011).

Despite the amount of previous research done on birth spacing and parity progression, more elucidation is in order on the progression to higher parities, as well as factors which influence birth intervals in Nigeria. Therefore, this chapter examines: (i) the level of adherence to recommended birth spacing in Nigeria, (ii) the sociodemographic factors associated with length of birth spacing among Nigerian women, (iii) the transitioning of Nigerian women to higher parities, and (iv) sociodemographic variations in progressions to higher parities among Nigerian women. Secondary data from the 2008, 2013 and 2018 Nigeria Demographic and Health Surveys were used for the analysis. This chapter provides information on birth spacing and parity progression and fertility behaviour in Nigeria, and also provides information for policy makers and government and non-government actors to encourage optimum birth spacing, as well as the reduction of the currently high fertility regime in the country.

Literature Review

Level of adherence to recommended birth spacing

From their review of the levels of adherence of women of reproductive age to 2 to 3 years minimum period of birth spacing/interval as recommended by World Health Organization, several researchers have documented low compliance with the minimum recommended birth interval among women. For instance, in a longitudinal survey of Rufiji Health Demographic Surveillance System (HDSS), Exavery et al. investigated the levels and reasons causing non-adherence to recommended minimum inter-birth spacing among 8,980 reproductive-age women in Rufuji, Tanzania, and found that 48.4% of the 15,373 inter-birth intervals fell short of the minimum 33-month period between two live births advised by the WHO. Their findings also revealed that non-adherence was linked to younger mother ages, lower maternal education levels, multiple births from the previous pregnancy, previous births not delivered in a hospital, being an in-migrant resident, multi-parity, and marital status (Exavery et al., 2012).

Another study at the Federal Teaching Hospital Abuja, by Agida et al. (2016) evaluated the adherence level of 400 Nigerian women of reproductive age. Their findings suggested that the Federal Capital Territory of Nigeria has a high non-adherence to the WHO's notion of Healthy Timing and Spacing of Pregnancy (HTSP). Once more, a cross-sectional study involving 296 women aged 15 to 49 years aimed at documenting birth intervals and associated characteristics among women of reproductive age in rural Uganda at Yumbe Hospital. The study's purpose was to identify women who had at least two consecutive live babies. It was determined that just over half of the women had frequent births. Being young, not planning a second pregnancy, inconsistent contraceptive use, and not having the husband's input on whether to have the next child were all linked to short birth intervals (Aleni et al., 2020).Moreover, among Ethiopian women of reproductive age, other researchers, Damtie et al. (2021) assessed the pooled prevalence of short birth spacing and its correlation with contraceptive use, level of education, and length of nursing. They established that a sizable portion of women continued to use close childbearing intervals. It was also established that factors like breastfeeding for a long time and not using contraceptives were significantly linked to short birth spacing.

Factors associated with birth intervals

This section examines several factors associated with birth interval among women of reproductive age. Some of the identified factors under review include but are not limited to sex of prior birth interval, mother’s age, period of breast feeding, modern contraceptive use, women’s age at marriage, husband’s age at marriage, age at menarche, and place of residence among others were associated with birth interval and parity progression in many developing countries including Nigeria.

Birth intervals among mothers of childbearing age were significantly influenced by socio-demographic, economic, and birth history factors, according to evidence from different studies (Muluneh et al., 2020; Singh et al., 2010; Yohannes et al., 2011). In a survey carried out by Fayehun et al. (2011) on how birth intervals are influenced by the sex of a prior child across ethnic groups while controlling for socioeconomic and demographic factors. They used information on birth histories from the 2008 Nigeria Demographic and Health Survey, and found that Igbo and Southern minority tribes, who tend to desire male children sooner if preceding births were female, are slightly more affected by the gender of previous births. Also, women who have not yet achieved their preferred sex preference had shorter birth intervals than those who have across all ethnic groups. These findings imply that Nigerian parents balance their children's sex roles in addition to

their clear sex preferences. The survival of a child and future birth interval is strongly correlated, suggesting that mothers have a short birth interval and a high family size because they are unsure that their children will live.

Meanwhile, Adebowale et al., (2011) examined how maternal depletion syndrome among 1,450 women of reproductive age negatively impacts short birth spacing and high frequency of childbearing, and found that among other things, the parity progression rate was greater in undernourished women, and that 38.3 percent of undernourished mothers were responsible for births that occurred after intervals of less than 24 months (short birth interval). Adebowale et al's findings suggested that birth intervals of at least 36 months will result in the best nutrition-related health outcomes for mothers. Children also suffer the health consequences of short birth spacing. In India, it was discovered that firstborns tend to have a height advantage over their younger siblings when there is short birth spacing, and this height advantage disappears when higher-order children have a birth spacing of 3 or more years (Dhingra & Pingali, 2021).

Dim et al. (2013) carried out a similar study among 420 women who enrolled in the family planning and antenatal clinics of two hospitals in Enugu also substantiate the claim that short inter-birth intervals were strongly associated with women's ages of 25 years or less, breastfeeding durations of 10 months or less, and non-use of contemporary contraception. Again, in a case-control study which was carried out from February to April 2014 in Ethiopia, having no formal education, breastfeeding for fewer than 24 months, having a female child before, using contemporary contraceptives, and having a low-income index of respondents were all found to be independent predictors of a short birth interval (Berhan et al., 2011).

Gebrehiwot et al. (2019) found that short birth intervals were linked to sub-optimal nursing, non-use of contraception, being Muslim, and not wanting the last child, according to their study. Meanwhile, Aleni et al. (2020) who examined birth intervals and related variables among 296 rural Ugandan women between the ages of 15 and 49 opined that the factors identified as being associated with birth interval included being younger (15–24 years old), not planning a second pregnancy, not deciding when to have a child with the husband, not always using contraceptives before the next pregnancy, and not having the husband's input when deciding when to have the next child.

Dehesh et al. (2022) investigated characteristics relating to the timing of the first child after the first marriage among 1,350 Iranian women, and found that woman's age at marriage, husband's age, age at first menstrual cycle, place of residence and having engagement period significantly influenced short first-birth interval while woman's body mass index (BMI), woman's university education, husband university education level, contraceptive use and income sufficiency determines long first-birth interval.

Mothers' age had different influences on birth spacing, as different studies in African countries had varying results. While Rafalimanana and Westoff found that older women preferred shorter birth intervals, Ajayi and Somefun found older women preferred longer birth intervals and younger women preferred short intervals, and Afolabi et al. found that women over 25 preferred longer birth intervals, except in Nigeria (Afolabi et al., 2021; Ajayi & Somefun, 2020; Rafalimanana & Westoff, 2000). Age at marriage is also an important decider of the length of birth intervals, as Muluneh et al. found in Ethiopia that women who married at 18 and older were less likely to have shorter birth intervals (Muluneh et al., 2020). Fayehun et al. however found out in Nigeria that women who married at age 20 and above had shorter birth intervals (Fayehun et al., 2011). Chernet

et al. found that women who married at younger ages had a longer time-to-first-birth interval in Ethiopia (Chernet et al., 2019).

The length of birth intervals is influenced by education. Women who are educated and who have educated husbands prefer longer birth intervals (Afolabi et al., 2021; Ajayi & Somefun, 2020; Muluneh et al., 2020; Rafalimanana & Westoff, 2000); however, Ajayi and Somefun (2020) found that women who have secondary and higher education in Nigeria are more likely to have short birth spacing. Women in employment in Chad, Tanzania and Nigeria are also more likely to have longer birth spacing (Ajayi & Somefun, 2020). Women with at least secondary education have shorter time-to-first birth after marriage (Chernet et al., 2019). Women with high socioeconomic status were found to have longer birth intervals in (Afolabi et al., 2021; Muluneh et al., 2020). In Uganda, women from rich households had a higher odds of short birth spacing (Ajayi & Somefun, 2020). In Nigeria, however, women from households in the middle wealth tertile had a higher odds of long birth spacing (Fayehun et al., 2011).

The influence of religion and culture on birth spacing is also important. Non-Christians had shorter birth intervals in Ethiopia and Nigeria (Afolabi et al., 2021; Gebrehiwot et al., 2019). In Nigeria, ethnicity was discovered to influence birth spacing, as Yoruba women had longer birth intervals than other ethnic groups, while Igbo women the shortest birth intervals (Fayehun et al., 2011). Urban women had longer birth intervals than rural residents (Afolabi et al., 2021; Chernet et al., 2019; Towriss & Timæus, 2018).

Contraceptive use is a significant influence on birth spacing, as women who use modern contraceptive methods tend to have longer birth spacing (Chernet et al., 2019; Damtie et al., 2021; Moultrie et al., 2012; Rafalimanana & Westoff, 2000; Towriss & Timæus, 2018). Contraception was acceptable for birth spacing but not for limiting family size in a study conducted among religious leaders in Somalia (Egeh et al., 2019). Similarly, where the length of breastfeeding duration is less than 24 months, women were likely to have shorter birth intervals (Damtie et al., 2021).

Marital status was found to influence birth spacing in a study conducted using DHS data from several sub-Saharan African countries. Married women had a lower odds of short birth spacing in Chad but higher odds in DR Congo (Ajayi & Somefun, 2020). Married women were also observed to have a short birth spacing between their first and second births (Afolabi et al., 2021). Marital dissolution influences birth spacing, as separation after first birth was found to result in an increase in the birth interval of the second birth in Western Europe (Kreyenfield et al., 2017).

The length of birth spacing is also associated with access to healthcare services. Women who live more than 20 minutes' distance to HF were more likely to have sub-optimal spacing, and women who used PNC after last birth were less likely to have sub-optimal spacing (Muluneh et al., 2020).

A study in Nigeria showed that birth intervals were influenced by child preference. Birth intervals were shorter where the sex preference was not met in the previous birth among Hausa/Fulani, Igbo and Southern minority women. Son preference caused shorter birth spacing among the Igbos while daughter preference did same among Yorubas (Fayehun et al., 2011). Also, child survival influenced birth spacing, as survival of the preceding child was associated with lower odds of short birth spacing (Ajayi & Somefun, 2020; Fayehun et al., 2011).

Conceptual Framework

Figure 1 below illustrates the interaction between the independent, intervening and dependent variables. For instance, the more educated the mothers are concerned about the consequences of short birth spacing, the more likely they would have longer intervals. Again, those in the rural areas are more likely to have shorter birth spacing when compared with their counterpart in the urban centres. This is partly because of their exposure, and the difference in the cost of raising children in the two locations.

It is also worthy to note that when women marry at older ages, they are more likely to have more children within a limited period of time when compared with women who do not have challenge in conception. The length of time for breastfeeding had also shown over time to prolong conception while those women who introduce supplement for their babies so quickly may have low birth spacing. The use of modern contraception such as condom, pills, intra-uterine devices among others prolong birth interval if properly and consistently used (Aleni et al., 2020, Damtie et al., 2021; Dehesh et al., 2022; Gebrehiwot et al., 2019).

In many African societies, which Nigeria is no exemption, the value placed on the male child is quite high due to patriarchal nature of the society. Woman with many female children may still keep having children in quick succession with the hope of having a male child. This often times results in short birth intervals.

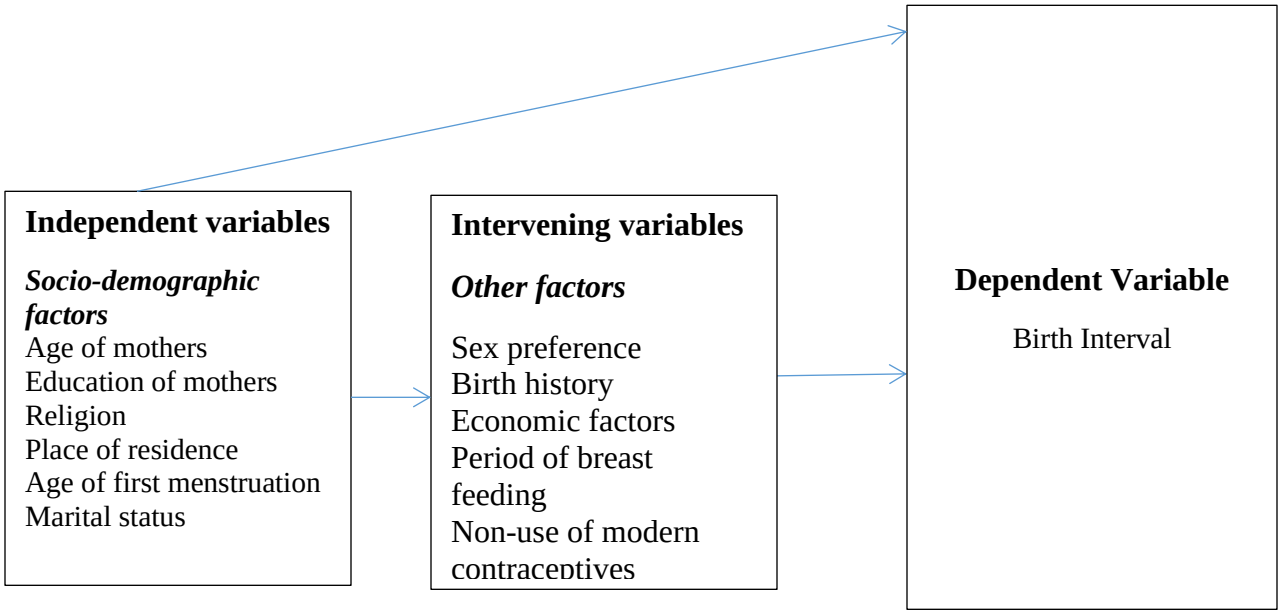

Figure 1: Conceptual Framework

Methodology

The study used the Nigeria Demographic and Health Survey data from surveys conducted in 2008, 2013, and 2018. The Demographic and Health Surveys are a series of nationally-representative household surveys conducted by Measure DHS every five years in more than 85 low- and middle-income countries since 1984. The surveys collect self-reported data on fertility, mortality, sexual and reproductive health indicators, general health, and household living conditions. The individual recode dataset was used for all three waves, and the study population comprised of all women aged 15-49 to calculate the parity progression ratios (N= 32706 (2008), 38555 (2013), and 35032 (2018)), and those with at least two children for the birth spacing analysis (N=15775 (2008), 22931 (2013), and 25189 (2018)). Sample weights were applied to the data to correct for imperfections in the sampling techniques, such as unequal probabilities of section, which might result in bias; to account for non-responses, and ensure that the samples are properly representative of the population (Yansaneh, 2003).

The parity progression ratio (PPR) was used to measure the probability of transitioning from lower to higher parities for women (Adebowale et al., 2011; Lerch & Spoorenberg, 2017). Total PPRs were calculated for women in 2008, 2013, and 2018, after which the PPRs were disaggregated by educational level, wealth status and ethnicity for each year. PPR analysis was conducted using Microsoft Excel.

For the birth spacing analysis, the outcome variable was coded in three categories, namely, less than 24 months, 24-36 months, and more than 36 months, representing short, medium-length, and long birth intervals respectively. Data analysis was conducted at three levels, which were univariate (frequency distributions), bivariate (chi-square tests of association and bivariate logistic regression) and multivariate (multinomial logistic regression). Only the independent variables which were significantly associated ($p<0.05$) in the bivariate analysis were included in the multivariate analysis. Data analysis were carried out using Stata version 14.

Results

Frequency Distribution

Table 1 shows the frequency distribution of selected variables between 2008 and 2018. From the table, it can be seen that the majority of respondents had long inter-birth intervals of more than 36 months (2008: 41.3%; 2013: 41.4%; 2018: 40.8%), followed by medium-length birth intervals (24-36 months) (2008: 37.7%; 2013: 38.7%; 2018: 38.5%), and short birth intervals of less than 24 months (2008: 21.0%; 2013: 19.9%; 2018: 20.7%).

Table 1: Frequency distributions

Variables	Year		
	2008 (%) **(N=15775)**	2013 (%) **(N=22931)**	2018 (%) **(N=25189)**
Age			
15-19	45 (0.3)	267 (1.2)	246 (1.0)
20-24	1022 (6.5)	2466 (10.8)	2672 (10.6)
25-29	3042 (19.3)	4862 (21.2)	5154 (20.5)
30-34	3237 (20.6)	4519 (19.7)	5109 (20.3)
35-39	3203 (20.4)	4262 (18.6)	4877 (19.4)
40-44	2612 (16.6)	3337 (14.6)	3648 (14.5)
45-49	2566 (16.3)	3217 (14.0)	3482 (13.8)

Educational level			
None	7745 (49.1)	11097 (48.4)	11251 (44.7)
Primary	4019 (25.5)	4950 (21.6)	4535 (18.0)
Secondary	3188 (20.2)	5439 (23.7)	7278 (28.9)
Higher	823 (5.2)	1445 (6.3)	2125 (8.5)
Wealth index			
Poor	7102 (45.0)	10013 (43.7)	10534 (41.8)
Middle	3166 (20.1)	4355 (19.0)	5065 (20.1)
Rich	5507 (34.9)	8562 (37.3)	9589 (38.1)
Marital status			
Never in union	40 (0.2)	113 (0.5)	265 (1.1)
Presently in union	14796 (93.8)	21417 (93.4)	23208 (92.1)
Formerly in union	939 (6.0)	1401 (6.1)	1715 (6.8)
Religion			
Christianity	7097 (45.0)	9257 (40.4)	10330 (41.0)
Islam	8375 (53.1)	13405 (58.5)	14699 (58.4)
Other	303 (1.9)	268 (1.2)	159 (0.6)
Ethnicity			
Yoruba	2429 (15.4)	3092 (13.5)	3607 (14.3)
Igbo	1994 (12.6)	2633 (11.5)	3388 (13.5)
Hausa/Fulani	5613 (35.6)	9326 (40.7)	10298 (40.5)
Other	5740 (36.4)	7878 (34.4)	7986 (31.7)
Place of residence			
Urban	4734 (30.1)	8508 (37.1)	10460 (41.5)
Rural	10991 (69.9)	14422 (62.9)	14728 (58.5)
Region of residence			
North Central	2226 (14.2)	3148 (13.7)	3498 (13.9)
North East	2434 (15.5)	3697 (16.1)	4215 (16.7)
North West	4629 (29.4)	8033 (35.0)	8204 (32.6)
South East	1582 (10.1)	2085 (9.1)	2636 (10.5)
South South	2093 (13.3)	2379 (10.4)	2577 (10.2)
South West	2761 (17.6)	3588 (15.7)	4058 (16.1)
Age at first cohabitation			
<18			
18+	9729 (61.8)	13652 (59.8)	13452 (54.0)
	6006 (38.2)	9.166 (40.2)	11471 (46.0)
Son preference			
No son preference	8126 (50.5)	14771 (64.4)	17057 (67.7)
Son preference	7548 (49.5)	8160 (35.6)	8131 (32.3)
Daughter preference			
No daughter preference	9078 (57.7)	15312 (66.8)	17784 (70.6)
Daughter preference	6648 (42.3)	7618 (33.2)	7405 (29.4)
Number of children ever born			
2-4	6331 (40.3)	11646 (50.8)	13333 (52.9)
>4	9395 (59.7)	11284 (49.2)	11856 (47.1)
Contraceptive use			
Using modern method	1719 (10.9)	2576 (11.2)	3334 (13.2)
Using traditional method	830 (5.3)	1368 (6.0)	1244 (4.9)
Non-user, intends to use	2504 (15.9)	4263 (18.6)	6900 (27.4)
Non-user, no intention to use	10674 (67.9)	14723 (64.2)	13710 (54.4)
Duration of breastfeeding			
Never breastfed	223 (2.0)	274 (1.7)	523 (2.9)
<6 months	267 (2.4)	2251 (13.6)	2590 (14.3)

6-12 months	922 (8.2)	2790 (16.8)	2870 (15.8)
>12 months	4247 (37.8)	2925 (17.6)	2830 (15.6)
Still breastfeeding	5583 (49.7)	8349 (50.3)	9324 (51.4)
Previous child survived			
No	1484 (9.4)	1748 (7.62	1840 (7.3)
Yes	14241 (90.6)	21182 (92.4)	23348 (92.7)
Birth interval			
<24 months	3315 (21.0)	4554 (19.9)	5195 (20.7)
24-36 months	5941 (37.7)	8840 (38.7)	9672 (38.5)
>36 months	6519 (41.3)	9469 (41.4)	10259 (40.8)

Parity Progression Ratios

Table 2 and Figure 2 show the total parity progression ratios between 2008 to 2018. The PPRs show the probability of a woman progressing from one parity to the next. In 2008, women had a 97.4% probability of moving from parity 0 to parity 1, while they had a 69.2% probability of moving from parity 9 to parity 10 and higher. In 2013, women had a 97% probability of moving from parity 0 to 1, and a 72.2% probability of moving from parity 9 to parity 10 and higher. In 2018, women had a 97.2% probability of moving from parity 0 to parity 1, while they had a 69.3% probability of moving from parity 9 to higher parities.

Table 2: Unaggregated parity progression ratios for 2008-2018

Parity	Parity Progression Ratios			Notation
	2008	2013	2018	
0	0.974	0.970	0.972	a_0
1	0.971	0.979	0.971	a_1
2	0.969	0.959	0.940	a_2
3	0.938	0.928	0.916	a_3
4	0.901	0.888	0.868	a_4
5	0.849	0.847	0.826	a_5
6	0.826	0.823	0.780	a_6
7	0.785	0.760	0.776	a_7
8	0.714	0.755	0.739	a_8
9	0.692	0.722	0.693	a_9
10+				

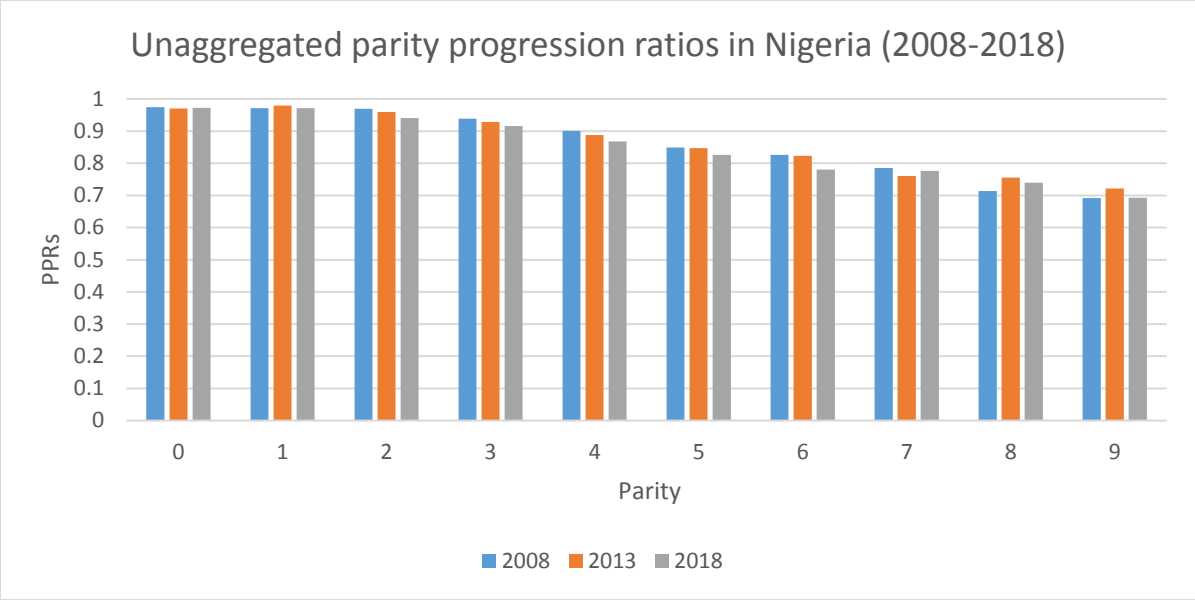

Figure 2: Unaggregated parity progression ratios in Nigeria (2008-2018)

Table 3 and Figure 3 show the parity progression ratios disaggregated by educational level from 2008 to 2018. The probability of advancing to higher parities was largest among women with no education across the three years, with greater decline as the level of education increased. While there was an increase in the PPR at the highest parity for women with no education in 2013, it decreased in 2018. For women with primary and secondary education, however, the PPR at highest parities increased from 2008 to 2018. The reverse was the case however for women with tertiary education, as the probability of transiting to higher parities declined from 2008 to 2018.

Table 4 and Figure 4 present the parity progression ratios disaggregated by wealth status from 2008 to 2018. PPRs across the different household wealth categories show a modest decline in the probability of progression to higher parities from poor, to middle-income and rich households. While the probability of transiting to the highest parities for women in poor households increased in 2013, it declined in 2018. For women in middle-income households, the PPR at highest parities remained constant between 2008 and 2013, and declined in 2018, while it increased year-on-year for women from rich households from 2008 to 2018.

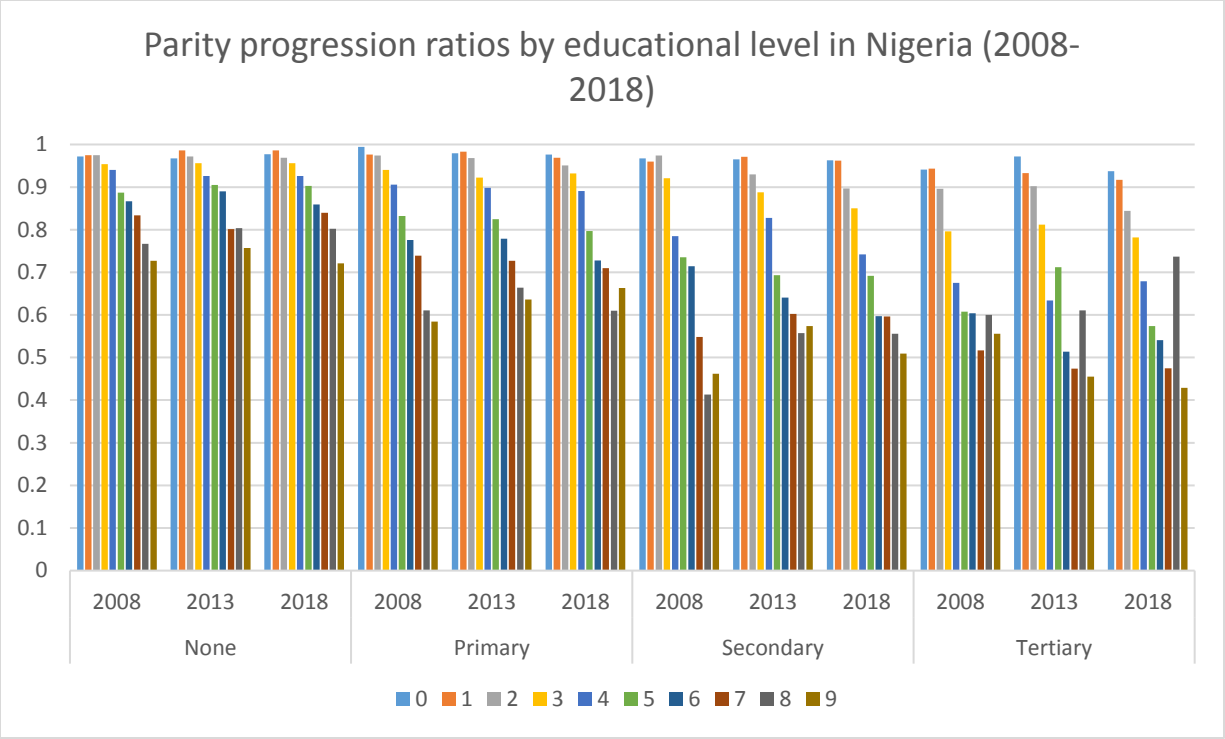

Figure 3: Parity progression ratios by educational level in Nigeria (2008-2018)

Table 5 and Figure 5 show the parity progression ratios disaggregated by ethnicity. PPRs at increasing parities declined the most among the Yoruba and Igbo tribes and the least among the Hausa/Fulani tribes, suggesting higher fertility among these women. For Yoruba and Igbo women, the PPRs at the highest parities first increased in 2013, before declining in 2018; they declined year-on-year for Hausa/Fulani women from 2008 to 2018, and increased year-on-year from 2008 to 2018 for women from minority tribes.

Table 3: Parity Progression by Educational Level (2008-2018)

Parity	Educational level												Notation
	None			Primary			Secondary			Tertiary			
	2008	2013	2018	2008	2013	2018	2008	2013	2018	2008	2013	2018	
0	0.972	0.967	0.977	0.994	0.979	0.976	0.967	0.965	0.963	0.941	0.972	0.937	a_0
1	0.975	0.986	0.986	0.976	0.983	0.969	0.960	0.971	0.962	0.943	0.933	0.917	a_1
2	0.975	0.972	0.969	0.974	0.968	0.951	0.974	0.930	0.897	0.896	0.902	0.844	a_2
3	0.954	0.956	0.956	0.940	0.922	0.932	0.921	0.888	0.850	0.796	0.812	0.782	a_3
4	0.940	0.926	0.926	0.906	0.898	0.891	0.785	0.828	0.742	0.675	0.634	0.679	a_4
5	0.887	0.905	0.903	0.832	0.825	0.797	0.735	0.693	0.692	0.608	0.712	0.574	a_5
6	0.867	0.890	0.859	0.776	0.779	0.728	0.714	0.641	0.597	0.604	0.514	0.541	a_6
7	0.834	0.801	0.840	0.739	0.727	0.710	0.548	0.602	0.596	0.517	0.474	0.475	a_7
8	0.767	0.804	0.802	0.611	0.664	0.610	0.413	0.557	0.556	0.600	0.611	0.737	a_8
9	0.727	0.757	0.721	0.584	0.636	0.663	0.462	0.574	0.509	0.556	0.455	0.429	a_9
10+													

Table 4: Parity Progression by Wealth Status (2008-2018)

Parity	Wealth status									Notation
	Poor			Middle			Rich			
	2008	2013	2018	2008	2013	2018	2008	2013	2018	
0	0.975	0.970	0.979	0.978	0.972	0.968	0.971	0.969	0.965	a_0
1	0.978	0.985	0.987	0.971	0.986	0.960	0.963	0.969	0.957	a_1
2	0.978	0.968	0.963	0.967	0.978	0.949	0.960	0.940	0.905	a_2
3	0.955	0.956	0.952	0.960	0.937	0.915	0.900	0.891	0.867	a_3
4	0.949	0.935	0.920	0.902	0.897	0.856	0.832	0.826	0.792	a_4
5	0.892	0.906	0.900	0.855	0.887	0.793	0.775	0.740	0.707	a_5
6	0.873	0.905	0.814	0.801	0.770	0.731	0.756	0.721	0.672	a_6
7	0.840	0.818	0.806	0.789	0.740	0.640	0.661	0.649	0.673	a_7
8	0.788	0.822	0.718	0.667	0.698	0.635	0.575	0.624	0.636	a_8
9	0.724	0.758	0.627	0.674	0.674	0.594	0.600	0.646	0.652	a_9
10+										

Table 5: Parity Progression by Ethnicity (2008-2018)

Parity	Ethnicity												Notation
	Yoruba			Igbo			Hausa/Fulani			Others			
	2008	2013	2018	2008	2013	2018	2008	2013	2018	2008	2013	2018	
0	0.998	0.992	0.990	0.956	0.946	0.939	0.960	0.972	0.982	0.978	0.964	0.972	a_0
1	0.968	0.976	0.968	0.959	0.969	0.947	0.970	0.985	0.988	0.977	0.975	0.968	a_1
2	0.967	0.942	0.918	0.975	0.958	0.911	0.974	0.968	0.974	0.963	0.952	0.931	a_2
3	0.888	0.847	0.835	0.938	0.925	0.882	0.959	0.963	0.970	0.943	0.917	0.920	a_3
4	0.762	0.749	0.724	0.898	0.885	0.792	0.952	0.944	0.952	0.924	0.866	0.878	a_4
5	0.647	0.594	0.616	0.840	0.876	0.721	0.910	0.894	0.936	0.874	0.836	0.817	a_5
6	0.664	0.535	0.569	0.761	0.784	0.609	0.885	0.909	0.896	0.829	0.759	0.735	a_6
7	0.507	0.451	0.431	0.715	0.646	0.602	0.866	0.814	0.869	0.773	0.707	0.719	a_7
8	0.500	0.390	0.380	0.581	0.628	0.538	0.772	0.804	0.804	0.678	0.649	0.626	a_8
9	0.486	0.563	0.211	0.570	0.592	0.386	0.713	0.696	0.649	0.634	0.642	0.678	a_9
10+													

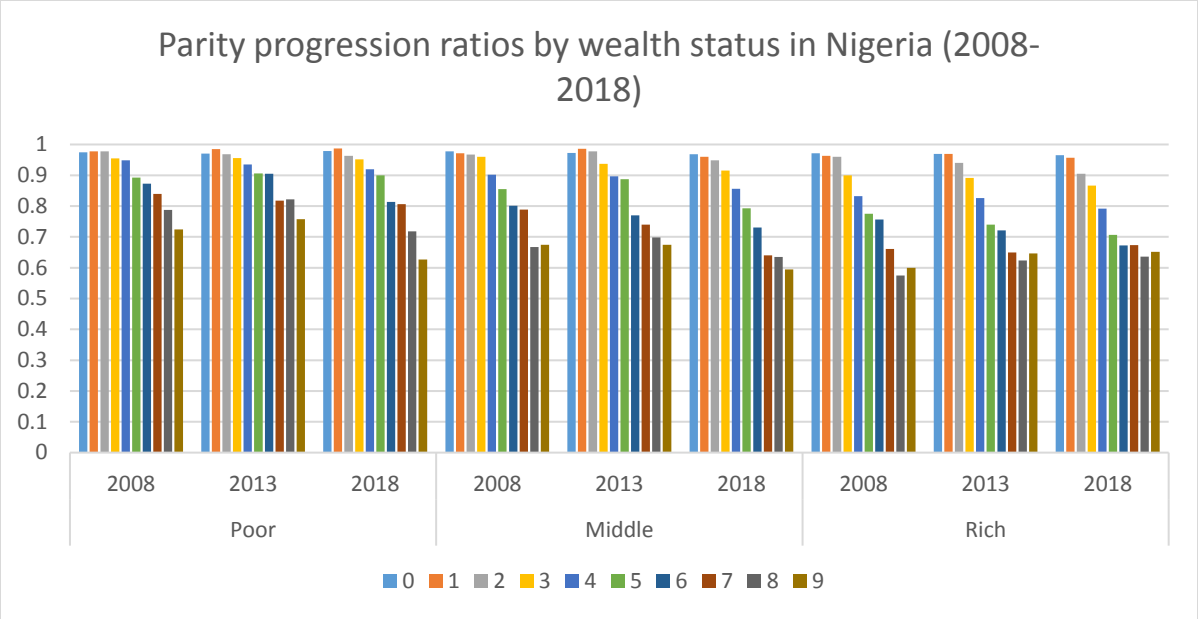

Figure 4: Parity progression ratios by wealth status in Nigeria (2008-2018)

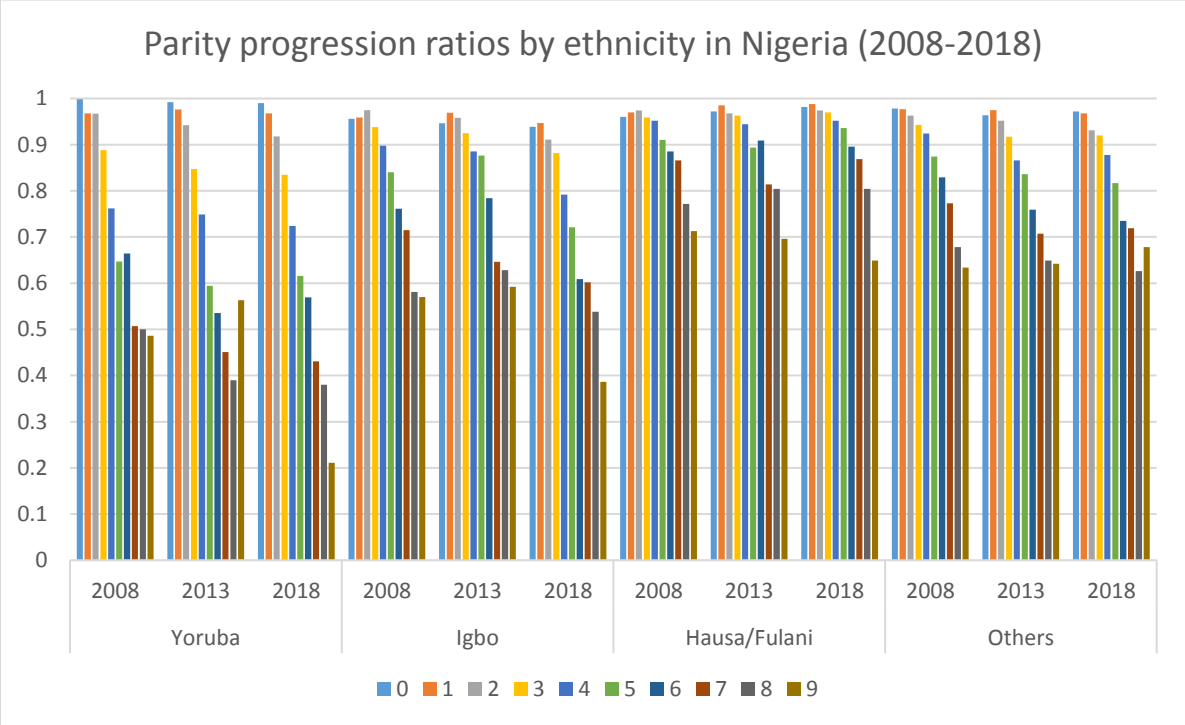

Figure 5: Parity progression ratios by ethnicity in Nigeria (2008-2018)

Birth spacing analysis

Table 6 shows the results of the chi-square test of association between variables and birth spacing length from 2008 to 2018. It was seen that age was significantly associated with length of birth spacing in all three years; so was education, wealth, marital status, region of residence, son and daughter preference, contraceptive use, duration of breastfeeding, and child survival. Religion and place of residence were significantly associated with length of birth spacing in 2013 and 2018 but not 2008; age at marriage was significantly associated with length of birth spacing in 2008 and 2018 but not 2013, and parity was only associated with birth spacing length in 2008.

Table 6: Bivariate analysis between variables and birth spacing length from 2008 to 2018

Variables	Duration of birth interval								
	2008			2013			2018		
	<24 months (%)	24-36 months (%)	>36 months (%)	<24 months (%)	24-36 months (%)	>36 months (%)	<24 months (%)	24-36 months (%)	>36 months (%)
Age			*			*			*
15-19	48.2	42.7	9.1	36.9	50.0	13.1	32.8	51.9	15.3
20-24	30.2	47.8	22.0	26.1	48.2	25.7	28.2	48.6	23.2
25-29	24.1	43.8	32.1	21.8	42.6	35.5	23.3	42.8	33.9
30-34	19.5	40.6	39.9	19.4	40.9	39.6	20.4	39.7	39.9
35-39	17.9	36.2	45.9	16.9	36.9	46.3	17.4	36.6	46.0
40-44	19.3	31.2	49.5	17.9	31.2	50.9	18.3	31.8	50.0
45-49	20.8	31.0	48.2	17.8	31.4	50.8	17.8	31.4	50.8
Education			*			*			*
No education	22.2	38.2	39.6	20.8	40.3	39.0	21.4	40.5	38.1
Primary	19.9	37.1	43.0	18.8	37.3	44.0	18.5	36.9	44.5
Secondary	20.3	37.5	42.2	19.2	38.0	42.8	20.6	36.8	42.6
Higher	18.1	36.4	45.5	20.0	33.7	46.3	21.3	37.2	41.5
Wealth status			*			*			*
Poor	21.7	38.3	40.0	21.4	40.8	37.8	21.1	41.0	37.9
Middle	22.6	37.7	39.7	19.2	38.8	42.0	20.9	38.6	40.5
Rich	19.3	36.8	43.9	18.6	36.1	45.3	20.1	35.6	44.3
Marital status			*			*			*
Never in union	29.0	38.9	32.0	17.5	34.2	48.4	18.1	34.4	47.5
Presently in union	20.8	37.9	41.3	19.8	39.0	41.2	20.9	38.8	40.3
Formerly in union	21.0	33.4	42.3	21.7	33.7	44.6	18.0	35.0	47.0
Religion						*			*
Christianity	20.5	37.0	42.4	19.5	36.7	43.8	20.1	35.9	44.0
Islam	21.5	38.2	40.3	20.2	40.0	39.7	21.0	40.3	38.7
Other	21.1	36.5	42.4	19.9	37.1	43.0	24.8	40.5	34.7
Ethnicity			*			*			*
Yoruba	13.2	34.2	52.6	11.7	33.3	54.9	14.4	31.6	54.0
Igbo	25.9	38.5	35.6	24.0	39.6	36.4	25.1	37.9	37.0
Hausa/ Fulani	22.8	38.9	38.3	21.4	40.7	38.0	21.7	41.6	36.7
Other	20.9	37.6	41.5	20.1	38.1	41.9	20.3	37.9	41.8
Place of residence						*			*
Urban	19.9	38.0	42.0	18.6	37.0	44.4	20.1	36.5	43.3
Rural	21.5	37.5	41.0	20.7	39.7	39.7	21.1	39.9	39.0
Region of residence			*			*			*
North Central	18.2	37.1	44.7	16.6	39.5	43.8	17.8	40.2	42.0

North East	22.9	39.4	37.8	22.9	40.7	36.4	23.0	39.7	37.4
North West	22.9	38.3	38.8	20.5	39.8	39.8	21.6	41.6	36.8
South East	28.0	37.7	34.3	24.5	39.5	36.0	25.7	38.5	35.8
South South	21.4	37.7	40.9	21.3	35.8	42.9	21.9	33.5	44.6
South West	14.3	35.4	50.3	14.8	34.7	50.4	15.0	32.5	52.4
Age at first cohabitation			*						*
<18	21.7	37.9	40.5	20.1	39.1	40.7	21.0	39.5	39.5
18+	19.9	37.4	42.7	19.6	38.1	42.3	20.3	37.4	42.3
Son preference			*			*			*
No son preference	19.8	37.0	43.2	19.4	38.4	42.2	20.4	37.6	42.0
Son preference	22.4	38.3	39.3	20.9	39.1	40.0	21.2	40.3	38.5
Daughter preference			*			*			*
No daughter preference	19.8	37.6	42.6	19.5	38.1	42.4	20.7	37.8	41.5
Daughter preference	22.8	37.7	39.5	20.9	39.8	39.4	20.7	40.1	39.1
Number of children ever born			*						
2-4	20.0	39.1	40.9	19.5	39.5	41.0	20.8	38.6	40.6
>4	21.7	36.7	41.5	20.3	37.8	41.8	20.5	38.4	41.1
Contraceptive use			*			*			*
Using modern contraceptives	18.8	37.7	43.5	17.3	35.7	47.0	20.1	36.5	43.4
Using traditional methods	18.5	38.3	43.2	16.7	38.9	44.4	20.3	36.4	43.3
Non-user, intends to use	20.7	40.4	38.9	20.3	41.1	38.6	21.1	41.1	37.8
Non-user, does not intend to use	21.7	37.0	41.4	20.6	38.5	41.0	20.6	37.9	41.5
Duration of breastfeeding			*			*			*
Never breastfed	23.6	36.8	39.6	25.3	37.3	37.3	23.1	35.4	41.5
<6 months	35.0	35.3	29.7	15.1	40.6	44.3	14.1	40.9	45.0
6-12 months	27.5	36.2	36.3	15.2	42.5	42.3	17.7	42.4	39.9
>12 months	19.5	38.2	42.3	18.3	40.9	40.8	20.6	42.4	37.0
Still breastfeeding	17.6	40.9	41.5	21.6	39.1	39.3	23.1	38.5	38.4
Child survival			*			*			*
No	33.1	35.8	31.1	27.0	40.1	32.9	27.9	39.1	32.9
Yes	19.8	37.9	42.4	19.3	38.5	42.1	20.1	38.4	41.5

Source: NDHS 2008-2018 *significant at $p<0.05$

Multinomial logistic regression

Table 7 presents the results of the multinomial logistic regression between selected variables and birth spacing in 2008, 2013, and 2018. In 2008, women aged 20-49 had a significantly higher likelihood of medium-length as well as long spacing compared to those aged 15-19. Similarly, in 2013, women aged 20-49 had a higher likelihood of medium-length and long spacing than women aged 15-19. The trend remained the same in 2018, as women aged 20-49 had a higher likelihood of long birth spacing compared to women aged 15-19. Women aged 25-49 had a higher likelihood of medium-length birth spacing.

The socioeconomic status, of women, measured by educational level and wealth status, influenced their birth spacing length. In 2008, women with primary education were more likely to have long birth spacing compared to those with no education. In 2013, women with higher education had a lower likelihood of medium-length and long birth spacing compared to those with no education. In 2018, women who had primary and secondary education had a higher likelihood of long birth spacing, while women with primary education had a higher likelihood of medium-length birth spacing. In 2018, women from rich households had a lower likelihood of medium-length spacing compared to women from poor households.

Marital status, religion and ethnicity were also significantly associated with birth spacing length in some instances. In 2013, women who were presently in union had a lower likelihood of long birth spacing. Muslim women were less likely to have medium-length and long birth spacing compared to Christian women. In 2018, Muslim women had a lower likelihood of long spacing, compared to Christian women. In 2008, Igbo women were less likely to have medium-length spacing compared to Yoruba women. Igbo, Hausa/Fulani and minority tribe women were less likely to have long birth spacing compared to Yoruba women. In 2013, Igbo, Hausa/Fulani and minority tribe women had a lower likelihood of medium-length and long birth spacing compared to Yoruba women. In 2018, Igbo women had a lower likelihood of medium-length spacing, while Igbo, Hausa/Fulani and minority tribe women had a lower likelihood of long spacing compared to Yoruba women.

Women's region of residence was also an important factor in determining birth spacing length. In 2008, women in the North West had a lower likelihood of medium-length birth spacing compared to women in the North Central zone. Women in the North East, North West, South East and South South zones had a lower likelihood of long spacing, compared to women in the North Central zone. In 2013, women in the North East, North West, South East, South South and South West had a lower likelihood of medium-length birth spacing, , while women in the North East, South East, South South and South West had a lower likelihood of long spacing compared with women in the North Central zone. In 2018, women in the North East and South South had a lower likelihood of medium-length spacing compared to women in the North Central zone, while women in the South East and South South had a lower likelihood of long spacing.

Age at marriage, contraceptive use and child sex preference determined length of birth spacing in some instances. In 2008, women who married at age 18 and older had a lower likelihood of both medium-length and long birth spacing compared to those who married before age 18. In 2018, women who were aged 18 and over at first cohabitation had a lower likelihood of long spacing compared to women who were under 18 at first cohabitation. In 2013, women who were non-users of contraception with the intention to use, and those without the intention to use had a lower likelihood of long birth spacing compared to those who used modern contraceptives. In 2018, women who did not use contraceptives and had no intention to use had a higher likelihood of long spacing. In 2008, women who reported having daughter preference were less likely to have medium-length and long birth spacing compared with women who had no daughter preference.

Breastfeeding duration and child survival were also important determinants of the length of birth spacing among Nigerian women. In 2008, women who breastfed for less than 6 months were less likely to have long birth spacing compared to those who never breastfed. In 2013, women who breastfed for less than six months, those who breastfed for 6-12 months, and above 12 months had a higher likelihood of medium-length birth spacing, while those who breastfed for less than six

months and between 6-12 months had a higher likelihood of long birth spacing compared to women who did not breastfeed at all. In 2018, women who breastfed for less than 6 months, and those who breastfed for 6-12 months had a higher likelihood of medium-length and long spacing, while those who were still breastfeeding had a lower likelihood of long spacing. In 2008, women whose previous child survived were more likely to have long birth spacing. In 2013, women whose previous child survived had a higher likelihood of long birth spacing in the adjusted model. In 2018, women whose last child survived had a higher likelihood of medium-length spacing, as well as higher likelihood of long spacing.

Table 7: Multinomial logistic regression showing adjusted relative risk ratios between selected variables and birth spacing

Variables	2008		2013		2018	
	24-36 months	>36 months	24-36 months	>36 months	24-36 months	>36 months
Age						
15-19	RC	RC	RC	RC	RC	RC
20-24	2.03* (1.09-3.82)	4.78* (1.74-13.15)	1.46* (1.04-2.03)	2.98*(1.82-4.87)	1.20 (0.86-1.66)	2.09*(1.33-3.29)
25-29	2.65* (1.41-4.99)	11.90* (4.33-32.67)	1.66* (1.22-2.26)	5.39*(3.32-8.76)	1.41* (1.01-1.95)	4.33*(2.79-6.72)
30-34	3.52* (1.84-6.71)	25.17* (9.10-69.64)	1.89*(1.36-2.63)	7.09*(4.31-11.64)	1.63*(1.17-2.28)	6.49*(4.17-10.12)
35-39	3.71*(1.99-6.94)	38.80*(13.91-108.24)	2.13*(1.52-2.99)	11.18*(6.83-18.33)	1.79*(1.26-2.54)	9.69*(6.20-15.16)
40-44	3.51*(1.79-6.89)	54.66*(19.60-152.47)	1.76*(1.25-2.48)	13.89*(8.42-22.92)	1.95*(1.35-2.81)	14.81*(9.39-23.36)
45-49	4.84*(2.38-9.86)	82.06*(28.47-236.55)	2.88*(1.89-4.39)	23.36*(13.63-40.03)	2.10*(1.37-3.21)	18.02*(10.55-30.78)
Educational level						
None	RC	RC	RC	RC	RC	RC
Primary	1.14 (0.97-1.34)	1.18* (1.00-1.39)	0.97 (0.83-1.13)	0.99 (0.84—1.18)	1.23* (1.05-1.44)	1.29* (1.08-1.52)
Secondary	1.07 (0.88-1.30)	1.11 (0.92-1.35)	0.88 (0.73-1.05)	0.88 (0.73-1.05)	1.12 (0.95-1.32)	1.24* (1.04-1.46)
Higher	1.11 (0.77-1.58)	1.02 (0.71-1.45)	0.70* (0.51-0.96)	0.72* (0.53-0.96)	1.03 (0.81-1.31)	0.85 (0.67-1.10)
Wealth status						
Poor	RC	RC	RC	RC	RC	RC
Middle	0.98 (0.85-1.14)	0.93 (0.79-1.09)	0.96 (0.83-1.11)	1.11 (0.95-1.30)	0.89 (0.77-1.03)	0.95 (0.83-1.09)
Rich	0.94 (0.79-1.12)	0.91 (0.77-1.08)	1.12 (0.78-1.12)	1.06 (0.87-1.30)	0.83* (0.69-1.00)	0.92 (0.77-1.10)
Marital status						
Never in union			RC	RC		
Presently in union			0.68 (0.35-1.30)	0.42* (0.21-0.85)		
Formerly in union			0.57 (0.28-1.13)	0.50 (0.24-1.07)		
Religion						
Christianity			RC	RC	RC	RC
Islam			0.96 (0.79-1.17)	0.83* (0.67-1.00)	0.87 (0.73-1.04)	0.69*(0.57-0.83)
Other			1.12 (0.68-1.83)	1.12 (0.70-1.80)	1.25 (0.77-2.05)	0.85 (0.49-1.48)
Ethnicity						
Yoruba	RC	RC	RC	RC	RC	RC
Igbo	0.64* (0.41-0.98)	0.51* (0.31-0.85)	0.57*(0.38-0.85)	0.24*(0.16-0.36)	0.63* (0.44-0.89)	0.39* (0.26-0.587
Hausa/Fulani	0.81 (0.56-1.18)	0.63* (0.44-0.91)	0.55*(0.39-0.78)	0.29*(0.19-0.43)	0.96 (0.71-1.31)	0.66* (0.50-0.87)
Other	0.79 (0.57-1.11)	0.65* (0.47-0.90)	0.58*(0.42-0.79)	0.36*(0.26-0.50)	0.89 (0.67-1.18)	0.61* (0.47-0.79)
Place of residence						
Urban			RC	RC	RC	RC
Rural			1.01 (0.89-1.15)	1.00 (0.87-1.16)	0.96 (0.84-1.10)	0.96 (0.84-1.09)
Region of residence						
North Central	RC	RC	RC	RC	RC	RC
North East	0.86 (0.70-1.04)	0.68* (0.54-0.85)	0.74*(0.61-0.88)	0.76* (0.61-0.94)	0.79* (0.66-0.95)	0.86 (0.70-1.04)
North West	0.80* (0.64-1.00)	0.65* (0.51-0.84)	0.80 (0.63-1.00)	0.99 (0.77-1.28)	0.88 (0.71-1.08)	0.88 (0.71-1.09)
South East	0.75 (0.50-1.13)	0.51* (0.32-0.82)	0.58*(0.41-0.83)	0.50*(0.33-0.75)	0.85 (0.62-1.15)	0.61* (0.43-0.89)
South South	0.92 (0.73-1.15)	0.72* (0.56-0.92)	0.69*(0.56-0.85)	0.68*(0.54-0.86)	0.69*(0.56-0.85)	0.79* (0.63-0.99)
South West	1.08 (0.79-1.49)	0.87 (0.64-1.18)	0.64*(0.48-0.84)	0.55*(0.41-0.75)	0.99 (0.77-1.29)	1.25 (0.99-1.57)

Age at first cohabitation						
<18	RC	RC			RC	RC
18+	0.84* (0.72-0.97)	0.61*(0.52-0.71)			0.95 (0.84-1.08)	0.71*(0.62-0.81)
Son preference						
No son preference	RC	RC	RC	RC	RC	RC
Son preference	1.06 (0.91-1.24)	0.94 (0.80-1.11)	0.99 (0.85-1.15)	1.06 (0.91-1.24)	1.04 (0.91-1.19)	0.92 (0.80-1.06)
Daughter preference						
No daughter preference	RC	RC	RC	RC	RC	RC
Daughter preference	0.85* (0.73-0.99)	0.83* (0.71-0.98)	0.99 (0.85-1.15)	0.87 (0.74-1.02)	0.99 (0.86-1.14)	1.07 (0.92-1.24)
Number of children ever born						
2-4	RC	RC				
>4	0.80*(0.69-0.92)	0.53*(0.45-0.61)				
Contraceptive use						
Using modern method	RC	RC	RC	RC	RC	RC
Using traditional method	1.08 (0.78-1.50)	1.22 (0.87-1.72)	1.22 (0.93-1.60)	1.20 (0.90-1.60)	1.16 (0.86-1.56)	1.03 (0.76-1.37)
Non-user, intends to use	1.01 (0.81-1.27)	0.99 (0.78-1.26)	1.02 (0.83-1.24)	0.85 (0.69-1.05)	1.12 (0.95-1.31)	1.02 (0.87-1.20)
Non-user, does not intend to use	1.06 (0.86-1.31)	1.20 (0.96-1.49)	0.95 (0.78-1.16)	1.02 (0.84-1.25)	1.15 (0.97-1.34)	1.21* (1.03-1.42)
Breastfeeding duration						
Never breastfed	RC	RC	RC	RC	RC	RC
<6 months	0.64 (0.38-1.08)	0.54* (0.31-0.93)	1.99*(1.29-3.07)	2.11*(1.37-3.23)	1.71*(1.23-2.38)	1.88*(1.33-2.67)
6-12 months	0.76 (0.50-1.17)	0.67 (0.43-1.04)	2.07*(1.34-3.19)	1.93*(1.26-2.97)	1.37* (1.00-1.88)	1.22 (0.88-1.70)
>12 months	1.08 (0.72-1.62)	0.97 (0.64-1.48)	1.56* (1.01-2.41)	1.35 (0.88-2.08)	1.13 (0.83-1.55)	0.88 (0.63-1.23)
Still breastfeeding	1.39 (0.93-2.09)	1.41 (0.92-2.16)	1.25 (0.83-1.88)	0.98 (0.65-1.47)	0.92 (0.68-1.23)	0.68* (0.50-0.93)
Previous child survived						
No	RC	RC	RC	RC	RC	RC
Yes	1.19 (0.91-1.56)	1.46* (1.09-1.95)	0.99 (0.78-1.25)	1.43*(1.13-1.82)	1.33*(1.09-1.62)	1.59*(1.27-1.99)

Source: NDHS 2008-2018 *significant at p<0.05

Discussion

The data showed that a higher number of women of childbearing age 15-49 had medium-length and long birth intervals (24-36 months and above 36 months respectively) as recommended by World Health Organization, during the period under review when compared with short birth intervals (below 24 months). The likely reasons for this seem to be as a result of the increase in family planning service uptake among women, the increase in the cost of raising children and cost of living, which is fueled by hyper-inflation and under-employment of Nigeria women among others. This finding contradicts those of Agida et al. (2016) and Aleni et al. (2020) who both established a high non-adherence to WHO's benchmark of Healthy Timing and Spacing of Pregnancy due to younger age, not always using contraceptives and not having husband's input on whether to have the next child. Moreover, Damtie et al. (2021) suggested a close birth interval among women of childbearing age which is caused by breastfeeding for a long time and not using contraceptives.

We examined the influence of some socio-demographic factors such as women's age, education, wealth status, marital status, religion, age at first cohabitation, son preference, daughter preference, number of children ever born, contraceptive use, duration of breastfeeding and child survival on birth interval among women of childbearing age between 2008 and 2018. This study found that age, education, wealth status, marital status, ethnicity, region of residence, age at first cohabitation, son preference, daughter preference, number of children ever born, contraceptive use, duration of breastfeeding and child survival were significant factors associated with birth interval in 2008. This result followed a similar pattern in 2013 and 2018. However, unlike in 2008, religion and place of residence were significantly associated with birth intervals in 2013 and 2018. The finding agrees with Singh et al. (2011) and Yohannes et al. (2011) who discovered that socio-demographic, economic and birth history factors were significantly associated with inter-birth interval. It also agrees with Fayehun et al. who discovered that ethnicity and sex of a prior child are associated with the length of birth spacing (Fayehun et al., 2011). Again, this finding concurred with Dim et al. (2013) who discovered that women's age, breastfeeding duration and non-use of contraception are associated with length of birth interval. In addition, non-use of contraception, region, and not wanting the last child significantly influence birth interval according to Gebrehiwot et al. (2019). The study findings also agreed with Dehesh et al. (2022), who found in their study that women's age at marriage and place of residence are significantly associated with the length of birth intervals.

Summary and Conclusion

This study concludes that Nigerian women generally have a high probability of progressing to higher parities, and this probability differs by educational level, wealth status and ethnicity. Women's probability of progressing to higher parities generally reduced with increasing education and wealth status, while the highest probabilities of transition to higher parities were found among Hausa/Fulani and minority tribe women.

Additionally, while we found that a relatively high number of women of childbearing age had birth intervals in agreement with the minimum WHO's standard (24-36 months) during the three years under review, a sizable number of Nigerian women still had short birth intervals. It is also concluded that the length of birth intervals among women of childbearing age are associated with socio-demographic factors such as women's age, education, wealth status, marital status, religion, age at first cohabitation, son preference, daughter preference, number of children ever born, contraceptive use, duration of breastfeeding and child survival.

Recommendations

Based on the findings from this study, we make the following recommendations.

1. Efforts in fertility reduction need to be targeted at women of low socioeconomic status, as well as those from Hausa/Fulani and minority ethnic groups to ensure that Nigeria is able to have a TFR of 4.0 or less by 2030.
2. Governments at all levels (local, state and federal) should continue to create more awareness campaigns, and intervention programs on the maternal and child health implications of short birth intervals. Health workers, such as doctors, midwives and community health workers should provide health education on the dangers of short birth intervals during antenatal and postnatal visits to the hospital/health facilities, as well as during community outreaches.
3. There needs to be more sensitization on the uptake of family planning services at the community and health sector levels. This will not only help to space the birth interval but also for preventing unwanted pregnancies, and by extension, improve the maternal and child health situation in Nigeria.

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