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Decomposing the effect of women's educational status on fertility across the six geo-political zones in Nigeria: 2003–2018

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Abstract

Background Nigeria faces a dual challenge of high fertility rates and limited female education. Studies suggest that education can contribute to fertility reduction. This study aimed to show the differences and quantify the disparity in fertility rates between educated and uneducated women in Nigeria.

Methods A repeated cross-sectional analysis was conducted using secondary data from the Nigeria Demographic and Health Surveys (2003, 2008, 2013, 2018; Total = 121,774). Fertility differentials for women aged 15–49 were measured using Oaxaca-Blinder decomposition ($\alpha = 0.05$).

Results The proportion of women without education remained high throughout the study period (41.6% in 2003, 35.8% in 2008, 37.8% in 2013 and 34.9% in 2018). Uneducated women consistently exhibited higher fertility rates than educated women across all survey years and regions. The risk difference of high fertility was greatest in the SouthEast region (34.0) and lowest in the North East (22.19). Factors contributing to the disparity included maternal age, age at first marriage, wealth index, and age at first birth.

Conclusion Marked fertility inequalities exist between educated and uneducated women across Nigerian regions. These findings highlight the crucial role of female education in fertility reduction efforts.

Keywords Fertility rate, Education, Decomposition, Gender equality, Nigeria

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Introduction

Fertility measures are significant in population planning, public health programs, and achieving some Sustainable Development Goals (SDGs) targets [1, 2]. Globally, average fertility levels have declined from 5.3 children per woman in 1900 to about 2.45 children per woman in 2019 and 2.43 children per woman in 2022 [3, 4]. While several developed countries have completed their fertility transition, fertility is rising in several developing countries [5–7]. The United Nations has reported that of the additional 2.2 billion inhabitants predicted to be on Earth by 2050, over 50% will come from sub-Saharan African countries [7]. While some countries in SSA, like Rwanda, have made significant progress in fertility transition [6], Nigeria, the most populous country in the region, needs help to reduce its fertility. A recent study documented a reducing but slow fertility decline in Nigeria, though the decline varied substantially across its region [8]. Nigeria's estimated total fertility rate (TFR) in 2018 was above five children per woman [35].

The integral role of women's educational status in reducing fertility rates has been reported in several countries, such as Bangladesh, Iran, South Korea, India, and China [9]. It has been persistently acknowledged that enhancing women's education contributes to declining fertility rates in developing countries [5, 10]. Studies have documented the contributory role of increasing maternal education in the downward changes observed in the fertility transition of SSA [11, 12]. Women's education as related to fertility can be direct or indirect. It is indirect if women receive interventional health education on fertility control measures via passive counseling, news media, social media, and schooling. These, in turn, can cause attitudinal and behavioral changes in factors that directly influence fertility. Also, time spent acquiring education or attaining a desired level of education can lead to the postponement of marriage and thus reduce the period of exposure to the risks of childbearing [11].

Additionally, women's education affects fertility by lowering the desired number of children, increasing the uptake of contraceptive use to control fertility, and improving knowledge of natural fertility control measures. Educational status was identified as one of the most critical factors contributing to the reduction in fertility in areas of some West African countries like Burkina Faso, the Gambia, and Nigeria [12–14]. Studies conducted in other parts of Africa, such as Uganda, Kenya, and Ethiopia, have also established a strong relationship between education and fertility [12, 15, 16]. In Nigeria, it has been documented that the number of children born to a woman during her lifetime is significantly associated with her educational level [39]. Studies have consistently indicated lower fertility among women with secondary and higher levels of education in the country [40, 41]. A recent study demonstrated that Nigerian female youth with less education continue to exhibit high fertility rates [42].

Despite the demonstrated impact of education on fertility reduction by studies conducted across countries, we deduce it is worthwhile to quantify the dissimilarity in fertility between educated and uneducated women because literature established a striking difference between women who can read and those who cannot. Nigeria is a country with six regions at different levels of education. The magnitude of fertility varies due to cultural diversities and differences in some socio-cultural factors [34]. Nigeria is considered a developing nation with a high poverty rate and low literacy level. Hence, examining fertility at the national level may need to be improved. It is essential to identify the factors that explain fertility variation in educational status and know if these factors are the same across the regions of Nigeria. This study, therefore, aimed to fill the gap in knowledge about the fertility differentials among uneducated and educated women across the six regions of Nigeria.

Methods

Study design and data

Data analyzed for this study were from the 2003, 2008, 2013, and 2018 Nigeria Demographic and Health Survey (NDHS) datasets. We used women's files for the analysis in this study. We used a women's and children's data set (child recode) for the study analysis. The women's data set was used to produce the denominator of the fertility rates, while the child's data set was used to estimate the numerator of the fertility rates. NDHS was a cross-sectional, nationally representative sample across all six geopolitical zones in Nigeria. The 2003 NDHS program made use of the sampling frame designed for the 1991 population census, while the sampling frame designed for the 2006 population and housing census was used for 2008, 2013, and 2018 NDHS but with modification due to expansion in the number of households between the census period and the survey year. As defined in all the survey rounds, the primary sampling unit (PSU) cluster was tagged as the Enumeration Areas (EAs) from the 1991 and 2006 EA census sampling frames. Samples for the 2003 and 2008 surveys were selected using a stratified two-stage cluster design consisting of 365 clusters in 2003 NDHS and 888 clusters in 2008 NDHS (National Population Commission (NPC)[17].

At the same time, the 2013 and 2018 NDHS were conducted in three and two stages, respectively. For 2013, 893 localities were selected at the first stage with probability proportional to the size and independent selection from each sampling stratum. In the second stage, one EA was randomly selected from most of the selected localities. In a few larger localities, more than one EA was selected, and in total, 904 EAs were selected [18]. For the 2018 NDHS, 1400 EAs were selected, and 30 households were selected from each cluster by an equal probability of systematic sampling in the second stage [19].

Data collected were highly comparable over time because of the standardization in sampling procedures. The number of households interviewed in 2003, 2008, 2013, and 2018 was 7864, 34,070, 40,680 and 42,000, respectively, while the number of women aged 15–49 years interviewed was 7,620, 33,385, 38,948, and 41,821, respectively. Sample weights were applied to each case to adjust for differences in the probability of selection. Weighting is essential to increase the extent of representativeness in the sample and reduce the errors associated with sample selection bias. For the women and children data used for this study, the weight given (v005) in the dataset was divided by 1,000,000.

Variable description

The dependent variable was fertility, measured by the total number of children ever born (CEB). CEB is the lifetime fertility obtained from information provided by women aged 15–49 on their full birth history. It is a discrete number in the DHS data set. However, this study categorized it into two: low if a woman has less than five children and high if she has five or more children. The categorization was based on the 1988 population policy revised in 2004, which emphasized the need to maintain four children per woman [20]. Since the younger women would not have completed their fertility, we adjusted the analysis to fit the age of the participants.

Women's education was the primary explanatory variable. We used literacy to denote women's education in this study because it is essential in measuring a population's level of education. Literacy is the ability to read and write a short, simple statement about one's life [21]. We, therefore, categorized education as having no education (Illiterate) for those who cannot read and write English or indigenous language and have not completed primary education while educated (if they can read and write and have a minimum of completed primary education—Literate). Other variables used were maternal Age (15–19, 20–24..., 45–49), age at first birth, age at first marriage, place of residence (urban, rural), religion, and modern contraceptives (no, yes). The age at first marriage (v511) and age at first birth (v212) were counted as data in years. We re-categorized them as < 20 years (teenagers) and ≥ 20 years. Religion was categorized as Christianity, Islam, and others. Likewise, the wealth index was re-grouped as poor, middle, and rich. Neighbourhood socioeconomic disadvantage is included only in the decomposition analysis. This study used the term "neighbourhood" to depict people living in the same cluster within the same geographical setting. The neighbourhoods were mapped out to include households of the same clusters, otherwise known as sharing the same primary sampling unit (PSU) across each region. We defined "neighbourhood" as clusters and "neighbours" as a member of the same cluster. The PSUs were identified using the 2006 census. A neighbourhood socioeconomic disadvantage was generated using principal component analysis of the proportion of respondents living in rural areas, with no education, unemployed, and belonging to the lowest two wealth quintiles. [22, 23].

Statistical analyses

Descriptive statistics were used to describe the distribution of respondents by explanatory variables. The difference in mean CEB between uneducated and educated women was examined using the Mann–Whitney test due to the skewness of the CEB. To estimate the total fertility rates (TFR), we used a direct method to produce the TFR by educational status. As presented by Moultrie (2013), the following steps are to be followed for direct estimation of fertility rate from survey data. Step 1: Births of children by age of mother at birth and year of birth were generated. The age of the mother at birth of a given child was calculated using: $\mathrm{x} = \mathrm{int}\left(\frac{12\,(Y_B^c - Y_B^m) + (M_B^c - M_B^m - b)}{12}\right)$...1. The age of mother at birth x was cross-tabulated with the year of birth of child to produce the numerator of the fertility rates (number of births $B_x(t)$). This was extracted from children data set (Child recode). Step 2: Calculation of the age of women at the start of the year in which she was interviewed. This was obtained with the use of women's data set (individual recode). It is given as: $x_I = Y_I^m - Y_B^m - 1$...2. Thereafter, the exposure to the risk of childbearing $(E_x(t))$ was estimated. This was derived through aggregation of these equations: $E(x_I - 1, Y_I - 1) = \frac{M_B^m - 0.5}{12}$...3 and $E(x_I, Y_I - 1) = 1 - \frac{M_B^m - 0.5}{12}$...4. The Age-specific fertility rates for five-year age groups in year t were generated using equation: $f(i,t) = \frac{\sum_{a=5i+10}^{5i+14} B_a(t)}{\sum_{a=5i+10}^{5i+14} E_a(t)}$...5.

Afterwards, the ASFRs generated were utilised to derive the TFR using equation $5 * \sum f(i,t)$ ...6. These procedures were applied for each category of women's educational status, that is, uneducated and educated women. Where the terms are: Y_B^c—The year of child's birth, Y_B^m- The year of mother's birth, M_B^c- The month of child's birth, M_B^m- The month of mother's birth, Y_I^m- The year of the mother was interviewed, b – equals to 1 if the day of interview was greater than 15, and 0 if was less than or equal to 15 [24]. We computed the risk difference in high fertility rate (≥ 5) between women who were educated and those who were uneducated. A risk difference (RD) greater than 0 (RD > 0) suggests that a high fertility rate was more prevalent among women with no formal education (pro-illiterate inequality). Conversely, a negative risk difference indicates that a high fertility rate was prevalent among educated women (pro-literate inequality). The results of the RD were presented in a forest plot. We estimated weights and random effects because, in a forest plot, weights and random effects are central to the representation of individual and overall effects in meta-analysis. Finally, we used the logistic regression method to conduct the Blinder-Oaxaca decomposition analysis [25, 26].

According to the logistic regression model, the blinder-Oaxaca decomposition assumes that a vector of determinants, x explains y.

$$y_i = \begin{cases} \beta^p x_i + \varepsilon_i^p \\ \beta^q x_i + \varepsilon_i^q \end{cases} \quad (1)$$

Where the vectors of β parameters include intercepts.

The gap between the mean outcomes, y^q, and y^p, is.

$$y^q - y^p = \beta^q x^q - \beta^p x^p \quad (2)$$

Where x^q and x^p are the explanatory variables at the means for the p and q. This study's explanatory variables were maternal age, educational status, religion, wealth index, place of residence, age at first marriage, age at first birth, and ever-used modern contraceptives.

If there are just two x's, x_1 and x_2.

It can be written as follows:

$$y^q - y^p = \left(\beta_0^q - \beta_o^p\right) + \left(\beta_1^q x_1^q - \beta_1^p x_1^p\right) + \left(\beta_2^q x_2^q - \beta_2^p x_2^p\right) = G_0 + G_1 + G_2 \quad (3)$$

The gap in y between p and q can be said to be.

differences in the intercepts (G_0)
differences in x_1 *and* β_1 (G_1)
differences in x_2 *and* β_2 (G_2)

To estimate the overall gap or the gap specific to any one of the x's is attributable to differences in the x's.

The gap between the two outcomes was expressed as follows:

$$y^q - y^p = \triangle x\beta^p + \triangle \beta x^q = E + (CE + C) \quad (4)$$

Where $\triangle x = x^q - x^p$ and $\triangle \beta = \beta^q - \beta^p$

The gap in the mean outcomes was from a gap in endowments (E) {the part that is due to group differences in the magnitudes of the determinants of the outcome}, a gap in coefficient (C) {the part that is due to group differences in the effects of these determinants}, and a gap arising from the interaction of endowments and coefficients (CE). We used a two-fold type of decomposition and applied sample weights. Based on the importance attached to the explanatory variables in the literature, the ordering of the variables with associated reference categories was ever used modern contraceptive (yes), neighborhood socioeconomic status (least disadvantaged community), household wealth quintile (wealthiest), maternal age (<20 years), place of residence (urban), age at first marriage (20 years and above), age at first birth (20 years and above), religion (Christianity). We used a heat map to show the result of the decomposition analysis as done in the literature. Heat maps show relationships between two variables, one plotted on each axis. The heat map is arranged by the magnitude of the effect of the risk factors and the specific survey years and how connected the risk factors are influencing the study outcome.

The values in each box show the percentage contribution of each of the explanatory variables to the educational inequalities in the respective regions and survey years and whether or not the contributions were "explained" (red color) or "unexplained" (blue color) part of the differences. Similar reporting patterns exist in the literature [22, 27]. The datasets were analyzed separately for the differences in CEB and estimation of TFR. The datasets were pooled together for decomposition analysis.

Results

Table 1 shows the percentage distribution of the women according to background characteristics across the survey rounds (2003–2018). Considering the level of education, women who had no education were the highest proportion of women in 2003 (41.6%), 2008 (35.8%), 2013 (37.8%) and 2018 (34.9%). However, the percentage of women with secondary education was highest in 2018 (39.7%). The percentage of women was higher in rural areas than in urban areas in all the survey periods. However, the number of residents in the metropolitan area increased from 34.5% in 2003 to 45.8% in 2018. The percentage of those who were poor remained unchanged between 2003 and 2013 but marginally declined to 36.5% in 2018 from about 37.4%. Modern contraceptive prevalence rates increased between 2003 and 2013 from 8.8% to 11.2% but declined to 10.51% in 2018.

In Table 2, data show that women's background characteristics were significantly different among uneducated and educated women. In 2018, about 84% of women living in urban areas were educated, while only 53% of rural women were educated. More than 90% of women practicing Christianity as a religion were educated, but only 41% of Muslim women were educated. Women from poor and rich households who were educated were 35% and 91%, respectively. This pattern was similar across the survey period.

Figure 1 compares the mean CEB of uneducated and educated women aged 15–49 in 2003, 2008, 2013, and 2018 surveys. Across all the regions and the year periods, there is a significant difference in the mean CEB of uneducated and educated women. In South-East 2003, the

Table 1 Percentage distribution of respondents according to background characteristics 2003, 2008, 2013, and 2018

Background Characteristics	2003		2008		2013		2018	
	%	No. of Women	%	No. of Women	%	No. of Women	%	No. of Women
Age Group								
15–19	23.0	1,749	19.7	6591	20.3	7,905	20.1	8,423
20–24	19.2	1,464	18.3	6103	17.2	6,714	16.4	6,844
25–29	17.8	1,356	18.9	6303	18.1	7,037	17.2	7,203
30–34	12.3	940	13.7	4557	13.8	5,373	14.3	5,997
35–39	10.5	798	11.6	3883	12.1	4,701	12.9	5,406
40–44	9.1	695	9.1	3043	9.4	3,663	9.7	4,057
45–49	8.1	618	8.7	2905	9.1	3,555	9.3	3,891
Education								
None	41.6	3171	35.8	11,942	37.8	14,729	34.9	14,603
Primary	21.4	1628	19.7	6566	17.3	6734	14.4	6039
Secondary	31.1	2370	35.7	11,904	35.8	13,927	39.7	16,583
Higher	5.9	451	8.9	2974	9.1	3558	11.0	4596
Place of Residence								
Urban	34.5	2629	35.8	11,934	42.1	16,414	45.8	19,163
Rural	65.5	4991	64.2	21,451	57.9	22,534	54.2	22,658
Religion								
Christian	48.0	3654	53.6	17,907	46.8	18,237	46.0	19,217
Islam	50.7	3862	44.4	14,826	51.7	20,149	53.5	22,372
Others	1.4	104	2.0	652	1.4	561	0.5	232
Wealth Index								
Poor	37.4	2853	37.2	12,428	37.4	14,560	36.5	15,267
Middle	19.9	1513	19.0	6341	19.2	7486	19.6	8207
Rich	42.7	3254	43.8	14,616	43.4	16,902	43.9	18,347
Modern Contraceptive Use								
No	91.2	6940	89.5	29,884	88.9	34,606	89.5	37,424
vYes	8.8	680	10.5	3501	11.1	4342	10.5	4397
Age at First Marriage								
< 20 years	78.7	4484	69.9	17,455	71.1	21,056	65.6	20,515
20 years and above	21.3	1211	30.2	7533	28.9	8566	34.4	10,756
Age at First birth								
< 20 years	66.7	3510	57.9	13,558	59.4	16,393	56.2	16,840
20 years and above	33.2	1747	42.1	9846	40.6	11,222	43.8	13,109

gap between the mean CEB of uneducated women (6.5) and educated women (1.8) was the widest. The trend in the mean CEB across the regions has remained the same meaningfully in the two groups. Figure 2 shows the estimated TFR by educational status across the six regions for the four survey periods. The data revealed that TFR was consistently higher among uneducated women than educated women. The pattern is similar across the regions in all the survey periods.

Figure 3 shows the risk difference between women who were uneducated and educated with high fertility rates across the six regions in 2003, 2008, 2013, and 2018. The results quantify the gap between uneducated and educated women with high fertility rates. A risk difference greater than 0 suggests that a high fertility rate is prevalent among uneducated women. As revealed by the result, a high fertility rate was more prevalent among women without education across the regions and periods. The result was statistically significant across the regions. As indicated in the result, the six regions at different periods were pro-uneducated inequality. Furthermore, as illustrated in the results the educated-uneducated risk difference was highest in Southeast 2003 (56.92) and lowest in North East 2003 (14.99). Also to be noted in the figures was the risk differences in Southwest 2003 (41.20) was higher than that of South West 2013

Table 2 Distribution of respondents by Educational Status

	2003		2008		2013		2018	
	Uneducated n (%)	**Educated n (%)**	**Uneducated n (%)**	**Educated n (%)**	**Uneducated n (%)**	**Educated n (%)**	**Uneducated n (%)**	**Educated n (%)**
Residence Location								
Urban	697(26.5)	1932(73.5)	2369(19.9)	9565 (80.1)	2447(14.9)	13,967(85.1)	3049(15.9)	16,114(84.1)
Rural	2340(48.1)	2591 (51.9)	10,455(48.7)	10,996 (51.3)	10,999(48.8)	11,535 (51.2)	10,670(47.1)	11,988 (52.9)
Religion								
Christian	496(13.6)	3158 (86.4)	2169(12.1)	15,738 (87.9)	1459(8.0)	16,778(92.0)	1791(9.3)	17,426 (90.7)
Islam	2558(66.2)	1304 (33.8)	10,243(69.1)	4583 (30.9)	12,883(63.9)	7266 (36.1)	13,197(59.0)	9175 (41.0)
Others	72(68.9)	32 (31.1)	417(63.9)	235(36.1)	309(55.1)	252 (44.9)	80 (34.6)	152 (65.4)
Wealth Index								
Poor	1758(61.6)	1095(38.4)	8347(67.2)	4081 (32.8)	10,349 (71.1)	4211 (28.9)	9893 (64.8)	5374 (35.2)
Middle	676(44.7)	837 (55.3)	2321(36.6)	4020 (63.4)	2202(29.4)	5284 (70.6)	2314 (28.2)	5893 (71.8)
Rich	561(17.2)	2693 (82.8)	1568(10.7)	13,048(89.3)	1357 (8.0)	15,545 (92.0)	1602(8.7)	16,745 (91.3)
Modern Contraceptive								
No	2933(42.3)	4007 (57.7)	12,743(42.6)	17,141 (57.4)	13,510 (39.0)	21,096 (61.0)	13,746 (36.7)	23,678 (63.3)
Yes	78(11.5)	602 (88.5)	381(10.9)	3120 (89.1)	259 (6.0)	4083 (94.0)	626 (14.2)	3771 (85.8)
Age at first marriage								
< 20 years	4484(61.1)	1745 (38.9)	10,707(61.3)	6748(38.7)	11,930 (56.7)	9126 (43.3)	11,531 (56.2)	8984 (43.8)
20 years	270(22.3)	941 (77.7)	1666(22.1)	5867 (77.9)	1478 (17.3)	7088 (82.7)	1835 (17.1)	8921 (82.9)
Age at first birth								
< 20 years	2076(59.1)	1434(40.9)	8017(59.1)	5541 (40.9)	8946(54.6)	7447 (45.4)	9304 (55.3)	7536 (44.7)
20 years	611(35.0)	1136 (65.0)	3366(34.2)	6480 (65.8)	3100(27.6)	8122 (72.4)	3106 (23.7)	10,003 (76.3)

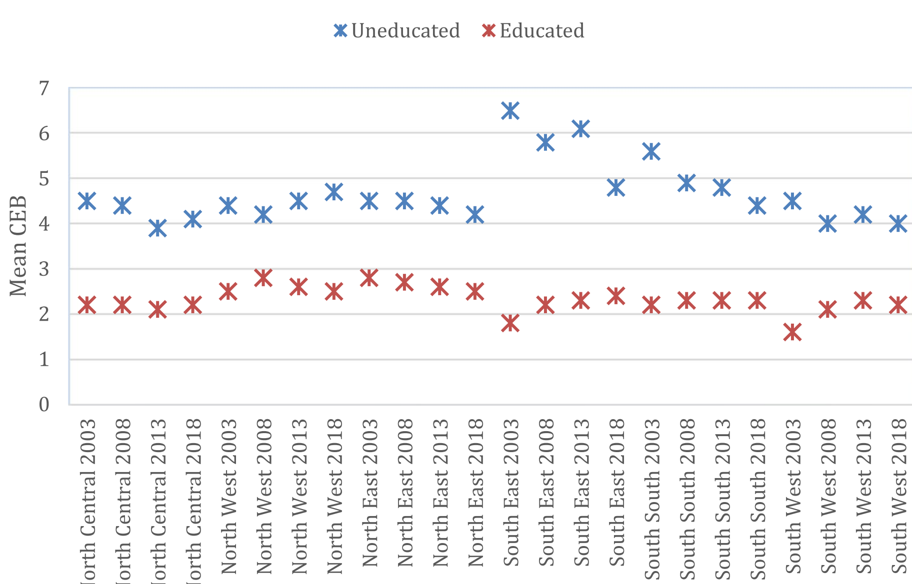

Fig. 1 Mean number of children ever born (CEB) to Uneducated and Educated women aged 15–49 across the region in Nigeria. Note: All are significant at 0.05 in the Mann–Whitney test

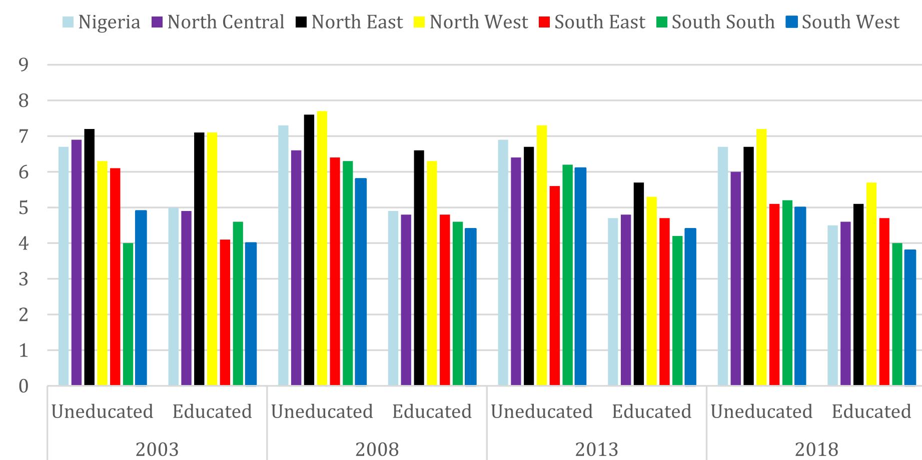

Fig. 2 Estimated total fertility rate by educational status across regions in Nigeria

(27.3), South-South 2003 (37.9) was higher than South-South 2013 (30.5), South East 2003 (56.92) was higher than South East 2013 (50.1), and North Central (25.9) was higher than North Central 2013 (22.8). The results of weights indicate the contribution of each year and region to the overall pooled effect estimate. They depend on the variance (precision) of individual studies. Weights influence the size of the boxes representing each year and region on the forest plot. Larger weights result in bigger boxes in the plot. The random-effects model accounts for variability across studies (heterogeneity), assuming the true effect size varies between studies.

Figure 4 shows the detailed decomposition of the educational inequality caused by compositional effects of the determinants of high fertility to the total gap between uneducated and educated women in high fertility by regions and periods. The important factors associated with the educational inequalities across the regions and periods were almost the same but to a different degree. The educational differences were due to the "explained" (compositional effect) and the "unexplained" (structural effect), which are shown by the colors red and blue, respectively. As the percentage contribution of the "explained" part goes down, the brightness of the red color fades. The same applies to the blue color that depicts the "unexplained" part. On average, the figures indicate that maternal age, wealth index, and age at first birth are important factors responsible for the inequality between the high fertility of uneducated and educated women across the regions and periods. In Northeast 2003, the highest "explained" contributions to the educational inequality in the prevalence of high fertility were by age at birth (105.0), religion (41.0), and then age at first marriage (34.3). In Southwest 2013, the wealth index (69.5) was the major factor responsible for the total gap in high fertility between uneducated and educated women, followed by age at first birth (32.8), then age at first marriage (19.1), place of residence (14.0), and religion (6.0). Also, of a note in the result is the "explained" contributions to the educational variations by maternal age in North West 2008 (69.8), North Central 2003 (69.4), South-South 2013 (68.0), South-South 2018 (63.6), South-South 2008 (62.1), South East 2018 (58.2) and South-South 2003 (54.9).

Discussion

This study set out to decompose educational inequalities in the high fertility rate across the six regions of Nigeria due to the country's heterogeneous nature. Considering Nigeria's vast population and socio-cultural differences, the regional analysis of fertility as it relates to maternal education is essential. The relevance of childbearing behavior in accomplishing sustainable development goals (SDGs 1, 3, and 5) underscores the need for this study in a country with a high population growth rate like Nigeria.

As shown from the total fertility rates we found a high fertility rate in Nigeria, and the mean children ever born above six by women in the age group 15–49 years irrespective of their literacy status is an indicator of high childbearing practices in Nigeria. The finding is similar to what was reported by Gerland and colleagues (2017) in their study conducted in SSA [28]. However, the fertility found in the current study was higher than estimates obtained in other countries like South Africa, Kenya, and Ghana [14, 15]. Several factors can explain the higher fertility situation in Nigeria. The persistent passive population policy, high poverty rate, sociocultural norms, and poor health system are possible explanations for our findings.

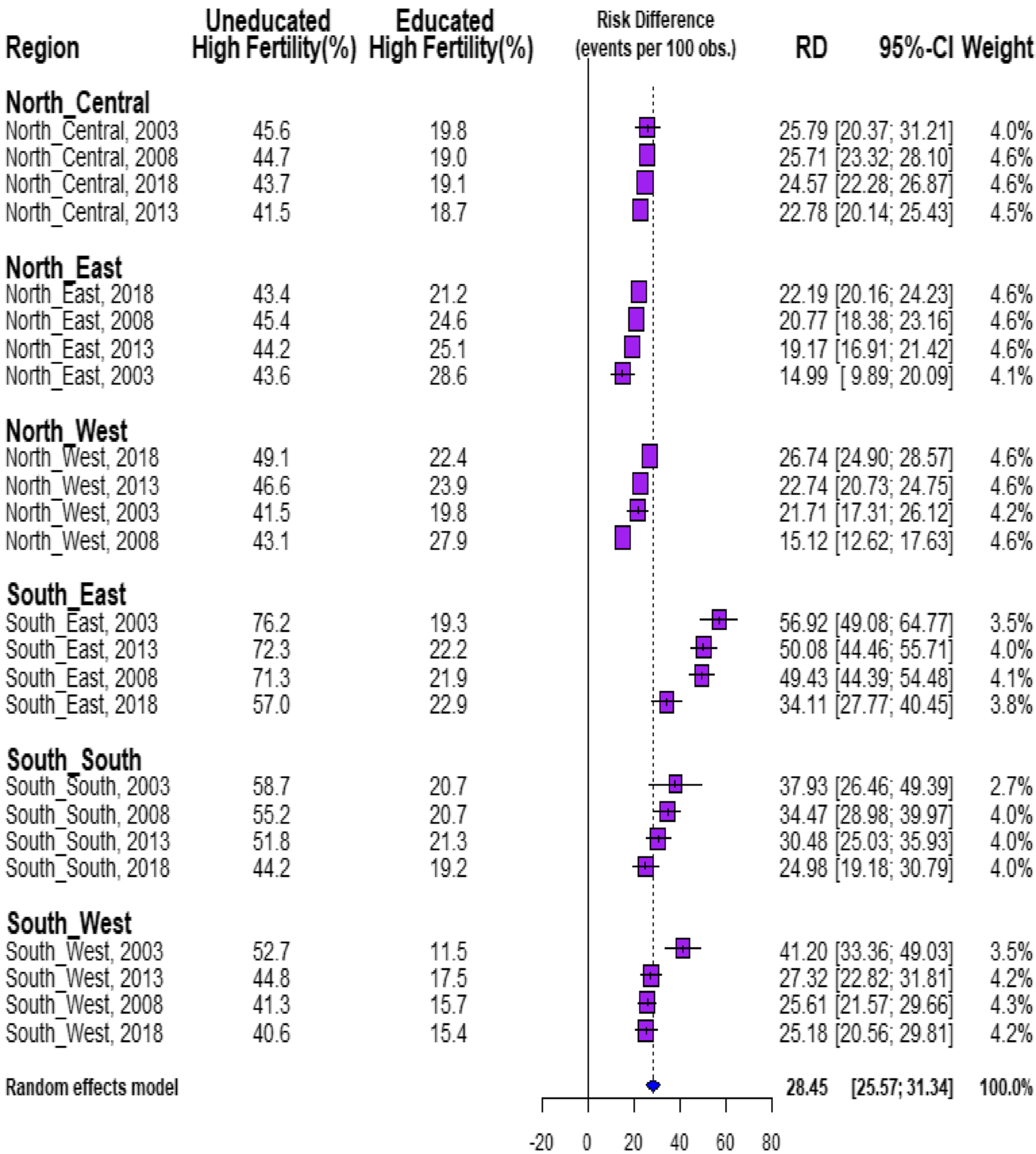

Fig. 3 Risk difference in high fertility rate between women who are uneducated and educated across regions between 2003 and 2018

We found that the prevalence of high fertility was significantly higher among uneducated women than among their educated counterparts across the regions. The high fertility pattern observed among uneducated and educated women was similar between 2003 and 2018. Frank et al. (2020) emphasize that fertility reduction is markedly more significant among educated women, especially in the Southwest [29]. Access to family planning resources and increased reproductive autonomy among educated women contributes to lower fertility rates. This finding reinforces the study's results, showing that education affects family planning uptake and enables

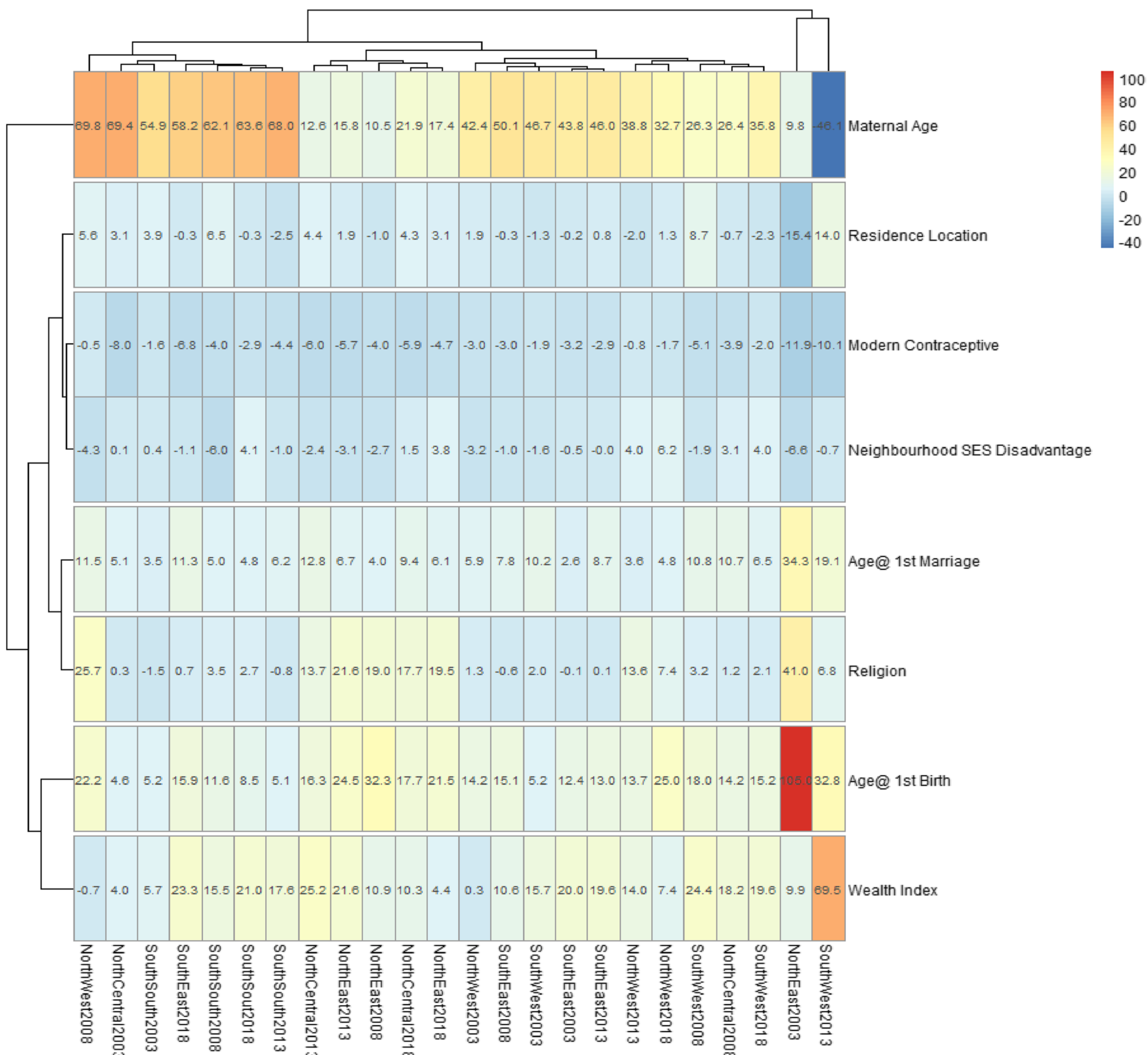

Fig. 4 Detailed decomposition of the part inequality that was caused by compositional effects of the determinants by regions and year periods

decision-making autonomy, reducing fertility, particularly in regions with higher educational access.

The most significant pro-uneducated inequality was observed in the Southeast and the least in the Northeast. Studies indicate that regions with stronger adherence to traditional norms, particularly in Northern Nigeria, exhibit higher fertility rates and conservative views on family planning [30, 31]. For example, Sinai et al. (2018) found that socio-cultural practices in Northern Nigeria, such as early marriage and limited reproductive autonomy, contribute to sustained high fertility, particularly among uneducated women [30]. In contrast, Southern regions, especially the Southeast, have greater access to education and healthcare, which correlates with lower fertility among educated women. This is because uneducated women are likely to commence childbearing early, increasing the number of years at risk of childbearing during the reproductive years [11]. Also, educated women may be more exposed to ideas that promote smaller family sizes and female equality [32], and they are more empowered to decide about reproductive health. In most cases, educated women can decide the number, timing, and spacing of their children [33].

The decomposition analysis showed that maternal age, household wealth quintile, and age at first birth are the greatest contributors to educational-related inequality in high fertility across the regions in Nigeria and survey periods. This finding aligns with previous studies that established a relationship between women's education, maternal age, wealth index, age at first birth, and fertility [35–38]. These results can serve as an indispensable guide for formulating programs that will facilitate fertility reduction across the regions of Nigeria.

Female education is imperative in the accomplishment of sustainable development. Educated women are likely to be more economically empowered, marry later, delay the onset of childbearing, have small family sizes, and make decisions about their health [28, 32]. Combining these factors is key to achieving a rapid reduction in fertility. Explaining the fertility differentials between educated and uneducated women has essential implications for population policy and programs. As indicated in this study, fertility is still high and more prevalent among uneducated women across the six geo-political zones of Nigeria. In 1990, Nigeria's population figure was 80 million, and 30 years later, the population was above 200 million. The growing size of Nigeria's population is a critical issue. The unrestrained population growth of Nigeria can lead to a population explosion, which might challenge the populace's health, environment, and infrastructural development. To avoid the crisis, immediate actions to reduce fertility drastically should be put in place across the region in Nigeria, especially among uneducated women. Public health interventions such as health education and promotion should be more frequent among uneducated women. Also, programs focusing on increasing girls' educational opportunities should be more robust across Nigeria, particularly Northern Nigeria, where high fertility is more prevalent. Research focusing on the uneducated populace's perception of fertility and population will be integral in pursuing fertility reduction in Nigeria.

Limitation and strength

The study was based on a cross-sectional study design, and high rates of error, particularly non-sampling errors, are associated with this study design. More so that the information collected was self-reported, some cultural beliefs and practices might affect the information on fertility behavior. There are tendencies to underreport births due to omission and displacement, which could lead to the underestimation of fertility. Establishing causality using secondary data takes a lot of work. Nonetheless, nationally representative data and regional-based analysis are significant strengths of this study. Also, with Blinder-Oaxaca decomposition analysis, our study measured the magnitude of the explained and unexplained factors associated with high fertility across the region in Nigeria.

Conclusion

The fertility in Nigeria was high but more prominent among the uneducated than the educated. This was also the pattern observed across the six geopolitical zones in Nigeria. In all the regions, high fertility prevalence was higher among uneducated women. The magnitude of inequalities observed in literate-illiterate high fertility across the regions underscores the importance of women's education in reducing fertility in Nigeria. Maternal age at first marriage, wealth index, and age at first birth were contributory factors to the dissimilarities found in fertility between educated and uneducated women. Improving the level of educational enrolment among Nigerian women of reproductive age will facilitate the reduction in the fertility rate in Nigeria. Through this effort, the age at first marriage and birth will likely increase, and women's socioeconomic advancement will be assured.

Abbreviations

CEB Children Ever Born
NDHS Nigeria Demographic Health Survey
RD Risk Difference
SDGs Sustainable Development Goals
TFR Total Fertility Rate

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None

Authors' contributions

TAO Conceptualized the study. TAO, ASA, AFF, OCO analyzed the data. TAO, ASA, AFF, OCO, NA, DBO, OZW were involved in writing the first and final draft. All authors read and approved the final manuscript.

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Data Availability

The data utilized for this paper can be found at https://dhsprogram.com/ .The data is accessible to the public, but permission to use the data is required. The authors obtained permission from the data owners to use the data.

Declarations

Ethics approval and consent to participate

The data analyzed for this study were from the 2003, 2008, 2013, and 2018 Nigeria Demographic and Health Survey (NDHS) datasets.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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