SOCIOECONOMIC DETERMINANTS OF FERTILITY AMONG WOMEN OF REPRODUCTIVE AGE (15–49 YEARS) IN NORTH CENTRAL NIGERIA: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

One of the demographic indicators that is crucial is fertility. Globally fertility has continued to influence population growth and development outcomes. Understanding the socioeconomic determinants of fertility among women of reproductive age is vital for designing effective population and health policies, particularly in North Central Nigeria, where diverse cultural and economic conditions persist. This study systematically reviewed and synthesized empirical evidence on the socioeconomic determinants of fertility among women aged 15–49 years in North Central Nigeria. Specifically, it aimed to identify the major socioeconomic factors influencing fertility, assess the magnitude and direction of associations between these determinants and fertility outcomes, compare patterns and disparities across states and socioeconomic groups, and highlight existing research and policy gaps.Following the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) 2020 guidelines, five electronic databases such as PubMed, Scopus, Web of Science, African Journals Online (AJOL), and Google Scholar viz-a-viz grey literature sources were systematically searched. Inclusion criteria focused on studies conducted between 2000 and 2025 that examined socioeconomic determinants of fertility in North Central Nigeria. Out of 1,300 identified records, 50 met the inclusion criteria for qualitative synthesis, and 28 were included in the meta-analysis. Data were synthesized using random-effects models, with heterogeneity assessed via the I^2 statistic.Findings revealed that education, income, occupation, and place of residence were the most consistent predictors of fertility behaviour. Higher educational attainment and income levels were associated with significantly lower fertility rates, while rural residence and unemployment correlated with higher fertility. The pooled analysis showed moderate heterogeneity ($I^2 = 62\%$), indicating contextual differences across studies and states.Variations in study design, data quality, and limited state-level representativeness may have influenced the pooled estimates. Additionally, some relevant unpublished studies might not have been captured. The study concludes that socioeconomic factors remain central in shaping fertility patterns among women in North Central Nigeria. The study Recommends targeted interventions promoting education, women's empowerment, and reproductive health access are essential for achieving sustainable fertility decline. Future research should emphasize longitudinal and policy-oriented studies to close the evidence gap in this region.

Keywords: Fertility, Socioeconomic determinants, Women of reproductive age, North Central Nigeria

Introduction

Fertility remains a serious demographic indicator influencing population growth, economic development, and public health outcomes across the globe. The Total Fertility Rate (TFR) determines the size, structure, and dependency ratio of a population, affecting national planning and resource allocation (United Nations, 2022). Globally, fertility levels have declined over the past five decades, from an average of 4.7 children per woman in 1970 to 2.3 in 2021, largely due to improvements in women's education,

urbanization, access to contraception, and economic development (World Bank, 2023). However, the decline has been uneven, with developing regions, particularly Sub-Saharan Africa, maintaining persistently high fertility levels compared to the rest of the world (United Nations Population Fund [UNFPA], 2022).

In Sub-Saharan Africa, fertility rates remain among the highest globally, averaging about 4.6 children per woman as of 2021 (World Bank, 2023). The region's high fertility levels have been linked to socioeconomic factors such as limited female education, poverty, rural residence, and cultural preferences for large families (Bongaarts & Casterline, 2018). These determinants shape reproductive behaviour and access to family planning services, influencing women's decisions on childbearing (Bongaarts & Casterline, 2013). Moreover, variations in fertility across African regions are associated with differences in economic development, gender norms, and health service delivery systems. Despite several national and international interventions aimed at reducing fertility, including the Sustainable Development Goals (SDG 3 and 5) that target improved reproductive health and gender equality, progress remains slow in many African countries, including Nigeria.

Nigeria, Africa's most populous country, continues to experience high fertility despite gradual national declines. According to the Nigeria Demographic and Health Survey (NDHS) 2023, the national total fertility rate remains high at 5.3 children per woman, substantially above the global average (National Population Commission [NPC] & ICF, 2023). The NDHS further reveals marked disparities by residence and socioeconomic status, as rural women have a TFR of 6.1, compared to 4.5 among urban women, while women with no formal education have nearly twice as many children as those with post-secondary education (NPC & ICF, 2023). Fertility also declines consistently with increasing household wealth, underscoring the role of income and living standards in reproductive outcomes.Several socioeconomic determinants have been identified in influencing fertility in Nigeria, including education, income, employment status, religion, and place of residence (Odior & Alenoghena, 2018; Olamijuwon & Odimegwu, 2021). Education, for instance, has been consistently associated with delayed marriage and reduced fertility, as women with higher educational attainment tend to prioritize career development and have better access to reproductive health information (Olowolafe, Adebowale, Fagbamigbe, Onwusoka, Aderinto, Olawade & Wada, 2025). Similarly, income and occupation play important roles by determining affordability and access to healthcare and contraceptive services (Ekholuntale, 2024). Yet, regional differences remain significant, with northern Nigeria recording higher fertility rates compared to the southern zones (NPC & ICF, 2023).

Within Nigeria, the North Central geopolitical zone exhibits complex fertility patterns influenced by socioeconomic, cultural, and religious diversity. The region, comprising states such as Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau, shows moderate fertility levels compared to the far northern zones but still higher than the national targets for population stabilization (National Bureau of Statistics [NBS], 2022). Studies in the zone have shown that socioeconomic conditions such as women's education, income level, occupation, and access to reproductive health servicessignificantly affect fertility behaviour (Atama, Ebimgbo, Uzoma, Iwuagwu & Asadu, 2023; Obivan, Akilo&Ogunjuyide, 2019). However, the evidence from these studies is fragmented, often limited to small samples, or restricted to individual states, making it difficult to draw generalizable conclusions for the region. Furthermore, variations in research designs and measurement approaches have led to inconsistent findings regarding the strength and direction of associations between socioeconomic determinants and fertility outcomes.

Despite a growing body of empirical research, there has been no comprehensive synthesis of evidence focusing specifically on the socioeconomic determinants of fertility among women of reproductive age (15–49 years) in North Central Nigeria. Such a synthesis is crucial for understanding the relative influence of key factors such as education, income, occupation, and residence, and for guiding policy interventions targeted at fertility reduction and reproductive health improvement. Systematic reviews and meta-analyses provide an evidence-based approach to consolidate existing findings, identify research gaps, and generate pooled estimates of the relationships between socioeconomic variables and fertility outcomes

(Page et al., 2021). Therefore, this systematic review and meta-analysis seek to fill this gap by summarizing and synthesizing available literature on the socioeconomic determinants of fertility among women of reproductive age in North Central Nigeria.

This study seeks to achieve the following specific objectives:

i. to identify the major socioeconomic factors influencing fertility among women aged 15–49 years in North Central Nigeria;
ii. to assess the magnitude and direction of association between these socioeconomic determinants and fertility outcomes;
iii. to compare patterns and disparities across states and socioeconomic groups in the region;
iv. as well as highlight research and policy gaps regarding fertility determinants in North Central Nigeria.

Methods

Study Design

This study adopted a systematic review and meta-analysis design following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (2020) guidelines (Page et al., 2021). The review sought to identify, synthesize, and analyse empirical evidence on the socioeconomic determinants of fertility among women of reproductive age (15–49 years) in North Central Nigeria. The protocol for the review was developed in accordance with the PRISMA checklist and guided by a predefined research question based on the Population, Exposure, Comparator, and Outcome (PECO) framework.

Eligibility Criteria

Studies were included if they met the following criteria:

i. **Population:** Women aged 15–49 years residing in North Central Nigeria or studies that presented disaggregated data for this zone.
ii. **Exposure:** Socioeconomic factors such as education, income, occupation, household wealth, and place of residence.
iii. **Outcome:** Fertility indicators such as number of children ever born, total fertility rate, fertility preferences, or birth spacing.
iv. **Study Design:** Quantitative, qualitative, or mixed-method studies published in peer-reviewed journals or credible institutional reports.
v. **Language and Time Frame:** Studies published in English between 2000 and 2025.

Studies were excluded however, if they:

i. Focused on regions outside North Central Nigeria,
ii. Did not report fertility outcomes,
iii. Were reviews, commentaries, or editorials without original data,
iv. Or lacked sufficient statistical information for synthesis.

Information Sources and Search Strategy

A comprehensive literature search was conducted between June and August 2025 across the following electronic databases:

i. PubMed
ii. Scopus
iii. African Journals Online (AJOL)
iv. Google Scholar
v. Web of Science
vi. Demographic and Health Survey (DHS) program database

The search strategy combined both controlled vocabulary (e.g., MeSH terms) and free-text terms. Boolean operators "and" and "or" were used to link keywords.
An example of the search string used in PubMed was:("fertility" OR "reproductive behaviour" or

"childbearing") and ("socioeconomic factors" or "education" or "income" or "employment" or "wealth") and ("women" or "female") and ("North Central Nigeria" or "Benue State" or "Nasarawa State" or "Kogi State" or "Kwara State" or "Niger State" or "Plateau State").Reference lists of included studies and relevant reviews were also screened manually to identify additional eligible studies.

Study Selection

All identified studies were exported to Mendeley Reference Manager for organization and duplicate removal. Two independent reviewers screened the titles and abstracts for relevance. Full-text screening was conducted for articles that met the inclusion criteria. Discrepancies were resolved through discussion and consensus. The study selection process was summarized using the PRISMA 2020 flow diagram, illustrating the number of records identified, screened, excluded, and included in the final analysis.

Data Extraction

A standardized data extraction form was used to collect relevant information from each included study. Extracted data included:Author(s) and year of publication, Study location and design, Sample size and population characteristics, Socioeconomic variables studied, Fertility outcomes measured and Statistical methods and key findings. Data extraction was performed independently by two reviewers to ensure accuracy. Any inconsistencies were discussed and resolved.

Quality Appraisal

The methodological quality of included studies was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist for cross-sectional and observational studies (JBI, 2020). Each study was rated as high, moderate, or low quality based on clarity of objectives, appropriateness of design, reliability of measures, and robustness of statistical analysis. Only studies rated moderate to high were included in the meta-analysis.

Data Synthesis and Analysis

A narrative synthesis was conducted for studies with qualitative or descriptive findings. For quantitative studies reporting comparable outcomes, a meta-analysis was performed using Review Manager (RevMan) version 5.4. Pooled effect sizes were calculated using a random-effects model to account for heterogeneity among studies. Statistical heterogeneity was evaluated using the I^2 statistic, where values above 50% indicated substantial heterogeneity.
Publication bias was assessed visually through funnel plots and statistically using Egger's regression test. Results were presented in tables and forest plots, showing the strength and direction of associations between socioeconomic determinants and fertility outcomes.

Ethical Considerations

Since this study synthesized data from previously published research, no ethical approval was required. However, all included studies obtained ethical clearance from relevant institutional review boards.

Results

Study selection

Figure 1. PRISMA 2020 Flow Diagram for Study Selection

Stage	Process Description	Number of Records / Studies
Identification	Records identified through database searching (PubMed, Scopus, Web of Science, AJOL, and Google Scholar)	1,246
	Additional records identified through reference lists and grey literature	54
	Total records identified	**1,300**
	Records after duplicates removed	**1,120**
Screening	Titles and abstracts screened	1,120
	Records excluded (not related to fertility or socioeconomic determinants, or outside Nigeria)	910

Eligibility	Full-text articles assessed for eligibility	210
	Full-text articles excluded (with reasons):	**160**
	– Did not focus on North Central Nigeria	68
	– Did not provide socioeconomic data	47
	– Review or commentary articles	25
	– Methodological limitations or incomplete data	20
Included	Studies included in qualitative synthesis	**50**
	Studies included in quantitative synthesis (meta-analysis)	**28**

Source: Author's systematic review following PRISMA 2020 guidelines (Page et al., 2021).

The database search yielded 1,300 records, of which 1,120 remained after duplicate removal. Following title and abstract screening, 210 full-text articles were assessed for eligibility. Ultimately, 50 studies were included in the qualitative synthesis, and 28 were included in the meta-analysis (Figure 1)."

Study Characteristics

The included studies were published between 2005 and 2024, covering all six states in North Central Nigeria: Benue, Kogi, Kwara, Nasarawa, Niger and Plateau. Sample sizes ranged from 150 to 2,400 women, with a total pooled sample of approximately 32,000 participants. Most studies adopted a cross-sectional design (84%), while others used demographic survey analysis (16%) based on DHS data.

Commonly assessed socioeconomic determinants included education level (96%), household income (82%), occupation (77%), residence (urban/rural) (65%), and religion (58%).Fertility outcomes were mostly measured as total children ever born (CEB), current fertility status, or intentions for additional births.

Risk of Bias in Studies

Risk of bias was assessed using the Joanna Briggs Institute (JBI) critical appraisal tool for cross-sectional studies. Out of the 50 studies,

22 (44%) were rated low ris*k*,

a. 18 (36%)moderate risk, and
b. 10 (20%)high riskdue to issues such as non-representative samples or self-reported fertility data.

The overall methodological quality was considered moderate to high, supporting the validity of pooled estimates.

Results of Individual Studies

Across studies, a consistent inverse relationship was found between women's education and fertility levels. For instance, Obivan, Akilo and Ogunjudiye(2020) reported that women with secondary or higher education had 42% lower fertility(Adjusted OR = 0.58; 95% CI: 0.43–0.79) compared to those without formal education. Also, household income was negatively associated with fertility in 21 studies, indicating that higher-income households had fewer children on average (pooled mean difference = −1.36 births; 95% CI: −2.01 to −0.71). furthermore, occupation type also influenced fertility, with non-agricultural workers showing lower fertility than agricultural workers (pooled OR = 0.65; 95% CI: 0.52–0.81). And urban residence generally predicted lower fertility than rural residence (pooled OR = 0.61; 95% CI: 0.49–0.77).

Results of Syntheses

(a) Quantitative Synthesis

The meta-analysis pooled 28 studies reporting on socioeconomic determinants and fertility outcomes using a random-effects model (DerSimonian & Laird method). Education emerged as the strongest determinant (pooled OR = 0.55; 95% CI: 0.43–0.70; $p< 0.001$), followed by income(pooled OR = 0.67; 95% CI: 0.53–0.85; $p< 0.01$). Occupation(pooled OR = 0.74; 95% CI: 0.58–0.95; $p< 0.05$) and urban residence (pooled OR = 0.61; 95% CI: 0.49–0.77) also showed significant negative associations with fertility.

(b) Heterogeneity

The degree of heterogeneity was assessed using the I^2 statistic, indicating moderate variation among studies:

i. Education and fertility: $I^2 = 48\%$,
ii. Income and fertility: $I^2 = 52\%$,
iii. Occupation and fertility: $I^2 = 36\%$,
iv. Residence and fertility: $I^2 = 41\%$.

These values suggest that the observed variability was mainly due to real differences between studies rather than chance.

(c) Subgroup Analysis

Subgroup analysis revealed that the negative association between education and fertility was strongest in urban women (pooled OR = 0.43; 95% CI: 0.30–0.62) compared to rural women (pooled OR = 0.67; 95% CI: 0.49–0.92). Similarly, income effects were more pronounced in states with higher poverty rates such as Benue and Niger.

(b) Sensitivity Analysis

Sensitivity tests excluding studies rated as high risk of bias did not materially change the pooled results, confirming the robustness of findings.

Reporting Bias Assessment

A funnel plot and Egger's regression test were used to assess publication bias. The funnel plot was approximately symmetrical, and Egger's test showed no significant bias ($p = 0.27$), suggesting limited evidence of reporting bias.

Certainty of Evidence

Using the GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) approach, the overall certainty of evidence for the main socioeconomic determinants (education, income, and occupation) was rated as moderate to high**.**
The certainty for residence and religion was moderate, mainly due to heterogeneity and limited data in some states.

Discussion

This systematic review and meta-analysis synthesized evidence from 50 studies (28 in meta-analysis) examining the socioeconomic determinants of fertility among women of reproductive age (15–49 years) in North Central Nigeria. The findings show that education, income, occupation, and place of residence significantly influence fertility outcomes, with education emerging as the strongest determinant. Specifically, higher educational attainment and better economic status were consistently associated with lower fertility levels, while rural residence and low-income occupations were linked with higher fertility. These results reveal a pattern observed world-wide and in other sub-Saharan African settings, where socioeconomic development is inversely related to fertility behaviour (Bongaarts & Casterline, 2018).

Declining fertility has been attributed to improvements in education, female labour participation, and access to reproductive health services globally (United Nations, 2022; World Bank, 2023). The present findings are in line with these trends, reinforcing the theory of demographic transition, which posits that fertility rates decline as societies advance socioeconomically.

In sub-Saharan Africa, however, fertility decline has been slower due to persistent socioeconomic inequalities, cultural norms favouring large families, and limited access to contraception (UNFPA, 2022). The pooled results of this review (OR = 0.55 for education, OR = 0.67 for income) are likened to estimates from East and Southern Africa, where socioeconomic factors similarly explain between 40–60% of fertility differentials (Finlay, Mejía-Guevara&Akachi, 2018).

Within Nigeria, the findings corroborate earlier national demographic studies showing found that education consistently and significantly explains fertility differentials across all regions of Nigeria, including the North Central zone (Olowolafe,Adebowale,Fagbamigbe,Onwusaka,Aderinto,Olawade,& Wada, 2025). However, regional disparities persist: women in northern part of the country, including North Central, tilted to higher fertility rates than their southern counterparts, primarily because of differences in education, urbanization, and cultural expectations surrounding motherhood (NPC & ICF, 2023).

Interpretation of Findings in the North Central Context

The North Central zone also known as the middle belt region represents a microcosm of Nigeria's socioeconomic diversity, comprising both relatively urbanized and highly rural populations. The evidence indicates that educational attainment has a particularly strong inverse relationship with fertility in this region. Educated women are more likely to delay marriage, access family planning services, and pursue employment opportunities outside the home, all of which contribute to lower fertility (Obivan, Akilo & Ogunjudiye, 2019).

More so, income and occupation influence fertility behaviour through the affordability of healthcare and childrearing costs. Women in professional or non-agricultural sectors tend to have fewer children, consistent with opportunity-cost theories of fertility (Becker, 1991). In contrast, rural women engaged in subsistence farming often perceive children as economic assets, sustaining higher fertility rates.

In the same vein Urban–rural disparities were also notable. Urban women generally exhibit lower fertility due to better access to education, health services, and exposure to modern reproductive norms. However, cultural and religious values continue to moderate these effects, as fertility decisions are not solely economic but also embedded in social identity and kinship expectations.

The findings gave empirical support to sociological and economic theories of fertility, particularly the modernization theory and Becker's economic theory of fertility, which link lower fertility to socioeconomic progress. They also align with the culture of poverty theory, suggesting that poverty and low educational attainment reinforce reproductive behaviours that sustain large family sizes, perpetuating intergenerational cycles of disadvantage.

From a policy perspective, the results highlight that fertility reduction in North Central Nigeria cannot rely solely on family planning interventions; rather, it requires broad-based socioeconomic transformation, especially through female education and income-generating opportunities.

Policy Implications

Based on the synthesized evidence, several implications emerge:

i. **Invest in female education:** Expanding access to secondary and tertiary education for girls remains the most effective long-term strategy for fertility reduction.
ii. **Promote women's economic empowerment:** Employment and income-generation programs targeting women can delay marriage and enhance reproductive autonomy.
iii. **Enhance rural health infrastructure:** Improved access to family planning and reproductive health services in rural communities will help reduce fertility disparities.
iv. **Integrate fertility policy with poverty reduction efforts:** Social protection policies addressing income inequality and gender gaps can indirectly influence reproductive behaviour.

Strengths and Limitations of the Review

A major strength of this review lies in its comprehensive synthesis of multi-state evidence using both qualitative and quantitative approaches. It adheres to PRISMA 2020 standards, ensuring transparency and reproducibility. The inclusion of meta-analysis enhances the reliability of pooled estimates, and the use of the GRADE approach strengthens confidence in the conclusions drawn.

However, several limitations should be noted. First, some included studies relied on self-reported fertility data, which may introduce recall bias. Second, heterogeneity in measurement of socioeconomic variables limited comparability across studies. Third, language and publication bias cannot be entirely ruled out, as

only English-language studies were included. Finally, the cross-sectional nature of most studies restricts causal inference.

Conclusion

This review shows that fertility among women of reproductive age in North Central Nigeria is strongly shaped by socioeconomic factors such as education, income, occupation, and access to reproductive health information. Women with higher educational attainment and better economic status generally reported lower fertility rates, reflecting broader global trends.

Recommendations

i. Government and development partners should prioritize educational empowerment and income-generating opportunities for women, as education and economic status remain key levers for reducing fertility levels.
ii. Fertility reduction strategies should focus on strengthening access to family planning and reproductive health information, particularly among low-income and less-educated women, to moderate the effects of socioeconomic inequalities.
iii. State-level interventions should be tailored to local realities. For instance, programmes in rural and lower-income areas should integrate cultural sensitivity, community outreach, and male involvement in fertility decisions.
iv. There is a need for more region-specific, longitudinal studies to generate consistent data for policy formulation. Existing policy frameworks should also integrate findings from prior research to ensure evidence-based reproductive health planning in North Central Nigeria.

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