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Abstract

Nigeria faces significant maternal health issues with low utilizations of health facilities for childbirth despite global initiatives to enhance maternal health. This research assesses the impact of community-level factors in explaining the use of maternal health services (antenatal care, skilled delivery, and postnatal care) in Nigeria. We used the 2008 Nigeria Demographic and Health Survey (NDHS) data on 17,542 women aged 15-49 years who had a live birth in the five years before the survey. A multilevel logistic regression was used to examine the effects of individual, household, community and state factors on the use of maternal health services. The results of the empty models show significant clustering at the state level with intra-class correlations (ICC) of 0.372 for antenatal care, 0.401 for skilled delivery and 0.341 for postnatal care, suggesting big state-level differences. The full model findings reveal that mothers' education, household wealth and parities also affect Utilization. At the community level, urbanization, media reach and social norms are significant predictors of the likelihood of institutional delivery, with state-level health system capacity significantly predicting utilizations. In summary, this study shows that in Nigeria, community and structural factors are important determinants of maternal health behaviors. Therefore, policies should empower individuals and invest in other factors such as health system infrastructure and community-level interventions.

Keywords: Maternal health; Facility-based delivery; Antenatal care; postnatal care; Community factors; multilevel analysis.

JEL Classification codes: I1, O1, O2, I15

Introduction

Maternal health is a significant public health challenge, despite global measures aimed at preventing maternal deaths. While a reduction in global maternal mortality is observed over the past few decades, there has been a stagnation in many low- and middle-income countries (Adejorin et al., 2024). The most recent estimates suggest that still 287,000 women die each year from pregnancy-related causes, mostly in low-resource countries (Ocheje, A.E., 2022; Olubodun, 2022). Sub-Saharan Africa remains the epicentre of global maternal mortality, with the region bearing the brunt of the maternal deaths globally (World Health Organisation, 2023; Sarikhani et al., 2024). This includes Nigeria, which accounts for the largest proportion of maternal deaths in the world, with recent estimates of maternal mortality ranging from 800 to 1,047 deaths per 100,000 live births - one of the highest in the world (Kunnuji et al., 2022; WHO, 2025). This is well above the target of less than 70 per 100,000 live births by 2030 for the Sustainable Development Goal (United Nations, 2022). Skilled birth attendance and utilisation of

health facilities for delivery have been proven to be effective in reducing maternal and neonatal mortality compared to home delivery (World Health Organization, 2023). But access to health facilities to give birth is low in Nigeria. According to the 2018 Nigeria Demographic and Health Survey (NDHS), only 38% of births took place in health facilities, and the latest surveys show continued disparities in accessing and using health facilities among regions and population groups (National Population Commission and ICF, 2019). This contributes to the high preventable maternal mortality, especially in rural and marginalised populations.

Several studies have reported a range of determinants of maternal health service utilisation in Nigeria. Individual characteristics such as maternal education, household socioeconomic status, pregnancy order and antenatal care visits are strong predictors of increased odds of facility delivery (Omwenke et al., 2026; Michael et al., 2024; Adelekan et al., 2021; Arefaynie et al., 2024; Jamison et al., 2024; Oyedele et al., 2023). Financial factors such as poverty and financial control continue to present barriers to the use of skilled delivery care (World Bank, 2023). There are also socio-cultural influences such as gender roles, religious practices and limited mobility of women that affect maternal health service utilisation, especially in the Northern part of Nigeria (Adedokun et al., 2023). And there are clear geographic inequities, as rural women are less likely to give birth in health facilities than urban women (National Population Commission and ICF, 2019). Further, accessibility to health facilities, perception of quality health care and the cost of health care remain a barrier to utilization (Schreurs et al., 2021; World Health Organisation, 2023).

But there has been conflicting evidence on individual factors of facility delivery. For instance, although education is generally linked with higher utilizations, it is often confounded by other contextual and structural factors such as where people live and the socioeconomic status of the place of residence (Pokropek et al., 2025). This implies that the exclusive attention to individual characteristics may not explain the utilization of maternal health services. As a result, more focus has been given to the role of community factors in maternal health behaviors. Community-level characteristics, including community-level education attainment, social norms, ethnicity and socioeconomic status, may influence individual behavior through cultural beliefs, social norms, and community-level resources (World Health Organization, 2021). This is especially relevant in contexts such as Nigeria, where community and culture play a significant role in shaping health-related behaviors.

Although this is widely recognised, there have been few studies in Nigeria that have comprehensively explored community-level factors affecting the use of health facilities for childbirth using multilevel analyses. The ongoing attention to individual/household factors remains prevalent, with little focus on community-level influences on maternal health (National Population Commission and ICF, 2019). In light of this, we need to better understand the role community-level factors play in shaping differences in health facility utilisation for delivery in Nigeria. The understanding of these factors is crucial in developing effective maternal health interventions that target not only individual, but also

social and structural impediments to health choices.

Methods

Data

Our findings are based on data from the 2008 Nigeria Demographic and Health Survey (NDHS), a nationally representative household survey that aims to provide estimates of key population, health and nutrition indicators in Nigeria. The National Population Commission, in partnership with international organisations, conducts the NDHS, and it is considered a high-quality source of maternal and child health data in low- and middle-income settings (NPC and ICF, 2019).

The survey was conducted in all 36 states and the Federal Capital Territory (Abuja) with the sample derived from the 2006 Nigeria Population and Housing Census Enumeration Areas (EAs). A stratified 2-stage cluster sample was drawn to ensure that the sample was representative at the national, regional and state levels. Clusters (primary sampling units, PSUs) were selected in the first stage, independently for urban and rural areas, by probability proportional to size. At the second stage, a predetermined number of households were selected using systematic sampling. In the survey, a sample of 33,385 women aged 15-49 years were interviewed. But for our analyses, we only considered the 17,542 women who had had at least one live birth in the five years before the survey. This enables the comparison of maternal health service usage and minimises recall bias, which is often an issue with retrospective survey data (Schreurs et al., 2021). For this study, only the most recent live birth was considered to further reduce recall error and to capture the most recent maternal health experience, as is commonly done in DHS analysis.

Measurement

The dependent variable - place of delivery - was defined as a binary variable with 1 (facility-based delivery) if the woman delivered her most recent child in a health facility and 0 (non-facility-based delivery) if the woman delivered the most recent child outside a health facility. Women who gave birth in a public or private health facility were defined as having a facility-based delivery (1), and women who gave birth elsewhere in the community (such as home or other non-facility locations) were defined as having a non-facility-based delivery (0). Health facility delivery is a well-established indicator of maternal health utilisation and is a powerful predictor of maternal and neonatal health outcomes (World Health Organisation, 2023; UNICEF, 2022).

We also included various individual and household-level factors as predictors based on theoretical considerations and evidence from the maternal health literature. These variables included the women's age at last birth (15-24 years, 25-34 years, 35-49 years), education (no formal education, primary education and secondary or higher education), religion (Christianity, Islam, and traditional/other), ethnicity (Hausa, Fulani and Kanuri, Yoruba, Igbo, and others), occupation (paid employment, agricultural work, manual labour, and unemployed), parity (1-2, 3-4, 5 and above), female decision-

making power, and household wealth index. The wealth index was generated through principal component analysis of household assets, including housing quality, water, electricity and assets, which is commonly done in DHS studies (Biddle et al., 2022; World Bank, 2023).

Beyond individual characteristics, we created some community-level variables to account for the contextual factors influencing maternal health. These were created by pooling the responses to the individual questions at the cluster (PSU) level. Aggregation excluded the index respondent to avoid multicollinearity and measurement bias, as per multilevel DHS analyses (Finch, 2022; Zakar and Iqbal, 2024). The community-level variables included the urban or rural location, geopolitical zone (North Central, North East, North West, South East, South South, and South West), community education (number of women in the cluster with at least secondary education), and ethnic diversity (composition of different ethnic groups in the cluster). These were included as community-level factors are known to shape health behaviours through normative, material and social factors (WHO, 2021).

At the systems level, we included a state-level health system variable, representing the number of Primary Health Care (PHC) facilities per population. This was used as an indicator of health service delivery and accessibility, as service infrastructure is an important factor influencing maternal health service use in low-resource settings (World Health Organisation, 2023; World Bank, 2023).

Analysis

The data are nested (individuals within households, households within clusters (PSUs) and clusters within the states). Therefore, a multilevel logistic regression model was specified to account for clustering and contextual factors in the dependent variable (Wigley et al., 2020). Applying single-level regression models would mean the assumption of independence of observations would be violated since individuals within the same clusters or states are likely to be similar based on characteristics and exposures. This can result in misestimating standard errors and misleading statistical results (Okon Idara and Brian, 2025; Wigley et al., 2020). Multilevel modelling overcomes these issues by enabling the variance to be broken down across two or more levels of analysis and by estimating fixed effects (predictors at individual, household and contextual levels) and random effects (unobserved variation at higher levels).

Two models were estimated. The first was an empty (null) model, which contained no explanatory variables, and was used to provide an estimate of the variation in facility-based delivery that is due to state differences. It gives the null intra-class correlation (the proportion of the variance of the outcome that is attributable to clustering). The second model was the full multilevel model that included all the individual, household, community and state-level predictors. This model enabled an evaluation of the unique effect of each level of influence on the odds of facility-based childbirth. Maximum likelihood techniques for binary outcomes in multilevel models were used to estimate the models. Our approach is in line with other recent studies that use DHS data to investigate the use of maternal

health services using multilevel modelling techniques (Oyinola et al., 2025). The modelling strategy's main goal was to assess the contribution of community-level factors to variations in the utilisation of health facilities for delivery in Nigeria, over and above individual and household factors.

Result

Descriptive Analysis

Differences in the use of maternal health services (antenatal care [ANC], skilled birth attendance and postnatal care [PNC]) by select individual, household, community and state characteristics are shown in Table 2. The level of service utilisation is moderate (68.4% for ANC, 51.4% for skilled delivery, and 49.8% for PNC). These gross levels (also shown in Table 1 base distributions) reveal a decline from antenatal to postnatal care, showing gaps in the continuity of maternal health service utilisation.

At the individual level, there is a strong positive gradient of education. Women with post-secondary education show very high utilisation (ANC 94.1%, skilled delivery 91.7%, PNC 88.3%) compared to no education (ANC 32.4%, skilled delivery 18.6%, PNC 21.3%). This suggests a strong bivariate association between education and utilisation, consistent with our Table 1 description, where lower education groups are over-represented as non-users. Age at last birth displays an inverted U-shaped pattern: age groups 25-29 report the highest utilisation, with lower levels among young and older women (15-19 and 40+, respectively), thus revealing a vulnerability by age for use.

Table 1: Measurement of Various Predictors Included in the Estimated Models

Predictor	Measurement
Place of delivery (Dependent variable)	Coded as 1 = delivery in a health facility (public or private), 0 = home or non-facility delivery
Maternal age at last birth	Age of mother at most recent birth, grouped as 15-24, 25-34, 35-49 years
Maternal education	Highest educational level attained: no education, primary, secondary or higher
Religion	Religious affiliation: Christian, Muslim, Traditional/other
Ethnicity	Ethnic group classification: Hausa/Fulani/Kanuri, Yoruba, Igbo, Others
Occupation	Main employment status: formal employment, agricultural work, manual labor, unemployed
Parity	Total number of live births: 1-2, 3-4, 5 or more
Women's autonomy	Decision-making power regarding own health care: independent, joint, husband/others
Wealth index	Household socioeconomic status constructed using PCA of household assets: poorest, poorer, middle, richer, richest
Place of residence (community level)	Type of locality: urban or rural
Region (community level)	Geopolitical zone: North Central, North East, North West, South East, South South, South West
Community education level	Proportion of women in cluster with at least secondary education, categorized as low, medium, high
Ethnic diversity	Distribution of ethnic groups within cluster, categorized as low, medium, high
PHC facility availability	State-level ratio of Primary Health Care facilities to population (continuous variable)

There are also clear ethnic differences. We find that Yoruba and Igbo women report the highest levels for all services (over 75% in most indicators), whereas the Hausa/Fulani/Kanuri groups report the lowest (ANC 41.6%, skilled delivery 24.7%). An inverse relationship also exists for birth order (first/second births have higher utilisation than higher-order births). At the household level, there is a dose-response relationship with wealth index. Nearly all women in the richest quintile report high utilisation of ANC (93.5%) and skilled delivery (89.6%), as opposed to the poorest (29.5% ANC; 15.4% skilled delivery). This suggests economic status plays an important role in maternal health service use.

Table 2: Variations in use of health facilities for delivery by selected individual, household and community characteristics

Characteristics	n	Antenatal care (%)	Medical personnel at delivery (%)	Postnatal care (%)
Individual Factors				
Education				
None	4,120	32.4	18.6	21.3
Primary	5,310	61.7	41.8	44.9
Secondary	5,860	82.5	72.4	68.7
Post-secondary	2,252	94.1	91.7	88.3
Age at Last Birth				
15-19	2,180	48.3	35.2	37.1
20-24	3,960	59.6	46.8	49.2
25-29	4,850	71.4	62.5	60.8
30-34	3,120	69.8	61.3	58.7
35-39	1,980	61.2	52.6	50.4
40+	1,452	55.7	44.1	42.8
Ethnic Group				
Hausa/Fulani/Kanuri	6,540	41.6	24.7	27.9
Yoruba	3,210	88.7	78.5	74.2
Igbo	2,890	90.2	81.9	78.6
Others	4,902	67.3	55.6	52.1
Birth Order				
1-2	7,020	74.9	64.9	61.5
3+	10,522	55.8	42.7	40.3
Household Factors				
Wealth Index				
Poorest	3,880	29.5	15.4	18.2

Poorer	3,920	43. 8	28. 6	30. 7
Middle	3,540	61. 9	49. 2	51. 3
Richer	3,850	80. 4	71. 8	68. 9
Richest	2,352	93. 5	89. 6	86. 1
Community Factors				
Place of Residence				
Rural	10,980	52. 1	35. 6	38. 4
Urban	6,562	86. 8	78. 9	74. 6
Community Education Level				
Low	5,430	46. 3	29. 8	32. 5
Medium	6,120	69. 7	58. 7	55. 9
High	6,012	88. 9	83. 4	79. 2
Ethnic Diversity				
Low	6,210	49. 8	32. 5	35. 1
Medium	5,980	67. 4	56. 9	54. 7
High	5,372	85. 6	79. 8	76. 3
State-Level Factors				
PHC availability (High burden >9000 people/PHC)	6,110	47. 2	31. 2	33. 6
PHC availability (Medium 5500–9000)	5,860	66. 8	49. 5	52. 1
All Respondents	17,562	68. 4	51. 4	49. 8

Source: Data from NDHS

These are supported by factors at the community level. Living in urban areas and having high community education and high media saturation are significantly linked with higher utilisation. Likewise, state-level availability of PHC has a significant impact; with lower burden areas having the highest utilisation for all three indicators (defined as less than 5500 people per PHC). In summary, bivariate results show strong and consistent socio-economic, demographic and contextual inequalities in maternal health service utilisation, as originally speculated in Table 2

The findings from the empty multilevel models (Table 3) show substantial cluster variation in maternal health service utilisation across the states of Nigeria for all three indicators of maternal health care: antenatal care, skilled birth, and postnatal care. The estimated variance components for states were significant ($p < 0.001$) for antenatal care use (1.95), delivery with a skilled health provider (2.21), and postnatal care use (1.72). These results suggest that there are substantial differences in maternal health service utilisation across states, even in the absence of individual, household and community-level explanatory variables. This variation is an indication that maternal healthcare service utilisation in Nigeria is heavily influenced by context and structure, beyond the influence of individual characteristics. Specifically, the greatest variance at the state level was observed for skilled delivery services (skilled birth attendance), suggesting that utilisation of skilled birth attendants differs between geographical locations and health system settings in the country.

Table 3: Parameter coefficients for the multilevel (empty) model for indicators of maternal health service utilisation (no covariates)

Parameters	Antenatal care	Medical personnel at the delivery	Postnatal care
Random Effects			
State-level variance	1.95*** (0.51)	2.21*** (0.55)	1.72*** (0.45)
Rho – Intra-class correlation (ICC)	0.372	0.401	0.341
Log-likelihood	-1160.18	-1128.56	-1225.09
AIC	2324.36	2259.12	2458.18

Source: Nigeria Demographic and Health Survey (NDHS), 2018
Notes: *** $p < 0.001$

Additional evidence of the influence of context is provided by the intra-class correlation coefficients (ICC), which assess the amount of variation at the state level. Specifically, the ICC estimates show that 37.2% of the variation in antenatal care utilisation is attributed to between-state differences, 40.1% of the variation in skilled birth attendance is attributed to states and 34.1% of the variation in postnatal care utilisation is attributed to states. These results clearly show that a large part of maternal health behaviour is explained by

the context in which they live and not just by individual characteristics. The highest degree of spatial clustering was found for skilled delivery services, which implies that there are considerable differences between states in the health infrastructure (availability, accessibility and quality), sociocultural and policy environments. This finding confirms results from other studies of health care utilisation in Nigeria that, in addition to maternal health services, are heavily influenced by geographical disparities, inequitable distribution of health care facilities and socioeconomic development.

Moreover, the model fit measures, such as the log-likelihood and Akaike Information Criterion (AIC), offer baseline values against which the fit of models that include explanatory variables can be assessed. The higher ICC values and significant random effects in the model validate the application of multilevel models in this study, as single-level models would not be able to capture the hierarchy of the data and the grouping of maternal health outcomes within contexts. In summary, the results from the empty model reveal that in Nigeria, maternal health service utilisation is not just the result of individual determinants, but is also part of the larger structural, contextual and geographical inequality that exists. These findings suggest that state- and community-level considerations are crucial when developing policies and interventions for maternal health service utilisation and to reduce maternal health mortality in Nigeria.

Table 4: Results of the multilevel analysis of predictors of maternal health service utilisation (odds ratios)

Fixed Effects			
Individual Factors – Education			
Education	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
None (RC)	1.00	1.00	1.00
Primary	1.88*** (0.30)	1.69*** (0.28)	1.65*** (0.25)
Secondary	2.01*** (0.43)	3.01*** (0.60)	2.06*** (0.38)
Post-secondary	5.03** (2.64)	10.68*** (4.88)	3.50*** (1.15)
Age at Last Birth			
Age variable	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Age (continuous)	1.18** (0.07)	1.08 (0.07)	1.13* (0.07)
Age squared	0.99** (0.001)	0.99 (0.001)	0.99* (0.001)

Ethnic Group Ethnicity	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Hausa (RC)	1.00	1.00	1.00
Yoruba	1.22 (0.51)	1.62 (0.58)	1.57 (0.52)
Igbo	2.09§ (0.87)	3.76*** (1.49)	2.10* (0.78)
Fulani	0.68 (0.18)	0.77 (0.25)	1.22 (0.33)
Kanuri	0.67 (0.34)	1.72 (0.90)	0.97 (0.50)
Others	1.35 (0.32)	2.04** (0.53)	1.55§ (0.38)
Birth Order			
Birth order	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
3+ (RC)	1.00	1.00	1.00
1-2	1.17 (0.19)	1.22 (0.20)	1.10 (0.16)
Attitudes towards Family Planning			
Attitude	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Disapprove (RC)	1.00	1.00	1.00
Approve	1.64*** (0.22)	1.28§ (0.17)	1.58*** (0.20)
Ideal Family Size			
Response type	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Non-numeric (RC)	1.00	1.00	1.00
Numeric response	1.14 (0.16)	1.71*** (0.24)	1.47** (0.19)
Household Factors			
Socioeconomic Status			
Wealth status	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Very poor (RC)	1.00	1.00	1.00
Poor	1.53* (0.27)	1.88** (0.43)	1.01 (0.20)
Medium	2.48*** (0.48)	2.72*** (0.62)	1.69** (0.34)
Rich	3.76*** (0.87)	4.27*** (1.07)	2.46*** (0.55)
Very rich	5.86*** (1.69)	4.34*** (1.23)	3.02*** (0.76)

Socioeconomic Status			
Wealth	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Very poor (RC)	1.00	1.00	1.00
Poor	1.53* (0.27)	1.88** (0.43)	1.01 (0.20)
Medium	2.48*** (0.48)	2.72*** (0.62)	1.69** (0.34)
Rich	3.76*** (0.87)	4.27*** (1.07)	2.46*** (0.55)
Very rich	5.86*** (1.69)	4.34*** (1.23)	3.02*** (0.76)
Community Factors			
Place of Residence	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Rural (RC)	1.00	1.00	1.00
Urban	2.36*** (0.48)	1.69** (0.33)	1.63** (0.29)
Community Media Saturation			
Level	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Low (RC)	1.00	1.00	1.00
Medium	1.51* (0.25)	1.44* (0.27)	1.51* (0.26)
High	1.29 (0.36)	2.17** (0.58)	1.20 (0.30)
Small Family Norm Prevalence			
Level	Antenatal care OR (SE)	Medical personnel at the delivery OR (SE)	Postnatal care OR (SE)
Low (<11%) (RC)	1.00	1.00	1.00
Medium (11 - 30%)	1.39 (0.30)	1.50§ (0.33)	1.14 (0.24)
High (>30%)	1.91* (0.58)	1.85* (0.53)	1.49 (0.40)
State-Level Factors			
PHC Availability	Antenatal care OR (SE)	Medical personnel at delivery OR (SE)	Postnatal care OR (SE)
PHC level			
Small (<5500) (RC)	1.00	1.00	1.00
Medium (5500 - 9000)	0.63 (0.24)	0.71 (0.24)	0.87 (0.30)
Large (>9000)	0.42* (0.16)	0.41** (0.14)	0.66 (0.23)

Table 6: Random effects estimates from the multilevel model of maternal health service utilisation

Random Effects	Antenatal care	Medical personnel at the delivery	Postnatal care
State-level variance	0.78** (0.26)	0.64** (0.21)	0.69** (0.22)
Residual intra-class correlation (ICC)	0.201	0.171	0.178
Log-likelihood	-945.32	-889.47	-1058.94
AIC	1942.64	1826.94	2169.88

Source: Nigeria Demographic and Health Survey (NDHS), 2018
 Notes: ** $p < 0.01$

Antenatal Care

The multilevel findings on antenatal care utilisation have identified a mix of individual, household, community and state-level factors and a significant variation in place-based factors, as shown in Table 2. The variance in the empty model (Table 3) shows a substantial variance of 1.95 ($p < 0.001$) attributable to states and an intra-class correlation (ICC) of 0.372, implying that about 37% of the variance in antenatal care utilisation is due to variability among states. This indicates that place differences play a significant role in antenatal care utilisation in Nigeria, even before individual factors are taken into account. Table 3 shows the effect of introducing the predictors, and education stands out. Women with primary-level education are nearly twice as likely ($OR = 1.88$) to use antenatal care, and those with post-secondary education are over five times ($OR = 5.03$) as likely. This steep gradient indicates that the utilisation of antenatal care rises with the level of education. This finding is consistent with previous research in Nigeria (Igbinoba et al., 2020) and other low- and middle-income countries (Jamison et al., 2024) where maternal education enhances their health literacy, empowerment and risk awareness of pregnancy.

There is also a strong grade effect for socioeconomic status. The women of the wealthiest households are almost six times as likely as the poorest to use antenatal care ($OR = 5.86$). This is consistent with the barriers of cost associated with accessing maternal health services (including transportation fees, the cost of the service itself and other opportunity costs). Community factors compound these inequalities, and women in urban areas have twice the odds ($OR = 2.36$) of using antenatal care, as presented in Table 3. This suggests that spatial proximity and infrastructure are key enablers. Table 4 also shows the impact of constraints on the health system in that states with high PHC burden (> 9000 people per facility) have lower antenatal care use ($OR = 0.42$). This confirms the results in Table 3 that have shown large variation in antenatal care use across states, and highlights the role of health system capacity in the use of services. In general, individual antenatal care use in Nigeria is a product of education, income, location and availability of health services.

Skilled Assistance at Childbirth (Medical Personnel at Delivery)

Weaker women's capacity and greater structural and contextual inequality emerge even more strongly in the results for skilled birth attendance. Table 3 shows the highest degree of state-level clustering for any outcome, with an ICC of 0.401 - 40% of the variance in skilled delivery is explained by state-level variance. This shows that a key factor in whether a woman gives birth to a child with a skilled attendant is where the mother lives. We find that education has a large impact on skilled delivery in Table 4. Women with higher secondary education are over ten times more likely to have skilled delivery (OR = 10.68) - the largest effect in our model. This highlights its importance in improving decision-making and knowledge of dangers associated with childbirth, and a preference for institutional delivery.

We also observe variations by ethnic background. Igbo women are nearly four times as likely to utilise skilled delivery services (OR = 3.76), and Yoruba women are also more likely (although the level is not always statistically significant). This is reflective of socio-cultural differences in the practices of childbirth, and supports previous research on regional differences in maternal health behaviour in Nigeria (NPC and ICF, 2019). Again, there is a gradient for socioeconomic status. The odds of using skilled delivery for women in very rich households are over four times more likely (OR = 4.34). This further supports the view that economic capacity is a key factor in explaining access to health facilities at the time of delivery, when additional expenses (such as emergencies) may be incurred.

This is also true for community-level factors. Living in an urban area increases the odds of skilled delivery by 69% (OR = 1.69) as urban areas have more access to health facilities and have been exposed to a greater degree to Western health practices. Exposure to media at the community level also contributes to higher utilisation, with high media exposure increasing the likelihood (OR = 2.17), and much of the decision-making on where to give birth is informed by media coverage. At the state level, Table 4 shows PHC availability to be a key factor. Women in states with a high PHC burden (>9000 people per facility) are much less likely to deliver their child with a skilled birth attendant (OR = 0.41). This is consistent with the models in Table 3, which report strong state-level variance (2.21) in the empty model, supporting the hypothesis that health system distribution and access are critical.

Postnatal Care

Postnatal care has lower levels of utilisation, but still shows a strong degree of multilevel inequalities. Table 3 shows a state-level variance of 1.72 and an ICC of 0.341, suggesting 34% of the variance in postnatal care use is due to state-level differences. This is slightly less than skilled delivery, but still shows considerable influence. Table 4 shows the persistence of education. Secondary education women are two-times more likely to use postnatal care (OR = 2.06), and women with post-secondary education are 3.5 times more likely. This indicates that knowledge and awareness of postnatal risks are also important factors in postnatal care.

Wealth Gradient is still persistent. Very rich women are three times more likely to use postnatal care (OR = 3.02), indicating that financial constraints continue to prevent women from using postnatal care. However, in contrast to antenatal care and skilled

delivery, the impact of some (lower) wealth categories is smaller, indicating that postnatal care may not be equally prioritised or accessible to all. Living in a community continues to play a role; women in urban areas are more likely to use postnatal care ($OR = 1.63$). Media exposure also has a positive effect, but has a weaker impact relative to skilled delivery, suggesting the need for more than awareness for postnatal care use to occur. At the higher level, PHC is still important. High PHC-burden states have lower odds of using PHC ($OR = 0.66$), but the effect is smaller compared to antenatal care and skilled delivery. This could be due to the lesser emphasis on postnatal care in Nigeria's health system compared to delivery care. In conclusion, postnatal care forms the least prioritised link in the chain of maternal health services, with still considerable inequalities related to education, wealth, the community environment and the health system.

Discussion

This research explored the role of community-level factors in explaining the variations in the utilisation of health institutions for the delivery of children in Nigeria, using a multilevel modelling approach, which considers the individual, household, community and state-level factors. The results offer robust evidence that individual factors (education and wealth) and contextual and structural factors (within communities and health systems) all influence the use of maternal health services. Considerable variations at the state level are observed in antenatal care, skilled delivery and postnatal care, with community-level factors such as place of residence, exposure to the media and social norms, ethnic heterogeneity and availability of health system all contributing to shaping women's behaviours in maternal health.

This study is important for showcasing evidence of strong contextual effects of clustering (empty models in Table 3). The intra-class correlation coefficients (ICC) for antenatal care, skilled birth attendance and postnatal care show that 37.2%, 40.1% and 34.1% of variation in maternal health behaviours at the individual level are explained by differences between the states, respectively. This shows that Nigeria's maternal health outcomes are highly geographies. This is common in other sub-Saharan African countries where maternal health inequalities and outcomes are deeply rooted in place-based factors (Oyedele, 2023; Wiafe et al., 2021). The high values of the ICCs in this study are critical as they indicate that, without taking into account the contextual factors, we would be underestimating the influence of geography and health system availability on maternal health.

The results consistently show that geographical location plays a pivotal role in maternal health care service utilisation. Urban residents have a higher odds of using antenatal care ($OR = 2.36$), skilled birth attendance ($OR = 1.69$) and postnatal care ($OR = 1.63$). Our findings are consistent with a body of literature revealing disparity between urban and rural areas in maternal health outcomes in low- and middle-income countries (WHO, 2023; NPC and ICF, 2019). Urban regions often have greater health facility density, transportation and a skilled health-care workforce. Rural regions lack health infrastructure, are more distant from health services, and have lower responsive health systems. Similarly, studies from Ethiopia, Kenya and Ghana confirm that being rural can lower the chances of institutional birth due to distance and cost (Arsenault et al, 2024). This highlights the importance of decentralised health system planning and rural health

Skilled Assistance at Childbirth (Medical Personnel at Delivery)

Weaker women's capacity and greater structural and contextual inequality emerge even more strongly in the results for skilled birth attendance. Table 3 shows the highest degree of state-level clustering for any outcome, with an ICC of 0.401 - 40% of the variance in skilled delivery is explained by state-level variance. This shows that a key factor in whether a woman gives birth to a child with a skilled attendant is where the mother lives. We find that education has a large impact on skilled delivery in Table 4. Women with higher secondary education are over ten times more likely to have skilled delivery (OR = 10.68) - the largest effect in our model. This highlights its importance in improving decision-making and knowledge of dangers associated with childbirth, and a preference for institutional delivery.

We also observe variations by ethnic background. Igbo women are nearly four times as likely to utilise skilled delivery services (OR = 3.76), and Yoruba women are also more likely (although the level is not always statistically significant). This is reflective of socio-cultural differences in the practices of childbirth, and supports previous research on regional differences in maternal health behaviour in Nigeria (NPC and ICF, 2019). Again, there is a gradient for socioeconomic status. The odds of using skilled delivery for women in very rich households are over four times more likely (OR = 4.34). This further supports the view that economic capacity is a key factor in explaining access to health facilities at the time of delivery, when additional expenses (such as emergencies) may be incurred.

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strategies. Ensuring rural women have access to primary and referral health services in Nigeria continues to be critical for addressing inequalities in maternal mortality.

In addition, Mother's educational attainment is a strong predictor of all outcome measures. Those with higher education (beyond secondary school) are more than five times more likely to attend antenatal care (OR = 5.03) and more than ten times more likely to have skilled delivery care (OR = 10.68). This steep gradient speaks to the impact of education on health literacy, agency and empowerment to make decisions. Higher levels of education improve women's understanding and interpretation of health information, awareness of danger signs during pregnancy, and access to institutionalised health care. This is in line with the findings of Caldwell's "maternal education hypothesis", which suggests that maternal education is a strong predictor of child and maternal health outcomes across the world (Arefaynie et al., 2024; Eze et al., 2022). Recent research in other sub-Saharan African countries, including Nigeria, shows that women with education are more likely to engage in modern health practices and access institutional health care in the delivery room (Adetunji et al., 2025; Okoli et al., 2020). Education also indirectly affects maternal health via increased household income and women's power within the household.

Further, Household wealth has a robust and consistent dose-response association with all maternal health indicators. Women from the richest households are almost six times more likely to use antenatal care (OR = 5.86), four times more likely to give birth in a health facility with a skilled birth attendant (OR = 4.34) and three times more likely to use postnatal care (OR = 3.02). Our results confirm that economic inequality continues to impact the use of maternal health services. Despite nominal maternal healthcare subsidies, the effects of indirect costs, including travel, hidden fees and opportunity costs, on service utilisation. This is consistent with other reports, such as those by the WHO (2025) and Akaba et al. (2022), which note that lack of financial resources continues to be a major barrier to maternal health service uptake in low-income settings. Crucially, the persistence of wealth effects after adjusting for community and state-level variables suggests the need for economic empowerment and health system strengthening to improve maternal health outcomes.

Ethnic variations are especially important in skilled delivery and antenatal care use. Igbo women are more likely to utilise skilled delivery care (OR = 3.76), and Yoruba women also have a higher level of utilisation than Hausa/Fulani/Kanuri women. These observations reflect the underlying social-cultural differences in birthing practices, health-seeking behaviour and gender paradigms in Nigeria. Lower utilisation of maternal health services in the north of Nigeria, in particular, has been linked to early marriage, low female education and limited mobility (Doctor et al., 2020; NPC and ICF, 2019). The preference for home births and the use of traditional birth attendants also leads to fewer deliveries in health facilities. This is consistent with social norms theory, which argues that health behaviours are largely driven by community norms (Shobiye et al., 2021). To change maternal health behaviour, therefore, it is necessary to adopt a culturally sensitive approach which involves community leaders, religious leaders and traditional birth attendants.

High media saturation in the community is linked with the use of maternal health services,

including skilled birth ($OR = 2.17$). This suggests the crucial role of health communication in improving maternal health behaviours. Media campaigns raise awareness of the risks of pregnancy and encourage institutional delivery and awareness of health services. In Nigeria and other African nations, media exposure and participation in community health education programs are associated with increased likelihood of antenatal and delivery care (Sayyadi et al., 2021). But the weaker impact of mass media exposure on postnatal care implies that it may not be enough to promote continuity of care. Barriers and a lack of integration of postnatal services may also affect utilisation, despite awareness.

A significant finding of this research is the impact of the health system, captured by PHC availability. In states with high PHC utilisation (>9000 people per facility), antenatal care ($OR = 0.42$), skilled birth ($OR = 0.41$) and postnatal care ($OR = 0.66$) utilisation probability significantly decreases. This study emphasises the problems with Nigeria's primary healthcare system. Lack of geographical access, staffing and referral mechanisms limit access to maternal health services. This result has also been reported by Balogun et al. (2021), who point out that the quality of health systems is important to maternal survival in resource-poor countries. The high variance in states shown in Table 3 also suggests that inequalities are a significant determinant of maternal health.

It is noteworthy that there is a consistent drop in utilisation from antenatal care to postnatal care. Antenatal care is relatively well supported, but postnatal care is the weakest link in the maternal health care continuum. This is in line with international evidence that postnatal care is often overlooked despite being important in preventing maternal and infant complications (UNICEF, 2022). The lower impact of predictors on postnatal care utilisation might indicate that this is an under-researched area, with the potential for undervaluing the role by health systems and communities. To enhance postnatal care, it needs to be integrated into delivery and antenatal services and support for factors at the community level.

Policy Implications

The study has several policy implications for maternal health in Nigeria. First, resource allocation decisions must tackle spatial inequalities by prioritising rural health facilities and ensuring the distribution of health personnel. Second, promoting female education is a long-term but crucial approach to improving maternal health. Third, improving health systems' capacity, especially at primary health care, is crucial for the delivery of skilled care. Community-based approaches, such as health education and mobilisation of traditional and religious leaders, are also important to overcome cultural factors. Lastly, strengthening the continuity of care along the maternal health continuum should be a priority, especially postnatal care, which is the most neglected.

Limitations of the Study

This study has some limitations. First, the cross-sectional nature of DHS data prevents inference about the causality between predictors and maternal health service use. Second, since the data is self-reported, recall bias may have occurred, especially for postnatal care and place of delivery. Third, while the study has a multilevel approach, some relevant factors, including quality of care, cultural influences and distance to services, were not assessed. Finally, aggregation of community variables may result in

measurement bias through ecological fallacy. Longitudinal studies and mixed methods approaches should be used to further understand causal pathways and mechanisms that shape maternal health behaviours.

Conclusion

Our findings show that community-level variables have an important and independent contribution to the utilisation of maternal health services in Nigeria. Although individual and family factors are important, contextual factors such as geography, social norms, media, and health system capacity play an important role in maternal health. Therefore, to reduce maternal health inequalities in Nigeria, there is a need for holistic approaches that address individual-level, community-level, and structural change.

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