

Household WASH Conditions and Skilled Birth Attendance Among Women in Nigeria

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Abstract

Background

Skilled birth attendance (SBA) is a key intervention for reducing maternal and neonatal mortality; however, utilization remains suboptimal in Nigeria. Although socioeconomic determinants of SBA have been widely documented, limited evidence exists regarding the role of household environmental conditions. This study examined the association between household Water, Sanitation and Hygiene (WASH) conditions and skilled birth attendance among women in Nigeria using data from the 2024 Nigeria Demographic and Health Survey (NDHS).

Methods

A cross-sectional analytical study was conducted using nationally representative data from the 2024 NDHS. The study included 15,993 women aged 15–49 years whose most recent live birth occurred within five years preceding the survey. Skilled birth attendance was the outcome variable, while household environmental conditions were measured using a composite WASH indicator. Descriptive statistics summarized participant characteristics and SBA prevalence. Chi-square tests assessed bivariate associations, while multivariable logistic regression models estimated adjusted odds ratios (aORs) and 95% confidence intervals (CIs) for factors associated with SBA utilization. Statistical significance was set at $p < 0.05$.

Results

The prevalence of skilled birth attendance was 53.9%, while 46.1% of women utilized unskilled birth attendants during childbirth. In the fully adjusted model, educational attainment, household wealth, place of residence, parity, internet use, and media exposure were significantly associated with SBA utilization. Women with higher education had significantly higher odds of utilizing SBA compared with those without formal education (aOR = 8.81; 95% CI: 6.84–11.34). Similarly, women in the richest wealth quintile were more likely to utilize SBA than those in the poorest quintile (aOR = 6.88; 95% CI: 5.49–8.61). Rural residence (aOR = 0.68; 95% CI: 0.62–0.75) and higher parity (aOR = 0.61; 95% CI: 0.52–0.72) were associated with lower odds of SBA utilization. Internet use (aOR = 1.37; 95% CI: 1.18–1.59) and media exposure (aOR = 1.40; 95% CI: 1.27–1.53) remained positively associated with SBA utilization. Household WASH conditions were not significantly associated with SBA utilization after adjustment for socioeconomic and information-related factors (aOR = 0.95; 95% CI: 0.85–1.06).

Conclusion

Skilled birth attendance utilization in Nigeria was primarily driven by socioeconomic and informational factors rather than household WASH conditions. Educational attainment, household wealth, media exposure, internet use, place of residence, and parity were significant determinants of SBA utilization. Policies aimed at improving maternal health outcomes should prioritize female education, poverty

reduction, access to health information, and equitable access to maternal healthcare services, particularly among rural populations.

Trial registration

Not applicable.

BACKGROUND & RATIONALE

Maternal mortality remains a major public health challenge globally, particularly in low- and middle-income countries where structural inequities continue to constrain access to essential maternal healthcare services. Nigeria contributes substantially to the global burden of maternal mortality, with persistently low utilization of skilled birth attendance (SBA) remaining a major contributor to preventable maternal and neonatal deaths (1). Skilled birth attendance, defined as childbirth care provided by trained health professionals such as doctors, nurses, and midwives, is among the most effective interventions for preventing maternal and newborn mortality through timely identification and management of obstetric complications (2). Despite considerable investments in maternal health programmes, substantial disparities in SBA utilization persist across socioeconomic and geographic groups in Nigeria (3, 4).

Although previous studies have predominantly focused on individual and household socioeconomic determinants of SBA, increasing attention has shifted toward broader social and environmental determinants that shape healthcare utilization patterns. Household environmental conditions, particularly access to improved water sources, sanitation facilities, and hygienic living environments, represent important indicators of social deprivation and infrastructural inequality. From both Health Policy and Management and Environmental Health Science perspectives, these conditions extend beyond physical exposures and may influence women's ability to access and utilize maternal healthcare services. Poor environmental conditions are frequently associated with poverty, inadequate infrastructure, increased disease burden, reduced household resilience, and limited access to essential public services, all of which may indirectly affect maternal healthcare-seeking behaviour.

The conceptual basis for this study is grounded in the Andersen Behavioral Model of Health Services Utilization, which posits that healthcare utilization is influenced by predisposing factors, enabling resources, and need factors (5). Within this framework, household environmental conditions may operate as enabling or constraining factors that influence access to healthcare services. Specifically, environmentally deprived households are more likely to experience socioeconomic disadvantage, reduced mobility, poor transportation networks, lower access to information, and diminished healthcare accessibility. Consequently, the pathway linking environmental conditions to SBA utilization can be conceptualized as:

Household Environmental Conditions → Socioeconomic Disadvantage → Healthcare Accessibility → Skilled Birth Attendance Utilization (Fig. 1).

This framework suggests that women living in households with unimproved water and sanitation facilities may face multiple overlapping barriers that reduce the likelihood of delivering with a skilled birth attendant. The framework is also consistent with the Social Determinants of Health approach, which recognizes that health outcomes and healthcare utilization are shaped by the conditions in which people are born, live, work, and age (6).

Existing evidence from Nigeria consistently demonstrates that maternal education, household wealth, antenatal care attendance, media exposure, and urban residence are important predictors of SBA utilization (1, 3, 7). Rural residence, poverty, and inadequate healthcare infrastructure have similarly been identified as major barriers to facility-based delivery care (8, 9). However, household environmental conditions have largely been treated as background socioeconomic indicators rather than independent structural determinants of maternal healthcare utilization. Consequently, limited empirical evidence exists regarding whether environmental deprivation exerts an influence on SBA utilization beyond conventional socioeconomic factors.

This gap is particularly important because households lacking improved water and sanitation facilities often experience multidimensional deprivation characterized by poor infrastructure, geographic isolation, increased exposure to environmental health risks, and limited access to healthcare services. Such conditions may reduce women's capacity to seek timely maternal care and contribute to persistent inequalities in skilled delivery utilization. Despite growing calls for multisectoral approaches to health equity and sustainable development, environmental health indicators remain insufficiently integrated into maternal healthcare research and policy discussions in Nigeria (3).

Therefore, this study examines the association between household environmental conditions and skilled birth attendance among women in Nigeria using nationally representative data from the 2024 Nigeria Demographic and Health Survey (NDHS). By applying the Andersen Behavioral Model as a guiding framework, the study investigates whether household environmental deprivation, measured through water source, sanitation facilities, hygiene conditions, and household WASH status, is associated with lower utilization of skilled birth attendance after accounting for relevant socioeconomic and demographic characteristics. The findings are expected to provide evidence for integrated environmental and maternal health policies aimed at reducing inequities in maternal healthcare utilization and improving maternal health outcomes in Nigeria.

METHODS

Study Design, Data Source and Study Population

This study employed a cross-sectional analytical design using secondary data from the 2024 Nigeria Demographic and Health Survey (NDHS), a nationally representative survey conducted under the Demographic and Health Surveys (DHS) Programme. The NDHS utilized a stratified two-stage cluster

sampling design to collect information on population health, reproductive health, maternal healthcare utilization, and household characteristics across Nigeria.

The analysis was conducted using the Birth Recode (BR) dataset. The unit of analysis was the most recent live birth occurring within five years preceding the survey among women aged 15–49 years. Restricting the analysis to the most recent birth reduced recall bias and ensured comparability of maternal and household characteristics at the time of delivery. A total weighted sample of 15,993 women with complete information on skilled birth attendance and study variables was included.

Sampling Technique

The NDHS adopted a stratified two-stage sampling procedure. In the first stage, Enumeration Areas (EAs) were selected from the national sampling frame using probability proportional to size. In the second stage, households were systematically selected within each sampled cluster. All eligible women aged 15–49 years residing in selected households were interviewed using standardized DHS questionnaires administered electronically through Census and Survey Processing (CSPro) software.

Variables and Measurement

Outcome Variable

The outcome variable was skilled birth attendance (SBA), derived from the type of assistance received during childbirth. Deliveries attended by a doctor, nurse, or midwife were classified as skilled birth attendance and coded as 1, while deliveries assisted by traditional birth attendants, relatives, friends, other untrained persons, or with no assistance were classified as unskilled birth attendance and coded as 0.

Explanatory Variables

The primary explanatory variable was household Water, Sanitation and Hygiene (WASH) status. WASH was constructed as a composite indicator based on WHO/UNICEF Joint Monitoring Programme (JMP) classifications. Improved drinking water sources and sanitation facilities were categorized according to DHS definitions. Household hygiene was assessed using the availability of a designated handwashing facility with water and cleansing agents. Households meeting all three criteria were classified as having improved WASH (“Yes”), while those lacking one or more components were classified as having unimproved WASH (“No”).

Covariates included maternal age (15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49 years), educational attainment (none, primary, secondary, higher), place of residence (urban/rural), household wealth index (poorest, poorer, middle, richer, richest), parity (1–3, 4–6, and ≥ 7 births), internet use, and

media exposure. Media exposure was generated as a composite variable based on access to newspapers, radio, or television.

Data Management and Statistical Analysis

Data management and analyses were performed using Stata version 18.0 (StataCorp LLC, College Station, Texas, USA). Variables were cleaned, recoded, and labelled before analysis. Descriptive statistics were used to summarize participants' characteristics and study variables.

To account for the complex survey design of the NDHS, sampling weights, clustering, and stratification were incorporated in all analyses. Sampling weights were generated by dividing the DHS weight variable (v005) by 1,000,000. Survey design specifications were applied using the primary sampling unit (v021) and sampling strata (v022), and all analyses were conducted using Stata's survey (svy) commands.

Weighted frequencies and percentages were used to describe categorical variables. Associations between explanatory variables and SBA utilization were examined using survey-adjusted Pearson chi-square tests.

Three survey-weighted logistic regression models were fitted to identify factors associated with SBA utilization. Model I included socio-demographic variables, Model II included WASH, internet use, and media exposure, while Model III represented the fully adjusted model. Adjusted odds ratios (aORs) and 95% confidence intervals (95% CIs) were reported. Statistical significance was determined at $p < 0.05$.

Multicollinearity among explanatory variables was assessed using Variance Inflation Factors (VIF), and all variables met acceptable thresholds ($VIF < 5$). Model adequacy was assessed using likelihood ratio statistics and pseudo R-squared values.

Ethical Considerations

The NDHS protocol received ethical approval from the National Health Research Ethics Committee of Nigeria and the Institutional Review Board of ICF International, USA. Written informed consent was obtained from all participants before data collection. Permission to use the anonymized NDHS dataset was obtained from the DHS Programme. As the study involved secondary analysis of publicly available de-identified data, additional ethical approval was not required.

RESULT

Socio-Demographic Characteristics of Participants

A total of 15,993 women of reproductive age were included in the study. The mean age of participants was 29.2 ± 6.7 years. Most respondents were aged 25–29 years (27.47%) and 30–34 years (22.83%). Approximately 42.96% had no formal education, while 34.68% attained secondary education. Most

participants resided in rural areas (61.36%). Regarding wealth distribution, 25.82% belonged to the poorest quartile, whereas 16.12% were in the richest quartile.

More than half of households owned a television or radio (53.57%), and 95.36% of respondents were currently in union. Slightly above half of the women had parity between one and three children (53.21%). Internet use was reported by 21.44% of respondents, while 54.60% had exposure to at least one form of media (Table 1).

Table 1
Descriptive Analysis; Socio-demographic Characteristics of Study
Participants (NDHS, 2024)

Characteristics (N = 15,993)	Frequency (n)	Percentage (%)
Average (Mean$\pm$SD) age	29.2 $\pm$ 6.7	
Age group (years)		
15–19	822	5.1
20–24	3458	21.6
25–29	4394	27.5
30–34	3651	22.8
35–39	2346	14.7
40–44	1058	6.6
45–49	264	1.6
Highest Educational Level		
None	6871	43.0
Primary	1784	11.1
Secondary	5547	34.7
Higher	1791	11.2
Residence		
Urban	6180	38.6
Rural	9813	61.4
Wealth index		
Poorest	4130	25.8
Poorer	3200	20.0
Middle	3079	19.2
Richer	3006	18.8
Richest	2578	16.1
Household has TV or Radio		
No	7426	46.4
Yes	8567	53.6

Characteristics (N = 15,993)	Frequency (n)	Percentage (%)
Marital status		
Never in union	353	2.2
In union	15251	95.4
Widowed/Divorced/Separated	389	2.4
Parity		
1–3	8510	53.2
4–6	5204	32.5
7+	2279	14.3
Internet use		
No	12564	78.6
Yes	3429	21.4
Reads newspaper		
No	14802	92.5
Yes	1191	7.5
Listens to radio		
No	9231	57.7
Yes	6762	42.3
Watches TV		
No	9881	61.8
Yes	6112	38.2
Exposure to media		
No	7261	45.4
Yes	8732	54.6

Prevalence of Skilled Birth Attendance

The prevalence of skilled birth attendance among women in Nigeria was 53.90%, whereas 46.10% utilized unskilled birth attendants during childbirth (Table 2).

Table 2
Proportion of SBA Usage among Participants

Skilled Birth Attendant Usage	Frequency (n)	Percentage (%)
Unskilled	7372	46.1
Skilled	8621	53.9

Association between Household Environmental Conditions and Skilled Birth Attendance

Household environmental conditions were significantly associated with skilled birth attendance utilization. Source of drinking water demonstrated a significant association with SBA utilization ($\chi^2 = 303.13$, $df = 1$, $p < 0.001$). Women from households with improved water sources recorded higher utilization of SBA compared with those using unimproved water sources.

Toilet facility type was also significantly associated with SBA utilization ($\chi^2 = 1000.00$, $df = 1$, $p < 0.001$). Similarly, hygiene practice showed a statistically significant relationship with SBA utilization ($\chi^2 = 26.85$, $df = 1$, $p < 0.001$).

Household WASH condition was significantly associated with SBA utilization ($\chi^2 = 96.92$, $df = 1$, $p < 0.001$) (Table 3).

Table 3
Bivariate Analysis of the Association between Household Environmental
Conditions and Skilled Birth Attendance

Characteristics (N = 15,993)	Unskilled	Skilled	Total	p-value
Age group (years)				
15–19	486(59.1)	336(40.9)	822	< 0.001
20–24	1746(50.5)	1712(49.5)	3458	
25–29	2007(45.7)	2387(54.3)	4394	
30–34	1520(41.6)	2131(58.4)	3651	
35–39	958(40.8)	1388(59.2)	2346	
40–44	500(47.3)	558(52.7)	1058	
45–49	155(58.7)	109(41.3)	264	
Highest Educational Level				
None	5239(76.2)	1632(23.8)	6871	< 0.001
	835(46.8)	949(53.2)	1784	
Secondary	1208(21.8)	4339(78.2)	5547	
Higher	90(5.0)	1701(95.0)	1791	
Residence				
Urban	1410(22.8)	4770(77.2)	6180	< 0.001
Rural	5962(60.8)	3851(39.2)	9813	
Wealth index				
Poorest	3232(78.3)	898(21.7)	4130	< 0.001
Poorer	2083(65.1)	1117(34.9)	3200	
Middle	1281(41.6)	1798(58.4)	3079	
Richer	632(21.0)	2374(79.0)	3006	
Richest	144(5.6)	2434(94.4)	2578	
Household has TV or Radio				
No	4713(63.5)	2713(36.5)	7426	< 0.001
Yes	2659(31.0)	5908(69.0)	8567	
Marital status				

Characteristics (N = 15,993)	Unskilled	Skilled	Total	p-value
Age group (years)				
Never in union	106(30.0)	247(70.0)	353	< 0.001
In union	7099(46.6)	8152(53.4)	15251	
Widowed/Divorced/Separated	167(42.9)	222(57.1)	389	
Parity				
1–3	3320(39.0)	5190(61.0)	8510	< 0.001
4–6	2604(50.0)	2600(50.0)	5204	
7+	1448(63.5)	831(36.5)	2279	
Internet use				
No	7040(56.0)	5524(44.0)	12564	< 0.001
Yes	332(9.7)	3097(90.3)	3429	
Reads newspaper				
No	7241(48.9)	7561(51.1)	14802	< 0.001
Yes	131(11.0)	1060(89.0)	1191	
Listens to radio				
No	5457(59.1)	3774(40.9)	9231	< 0.001
Yes	1915(28.3)	4847(71.7)	6762	
Watches TV				
No	6387(64.6)	3494(35.4)	9881	< 0.001
Yes	985(16.1)	5127(83.9)	6112	
Exposure to media				
No	5046(69.5)	2215(30.5)	7261	< 0.001
Yes	2326(26.6)	6406(73.4)	8732	
Source of drinking water				
Unimproved	3415(54.9)	2807(45.1)	6222	< 0.001
Improved	3937(40.8)	5719(59.2)	9656	
Type of toilet				
Unimproved	4110(61.3)	2597(38.7)	6707	< 0.001

Characteristics (N = 15,993)	Unskilled	Skilled	Total	p-value
Age group (years)				
Improved	3242(35.3)	5929(64.7)	9171	
Hygiene				
Unimproved	2663(43.3)	3486(56.7)	6149	< 0.001
Improved	2688(48.1)	2903(51.9)	5591	
WASH				
No	6414(47.8)	7006(52.2)	13420	< 0.001
Yes	958(37.2)	1615(62.8)	2573	

Socio-Demographic Factors Associated with Skilled Birth Attendance

Several socio-demographic factors demonstrated significant associations with SBA utilization. Age group was significantly associated with SBA ($\chi^2 = 156.24$, $df = 6$, $p < 0.001$). Educational level demonstrated a strong association with SBA utilization ($\chi^2 = 5100.00$, $df = 3$, $p < 0.001$), while place of residence was also significantly associated with SBA utilization ($\chi^2 = 2200.00$, $df = 1$, $p < 0.001$).

Household wealth index showed a statistically significant relationship with SBA utilization ($\chi^2 = 4700.00$, $df = 4$, $p < 0.001$). Marital status ($\chi^2 = 39.50$, $df = 2$, $p < 0.001$) and parity ($\chi^2 = 483.37$, $df = 2$, $p < 0.001$) were also significantly associated with SBA utilization.

Media-related variables, including internet use, newspaper readership, radio listening, television viewing, and overall media exposure, demonstrated statistically significant associations with SBA utilization ($p < 0.001$) (Table 3).

Factors Associated with Skilled Birth Attendance

Three adjusted logistic regression models were fitted to identify factors associated with skilled birth attendance (SBA) (Table 4).

Table 4
Adjusted Models for Factors Associated with Skilled Birth Attendant Usage

	aOR (95% CI)		
	Model I	Model II	Model III
Age group (years)			
15–19	reference		reference
20–24	0.87(0.72–1.04)		0.85(0.70–1.02)
25–29	0.92(0.76–1.11)		0.89(0.73–1.07)
30–34	1.19(0.97–1.46)		1.16(0.95–1.42)
35–39	1.46(1.17–1.83)		1.42(1.14–1.78)
40–44	1.59(1.23–2.05)		1.55(1.20–2.00)
45–49	1.43(0.99–2.06)		1.39(0.96–1.99)
Highest Educational Level			
None	reference		reference
Primary	2.56(2.28–2.88)		2.45(2.18–2.75)
Secondary	4.99(4.51–5.53)		4.34(3.91–4.82)
Higher	11.64(9.13–14.84)		8.81(6.84–11.34)
Residence			
Urban	reference		reference
Rural	0.67(0.61–0.74)		0.68(0.62–0.75)
Wealth index			
Poorest	reference		reference
Poorer	1.35(1.21–1.51)		1.32(1.18–1.48)
Middle	2.20(1.95–2.49)		2.02(1.78–2.28)
Richer	3.62(3.10–4.22)		3.04(2.62–3.52)
Richest	9.00(7.17–11.31)		6.88(5.49–8.61)
Household has TV or Radio			
No	reference		
Yes	0.99(0.90–1.09)		

	aOR (95% CI)		
	Model I	Model II	Model III
Age group (years)			
Marital status			
Never in union	reference		
In union	1.14(0.87–1.48)		
Widowed/Divorced/Separated	1.16(0.81–1.66)		
Parity			
1–3	reference		reference
4–6	0.73(0.65–0.81)		0.74(0.66–0.82)
7+	0.60(0.51–0.70)		0.61(0.52–0.72)
Internet use			
No		reference	reference
Yes		5.65(4.98–6.41)	1.37(1.18–1.59)
Exposure to media			
No		reference	reference
Yes		3.71(3.44–4.01)	1.40(1.27–1.53)
WASH			
No		reference	reference
Yes		1.33(1.21–1.47)	0.95(0.85–1.06)

In Model I, socio-demographic characteristics were significantly associated with SBA utilization. Compared with women aged 15–19 years, women aged 35–39 years (aOR = 1.46; 95% CI: 1.17–1.83) and 40–44 years (aOR = 1.59; 95% CI: 1.23–2.05) had higher odds of utilizing SBA. Educational attainment showed a positive dose-response relationship, with higher odds observed among women with primary (aOR = 2.56; 95% CI: 2.28–2.88), secondary (aOR = 4.99; 95% CI: 4.51–5.53), and higher education (aOR = 11.64; 95% CI: 9.13–14.84) compared with those with no formal education. Rural residence was associated with lower odds of SBA utilization (aOR = 0.67; 95% CI: 0.61–0.74). Similarly, increasing household wealth was associated with progressively higher odds of SBA utilization, while higher parity was associated with lower odds.

In Model II, internet use (aOR = 5.65; 95% CI: 4.98–6.41), media exposure (aOR = 3.71; 95% CI: 3.44–4.01), and improved household WASH conditions (aOR = 1.33; 95% CI: 1.21–1.47) were significantly associated with SBA utilization.

In the fully adjusted model (Model III), educational attainment, household wealth, place of residence, parity, internet use, and media exposure remained significantly associated with SBA utilization. Women with higher education had greater odds of utilizing SBA (aOR = 8.81; 95% CI: 6.84–11.34), while those in the richest wealth quintile had nearly seven times higher odds of SBA utilization than women in the poorest quintile (aOR = 6.88; 95% CI: 5.49–8.61). Rural residence remained negatively associated with SBA utilization (aOR = 0.68; 95% CI: 0.62–0.75). Women with parity of 4–6 births (aOR = 0.74; 95% CI: 0.66–0.82) and ≥ 7 births (aOR = 0.61; 95% CI: 0.52–0.72) had lower odds of utilizing SBA. Internet use (aOR = 1.37; 95% CI: 1.18–1.59) and media exposure (aOR = 1.40; 95% CI: 1.27–1.53) remained positively associated with SBA utilization. Household WASH conditions were not significantly associated with SBA utilization after adjustment for socio-demographic and information-related factors (aOR = 0.95; 95% CI: 0.85–1.06).

DISCUSSION

This study examined the association between household Water, Sanitation, and Hygiene (WASH) conditions and skilled birth attendance (SBA) among women in Nigeria using nationally representative NDHS 2024 data. The findings showed that household WASH conditions were associated with SBA utilization at the descriptive and partially adjusted levels; however, the association was attenuated and no longer statistically significant after adjustment for socio-demographic and information-related factors. In contrast, educational attainment, household wealth, place of residence, parity, internet use, and media exposure remained significant determinants of SBA utilization.

The observed level of SBA utilization indicates that a substantial proportion of women in Nigeria continue to rely on unskilled delivery care despite ongoing efforts to improve maternal health outcomes. This finding reflects persistent inequities in maternal healthcare utilization and highlights continuing barriers to skilled delivery services. Although women from households with improved WASH conditions demonstrated higher utilization of SBA at the descriptive and bivariate levels, the loss of significance in the fully adjusted model suggests that environmental deprivation may influence maternal healthcare utilization indirectly through broader socioeconomic and informational pathways.

This finding is consistent with Andersen's Behavioral Model of Health Services Utilization, which proposes that healthcare use is influenced by predisposing, enabling, and need factors (5). Within this framework, household WASH conditions may function as contextual enabling resources that are closely linked to education, wealth, access to information, and healthcare accessibility. Households with improved water and sanitation facilities often possess greater socioeconomic resources and stronger connections to healthcare services. Consequently, the attenuation of the WASH association after adjustment suggests that environmental deprivation may influence SBA indirectly through

socioeconomic resources and healthcare accessibility rather than acting as an independent determinant of maternal healthcare utilization.

The attenuation of the WASH effect should not be interpreted as evidence that environmental health interventions are unimportant for maternal and newborn health outcomes. Previous evidence demonstrates that integrated WASH and maternal-newborn health interventions can improve maternal healthcare utilization when implemented alongside health system strengthening activities. For example, a significant improvements in facility deliveries, antenatal care attendance, hygiene practices, and maternal-newborn health outcomes following implementation of an integrated WASH/MNCH programme in Uganda (10). Similarly, global maternal and newborn health frameworks emphasize the importance of strengthening WASH systems within healthcare settings as part of broader efforts to improve maternal and newborn survival (11). Inadequate WASH infrastructure in healthcare facilities remains a recognized barrier to quality maternal and newborn care, particularly in resource-constrained settings (12).

Educational attainment emerged as one of the strongest determinants of SBA utilization. Women with higher levels of education were more likely to utilize skilled delivery services than women without formal education. Education may improve health literacy, increase awareness of pregnancy-related risks, strengthen decision-making autonomy, and enhance engagement with healthcare systems. This finding is consistent with studies conducted in Bangladesh and other low- and middle-income countries, which identified maternal education as a key determinant of skilled birth attendance and facility-based delivery utilization (13–15).

Household wealth also remained a strong predictor of SBA utilization. Women from wealthier households were more likely to access skilled delivery services than women from poorer households. Financial resources may facilitate transportation, reduce cost-related barriers, and improve access to quality maternal healthcare services. Similar socioeconomic inequalities in SBA utilization have been reported across low- and middle-income countries (16, 17). The persistence of wealth-related disparities observed in this study suggests that financial barriers continue to influence access to skilled maternal healthcare in Nigeria.

The lower likelihood of SBA utilization among rural women highlights continuing geographic inequities in maternal healthcare access. Rural communities frequently experience shortages of healthcare personnel, inadequate transportation systems, poor road networks, and limited access to health facilities. Similar rural–urban disparities have been reported across sub-Saharan Africa (18, 19). These findings underscore the importance of strengthening rural health systems and improving healthcare accessibility in underserved communities.

Women with higher parity were less likely to utilize SBA than women with fewer births. This finding may reflect increased confidence resulting from previous childbirth experiences, reduced perceived need for professional delivery care, or competing household responsibilities. Similar patterns have been reported in previous maternal health studies conducted in sub-Saharan Africa.

Internet use and media exposure remained independently associated with SBA utilization in the fully adjusted model. Women exposed to digital platforms and mass media were more likely to utilize skilled delivery services. Access to health information may improve awareness of pregnancy complications, birth preparedness, and available maternal health services. This finding supports previous evidence highlighting the contribution of health communication and media exposure to maternal healthcare utilization and reduction of maternal health inequalities (20–22).

A major strength of this study was the use of nationally representative NDHS 2024 data, which enhances the generalizability of the findings. The study also contributes to the literature by integrating environmental health indicators into maternal healthcare research within a recognized theoretical framework. However, the cross-sectional design limits causal inference. In addition, the analysis was restricted to variables available within the NDHS dataset and did not capture contextual factors such as distance to health facilities, quality of obstetric care, cultural beliefs, and community-level healthcare characteristics.

CONCLUSION

The findings suggest that improving SBA utilization in Nigeria requires addressing the broader social determinants of maternal health. Although household WASH conditions were associated with SBA utilization at the descriptive level, their effect was attenuated after adjustment for socioeconomic and informational factors. Educational attainment, household wealth, access to information, place of residence, and parity emerged as the most important determinants of SBA utilization. Consequently, policies aimed at improving maternal health outcomes should prioritize female education, poverty reduction, health information dissemination, and equitable access to maternal healthcare services, particularly among underserved rural populations. Integrated environmental and health-system interventions may further support maternal health improvements when implemented alongside these broader social and economic strategies.

ABBREVIATIONS

- aOR
Adjusted Odds Ratio
- BR
Birth Recode
- CI
Confidence Interval
- CSPro
Census and Survey Processing
- DHS
Demographic and Health Survey
- EA

Enumeration Area
JMP
Joint Monitoring Programme
MNCH
Maternal, Newborn and Child Health
NDHS
Nigeria Demographic and Health Survey
OR
Odds Ratio
SBA
Skilled Birth Attendance
SD
Standard Deviation
SDGs
Sustainable Development Goals
VIF
Variance Inflation Factor
WASH
Water, Sanitation and Hygiene
WHO
World Health Organization

DECLARATIONS

Ethics Approval and Consent to Participate

The 2024 Nigeria Demographic and Health Survey (NDHS) protocol was reviewed and approved by the National Health Research Ethics Committee of Nigeria (NHREC) and the Institutional Review Board of ICF International, USA. Written informed consent was obtained from all participants prior to data collection. All procedures involving human participants were performed in accordance with relevant ethical guidelines and regulations, including the principles of the Declaration of Helsinki. Permission to use the anonymized NDHS dataset was obtained from the DHS Program. The present study involved secondary analysis of publicly available de-identified data and therefore did not require additional ethical approval.

Consent for Publication

Not applicable.

Availability of Data and Materials

The datasets analysed during the current study are publicly available from the Demographic and Health Surveys (DHS) Program repository and can be accessed upon reasonable request and approval at <https://dhsprogram.com/data/>. No new datasets were generated during the current study.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

HOA conceived the study. HOA and OTO designed the study methodology. OG performed the statistical analyses. HOA, OTO, and OG contributed to data management and interpretation of findings. HOA drafted the original manuscript. HOA, OTO and OG critically revised the manuscript for important intellectual content. All authors reviewed, read, and approved the final manuscript.

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Figures



Figure 1

Pathway Linking Environmental Conditions to SBA Utilization