

Regional Disparities and Maternal Sociodemographic Determinants of Full Immunization Coverage Among Children Aged 12–23 Months in Nigeria: Insights from NDHS 2018

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Background: Childhood immunization is crucial for reducing morbidity and mortality from vaccine-preventable diseases. Despite global efforts, Nigeria faces persistently low immunization uptake with significant regional and socioeconomic disparities. This study investigated the prevalence, regional disparities, and sociodemographic determinants of full immunization coverage among children aged 12–23 months in Nigeria.

Methods: This secondary analysis utilized data from the 2018 Nigeria Demographic and Health Survey (NDHS), focusing on 2453 mothers with children aged 12–23 months. Full immunization coverage was defined per World Health Organization (WHO) guidelines. Descriptive statistics, bivariate analysis, and multivariable logistic regression identified predictors of coverage.

Results: Only 26% of children were fully immunized nationwide. Marked regional disparities were observed, with the North West (13%) and North East (18%) exhibiting the lowest rates, while the South East (42%) and South South (41%) had the highest. Multivariable analysis revealed that maternal education, household wealth, and region of residence were significant predictors. Children of mothers with higher education were more likely to be fully immunized (AOR: 1.87, 95% CI: 1.10–3.18, $p = 0.022$), as were those from the richest households compared to the poorest (AOR: 3.20, 95% CI: 1.95–5.25, $p < 0.001$). Children in the South East (AOR: 2.00, 95% CI: 1.16–3.46, $p = 0.013$) and South South (AOR: 1.73, 95% CI: 0.99–3.02, $p = 0.052$) also showed significantly higher odds of full immunization compared to the North West.

Conclusion: Full immunization coverage in Nigeria remains critically low, driven by pronounced regional and socioeconomic inequities. Targeted interventions focusing on improving maternal education, expanding equitable healthcare access in underserved regions, and providing financial support to low-income families are essential. Policy efforts must prioritize these vulnerable groups to enhance child health outcomes and achieve universal immunization coverage in Nigeria.

Keywords: childhood immunization, vaccine coverage, Nigeria, NDHS, regional disparities, child health, FIC

Background

Childhood immunization remains one of the most cost-effective public health interventions for reducing morbidity and mortality from vaccine-preventable diseases.^{1,2} Globally, immunization prevents an estimated four to five million deaths annually, primarily from diseases such as measles, diphtheria, pertussis, tetanus, and polio.^{3–5} Despite its well-documented benefits, immunization coverage remains suboptimal in many low- and middle-income countries (LMICs), including Nigeria, where disparities in vaccine uptake persist across socioeconomic, geographic, and demographic groups.^{6–8}

Nigeria accounts for a significant proportion of the global burden of vaccine-preventable diseases, with immunization coverage consistently falling below recommended targets.⁹ According to the Nigeria Demographic and Health Survey (NDHS) 2018, only 31% of children aged 12–23 months received all basic vaccines, far below the 90% global target set by the WHO.¹⁰ Immunization coverage in Nigeria is characterized by wide regional and socioeconomic disparities, with children in northern, rural, and low-income households facing the greatest barriers to vaccine uptake.^{11,12} These disparities contribute to Nigeria's persistently high rates of infant and child mortality, which remain among the highest globally.^{13,14}

Several factors influence childhood immunization coverage, including maternal education, socioeconomic status, geographic location, cultural beliefs, and healthcare access.^{11,12,15} Maternal education is particularly important, as higher levels of education have been associated with greater vaccine awareness, improved health-seeking behaviors, and higher immunization uptake.¹⁶ Economic status also plays a crucial role, with children from wealthier households being more likely to receive complete immunization due to fewer financial barriers to healthcare access.¹⁷

Geographic and infrastructural challenges further hinder immunization efforts in Nigeria. Children residing in rural and remote areas often experience limited access to healthcare facilities, long travel distances, and inadequate vaccine supply chains, all of which contribute to missed immunization opportunities.^{18,19} In northern Nigeria, sociocultural and religious beliefs also play a significant role, with some communities exhibiting vaccine hesitancy due to misconceptions about vaccine safety and efficacy.^{20,21} Past incidents of vaccine boycotts and misinformation campaigns have exacerbated these concerns, further reducing vaccine acceptance in certain regions.^{22–24}

In addition to individual and household-level factors, systemic challenges within Nigeria's healthcare system contribute to low immunization coverage.²⁵ Inconsistent vaccine supply chains, weak health infrastructure, and inadequate funding for immunization programs have been persistent issues.^{26,27} The country also faces poor data collection and monitoring systems, which hinder effective tracking of immunization defaulters and planning for targeted interventions.^{14,28,29} Addressing these barriers requires a multifaceted approach, including improving maternal education, expanding healthcare infrastructure, engaging community leaders, and implementing financial support programs for low-income families.²⁹

While previous studies have explored sociodemographic determinants of childhood immunization in Nigeria, gaps remain in understanding how these factors interact across different regions and socioeconomic groups. Our focus on maternal sociodemographic factors was guided by existing evidence linking maternal characteristics to child health outcomes and by the data availability in the NDHS, which primarily collects information from mothers. This study aims to examine the prevalence, regional disparities, and sociodemographic predictors of full immunization coverage among children aged 12–23 months in Nigeria. The findings will provide evidence-based insights to inform policies and interventions aimed at improving immunization coverage and reducing preventable childhood deaths”.

Methods

Study Setting, Design, and Data Source

This study utilized data from the 2018 Nigeria Demographic and Health Survey (NDHS), a nationally representative survey conducted across Nigeria's six geopolitical zones: North Central, North East, North West, South East, South South, and South West. The NDHS is part of the Demographic and Health Surveys (DHS) program, which collects comprehensive health and demographic data from women of reproductive age (15–49 years) and children under five years. The study employed a cross-sectional design, analyzing data from the Kids Recode (KR) dataset of the 2018 NDHS. The KR dataset contains detailed information on child health indicators, including immunization status, as well as maternal sociodemographic and reproductive health data.

Study Population and Sampling

The study population included women aged 15–49 years from the 2018 NDHS who had given birth in the past five years. While the unit of analysis was the child aged 12–23 months, data were obtained from their mothers. Therefore, the study population comprised women aged 15–49 years with eligible children, while the target population for the study's

outcomes was children aged 12–23 months, totalling 2453 children, as they are expected to have completed the full vaccination schedule.

Survey Instrument and Data Collection

The 2018 NDHS employed a structured Woman's Questionnaire to gather data on sociodemographic characteristics, reproductive health, service utilization, and child health indicators, including immunization status. Information on vaccination coverage was collected using two methods: verification of vaccination cards when available, where interviewers recorded vaccination dates directly onto the questionnaire, and mothers' verbal reports when cards were unavailable or incomplete. This dual approach allowed for a comprehensive assessment of vaccination status among children. The structured Woman's Questionnaire used in the 2018 NDHS is publicly available via the DHS Program website (<https://dhsprogram.com/Methodology/Survey-Types/DHS-Questionnaires.cfm>)".

Study Variables

The dependent variable in this study was full immunization coverage (FIC), defined according to World Health Organization (WHO) guidelines.³⁰ A child was considered fully immunized if they had received the following vaccines: one dose of Bacillus Calmette-Guérin (BCG) for tuberculosis, three doses of diphtheria-pertussis-tetanus (DPT) vaccine, at least three doses of polio vaccine, and one dose of measles vaccine. The immunization status variable was recoded into a binary outcome: "fully immunized" (1) if the child had received all recommended vaccines, and "not fully immunized" (0) if the child had missed one or more doses. Responses such as "vaccination date on card" were categorized as "fully immunized", while "no vaccination" or "don't know" responses were categorized as "not fully immunized". Responses based solely on maternal recall or marked cards without dates were excluded from the analysis due to potential inaccuracies.

The independent variables included sociodemographic characteristics of the mothers, such as age, educational attainment, marital status, religion, wealth index, distance to the nearest health facility, employment status, number of living children, sex of the household head, place of residence (urban/rural), and region of residence.

Statistical Analysis

Descriptive statistics were used to summarize the sociodemographic characteristics of the study population and the prevalence of FIC. Bivariate and multivariable logistic regression analyses were conducted to examine the associations between sociodemographic factors and immunization status. Crude odds ratios (CORs) and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated to quantify the strength and significance of these associations. A p-value of <0.05 was considered statistically significant.

All analyses were performed using Stata version 17, with sampling weights applied to account for the complex survey design. Data visualization tools, including pie charts, bar charts, and geographical maps, were generated using GeoPandas in Python with GADM map data for Nigeria. These visualizations were used to illustrate regional disparities in immunization coverage and the spatial distribution of immunization rates across Nigeria.

Results

Sociodemographic Characteristics of Mothers

The study analyzed data from 2453 mothers with children aged 12–23 months, and their sociodemographic characteristics are summarized in Table 1. The majority of mothers (27.9%) were aged 25–29 years, followed by those aged 30–34 years (21.7%) and 20–24 years (20.2%). The smallest proportion of mothers (1.7%) were aged 45–49 years. Education levels varied, with 37.8% of mothers having no formal education, while 14.9% had primary education, 37.1% had secondary education, and 10.3% had higher education. Most mothers were married (92.3%), while 3.3% were cohabiting, 2.2% had never been in a union, and 1.4% were divorced or separated.

Table 1 Sociodemographic Characteristics of Mothers (N=2453)

Variable	Category	Weighted Freq.	Percent
Age in 5-year groups	15-19	109	4.4%
	20-24	496	20.2%
	25-29	685	27.9%
	30-34	532	21.7%
	35-39	441	18.0%
	40-44	149	6.1%
	45-49	42	1.7%
Education Level	No Education	927	37.8%
	Primary	365	14.9%
	Secondary	910	37.1%
	Higher	252	10.3%
Marital Status	Never in union	54	2.2%
	Married	2263	92.3%
	Living with partner	81	3.3%
	Widowed	21	0.9%
	Divorced/Separated	34	1.4%
Wealth Index	Poorest	482	19.7%
	Poorer	465	19.0%
	Middle	472	19.2%
	Richer	516	21.0%
	Richest	518	21.1%
Currently Working	No	752	30.7%
	Yes	1701	69.3%
Religion	Catholic	276	11.3%
	Other Christian	842	34.3%
	Islam	1322	53.9%
	Others	13	0.5%
Sex of Household Head	Male	2174	88.6%
	Female	279	11.4%
Distance to Health Facility	Big problem	705	28.7%
	Not a big problem	1748	71.3%
Births in Last Five Years	1	1001	40.8%
	2	1235	50.3%
	3	201	8.2%
	4 +	16	0.7%
Number of Living Children	0-1	482	19.6%
	2-3	947	38.6%
	4-5	608	24.8%
	6-7	285	11.6%
	8 +	131	5.3%
Residence	Urban	1107	45.1%
	Rural	1346	54.9%

(Continued)

Table 1 (Continued).

Variable	Category	Weighted Freq.	Percent
Region	North Central	337	13.7%
	North East	398	16.2%
	North West	660	26.9%
	South East	328	13.4%
	South South	282	11.5%
	South West	450	18.3%

Regarding socioeconomic status, 19.7% of mothers belonged to the poorest wealth quintile, whereas 21.1% were in the richest quintile. A majority of mothers (69.3%) were currently employed. In terms of residence, 54.9% lived in rural areas, while 45.1% resided in urban settings.

Prevalence of Full Immunization Coverage

The overall prevalence of full immunization coverage among children aged 12–23 months was 26.0%, indicating that 74.0% of children were not fully immunized (Figure 1).

Proportion of Full Immunization Coverage (12-23 months)

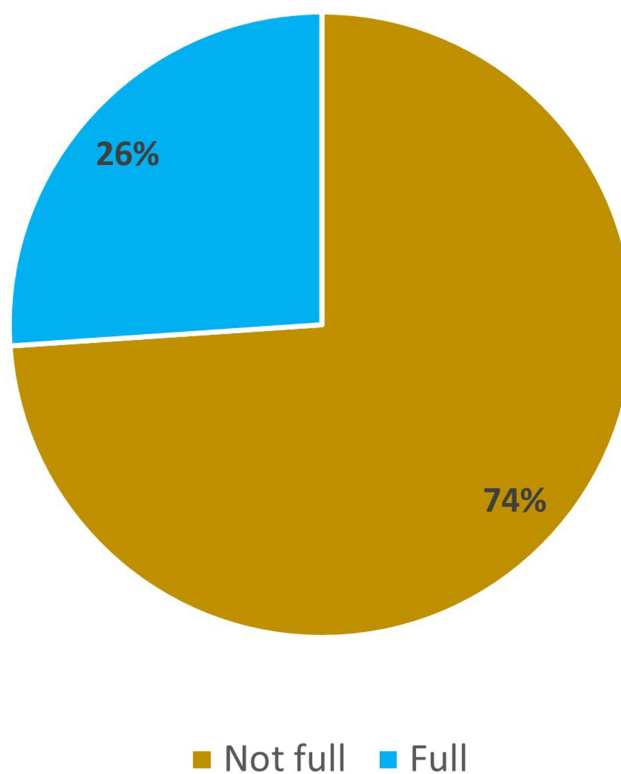


Figure 1 Full Immunization Coverage in Nigeria.

Regional Disparities in Full Immunization Coverage (FIC)

There were substantial regional variations in full immunization coverage (Figure 2). The North West had the lowest coverage at 13.0%, followed by the North East (18.0%) and North Central (22.0%). The highest immunization rates were observed in the South East (41.50%), South South (41.0%), and South West (34.0%). The geographic disparities in full immunization coverage are further illustrated in Figure 3.

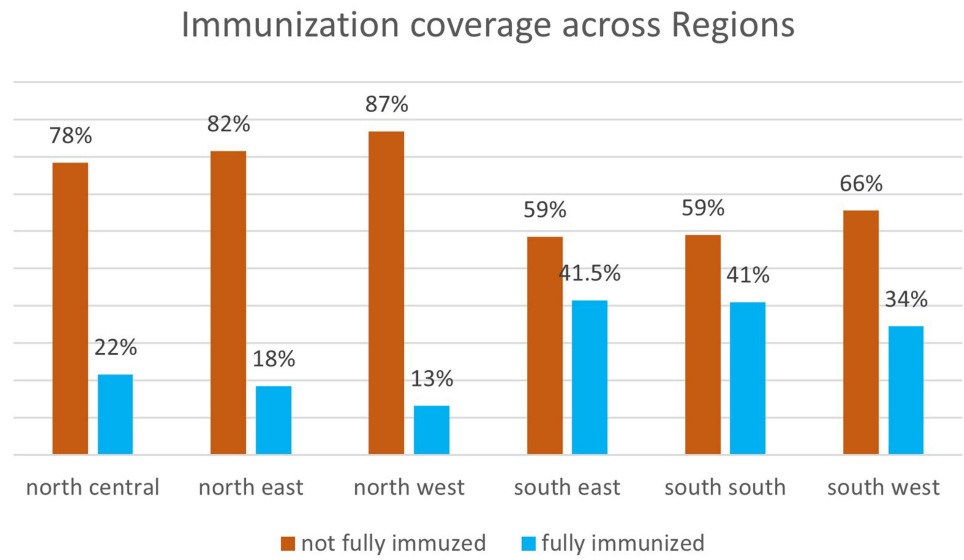


Figure 2 Immunization coverage across Regions of Nigeria.

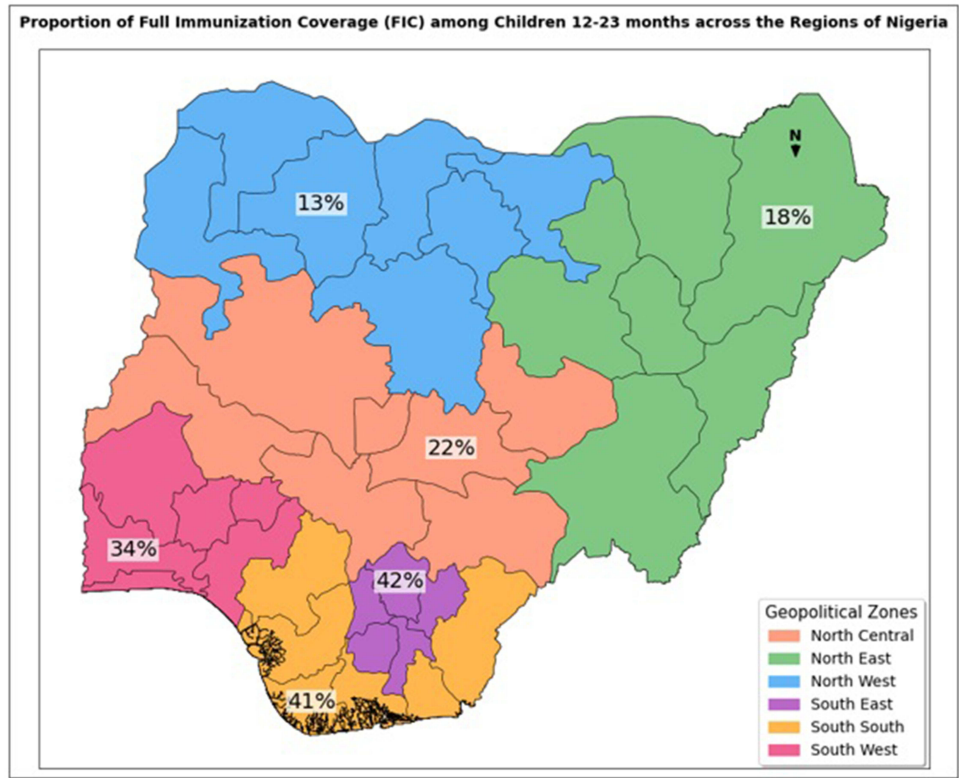


Figure 3 Map of Nigeria showing Full Immunization Coverage across Regions of Nigeria.

Bivariate Analysis of Maternal Characteristics and Full Immunization Coverage

Bivariate analysis showed significant associations between FIC and maternal characteristics such as age, education, wealth index, employment, distance to a health facility, and religion (Table 2). Full immunization rates increased with maternal age, with mothers aged 35–39 years having the highest immunization rates (33.98%), while those aged 15–19

Table 2 Bivariate Analysis of Mothers' Characteristics and Immunization Coverage

Variable	Immunization Coverage		COR [95% C.I.]	P-value
	Not Fully Immunized Freq. (%)	Fully Immunized Freq. (%)		
Age Group				
14-19 (Ref.)	95 (87.68)	13 (12.32)		
20-24	392 (79.02)	104 (20.98)	1.89 [0.99–3.62]	<0.05*
25-29	500 (72.96)	185 (27.04)	2.64 [1.40–4.95]	<0.01**
30-34	389 (73.15)	143 (26.85)	2.61 [1.37–4.96]	<0.01**
35-39	291 (66.02)	150 (33.98)	3.66 [1.88–7.15]	<0.001***
40-44	110 (73.60)	40 (26.40)	2.55 [0.98–6.65]	<0.05*
45-49	37 (87.44)	5 (12.56)	1.02 [0.30–3.43]	0.972
Education Level				
No education (Ref.)	822 (88.73)	104 (11.27)		
Primary	261 (71.59)	104 (28.41)	3.12 [1.95–5.00]	<0.001***
Secondary	593 (65.24)	316 (34.76)	4.19 [3.20–5.50]	<0.001***
Higher	136 (54.14)	116 (45.86)	6.67 [4.51–9.86]	<0.001***
Marital Status				
Never married (Ref.)	37 (67.93)	17 (32.07)		
Married	1673 (73.90)	591 (26.10)	0.75 [0.40–1.40]	0.366
Living with partner	63 (77.66)	18 (22.34)	0.61 [0.27–1.40]	0.242
Widowed	17 (79.10)	4 (20.90)	0.56 [0.16–1.91]	0.355
Divorced/Separated	25 (72.81)	9 (27.19)	0.79 [0.24–2.63]	0.702
Wealth Index				
Poorest (Ref.)	428 (88.73)	54 (11.27)		
Poorer	413 (88.90)	52 (11.10)	0.98 [0.65–1.47]	0.933
Middle	343 (72.64)	130 (27.36)	2.96 [2.07–4.25]	<0.001***
Richer	349 (67.63)	167 (32.37)	3.77 [2.58–5.50]	<0.001***
Richest	281 (54.14)	238 (45.86)	6.67 [4.61–9.65]	<0.001***
Working Status				
No (Ref.)	593 (78.86)	159 (21.14)		
Yes	1220 (71.74)	481 (28.26)	1.47 [1.15–1.87]	<0.01**
Religion				
Christianity (Ref.)	713 (63.72)	406 (36.28)		
Islam	1092 (82.60)	230 (17.40)	0.32 [0.23–0.45]	<0.001***
Others	9 (68.32)	4 (31.68)	0.71 [0.23–2.19]	0.55
Sex of Household Head				
Male (Ref.)	1614 (74.27)	559 (25.73)		
Female	199 (71.20)	80 (28.80)	1.17 [0.86–1.59]	0.327
Distance to Health Facility				
Big problem (Ref.)	576 (81.83)	128 (18.17)		
Not a big problem	1237 (70.73)	512 (29.27)	1.86 [1.36–2.55]	<0.001***

(Continued)

Table 2 (Continued).

Variable	Immunization Coverage		COR [95% C.I.]	P-value
	Not Fully Immunized Freq. (%)	Fully Immunized Freq. (%)		
Births in Last 5 Years				
1 (Ref.)	692 (69.19)	308 (30.81)		
2	945 (76.53)	290 (23.47)	0.69 [0.54–0.88]	<0.01**
3	160 (79.72)	41 (20.28)	0.57 [0.38–0.87]	<0.05*
4+	15 (95.50)	1 (4.50)	0.11 [0.01–0.82]	<0.05*
Number of Living Children				
0-1 (Ref.)	355 (73.59)	127 (26.41)		
2-3	661 (69.87)	285 (30.13)	1.20 [0.89–1.63]	0.234
4-5	455 (74.81)	153 (25.19)	0.94 [0.66–1.34]	0.725
6-7	230 (80.71)	55 (19.29)	0.67 [0.43–1.02]	0.063
8+	112 (85.51)	19 (14.49)	0.47 [0.27–0.84]	<0.05*
Residence				
Urban (Ref.)	723 (65.26)	385 (34.74)		
Rural	1091 (81.04)	255 (18.96)	0.44 [0.35–0.55]	<0.001***
Region				
North West (Ref.)	573 (86.82)	87 (13.18)		
North Central	264 (78.40)	73 (21.60)	1.82 [1.27–2.60]	<0.01**
North East	324 (81.52)	73 (18.48)	1.49 [1.01–2.21]	<0.05*
South East	192 (58.50)	136 (41.50)	4.67 [3.25–6.71]	<0.001***
South South	166 (58.99)	115 (41.01)	4.58 [3.14–6.68]	<0.001***
South West	294 (65.52)	155 (34.48)	3.47 [2.28–5.27]	<0.001***

Notes: *Significant at: *p < 0.05; **p < 0.01; ***p < 0.001.

years had the lowest coverage (11.27%). Compared to younger mothers, older mothers had significantly higher odds of fully immunizing their children (COR: 3.66, 95% CI: 1.88–7.15, $p < 0.001$).

Higher levels of maternal education were associated with increased immunization rates. Mothers with higher education had the highest immunization rate (45.86%), followed by those with secondary education (34.76%) and primary education (28.41%). Compared to mothers with no formal education, those with higher education were significantly more likely to fully immunize their children (COR: 6.67, 95% CI: 4.51–9.86, $p < 0.001$). Similarly, wealth status played a crucial role in immunization uptake. Full immunization rates were lowest among children from the poorest households (11.27%) and highest among children from the richest households (45.86%). Children from the highest wealth quintile were significantly more likely to be fully immunized than those from the lowest quintile (COR: 6.67, 95% CI: 4.61–9.65, $p < 0.001$).

Employment status was also associated with immunization coverage. Children of employed mothers had a higher immunization rate (28.26%) compared to those of unemployed mothers (21.14%) (COR: 1.47, 95% CI: 1.15–1.87, $p = 0.002$). Access to health facilities influenced immunization uptake, as mothers who reported that distance was “not a big problem” had higher immunization rates (29.27%) compared to those who considered distance a major barrier (18.17%) (COR: 1.86, 95% CI: 1.36–2.55, $p < 0.001$). Additionally, religious affiliation was significantly associated with immunization status. Immunization coverage was higher among Christian mothers (36.28%) compared to Muslim mothers (17.40%) (COR: 0.32, 95% CI: 0.23–0.45, $p < 0.001$).

Multivariable Analysis of Maternal Predictors of Full Immunization Coverage

After adjusting for confounders, maternal education, wealth index, and regional variations remained significant predictors of full immunization coverage (Table 3). Maternal education remained a strong determinant, as mothers with higher education were significantly more likely to fully immunize their children compared to those with no education (AOR: 1.87, 95% CI: 1.10–3.18, $p = 0.022$). Household wealth status also played a crucial role, with children from the richest households having over three times higher odds of full immunization coverage compared to those from the poorest households (AOR: 3.20, 95% CI: 1.95–5.25, $p < 0.001$).

Table 3 Multivariable Association Factors with Full Immunization Coverage

Variable	Immunization Coverage		AOR [95% C.I.]	p-value
	Not Fully Immunized Freq. ()	Fully Immunized Freq. ()		
Age Group				
14-19 (Ref.)	95 (87.68)	13 (12.32)		
20-24	392 (79.02)	104 (20.98)	1.74 [0.86, 3.50]	0.122
25-29	500 (72.96)	185 (27.04)	2.08 [1.04, 4.14]	<0.05*
30-34	389 (73.15)	143 (26.85)	1.79 [0.88, 3.61]	0.106
35-39	291 (66.02)	150 (33.98)	2.89 [1.39, 5.99]	<0.01**
40-44	110 (73.60)	40 (26.40)	2.15 [0.87, 5.29]	0.097
45-49	37 (87.44)	5 (12.56)	1.11 [0.31, 4.01]	0.868
Education Level				
No education (Ref.)	822 (88.73)	104 (11.27)		
Primary	261 (71.59)	104 (28.41)	1.83 [1.19, 2.80]	<0.01**
Secondary	593 (65.24)	316 (34.76)	1.66 [1.11, 2.49]	<0.05*
Higher	136 (54.14)	116 (45.86)	1.87 [1.10, 3.18]	<0.05*
Wealth Index				
Poorest (Ref.)	428 (88.73)	54 (11.27)		
Poorer	413 (88.90)	52 (11.10)	0.81 [0.53, 1.25]	0.345
Middle	343 (72.64)	130 (27.36)	1.81 [1.19, 2.74]	<0.01**
Richer	349 (67.63)	167 (32.37)	2.06 [1.30, 3.25]	<0.01**
Richest	281 (54.14)	238 (45.86)	3.20 [1.95, 5.25]	<0.001***
Religion				
Other Christian (Ref.)	713 (63.72)	406 (36.28)		
Islam	1092 (82.60)	230 (17.40)	0.88 [0.59, 1.30]	0.511
Others	9 (68.32)	4 (31.68)	1.24 [0.36, 4.27]	0.73
Distance to Health Facility				
Big problem (Ref.)	576 (81.83)	128 (18.17)		
Not a big problem	1237 (70.73)	512 (29.27)	1.29 [0.95, 1.75]	0.107
Births in Last 5 Years				
1 (Ref.)	692 (69.19)	308 (30.81)		
2	945 (76.53)	290 (23.47)	0.73 [0.57, 0.95]	<0.05*
3	160 (79.72)	41 (20.28)	0.66 [0.43, 1.01]	0.054
4+	15 (95.50)	1 (4.50)	0.09 [0.01, 0.67]	<0.05*
Residence				
Urban (Ref.)	723 (65.26)	385 (34.74)		
Rural	1091 (81.04)	255 (18.96)	1.09 [0.82, 1.44]	0.551

(Continued)

Table 3 (Continued).

Variable	Immunization Coverage		AOR [95% C.I.]	p-value
	Not Fully Immunized Freq. ()	Fully Immunized Freq. ()		
Region				
North West (Ref.)	573 (86.82)	87 (13.18)		
North Central	264 (78.40)	73 (21.60)	1.24 [0.80, 1.91]	0.329
North East	324 (81.52)	73 (18.48)	1.45 [0.96, 2.17]	0.074
South East	192 (58.50)	136 (41.50)	2.00 [1.16, 3.46]	<0.05*
South South	166 (58.99)	115 (41.01)	1.73 [0.99, 3.02]	0.052
South West	294 (65.52)	155 (34.48)	1.22 [0.76, 1.96]	0.405

Notes: *Significant at : $p < 0.05$; ** $p < 0.01$; g*** $p < 0.001$.

Regional differences persisted in the multivariable analysis. Compared to the North West, children from the South East (AOR: 2.00, 95% CI: 1.16–3.46, $p = 0.013$) and South South (AOR: 1.73, 95% CI: 0.99–3.02, $p = 0.052$) were significantly more likely to be fully immunized. These findings highlight the persistent inequities in immunization coverage across Nigeria, emphasizing the need for targeted interventions in regions with low immunization uptake.

Discussion

This study examined the factors influencing full immunization coverage among children aged 12–23 months in Nigeria, highlighting significant disparities based on sociodemographic, economic, and geographic factors. It is important to distinguish between immunization coverage—defined as the proportion of children who received all recommended vaccines—and uptake, which may refer to partial or incomplete vaccination. The findings indicate that only 26% of children were fully immunized, far below the World Health Organization (WHO) target of 90% coverage for essential childhood vaccines.³⁰ This finding is consistent with previous NDHS-based studies reporting full immunization rates between 23–31% across Nigeria. However, some regional or community-based studies report slightly higher rates due to focused interventions or sampling differences. Regional disparities were also notable, with the North West (13%) and North East (18%) having the lowest immunization rates, while the South East (41.5%) and South South (41%) had the highest. These findings reflect longstanding inequalities in healthcare access, cultural influences, and socioeconomic factors, which continue to hinder immunization uptake in Nigeria.³¹

Maternal education emerged as a key determinant of immunization coverage. The results showed that children of mothers with higher education were significantly more likely to be fully immunized compared to those whose mothers had no formal education. This aligns with previous studies in sub-Saharan Africa, which indicate that educated mothers are more likely to seek preventive healthcare services and understand the importance of immunization.^{16,18,32} Education empowers women to make informed health decisions, increases awareness of vaccine-preventable diseases, and enhances trust in modern healthcare systems. Expanding access to education, particularly for girls, is essential for improving childhood immunization rates.^{16,33}

Wealth status also played a significant role in determining immunization uptake. The study found that children from the richest households were more than three times more likely to be fully immunized compared to those from the poorest households. This supports prior research demonstrating that financial stability improves healthcare access, allowing families to afford transportation costs and out-of-pocket expenses associated with immunization.^{34,35} Conversely, poorer households often face economic constraints that limit healthcare utilization, exacerbating immunization inequities. Implementing financial support programs, such as conditional cash transfers and immunization incentives, may help increase vaccine coverage among low-income families.³⁶

Geographic disparities in immunization coverage were evident, with children in rural and northern regions being less likely to be fully immunized compared to their urban and southern counterparts. These findings are consistent with studies showing that rural areas have limited access to healthcare facilities, leading to delays in childhood

vaccinations.^{37–39} Distance to a health facility was a significant barrier in this study, as mothers who reported distance as a “big problem” were significantly less likely to fully immunize their children. Poor road networks, inadequate vaccination outreach programs, and security concerns in some northern regions further compound these challenges.¹¹ Strengthening community-based immunization programs, expanding mobile vaccination units, and integrating immunization services into routine child health visits could help improve coverage in hard-to-reach areas.⁴⁰

Religious affiliation was another factor influencing immunization coverage. The study revealed that children born to Christian mothers had significantly higher immunization rates than those born to Muslim mothers. This may be linked to differences in health-seeking behaviors, religious beliefs, and vaccine acceptance.^{41,42} Previous studies have reported vaccine hesitancy in some religious communities, often driven by misconceptions about vaccine safety, fertility concerns, and distrust in Western medicine.^{21,43} Addressing religious and cultural resistance through engagement with religious leaders, culturally appropriate health education campaigns, and targeted community outreach is critical to overcoming vaccine hesitancy.²¹

Conclusion

This study highlights the low full immunization coverage (26%) among children aged 12–23 months in Nigeria, with significant regional, socioeconomic, and demographic disparities. Maternal education, household wealth status, and geographic location were strong predictors of immunization uptake. Geographic disparities were evident, with children in northern and rural regions facing lower immunization rates compared to those in urban and southern areas. Barriers such as distance to health facilities, financial constraints, and religious or cultural hesitancy contribute to the suboptimal vaccine coverage observed in this study. Addressing these barriers through education, financial support programs, community engagement, and improved healthcare accessibility is essential to achieving Nigeria’s immunization targets. Strengthening routine immunization services and expanding outreach programs, particularly in underserved regions, will be critical in reducing vaccine-preventable diseases and improving child survival outcomes.

Recommendations

To improve childhood immunization coverage in Nigeria, several strategies are recommended based on recent findings. Expanding education programs for women is crucial, as increasing female education enhances maternal health literacy and vaccine awareness, with long-term benefits for immunization uptake. Improving healthcare access in rural and underserved areas involves strengthening primary healthcare infrastructure, expanding mobile vaccination units, and integrating immunization services into routine child health visits. Implementing financial support programs, such as conditional cash transfers and immunization incentives, can assist low-income families in accessing vaccination services. Enhancing community-based immunization outreach through community health workers can improve coverage, especially in regions with vaccine hesitancy. Engaging religious and community leaders is vital for addressing vaccine hesitancy by promoting culturally appropriate campaigns. Strengthening immunization data systems with electronic records and improved surveillance will ensure accurate tracking of vaccinated children. By implementing these strategies, Nigeria can improve immunization coverage, move closer to the WHO-recommended target of 90% vaccine coverage, and reduce childhood morbidity and mortality from vaccine-preventable diseases.

Study Limitations

This study has some limitations. First, its cross-sectional design prevents causal inferences, as only associations between predictors and immunization coverage were examined. Additionally, the study relied on self-reported immunization data, which may be subject to recall bias. Moreover, the use of secondary data limits control over variable definitions, measurement accuracy, and missing data. Some vaccinations may have been misclassified due to reliance on maternal recall or incomplete health cards. Future research should incorporate longitudinal data and immunization registry validation to improve data accuracy. Despite these limitations, this study provides valuable insights into the determinants of immunization coverage in Nigeria and offers evidence-based recommendations for improving vaccine uptake.

Data Sharing Statement

The datasets supporting the findings of this study are derived from the 2018 Nigeria Demographic and Health Survey (NDHS), which is publicly available. These data can be accessed directly from The DHS Program website: <https://dhsprogram.com/>.

Ethical Consideration

This study involved the secondary analysis of publicly available and de-identified data from the 2018 Nigeria Demographic and Health Survey (NDHS). The research was reviewed and deemed exempt from full ethical review by the Federal University Birnin Kebbi Research Ethics Committee, in accordance with national guidelines for secondary data use. The 2018 NDHS, as the primary data source, was conducted following established ethical standards and originally approved by the National Health Research Ethics Committee (NHREC) and the ICF Institutional Review Board. During the original data collection, written informed consent was obtained from all participants aged 15 years and older, with consent for minors obtained from their guardians. All data utilized in this study were analyzed in a manner that ensured participant anonymity and maintained strict confidentiality.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the revision to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors declare no competing interest in this work.

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