

Maternal Health Literacy and Childhood Immunization Uptake: A Social and Educational Analysis in North-Central Nigeria

Egwuaba, Edward Ukwubile¹ ; Sunday, Blessing Adeyi² ; and Ume Ignatius Sunday³ 

¹Department of Sociology, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria. ²Department of Sociology, Prince Abubakar Audu University, Anyigba, Kogi State, Nigeria.

³Department of Sociology, Faculty of Social Sciences, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria.

Corresponding author: eu.egwuaba@coou.edu.ng

DOI: <https://doi.org/10.62154/ajhcer.2026.022.01012>

Abstract

Childhood immunization remains one of the most effective public health interventions for preventing vaccine-preventable diseases, yet coverage in Nigeria continues to exhibit marked regional and socio-economic disparities. Maternal health literacy has emerged as an important but insufficiently explored determinant of childhood immunization behaviour, particularly within complex socio-cultural contexts. This study examined the relationship between maternal health literacy and childhood immunization uptake in North-Central Nigeria, with attention to the social and structural factors shaping mothers' vaccination decisions. A cross-sectional mixed-methods design was employed among 400 mothers of children aged 0–23 months selected from urban and rural communities. Maternal health literacy was assessed across functional, interactive, and critical domains using an adapted, context-specific version of the European Health Literacy Survey Questionnaire (HLS-EU-Q16). Childhood immunization status was determined using maternal reports and immunization cards where available. Quantitative data were analysed using descriptive statistics, chi-square tests, and multivariate logistic regression, while qualitative data from focus group discussions and in-depth interviews were analysed thematically. Findings showed that 55% of children were fully immunized, with significantly higher coverage in urban than rural communities. Higher maternal health literacy was strongly associated with full immunization, particularly functional, interactive, and critical literacy domains ($p < 0.001$). Qualitative results revealed that family influence, community norms, religious beliefs, misinformation, and access barriers moderated the effect of literacy on immunization behaviour. The study concludes that maternal health literacy is a key predictor of childhood immunization uptake, but its effectiveness is shaped by broader socio-cultural and structural conditions, underscoring the need for integrated literacy-based and community-focused immunization interventions.

Keywords: Maternal Health Literacy, Childhood Immunization, Socio-Cultural Factors, North-Central Nigeria.

Introduction

Maternal and child health remains a critical public health and social development concern in many low- and middle-income countries, particularly in sub-Saharan Africa. Despite sustained global efforts to reduce preventable childhood morbidity and mortality, vaccine-preventable diseases continue to account for a substantial proportion of deaths among children under five years of age (World Health Organization, 2024). Childhood immunization is widely recognized as one of the most cost-effective public health interventions; however, its effectiveness depends not only on vaccine availability but also on caregivers' knowledge, beliefs, and decision-making capacities (UNICEF, 2022).

In Nigeria, childhood immunization coverage remains uneven, with pronounced disparities across regions, socio-economic groups, and educational levels. Although national policies provide routine immunization services free of charge, uptake remains suboptimal in several states, particularly in North-Central Nigeria (National Population Commission (NPC) & ICF, 2019). Empirical evidence indicates that maternal characteristics especially education, access to health information, and health-related knowledge play an important role in determining whether children complete recommended immunization schedules (Antai, 2009; Adeloye, Jacob, & Amuta, 2017).

Maternal health literacy refers to a mother's capacity to access, understand, appraise, and apply health information in ways that enable informed decisions concerning her own health and that of her child (Nutbeam, 2008). Extending beyond formal schooling, health literacy encompasses comprehension of immunization schedules, awareness of vaccine benefits and risks, navigation of health systems, and interpretation of health communication messages (Sørensen, Van den Broucke, Fullam, Doyle, Pelikan, Stonska, & Brand, 2012). Evidence from Nigeria and similar contexts suggests that limited maternal health literacy is associated with delayed vaccination, missed doses, and incomplete immunization, particularly in settings where misinformation and distrust of health institutions persist (Antai, 2009; Konwea, David, & Ogunsile, 2018).

From a social and educational perspective, childhood immunization decisions are embedded within broader social contexts rather than made in isolation. Mothers' choices are shaped by cultural norms, family expectations, community narratives, and access to credible health information. In many Nigerian communities, informal sources such as family members, religious leaders, and peer networks play a significant role in influencing health behaviours, sometimes reinforcing misconceptions or fears surrounding vaccines (Oku, Oyo-Ita, Flenton, Fretheim, Anes, Muloliwa, 2017). Where formal health education and communication systems are weak or inconsistently delivered, these social influences may undermine immunization uptake (Oyo-Ita, Nwachukwu, Oringanje, & Meremikwu, 2011).

North-Central Nigeria provides a particularly relevant context for examining the relationship between maternal health literacy and childhood immunization uptake. The region is characterized by ethnic diversity, mixed urban-rural settlements, and wide variations in female educational attainment, all of which shape health communication processes and patterns of health service utilization (NPC & ICF, 2019). Understanding how

maternal health literacy operates within this socio-cultural environment is therefore essential for designing effective educational and community-based immunization interventions.

While previous studies in Nigeria have explored determinants of childhood immunization, many focus predominantly on socio-demographic variables such as income, place of residence, and formal education, with limited attention to health literacy as a multidimensional construct that incorporates communication, comprehension, and decision-making skills (Odusanya et al., 2008; Adelaye et al., 2017). Consequently, there remains a gap in research that explicitly integrates maternal health literacy within a broader social and educational framework, particularly in North-Central Nigeria.

Against this backdrop, this study examines the relationship between maternal health literacy and childhood immunization uptake in North-Central Nigeria. By adopting a social and educational lens, the study contributes to existing scholarship on maternal and child health and provides evidence to inform health education strategies, policy development, and community-based interventions aimed at improving immunization coverage and child survival.

Statement of the Problem

Despite sustained national and global efforts to improve routine childhood immunization coverage, Nigeria continues to record suboptimal uptake of essential vaccines, with pronounced regional and socio-economic disparities. National survey data indicate that a substantial proportion of children fail to complete age-appropriate immunization schedules, leaving them vulnerable to preventable diseases and avoidable childhood mortality (National Population Commission (NPC) & ICF, 2019). These gaps persist even in areas where immunization services are officially available and provided at no cost, suggesting that factors beyond service availability influence utilization.

Existing evidence consistently identifies maternal education as a significant predictor of childhood immunization uptake. However, formal education alone does not adequately explain maternal health-related decision-making. Many mothers with basic or secondary education demonstrate limited understanding of immunization schedules, vaccine benefits, and potential side effects, which often results in delayed or missed vaccinations. This underscores the importance of maternal health literacy rather than schooling alone as a critical determinant of immunization behaviour (Nutbeam, 2008; Sørensen et al., 2012).

In North-Central Nigeria, childhood immunization decisions are further shaped by socio-cultural beliefs, misinformation, weak health communication systems, and reliance on informal sources of health information. Traditional beliefs, religious interpretations, and community narratives can influence attitudes toward vaccines, sometimes reinforcing fear, mistrust, or complacency. Qualitative evidence from Nigeria demonstrates that such social influences significantly affect caregivers' immunization decisions, particularly where clear and consistent communication from health services is lacking (Oku et al., 2017; Oyo-Ita et al., 2011).

Although numerous studies have examined the determinants of childhood immunization in Nigeria, limited attention has been paid to maternal health literacy as a multidimensional social and educational construct, particularly within the North-Central region. Much of the existing literature emphasizes demographic and structural correlates such as income, residence, and maternal education while giving insufficient consideration to how mothers access, interpret, and apply health information within their social environments (Odusanya, Alufolani, Meurice, & Ahonkhai, 2008; Adeloye et al., 2017). This gap constrains the effectiveness of health education programmes and policy interventions aimed at improving immunization outcomes.

Therefore, there is a clear need for a focused investigation into the relationship between maternal health literacy and childhood immunization uptake in North-Central Nigeria. Addressing this gap will generate context-specific evidence to inform more effective health education strategies, strengthen community-based interventions, and ultimately improve maternal and child health outcomes.

Objectives of the Study

The study examined the influence of maternal health literacy on childhood immunization uptake in North-Central Nigeria. The specific objectives are:

1. To assess the level of maternal health literacy among mothers of children aged 0–23 months in North-Central Nigeria.
2. To determine the extent of childhood immunization uptake among children of the respondents.
3. To examine the relationship between maternal health literacy and childhood immunization uptake.
4. To identify socio-cultural and educational factors influencing maternal health literacy.
5. To explore mothers' sources of immunization-related information and their influence on immunization decisions.

Literature Review

Maternal health literacy has increasingly been recognised as a critical determinant of child health outcomes in low- and middle-income countries. It refers to the capacity of mothers to access, understand, evaluate, and apply health information to make informed decisions regarding their children's health (Nutbeam, 2008). Health literacy extends beyond the ability to read or write and includes skills related to communication, comprehension, and critical appraisal of health information (Sørensen et al., 2012). Mothers with higher levels of health literacy are better positioned to understand immunization schedules, recognise the preventive value of vaccines, and comply with recommended clinic appointments.

Empirical evidence from sub-Saharan Africa demonstrates that maternal knowledge and understanding significantly influence childhood immunization outcomes. Studies conducted in informal urban settlements in Kenya show that maternal knowledge and

social context are strong predictors of timely and complete childhood vaccination (Mutua, M.K., et al., 2011). These findings suggest that beyond service availability, mothers' capacity to interpret and act on immunization information plays a decisive role in vaccination behaviour.

In Nigeria, research consistently shows that maternal characteristics particularly access to health information, knowledge of vaccination schedules, and engagement with health services are associated with immunization completion (Odusanya et al., 2008; Konwea et al., 2018; Adelaye et al., 2017). Evidence further indicates that some mothers with formal education still exhibit limited understanding of immunization benefits and schedules, leading to delayed or missed vaccinations. This reinforces the argument that maternal health literacy, rather than years of schooling alone, is a more meaningful predictor of immunization behaviour (Nutbeam, 2008).

Childhood immunization decisions are also embedded within broader socio-cultural contexts. Family structures, community norms, and religious beliefs shape how mothers interpret health messages and whether they act on biomedical advice. Qualitative studies in Nigeria reveal that informal social networks such as relatives, peers, and religious leaders often serve as primary sources of health information and can either support or discourage vaccination practices (Oku et al., 2017). Where misinformation circulates within these networks and formal health communication is weak or inconsistent, mothers may develop fear, mistrust, or complacency toward immunization (Oyo-Ita et al., 2011).

Media exposure and community-based health education initiatives have been shown to influence maternal decision-making regarding immunization. However, their effectiveness depends on message clarity, credibility, and cultural sensitivity, as well as the extent to which messages align with mothers' existing knowledge and beliefs (Afolabi, Sopekan, & Olayemi, 2019; UNICEF, 2022). In settings where maternal health literacy is low, even well-designed communication strategies may fail to translate into sustained immunization uptake.

Despite growing recognition of the role of maternal education and socio-demographic factors, limited Nigerian research explicitly conceptualises maternal health literacy as a multidimensional social and educational construct that interacts with community norms and health system factors. Much of the existing literature focuses on demographic correlates while giving insufficient attention to how mothers access, interpret, and apply health information within their everyday social environments (Odusanya et al., 2008; Adelaye et al., 2017). This gap underscores the need for studies that integrate quantitative and qualitative approaches to examine how maternal health literacy and socio-cultural influences jointly shape childhood immunization behaviour.

The present study addresses this gap by systematically examining the relationship between maternal health literacy and childhood immunization uptake in North-Central Nigeria, using a social and educational framework to generate evidence relevant for health education, policy formulation, and community-based interventions.

Research Gap

Although existing studies have established the influence of maternal education and selected socio-demographic factors on childhood immunization uptake in Nigeria, relatively little attention has been paid to maternal health literacy as a multidimensional construct that operates within broader social and cultural contexts, particularly in North-Central Nigeria. Much of the available research treats maternal education as a proxy for knowledge, thereby overlooking differences in mothers' ability to access, understand, evaluate, and apply immunization-related information in everyday decision-making.

Furthermore, most Nigerian studies rely predominantly on quantitative analyses and rarely integrate qualitative inquiry to explain how socio-cultural factors such as family influence, community norms, informal information networks, and health system interactions moderate immunization behaviour. As a result, there is limited empirical understanding of how the functional, interactive, and critical dimensions of maternal health literacy interact with social and structural conditions to shape childhood immunization outcomes.

This gap constrains the development of context-sensitive health education strategies and community-based interventions aimed at improving immunization coverage. The present study addresses these gaps by adopting a mixed-methods approach to systematically examine the relationship between maternal health literacy and childhood immunization uptake within a social and educational framework in North-Central Nigeria.

Theoretical Framework

This study is anchored on Don Nutbeam's Health Literacy Theory, which conceptualizes health literacy as a multidimensional construct influencing individuals' capacity to access, understand, appraise, and apply health information for informed decision-making and health-promoting behaviour (Nutbeam, 2000; Nutbeam, 2008). The theory extends beyond basic reading and writing skills to emphasize the role of cognitive, social, and critical competencies in shaping health behaviours and outcomes.

Nutbeam's framework identifies three interrelated levels of health literacy: functional, interactive, and critical health literacy. Functional health literacy refers to basic skills in reading and comprehension that enable individuals to understand essential health information, such as immunization schedules, appointment dates, and instructions provided by healthcare workers. At this level, mothers are able to receive, comprehend, and act on routine health messages related to childhood immunization (Nutbeam, 2000).

Interactive health literacy involves more advanced cognitive and social skills that enable individuals to actively engage with health information and health service providers. Mothers with interactive health literacy can communicate effectively with healthcare workers, ask questions, seek clarification, and apply health information to their specific circumstances. This level emphasizes participation, confidence, and interpersonal engagement in healthcare interactions and decision-making (Nutbeam, 2008).

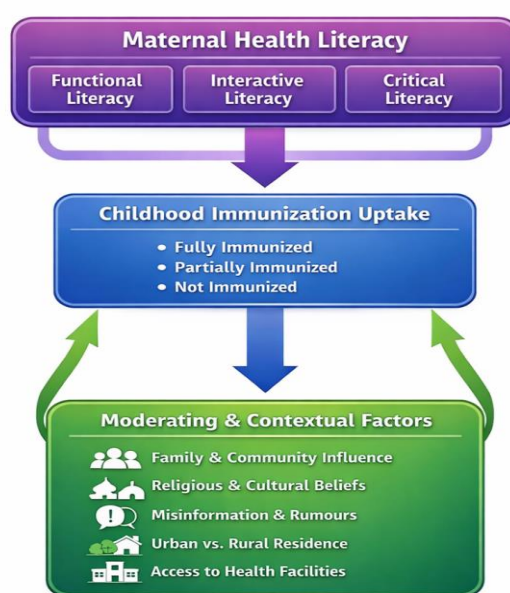
Critical health literacy represents the highest level within the framework and refers to the ability to critically analyze health information, evaluate its credibility, and make

autonomous health decisions. In the context of childhood immunization, critical health literacy enables mothers to assess conflicting messages, resist misinformation, and make informed vaccination decisions despite socio-cultural pressures, rumours, or misleading media content (Nutbeam, 2000; Kristine Sørensen et al., 2012).

The relevance of Nutbeam's Health Literacy Theory to the present study lies in its capacity to explain how different dimensions of maternal health literacy influence childhood immunization uptake. The framework assumes that higher levels of functional, interactive, and critical literacy enhance mothers' ability to understand immunization information, engage effectively with health services, and make informed decisions regarding their children's vaccination. Importantly, the theory also recognizes that health literacy operates within broader social, cultural, and environmental contexts that may either facilitate or constrain health behaviour (Nutbeam, 2008).

By adopting Nutbeam's Health Literacy Theory, this study provides a structured analytical lens for examining how maternal literacy skills translate into childhood immunization behaviour and how deficits at any literacy level may contribute to delayed, incomplete, or non-immunization. The framework is therefore well suited to examining maternal health literacy within the complex socio-cultural environment of North-Central Nigeria.

Conceptual Framework



This study is grounded in Don Nutbeam's Health Literacy Model, which conceptualizes health literacy as a multidimensional construct shaping individuals' ability to make informed health decisions and engage in health-promoting behaviours. The model identifies three interrelated levels of literacy: functional, interactive, and critical health literacy.

Functional health literacy involves basic skills required to read, comprehend, and act on health information. In the context of childhood immunization, this includes understanding vaccination schedules, clinic appointment dates, and instructions provided by health workers. Interactive health literacy encompasses more advanced cognitive and social skills that enable individuals to engage actively with health information, communicate effectively with healthcare providers, and apply health advice to everyday situations. Critical health literacy represents the capacity to critically appraise health information, weigh risks and benefits, and exercise greater control over health-related decisions.

Applied to childhood immunization, maternal health literacy is hypothesized to influence vaccination uptake by enabling mothers to understand immunization schedules, engage constructively with health services, and evaluate conflicting information obtained from social networks or media sources. Functional literacy ensures comprehension of routine immunization messages; interactive literacy facilitates effective communication with health workers and the practical application of advice; and critical literacy supports independent decision-making in the presence of misinformation, rumours, or socio-cultural pressures.

The framework further recognizes that maternal health literacy does not operate in isolation. Structural factors such as access to health facilities, place of residence (urban or rural), and service availability, as well as socio-cultural influences including family expectations, community norms, and religious guidance, act as moderating variables. These factors can either strengthen or weaken the translation of maternal literacy into consistent immunization behaviour.

This conceptual framework therefore provides the basis for selecting study variables and interpreting findings, emphasizing the dynamic interaction between maternal health literacy and social-environmental contexts in determining childhood immunization outcomes in North-Central Nigeria.

Methodology

Study Design

This study adopted a cross-sectional mixed-methods design, integrating quantitative and qualitative approaches to examine the relationship between maternal health literacy and childhood immunization uptake in selected urban and rural communities of North-Central Nigeria. The mixed-methods approach enabled quantitative assessment of maternal health literacy and immunization status, while qualitative inquiry provided in-depth understanding of socio-cultural factors shaping maternal decision-making within community contexts (Creswell & Plano Clark, 2018).

Study Population

The study population comprised mothers of children aged 0–23 months residing in the selected communities. Mothers were eligible to participate if they had at least one child within the specified age range and provided informed consent to participate in the survey.

and/or qualitative interviews. The 0–23 months age range aligns with Nigeria’s routine immunization schedule and is commonly used in immunization coverage studies (National Population Commission [NPC] & ICF, 2019).

Sample Size Determination

The minimum sample size for the quantitative component was determined using Cochran’s formula for cross-sectional studies (Cochran, 1977):

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where:

n_0 = minimum sample size

$Z = 1.96$ (standard normal deviate at 95% confidence level)

$p = 0.5$ (assumed proportion of mothers with adequate health literacy)

$q = 1 - p$

$e = 0.05$ (margin of error)

The calculated minimum sample size was 384. To account for a potential 5% non-response rate, the sample size was adjusted and rounded up to 400 respondents, evenly distributed between urban ($n = 200$) and rural ($n = 200$) communities to allow for comparative analysis.

Sampling Technique

A multistage sampling technique was employed:

Stage 1: Community Selection: Urban and rural communities were selected using simple random sampling.

Stage 2: Household Selection: Eligible households were selected through systematic sampling based on household listings within each community.

Stage 3: Respondent Selection: In households with more than one eligible mother, one respondent was selected using simple random sampling to minimize selection bias.

For the qualitative component, 30–40 mothers were selected through purposive sampling to ensure diversity in place of residence (urban/rural), educational attainment, parity, and childhood immunization experience. This approach enhanced the depth and contextual richness of the qualitative data.

Data Collection

Quantitative Data

Quantitative data were collected using a structured interviewer-administered questionnaire comprising four sections:

- Socio-demographic characteristics
- Maternal health literacy
- Childhood immunization status
- Sources of immunization information

Maternal health literacy was measured using an adapted version of the European Health Literacy Survey Questionnaire (HLS-EU-Q16), which assesses functional, interactive, and

critical health literacy domains (Sørensen et al., 2012). The instrument aligns with Nutbeam's conceptualization of health literacy (Nutbeam, 2008). Trained research assistants administered the questionnaires, and completed instruments were checked for completeness and accuracy prior to analysis.

Qualitative Data

Qualitative data were generated through focus group discussions (FGDs) and in-depth interviews (IDIs) to explore socio-cultural influences on childhood immunization decisions. FGDs consisted of 6–8 participants per group and focused on community norms, family influence, religious beliefs, and sources of health information. IDIs enabled detailed exploration of individual experiences, challenges, and decision-making processes related to child vaccination.

All sessions were conducted in local languages where necessary, audio-recorded with informed consent, transcribed verbatim, and translated into English for analysis.

Data Analysis

Quantitative Analysis

Quantitative data were analyzed using statistical software. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize respondents' socio-demographic characteristics, maternal health literacy levels, and childhood immunization coverage. Chi-square tests were conducted to examine associations between maternal health literacy domains and immunization uptake. Variables that were statistically significant were entered into a multivariate logistic regression model to estimate adjusted odds ratios (AORs) and 95% confidence intervals, controlling for maternal age, education, household income, place of residence, and parity. Statistical significance was set at $p < 0.05$.

Qualitative Analysis

Qualitative data were analyzed thematically using the approach described by Braun and Clarke (2006). Transcripts were coded inductively, grouped into categories, and organized into themes reflecting socio-cultural beliefs, information sources, and barriers to immunization. The qualitative findings were used to complement and contextualize the quantitative results, particularly in explaining how social and cultural factors moderate the relationship between maternal health literacy and childhood immunization uptake.

Results

A total of 400 mothers participated in the study, evenly split between urban ($n = 200$) and rural ($n = 200$) communities. Table 1 summarizes the socio-demographic characteristics of respondents.

Table 1: Socio-Demographic Characteristics of Respondents (n = 400)

Variable	Frequency (n)	Percentage (%)
Age (years)		
15–24	88	22.0
25–34	208	52.0
35–44	84	21.0
≥45	20	5.0
Marital Status		
Married	352	88.0
Single	32	8.0
Divorced/Widowed	16	4.0
Education Level		
No formal education	60	15.0
Primary	92	23.0
Secondary	184	46.0
Tertiary	64	16.0
Occupation		
Housewife	208	52.0
Trading	112	28.0
Farming	48	12.0
Formal employment	32	8.0
Residence		
Urban	240	60.0
Rural	160	40.0

Source: Field Survey, 2025

Most respondents were aged 25–34 years (52%), followed by 35–44 years (21%). Educational attainment varied, with 46% completing secondary education, 16% attaining tertiary education, and 15% having no formal education. Rural mothers were disproportionately represented among those without formal education. Occupation patterns showed urban mothers were more likely to be formally employed, whereas rural mothers were predominantly engaged in agriculture and trading. The mean parity was 2.7 ± 1.2 children (range: 1–5). These characteristics are consistent with prior studies linking maternal education and occupation to health literacy and immunization behavior.

Table 2: Maternal health literacy was assessed across functional, interactive, and critical domains

Literacy Domain	High (%)	Moderate (%)	Low (%)
Functional	65	25	10
Interactive	58	30	12
Critical	45	35	20

Source: Field Survey, 2025

Functional literacy was the highest, indicating that most mothers could understand basic health information, including vaccination schedules (Nutbeam, 2008; Sørensen et al., 2012). Interactive literacy was moderate, suggesting challenges in applying information or engaging health workers effectively. Critical literacy was lowest, reflecting limited ability to evaluate information or resist misinformation. These results highlight the need for interventions that strengthen mothers' decision-making and critical appraisal skills, particularly in rural communities.

Table 3: Childhood Immunization Uptake (n = 400)

Immunization Status	Frequency (n)	Percentage (%)
Fully immunized	220	55.0
Partially immunized	120	30.0
Not immunized	60	15.0

Source: Field Survey, 2025

Overall, 55% of children were fully immunized, 30% partially immunized, and 15% not immunized (Table 3). Urban children exhibited higher full immunization coverage (62.5%) than rural children (43.8%). Partial and non-immunization were more prevalent in rural areas (36% and 20%, respectively), reflecting disparities in service access, maternal literacy, and exposure to health information (NPC & ICF, 2019; Antai, 2012).

Table 4: Logistic Regression Analysis of Maternal Literacy and Childhood Immunization Uptake (n = 400)

Predictor Variable	AOR _{95%}	CI	p-value	Interpretation
Maternal Health Literacy				
Functional	3.5	2.0–6.1	<0.001	Mothers with higher functional literacy are 3.5 times more likely to fully immunize their children; supports comprehension of schedules (Nutbeam, 2008).
Interactive	3.1	1.8–5.4	<0.001	Interactive literacy enables application and communication with health workers; promotes timely immunization.
Critical	2.8	1.5–5.2	<0.001	Critical literacy allows evaluation of information and resistance to misinformation; essential in socio-cultural context.
Maternal Age (years)				
15–24	Reference	–	–	–
25–34	1.2	0.7–2.0	0.50	Slightly higher likelihood, not statistically significant.
35–44	1.1	0.6–1.9	0.70	No significant effect.
≥45	0.9	0.3–2.5	0.80	No significant effect.

Maternal Education				
No formal education	Reference	–	–	–
Primary	1.5	0.8–2.7	0.18	Higher education increases odds but not significant.
Secondary	2.2	1.2–4.0	0.01	Secondary education significantly improves full immunization.
Tertiary	2.8	1.4–5.7	0.004	Tertiary education strongly associated with full immunization.
Household Income (monthly)				
Low	Reference	–	–	–
Medium	1.4	0.8–2.5	0.23	Not significant.
High	2.0	1.1–3.7	0.03	High income significantly increases odds of full immunization.
Residence				
Rural	Reference	–	–	–
Urban	1.9	1.1–3.3	0.02	Urban mothers more likely to fully immunize; reflects better access and information.
Parity				
1	Reference	–	–	–
2–3	1.3	0.8–2.3	0.25	Not significant.
≥4	0.9	0.4–1.8	0.78	No effect observed.

Model Fit: Pseudo $R^2 = 0.21$; Hosmer–Lemeshow $\chi^2 = 7.2$, $p = 0.51$ (good fit)

Source: Field Survey, 2025

Notes:

AOR = Adjusted Odds Ratio; CI = Confidence Interval.

Functional > Interactive > Critical literacy hierarchy aligns with Nutbeam’s model (2008), showing that basic comprehension (functional) has the strongest effect, followed by the ability to apply information (interactive), and the ability to critically evaluate information (critical).

All covariates included to account for socio-demographic confounding effects.

Table 5: Childhood Immunization by Residence

Residence	Fully Immunized n (%)	Partially/Not Immunized n (%)
Urban (n=240)	150 (62.5)	90 (37.5)
Rural (n=160)	70 (43.8)	90 (56.2)

Source: Field Survey, 2025

Socio-cultural factors played a significant moderating role in immunization behavior. Mothers who reported family support and positive community norms were significantly

more likely to fully immunize their children ($p < 0.01$). Conversely, exposure to misinformation, traditional beliefs, and religious restrictions was associated with partial or non-immunization. Rural mothers were particularly affected by these socio-cultural influences, which often compounded the challenges posed by limited literacy and access to health facilities. Even literate mothers may face constraints if socio-cultural pressures discourage vaccination. Family opinions, community expectations, and religious beliefs can either reinforce or counteract the effects of maternal literacy on child immunization. This emphasizes the importance of community-based interventions that address social norms alongside literacy enhancement.

Table 6 presents the main sources of information cited by mothers.

Source	Frequency (n)	Percentage (%)
Health workers	180	45.0
Family/Relatives	100	25.0
Media (radio, TV, social media)	60	15.0
Religious/Community leaders	40	10.0
Others	20	5.0

Source: Field Survey, 2025

Health workers were the primary source of information, highlighting the importance of facility-based education programs. Family and community networks also play a substantial role, especially in rural areas. Media platforms offer opportunities for broader outreach, while religious and community leaders can serve as influential advocates in communities with strong traditional or religious adherence.

Qualitative Findings: Socio-Cultural Influences

Focus group discussions (FGDs) and in-depth interviews (IDIs) conducted with **30–40 mothers** identified five key socio-cultural themes influencing childhood immunization uptake. These findings illustrate how maternal health literacy interacts with community contexts to shape vaccination decisions.

Family Influence

Family members including spouses, mothers-in-law, and extended relatives exerted significant influence on maternal immunization decisions. Supportive family dynamics encouraged timely vaccination, whereas opposition or skepticism contributed to missed or delayed doses.

Example:

"I consult my mother-in-law before taking the child for any vaccine. Her advice matters a lot; if she disagrees, I hesitate."

This theme reflects how maternal literacy must operate within existing family decision structures, consistent with evidence that social networks and family expectations shape health behaviour in Nigerian settings (Oku et al., 2017).

Community Norms

Prevailing community attitudes and norms exerted strong influence on mothers' immunization choices. In communities where vaccination was socially valued, uptake was higher. Conversely, in settings where traditional remedies or negative perceptions prevailed, mothers reported hesitation.

Example:

"Some women are afraid of being laughed at if they bring their child to the clinic because the rumors say vaccines cause sickness."

These dynamics are consistent with research showing that community narratives and norms significantly shape immunization behaviour in contexts where formal health messaging is weak (Oku et al., 2017; Oyo-Ita et al., 2011).

Religious Beliefs

Guidance from religious leaders emerged as a salient influence. In some communities, religious teachings encouraged immunization, while in others, religious interpretations discouraged vaccine use.

Example:

"Some churches in my area do not allow vaccines; mothers there cannot take their children."

This finding underscore how socio-cultural belief systems can moderate the application of maternal knowledge and engagement with health services (Oku et al., 2017).

Misinformation

Misinformation spreading through informal social networks and media was reported as a barrier, even among mothers with relatively high educational attainment.

Example:

"I heard on social media that vaccines can make children infertile. That made me afraid to take my second child for vaccination."

While individual mothers may possess basic health knowledge, these experiences highlight the importance of critical health literacy the ability to assess the credibility of information in navigating conflicting messages and rumours (Nutbeam, 2008; Sørensen et al., 2012).

Access Barriers

Structural constraints related to health services—including distance to facilities, transportation costs, and inconsistent vaccine availability—limited immunization uptake.

Example:

"The nurse sometimes tells us vaccines are not available. We have to return another day, which is frustrating."

These infrastructural barriers reduce the effectiveness of maternal health literacy in promoting full immunization, echoing patterns reported in national coverage surveys (NPC & ICF, 2019) and studies of rural immunization determinants (Odusanya et al., 2008).

Discussion

Maternal Health Literacy as a Determinant of Immunization

This study demonstrates that maternal health literacy is a significant determinant of childhood immunization uptake in North-Central Nigeria. Literacy across the functional, interactive, and critical domains was strongly associated with full immunization coverage. Functional health literacy recorded the highest prevalence (65%), reflecting mothers' ability to comprehend vaccination schedules and basic health instructions. However, lower levels of interactive (58%) and critical literacy (45%) indicate challenges in applying health information and critically evaluating competing messages, particularly in socially complex environments (Nutbeam, 2008; Sørensen et al., 2012).

Multivariate logistic regression analysis further confirmed the strength of this relationship. Mothers with higher levels of functional, interactive, and critical literacy were significantly more likely to fully immunize their children (Functional AOR = 3.5; Interactive AOR = 3.1; Critical AOR = 2.8; $p < 0.001$). Functional literacy exerted the strongest influence, underscoring the importance of understanding immunization schedules as a prerequisite for timely vaccination. Interactive literacy enhanced mothers' capacity to engage with health workers and apply advice appropriately, while critical literacy supported independent decision-making and resistance to misinformation. These findings are consistent with previous Nigerian and sub-Saharan African studies linking maternal literacy and knowledge to improved immunization outcomes (Antai, 2009; Babalola, 2014; Nutbeam, 2008).

Qualitative findings reinforced these quantitative results. For instance, UID-07 (Female) stated: *"I consult my mother-in-law before taking the child for any vaccine. Her advice matters a lot; if she disagrees, I hesitate."* This highlights how interactive and critical literacy are required to navigate family influence and apply biomedical knowledge within existing social hierarchies.

Urban–Rural Disparities in Immunization Uptake

The study identified marked urban–rural disparities in childhood immunization coverage. Children residing in urban areas were more likely to be fully immunized (62.5%) than those in rural communities (43.8%). These differences reflect variations in maternal education, proximity to health facilities, and exposure to health information, patterns widely reported in national survey data and Nigerian immunization studies (NPC & ICF, 2019; Antai, 2009). Rural mothers reported persistent structural barriers, including long distances to health facilities, transportation challenges, and inconsistent vaccine availability. As RID-18

(Female) noted: *"I walked 5 km to the clinic. If it rains, I cannot go, and sometimes I miss the scheduled vaccine."* Such constraints demonstrate that maternal health literacy alone may be insufficient to ensure full immunization where access barriers persist, reinforcing the need for context-responsive service delivery strategies.

Influence of Socio-Cultural Factors

Socio-cultural factors emerged as important moderators of the relationship between maternal health literacy and immunization behaviour.

Family Influence: Support from family members, particularly older women and spouses, facilitated timely immunization, while opposition or indifference undermined uptake. RFGD-03 (Female) remarked: *"My mother always tells me to take my child for every vaccine on time. When she reminds me, I never forget?"* Conversely, RFGD-05 (Female) explained: *"Sometimes, my husband doesn't think vaccination is important. When he is away, I skip the clinic."* These findings align with evidence that household decision-making dynamics significantly shape maternal health behaviours in Nigeria (Antai, 2009; Oku et al., 2017).

Community Norms: Community perceptions and shared practices influenced maternal decisions. Where traditional remedies were favoured or skepticism toward vaccines prevailed, immunization uptake was reduced. Such normative pressures may discourage mothers from acting on health knowledge, particularly in settings with weak formal health communication (Oku et al., 2017).

Religious Beliefs: Religious leadership played a dual role, either encouraging or discouraging vaccination. As RID-20 (Female) explained: *"I wanted to vaccinate my child, but the religious leader said it is against our faith, so I waited until he allowed it."* This underscores the importance of engaging religious institutions in immunization advocacy to support informed maternal decision-making.

Together, these findings confirm that maternal health literacy does not operate in isolation but is embedded within social, cultural, and normative structures that can either reinforce or constrain immunization behaviour (Nutbeam, 2008; Oku et al., 2017).

Role of Misinformation

Misinformation circulating through informal networks and social media emerged as a major barrier to timely immunization. UFGD-08 (Female) reported: *"I heard on social media that vaccines can make children infertile. That made me afraid to take my second child for vaccination."* Even among mothers with basic literacy, exposure to persistent rumours undermined confidence in vaccination. This finding highlights the critical importance of critical health literacy, particularly the ability to evaluate the credibility of health information and resist false claims (Nutbeam, 2008; Sørensen et al., 2012).

Access and Environmental Barriers

Structural constraints including distance to health facilities, transportation costs, and vaccine stock-outs further limited immunization uptake, especially in rural communities.

These barriers weakened the translation of maternal literacy into practice and contributed to missed vaccination opportunities. Consistent with national survey findings, the results indicate that improving maternal health literacy must be complemented by strengthened health systems, outreach services, and reliable vaccine supply chains to achieve sustained improvements in immunization coverage (NPC & ICF, 2019).

Implications for Policy and Practice

The study underscores several key implications:

1. **Maternal Literacy Programs:** Strengthen functional, interactive, and critical literacy to enable mothers to understand, apply, and evaluate immunization information.
2. **Community Engagement:** Collaborate with family, community, and religious leaders to reinforce positive norms and reduce socio-cultural barriers.
3. **Misinformation Management:** Health workers should proactively counter myths using trusted communication channels, including mass media and social platforms.
4. **Structural Support:** Improve access through mobile clinics, outreach services, and consistent vaccine supply, especially in rural areas.
5. **Focus on Rural Communities:** Target literacy enhancement, socio-cultural engagement, and infrastructure support to address compounded barriers.

Strengths and Limitations

The mixed-methods design allowed integration of quantitative and qualitative insights, providing a comprehensive understanding of maternal literacy and childhood immunization uptake. Inclusion of urban and rural participants enhances generalizability. Limitations include reliance on self-reported immunization data, potentially introducing recall bias, and the cross-sectional design, which precludes causal inference.

Conclusion

This study provides clear evidence that maternal health literacy is a critical determinant of childhood immunization uptake in North-Central Nigeria. Mothers with higher functional, interactive, and critical literacy were significantly more likely to ensure that their children completed age-appropriate immunization schedules. Among the literacy domains, functional literacy exerted the strongest influence, underscoring the importance of mothers' ability to understand immunization schedules and basic health messages. However, the findings also demonstrate that maternal literacy operates within broader social and structural contexts. Socio-cultural influences such as family expectations, community norms, and religious guidance—as well as structural barriers including distance to health facilities and vaccine stock-outs, significantly shape immunization behaviour. The original scholarly contribution of this study lies in its multidimensional examination of maternal health literacy and its interaction with socio-cultural and structural factors in a North-Central Nigerian context. By moving beyond formal education as a proxy for

knowledge, the study advances understanding of how different literacy domains jointly influence health behaviour. The mixed-methods approach further enriches this contribution by integrating quantitative associations with qualitative insights into community-level dynamics affecting immunization decisions.

Overall, the study highlights that improving childhood immunization coverage requires more than increasing service availability. Effective strategies must strengthen maternal health literacy while simultaneously addressing social norms, misinformation, and access constraints that limit the translation of knowledge into action.

Recommendations

Based on the findings, the following recommendations are proposed:

1. **Strengthen Maternal Health Literacy Programs:** Health education interventions should be designed to improve not only functional literacy but also interactive and critical literacy skills, enabling mothers to communicate effectively with health providers and critically evaluate vaccine-related information.
2. **Community-Based Engagement:** Immunization programs should actively engage community leaders, religious authorities, and family decision-makers to address socio-cultural concerns and reduce resistance to vaccination.
3. **Improve Health Communication Strategies:** Public health messaging should be clear, culturally sensitive, and delivered through trusted channels to counter misinformation and enhance confidence in immunization services.
4. **Enhance Access to Immunization Services:** Policymakers should prioritize reducing structural barriers by improving health facility coverage in rural areas, ensuring consistent vaccine supply, and supporting outreach services for hard-to-reach populations.
5. **Integrate Literacy into Primary Health Care:** Maternal health literacy assessment and support should be incorporated into routine maternal and child health services to identify mothers who may require additional guidance.
6. **Future Research:** Further studies should explore longitudinal relationships between maternal health literacy and child health outcomes, as well as intervention-based research to evaluate the effectiveness of literacy-focused immunization programs.

These recommendations provide a comprehensive framework for policymakers, health practitioners, and community stakeholders to improve childhood immunization uptake and child health outcomes in similar low- and middle-income settings.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The study was conducted as part of institutional research activities supported by the authors' respective affiliations.

Conflict of Interest

The authors declare no conflict of interest in relation to this study. All authors confirm that the results presented are unbiased and free from any financial or personal relationships that could have influenced the work.

References

- Adeloye, D., Jacobs, W., Amuta, A. O., et al. (2017). Coverage and determinants of childhood immunization in Nigeria: A systematic review and meta-analysis. *Vaccine*, 35(22), 2871–2881. <https://doi.org/10.1016/j.vaccine.2017.04.034>
- Afolabi, M. O., Sopekan, A. O., & Olayemi, O. (2019). Health communication and vaccine uptake in Nigeria: A focus on maternal knowledge. *Global Health Action*, 12(1), 1552334. <https://doi.org/10.1080/16549716.2019.1552334>
- Akinwunmi, O. A., Oluwaseun, A. M., & Akintoye, S. O. (2016). Factors influencing vaccination uptake in Nigerian communities. *Global Health Action*, 9(3), 45–54. <https://doi.org/10.3402/gha.v9.31699>
- Antai, D. (2009). Inequitable childhood immunization uptake in Nigeria: A multilevel analysis. *BMC Infectious Diseases*, 9, Article 181. <https://doi.org/10.1186/1471-2334-9-181>
- Antai, D. (2010). Migration and child immunization in Nigeria: Individual- and community-level contexts. *BMC Public Health*, 10(1), 116. <https://doi.org/10.1186/1471-2458-10-116>
- Babalola, S., & Aina, O. (2004). *Community and systemic factors affecting the uptake of immunisation in Nigeria: A qualitative study in five states* (National Report). PATHS, Abuja, Nigeria.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Isa, A., Adebayo, A., Rasaq, A., Ipinnimo, T., Adebisi, O., & Azees, A. (2025). Maternal satisfaction with routine immunization services at a tertiary healthcare facility in Ekiti State, South Western Nigeria: A cross-sectional study. *The Nigerian Health Journal*, 25(3), 1197–1205. <https://doi.org/10.71637/tnhj.v25i3.1164>
- Konwea, P. E., David, F. A., & Ogunsile, S. E. (2018). Determinants of compliance with child immunization among mothers of children under five years of age in Ekiti State, Nigeria. *Journal of Health Research*, 32(3), 229–236. <https://doi.org/10.1108/JHR-05-2018-024>
- Mutua, M. K., Kimani-Murage, E., & Ettarh, R. R. (2011). Childhood vaccination in informal urban settlements in Nairobi, Kenya: Who gets vaccinated? *BMC Public Health*, 11, 6. <https://doi.org/10.1186/1471-2458-11-6>
- National Population Commission (NPC) & ICF. (2019). *Nigeria Demographic and Health Survey 2018*. NPC & ICF, Abuja, Nigeria.
- Nutbeam, D. (2008). The evolving concept of health literacy. *Social Science & Medicine*, 67(12), 2072–2078. <https://doi.org/10.1016/j.socscimed.2008.09.050>
- Odusanya, O. O., Alufohai, E. F., Meurice, F. P., & Ahonkhah, V. I. (2008). Determinants of vaccination coverage in rural Nigeria. *BMC Public Health*, 8, 381. <https://doi.org/10.1186/1471-2458-8-381>
- Oku, A., Oyo-Ita, A., Glenton, C., Fretheim, A., Ames, H., Muloliwa, A., et al. (2017). Perceptions and experiences of childhood vaccination communication strategies among caregivers and health workers in Nigeria: A qualitative study. *PLoS ONE*, 12(4), e0186733. <https://doi.org/10.1371/journal.pone.0186733>
- Oyo-Ita, A., Nwachukwu, C., Oranganje, C., & Meremikwu, M. (2011). Interventions for improving coverage of child immunization in low- and middle-income countries. *Cochrane Database of Systematic Reviews*, 17, CD008145 <https://doi.org/10.1002/14651858.CD008145.pub2>

- Sørensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., & Brand, H.; HLS-EU Consortium Health Literacy Project European. (2012). Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health*, 12, 80. <https://doi.org/10.1186/1471-2458-12-80>
- UNICEF. (2022). *Immunization coverage and challenges in Nigeria*. UNICEF Nigeria Country Office. <https://www.unicef.org/nigeria/reports/immunization-coverage-and-challenges>
- Umoke, P. C. I., Umoke, M., Nwalieji, C. A., et al. (2021). Investigating factors associated with immunization incompleteness of children under five in Ebonyi State, Southeast Nigeria: Implication for policy dialogue. *Global Pediatric Health*, 8, 2333794X21991008. <https://doi.org/10.1177/2333794X21991008>
- World Health Organization. (2024). *Immunization coverage fact sheet*. WHO. <https://www.who.int/news-room/fact-sheets/detail/immunization-coverage>