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Relationships among maternal literacy, health worker behaviour and immunization outcomes in primary health care centres: Evidence from a sub-urban community in Delta State, Nigeria

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Abstract

This paper examines mothers' awareness of infant immunisation and the success of childhood immunization in the Ika South Local Government Area (LGA). A descriptive cross-sectional survey with a sample population of 150 women and health workers was conducted to assess how maternal literacy levels and health worker behaviour (Communication, Empathy and Commitment to Duty) influence immunization practices. Data were collected through printed structured questionnaires that assessed participants' literacy level, the relationship between immunization and infant mortality and the impact of the behaviour of health workers towards immunization. Chi-square statistical analysis was used to analyse the results. Findings suggest that illiterate mothers often struggle to understand vaccination schedules, the importance of immunization, and how to access health services ($p < 0.05$). As a result, children of such mothers are more likely to miss essential vaccines, increasing their risk of preventable diseases (such as tuberculosis, poliomyelitis (polio), measles, diphtheria, pertussis, tetanus, hepatitis B, Haemophilus influenzae type b disease, pneumococcal disease (including pneumonia and meningitis), rotavirus diarrhoea, yellow fever, and human papillomavirus-related diseases (where applicable). Cultural beliefs and misinformation arising from inadequate and sometimes unwilling health personnel charged with the responsibility of counselling and enlightening these women, further worsen the situation, leading to mothers lacking the ability to critically assess health-related information and literacy programs aimed at empowering women. Improving maternal literacy in Ika South LGA is not only a step towards educational development but also a key strategy for enhancing child health. The study highlights the urgent need for targeted health education, thereby increasing community sensitization and immunization success rates.

Keywords: Child mortality, Health workers, Immunization, Maternal literacy

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Introduction

Immunization is one of the most powerful and cost-effective public health interventions for preventing morbidity and mortality from vaccine-preventable diseases (VPDs). It remains a cornerstone of global health efforts to ensure child survival and development. According to the World Health Organization (WHO, 2025), approximately 89% of infants worldwide received at least one dose of the diphtheria-tetanus-pertussis vaccine, while 85% completed the three-dose series. However, about 14.3 million infants termed “zero-dose children” received no vaccine at all, highlighting persistent inequities and gaps in vaccine access and coverage across low- and middle-income countries (WHO, 2025). The principle underlying immunization is herd immunity, which occurs when a sufficiently large proportion of a population is immunized, thereby reducing disease transmission (Desai and Majumder, 2020). Research suggests that immunizing more than half of a community could eliminate epidemic risk; modern epidemiological models emphasize that thresholds differ by disease (Randolph and Barreiro, 2020). For example, measles requires a community coverage of about 95% to prevent outbreaks (CDC, 2024). Therefore, high and sustained vaccination coverage is critical to maintaining population-level immunity.

In Nigeria and similar developing contexts, the National Programme on Immunization targets vaccination of children from birth to two years of age and pregnant women. The programme initially focused on six major childhood diseases tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus, and measles but has since expanded to include vaccines against hepatitis B, *Haemophilus influenzae* type b, pneumococcal infections, and rotavirus (Federal Ministry of Health (FMOH, 2024). Despite these advancements, routine immunization coverage in Nigeria remains below global targets, and dropout between vaccine doses continues to undermine the effectiveness of the programme (UNICEF, 2024). The success of any immunization programme depends largely on the knowledge, attitude, and practice of caregivers, particularly mothers. In most African societies, mothers are the primary caregivers and decision-makers in child health, making their literacy level and health-seeking behaviour crucial factors influencing immunization uptake (Afolabi et al., 2023). A recent study in Pakistan confirmed that maternal literacy strongly correlates with full immunization coverage, as literate mothers are more likely to understand immunization schedules and perceive vaccines as safe and effective (Sohail et al., 2023). Similarly, studies in sub-Saharan Africa have demonstrated that vaccine literacy the ability to access, understand, and evaluate vaccine information predicts positive attitudes toward immunization and higher completion rates (Okeke et al., 2024; BMC Public Health, 2025).

Conversely, poor literacy, superstition, misinformation, and cultural beliefs remain significant barriers. Some caregivers attribute illnesses to supernatural causes such as witchcraft, ancestral punishment, or evil spirits, preferring traditional remedies or religious rituals to biomedical prevention (WHO, 2024). The rise of vaccine misinformation on social media has also exacerbated vaccine hesitancy, reducing confidence in immunization programmes even among educated populations (CDC, 2024). Another factor influencing immunization outcomes is the attitude and behaviour of health workers. Inconsistent vaccine supply, long waiting times, and negative staff interactions can discourage caregivers from completing immunization schedules. Evidence shows that caregivers providing trust, effective communication, and friendly service delivery significantly increase adherence and timely vaccine completion (Nwankwo et al., 2023). Furthermore, structural barriers such as poor access to health facilities, vaccine stockouts, and competing work responsibilities also affect immunization compliance.

Incomplete immunization patterns reflect broader systemic challenges that persist today. In Agbor, Delta State, Nigeria, where this study was conducted, response to immunization programmes by caregivers, especially mothers, is rather slow. Primary health care centres operating in local councils have devised means such as making health workers go from house to house, religious centres (churches and mosques), as well as schools to reach target groups. Recently, the scope of immunization has expanded beyond traditional childhood vaccines. In 2024, WHO recommended the use of maternal vaccines and monoclonal antibody therapies to protect infants against respiratory syncytial virus, a major cause of infant mortality (WHO, 2024). Additionally, malaria vaccines such as RTS, S, and R21 have been introduced in high-transmission regions of Africa, marking a new era in preventive immunology (WHO Africa, 2025). These advancements underscore the evolving role of immunization in global and national health agenda.

In summary, immunization remains vital for child survival, but its success depends on multiple interlinked factors: maternal literacy, vaccine accessibility, caregivers' attitudes, and health system efficiency. Understanding these determinants is crucial to improving immunization uptake and reducing infant mortality. This paper, therefore, examines the relationship between literacy level and child immunization, explores maternal attitudes toward immunization, and evaluates how health worker behaviour influences vaccine compliance in Agbor, Delta State, Nigeria.

The following research questions were made to guide the study:

1. Does the ignorance of mothers contribute to their attitude towards immunization?
2. Does lack of immunization lead to death of children?
3. Does the behaviour of health workers affect the immunization process?

To guide this study the following hypotheses were made:

1. Ignorance of mothers does not significantly contribute to success of the immunization(H_01).
2. Lack of immunization in children does not result in infant mortality(H_02).
3. The behaviour of health workers does not affect child immunization(H_03).

Methodology

Data collection

A descriptive cross-sectional survey was adopted to evaluate the effect of women's literacy and the attitude of health workers on the success of immunization among children in Primary Health Care Centres in Agbor. Data for the study were collected using printed and structured questionnaires. The questionnaire's validity was established through expert review by professionals in public health. A pilot test was carried out among a small group outside the study area to ensure clarity, consistency, and reliability of the items before final administration.

Study population and sampling procedure

The study population comprised all health workers and post-natal mothers attending or working in primary health care centres in Agbor. The study area, Agbor, is located within longitudes 6°-6°

30' E and latitudes 6°-6° 30' N, with a population size of 167,060 (2006 census); projected to be about 229,000 in 2022. Its socioeconomic profile is characterized by a mixture of agricultural, commercial, educational and public-sector activities. There are three Primary Health Care Centres (PHC) in Agbor with about 75 health workers across the three PHCs visited, and about 150 mothers attend post-natal care in these centres. From this population, using Taro Yamane's formula, a representative sample of 150 respondents (50 health care workers and 100 mothers) was selected to ensure fair representation of both health workers and mothers. A random sampling technique was employed to avoid bias and ensure every member of the target population had an equal chance of being selected.

Ethical considerations

Ethical approval for this study was obtained from the Health Research Committee in Ika South Local Government Council. Participation was voluntary, and informed consent was obtained from all respondents before completing the questionnaire. They were assured of confidentiality and anonymity, and no personal identifiers were collected.

Instrument for data collection

The main instrument used for data collection in this study, as earlier stated, was a structured questionnaire. The questionnaire was divided into two sections. Section A contained questions on the demographic characteristics of respondents such as age, occupation, educational level, and marital status, while Section B focused on the variables related to the research hypotheses. The researchers visited the 3 Primary Health Care centres in the study area to distribute and retrieve the questionnaires, ensuring a high response rate and proper guidance during completion of the questionnaire, especially for illiterate mothers.

Presentation and analysis of data

Data collected from the questionnaire were carefully coded, organized, and analysed using the chi-square (χ^2) test. This test was employed to determine the relationship between women's literacy levels, immunization outcomes, and health workers' attitudes towards the success of immunization among children within the locality.

Results

Research Question 1: Does the ignorance of mothers contribute to their attitude towards immunization?

Table 1: Responses on the ignorance of mothers contributing to their attitude towards immunization

No.	Items on Questionnaire	Yes	No
1.	Are mothers aware of the potential risks associated with not vaccinating children?	126(84%)	24(16%)
2.	Vaccines can cause autism or other developmental disorders.	108(72%)	42(28%)

3.	Do you think it is important for children to receive all recommended vaccines on time?	114(76%)	36(24%)
4.	Do you feel confident in making decisions about your child's immunization?	126(84%)	24(16%)
5.	Is natural immunity sufficient to protect your child from diseases?	48(32%)	102(68%)
6.	I believe that traditional remedies are better than vaccines.	126(84%)	24(16%)
7.	I believe immunization causes more harm than good.	108(72%)	42(28%)
8.	I do not take my child for immunization because I lack information.	114(76%)	36(24%)
9.	I would immunize my child if I had more information.	126(84%)	24(16%)
10.	Health talks at clinics help me understand the need for immunization.	102(68%)	48(32%)

Overall, the findings suggest that although many mothers possess basic knowledge about immunization, ignorance and misinformation remain major factors influencing negative attitudes toward childhood vaccination (Table 1). Increasing maternal education and providing accurate health information would likely improve immunization uptake.

Research Question 2: Does lack of immunization lead to death of children?

Table 2: Responses on lack of immunization leading to death of children

No.	Items on Questionnaire	Yes	No
11.	Can mothers' delay on immunization lead to deadly diseases?	114(76%)	36(24%)
12.	Lack of immunization does not lead to children's death?	111(75%)	39(25%)
13.	Illiteracy of mothers towards immunization leads to the death of the child?	114(76%)	36(24%)
14.	Lack of immunization has led to the death of hundreds of children in the country.	126(84%)	24(16%)
15.	Are there geographical barriers preventing access to immunization services?	102(68%)	48(32%)
16.	I believe my child's survival depends partly on proper immunization.	114(76%)	36(24%)
17.	Children without immunization are weaker than those immunized.	111(75%)	39(25%)
18.	Infant mortality can be reduced by regular vaccination.	114(76%)	36(24%)
19.	I always make sure my child receives all recommended vaccines.	126(84%)	24(16%)
20.	I would advise other mothers to immunize their children to avoid loss.	102(68%)	48(32%)

Table 2 implies that respondents generally recognize immunization as an essential preventive measure against childhood diseases and mortality. Consequently, inadequate immunization is perceived as a major contributor to preventable child deaths.

Research Question 3: Does the behaviour of health workers affect the immunization process?**Table 3:** Responses on the behaviour of health workers regarding the immunization process

No.	Items on Questionnaire	Yes	No
21.	Health workers provide clear and accurate information about the importance and benefits of child immunization.	135(90%)	15(10%)
22.	Health workers are approachable and willing to address mothers' concerns or questions regarding immunization.	126(84%)	24(16%)
23.	Do health workers actively engage with mothers to promote awareness about child immunization?	75(50%)	75(50%)
24.	Health workers maintain confidentiality regarding mothers' personal information during visits.	87(58%)	63(42%)
25.	Health workers communicate potential side effects or risks associated with child immunization.	102(68%)	48(32%)
26	Health workers are lackadaisical when it comes to guiding mothers regarding immunization.	87(58%)	63(42%)
27	I have seen health workers neglect their duties during immunization.	75(50%)	75(50%)
28	Friendly health workers encourage more mothers to immunize their children.	126(84%)	24(16%)
29	I am afraid to go to the clinic because of how staff behave.	75(50%)	75(50%)
30	Health workers' attitudes are a major reason for low turnout at centres.	75(50%)	75(50%)

The findings suggest that health workers' attitudes and interpersonal behaviour significantly influence mothers' willingness to participate in child immunization programmes (Table 3). Positive staff behaviour encourages immunization uptake, whereas negative attitudes discourage attendance.

Table 4 provides the Chi-Square test summary for the test of the three hypotheses. The Chi-square analysis produced a calculated value of $\chi^2 = 69.36$ with $df = 1$ and $p < 0.001$ for the hypothesis 01 (ignorance of mothers does not significantly contribute to their attitude towards child immunization.). Since the p-value is less than the 0.05 level of significance, the null hypothesis was rejected. Therefore, there is a statistically significant relationship between maternal ignorance and attitudes toward child immunization. This indicates that mothers' level of knowledge significantly influences their attitudes and decisions regarding childhood vaccination. Therefore, improving maternal knowledge through health education and awareness campaigns would likely enhance positive attitudes toward immunization.

The Chi-square test yielded $\chi^2 = 40.56$, $df = 1$, with $p < 0.001$ for the hypothesis 02 (lack of immunization in children does not significantly result in infant mortality). Since the p-value is below the 0.05 significance level, the null hypothesis was rejected. Therefore, there is a statistically significant relationship between lack of immunization and infant mortality. This finding suggests that failure to immunize children increases their susceptibility to vaccine-preventable diseases, thereby contributing significantly to childhood illness and death.

The Chi-square analysis produced a calculated value of $\chi^2 = 96.00$, $df = 1$, with $p < 0.001$ for the hypothesis 03 Health workers' behaviour does not significantly affect the child immunization process). Since the p-value is less than the 0.05 level of significance, the null hypothesis was rejected. Therefore, it is concluded that the health workers' behaviour has a statistically significant effect on the child immunization process. Positive attitudes, effective communication, and supportive interactions with mothers encourage greater participation in immunization programmes, whereas unfriendly or unprofessional behaviour discourages attendance and may reduce immunization coverage.

Table 4: Chi-Square test summary for the test of hypotheses

Hypothesis	Observed Frequency (Agree, Disagree)	Expected Frequency (Agree, Disagree)	χ^2	df	p-value	Decision and Interpretation
H ₀ 1: Ignorance of mothers does not significantly contribute to their attitude towards child immunization.	126, 24	75, 75	69.36	1	< 0.001	Reject H ₀ 1 (Significant)
H ₀ 2: Lack of immunization in children does not significantly result in infant mortality.	114, 36	75, 75	40.56	1	< 0.001	Reject H ₀ 2 (Significant)
H ₀ 3: Health workers' behaviour does not significantly affect the child immunization process.	135, 15	75, 75	96.00	1	< 0.001	Reject H ₀ 3 (Significant)

Discussion

The results of this research show that mothers who are not literate do not positively respond to calls for immunization of their children. The data exposed the fact that most respondents are aware of the dangers of not immunizing their children, as is seen in the high proportion of “Yes” responses, but are handicapped by certain factors such as illiteracy. This aligns with the work of Ozor et al (2023), who stated that women’s level of education is a factor in immunization uptake in Ebonyi State, Nigeria. He opined that the more educated a mother is, the higher her chances of accepting child immunization programmes. Illiteracy in mothers has been the bane of immunization success across communities in Nigeria. Mothers who are less educated are often daunted with several challenges that are interrelated; limited understanding of health-related issues, a decline in advocacy strength, financial constraints, lack of access to information and susceptibility to misinformation amongst others. According to Nwokolo et al. (2023), maternal literacy remains a strong predictor of complete immunization in Nigeria. The Nigeria Demographic and Health Survey similarly showed that maternal literacy, poor social economic standing, and differences within regions significantly affect immunization rates among children aged 12-23 months (Sani et al., 2025). Illiteracy in a broader sense also contributes to health disparities within the populace, whereby children of the less educated are more likely to experience poor nutrition, delayed growth and increased mortality rates, as is the case in the study area.

It was also observed from the respondents that lack of immunization contributes to child morbidity and mortality. Delays in immunization were found to expose children to vaccine-preventable diseases, often resulting in fatal consequences. This observation agrees with the World Health Organization (2024) report, which noted that global childhood immunization levels have stagnated, leaving millions of children susceptible to preventable diseases and death. Immunization is one of the most effective public health interventions for reducing childhood morbidity and mortality. In suburban areas of Nigeria, gaps in routine vaccination coverage directly contribute to preventable deaths among children under five years of age. Vaccines protect against deadly diseases such as measles, pertussis, tetanus, polio, and pneumococcal infections. When children miss these vaccines, they remain highly vulnerable to infections that have high case-fatality ratios, particularly in settings with limited healthcare access and high malnutrition rates (Gavi, 2024; UNICEF & NPHCDA, 2025). Outbreaks of vaccine-preventable diseases are more common in areas with low immunization coverage (NJCP, 2023). Measles, for instance, has repeatedly caused significant mortality in Nigeria's suburban and peri-urban communities. Where routine immunization fails, outbreaks spread rapidly, disproportionately affecting children who have never received vaccines. These outbreaks demonstrate a direct link between low vaccine coverage and increased child mortality (WHO, 2023; BMC Public Health, 2025). A substantial proportion of Nigerian children are "zero-dose", meaning they have not received any routine vaccines. This population is particularly vulnerable; zero-dose children are significantly more likely to die from preventable infections than those with partial or full immunization.

National and subnational data have shown that the majority of children live in sub-urban and peri-urban areas, where health care delivery and programmes targeting the masses to better their health needs are not consistent (Gavi 2023; UNICEF & NBS, 2022). The coverage achieved by routine immunization programmes across the country still falls short of what is required to establish herd immunity for various VPDs. Measles, for example, requires a 95% coverage to confer herd immunity. Reports from many quarters indicate that the threshold is still around 50%, which is grossly inadequate for measles prevention (Gavi 2024; BMC Public Health 2025). Children in suburban communities are exposed to multiple challenges that increase the effects of incomplete immunization. Overcrowding, poor living conditions, malnutrition and poor access to health care delivery services worsen the problem of vaccine-preventable diseases. Inadequate or complete absence of immunization increases child mortality in the event of contracting these preventable diseases (WHO 2023; UNICEF & NPHCDA, 2025).

Health systems and logistical failures also contribute to the low vaccination rate in suburban communities. Children's vulnerability due to missed doses resulting from frequent stock shortages, inconsistent outreach programmes, and poor cold-chain management. There is evidence proving that reliable and effective immunization outcomes are key to preventing child death (Gavi, 2023; Gavi, 2024). Vaccine hesitancy, misinformation, and illiteracy further complicate the matter. These behavioural barriers increase the risk associated with incomplete vaccination (UNICEF & NPHCDA, 2025; WHO/UNICEF, 2025).

Furthermore, the study revealed that the behaviour and communication of health workers strongly reduce mothers' willingness to immunize their children. When health workers are respectful, follow up and give concise information about the merits of vaccination, women are encouraged to bring their children for immunization. This tallies with the work of Adewale and

Omotayo (2024), who opined that effective communication and cordial interpersonal relationships between caregivers and health workers enhanced immunization outcomes in Lagos State. On the contrary, rudeness and breakdown in communication do not further the course of immunization, reducing completion rate for essential vaccines (BMC Health Services, 2024; Nigerian Journal of Health Promotion, 2023). Operational behaviours such as frequent absenteeism, inconsistent timing of check-ups, and extremely long waiting hours make the process even more laborious, thereby exacerbating the problem of poor vaccine coverage (Okagbue et al., 2025).

Evidence from Nigeria reports that gaps in health workers' training contribute to a decline in immunization coverage, making the need for professional development and standardization of guidelines indubitable. (Iwu et al 2021; Scoping Review, 2024). Myths leading to vaccine hesitancy and personal doubt among caregivers further compound the problem. Mothers are more likely to trust and accept vaccines if they are recommended by health workers. However, when this is not the case, hesitancy and uncertainty on the part of these health workers undermine vaccination rates (CHRISMED Journal of Health & Research, 2023; Omoleke & Cleenewerck de Kiev, 2024).

When health workers fail to engage groups or communicate effectively using cultural context, mobilization efforts are less effective and immunization coverage declines (Fogg, 2021; UNICEF & NPHCDA, 2024). The use of local languages in communication has proven effective in boosting immunization outcomes (Eze and Okafor, 2024). Digital platforms and mobile health technologies also present innovative avenues for educating mothers and improving vaccination outcomes in resource-limited settings.

Conclusions

Ignorance among mothers has a profound negative effect on immunization outcomes. Less educated mothers lack understanding of the importance of immunization, are susceptible to misinformation and are limited in their access to available health resources. This results in illiterate mothers being less likely to complete immunization schedules for their children, contributing to preventable child mortality in suburban communities. Lack of immunization in suburban Nigerian communities like Agbor substantially increases child mortality by leaving children susceptible to highly preventable infectious diseases. Addressing gaps in routine immunization activities, through reliable services, outreach programmes, caregiver education and community engagements, is essential to reducing preventable deaths and improving child survival rates. Health workers' behaviour encompassing communication, interpersonal attitudes, reliability, knowledge, ethical conduct and community engagement significantly affects the immunization process. Improving staff training, professionalism and accountability, in addition to supportive supervision, can directly enhance immunization outcomes and reduce preventable childhood mortality in suburban Nigerian settings. Through these coordinated efforts, maternal literacy can be improved, misinformation checked, and immunization coverage expanded, eventually contributing to better child health outcomes and a sharp decline in child mortality rates in suburban communities in Nigeria.

Based on the findings of this study, several recommendations are proposed to enhance immunization awareness and improve childhood vaccination uptake among mothers attending Primary Health Care centres in sub-urban communities in Delta State, Nigeria. First, maternal education and literacy should be strengthened through the implementation of community-based adult literacy and health education programmes that emphasize the importance, safety, and benefits of childhood immunization. Such programmes would empower mothers with the knowledge and skills needed to make informed decisions regarding their children's health. Furthermore, communication between health workers and mothers should be improved by providing continuous training for healthcare personnel on effective interpersonal communication, cultural competence, and client-centered care. Health workers should be encouraged to deliver simple, culturally appropriate, and multilingual explanations of vaccination schedules, benefits, and possible side effects to enhance mothers' understanding and confidence in immunization services. In addition, access to immunization services should be expanded through regular community outreach programmes, mobile vaccination clinics, and effective follow-up mechanisms to identify and track defaulters. These strategies would help reduce missed vaccination appointments and improve the completion of recommended immunization schedules, particularly among hard-to-reach populations.

Community participation should also be strengthened by actively engaging traditional rulers, religious leaders, community-based organizations, and other influential stakeholders in promoting accurate information about immunization and addressing myths and misconceptions surrounding vaccines. Public-private partnerships involving government agencies, non-governmental organizations, development partners, and private healthcare providers should be encouraged to mobilize additional resources, expand vaccination coverage, and provide logistical support to underserved communities.

Finally, both the Federal and Delta State Ministries of Health should increase investment in routine immunization programmes by providing adequate funding for vaccine procurement, cold-chain infrastructure, health worker capacity building, public awareness campaigns, and supportive policies that promote equitable access to immunization services. Sustained political commitment and effective policy implementation will be essential for improving immunization awareness, increasing vaccine uptake, and reducing childhood morbidity and mortality in Nigeria.

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Conflict of Interest Statement

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