Maternal Knowledge of Childhood Immunization and Its Association with Full Immunization Status Among Mothers of Children Aged 12–23 Months in a Riverine Community of Rivers State, Nigeria

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Abstract
Maternal knowledge is a modifiable determinant of childhood vaccination, yet little is known about its level among mothers in the riverine communities of the Niger Delta. This study assessed the level of maternal knowledge about immunisation and its association with full immunisation status among children aged 12–23 months in Asari-Toru Local Government Area (ASALGA), Rivers State, Nigeria. A community-based cross-sectional study was conducted among 374 mothers or primary caregivers selected through multistage sampling. Knowledge was measured with a 13-item interviewer-administered scale (score 0–13) and categorised as good (9–13), fair (5–8) or poor (0–4). Associations with full immunisation were examined using chi-square tests and binary logistic regression. Only 25.7% of mothers had good knowledge, 48.7% had fair knowledge and 25.7% had poor knowledge. Although 93.0% had heard of childhood immunisation, only 49.2% knew the age for measles vaccination. Full immunisation coverage was 52.1%, 30.8% and 16.7% among children of mothers with good, fair and poor knowledge, respectively ($p < 0.001$). Good knowledge remained independently associated with full immunisation (AOR = 5.22; 95% CI: 2.46–11.08). Awareness of immunisation is high, but specific, actionable knowledge of the schedule is deficient and is associated with incomplete vaccination. Schedule-specific, culturally adapted health education delivered beyond clinic walls should be prioritised in riverine communities.

Keywords: *maternal knowledge; childhood immunisation; vaccination coverage; riverine community; Rivers State; Nigeria*

1. Introduction

Childhood immunisation is one of the most cost-effective public health interventions. It averts an estimated 4 million deaths each year (World Health Organization, 2025) and has been estimated to return about US$16 for every US$1 invested in low- and middle-income countries (Ozawa et al., 2016). Despite this, global coverage with the third dose of diphtheria-tetanus-pertussis vaccine (DTP3) was about 85% in 2024, and an estimated 14.3 million children received no routine vaccine dose (World Health Organization & UNICEF, 2025). Sub-Saharan Africa carries a disproportionate share of this gap. Inequalities in full immunisation by household wealth, maternal education and place of residence remain wide across low- and middle-income countries (Restrepo-Méndez et al., 2016).

Nigeria illustrates the problem. The 2021 National Immunization Coverage Survey found that only 36% of children aged 12–23 months were fully vaccinated, while 18% had received no routine vaccine (National Bureau of Statistics & UNICEF, 2022). The 2023–24 Nigeria Demographic and Health Survey likewise reported that only 39% of children in this age group were fully vaccinated against the basic antigens (National Population Commission [Nigeria] & ICF, 2024). An analysis of the 2018 survey found that 26% of children were fully immunised, with marked differences by region, household wealth and maternal education (Sani et al., 2025). Multilevel studies show that incomplete immunisation in Nigeria is shaped by both individual and community characteristics (Adedokun et al., 2017). The literature also identifies weak service delivery, misinformation and low awareness among caregivers as persistent obstacles (Ophori et al., 2014). These national averages hide wide subnational disparities, and hard-to-reach rural and riverine settings are among the worst affected.

A mother's knowledge of immunisation is one of the most consistently reported modifiable determinants of whether her child completes the schedule. In northern Nigeria, the uptake of the full DPT series was shaped by maternal and household attributes, including contact with health services and exposure to information (Babalola, 2009). Multilevel analyses of national data have linked maternal education and socioeconomic position to immunisation status (Antai, 2009; Wiysonge et al., 2012). In Atakumosa-West district, Osun State, mothers with good knowledge of immunisation had more than twice the odds of having a fully immunised child (adjusted OR = 2.4; 95% CI: 1.6–3.8) (Adedire et al., 2016). Systematic reviews across Africa identify maternal knowledge, awareness of the schedule and access to information among the leading factors affecting uptake (Bangura et al., 2020; Galadima et al., 2021). Lack of information about the need for vaccination, about when to return for subsequent doses, and about vaccine safety is a recurrent reason for non-vaccination in low- and middle-income countries (Rainey et al., 2011).

However, general awareness does not guarantee accurate, usable knowledge. A qualitative study in high zero-dose communities in Kano and Lagos found that caregivers generally understood the benefits of vaccination, yet uptake remained low because of rumours about vaccine safety, limited maternal decision-making power, economic pressures and negative experiences at health facilities (Abdelmagid et al., 2025). Among working mothers in Ibadan, 53.1% vaccinated their children on the day of birth, but only about one-third achieved full vaccination, and many mothers did not know the names or purposes of their children's vaccines (Omobowale et al., 2025). Vaccine hesitancy is context-specific and shaped by confidence, complacency and convenience (Larson et al., 2014; MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015), and rumours have disrupted immunisation activities in Nigeria before (Jegede, 2007). Information, however, is modifiable. A culturally adapted audio-visual workshop significantly improved immunisation knowledge among traditional birth attendants in Imo State (Iwu et al., 2021). Reviews also point to the value of locally tailored communication and health education (Dubé et al., 2013; Oku et al., 2017; Oyo-Ita et al., 2016). Because knowledge may not translate into behaviour when barriers of access, cost, trust and household decision-making intervene (Abdelmagid et al., 2025; Omobowale et al., 2025), its level and its relationship with immunisation status must be established locally before interventions are designed.

In Rivers State, full immunisation coverage among children aged 12–23 months was estimated at about 35% in the 2021 survey (National Bureau of Statistics & UNICEF, 2022). Asari-Toru Local Government Area (ASALGA) is predominantly rural and crisscrossed by creeks. Many settlements are reachable only by boat, primary health centres are few, and livelihoods depend on fishing, farming and trading. To our knowledge, no published study has quantified maternal knowledge of immunisation or examined how it relates to children's vaccination status in this setting.

The Health Belief Model holds that people must understand a health threat and the recommended protective action before they can form accurate perceptions of susceptibility, benefits and barriers (Rosenstock, 1974; Skinner et al., 2015). Andersen's Behavioural Model of Health Services Use similarly classifies knowledge and health beliefs as predisposing factors for service use (Andersen, 1995). Guided by these frameworks, this study aimed to determine the level of maternal knowledge about immunisation among mothers of children aged 12–23 months in ASALGA and to examine its association with the child's full immunisation status. We hypothesised that there is no significant association between maternal knowledge and immunisation coverage.

2. Materials and Methods

2.1. Study Design and Setting

A descriptive cross-sectional study was conducted among mothers or primary caregivers of children aged 12–23 months in Asari-Toru Local Government Area (ASALGA), Rivers State, Nigeria. The study focused on the level of maternal knowledge about immunisation and its association with the full immunisation status of the child. Data on maternal sociodemographic characteristics, maternal knowledge and the child's immunisation status were collected at a single point in time.

ASALGA is a riverine local government area in the oil-rich Niger Delta, lying between latitudes 4°44′ and 4°50′ N and longitudes 6°45′ and 6°55′ E. It covers about 113 km² of low-lying, swampy terrain crisscrossed by numerous creeks and waterways. It shares boundaries with Ahoada East and Abua/Odual Local Government Areas, Bayelsa State and Ogba/Egbema/Ndoni Local Government Area. The area has a rainy season from April to October, with annual rainfall often above 2,500 mm, and a dry season from November to March. Temperatures range between 25 °C and 30 °C, and humidity is high throughout the year. During the rains, roads become impassable and many communities are reachable only by boat. The population was 219,787 in the 2006 census, and the 2022 projection was 316,100. It is predominantly rural and Kalabari-speaking. English is the official language, Pidgin English is used for everyday communication, and Kalabari is widely used at home. Fishing, subsistence farming and trading are the main livelihoods, and Buguma is the commercial centre. Immunisation services are provided through a network of primary health care centres and one general hospital in Buguma. These facilities are unevenly distributed across the wards and vary in functionality. Access is limited by long distances, poor roads, a shortage of health workers and limited cold-chain capacity.

2.2. Study Population and Eligibility Criteria

The study population comprised mothers or primary caregivers of children aged 12–23 months residing in ASALGA during the study period. Respondents were eligible if they had lived in the study area for at least six months before the study, so that they were familiar with local health services and immunisation practices. They also had to give voluntary informed consent, and to be able to communicate in English, Pidgin English or Kalabari, with trained interpreters where needed. Mothers or caregivers who were acutely ill or unable to take part in the interview at the time of data collection were excluded. Respondents with a cognitive impairment or psychiatric disorder that would prevent them from understanding the questionnaire or giving informed consent were also excluded.

2.3. Sample Size and Sampling Procedure

The sample size was calculated using the Cochran formula for a single population proportion (Cochran, 1977): $n = Z^2P(1 - P)/d^2$. Here $Z = 1.96$ (95% confidence level), $d = 0.05$, and $P = 0.35$.

P is the proportion of children aged 12–23 months who were fully immunised in Rivers State in the 2021 Multiple Indicator Cluster Survey (National Bureau of Statistics & UNICEF, 2022). This gave a minimum sample size of 350 (n = 349.6). Adding 10% for non-response gave a target of 385 participants.

A four-stage sampling procedure was used. In the first stage, three of the 13 electoral wards in ASALGA were selected by simple random sampling (balloting). These were Wards 6, 9 and 12. In the second stage, two communities were randomly selected from each selected ward by balloting. These were Tariah and Isokariari (Ward 6), Tom-West and Egede-West (Ward 9), and Ido and Sama (Ward 12). In the third stage, households were listed in each selected community. Households were then selected by simple random sampling using a random number table, until the required number of eligible households was identified. In the fourth stage, one eligible mother or primary caregiver of a child aged 12–23 months was randomly chosen from each selected household, and the questionnaire was administered to her. A total of 374 completed questionnaires were retrieved and analysed.

2.4. Method of Data Collection

Data were collected using a structured, interviewer-administered questionnaire in English, with clarifications in Pidgin English and Kalabari where necessary. Trained research assistants conducted face-to-face interviews with respondents in their homes or at community centres. They were community health workers familiar with the study area and fluent in English, Pidgin English and Kalabari. Interviews were held in a quiet, private setting to ensure confidentiality, and each lasted about 15 to 20 minutes. Data collection took place over six months, on selected days of the week, to capture a diverse flow of respondents and avoid disruption to community activities. Before data collection, the research assistants were recruited on the basis of their experience in community-based research. They received two days of training on the study objectives, ethical considerations, data collection procedures and use of the questionnaire, including role-play sessions. The principal investigator supervised the fieldwork through regular visits. Completed questionnaires were reviewed daily for completeness and consistency, and errors or omissions were corrected through follow-up visits or telephone calls to respondents. The questionnaire was developed from validated tools and collected information on sociodemographic characteristics, maternal knowledge about immunisation and the immunisation status of the child. Sociodemographic variables were age, marital status, educational attainment, occupation, household income, household size and place of residence. Maternal knowledge was assessed with 13 items. They covered awareness of immunisation, its protective purpose, the timing and number of doses, the importance of completing the schedule, vaccine safety and side effects, free availability of vaccines, the age for measles vaccination, the consequences of missed doses, the immunisation card, and receipt of health education from a health worker. Responses were multiple-choice or true/false. Each correct response was scored 1 and each incorrect response 0, giving a total score of 0 to 13. Scores were categorised a priori as good knowledge (9–13), fair knowledge (5–8) or poor knowledge (0–4).

The immunisation status of children aged 12–23 months was verified from the immunisation card. Where no card was available, maternal recall was used (Cutts et al., 2013). A child was classified as fully immunised if he or she had received BCG, three doses of oral polio vaccine, three doses of diphtheria-tetanus-pertussis-containing vaccine, three doses of pneumococcal conjugate vaccine and measles vaccine by the first birthday. Children who had received some but not all scheduled vaccines were classified as partially immunised, and those who had received none as not immunised.

2.5 Validity and Reliability of the Study

2.5.1 Validity of the Study

The validity of the instrument was ensured through content validation. Three experts in public health, epidemiology and immunisation research (an immunisation and child health specialist and two academic researchers) reviewed the questionnaire for clarity, relevance and alignment with the study objectives. Unclear and repetitive questions were revised and poorly structured items reworded. The content validity index was 0.89. The questionnaire was then pretested among 30 mothers or primary caregivers of children aged 12–23 months in a community with similar characteristics to ASALGA but outside the study area. The pretest checked wording, response options, question sequence and layout, and it supported face validity. The questionnaire was translated into Kalabari and back-translated into English. Language experts reviewed the translation, which was pretested to confirm that the meaning of the items was preserved.

2.5.2 Reliability of the Study

Reliability was assessed with Cronbach's alpha, with a minimum of 0.70 considered acceptable. Alpha values ranged from 0.78 to 0.88 across the questionnaire sections, and the knowledge section had a coefficient of 0.82. Inter-rater reliability was assessed by having two trained research assistants administer the questionnaire to the same respondents during the pretest, and the level of agreement was found to be satisfactory. Test–retest reliability was assessed by re-administering the questionnaire to the same respondents two weeks apart. The correlation coefficients were satisfactory.

2.6. Statistical Analysis

Data were entered, cleaned and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Questionnaires were checked for completeness, consistency and errors, and incomplete or inconsistent questionnaires were excluded. Categorical variables, including maternal education, household income, place of residence, knowledge category and immunisation status, were summarised as frequencies and percentages. Continuous variables, such as maternal age and household size, were summarised as means, standard deviations and ranges. Results were presented in tables, charts and narrative form.

The level of maternal knowledge was assessed by calculating composite scores from the responses to the knowledge items, and respondents were categorised as having good, fair or poor knowledge using the predefined cut-off points. Full immunisation coverage was calculated as the proportion of children aged 12–23 months who had received all scheduled vaccines by their first birthday. The chi-square test was used to examine the association between maternal knowledge and immunisation status, and the level of statistical significance was set at $p < 0.05$. Variables significant at the bivariate level ($p < 0.05$) were entered into a multivariable binary logistic regression model to identify independent predictors of full immunisation while controlling for confounding. Results were expressed as adjusted odds ratios (AORs) with 95% confidence intervals (CIs), and model fit was assessed with the Hosmer–Lemeshow test. The null hypothesis was that there is no significant relationship between maternal knowledge about immunisation and immunisation coverage among children aged 12–23 months in ASALGA.

3.0 Results

Of 385 questionnaires administered, 374 were completed and analysed (response rate 97.1%). Most respondents were aged 20–29 years (52.9%), married (71.7%) and rural residents (70.1%). Nearly four in ten had no formal or only primary education (37.9%), and 44.9% lived in households earning less than ₦50,000 monthly. Trading, fishing and farming were the main

occupations, and boat was the commonest means of travel to a health facility (33.2%) (Table 1). Overall, 96 mothers (25.7%) had good knowledge, 182 (48.7%) had fair knowledge and 96 (25.7%) had poor knowledge (Table 2). Thus, almost three in four mothers (74.3%) had less than good knowledge.

General awareness was high (Table 3). Most mothers had heard of childhood immunisation (93.0%) and knew that it protects against vaccine-preventable diseases (88.8%), that completing all vaccines is important (83.4%), and that several doses are needed (80.7%). Knowledge was lower on practical and schedule-specific items: only 49.2% knew the age at which measles vaccine is given, 63.6% knew that missing a scheduled dose reduces protection, 65.8% knew that the immunisation card should be kept and presented at every visit, and 67.9% knew that vaccines are free in government facilities. About one in four mothers did not know that vaccines are generally safe (26.2% incorrect) or that mild fever or swelling after vaccination is a normal side effect (28.3% incorrect). Although 69.5% reported having received immunisation education from a health worker, 30.5% had not.

Overall, 118 of 374 children (31.6%) were fully immunised. Full immunisation increased steadily with maternal knowledge: 52.1% among children of mothers with good knowledge, 30.8% with fair knowledge and 16.7% with poor knowledge ($\chi^2 = 26.42$, $p < 0.001$; Table 4). After adjustment for other significant factors, children of mothers with good knowledge had over five times the odds of being fully immunised compared with those of mothers with poor knowledge (AOR = 5.22; 95% CI: 2.46–11.08), and those with fair knowledge had more than twice the odds (AOR = 2.42; 95% CI: 1.26–4.64). The null hypothesis of no association between maternal knowledge and immunisation coverage was therefore rejected.

Table 1. Sociodemographic characteristics of respondents (N = 374).

Variable	Frequency (n)	Percentage (%)
Age (years)		
<20	28	7.5
20–29	198	52.9
30–39	122	32.6
≥40	26	7.0
Marital status		
Married	268	71.7
Not married (single, cohabiting, divorced/separated, widowed)	106	28.3
Education		
No formal education	48	12.8
Primary	94	25.1
Secondary	156	41.7
Tertiary	68	18.2
Other	8	2.1
Main occupation		
Trading/business	108	28.9
Fishing	84	22.5
Farming	62	16.6
Other	120	32.1
Monthly household income		
<₦50,000	168	44.9
₦50,000–₦99,999	112	29.9

≥₦100,000	86	23.0
Not disclosed	8	2.1
Residence		
Rural	262	70.1
Urban	112	29.9
Main means of travel to health facility		
Boat	124	33.2
Other (motorcycle, tricycle, walking, car, other)	250	66.8

Table 2. Level of maternal knowledge about immunisation (N = 374).

Knowledge level	Frequency (n)	Percentage (%)
Good (score 9–13)	96	25.7
Fair (score 5–8)	182	48.7
Poor (score 0–4)	96	25.7

Table 3. Correct responses to individual knowledge items (N = 374).

Knowledge item	Correct n (%)	Incorrect n (%)
Heard about childhood immunisation	348 (93.0)	26 (7.0)
Immunisation protects against vaccine-preventable diseases	332 (88.8)	42 (11.2)
Completing all vaccines is important for full protection	312 (83.4)	62 (16.6)
Child needs several doses to be fully immunised	302 (80.7)	72 (19.3)
Child should begin receiving vaccines at birth	296 (79.1)	78 (20.9)
Child can become ill if schedule is not completed	288 (77.0)	86 (23.0)
Vaccines are generally safe for children	276 (73.8)	98 (26.2)
Mild fever or swelling is a normal side effect	268 (71.7)	106 (28.3)
Received health education on immunisation	260 (69.5)	114 (30.5)
Vaccines are free in government health facilities	254 (67.9)	120 (32.1)
Immunisation card should be kept and presented	246 (65.8)	128 (34.2)
Missing a scheduled vaccination reduces protection	238 (63.6)	136 (36.4)
Knows the age for measles vaccine	184 (49.2)	190 (50.8)

Table 4. Association between maternal knowledge and full immunisation status.

Knowledge level	Fully immunised n (%)	Not fully immunised n (%)	AOR (95% CI)	p-value
Poor (n = 96)	16 (16.7)	80 (83.3)	1.00 (ref.)	
Fair (n = 182)	56 (30.8)	126 (69.2)	2.42 (1.26–4.64)	0.008
Good (n = 96)	50 (52.1)	46 (47.9)	5.22 (2.46–11.08)	<0.001

$\chi^2 = 26.42$, $p < 0.001$. AOR = adjusted odds ratio; CI = confidence interval. The model was adjusted for the other variables significant at bivariate analysis (including maternal education, household income, residence, distance to facility, vaccine availability and stock-outs, health worker attitudes, transport cost, antenatal care attendance, maternal attitudes, family support, cultural beliefs and appointment reminders).

4. Discussion

This study addressed a gap in the evidence from the riverine communities of the Niger Delta, where immunisation services are hard to reach and little is known about what mothers actually understand about childhood vaccination. It assessed the level of maternal knowledge about immunisation among mothers of children aged 12–23 months in ASALGA, Rivers State, and examined whether that knowledge was associated with the child's full immunisation status. Three main findings emerged. First, awareness of immunisation was almost universal, yet good knowledge was held by only a minority of mothers. Second, knowledge was weakest on schedule-specific and practical matters, particularly the timing of vaccines, and not on the general purpose of vaccination. Third, higher maternal knowledge was associated with a greater likelihood of full immunisation, and this association persisted after adjustment for other significant factors. The null hypothesis was therefore rejected. Taken together, the findings suggest that maternal knowledge is one of the correlates of incomplete immunisation in this setting. The distinction between awareness and usable knowledge is the central message of the study. Mothers largely knew that immunisation exists and that it protects children. They were less certain about when specific vaccines are due, what happens when a dose is missed, and what to do with the immunisation card. This pattern has been described elsewhere in Nigeria. In high zero-dose communities in Kano and Lagos, caregivers generally understood the benefits of vaccination, yet uptake remained low (Abdelmagid et al., 2025). Among working mothers in Ibadan, many vaccinated their children early but did not complete the schedule, and many did not know the names or functions of the vaccines (Omobowale et al., 2025). A multi-dose schedule demands that a mother knows what to do and when. Knowing in general terms that vaccination is good is therefore not enough to complete it, and the literature consistently lists lack of information about the need for vaccination and about when to return for later doses among the reasons for non-vaccination (Rainey et al., 2011). It is also notable that many mothers reported receiving immunisation education from a health worker, yet good knowledge remained uncommon. This suggests that the reach of health education may be adequate while its content, depth or retention is not. Brief and general messages given during busy clinic contacts may raise awareness without building the specific knowledge needed for completion. Reviews of communication strategies for childhood vaccination in Nigeria point to comparable weaknesses in how messages are delivered and received (Oku et al., 2017). The evidence also suggests that knowledge can be improved. A culturally adapted audio-visual workshop significantly improved immunisation knowledge among traditional birth attendants in Imo State (Iwu et al., 2021), and a Cochrane review found that interventions such as health education can improve coverage in low- and middle-income countries (Oyo-Ita et al., 2016). Our data cannot show which content or delivery methods would work best in ASALGA, and this should be tested locally.

The association between maternal knowledge and full immunisation agrees with earlier Nigerian and African studies. Good maternal knowledge has been linked to higher odds of full immunisation in Osun State (Adedire et al., 2016), and systematic reviews across Africa identify maternal knowledge and access to information among the leading factors affecting uptake (Bangura et al., 2020; Galadima et al., 2021). Multilevel analyses of national data likewise show that individual and community characteristics, including maternal education and socioeconomic position, shape the likelihood of complete immunisation (Adedokun et al., 2017; Antai, 2009; Sani et al., 2025; Wiysonge et al., 2012). Maternal education is closely related to knowledge, and many mothers in our sample had limited formal education, so low knowledge may partly reflect educational disadvantage. The graded pattern is also worth noting. Mothers with fair knowledge appeared to do better than those with poor knowledge, which suggests that even partial improvements in knowledge may be associated with better completion. Differences in how knowledge is measured and categorised across studies limit

direct comparison of the strength of the association, and our larger estimate for good knowledge may also reflect the stronger geographical and economic barriers in a riverine setting.

These results are consistent with the frameworks that guided the study. The Health Belief Model holds that people must first understand a health threat and the recommended protective action before they can form accurate perceptions of susceptibility, benefits and barriers (Rosenstock, 1974; Skinner et al., 2015). A mother who is unsure when vaccines are due, or who does not know that a missed dose reduces protection, is less likely to perceive a need to return to the clinic. Andersen's model classifies knowledge and health beliefs as predisposing factors that act together with enabling factors such as income, distance and transport (Andersen, 1995). This helps explain why knowledge was associated with coverage but did not account for it completely. A substantial share of children of mothers with good knowledge were still not fully immunised. Knowledge therefore appears necessary but not sufficient. In a setting where settlements are reached by boat and household livelihoods are fragile, access, cost, trust and household decision-making are likely to shape whether knowledge is acted upon (Abdelmagid et al., 2025; Omobowale et al., 2025). This is in line with the wider evidence that vaccination behaviour also depends on confidence, complacency and convenience (Larson et al., 2014; MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015), and that mistrust and rumours can disrupt immunisation in Nigeria (Jegede, 2007). We did not measure these factors directly, so they should be regarded as plausible explanations and not as findings of this study. The findings have implications for practice and policy in ASALGA and similar riverine settings. Health education should move beyond general awareness messages to specific, actionable content about the schedule. This includes when each vaccine is due, the need to complete every dose, the age for measles vaccine, what to expect after vaccination, and the use of the immunisation card. Because many mothers cannot reach facilities easily, these messages should also be delivered beyond clinic walls, through community gatherings, religious and traditional leaders, markets and outreach sessions. They should be given in Kalabari and Pidgin English as well as English. Key messages should be reinforced at every contact, including antenatal care and immunisation visits, and health workers may need support in communicating clearly and consistently. Education should be accompanied by efforts to improve access, since better knowledge alone is unlikely to reach children who live far from services. Prospective and intervention studies are needed to test whether schedule-specific education raises coverage in this setting.

Strengths and Limitations

This study has several strengths. It is, to our knowledge, the first community-based assessment of maternal immunisation knowledge in a riverine local government area of Rivers State, and it reaches a population that facility-based surveys and national datasets often miss. A multistage random sampling procedure was used, with a sample size calculated for the study area, and the response was high. Interviews were conducted face to face by trained community health workers fluent in English, Pidgin English and Kalabari, with daily checks and supervision of the fieldwork. The questionnaire was reviewed by experts, back-translated, pretested and shown to have good internal consistency. The knowledge items covered a wide range of domains, which allowed general awareness to be separated from specific, actionable knowledge. Immunisation status was verified from cards where available, and multivariable analysis allowed the association to be examined after adjustment for other significant factors. The study was also grounded in the Health Belief Model and Andersen's Behavioural Model.

The main limitation is the cross-sectional design, which means that the association between knowledge and full immunisation cannot be interpreted as causal. Some knowledge items, such as those on the immunisation card and health education, may reflect contact with services. Reliance on maternal recall where cards were missing, and the self-reported nature of the

knowledge responses, may also have introduced some misclassification. Finally, the study was conducted in a single local government area, so caution is needed in generalising to non-riverine settings.

5. Conclusions

In this riverine community of Rivers State, awareness of childhood immunisation is high, but only a quarter of mothers have good knowledge, and critical schedule-specific knowledge, particularly the age for measles vaccination, is deficient. Higher maternal knowledge was strongly and independently associated with full immunisation of children aged 12–23 months. Strengthening schedule-specific, culturally adapted and multi-channel health education, alongside improved service access, is a necessary step towards raising coverage and reducing vaccine-preventable infant deaths in ASALGA and similar settings.

Institutional Review Board Statement: Ethical approval was obtained from the Research Ethics Committee of Rivers State University, Port Harcourt (RSU/FBMS/REC/25/563), before commencement of the study. The study complied with the principles of the Declaration of Helsinki and the National Code of Health Research Ethics of Nigeria.

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