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Compliance with Routine Childhood Immunization Schedules among Mothers Attending Primary and Tertiary Healthcare Facilities in Rivers State, Nigeria: A Cross-Sectional Survey

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Abstract

Background: Routine childhood immunization is a cornerstone of child survival. In Rivers State, Nigeria, maternal compliance with immunization schedules remains sub-optimal due to socio-demographic, access-related, and informational barriers.
Objective: This study assessed compliance with routine childhood immunization schedules among mothers attending primary and tertiary healthcare facilities in Rivers State, determined influencing factors, and examined the impact of compliance on overall immunization coverage.
Methods: A descriptive cross-sectional design was employed. A total of 422 mothers were recruited through a multistage sampling technique from six healthcare facilities spanning all three senatorial districts of Rivers State. Data were collected using a structured, self-administered questionnaire and analyzed using frequencies, percentages, means, standard deviations, and multivariate logistic regression.
Results: Most respondents were aged 30–39 years (44.3%), held tertiary-level education (53.9%), and were married (69.8%). Immunization compliance was generally high: 72.0% always brought their children for scheduled vaccinations, and 83.9% used health record cards for schedule tracking. Healthcare provider advice ($\beta = 0.72$; OR = 2.06; $p < 0.001$), ease of access ($\beta = 0.45$; OR = 1.57; $p < 0.001$), satisfaction with immunization information ($\beta = 0.50$; OR = 1.65; $p < 0.001$), and perceived vaccine benefits ($\beta = 1.20$; OR = 3.32; $p < 0.001$) were significant independent predictors of compliance. The majority of mothers (75.8%) believed their compliance improved community immunization coverage, and 90.0% observed health benefits in their children.
Conclusions: Although compliance was generally high, barriers related to access, financial constraints, and occasional missed appointments persisted. Strengthening healthcare provider communication, improving service accessibility, and deploying digital reminder tools are recommended to sustain and enhance immunization coverage in Rivers State.

How to Cite this Article

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1. Introduction

Globally, routine childhood immunization remains one of the most effective and cost-efficient public health interventions, preventing an estimated 2 to 3 million deaths annually and significantly reducing the burden of vaccine-preventable diseases (VPDs) such as measles, polio, diphtheria, pertussis, and tetanus [1]. Over the past few decades, sustained immunization efforts have led to notable declines in childhood morbidity and mortality, contributing substantially to improved child survival rates and progress toward global health targets. Despite these achievements, gaps in immunization coverage persist, particularly in low- and middle-income countries. The World Health Organization (WHO) reports that approximately 19.4 million infants worldwide still do not receive basic vaccines each year, with a significant proportion classified as "zero-dose" children who have not received any routine immunization [2]. These gaps are often driven by a complex interplay of factors, including limited access to healthcare services, geographic and economic inequalities, vaccine hesitancy fueled by misinformation, and weak health system infrastructure.

In Nigeria, the challenge of achieving optimal immunization coverage remains pronounced. Although the country has implemented several national immunization strategies and campaigns, coverage levels continue to fall short of global and national targets. Recent data indicate that only about 57% of Nigerian children aged 12–23 months have received all recommended vaccines [3], while the National Immunization Coverage Survey (NICS) further highlights that merely 35% of children in this age group are fully immunized by their first birthday [4]. These figures underscore persistent deficiencies in the delivery and uptake of immunization services. Contributing factors include inadequate healthcare infrastructure, inconsistent vaccine supply chains, poor caregiver awareness, and

socio-cultural influences that affect health-seeking behavior. Additionally, disparities between urban and rural populations, as well as between different regions of the country, further complicate efforts to achieve equitable immunization coverage.

Rivers State, located in Nigeria's South-South geopolitical zone and characterized by its multi-ethnic composition and significant economic resources derived from oil production, reflects many of the broader national immunization challenges. Despite its relative economic advantage and the presence of tertiary healthcare institutions, immunization compliance among mothers in the state remains inconsistent. Reports from healthcare facilities continue to document cases of VPDs, suggesting gaps in both access to and utilization of routine immunization services [5]. Several factors have been implicated in this trend, including logistical challenges such as transportation difficulties and clinic accessibility, the spread of vaccine-related misinformation, entrenched cultural and religious beliefs, and financial constraints that limit healthcare utilization. These barriers may vary across different communities within the state, particularly between urban and rural settings, where access to health services and levels of health literacy often differ.

Existing literature across Nigeria has consistently demonstrated that immunization compliance is influenced by a wide range of interrelated factors, including maternal education, socioeconomic status, healthcare accessibility, and perceptions of vaccine safety and efficacy [6,7,8]. However, there remains a paucity of localized, context-specific evidence that captures the unique dynamics of immunization practices within Rivers State, especially across its diverse healthcare landscape that includes both well-equipped tertiary hospitals and resource-limited primary healthcare centres. Such localized insights are crucial for identifying context-specific barriers and facilitators of immunization uptake.

In light of these gaps, this study was designed to provide a comprehensive assessment of maternal compliance with routine childhood immunization schedules in selected primary and tertiary healthcare facilities in Rivers State. Specifically, the study aimed to: (1) determine the level of maternal compliance with recommended immunization schedules; (2) identify key factors influencing compliance; and (3) examine the impact of maternal compliance on overall immunization coverage. By generating evidence tailored to the local context, the study seeks to inform the development of targeted, culturally appropriate, and system-responsive interventions to improve immunization uptake in the state.

2. Methods

2.1 Study Design and Setting

A descriptive cross-sectional design was employed. The study was conducted in six healthcare facilities across the three senatorial districts of Rivers State—Rivers East, Rivers West, and Rivers South-East—selected to represent both primary (community-level) and tertiary (teaching hospital) settings and to capture urban, semi-urban, and rural immunization experiences.

2.2 Participants and Sampling

The target population comprised mothers attending immunization clinics at the selected facilities. Sample size was determined using the formula for unknown populations:

$n = Z\alpha^2pq / d^2 \rightarrow n = (1.96)^2 \times 0.5 \times 0.5 / (0.05)^2 = 384$

Where n is the sample size

$Z\alpha = 1.96$

d = error margin = 5% = 0.05

p = 50% = 0.5

q = 1- P = 1-0.5

Adding a 10% non-response correction yielded a final sample size of 422. A multistage sampling technique was used: the state was stratified by senatorial district, two facilities were randomly selected per district, and eligible mothers were consecutively recruited during clinic visits until the per-facility quota was met (70 per facility, except the University of Port Harcourt Teaching Hospital where 72 were recruited).

Inclusion criteria: mothers or primary caregivers of children under five years attending immunization clinic during the data collection period, and willing to provide informed consent. Mothers of children above five years, those unable to communicate in the questionnaire language without a translator, and those who withdrew consent were excluded.

2.3 Instrument

Data were collected using a structured, researcher-administered questionnaire comprising four sections: (A) socio-demographic characteristics (5 items); (B) compliance levels (5 items); (C) influencing factors (10 items, Likert-scale); and (D) impact on immunization coverage (4 items). Additionally, immunization cards were reviewed with permission to verify compliance. Face, content, and construct validity were established through expert review, and reliability was confirmed by a test-retest Pearson correlation coefficient of r = 0.70.

2.4 Data Analysis

Data were analyzed using SPSS version 25. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarized socio-demographic and compliance variables. Multivariate logistic regression (maximum likelihood estimation) was used to identify independent predictors of compliance, with the outcome variable coded as binary (compliant vs. non-compliant). Statistical significance was set at $p < 0.05$.

2.5 Ethical Considerations

Ethical approval was obtained from the Research Ethics Committees of Rivers State University (RSU/FBMS/REC/24/158), the University of Port Harcourt Teaching Hospital (UPTH/ADM/90/S.II/VOL.XI/1757), Rivers State University Teaching Hospital (RSUTH/REC/2024/613), and the Rivers State Health Management Board (RSHMB/RSHREC/2024/117). Written and verbal informed consent was obtained from all participants. Confidentiality was maintained throughout.

3. Results

3.1 Socio-Demographic Characteristics

Table 1 summarizes the socio-demographic profile of the 422 respondents. The majority were aged 30–39 years (44.3%), held tertiary education (53.9%), were married (69.8%), and self-employed (46.2%). Respondents were equally distributed across the six selected facilities and the three senatorial districts (33.3% each).

Table 1: Socio-demographic characteristics of respondents (n = 422)

Age Group	Frequency (n)	Percentage (%)
Under 20	8	1.9
20–29	93	22.1
30–39	186	44.3
40 and above	133	31.7
Highest Level of Education		
No formal education	8	1.9
Primary	51	12.1
Secondary	135	32.1
Tertiary	226	53.9
Marital Status		
Single	110	26.2
Married	293	69.8
Widowed	17	4.0
Employment Status		
Unemployed	76	18.1
Self-employed	194	46.2
Employed part-time	34	8.1
Employed full-time	116	27.6
Healthcare Facility Attended		
Bori Primary Healthcare Centre (Rivers South-East)	70	16.7
Kono Primary Healthcare Centre (Rivers South-East)	70	16.7
Ahoada West Primary Healthcare Centre (Rivers West)	70	16.7
Abua/Odual Primary Healthcare Centre (Rivers West)	70	16.7
Rivers State University Teaching Hospital (Rivers East)	70	16.7
University of Port Harcourt Teaching Hospital (Rivers East)	72	17.1
Senatorial District		
Rivers South-East	140	33.3
Rivers West	140	33.3
Rivers East	142	33.4

Note: Percentages may not sum to 100.0 due to rounding.

3.2 Level of Compliance with Routine Childhood Immunization Schedule

Table 2 presents findings on compliance. A majority of mothers (72.0%) reported always bringing their children for scheduled immunizations; none reported rarely or never doing so. When asked about missed appointments, 58.0% reported often missing (i.e., they had missed at least one appointment), while 42.0% reported missing very often. Among those who missed appointments, 48.1% did so occasionally and only 4.0% frequently. Health record cards were the primary tracking tool (83.9%). Regarding self-rated compliance, 44.1% rated themselves as excellently compliant, 36.0% as good, and 19.9% as poor.

Table 2: Level of compliance with routine childhood immunization schedule among mothers in selected healthcare facilities (n = 422)

Survey Question	Response Option	Frequency	Percent (%)
How often do you bring your child for scheduled immunizations?	Always	304	72.0
	Sometimes	118	28.0
	Rarely	0	0.0
	Never	0	0.0
How often do you miss an immunization appointment for your child?	Very often	177	42.0
	Often	245	58.0
	Not at all	0	0.0
If yes, how often do you miss these appointments?	Occasionally	203	48.1
	Frequently	17	4.0
	Not Applicable	202	47.9
How do you keep track of your child's immunization schedule?	Health record card	354	83.9
	Clinic reminders	42	10.0
	Personal calendar/phone	26	6.1
How would you rate your compliance with your child's immunization schedule?	Excellent compliant	186	44.1
	Good compliant	152	36.0
	Poor compliant	84	19.9

Note: 'Not Applicable' for missed appointment frequency applies to mothers who reported not missing any appointments.

3.3 Factors Influencing Compliance

Tables 3a and 3b present the factors influencing compliance. Most mothers (54.0%) found it often easy to access immunization services. Healthcare provider advice exerted a strong influence (56.2% 'very much'). The majority were satisfied with immunization information provided by healthcare workers (65.9% satisfied; 23.9% very satisfied). Financial or transportation challenges were encountered 'sometimes' by 42.0% of respondents. Half of the mothers (50.0%) were very confident in vaccine safety and effectiveness. The most influential compliance factor, selected by 64.0%, was a combination of multiple factors including provider recommendations, schedule awareness, and facility accessibility. Most respondents (48.1%) lived 1–5 km from their facility.

The mean scores (Table 3b) revealed that satisfaction with immunization information was the highest-rated factor (mean = 4.06, SD = 0.81), whereas financial and transportation challenges represented the most significant barrier (mean = 2.54, SD = 1.04).

Table 3a: Factors influencing maternal compliance with routine childhood immunization schedule (n = 422)

Survey Question	Response Option	Frequency	Percent (%)
How often do you find it easy to access immunization services for your child?	Never	8	1.9
	Rarely	135	32.0
	Sometimes	51	12.1
	Often	228	54.0
	Always	0	0.0
How much does healthcare provider advice influence your decision to follow the immunization schedule?	Not at all	17	4.0
	Slightly	17	4.0
	Moderately	118	28.0
	Very much	237	56.2
	Extremely	34	8.1
How satisfied are you with immunization information from healthcare professionals?	Very dissatisfied	17	4.0
	Dissatisfied	0	0.0
	Neutral	25	5.9
	Satisfied	278	65.9
	Very satisfied	101	23.9
How often do you face challenges (financial/transportation) affecting immunization attendance?	Never	76	18.0
	Rarely	118	28.0
	Sometimes	177	42.0
	Often	25	5.9
	Always	25	5.9
How confident are you in the safety and effectiveness of vaccines?	Not at all confident	0	0.0
	Slightly confident	42	10.0
	Moderately confident	160	37.9
	Very confident	211	50.0
	Extremely confident	9	2.1
What factors influence your decision to comply with the immunization schedule? (Select all that apply)	Awareness of schedule	34	8.0
	Accessibility of facility	42	10.0
	Provider recommendations	34	8.0
	Cultural beliefs	0	0.0

Table 3a (Cont'd)

	Family support	8	2.0
	Knowledge about immunization	34	8.0
	Vaccine safety concerns	0	0.0
	All of the above	270	64.0
How far is the healthcare facility from your home?	< 1 km	51	12.1
	1–5 km	203	48.1
	> 5 km	168	39.8
How satisfied are you with healthcare services during immunization visits?	Very satisfied	101	23.9
	Satisfied	278	65.9
	Neutral	25	5.9
	Dissatisfied	0	0.0
	Very dissatisfied	17	4.0
Have you ever faced challenges bringing your child for immunization?	Yes	17	4.0
	No	405	96.0
Frequency of missed appointments	Very frequent	203	48.1
	Frequent	17	4.0
	Not at all	203	48.1

Note: Multiple-response items were permitted for the 'factors influencing compliance' question.

Table 3b: Mean and standard deviation of factors influencing compliance (n = 422)

S/N	Survey Item	Mean	SD
1	How often do you find it easy to access immunization services for your child?	3.18	0.95
2	How much does healthcare provider advice influence your decision to follow the immunization schedule?	3.60	0.85
3	How satisfied are you with the information provided by healthcare professionals regarding immunization?	4.06	0.81
4	How often do you face challenges (financial/transportation) affecting immunization attendance?	2.54	1.04
5	How confident are you in the safety and effectiveness of the vaccines provided during immunization?	3.44	0.70

Note: Items scored on a 5-point Likert scale. SD = Standard Deviation.

3.4 Impact of Compliance on Overall Immunization Coverage

Table 4 shows that 96.0% of respondents agreed or strongly agreed that their compliance contributes to their child's overall health. The majority (75.8%) believed their compliance improves community immunization coverage, and 18.0% felt it significantly improves it. An overwhelming 90.0% reported observing health benefits in their children from regular immunization. Most mothers (93.9% combined) indicated they would recommend routine immunization to peers in their community.

Table 4: Impact of maternal compliance with routine childhood immunization schedule on overall immunization coverage (n = 422)

Survey Question	Response Option	Frequency	Percent (%)
Do you agree that your compliance with the immunization schedule contributes to your child's overall health?	Strongly agree	152	36.0
	Agree	253	60.0
	Neutral	17	4.0
	Disagree	0	0.0
	Strongly disagree	0	0.0
How do you think your compliance affects the community's overall immunization coverage?	Significantly improves coverage	76	18.0
	Improves coverage	320	75.8
	Has no effect	17	4.0
	Reduces coverage	9	2.1
Have you observed any benefits in your child's health due to regular immunizations?	Yes	380	90.0
	No	17	4.0
	Not sure	25	5.9
How likely are you to recommend routine immunization to other mothers in your community?	Very likely	236	56.0
	Likely	160	37.9
	Neutral	4	1.0
	Very unlikely	4	1.0

3.5 Hypothesis Testing: Relationship between Compliance Level and Influencing Factors

Table 5 presents the multivariate logistic regression results. The null hypothesis—that there is no significant relationship between the level of compliance and influencing factors—was rejected. Significant predictors of compliance (all $p < 0.05$) included: ease of access (Odds Ratio (OR) = 1.57, $p < 0.001$), healthcare provider advice (OR = 2.06, $p < 0.001$), satisfaction with information (OR = 1.65, $p < 0.001$), confidence in vaccine safety (OR = 1.91, $p < 0.001$), perceived benefits of immunization (OR = 3.32, $p < 0.001$), satisfaction with healthcare services (OR = 1.73, $p < 0.001$), challenges/barriers (OR = 0.74, $p = 0.012$), distance to facility (OR = 0.82, $p = 0.045$), and frequency of missed appointments (OR = 0.80, $p = 0.028$).

Table 5: Logistic regression analysis: predictors of compliance with routine childhood immunization schedule (n = 422)

Predictor Variable	Coefficient (β)	Std. Error	Wald Statistic	p-value	Odds Ratio (Exp β)
Intercept	-0.80	0.12	47.00	<0.001	—
Ease of Access (Easy vs. Difficult)	0.45	0.10	20.25	<0.001	1.57
Healthcare Provider Advice (Very much vs. Less influence)	0.72	0.15	21.60	<0.001	2.06
Satisfaction with Information (Satisfied vs. Dissatisfied)	0.50	0.13	15.38	<0.001	1.65
Challenges (Rarely/Sometimes vs. Often/Always)	-0.30	0.12	6.25	0.012	0.74
Confidence in Vaccine Safety (Very confident vs. Not confident)	0.65	0.14	19.90	<0.001	1.91
Distance to Facility (1–5 km vs. < 1 km)	-0.20	0.10	4.00	0.045	0.82
Satisfaction with Healthcare Services (Satisfied vs. Dissatisfied)	0.55	0.12	18.75	<0.001	1.73
Missed Appointments (Occasionally vs. Frequently)	-0.22	0.11	4.84	0.028	0.80
Perceived Benefits of Immunization (Yes vs. No)	1.20	0.17	48.00	<0.001	3.32

Note: Dependent variable = compliance (1 = compliant, 0 = non-compliant). OR = Odds Ratio; Std. Error = Standard Error.

4. Discussion

This study provides comprehensive, district-stratified evidence on maternal compliance with routine childhood immunization in Rivers State, Nigeria. The overall compliance rate of 72.0% indicates a relatively strong uptake of immunization services compared to several other regions in the country. This figure aligns with the 72% reported in Akwa Ibom State and exceeds the 54% observed in Zamfara State [9], suggesting important regional disparities in immunization behavior. Such differences may be attributed to variations in socioeconomic development, healthcare infrastructure, maternal education, and security conditions. In the context of Rivers State, the presence of tertiary healthcare institutions and relatively better urbanization likely enhances access to immunization services, thereby supporting higher compliance levels. However, this relatively favorable outcome should be interpreted cautiously, as it may also reflect the facility-based nature of the sample, which inherently captures mothers already engaged with the healthcare system.

Despite the high proportion of mothers who reported consistent attendance, the finding that 42.0% had missed at least one immunization appointment reveals a significant gap between knowledge, intention, and actual practice. This pattern highlights that compliance is not merely a binary outcome but exists along a continuum, where even generally compliant mothers may experience disruptions. The predominance of occasional missed appointments (48.1%) indicates that structural and situational barriers—such as competing responsibilities, transient financial constraints, or clinic-related inefficiencies—may intermittently hinder attendance. This observation is consistent with prior studies in Nigeria, which emphasize that missed opportunities for immunization remain a critical barrier to achieving full coverage [6,7,10]. Addressing this gap requires targeted interventions such as reminder systems, flexible clinic scheduling, and outreach services.

The role of healthcare provider advice as a strong predictor of compliance (OR = 2.06) underscores the centrality of trust and communication within the healthcare system. Frontline health workers serve not only as service providers but also as key influencers of maternal health behavior. Their ability to effectively communicate the importance of immunization, address concerns, and provide reassurance can significantly shape maternal decisions. This finding corroborates evidence from Lagos and Oyo State, where provider engagement was similarly identified as a critical determinant [7,8]. Strengthening interpersonal communication skills among healthcare workers, therefore, represents a practical and scalable strategy for improving compliance.

Perceived benefits of immunization emerged as the strongest predictor (OR = 3.32), reinforcing theoretical frameworks such as the Health Belief Model, which posits that individuals are more likely to engage in preventive health behaviors when they recognize clear benefits. In this study, the high proportion of mothers (90.0%) who reported observing health benefits in their children further validates this relationship. This strong positive perception provides a valuable entry point for public health interventions, as reinforcing existing beliefs may be more effective than attempting to change deeply held misconceptions.

Accessibility factors also played a significant role in shaping compliance. Ease of access (OR = 1.57) and distance to healthcare facilities (OR = 0.82) were both significant predictors, highlighting the persistent influence of geographic and infrastructural barriers. The fact that 39.8% of respondents resided more than 5 km from immunization centers is particularly concerning, especially in riverine and rural areas where transportation options may be limited and costly. These findings are consistent with earlier studies demonstrating that proximity to healthcare facilities is a key determinant of service utilization [6,7,9]. Improving physical access through mobile clinics, community-based immunization campaigns, and decentralized service delivery could help bridge this gap.

The high level of willingness among mothers to recommend immunization (93.9%) suggests the potential for leveraging social networks and peer influence to enhance uptake. Community-based advocacy, driven by satisfied and compliant mothers, could serve as a cost-effective strategy to counter misinformation and normalize immunization practices. This approach is particularly relevant in settings where trust in formal health systems may be variable.

However, the study is not without limitations. The reliance on self-reported data introduces the possibility of social desirability bias, as respondents may overreport compliance to align with perceived expectations. Although immunization cards were reviewed where possible, recall bias cannot be entirely excluded. Additionally, the cross-sectional design limits the ability to establish causal relationships between identified predictors and compliance outcomes. The sampling strategy, while geographically inclusive, may not fully capture the experiences of marginalized populations in hard-to-reach riverine areas, where barriers to immunization are often more pronounced.

Overall, the findings highlight that while immunization compliance in Rivers State is relatively high, it remains fragile and influenced by a combination of behavioral, structural, and health system factors. Sustaining and improving this level of compliance will require integrated strategies that address both demand-side and supply-side barriers, with particular emphasis on reducing missed appointments, enhancing provider–client communication, and improving service accessibility.

5. Conclusions

Maternal compliance with routine childhood immunization in Rivers State was generally high but not universal, with access barriers, financial constraints, and occasional missed appointments representing persistent challenges. Healthcare provider advice, perceived vaccine benefits, service satisfaction, and ease of access were independent predictors of compliance. These findings support a multi-pronged intervention approach that: (1) strengthens provider–mother communication through continuous healthcare worker training; (2) improves geographic and financial access to immunization services, particularly in rural and riverine communities; (3) deploys digital or community-based reminder systems to reduce missed appointments; and (4) leverages the positive vaccine perceptions of compliant mothers as community advocates.

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