

Original Research Article

Knowledge and practice of primary healthcare workers on the routine childhood immunization schedule in Osun State

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Received: 04 April 2025

Revised: 19 April 2025

Accepted: 21 April 2025

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ABSTRACT

Background: Despite global progress in immunization, Nigeria continues to face challenges in achieving adequate vaccination coverage. This study examined the knowledge and practices of primary healthcare workers regarding routine childhood immunization in Osun State, where coverage exceeds national averages but remains below global targets.

Methods: A descriptive cross-sectional study was conducted among 273 primary healthcare workers across 48 primary health centers in Osun State.

Results: There was a significant disparity between the knowledge (86.5%) and practice of routine childhood immunization (40.6%). Key gaps included inadequate vaccine storage (with 59% failing to maintain temperature records) and inconsistent caregiver communication (only 53.7% consistently obtained consent). Training deficiencies were evident, with 12.3% of staff lacking pre-service immunization training and 60% not having received refresher training within the previous six months.

Conclusions: These findings suggest that achieving better immunization outcomes requires more than just knowledge transfer. Health system strengthening should focus on improving cold chain infrastructure, implementing regular competency-based training, and strengthening supervision mechanisms. The study emphasizes the importance of ongoing support for healthcare workers to bridge the gap between knowledge and practice in routine immunization services.

Keywords: Immunization, Primary healthcare workers, Knowledge-practice gap

INTRODUCTION

Immunization has been proven to be one of the most cost-effective health promotion strategies. The morbidity and mortality rates of vaccine-preventable diseases tend to decline in many countries after achieving high

immunization coverage but increase in areas with low coverage.¹ Globally, immunization has saved about 3 million lives annually, or six people every minute, for the past five decades. In the same period, infant mortality has reduced by 40%.² It is an integral part of the country's health system, the central function and focus of the

community's overall social and economic development. It is the first level of contact with individuals, the family, and the community with the national health system, bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing healthcare process.³

In 2023, approximately 4.8 million children under the age of five died worldwide; the leading causes of most deaths were vaccine-preventable diseases like pneumonia, diarrhea, and malaria.⁴ Nigeria carries a significant burden of zero-dose and under-immunized children, accounting for over 2.1 million children, according to 2023 estimates from the United Nations Children's Fund (UNICEF) and World Health Organization (WHO).⁵ Based on the Nigerian national immunization schedule, 41.2% of children aged 12-23 months were fully immunized between 2023 and 2024, while 27.1% of children aged 24-35 months were fully immunized during the same period in Osun State. This is more than the national coverage rate of 20% and 11% for 12-23 months and 24-35 months, respectively, for the same period.⁶ This is far below the 90% national and 80% subnational immunization targets set by the Global Vaccine Action Plan (GVAP), endorsed by the World Health Assembly in 2012. GVAP has been replaced with the WHO Immunization Agenda 2030 (IA2030) due to the inability of most countries, especially African countries, to meet GVAP targets. The same national and subnational targets set by GVAP were adopted by IA2030.⁷

In many developing countries, including Nigeria, healthcare workers lack the requisite training or skills to effectively administer vaccines, as many vaccination events rely on the lowest cadre of staff and volunteers.⁸ It has been reported that health workers' knowledge of immunization tends to decline or become outdated over the years after their basic training because of technological changes and the emergence of new diseases and concepts in disease prevention and management.⁹ In a study conducted to determine the knowledge and practice of primary health workers on vaccination logistics management in Osun state, Nigeria, a gap was found in the knowledge, attitude, and practice of primary health care workers regarding the effective management of vaccination logistics.¹⁰

Although there have been studies on the importance of immunization, views, perceptions, and satisfaction of caregivers and the journey so far in Nigeria, there has been a dearth of studies assessing health workers' knowledge and practices regarding the routine National Programme on Immunization (NPI) schedule in Osun State, which necessitated the conduct of this study.

METHODS

This descriptive cross-sectional study was conducted between January and March 2022 in 48 primary health centers across six selected local governments in Osun

State. The sampling method used was a multistage sampling technique. A simple random sampling method was used to select two local governments in each senatorial district by balloting. In each local government, eight primary healthcare centers were chosen by ballot, utilizing the simple random sampling technique. Healthcare workers in these primary healthcare centers were interviewed using the already prepared questionnaire. Osun State is in the southwestern part of Nigeria, with three senatorial districts and 30 local governments.¹¹ It has an estimated population of 4,435,800 people as of 2022.¹²

Inclusion criteria were primary healthcare workers directly engaged in routine immunization, with a minimum six-month unbroken period of professional tenure in that capacity. Exclusion criteria comprised temporary staff, healthcare workers on extended leave, and respondents whose responses to the list of questionnaires were less than 80% complete.

The study population was health workers of primary healthcare centers within Osun State who directly administered the vaccines to children under five, including the community health extension worker (CHEW), junior community health extension worker (JCHEW), public health nurse, and community health officer (CHO) with midwifery skills. The sample size was determined using the Leslie Fisher formula for population >10,000, where n =sample size, Z =1.96, and P =prevalence of the subject of study from previous studies=0.8, Q =1- P =0.2, and d is the degree of accuracy of the study=0.05.^{13,14}

$$\begin{aligned} \text{Sample size } (n) &= Z^2 PQ/d^2 \\ &= (1.96)^2 \times 0.8 \times 0.2/(0.05)^2 \\ &= 245.86 = 246 \end{aligned}$$

A non-response rate of 10% was anticipated and adjusted to 246/0.9=273.

The research instrument was a semi-structured self-administered questionnaire that contained five sections, including socio-demographic characteristics, knowledge of healthcare workers about the routine immunization schedule, practice of healthcare workers, factors influencing the knowledge and practice among healthcare workers, and the level of training among healthcare workers. The questionnaire was developed based on the Nigerian Expanded Program on Immunization (EPI) policy, the GVAP guideline, and existing studies.^{8,14,15} Verbal consent was obtained from each respondent before administering the questionnaire, with confidentiality assured. 10% of the total questionnaires were pre-tested at four primary health care centers randomly selected in Orolu Local Government Area (LGA), Osun State. The pilot study was done to assess clarity and practicability. The pilot study yielded satisfactory results with a reliability coefficient of 0.75.¹⁶ Out of the 273 questionnaires administered, 251 were adequate for analysis, giving a response rate of 92%.

We checked the questionnaires for errors, sorted and imputed data into the computer, and made an analysis using the IBM statistical package for social sciences (SPSS) version 25.0. Results were presented in frequency tables, pie charts, and bar charts. Association between variables was assessed at the level of statistical significance, $p < 0.05$. We used descriptive statistics (frequency, mean, and percentage) to summarize the study data and inferential statistics (Chi-squared test) to determine associations between socio-demographic factors, knowledge, and practice responses.

The knowledge score was computed using 86 questions in the Knowledge section of the questionnaire. Each correct option was scored one (1) unit, while incorrect options were scored zero (0). A total score of 86 was made, with a mean score of 43.9 ± 3.7 .¹⁷ A respondent with scores from the mean and above was referred to as having good knowledge, while a respondent with scores below the mean was referred to as having poor knowledge. Practice score was computed using eight questions from the practice section of the questionnaire. Each correct option was scored 1 unit, while incorrect options were scored zero (0). A total score of 12 was made. A respondent with a score of 12 was referred to as having good practice, while a respondent with a score below 12 was referred to as having poor practice.¹⁷

RESULTS

The mean age of respondents was 37.5 ± 9.7 years, with the majority (41.4%) in the 31-40 age group. The majority were female (87.6%), educated up to diploma level (88.8%), and CHEW in cadre (49.0%). The mean year of work experience was 12.4 ± 8.0 years, with a more significant proportion (35.5%) having at least 15 years of work experience (Table 1). The entire respondents knew about routine immunization, with the majority (86.5%) having good knowledge about immunization, while only 40.6% have good practice of routine childhood immunization (Table 2).

Only 41.0% of the respondents keep a temperature record chart of the vaccine during storage, with the majority (69.9%) keeping temperature records on a temperature monitoring chart. All the respondents who did not keep temperature records had no storage facility in their center. The majority (63.0%) disposed of their used syringes and needles in safety boxes (Table 3).

More than 80% of the respondents have policy guidelines available in their facility, with the majority (65.7%) having seen standard policy guidelines being used before. The majority record the vaccines given in the child immunization card (90.8%) and keep a record of adverse effects following immunization (Table 3). Most (81%) respondents informed the caregiver about the vaccine administration (Figure 1). In the majority (75.4%), the reason for informing the caregiver was to let them know the purpose of the vaccine (Figure 2).

Table 1: Sociodemographic distribution of respondents.

Variables	Frequency (n=251)	Percentage
Age in years		
<21	9	3.6
21–30	61	24.3
31–40	104	41.4
41–50	52	20.7
>50	25	10.0
Mean±SD	37.5±9.7	
Sex		
Male	31	12.4
Female	220	87.6
Highest level of educational attainment		
Diploma	223	88.8
Degree	28	11.2
Cadre		
JCHEW	65	25.9
CHEW	123	49.0
CHO	23	9.2
Nurse/midwife	40	15.9
Years of work experience		
<5	46	18.3
5–9	65	25.9
10–14	51	20.3
15 and above	89	35.5
Mean±SD	12.4±8.0	

Table 2: Knowledge and practice of healthcare workers about the routine immunization schedule.

Variables	Frequency (n=251)	Percentage
Know about routine immunization		
	251	100.0
Knowledge about the routine immunization schedule		
Good	217	86.5
Poor	34	13.5
Practice		
Good	102	40.6
Poor	149	59.4

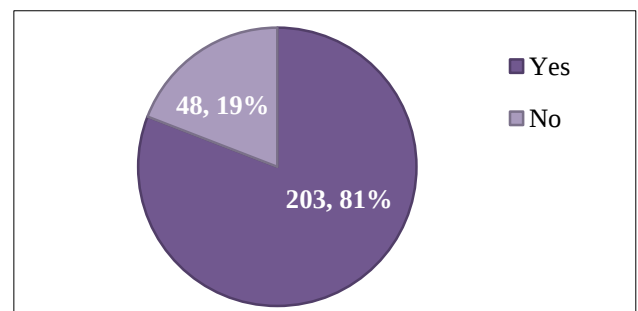


Figure 1: Proportion of respondents who informed the caregiver about the vaccine administration.

Table 3: Practice of healthcare workers about the routine immunization schedule.

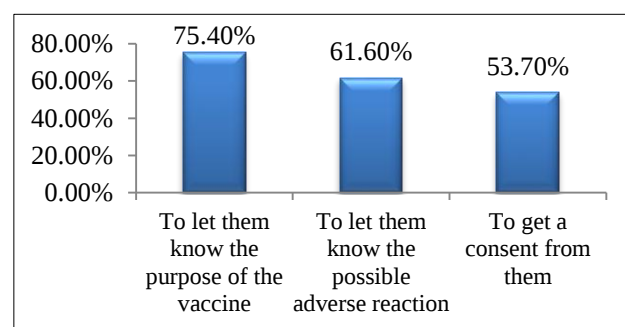
Variables	Frequency (n=251)	Percentage
Keep a temperature record chart of the vaccine during storage		
Yes	103	41.0
No	148	59.0
Where the temperature record chart of the vaccine is kept (n=103)		
Temperature monitoring chart	72	69.9
On top of the solar refrigerator	31	30.1
Why not keep a temperature record cart (n=148)		
No storage facility	148	100.0
Disposal of used syringes and needles		
Use of the safety box	158	63.0
Use of the waste bin	93	37.0
Availability of policy guidelines in the facility		
Yes	201	80.1
No	21	8.4
Do not know	29	11.5
Seen standard policy guidelines being used before (n=201)		
Yes	132	65.7
No	73	36.3
Record the vaccines given in the child's immunization card		
Yes	228	90.8
No	23	9.2
Keep a record of adverse effects following immunization		
Yes	167	66.5
No	84	33.5
Where the adverse effects are recorded (n=167)		
Notification book	12	7.2
Record book	155	92.8

All respondents have the vaccines available when needed. The majority rendered immunization services once a week (63.0%), had adequate supportive supervision (96.4%), monthly supervision (56.6%), and had the last supervisory visit between 1–3 months (47.6%) (Table 4).

Most of the respondents had training before administering vaccines (87.7%), with most being trained for less than 1 month (69.5%), and the last training attended was more than 6 months ago in the majority (60.5%). A more significant proportion (65.3%) were aware of organizations for training on immunization, with the majority (35.4%) outlining UNICEF as an organization involved in training on immunization. The majority (66.9%) of the respondents participated in the training of other health workers (Table 5).

Table 4: Factors influencing the practice among respondents.

Variables	Frequency (n=251)	Percentage
Vaccines are available when needed	241	96.0
How often immunization services are rendered per week (days)		
1	158	63.0
2	46	18.2
3	21	8.4
4	15	6.0
5	11	4.4
Adequate supportive supervision		
Yes	242	96.4
No	9	3.6
Supportive supervision from*		
Ministry of Health	219	87.3
Local Government	223	88.8
Frequency of supervision		
Weekly	66	26.3
Monthly	142	56.6
Quarterly	43	17.1
When was the last supervisory visit to the facility (in month(s))		
<1	19	7.6
1–3	119	47.4
4–6	103	41.0
>6	10	4.0

**Figure 2: Respondents' reasons for informing the caregiver about the vaccine before administering.**

The highest level of educational attainment and the cadre of respondents showed a statistically significant relationship with knowledge of routine immunization ($p < 0.005$), while age in years and years of working experience showed no statistically significant relationship ($p > 0.005$) (Table 6). The highest level of educational attainment, cadre, and years of working experience showed a statistically significant relationship with the practice of routine immunization ($p < 0.005$), while age in years showed no statistically significant relationship ($p = 0.067$) (Table 7). There was a statistically significant relationship between the knowledge and practice of respondents on routine childhood immunization (Table 8).

Table 5: Factors influencing the knowledge and practice among healthcare workers.

Variables	Frequency (n=251)	Percentage
Trained before administering vaccines		
Yes	220	87.7
No	31	12.3
Duration of training (months) (n=220)		
<1	153	69.5
1-3	40	18.2
>3	27	12.3
Last time I attended a seminar/training on immunization (months) (n=220)		
<3	26	11.8
3-6	61	27.7
>6	133	60.5
Awareness of any organization for training on immunization		
Yes	164	65.3
No	87	34.7
Organization for training immunization (n=164)*		
IPDS	46	28.1
UNICEF	58	35.4
EU PRIME	39	23.8
Ministry of Health	36	22
WHO	95	57.9
Involved in the training of other health workers		
Yes	168	66.9
No	83	33.1

Table 6: Relationship between socio-demographic distribution and knowledge of respondents on routine childhood immunization.

Variables	Knowledge				
	Good, N (%)	Poor, N (%)	Chi-square	Df	P value
Age in years					
<21	7 (77.8)	2 (22.2)	3.973	4	0.41
21–30	54 (88.5)	7 (11.5)			
31–40	89 (85.6)	15 (14.4)			
41–50	43 (82.7)	9 (17.3)			
>50	24 (96.0)	1 (4.0)			
Highest level of educational attainment					
Diploma	189 (84.8)	34 (15.2)	4.938	1	0.026*
Degree	28 (100.0)	0 (0.0)			
Cadre					
JCHEW	52 (80.0)	13 (20.0)	21.624	1	<0.001*
CHEW	102 (82.9)	21 (17.1)			
CHO	23 (100.0)	0 (0.0)			
Nurse/midwife	35 (100.0)	0 (0.0)			
Years of working experience					
<5	41 (89.1)	5 (10.9)	2.965	3	0.397
5–9	55 (84.6)	10 (15.4)			
10–14	41 (80.4)	10 (19.6)			
15 and above	80 (89.9)	9 (10.1)			

*P<0.05

Table 7: Relationship between socio-demographic distribution and practice of respondents on routine childhood immunization.

Variables	The practice of healthcare workers				
	Good, N (%)	Poor, N (%)	Chi-square	Df	P value
Age in years					
<21	3 (33.3)	6 (66.7)	8.786	4	0.067
21–30	22 (36.1)	39 (63.9)			
31–40	39 (37.5)	65 (62.5)			
41–50	21 (40.4)	31 (59.6)			
>50	17 (68.0)	8 (32.0)			
Highest level of educational attainment					
Diploma	76 (34.1)	147 (65.9)	35.625	1	<0.001*
Degree	26 (92.9)	2 (7.1)			
Cadre					
JCHEW	12 (18.5)	53 (81.5)	56.134	4	<0.001*
CHEW	42 (34.1)	81 (65.9)			
CHO	14 (60.9)	9 (39.1)			
Nurse/Midwife	29 (82.9)	6 (17.1)			
Years of working experience					
<5	10 (21.7)	36 (78.3)	12.446		0.006*
5–9	25 (38.5)	40 (61.5)			
10–14	20 (39.2)	31 (60.8)			
15 and above	47 (52.8)	42 (47.2)			

*P<0.05

Table 8: Relationship between knowledge and practice of respondents on routine childhood immunization.

Variables	Knowledge of routine childhood immunization				
	Good, N (%)	Poor, N (%)	Chi-square	Df	P value
Practice					
Good	97 (95.1)	5 (4.9)	10.963	1	0.001*
Poor	120 (80.5)	29 (19.5)			

*P<0.05

DISCUSSION

Most of the respondents in this study were females, and this indicates that the majority of healthcare workers who directly administer vaccines in immunization clinics are predominantly women, a finding similar to that obtained in a study reviewing the global landscape of community health workers as vaccinators where about 70% of the global community health workers were females.¹⁸ This observation is a reflection of what is seen in most health facilities in Nigeria, where women dominate Nursing and other nursing-related professions, such as CHOs and CHEWs.¹⁹

In this study, we sought to assess the knowledge of health workers in primary health centers in Osun state about the routine immunization schedule, and we found out that 86.5% of primary health workers had good knowledge, showing a marked improvement over a similar study among health workers in Kaduna state, Northwest of Nigeria, where 56.4% of the health workers had adequate training for childhood immunization.²⁰ This finding is also considerably better when compared to a study done in

Doha, Qatar, assessing the primary healthcare nurses' knowledge of immunization, which showed that about 45% had good knowledge concerning routine immunization schedules.²¹ The high percentage of health workers with good knowledge in this study could be because Osun State is one of the nine pilot states in the federation where the National Primary Health Care Development Agency (NPHCDA) launched its programs on the addition of Pentavalent vaccine to the routine immunization schedule with increased investment in these pilot states.

This could also be because more than half (55.8%) of the healthcare workers had at least 10 years of working experience, nine out of every 10 (88.8%) were educated to at least a diploma level, and 66.8% of the healthcare workers participated in the training of other health workers.

In our bid to determine the extent to which their practice complies with the standard, we found out that only 40.6% have good practice, although the majority (80.1%) of respondents have policy guidelines available at their

primary health centers, only two-thirds make use of them (65.7%). This lag between availability and implementation of policy guidelines is significant in healthcare delivery and immunization coverage and could account for why only 41.2% of children aged 12-23 months were fully immunized between 2023 and 2024 in Osun State, well below the WHO target of 80%.⁶ 59% don't keep the temperature record of vaccines during storage which they accounted for as due to a lack of storage facility for the vaccines in their centers, reiterating the report of a survey carried out by Nigeria National Routine Immunization Strategic Plan (2013-2015) on cold chain assessment in 2012 covering 20 states showed only 1199 (23%) of total wards (5199) have a solar refrigerator in at least one Health Facility as against the national policy of having at least one Health Facility with solar for all wards.²²

Regarding injection safety and hygienic methods of waste disposal, two-thirds (63%) make use of safety boxes, and the remaining third (37%) dispose of injectable needles and syringes into the waste bin, which is worse compared to a study assessing the safe injection awareness and practices among primary healthcare workers in Egypt, where most of them (89.7%) disposed their needles in sharp containers after use.²³

Concerning the practice of giving appropriate information to caregivers about routine immunization, the majority (81%) of the respondents informed the caregiver about the vaccine administration, three quarters (75.4%) informed the caregivers about the purpose of immunization, two-thirds (61.6%) about the possible adverse reaction and half (53.7%) took consent from the caregivers.

In assessing the level of training of health workers on immunization in Osun state, we found out that 31 (12.3%) of the 251 respondents had no pre-service training before they started administration of vaccines, which is also similar to a study finding that revealed poor pre-service immunization training in low-resource countries in contrast to high-resource countries with adequate pre-service immunization training.²⁴

In terms of duration of training, 70% and 20% of the 220 respondents who had pre-service training before the administration of the vaccine had a duration of training of less than one month and three months, respectively. The period in which over 60% of respondents attended a seminar/training on immunization was over 6 months before the time of the study, with only 40% having attended a seminar/training in the last six months. Pre-service training for primary healthcare workers is far from uniform. Seven in ten workers underwent a brief, four-week pre-service training, while only about one in five completed the more robust three-month pre-service training. That imbalance will likely leave many new staff with an uneven grasp of basic competencies. A similar pattern emerged for ongoing learning: during the six months leading up to data collection, three-fifths of respondents had not attended a single workshop or

seminar, and the remainder had managed just one. Irregular training makes it hard for staff to stay in step with recommended practice. The findings make a strong case for putting a structured, recurring program of refresher courses in place so that workers can keep pace with current protocols and policy requirements.

Limitations

The study is limited to only some primary health centers in Osun State, which has a higher immunization coverage rate than most States in Nigeria. Adequate data collection and analysis from other states, especially States with low coverage, across Nigeria, would be needed to generalize the outcome of the study. This could not be done due to limited funding and manpower.

CONCLUSION

This study identified a disconnect in Nigeria's immunization efforts: while most healthcare workers in Osun State have adequate knowledge of routine childhood immunization, fewer than half apply them consistently in practice. Challenges like outdated storage facilities, sporadic use of guidelines, and infrequent training updates undermine service quality.

Urgent action is needed to address the issue. Investing in better infrastructure, such as reliable cold storage, regular hands-on training, and stricter supervision, could empower workers to align their knowledge with practice. While Osun outperforms national averages, reaching global targets demands systemic changes. Future studies should explore these barriers in harder-hit regions, incorporating surveys with community feedback. By addressing these issues comprehensively, Nigeria can ensure every child has equal access to life-saving vaccines.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Osun State Health Research and Ethical Committee (OSHREC)

REFERENCES

1. Lindstrand A, Cherian T, Chang-Blanc D, Feikin D, O'Brien KL. The World of Immunization: Achievements, Challenges, and Strategic Vision for the Next Decade. *J Infect Dis*. 2021;224(4):S45267.
2. World Health Organization (WHO). World Immunization Week 2025 - 24 to 30 April. 2025. Available at: <https://www.who.int/news-room/events/detail/2025/04/24/default-calendar/world-immunization-week-2025---immunization-for-all-is-humanly-possible>. Accessed on 01 April 2025.
3. Barbazza E, Allen L, Abimbola S, Kringos D. PHC: definitions, terminology and frameworks. In: *Implementing the Primary Health Care approach*. 2024.

4. United Nations Children's Fund (UNICEF). Child Mortality - UNICEF DATA. 2024. Available at: <https://data.unicef.org/topic/child-survival/under-five-mortality/>. Accessed on 10 February 2025.
5. Mohammed Y, Reynolds HW, Waziri H, Attahiru A, Olowo-Okere A, Kamateeka M, et al. Exploring the landscape of routine immunization in Nigeria: A scoping review of barriers and facilitators. *Vaccine X*. 2024;20:100563.
6. Federal Ministry of Health and Social Welfare of Nigeria (FMOHSW), ICF, National Population Commission (NPC) [Nigeria]. Nigeria Demographic and Health Survey 2023-24 Key Indicators. 2024. Available at: <https://www.dhsprogram.com/pubs/pdf/PR157/PR157.pdf>. Accessed on 10 March 2025.
7. Fahmy K, Hasan Q, Sharifuzzaman M, Hutin Y. Analyzing Subnational Immunization Coverage to Catch up and Reach the Unreached in Seven High-Priority Countries in the Eastern Mediterranean Region, 2019–2021. *Vaccines (Basel)*. 2024;12(3):285.
8. Uwaibi NE, Erah FO. Assessment of healthcare workers' implementation of childhood routine immunization in primary healthcare centers in Edo State, Nigeria: A mixed method survey. *Ann Clin Biomed Res*. 2021;21:2.
9. Douville LE, Myers A, Jackson MA, Lantos JD. Health Care Worker Knowledge, Attitudes, and Beliefs Regarding Mandatory Influenza Vaccination. *Arch Pediatr Adolesc Med*. 2010;164(1).
10. Adebimpe WO, Adeoye OA. Knowledge and practice of vaccination logistics management among primary health care workers in Nigeria. *Hum Vaccin Immunother*. 2021;17(5):1490-5.
11. Adesanmi FO. Political Party, Voters' Mobilization and Democratic Governance in Nigeria: Analysis of the 2018 Osun State Gubernatorial Election. *NIU J Soc Sci*. 2022;8(4).
12. Brinkhoff T. Osun State, Nigeria - Population Statistics, Charts, Map and Location. *citypopulation.de*. 2022. Available at: https://citypopulation.de/en/nigeria/admin/NGA030__osun/. Accessed on 04 April 2025.
13. Adewoye KR, Aremu SK, Adegbiyi WA, Achebe CC. Awareness, knowledge, and factors that influenced the uptake of screening tests for prostate cancer among men aged 40 and older in Ido-Ekiti, Ekiti State, Nigeria. *J Public Health Afr*. 2023;14(4):2134.
14. Azhar S, Rashid L, Islam T, Akhtar S, Hopkins KL, Sommers T, et al. Knowledge, attitudes, and practices of vaccinators about expanded programs on immunization: a cross-sectional study. *Front Public Health*. 2024;6:12.
15. World Health Organization (WHO). Title of Section (TK) Global Vaccine Action Plan. 2013. Available at: www.who.int. Accessed on 10 December 2024.
16. Piedmont RL. Reliability Coefficient. In: *Encyclopedia of Quality of Life and Well-Being Research*. Cham: Springer International Publishing. 2023;5888-9.
17. Mohamud AK, Ali IA, Ali AI, Dirie NI, Inchon P, Ahmed OA, et al. Assessment of healthcare workers' knowledge and attitude on Ebola virus disease in Somalia: a multicenter nationwide survey. *BMC Public Health*. 2023;23(1):1650.
18. Gibson E, Zameer M, Alban R, Kouwanou LM. Community Health Workers as Vaccinators: A Rapid Review of the Global Landscape, 2000-2021 Key Findings. *Global Health: Science and Practice*. 2023;11(1):e2200307.
19. Ogundejì Y, Abubakar H, Ezech U, Hussaini T, Kamau N, Love E, et al. An assessment of primary health care costs and resource requirements in Kaduna and Kano, Nigeria. *Front Public Health*. 2023;19:11.
20. Jonathan JG, Victoria BB, Oyeninahun OA, Nathaniel OO, Iyabo DO, Mukhtar AB, et al. Health Providers' Readiness for Immunization Services in Selected Primary Health Care Facilities in Kaduna State, Nigeria. *Niger J Paediatr*. 2024; 51(3):251-64.
21. Abdulla E, Johnson J, Munir S, O'Dwyer R. Assessing primary health care nurses' knowledge toward immunizations: A quantitative study. *J Public Health Res*. 2020;9(4):381-7.
22. National Primary Health Care Development Agency (NPHCDA). Federal Republic of Nigeria National Routine Immunization Strategic Plan Intensifying Reaching Every Ward through Accountability. 2013. Available at: https://www.nitag-resource.org/sites/default/files/2b302ead55915d61468ac747e2e437aee65871b1_1.pdf. Accessed on 10 November 2024.
23. Ali L, Eldessouki R. Assessment of safe injection awareness and practices among healthcare providers at primary healthcare facilities. *J Egypt Public Health Assoc*. 2022;97(1):1-8.
24. Tchoualeu DD, Fleming M, Traicoff DA. A systematic review of pre-service training on vaccination and immunization. *Vaccine*. 2023;41(20):3156-70.

Cite this article as: Ogunwale WO, Oladapo JS, Ojo PA, Okanya PC, Fasheyi KO, Ogunrinu OG, et al. Knowledge and practice of primary healthcare workers on the routine childhood immunization schedule in Osun State. *Int J Community Med Public Health* 2025;12:1978-85.