

Factors Influencing Routine Vaccination Uptake and Completion among Children Aged 12–23 Months in Ilorin, North-Central Nigeria: A Cross-Sectional Survey

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ABSTRACT

Background: In spite of the enormous benefits of immunization, uptake of the expanded programme on immunization vaccines has remained low, especially in Northern Nigeria. Pentavalent-3 uptake in Nigeria was 33% in 2017, and up to 40% of children 12 months old were not vaccinated. **Objectives:** This study aimed at determining the factors influencing routine vaccination uptake and completion among children 12–23 months in North-central Nigeria. **Materials and Methods:** This was a cross-sectional survey conducted in Ilorin between December 2019 and January 2020 among 456 mothers/caregivers-children pairs. Participants were recruited using multistage cluster sampling technique. **Results:** Eighty percent (80%) of the children studied were fully vaccinated, with a vaccine uptake of 100% for Bacille Calmette-Guerin, OPV0, HBV0, OPV1, and Penta1; 83.8% for measles; and 83.1% for yellow fever. Significant factors associated with complete vaccination are: mothers/caregivers having formal education, $P = 0.001$; antenatal care (ANC) attendance, $P = 0.001$; being employed, $P = 0.007$, delivery in hospital, $P = 0.001$ and low birth order, $P = 0.003$.

Predictors of complete vaccination are mothers with tertiary education (odd ratio [OR]: 11.51, confidence interval [CI]: 2.43–54.64, $P = 0.002$), ANC attendance (OR: 7.76, CI: 2.58–23.33, $P < 0.001$), and hospital delivery (OR: 2.86, CI: 1.6–5.0, $P < 0.001$). Psychosocial factors such as religious belief, cultural acceptance, and husbands' support are also associated with vaccination uptake and completion among the children. **Conclusion:** Vaccination uptake for the various antigens and full vaccination status are generally high in this study, but still below the global target. Access to ANC services, hospital delivery, and female empowerment will enhance and improve vaccine uptake and completion.

KEYWORDS: Children 12–23 months, completion, North central Nigeria, vaccination uptake

INTRODUCTION

The benefits of immunization in pediatric preventive medicine are enormous and cannot be overemphasized. In accordance with the World Health Organization (WHO) vaccine-preventable diseases monitoring system summary for the year 2020, the

number of surviving infants in Nigeria has increased by 60% from 2997 in 1980 to 7086 in 2019, having noticed significant reduction in all vaccine-preventable deaths.^[1]

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Nigeria was certified polio-free in the year 2020, due to the various immunization programs, including routine immunization, supplemental and mop-up immunization activities. There were also no reported cases of mumps, pertussis, and rubella in the year 2019, on the WHO monitoring system summary of the year 2020.^[1] Despite all of these keystone gains and achievements from immunization, many children in Nigeria are still not fully vaccinated, and as such, are contributing to the burden of vaccine-preventable deaths that is, still being recorded.

Several factors have however been reported to affect the uptake of these antigens, including mothers' knowledge of the benefits of vaccination, high birth order and hospital delivery.^[2]

Northern states, including Kwara, have been shown to have the lowest uptake of the NPI vaccines when compared with other regions of the country.^[3] In 2018, only 26% of children in Kwara State aged 12–23 months completed routine immunization, far below the 90% global target.^[4] It is, therefore, pertinent to appraise the vaccination exercise and determine some of the factors influencing vaccination uptake and completion in this region of Nigeria. Therefore, the present study was conducted to identify some of the factors affecting the uptake and completion of vaccination among children aged 12–23 months in Ilorin, North-central Nigeria.

MATERIALS AND METHODS

This was a community-based cross-sectional survey carried out in Ilorin East Local Government Area of Kwara State, from December 2019 to January 2020, involving children aged 12–23 months and their mothers/caregivers.

The local government has 12 wards, 16 primary health centers, and one comprehensive health center. The calculated sample size was 456 children aged between 12–23 months of age, using the formula for a qualitative variable.

Ethical approval

The study was approved by the Kwara State Ministry of Health and University of Ilorin Ethical Review Board with a Protocol Identification Code: UERC/CLS/216 and UERC Approval Number: UERC/ASN/2020/1987. Participants were well informed about the details of the study and their questions were answered before obtaining their written consent for participation in the study. They were also assured of confidentiality.

Sampling technique

The eligible children were recruited using a multi-stage cluster sampling technique, with stage one, involving

the selection of four wards out of the 12 wards in Ilorin East Local Government Area, using simple random sampling. Four communities were selected from each of the four selected wards by balloting, making a total of 16 communities for the study. Proportionate allocation was used to allocate the sample size to each of the selected communities using the estimated size of the target population, that is, number of children aged 12–23 months (3.5% of the total population of that community as stated in the year 2019 Kwara State harmonized microplan for immunization, Ilorin East Local Government Area) in the 16 communities, total estimated size of the target population in all the selected communities and the calculated sample size ($n = 456$). The sample size in each community was thus allocated as follows: number of children aged 12–23 months in each community divided by total number of children aged 12–23 months in the 16 communities for the study multiplied by 456.

The first house to start the study from was randomly selected and consecutive houses were visited. All eligible children in all the households in the houses visited were recruited until the allocated sample size was completed for each of the communities. Mothers/caregivers of the recruited children were interviewed. The ward immunization focal persons were trained and used as research assistants for the study to facilitate access to the households and translation of the questionnaire in Yoruba/local dialect. They also obtained some data which were checked for correctness and accuracy by the researcher.

Data collection and analysis

Data were obtained using a pretested semi-structured interviewer-administered questionnaire which was designed by the researchers using templates from other researchers; featuring the socio-demographic characteristics of mothers/caregivers and their children (including respondents' age and level of education; employment status, that is, those employed by government or private sector and those that are self-employed or unemployed; child's age and birth order; place of birth; and antenatal care attendance), vaccination uptake prevalence for each antigen by card or certificate, and other psychosocial and facility-related questions (including whether they believe in immunization, travel far to the vaccination posts and bothered, and make some payments before vaccinating their children).

The data obtained were analyzed using a Statistical Package for Social Sciences (SPSS), IBM Statistical Package for Social Sciences, Chicago, version 23. Descriptive statistical analysis with frequency and proportions generation for the various vaccines was conducted to determine their uptake rates. Chi square was used for bivariate analysis of the relationship between

sociodemographic characteristics, psychocultural factors, and vaccination status. Multivariate logistic regression was done for those sociodemographic factors that were significant in the bivariate analysis to determine the predictors among them. A P value < 0.05 was considered statistically significant.

RESULTS

Vaccination uptake for the various expanded programme on immunization antigens

Of the 456 children studied, 439 children (96.3%) had immunization cards whereas 17 children (3.7%) had none. By verification of antigens from cards, 365 (80%) children were fully vaccinated, 74 (16.2%) were partially vaccinated, and 17 (3.7%) were not vaccinated.

The findings in this study show that the highest uptake rate of 100% was recorded for Bacille Calmette-Guerin (BCG), oral polio vaccine₀ (OPV₀), hepatitis-B vaccine₀, OPV₁, and Penta 1, being vaccines for 1st and 2nd visits, after which there was a steady decline from pneumococcal conjugate vaccine 1 (98.9%), being one of the vaccines for 2nd visit to inactivated polio vaccine (93.2%), a vaccine during 4th visit; and then least uptakes were with measles vaccine (83.8%) and yellow fever vaccine (83.1%) [Table 1].

Table 2 shows the socio-demographic characteristics of mothers/caregivers-children pair including some

healthcare-seeking behavior and the children's vaccination status. On bivariate analysis, there is a significant relationship between vaccination status of a child and mothers/caregivers' level of education $P = 0.001$; being employed $P = 0.007$; antenatal care attendance $P = 0.001$; place of birth of a child $P = 0.001$, and birth order of the child $P = 0.003$.

A multivariate logistic regression of the independent variables that were significantly related with vaccination status ($P < 0.05$) in Table 2 shows mothers that attended antenatal care clinic are about 8 times more likely to fully vaccinate their children when compared to those who did not attend (OR: 7.76, 95% CI: 2.58–23.22, adjusted P value < 0.001). Likewise, mothers/caregivers with tertiary education had almost 12 times odds or likelihood to fully vaccinate their children than those with lower levels of education or no formal education (OR: 11.51, 95% CI: 2.43–54.64, adjusted P value = 0.002) [Table 3].

[Table 4] shows that some psychocultural factors affect immunization service utilization or vaccination uptake for the studied children. Religious acceptance of immunization practice, cultural acceptance, husband's support for vaccination, believe that a child must complete vaccination for it to be protective showed significant association with full vaccination uptake (P value = 0.001).

Regarding health facility-related factors and vaccination status of the children, 85 (18.6%) respondents waited for 2–3 h at the facility before being vaccinated; however, this did not prevent them from vaccinating their children ($P = 0.003$). Payment of fifty to two hundred naira at the facilities before vaccination did not serve as a deterrent to fully vaccinating their children (P value < 0.001). [Table 5].

DISCUSSION

The vaccination uptake rates for the various antigens in this study were generally higher than the Nigeria Demographic and Health Survey 2018 report for Kwara State.^[4] This can be adduced to the fact that vaccination posts are readily accessible in the study area, as majority of the respondents reported that they did not travel long distance to the immunization centers. However, the study was carried out among a small subset of the State when compared to that of the National demographic and health survey (NDHS); hence it cannot be generalized for Kwara State. Notably, in the current study, there was a steady reduction in vaccine uptake from the doses obtained at first visit to those at last visit. This is due to missed opportunity experienced by some of the respondents as a result of non-availability of vaccines at the immunization center

Table 1: Vaccination uptake for the different antigens

Vaccine antigens	Received <i>n</i> (%)	Not received <i>n</i> (%)
1st visit		
BCG	439 (100)	0 (0)
OPV 0	439 (100)	0 (0)
HBV 0	439 (100)	0 (0)
2nd visit		
OPV 1	439 (100)	0 (0)
Penta 1	439 (100)	0 (0)
PCV 1	434 (98.9)	5 (1.1)
3rd visit		
OPV 2	431 (98.2)	8 (1.8)
Penta 2	430 (97.9)	9 (2.1)
PCV 2	428 (97.5)	11 (2.5)
4th visit		
OPV 3	415 (94.5)	24 (5.5)
Penta 3	413 (94.1)	26 (5.9)
PCV 3	409 (93.2)	30 (6.8)
IPV	409 (93.2)	30 (6.8)
5th visit		
Measles	368 (83.8)	71 (16.2)
Yellow fever	365 (83.1)	74 (16.9)

BCG: Bacille Calmette-Guerin, HBV: hepatitis-B Vaccine, IPV: inactivated polio vaccine, OPV: oral polio vaccine, PCV: pneumococcal conjugate vaccine

Table 2: Socio-demographic characteristic, healthcare-seeking behavior of mother/caregiver-child pair and vaccination status

Variable	Vaccination status				χ^2	P value
	Full	Partial	None	Total		
Religion						
Islam	323 (79.6)	67 (16.5)	16 (3.9)	406	0.73	0.694
Christianity	42 (84.0)	7 (14.0)	1 (2.0)	50	34.42	
Formal education						<0.001*
Yes	319 (82.4)	62 (16.0)	6 (1.6)	387		
No	46 (66.7)	12 (17.4)	11 (15.9)	69		
Levels of Education						
No formal education	46 (66.7)	12 (17.4)	11 (15.9)	69	48.55 ^Y	<0.001*
Primary education	74 (72.5)	23 (22.5)	5 (4.9)	102		
Secondary education	162 (81.0)	37 (18.5)	1 (0.5)	200		
Tertiary education	83 (97.6)	2 (2.4)	0 (0.0)	85		
Mothers' age group (years)						
≤20	4 (57.1)	2 (28.6)	1 (14.3)	7	3.92 ^Y	0.688
21–30	190 (81.5)	34 (14.6)	9 (3.9)	233		
31–40	160 (80.8)	32 (16.2)	6 (3.0)	198		
41–50	11 (61.1)	6 (33.3)	1 (5.6)	18		
Marital status						
Single or divorced	11 (68.8)	3 (18.8)	2 (12.5)	16	1.56 ^Y	0.458
Married	354 (80.5)	71 (16.1)	15 (3.4)	440		
Relationship to child						
Mother	335 (79.4)	73 (16.3)	19 (4.3)	447	0.06 ^Y	0.970
Caregiver	8 (88.9)	1 (11.1)	0 (0.0)	9		
Employment status						
Employed by government/private sector	91 (91.0)	8 (8.0)	1 (1.0)	100	9.82	0.007*
Self-employed/unemployed	274 (77.0)	66 (18.5)	16 (4.5)	356		
ANC attendance						
Yes	359 (82.9)	70 (16.2)	4 (0.9)	433	174.61 ^Y	<0.001*
No	6 (26.1)	4 (17.4)	13 (56.5)	23		
Hospital delivery						
Yes	311 (85.9)	49 (13.5)	2 (0.6)	362	62.90	<0.001*
No	54 (57.4)	25 (26.6)	15 (16.0)	94		
Sex of child						
Male	195 (78.0)	45 (18.0)	10 (4.0)	250	1.47	0.480
Female	170 (82.5)	29 (14.1)	7 (3.4)	206		
Birth order						
1st	45 (71.4)	10 (15.9)	8 (12.7)	63	16.07 ^Y	0.003*
2nd–4th	307 (82.1)	60 (16.0)	7 (1.9)	374		
≥5th order	13 (68.4)	4 (21.1)	2 (10.5)	19		

 χ^2 : Chi square test; Y: yates corrected Chi square

*P value < 0.05

during their visits. Despite the missed opportunities, the proportion of children that were fully vaccinated (80.0%) was higher than the proportion (29.3%) reported for Kwara State in the 2018 NDHS but below the United Nations General Assembly set target of 90% for full immunization of children under one year nationally. The findings in this study are however impressive when compared with that of Odusanya and colleagues, where up to 93% of the children had BCG and 74% had measles, with 62% being fully vaccinated eventually.^[5]

Several factors have been identified as determinants of vaccination uptake in this study. These include maternal level of education, antenatal care clinic attendance and hospital delivery. Similarly, a study in Kwara State found hospital delivery, antenatal care attendance, post-secondary education to be associated with timely uptake of these vaccines.^[3] Psychocultural factors such as religious belief, cultural acceptance, support by fathers, and belief that a child must complete vaccination for his/her full protection were also associated with full vaccination status and thus improved vaccination

coverage of the children in the present study. In the past, religious and cultural beliefs against vaccination were major deterrent for vaccination uptake. However, with improved access to formal education and consequently, better knowledge of routine immunization, as observed in the respondents, these barriers have been overcome to a large extent, even in Northern Nigeria. Health facility-related factors such as long-distance travel to the immunization clinic did not significantly affect the vaccination uptake for the children in the current study, contrary to the findings in some studies.^[6-9] This suggests that the vaccination clinics are accessible and user-friendly for most of them. ADEYINKA and colleagues observed that 41.6% of respondents in their study reported they waited too long on the queue for the vaccination of their children, but it did not discourage them.^[10] Similarly, in the current study,

18.6% of the respondents were bothered about the long time they spent waiting at the health facility during the periods of vaccination but it did not prevent majority of them from completely vaccinating their children. The immunization facilities of concern may be some of the very busy ones, possibly centrally located and with high children load for vaccination. Payment before vaccination was also noticed in this study but it did not discourage majority of the respondents from vaccinating their children. Although vaccination is absolutely free, some centers may not have complete access to fund for procuring the needed consumables. However, it is also possible that some health workers in remote areas use the avenue as money-making ventures.

This study and several other studies showed no significant association between vaccination status and mothers' age, religion, relationship with child (mother or caregiver), and sex of the child.^[10-12] The proportion of the studied children who were delivered in a hospital was high, and associated with a higher vaccination uptake and completion in the children, similar to the findings by other authors.^[13,14] Hospital delivery provides quicker access for vaccinating a child, and therefore remains one of the most important preventive measures against maternal and child mortality. In fact, in this study, hospital delivery related to about three times likelihood of a child being fully vaccinated compared with non-hospital delivery. It is therefore not unconnected with the high proportion of full vaccination status of children in the study area. The high percentage of hospital delivery in the study communities is also an indication of good access to maternal and child health care services.

It suffices to say that mothers/caregivers being employed (in private or government organization) confers a higher

Table 3: Multivariate logistic regression of some socio-demographic characteristics of mothers/caregivers and vaccination status

Parameters	Full vaccination OR (95% CI)	P value
ANC attendance		
Yes versus No	7.76 (2.58–23.33)	<0.001*
Hospital delivery		
Yes versus No	2.86 (1.64–5.00)	<0.001*
Employment status		
Employed versus unemployed	1.15 (0.49–2.68)	0.753
Mothers' level of education		
Tertiary versus ≤Secondary and none	11.51 (2.43–54.64)	0.002*
Child's birth order		
1st	0.90 (0.25–3.27)	0.867
2nd–4th	1.31 (0.42–4.10)	0.648
>5th ^{REF}	0	

Table 4: Psychocultural factors and immunization service utilization

Variables	Frequency	Vaccination			P value
		Percent	Full	None/partial	
Do you believe (religion) in immunization?					χ^2
Yes	446	97.8	365	81	36.05 ^Y
No	10	2.2	0	10	<0.001*
Does your culture permit it?					
Yes	451	98.9	365	86	15.53 ^Y
No	5	1.1	0	5	<0.001*
Does your husband support it?					
Yes	444	97.4	364	80	35.20 ^Y
No	12	2.6	1	11	<0.001*
Do you believe protection requires complete immunization?					
Yes	441	96.7	359	82	13.09 ^Y
No	15	3.3	6	9	<0.001*

χ^2 : Chi square test, Y: Yates corrected Chi square, *P value < 0.05

Table 5: Facility-related factors and immunization service utilization

Variables	Frequency	Vaccination			χ^2	P value
		Percent	Full	None/ partial		
Were you bothered by the waiting time at the facility?					1.48	0.224
Yes	85	18.6	64	21		
No	371	81.4	301	70		
Did prolonged waiting prevent you from bringing your child? (n = 85)					8.75 ^Y	0.003*
Yes	26	30.6	17	9		
No	59	69.4	55	4		
Did you pay before vaccination?					7.29	0.007*
Yes	165	36.2	121	44		
No	291	63.8	244	47		
Did paying discourage you from bringing your child to immunization clinic? (n= 165)					19.65 ^Y	<0.001*
Yes	23	13.9	13	10		
No	142	86.1	131	11		
Did you travel a long distance to immunization center?					0.98 ^Y	0.322
Yes	15	3.3	10	5		
No	441	96.7	355	86		
Did travelling discourage you from coming? (n = 15)					0.47 ^Y	0.490
Yes	12	80.0	10	5		
No	3	20.0	3	0		
Were there vaccines at the immunization center anytime you took your child for immunization?					1.11 ^Y	0.293
Yes	449	98.5	361	88		
No	7	1.5	4	3		

χ^2 : Chi square test, Y: Yates corrected Chi square; * P value < 0.05

chance of children being fully vaccinated, as more than 90% of the children of employed mothers/caregivers in this study were fully vaccinated. This is supported by findings by other authors that being employed was significantly associated with higher likelihood of the child being fully vaccinated.^[11,13,15] Most salary earners especially civil servants, enjoy maternity leave with regular salary payment which affords them the opportunity of taking their children for vaccination unlike the artisans and business women who may miss vaccination appointments because of busy schedules. More so, women who are employed in either private or government establishment to some extent are socially and economically independent; as such, they will be able to procure good health care services for their children, including vaccination. Child's birth order also has a significant association with full vaccination uptake in the current study, although not a significant predictor just like mother's/caregiver's employment status, after a multivariate logistic regression analysis. Full vaccination uptake rates increased from the first to fourth birth order and decreased with higher birth orders (≥ 5 th). This is consistent with the finding in a study in North-Western Nigeria where the likelihood

of completing immunization was seen to have decreased after the fourth birth.^[16] This finding may not be unconnected to a reduced mothers' attention, and forgetfulness, with a growing number of children. Besides, having a large family size might also affect the mothers' ability to care for the younger children, as duties tend to increase.

Considering the findings in this study, we recommend that antenatal care services should be made accessible, user friendly, interesting, and very educative in order to attract more mothers and caregivers to the clinic; hospital delivery should be improved; female education should be promoted, in order to boost the current vaccination uptake rates and completeness among the children.

The strength in the current study is the fact that immunization ward focal persons of each of the four wards were trained and used as research assistants, thus facilitating easy access and cooperation of the respondents when interviewed.

A major limitation of the current study is the language barrier encountered in those houses dominated by the Hausa/Fulani tribes. The affected houses were skipped due to unavailability of an of an interpreter.

Authors' contributions

SOA, AIO, RMI, and FMA, conceptualized and designed the study and data collection instrument. SOA, POA, and ROA, carried out data collection and analysis. SOA wrote the first draft of the manuscript, while AIO, and RMI, did a critical review and approved the final version for submission.

Ethical approval

The study was approved by the Kwara State Ministry of Health and University of Ilorin Ethical Review Board with a Protocol Identification Code: UERC/CLS/216 and UERC Approval Number: UERC/ASN/2020/1987. Written informed consent was obtained from each participant before enrollment into the study. The study was conducted in line with ethical principles of Helsinki declaration.

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Availability of research data

The research data for this study is available and will be released on demand through the corresponding author.

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Conflicts of interest

There is no conflict of interest.

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