

## Original Article

## FACTORS INFLUENCING IMMUNIZATION COVERAGE AMONG CHILDREN UNDER 2 YEARS OF AGE IN RURAL LOCAL GOVERNMENT AREAS IN KEBBI STATE, NIGERIA

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## Abstract

**Background:** The National Demographic and Health Survey (NDHS) 2013 revealed that, only 25% of the children had received all recommended vaccines and about 21% of children were unvaccinated which is far below World Health Organization (WHO) target of (80%). The objective of this study is to assess the complete immunization coverage and its determinants among children under 2 years in Arewa and Dandi LGA, North west, Nigeria.

**Methods:** A cross-sectional community-based study was conducted in 2 Local Government Areas (LGA) in Kebbi State, North West Nigeria, during October 2016 to March 2017. Around 420 households were interviewed by trained data collectors on assessment of vaccination status of the children based on vaccination cards and mother's verbal reports. Descriptive statistics, Bivariate and multivariate logistics regression analyses were used to assess the factors associated with complete immunization status.

**Results:** About 66.4% of children under 2 years were un-vaccinated, 26.1% were partially vaccinated, only 7.4% were fully vaccinated by card plus recall. About 31% of the mothers knew about vaccination, only 25% could name four or more types of vaccine preventable diseases and 21.2% knew the benefit of immunization. The factors significantly associated with complete immunization status were mothers' education (AOR=0.069, 95% CI: 0.012-0.0390), maternal daily income (AOR=0.013, 95%CI: 0.001-0.216), mother's knowledge about benefit of immunization (AOR=0.080, 95%CI:0.008-0.776), knowledge about vaccine side effects (AOR=0.014, 95% CI: 0.003-0.056), mothers knowledge about the age at which vaccination begins and completes (AOR= 0.139, 95% CI:0.041-0.469) and information received about the next vaccination schedule (AOR= 0.015, 95% CI: 0.003-0.071).

**Conclusion:** Study concluded that the factors like mother's education, knowledge and income were significantly associated with complete vaccination among children in Nigeria.

**Keywords:** Immunization coverage, rural lgas, northwest, nigeria

## Introduction

Immunization has been shown to be one of the most cost-effective public health interventions to reduce morbidity and mortality associated with vaccine preventable diseases. The Expanded Programme on Immunization (EPI) was launch by the World Health Organization (WHO) in 1974 with the mandate of reaching 90% national vaccination coverage and at least 80% vaccination coverage in every district. However, many developing countries still not achieved the goal (1,2). Despite decades of remarkable progress in immunization services in Africa, large number of children remain unvaccinated. The performance of routine immunization in African region has stalled during the last

decades for majority of vaccine delivered- antigens. In 2017, the global DPT3 coverage remains at 85% approximately (116.2 million) children with no significant changes during the past few years (3).

In Nigeria, vaccine preventable diseases (VPD) are known to account for 22% of childhood death amounting to over 200,000 children per annum (4). Even though vaccine is provided free of charge by the government, but coverage rates for routine immunization antigens in many part of the country still fall low below 50% (4,6). According to the National Demographic and Health Survey 2013 report, only 2.8% of children under 2 years in Kebbi State were fully immunized, far below the WHO target of 80% (5). The situation is worse in the rural areas

as children in these areas were twice likely to receive full doses of routine immunization than those in the urban areas (5). Previous studies have shown that uptake of immunization services depends not only on provision of these services but other factors related to maternal knowledge, geographical accessibility and many other socio-demographic characteristics (5, 7).

Rural communities represent highly marginalised areas especially access to health care interventions including immunization services. This underscores the need to assess immunization coverage rates and identify factors influence uptake of routine immunization services in these marginalised areas. Thus, we conducted this study to assess the complete immunization status among under 2 year children and factors associated with immunization status of under 2 year children in rural districts in Kebbi State, Nigeria.

### Methodology

This community-based cross sectional study conducted in Arewa and Dandi Local Government Areas (LGAs) both are predominantly rural LGAs in Kebbi State, north western Nigeria. Data was collected from October 2016 to March 2017. The required sample size of 420 children 12-23 months old was determined using WHO immunization coverage cluster survey (thirty -by seven cluster sampling technique), (8). A two -stage cluster sampling technique to sample eligible children was used. At stage one (Selection of clusters), based on the available 11 political wards from each LGA, two political wards in each of the two LGAs were chosen by random sampling. For Arewa LGA (Gumude- Rafin Tsaka and Kangiwa ward) were selected, while Dandi LGA (Kamba-Kamba and Geza ward) were chosen being one ward in the LGA headquarter and one ward in the rural, 30 clusters were selected in each LGA. In each of the four selected wards from the two LGAs, 15 clusters were selected by random sampling method. In stage two (selection of households), 15 permanent resident households from each of the 15 clusters in each ward were selected randomly. Subsequent households were selected contiguously in the right direction until the required number of households for that cluster was completed. If a selected household had more than one eligible child, only one was randomly selected. If a selected household had no eligible child the next contiguous household was visited and one eligible child selected. Equal number of children from each of the 30 clusters were sampled (8); thus, seven children were sampled per cluster having 210 children per LGA. Inclusion criteria include children under 2 years old from the selected permanent households willing to participate in the study. An exclusion criterion includes migrant household and household plan to leave the community within the period of the study. Data was obtained by using a house hold multi-stage questionnaire adapted from World Health Organization (WHO, 2005) (8). The content validity of the tool was performed by three experts in the relevant field, and reliability was tested by

KR20 and Cronbach's alpha was calculated as 0.60 and 0.82, respectively. Data for the study were collected using ten Primary Health worker's data collectors and two senior health professional supervisors were selected and thoroughly trained on data collection.

Questionnaire consisted of four parts. First was socio-demographic characteristics of variables, second part included variables related to knowledge, attitude and practice regarding routine immunization, third part included vaccination information of the child based on vaccination card or mothers verbal report. Data were taken from mothers/caregivers in local language by the interviewer. Duration of each session was about 25 to 35 minutes. Ethical approval was obtained from the ethical review committee of Kebbi state Ministry of Health Ethical Research Committee Board. Anonymity and confidentiality were maintained during data collection. Verbal consent was obtained from participants. Data were analysed by using SPSS version 22. Descriptive statistics like frequency tables and percentages were used. Bivariate analysis was conducted primarily to check which variables have association with the dependent variable individually. Variables which had association with the dependent variables at 0.25 P-value were entered in to multivariable logistic regression. Variables below 0.05 p-values were used to identify independent factors of complete immunization status. The goodness of model fit for the multivariate logistics regression was assessed with Hosmer and Lemeshow test.

### Results

The response rate of mothers/caregivers was 100%. Out of the total 420 children, 51% were females. The majority (21.7%) of the children were aged 12 months with a mean of 14.6 months. The highest percent of mothers/caregivers 261 (62.1%) ranged from 21-30 years. Majority of the mothers/caregivers did not attend formal education 247 (58.8%) while, 173 (41.2%) had complete formal education. Four hundred and nineteen (419 ie 99.8%) were Muslims by religion, Hausa by tribe 369(87.9%) and 238 (56.7%) by occupation. In the bivariate analysis, mother's educational status, daily income and occupation were significant at p-value <0.05 from the socio-demographic variables (Table 1).

**Table 1: Result from bivariate analysis of Socio demographic factors related to childhood immunization coverage in Arewa and Dandi Local Government Areas**

Variables	Category	Number (%)	OR	P-value
			(95% CI)	
Maternal Age (in years)				
	<30	281 (66.9)	reference	
	>30	139 (33.1)	0.499 (0.239,1.042)	0.064
Mother's Educational Status				
	No Formal Education	247 (58.8)	reference	
	Formal Education	173 (41.2)	0.064 (0.019,0.213)	<0.001 *
Daily Income (in Naira)				
	N100 -N300	181 (43.1)	reference	
	N300 and above	239 (56.9)	0.293 (0.118,0.731)	0.009*
Mother's Occupation				
	Full housewife	182 (43.3)	0.043 (0.188,0.985)	0.046*
	Petty trading/Employee	238 (56.7)	reference	
Mother's Ethnicity				
	Hausa	369 (87.9)	1.078 (0.361, 3.217)	0.893
	Fulani/Zabarma/Others	51 (12.1)	reference	
Child Sex				
	Male	206 (49.0)	1.183 (0.568, 2.467)	0.653
	Female	214 (51.0)	reference	

\*Significance  $P < 0.05$  \*\*Significant  $P < 0.01$

Out of the total surveyed children, vaccination card was only seen and confirmed for 102 (24.2%) children. Based on vaccination card plus mothers' recall, 141 (33.5%) children received one or more of the 8 recommended vaccines and 279 (66.4%) have never been vaccinated. Only 31 (7.4%) of children completed all the recommended vaccines and 110 (26.1%) received one or more vaccines, but did not complete all the recommended doses. From the eight vaccines, OPV0, BCG and Hep B was the most frequently received vaccine 141 (33.6%). Followed by OPV1 (33.3%), Pentavalent1 (33.3%) and PCV1 (33.3%). OPV3 (7.4%), Pentavalent3, PCV3 (7.4%), Measles (7.4%) and Yellow fever (7.4%) coverage was the least taken vaccines when compared with other vaccines. The coverage showed a decrement from the first doses to the last doses (Table 2).

#### **Immunization coverage by card only**

Coverage by card was calculated by taking children who had immunization card as a numerator. From the total 420 surveyed children, 102 (24.2% took BCG, Hep B and OPV0 vaccines, followed by OPV1, Pentavalent 1 and PCV 1 101 (24%). Pentavalent 2 was also taken by 18.6% and 7.4% took Pentavalent 3. Measles and yellow fever vaccine was taken by 7.4% of children and 7.4% were fully vaccinated by care

**Table 2: Immunization Status by card and plus mothers' recall in Arewa and Dandi Local Government Areas (n= 420)**

Antigens	Card Plus recall (no=141)		Card Only (no=102)	
	Frequency	Percent	Frequency	Percent
BCG	141	33.6	102	24.2
OPV0	141	33.6	102	24.2
Hep B	141	33.6	102	24.2
OPV1	140	33.3	101	24
OPV2	89	21.2	78	18.6
OPV3	31	7.4	31	7.4
Pentavalent1	140	33.3	101	24
Pentavalent2	89	21.2	78	18.6
Pentavalent3	31	7.4	31	7.4
IPV	31	7.4	31	7.4
PCV1	140	33.6	101	24
PCV2	89	21.2	78	18.6
PCV3	31	7.4	31	7.4
Measles	31	7.4	31	7.4
Yellow Fever	31	7.4	31	7.4
<b>Vaccination coverage</b>	279	66.4	279	66.4
Unvaccinated				
Partially Vaccinated	110	26.1	71	17
Fully Vaccinated	31	7.4	31	7.4

Out of 420 mothers/caregivers, only 133 (31.7%) knew immunization is to prevent childhood diseases, 105 (25.0%) could name four or more types of diseases that could be prevented by immunization and 289 (67.4%) could not even name one disease. Only 89 (21.2%) of the mothers knew the benefit of immunization. The proportion of mothers who knew the schedule of at least four type of vaccine was 62 (14.8%). The proportion of mothers/caregivers who knew the age at which the child immunization begins and complete was 106 (25.2%) and 127 (30.2%) knew about vaccine side effect. Seventy percent of the mothers had a positive attitude towards the vaccine side effect. The knowledge of mothers was significantly different with vaccine preventable diseases, number of vaccine preventable diseases, benefit of immunization, vaccine, session needed for complete immunization and vaccine side effect in the bivariate analysis (Table 3).

**Table 3: Results from bivariate analysis of mother's/ care givers knowledge and attitude about immunization in Arewa and Dandi LGAs, North west Nigeria**

Variables	(%)	OR (95% CI)	P-value
<b>Knew Immunization is to prevent diseases</b>			
Yes	133 (31.7%)	0.092 (0.037, 0.231)	<0.001*
No	287 (68.3%)	reference	
<b>Knew types of vaccine preventable diseases</b>			
Yes	105 (25.0%)	0.062 (0.025,0.157)	<0.001*
No	315 (75.0%)	reference	
<b>Knew the schedule of vaccines</b>			
Yes	62(14.8%)	0.006 (0.001, 0.028)	<0.001*
No	358 (85.2%)	reference	
<b>Knew the benefit of immunization</b>			
Yes	89 (21.2%)	0.047 (0.019, 0.120)	<0.001*
No	331 (74.8%)	reference	
<b>Knew about vaccine side effects</b>			
Yes	127 (30.2%)	0.013 (0.005, 0.035)	<0.001*
No	293 (69.8%)	reference	
<b>Knew the age child immunization begins and Complete</b>			
Yes	106 (25.2%)	1.895 (0.578, 6.213)	0.292
No	314	reference	

\*Significance P<0.05 \*\*Significant P<0.01

As per the mothers' report, 68 (16.2%) mothers/care givers took their children to the health institution for child health services other than immunization and were advised to vaccinate their children. Of these, about 59 (14.0%) were not aware of the need to come for the second or third dose, 171(40.7%) did not know the place or time for immunization, 55(13.1%) gave reasons of long queues and waiting time, while mothers/caregivers were not allowed to take decision for their child immunization 261(62.14%) as shown in Table 4.

**Table 4: Result from bivariate analysis of factors related to immunization service delivery in Arewa and Dandi LGAs, North west Nigeria**

Variables	(%)	OR (95% CI)	P-value
<b>Advice to vaccinate child during Health Institution visit</b>			
Yes	68 (16.2%)	0.008 (0.001, 0.033)	<0.001*
No	352 (83.8%)	reference	
<b>Information received about the next vaccination schedule</b>			
Yes	59 (14.0%)	0.006 (0.001, 0.025)	<0.001*
No	361 (86.0%)	reference	
<b>Difficulty in getting immunization shots</b>			
Yes	160 (38.1%)	0.523 (0.192, 1.428)	0.206
No	260 (61.9%)	reference	
<b>Convenient hours for immunization</b>			
Yes	130 (31.0%)	0.089(0.035, 0.222)	<0.001*
No	290 (69.0%)	reference	

\*Significance P<0.05 \*\*Significant P<0.01

Using information obtained from the mothers/caregivers; mothers educational status, mothers daily income, maternal knowledge on immunization preventable diseases, benefit of immunization, vaccine side effects, vaccine schedule and perception of mothers towards vaccine side effects were significantly associated with immunization status in bivariate analysis. However, following multiple logistic regression analysis, mothers level of education had a statistically influence on the child being correctly vaccinated (AOR= 0.069, 95% CI = 0.012-0.0390). Mother's daily income had statistically significant association with vaccination status (AOR= 0.013, 95% CI= 0.001-0.0216), mothers knowledge on age at the children vaccination begins and completes (AOR=0.139, 95% CI= 0.041 - 0.469), vaccine side effects (AOR= 0.08, 95% CI= 0.003 - 0.056), and information on the next schedule vaccine doses (AOR=0.015, 95% CI= 0.003 - 0.071) were significantly associated with complete immunization status (Table 5).

**Table 5: Result of Multiple Logistic Regression of determinants of complete immunization status in Arewa and Dandi LGAs**

Variables	Adjusted OR	95% CI	P-value
Mother's Educational Status			
No formal Education	reference		
Formal Education	0.069*	0.012 - 0.390	0.003
Daily Income (in Naira)			
N100 -N300	reference		
N300 and above	0.013*	0.001 - 0.216	0.003
Knew Immunization is to prevent diseases			
No	reference		
Yes	0.686	0.020 - 23.663	0.835
Knew the benefit of immunization			
No	reference		
Yes	0.080*	0.008 - 0.776	0.029
Knew about vaccine side effects			
No	reference		
Yes	0.014*	0.003 - 0.056	0.001
Knew the age child immunization begins and Complete			
No	reference		
Yes	0.139*	0.041 - 0.469	0.001
Information received about the next vaccination schedule			
No	reference		
Yes	0.015*	0.003 - 0.071	0.001
Perception about vaccine side effects			
Positive	reference		
Negative	0.192	0.010 - 3.765	0.277

\*Significance  $p < 0.05$  \*\*Significant  $p < 0.01$

## Discussion

Immunization is a major health intervention for child survival throughout the world, and helps to achieve the Sustainable Development Goals (SDGs) especially the goal to reduce child mortality and morbidity thereby achieving universal health coverage by 2030.

This study found a significant gap in immunization coverage in Arewa and Dandi LGAs. Based on information from the vaccination cards and mothers recall (history), only 7.4% of children were fully immunized and 66.4% of children were un-immunized. However, based on immunization of individual vaccines there were variations in the coverage rates for each specific antigen given. Three of the antigens (BCG, OPV0 and Hepatitis B virus (HBV) recorded (33.6%) because they were administered either at the place of birth or were tracked by the volunteer community mobilizer (VCM). The coverage of full immunization reported here was found to be far below the national goal of 80% coverage set in every district or equivalent administrative unit (5). However, this prevalence is lower when compared to what is seen in other rural LGAs from north and southern part of Nigeria (6,9,10) which was 57.9%, 75.3% and 45.7% respectively. It is

comparable with figures obtained by the NDHS of 2013 (5). The variation in immunization coverage between different LGAs can be explained by factors such as mother's educational level, household income, walking distance to healthcare centre and knowledge on immunization and feeling that immunization is free of charge. Similar factors have been found from previous studies in sub-Saharan African countries (11).

The Results from the bivariate analysis confirmed eight independent variables to be associated with the complete immunization status of children under 2 years old. These includes: maternal educational status, daily income, knowledge about benefit of immunization, knowledge about vaccine side effects, knew the age at which a child immunization begins and finishes and information received by health worker about the next visit were all significantly associated with the complete immunization status.

The variables found to be significant in the multivariate analysis in this study were maternal educational status, maternal daily income, knowledge about benefit of immunization, knowledge about vaccine side effects, knowledge of the age at which a child begins and complete immunization and information received about the next vaccination schedule.

Maternal education was one of the factors that was significantly associated with complete immunization status. Other investigations have also found similar association between complete immunization schedules and mothers with higher level of education (10, 12) in which mothers with high level of education are more likely to accept and complete immunization schedules for their children than less educated mother. In both Arewa and Dandi LGA, almost two-third of the mothers in the study area had no formal education, this could have been contributed possibly due to the low literacy level of women in the northern part of Nigeria. Similar study was found in Kaduna (13). This low educational status has also reflected in poor knowledge and information on vaccines among mothers as stated in our result. Similar finding also stated that, educational level of parent or caregiver has a vital role to play in determining if a child is vaccinated or not (14). Maternal income was strongly associated with a child being vaccinated. Those in the high-income category are more likely to receive all the recommended vaccinations compared to those in the middle or low-income categories. This is consistent with previous research which found that higher economically households have better immunization coverage than those in the low-income households. (15-17). Though vaccination is provided free of charge through the national immunization program, the clear impact of income on vaccination status indicates that other monetary and time cost affect poorer individuals to receive vaccination. This agrees with the findings of studies in Mozambique and Ethiopia, where children from the poor households living farther from health facility left their children partially

vaccinated or not-vaccinated as they could not afford to pay for transport expenses for going to the health facility (18, 19).

Regarding factors associated with full immunization status of children and mothers' knowledge of the age at which the child to be fully immunized were found to be significantly associated with the outcome variable. Mothers who know the correct age at which a child will be fully immunized are more likely to complete their children immunization compared to those who do not know. This finding was found to be similar with previous studies (20, 21). Other studies also reported that, mothers who could know the age at which a child will be fully immunized might have good awareness on completing child immunization during ANC follow-up, through media or other source of information (21). The low knowledge of mothers in our study may be partly attributed to the low level of education found in our study.

Mothers' knowledge of the benefit of immunization in our study is significantly associated with full immunization status. Mother's ignorance of these benefits may have also contributed to many children not being fully immunized. The relationship between mothers' knowledge of the benefits of immunization and full vaccination has been highlighted in other studies in Nigeria (10) and Bangladesh (22). Mothers' awareness of the importance of vaccination has a strong association with complete childhood immunization (23).

Fear of vaccine side effects was also found to be significantly associated with complete immunization status. Although, vaccine side effects were found to be deterring parents from immunizing their children fully in this study. Similar studies in Nigeria, reported the impact of trust and norms more than perceived benefits and risks of vaccination (24-26). The perception and belief in vaccine's ability to prevent disease were significant reasons for mothers to vaccinate their children. This is consistent with a study, which cited that trust in vaccines is associated with information sources (27).

This study assessed the factors influencing immunization coverage among children under 2 years old about routine immunization services in rural districts. However, it had certain limitations. Report by the mothers/caregivers might have likely under/overestimated the immunization coverage. Because mothers' may have lost their card or forgot the total doses of vaccine the child received. This study did not consider the validity of the doses of vaccines child took. In addition, problems from the health facility perspectives were not addressed by this study. Despite the above limitations, our findings are important to understand factors associated with complete immunization coverage in the rural district.

### Conclusion

In conclusion, we found that immunization coverage among children under 2 years was below the national (>80%) and international (>90%) coverage. Our findings show that, childhood full immunization depend on

different factors related to mother's education, income and knowledge on immunization services. We therefore, recommend more efforts to increase full immunization services targeting rural communities and identifying effective strategies for community engagement that would increase demand for routine immunization services.

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