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Determinants of Full Vaccination Status in a Rural Community with Accessible Vaccination Services in South-South Nigeria

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Key-words:

Full Vaccination, Immunization Coverage, Child Survival, Rural Area, Nigeria.

ABSTRACT

Background: Immunization promotes child survival. Low vaccination coverage in rural areas in Nigeria is associated with vaccination posts being too far, but other determinants exist.

Objective: To assess the proportion and determinants of full vaccination of children in a rural community with accessible immunization services.

Methods: A cross-sectional house-to-house survey was conducted in a rural community in Edo State, Nigeria. The community has two readily accessible vaccination posts. Using an interviewer-administered questionnaire, data on the vaccination status of 12-to-59 month-old children and other variables related to the child were collected from their mothers. . Fisher's exact test and odds ratios (OR) with their 95% confidence intervals (CI) were used to explore factors associated with full vaccination.

Results: A total of 305 mothers were interviewed and 299 (98.0%) reported that their children received at least one of BCG, OPV, DPT and measles vaccine. Fully vaccinated children were 246 (80.7%). A child's birth in a health facility (P < 0.001; OR = 0.15, 95%CI = 0.07-0.33), mother's knowledge of the benefits of immunization (P = 0.001; OR = 0.21, 95%CI = 0.08-0.60) a mother being employed (P = 0.003; OR = 2.48, 95%CI =1.32-4.68) and a high birth order (P = 0.002) were significantly associated with full vaccination.

Conclusion: Birth and maternal factors facilitate full vaccination in rural areas, especially where vaccination posts are readily accessible. Knowledge and behavioural gaps should be corrected using health education. Qualitative studies are required to better understand the behavioural determinants of full vaccination.

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INTRODUCTION

United Nations General Assembly Special Session set a goal for full immunization of children less than one year old at minimum coverage of 90% nationally and 80% in every district or equivalent administrative unit by 2010.[1] Despite global progress in the use of immunization as a child survival strategy,[2] coverage values for all the major vaccines for children in Nigeria are still below the 80% level.[3] Furthermore, Nigeria accounted for 14% of incompletely vaccinated children globally in 2011.[4]

According to Nigeria Demographic and Health Survey (NDHS) 2013, vaccination status of children varied with residence (urban or rural) and geopolitical zones. The survey showed that 42.5% of children 12-23 months old were fully vaccinated in urban areas compared to 15.8% in rural areas.[5] A recent vaccine summit in Nigeria highlighted long distance to vaccination posts as a barrier to immunization in rural areas.[6,7] In a study in Edo State, South-South Nigeria, the investigators found that a higher percentage of children had full vaccination in a community where vaccination posts were located (68.4%) than children brought to those posts from other communities for vaccination (53.1%).[8]

Other determinants of vaccination coverage in rural areas may exist. Therefore, investigations into coverage and determinants of vaccination in rural communities where vaccination services are available and accessible are required. Highlighting these additional determinants can provide a wider range of opportunities for improvement in vaccination coverage in rural areas in Nigeria,

especially in the South-South Zone.

The aim of the study, therefore, was to assess the proportion and determinants of full vaccination status of children in a rural community with accessible immunization services in South-South Nigeria.

METHODS

Study area.

This study was carried out in Ivhiarua, a rural community in Fugar, Etsako Central Local Government Area (LGA) of Edo State, South-South Nigeria. The community has a government-owned General Hospital and a Primary Health Centre. They both offer free immunization services in line with the National Program on Immunisation and either of them is within about 20-minute walking distance from all residential locations in the community.

Study design, study population and sample.

The study was a cross-sectional survey. The study population consisted of mothers of children aged 12-59 months in Ivhiarua community. A foster mother or caregiver was included in this definition if she had the requested information in addition to playing major decision roles in the day-to-day care of the child. Mothers that were too ill to participate in the study were excluded. The lower limit of 12 months for children's age range was chosen to allow for a period long enough to be eligible for all the vaccines in the national schedule for children. The upper limit is for under-fives.

The minimum sample size, n, for the study was determined using the Cochran formula [$n = Z_{á}^{2}pq/d^{2}$];[9] where $Z_{á}$ is the standard normal deviate, chosen as 1.96, corresponding to an á level of 0.05; p is the proportion of units to be measured (taken as 25.3%, which is the percentage of children 12-23 months old that are fully vaccinated in Nigeria according to the 2013 NDHS[5]); q=1-p; and d is the error margin tolerated, chosen as 0.05. The computed value of n was 291. All eligible mothers were included as study participants as their estimated population was considered adequate.

Ethical considerations.

The Research Ethics Committee of University of Benin Teaching Hospital, Benin City, provided ethical clearance for the study. Permission to conduct the study was given by Etsako Central LGA and the traditional ruler of Ivhiarua community. Eligible mothers who gave voluntary informed consent were interviewed. Study participants and other community members were offered health education, treatment of minor illnesses and appropriate referral as research benefits.

Survey tool, measures and procedures.

Data was collected using an interviewer-administered structured questionnaire. The questionnaire covered socio-demographic information on mother and child. Information sought on the child were the birth place, immunization status for each vaccine (BCG, OPV, HBV, DPT, measles vaccine and yellow fever vaccine), and birth order. The attitude of mothers to immunization was assessed by asking them if they felt that immunization was beneficial to their children. Mothers who answered 'yes' were adjudged as having a positive attitude to immunization and those who answered 'no' a negative attitude. Those who gave 'yes' answers were further asked to state the benefits they knew. Correct knowledge of the benefits of vaccination was considered as a spontaneous statement that immunization prevents either diseases or death or both. In line with the definition given in the NDHS 2013, a child was regarded as fully vaccinated if he/she received a dose of BCG, three doses each of OPV and DTP and one dose of measles vaccine.[5]

Survey procedure.

Data collection was done house-to-house by pre-trained interviewers. Each eligible mother was required to provide information on only one 12-59-month-old child. Where a mother had more than one eligible child, information was required on the younger or youngest. Information on vaccination status was obtained in two ways on request by the

interviewer from child health cards presented by the mothers and from mothers' verbal reports.

Data analysis.

Data from completed questionnaires were entered into SPSS version 20.0 for analysis. Characteristics of mothers and their children were presented as simple frequency tables. Further analysis was done with the aid of COMPARE2 in WinPepi® (Computer Programs for Epidemiologists) version 11.10. Fishers' exact probability test was used to compute p values. Odds ratios and their Fisher's exact 95% confidence intervals (CIs) were also computed. To achieve this in each unit of analysis (cross-table), an odds ratio of 1.00 was assigned to a reference category with which an odds ratio and its corresponding 95% CI was computed for each of the other categories. The level of statistical significance was $P < 0.05$ and the absence of the null value (1.00) from the CIs of the odds ratios.

RESULTS

Background characteristics.

All the 305 mothers who were approached for participation consented, giving a respondent proportion of 100.0%. Table I shows the characteristics of mothers. Majority of mothers had either primary, 113 (37.0%), or secondary, 137 (44.9%) levels of education. More than one-third, 109 (35.7%) were unemployed. The predominant ethnic group was Etsako, 283 (92.8%); 268 (87.9%) were Christians; and 267 (87.5%) were married.

As shown in Table II, children were almost equally distributed across four 12-month age groups. Their mean age was 32.9 (SD, 13.3) months. The male children were 162 (53.1%) and the females 143 (46.9%). Majority of them, 266 (87.2%), were delivered in the hospital.

Immunization status. The coverage for the various vaccines is shown in Table III. A total of 299 (98.0%) children aged 12-59 months received at least one of BCG, OPV, DPT and measles vaccine. Fully vaccinated children aged 12-59 months and 12-23 months were 246 (80.7%) and 58 (75.3%) respectively.

Table I: Characteristics of mothers N = 305

Variable	Frequency	Percent
Educational level		
No formal	29	9.5
Primary	113	37.0
Secondary	117	44.9
Tertiary	26	8.6
Marital status		
Single	9	3.0
Married	267	87.5
Divorced	21	6.9
Widowed	5	1.6
Co -habiting	3	1.0
Employment status		
Employed	196	64.3
Unemployed	109	35.7
Religion		
Christian	268	87.9
Muslim	37	12.1

Table II Characteristics of children N = 305

Variable	Frequency	Percent
Age group (months)		
12 -23	77	25.2
24 -35	78	25.6
36 -47	76	24.9
48 -59	74	24.3
Sex of children		
Male	162	53.1
Female	143	46.9
Place of birth		
Hospital	266	87.2
Home	29	9.5
TBA	8	2.6
Others	2	0.7
Birth order		
1&2	142	46.6
3&4	103	33.8
>4	60	19.7

BCG antigen coverage for children aged 12-59 months and 12-23 months was 297 (97.4%) and 72 (93.5%) respectively; these were the highest coverage values reported. The lowest coverage reported for children aged 12-59 months and 12-23 months were for DPT (three doses) 261 (85.6%) and 64 (83.1%) respectively.

Only 16.1% (48/299) of all reports of immunization were verified with a child health card.

Attitude of mothers towards immunization. Majority of mothers, 302 (99.0 %) had a positive attitude towards immunization as they stated that it was beneficial to their children.

The benefits the prevention of diseases and deaths were reported by 94.0% (284/302) of these respondents.

Reasons reported by mothers for non-immunization. Of the 5 children that did not receive any vaccine, two of their mothers stated that it was due to lack of money and one believed that vaccines caused male sterility.

Factors associated with full vaccination status. Table IV shows the bivariate analysis of various variables and full vaccination status of children. Seventy-nine (72.5%) children whose mothers were unemployed were fully vaccinated, compared to 170 (86.7%) children of employed mothers (P = 0.003). Eleven (52.4%) children whose mothers could not correctly state a benefit of vaccination, compared to 238 (83.8%) children whose mothers could correctly state one were fully vaccinated (P = 0.001).

The percentage of fully vaccinated children was higher among children of the third and fourth (89.3%) and higher (88.3%) birth orders than that of the first and second (73.2%) birth orders (P = 0.002). Majority of children born in a health facility, 230 (86.5%) were fully vaccinated, compared to 19 (48.7%) of those born outside health facilities (P < 0.001).

A child's age or sex, mother's educational level and presentation of a child health card to verify vaccination were not significantly associated with being fully vaccinated.

DISCUSSION

One major finding in this study was that the percentage of children fully vaccinated was higher than national values. Other major findings were that a child was likely to be fully vaccinated if he or she was born in the hospital, was of the third birth order or beyond, had a mother that knew the benefits of immunization or that was employed.

The percentage of fully vaccinated 12-23-month-old children in this study (75.3%) was higher than the national rural average of 15.8% and the overall national average of 25.3%.[5] In a similar study in Edo State, Nigeria, most of the mothers interviewed

Table III: Vaccination coverage of children N = 305

Vaccine	12 -59 months n = 305 (%)	Coverage 12 -23 months n = 77 (%)
BCG	297 (97.4)	72 (93.5)
OPV (all doses)	270 (88.5)	65 (84.4)
DPT (all doses)	261 (85.6)	64 (83.1)
Measles	279 (91.5)	65 (84.4)
At le ast one of the above	299 (98.0)	73 (94.8)
'Fully vaccinated' (all of the above)	249 (81.6)	58 (75.3)
HBV (all doses)	268 (87.8)	67 (87.0)
Yellow fever	275 (90.2)	65 (84.4)
At least one of the above	300 (98.4)	74 (96.1)
All of the above	246 (80.7)	58 (75.3)

Table IV: Factors associated with full vaccination status N = 305

Variable	Fully vaccinated Yes (%) n = 249 (81.6)	Fully vaccinated No (%) n = 56 (18.4)	*P*	OR (95% CI)
Child's age *(months)*				
12-23	58 (75.3)	19 (24.7)	0.242	1.00
24-35	65 (83.3)	13 (16.7)		1.64 (0.69 -3.94)
36-47	61 (80.3)	15 (19.7)		1.33 (0.58 -3.10)
48-59	65 (87.8)	9 (12.2)		2.37 (0.93 -6.40)
Child's sex				
Male	129 (79.6)	33 (20.4)	0.375	1.00
Female	120 (83.9)	23 (16.1)		1.33 (0.71 -2.52)
Mother's educational level				
Primary & no formal education	110 (77.5)	32 (22.5)	0.102	1.00
Secondary and tertiary	139 (85.3)	24 (14.7)		1.68 (0.90 -3.17)
Mother's employment status				
Unemployed	79 (72.5)	30 (27.5)	0.003	1.00
Employed	170 (86.7)	26 (13.3)		2.48 (1.32 -4.68)
Correct knowledge of benefits of immunization				
Yes	238 (83.8)	46 (16.2)	0.001	1.00
No	11 (52.4)	10 (47.6)		0.21 (0.08 -0.60)
Child's birth order				
1&2	104 (73.2)	38 (26.8)	0.002	1.00
3&4	92 (89.3)	11 (10.7)		3.06 (1.42 -7.00)
>4	53 (88.3)	7 (11.7)		2.77 (1.11 -7.81)
Child's place of birth				
Health facility	230 (86.5)	36 (13.5)	< 0.001	1.00
Outside health facility	19 (48.7)	20 (51.3)		0.15 (0.07-0.33)
Immunization card seen				
Yes	44 (91.7)	4 (8.3)	0.066	1.00
No	205 (79.8)	52 (20.2)		0.36 (0.09-1.05)

OR, odds ratio; CI, confidence interval

resided in a rural community with functional immunization posts. The study showed that the respective coverage for BCG and vaccines against hepatitis B (3 doses), measles and yellow fever were 92.6%, 80.8%, 74.3% and 51.3% for 12-23-month-old children.[9] These values are closer to those of this study than those of rural communities in NDHS 2013. These comparisons illustrate the relatively high percentages of coverage that can be expected when there is spatial access to vaccination services. Long distance from vaccination posts as a factor associated with incomplete vaccination is further illustrated in other Nigerian studies.[9,10]

The high percentage of full vaccination status is traceable to three major sets of factors: health-facility-related factors, maternal factors and child's birth order.

Apart from the accessibility of the health facilities, the study also shows that children born in health facilities were more likely to be fully vaccinated than those born outside health facilities. Similar findings were made in an analysis of NDHS 2003,[11] another study in Nigeria,[12] and studies in Uganda,[13] Ethiopia,[14] and Kenya.[15,16] This pattern is attributable to the fact that women receive health education on immunization at delivery. Vaccinating babies before discharge from the hospital (with, at least, BCG and the first dose of OPV) may further motivate mothers to continue immunization to completion. The mothers may have similarly received information on vaccination while attending antenatal care. A clinic-based study in Nigeria did not find a significant association between a child's birth place and completion of vaccination, a finding that may be inconclusive because children that did not complete their vaccination schedule in that clinic, but elsewhere, were classified as not fully vaccinated.[17]

Mothers' knowledge of the benefits of immunization in this study may have influenced their decision to ensure full vaccination. Conversely, mothers' ignorance of these benefits may have also contributed to some children not being fully vaccinated. The relationship between mothers' knowledge of the benefits of immunization and full vaccination status has similarly been highlighted in other studies in Nigeria,[9,10] and Bangladesh.[18] Perceived benefits of vaccination and risks of vaccine-preventable diseases may explain a link between mother's knowledge and practice. This explanation is in harmony with the Health Belief Model which explains people's health-seeking behaviour on the basis of their perceptions of the risks and benefits regarding the behaviour.[19] Thus, mothers are unlikely to take their children for vaccination if they do not perceive vaccine-preventable diseases as severe enough or vaccines as beneficial enough to warrant vaccination.

The positive association between mothers' employment status and full vaccination status in this study contradicts the NDHS 2003 finding that children of unemployed mothers were more likely to be fully vaccinated than those of the employed.[11] Findings from other studies in Nigeria[12] and Kenya[6] did not demonstrate an association between maternal employment status and full vaccination status. It is possible that, in such scenarios as in this study, employment provides some psychological motivation to access optimal child care, including vaccination. Conversely, unemployed mothers may have more time to take a child for vaccination. This finding and possible explanations need to be further explored in studies.

One unexpected finding in this study was that a higher birth order was associated with a higher proportion of children with full vaccination status. Other studies found lower proportions of full vaccination status with higher birth order[5,11,12,20,21] or failed to demonstrate an association.[14] It is possible that, with successive births, mothers in this study had improving motivation to complete vaccination. The discrepancies in the direction of association suggest that other factors may be differentially influencing the associations.

The lack of association between maternal educational level and full vaccination was not consistent with

findings from other studies that show a positive association between both variables.[9,12] The lack of association suggests that other factors such as hospital delivery and knowledge of the benefits of immunization influenced full vaccination status somewhat uniformly across different levels of maternal education.

Mothers who could not state a benefit of immunization or stated lack of money or fear of male sterility as reasons for their children not being vaccinated require health education, including counselling, on the benefits of full immunization. Some mothers and their households may require social support to access vaccination services.

Despite the strengths of this study, it has some limitations. There may have been recall bias from mothers' verbal reports leading to possible over- or underestimation of vaccination status. In addition, reports of vaccination may have been exaggerated because of its social desirability. Only commonly explored determinants were included in this study. Because of supplemental doses of OPV during National Immunisation Days in Nigeria, the relative proportion of OPV vaccination may have been overestimated. There were differences in age groups and definitions of full vaccination across childhood vaccination studies, thus necessitating caution in the comparisons made. The cross-sectional design confers some difficulty in demonstrating temporality between full vaccination status and some independent variables such as mother's educational level or knowledge of the benefits of immunization. This limits the extent to which cause-effect relationship, or lack of it, could be assigned to the associations explored.

CONCLUSION

This study demonstrated high coverage for most vaccines in the community studied, compared to national coverage data. The birth of a child in a health facility, a mother's knowledge of the benefits of immunization, a mother being employed and a high birth order were the factors associated with full vaccination status.

Two important lessons may be learnt from this study. Firstly, high vaccination coverage is achievable in rural areas if vaccination posts are readily accessible. Secondly, full vaccination status is associated with demographic and behavioural factors that still need to be addressed in rural areas in addition to overcoming spatial barriers to vaccination services.

Vaccination coverage can be increased by educating mothers on the benefits of full vaccination for children and giving birth in health facilities. Qualitative studies to clarify cultural and behavioural determinants of full vaccination are required.

REFERENCES

1. WHO. Immunization surveillance, assessment and monitoring. 2013. URL: http://www.who.int/immunization_monitoring/en/ Accessed 16th Oct, 2013.
2. WHO, UNICEF. Global immunization data. World Health Organization 2013.URL: http://www.who.int/immunization_monitoring/data/en/ Accessed 11th Aug, 2013.
3. National Bureau of Statistics. Nigeria Multiple Indicator Cluster Survey 2011 Main Report. Abuja, Nigeria: National Bureau of Statistics; 2013.
4. WHO. Campaign essentials. World Immunization Week 2013. URL: http://www.who.int/campaigns/immunization-week/2013/WIW_campaign_essentials.pdf Accessed 15th Oct, 2012.
5. National Population Commission of Nigeria and ICF International. Nigeria Demographic and Health Survey 20013. Abuja, Nigeria: National Population Commission and ICF International; 2014.
6. Johns Hopkins Bloomberg School of Public Health International Vaccine Access Center (IVAC). Nigeria 1st National Vaccine Summit:

Town hall meetings report 2012. April 2012. 2012 International Vaccine Access Center (IVAC) at Johns Hopkins Bloomberg School of Public Health. 2012. URL: http://www.jhsph.edu/research/centers-and-institutes/ivac/projects/nigeria/nigeria-national-vaccine-summit-town-hall-report.pdf Accessed 19th Oct, 2013.

7. National Primary Health Care Development Agency. 1st National Vaccine Summit. International Conference Centre, Abuja. April 16th-17th, 2012.URL: http://www.jhsph.edu/research/centers-and-institutes/ivac/projects/nigeria/nigeria-national-vaccine-summit-report.pdf

8. Odusanya OO, Alufohai EF, Meurice FP, Ahonkhai VI. Determinants of vaccination coverage in rural Nigeria. BMC Public Health. 2008;8:381.URL: http://www. biomedcentral.com/1471-2458/8/381 Accessed 15th October, 2013.

9. Cochran WG. Sampling techniques. Third Ed. New York: Wiley; 1977. p. 75-76.

10. Abdulraheem IS, Onajole AT, Jimoh AA, Oladipo AR. Reasons for incomplete vaccination and factors for missed opportunities among rural Nigerian children. J Public Health Epidemiol 2011;3:194-203.

11. Antai D. Migration and child immunization in Nigeria: individual- and community-level contexts. BMC Public Health 2010;10.URL: http://www.biomedcentral.com/1471-2458/10/116 Accessed 19th Oct, 2013.

12. Adebayo BE, Oladokun RE, Akinbami FO. Immunization coverage in a rural community in southwestern Nigeria. J Vaccines Vaccin 2012;3. URL: http://dx.doi.org /10.4172/2157-7560.1000143 Accessed 10th Aug, 2013.

13. Odiit A, Amuge B. Comparison of vaccination status of children born in the health units and those born at home. East Afr Med J 2003;80:3-6.

14. Etana B Deressa W. Factors associated with complete immunization coverage in children aged 1223 months in Ambo Woreda, Central Ethiopia. BMC Public Health 2012;12.URL: http://www.biomedcentral.com/1471-2458/12/566 Accessed 21st Oct, 2013.

15. Mutua KM, Kimani-Murage E, Ettarh ER. Childhood vaccination in informal urban settlements in Nairobi, Kenya: who gets vaccinated? BMC Public Health 2011;11. URL:http://www.biomedcentral.com/1471-2458/11/6 Accessed 22nd Oct, 2013.

16. Maina LC, Karanja S, Kombich J. Immunization coverage and its determinants among children aged 12-23 months in a peri-urban area of Kenya. Pan Afr Med J 2013;14. URL: http://www.panafrican-med-journal.com/content/article/14/3/full/ Accessed 16th Oct, 2013.

17. Sadoh AE, Eregie C. Timeliness and completion rate of immunization among Nigerian children attending a clinic-based immunization service. J Health Popul Nutr 2009;27:391-395.

18. Rahman M, Obaida-Nasrin S. Factors affecting acceptance of complete immunization coverage of children under five years in rural Bangladesh. Salud Publica Mex 2010;52:134-140.

19. Strecher V, Rosenstock I. The health belief model. In: Glanz K, Lewis FM, Rimer BK, editors. Health behavior and health education: theory, research, and practice. 2nd ed. San Francisco: Jossey-Bass Publishers; 1997. p. 41-59.

20. Antai D. Rural-urban inequities in childhood immunization in Nigeria: The role of community contexts. Afr J Prim Health Care & Fam Med 2011;3:238-246.

21. Afzal N, Zainab B. Determinants and status of vaccination in Bangladesh. Dhaka Univ J Sci 2012;60:47-51.