IMMUNIZATION COVERAGE AND ITS DETERMINANTS IN URBAN AND RURAL POPULATIONS OF SOUTH-EASTERN NIGERIA,

BY

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ABSTRACT

BACKGROUND:
Immunization against childhood vaccine preventable diseases is an important public health intervention that averts an estimated 2-3 million deaths annually. Despite its importance, immunization coverage rates in Nigeria have remained poor irrespective of numerous strategies formulated to improve coverage. This study was designed to determine the immunization coverage rates in urban and rural populations and their determinants.

METHODOLOGY:
This was a cross-sectional descriptive study carried out in Ideato North Local Government Area (LGA) and Owerri Municipal Council of Imo State, Nigeria between August, 2013 and June, 2017. Ideato LGA represented the rural community while Owerri Municipal Council represented the urban community. Data was collected by the use of a pre-tested, interviewer administered questionnaire and documentation of findings from the immunization cards. The sample size was 500 mothers/care –givers who were randomly selected.
Bivariate analysis was used to assess factors that were associated with full immunization coverage while the level of significance was set at p ≤0.05.

RESULTS:
The result showed that 81.1% of the children in the urban area were fully immunized whereas only 18.9% of those from the rural community were fully immunized. Maternal age, methods of data cataloging, place of residence, socio-economic class and maternal health care utilization were observed as factors positively associated with full immunization coverage.

CONCLUSION:
The immunization coverage of infants in the rural community was abysmally poor. Efforts should be made at improving immunization coverage in the rural areas of Imo state.

INTRODUCTION:
Sequel to the launching of the Expanded Programme on Immunization (EPI) in 1974, global immunization coverage rate rose from 5% to 84%.[1] Immunization has be observed as the most effective and successful public health intervention for reducing morbidity and mortality in children, averting about 2- 3 million deaths yearly and preventing illnesses and disabilities from vaccine preventable diseases (VPDs).[1] The Nigerian government in a bid to re-energize or strengthen the program on immunization and reduce the scourge of VPDs, substituted the EPI with the National Program on Immunization (NPI) in 1995.[1,2] By the end of the year 2011, Immunization was estimated to have saved about 2-3 million lives. In spite of the above benefits and disproportionately too, nearly one in five children still miss out on basic vaccine coverage.

Hence, the morbidity and mortality associated with VPDs persist and continue to plague many regions of the world; especially, sub-Saharan Africa.[4] To buttress this assertion, Nigeria loses about 2,300 under-five children yearly.[5] This poor record dents Nigeria as the second largest contributor to under –five mortality in the world and more than 70% of these deaths are attributable to VPDs.[5] Underneath these statistics lie the psychological pain for thousands of families that have lost their children. Even more devastating is the knowledge that essential and easily affordable interventions would have prevented most of these deaths. Additional evidence has shown that a child dies every 20 seconds from a VPD.[4,5] These deaths occur more in hard –to – reach areas where parents face multiple barriers to timely immunization.

Consequent upon an endorsement by 194 member states of the World Health Assembly in May, 2012, the World Health Organization (WHO) came up with the Global Vaccine Action Plan (GVAP). The GVAP is a framework to prevent millions of deaths by 2020 through a more equitable access to existing vaccines for people in all communities.[6] However, at the mid-point of the target period (2016), the strategic advisory group of experts on immunization (SAGE) was greatly disturbed about the slow progress made towards the program despite improvements recorded in some countries and the introduction of new vaccines.[7] Unfortunately, Nigeria is amongst the ten countries that still record immunization coverage rates below 50%.[8] Individual, community and systemic factors have been shown to influence the equitable uptake of childhood immunization in Nigeria and sub-Saharan Africa. Whist much is known about systemic barriers to effective immunization coverage (vaccine supply, distribution, costs, provider skills) and individual-level factors (Such as poor understanding of immunization, suspicions, myths / rumours, low maternal education, maternal employment, young maternal age, delivery outside a health facility and inability to possess an immunization card) that determine immunization uptake within rural areas of developing countries, such as Nigeria, much less is known about the role of community –level characteristics on rural –urban inequities in childhood immunization. [9] Nigerian population is largely rural. However, there is a skew in the provision of health facilities for better immunization coverage in favour of the urban populations. Studies have shown that patients' socio-economic status and health seeking behavior are influenced by various infrastructural and institutional characteristics at the community level. Such characteristics include; availability of health care services, distance to health facility and transportation.[8,9,10] These factors inadvertently influence the immunization uptake in rural communities. Immunization coverage rates in Nigeria have remained poor irrespective of numerous programs and strategies, specifically designed to improve coverage. A cross-sectional study designed to assess the effects of community participation on immunization coverage in South South Nigeria was conducted by Kalamawei et al.[8] Though the respondents in the urban areas were significantly younger (P

MATERIALS AND METHODS:

The study was cross-sectional descriptive conducted between January, 2013 and December, 2017. Two LGAs were randomly selected for this study; Owerri Municipal Council (urban area) and Ideato North LGA (rural area). The target population were infants aged 0-11 months and simple random sampling was used in the selection of

the two communities. The 2015 WHO-vaccination coverage cluster sampling method was used for the selection of households. A minimum sample size of 590 children/mothers or care-givers was obtained for this study after adjustments were made by the use of finite population correction formular and 10% non-response rate. Fifty percent of the minimum sample size was recruited from each of the two communities. Data was collected by the use of a pre-tested interviewer administered questionnaire and assessment of the immunization cards.

Data analysis was done using SPSS version 20 while bivariate and multivariate analyses were used in the determination of association between dependent and independent variables. The level of significance was set at $p \leq 0.05$

DEFINITION OF KEY WORDS

The following terms were used repeatedly in this study.

1. Full immunization:

A child aged 0-12 months who had received all the immunizations appropriate for age and in accordance with the NPI schedule. This invariably implies that, at this age the child would have received one dose of Bacille Calmette Guerin (BCG) at birth to I week, four doses of OPV (at birth, 6 weeks, 10 weeks and 14 weeks, at least three doses of pentavalent vaccine at 6 weeks, 10 weeks and 14 weeks and one dose of measles vaccine at 9 months. Findings from immunization cards plus observations from the mothers'/care-givers' history assisted in the classification

Not fully immunized:

A child aged 0-12 months who had missed at least one dose of the above listed vaccines is said not to be fully immunized.

Maternal card retention:

This is the ability of mothers/caregivers to safely keep the child's immunization card for the child's immunization information to be extracted from the card when needed.

COVERAGE BY CARD PLUS HISTORY (CARD PLUS):

Coverage calculated with numerator based on child's immunization card and mother/caregivers' report.

Caregiver: The most responsible person that provides child care for the 0-12months old child whose biological mother couldn't provide the intimate care. Drop-out rate **(DOR):**
This is the rate difference between the initial vaccines (BCG or Pentavalent) and the final vaccines (pentavalent or measles).

Percentage Coverage:

Is the percentage of total numbers immunized over the target population.

Ethical Consideration:

Approvals were obtained from the Ethics Review Committee of School of Postgraduate Studies, Imo State University Nigeria, Imo State Ministry of Health and the Heads of Immunization Units of the two LGAs of study. Assent was obtained from the respondents prior to data collection.

Results:

A total of 590 mothers/caregivers participated in the study. Two hundred and ninety-five (50%) of the respondents were recruited from the urban area while the remaining 50% (295) were recruited from the rural area. About 2.7% (n=16) of the mothers/caregivers had no formal education while 44.4% (n=262) attained primary level of education in both LGAs. The married respondents constituted about 74.7% (n=441) of the study population while 7.5% (n=44) were single. The age of the mothers /caregivers ranged from 18-45 years. Two hundred and seventy-seven (46.7%) respondents belonged to the middle socio-economic class (SEC) while 155 (26.3%) belonged to the low SEC.

The other variables analyzed in this study included; rate of utilization of health facilities/antenatal care (ANC), maternal card retention, type of facility where immunization was received and the availability of facilities for data cataloging. The findings showed that 484 (84%) of mothers utilized health facility/ANC whereas 106 (18.0%) did not and child's immunization card was retained by 393 (66.6%) of mothers /caregivers. However, 197 (33.4%), did not have their children's card as at the time of contact. Further observations revealed that the children of the respondents received immunization in the following places; district hospital -421 (71.4%), mission hospitals -117 (19.8%) and supplementary Immunization -52 (8.8%).

The urban population had technologies for data cataloging while the rural population lacked the facilities. The analysis further showed that 312 (52.9%) of the respondents from both populations were fully immunized in accordance with the NPI vaccination programme.

The above results were further illustrated in table I.

Variable	Category	Frequency	Percent
Maternal/ caregivers level of education	No formal education	16	2.7
	Primary	262	44.4
	Secondary	197	33.4
	Tertiary	115	19.5
Marital Status of the Mother/Caregiver	Single	44	7.5
	Married	441	74.7
	Divorced / Separated	49	8.3
	Widowed	56	9.5
Place of Residence	Urban	295	50.0
	Rural	295	50.0
Maternal / Caregiver's age (in years)	18-21	25	4.2
	22-25	118	20.0
	26-29	159	26.9
	30-33	190	32.2
	34-37	63	10.7
	38-41	10	1.7
	42-45	25	4.2
Child's age (in months)	0-2	161	27.3
	3-5	189	32.0
	6-8	94	15.9
	9-11	146	24.7
Social economic class	First grade	158	26.8
	Middle grade	277	46.9
	Low grade	155	26.3
Other variables			
Technologies for data cataloging	Yes	295	50.0
	No	295	50.0
Maternal Health care utilization	Yes	484	82.0
	No	106	18.0
Immunization Card retention	Yes	393	66.6
	No	197	33.4
Place of immunization	District hospital	421	71.4
	Mission Hospital	117	19.8
	Supplementary	52	8.8
Immunization status	Fully immunized	312	52.9
	Not fully immunized	278	47.1

4.2 Logistic regression of factors associated with a full immunization:

Bivariate and multivariate analyses were used to analyze factors associated with full immunization status. The result of the logistic analysis is as shown in table 2 below

Table 2: Multivariate Logistic regression for the identification of factors associated with full immunization

Variable	Category	Immunization status Fully Immunized %	Not fully Immunized %	Odds ratio	P-value	Phi
Residence	Urban	253(81.1)	42(15.1)	24.095(15.617, 37.175)	0.000	0.659
	Rural	59(18.9)	236(84.1)			
Technologies for Data Cataloging	Yes	253(81.1)	42(15.1)	24.095(15.617, 37.175)	0.000	0.860
	No	59(18.9)	236(84.1)			
Maternal educational level	No formal Education	2(12.5)	14(87.5)	0.001(4.732E-05-0.020)	0.000	0.860
	Primary	19(7.3)	243(92.7)	0.001(0.000, 0.015		
	Secondary	177(89.8)	20(102)	0.117(0.010, 1.340		
	Tertiary	114(99.1)	1(0.9)			
Maternal Health care Utilization	Yes	312(100.0)	172(61.9)	0.355(0.315, 0.401)	0.000	0.496
	No	0(0.0)	106(38.1)			
Social class	First Grade	149(47.8)	9(3.2)	71.362(16.390, 310.717)	0.000	0.658
	Middle Grade	156(50.0)	121(43.5)	24.160(7.449, 78.364)		
	Low grade	7(2.2)	148(53.2)			
Place of immunization Service	District Hospital	218(69.9)	203(73.0)	0.787(0.171, 3.611	0.181	0.076
	Mission Hospital	70(22.4)	47(16.9)	1.806(0.360, 9.062)		
	Supplementary	24(7.1)	28(10.1)			
Immunization card Retention by Mothers/caregivers	Yes	226(57.5)	167(45.5)	1.747(1.237, 2.467)	0.001	0.131
	No	86(43.70	111(56.3)			
Marital status of mother	Single	4(1.3)	40(14.4)	0.026(0.003, 0.221	<0.001	0.332
	Married	257(82.4)	184(66.2)	1.261(0.324, 4.911)		
	Divorced / separated	11(3.5)	38(13.7)	0.247(0.033, 1.831)		
	Widowed	40(12.8)	16(5.3)			
Maternal age (years)	18-21	3(1.0)	22(7.9)	1.323(0.883, 1.982	<0.001	0.251
	22-25	54(17.3)	64(23.0)			
	26-29	85(27.2)	74(26.6)			
	30-33	105(33.7)	85(30.6)			
	34-37	43(13.8)	20(7.2)			
	38-41	2(0.6)	8(2.9)			
	42-45	20(6.4)	15(1.8)			
Child age (months)	0-2	105(33.7)	56(20.1)		0.000	0.185
	3-5	104(33.3)	85(30.6)	0.711(0.473, 1.069)		
	6-8	43(13.8)	51(18.3)			
	9-11	60(19.2)	86(30.9)			

DISCUSSION:

Immunization is one of the most successful and cost effective public health interventions and remains the key to the prevention of childhood diseases.[7,8,10]

The outcome of this study showed that 81% and 18.9% of children aged 0-11 months were fully immunization in urban and rural communities respectively. However, 54.9% of the study population (irrespective of place of residence) were fully immunized. The abysmal rate of immunization coverage recorded in the rural population in Nigeria should attract an urgent medical attention. The unimaginable rate recorded amongst the rural population in Imo state, Nigeria, could be a reflection of the moribund state of most of the Primary Health Centers (PHC) in Imo states as at the period the index study was conducted.

A study on the assessment of EPI coverage in a peri-urban area of Karachi , Pakistan reported an age-appropriate vaccination coverage of 44.8%[13] while another similar study done in a rural settlement amongst pre-school children who were between the ages of 19-35 months reported an immunization coverage rate of 47%.[13] Another study conducted in an urban community in Gondar, Ethiopia amongst subjects aged 12-24 months reported a full immunization coverage rate of 47.4%.[14] However, Fasih et al reported an EPI coverage rate of 26.5% for children aged ≤2 years.[15] Closer home, an immunization coverage rate of 37% was recorded in the Northern part of Nigeria.[2] Surprisingly, Itimi et al, [16] in a comparative study between rural and urban communities in south-south, Nigeria reported an immunization coverage rate of 88.54% for rural and 52.96% for urban populations. Better community mobilization and participation were adduced as reasons for the high immunization coverage rates recorded amongst the rural community in south-south Nigeria. Most of the reasons given by the urban dwellers for the incomplete immunization and poor coverage rates were linked to lack of motivation, relocation, and adverse rumour about childhood immunization.[16]

A critical and in dept analysis of the above cited studies showed that non of the studies recorded a coverage rate that was in tandem with the WHO recommended bench mark of 90%.

The dynamics associated with the use of card plus or card only in the recruitment of the respondents, age range of the different study populations, influence of culture/norms, level of utilization and availability of health facilities, provision of medical outreach programs, and the degree of community mobilization and participation would have accounted for the heterogeneity of findings.

Furthermore, the present study assessed the influence of the following variables on immunization coverage rates: maternal/caregivers' level of education, marital status of mothers/caregiver, place of residence (urban/rural), maternal/caregivers' age (years), child's age (months), socio-economic class (SEC), availability of facilities for data cataloging, maternal health care utilization, immunization card retention and place of immunization (district/missionary hospital, supplementary).

The study showed that maternal/care-givers' educational status was significantly associated with full immunization coverage as mothers /care-givers of higher educational attainment recorded better immunization coverage rates than those with no formal education. Better health seeking behavior and easy affordability of health services by literate mothers could proffer an explanation for this disparity. This finding is also consistent with the report of the 2008 demography and health survey in Nigeria which showed that mothers educational level is strongly related to immunization coverage as mothers with secondary or tertiary educational attainment are more than eight times more likely to immunize their children than mothers without formal education.[17] However, a similar study done in Kiandutu slum of Kenya showed no relationship between maternal literacy level and the coverage rate of childhood immunization.[18] Maternal education has been proven to be a reflection of the level of health seeking behavior.[4,3,12,17]

Socio-economic class is another determinant of health service utilization Via –a viz level of immunization coverage. Surprisingly, children of high income and middle income strata showed lower level of immunization rates in this study when compared with the middle income group. However, several studies have reported a positive relationship between family income/SEC and immunization coverage rates.[12,13,17,18,19]

Maternal health care utilization was one of the factors reported in the present study to be associated with childhood immunization. Children whose mothers received antenatal care are more likely to be fully immunized than children of mothers who did not receive antenatal care (ANC) during pregnancy. For instance, Babalola et al in a study aimed at determining the factors that predict BCG immunization status in Northern Nigeria reported a strong correlation between ANC attendance and immunization coverage in childhood.[20]

The place where immunization was received is an important determinant in assessing immunization coverage in sub-Saharan African. Evidence has shown that immunization might be administered in district/government and mission hospitals. It could also be supplementary; in this case, it is administered at home.

Itimi et al,[16] reported a significant relationship between the place of administration of vaccines and immunization coverage rate. It was further observed from the above cited study that children who received supplementary vaccination usually have higher coverage rates. Nonetheless, the present study did not report any relationship between the place vaccination was received and the degree of immunization coverage.

The marital status of the mothers/caregivers has been reported as an important denominator in assessing immunization coverage. Mothers who were single, divorced, separated or widowed have been reported to have a lower coverage rates when compared to their married counterparts.[17,16] Though, the index study failed to identify an association between marital status and immunization coverage, a study on childhood immunization done in the slums of Dakhar city, India showed an outcome that was consistent with this finding.[21]

Further observation from the present study recorded no association between the availability of immunization card and immunization coverage. It should be noted that the recall method (which is subject to bias) was used to extract information from mothers/caregivers of infants ($\leq$ 11months) who did not present their immunization cards. A study carried out in India reported a low sensitivity of 41.3% in the recall method of obtaining information from under-five mothers/caregivers.

LIMITATIONS OF THE STUDY
1. An analytical study design (rather than cross-sectional) would have been able to effectively compare immunization status in both settings and establish a casual relationship between factors identified as determinants of immunization and the rate of coverage.
2. The use of caregiver recall in the assessment of immunization coverage in addition to vaccination card could easily introduce recall bias.

CONCLUSION:
The immunization coverage of both the urban and rural areas of Imo State, Nigeria did not meet the WHO bench-mark. More worrisome is the abysmal rate recorded in the rural area. In addition to improving on the factors that have significant relationship with immunization coverage, the PHC in the state should be reactivated and the necessary facilities provided.
Community participation and mobilization must receive utmost priority prior to vaccination.

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