Immunization coverage and its determinants in urban and rural populations of South-Eastern Nigeria.

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Abstract

Background: Immunization against childhood Vaccine Preventable Diseases (VPDs) is an important public health intervention which averts an estimated 2-3 million deaths annually. Despite this and disproportionately too, nearly one in five children miss out on basic vaccines.

Aim: This study aimed to contribute towards achieving the global vaccine action plan, a framework to prevent millions of deaths by 2020 through equitable access to existing vaccines; by determining the immunization coverage of eight childhood VPDs among children 0-11 months (under-one), in the urban and rural populations of south-eastern Nigeria.

Methods: A cross-sectional community based descriptive study was conducted in Ideato North Local Government Area (LGA) and Owerri municipal council of Imo State, south-east Nigeria. This covered the period from January 2013 to December 2017. Ideato North LGA represented the rural community while Owerri municipal council represented the urban community. A modified WHO-expanded programme on immunization cluster sampling methods were used for household selection using a sample design for multiple levels of geographic hierarchy. After adjustment by using finite population correction formula with addition of 10% non-response rate and design effect of 2.3, the minimum sample size was 590 children and their corresponding mothers/caregivers, 295 (50%) per LGA. Data was collected using a pre-tested interviewer administered questionnaire, focused group discussions, documentation of findings from the immunization cards and review of existing records in the National Program on Immunization units, public health care departments of the LGAs of study. Factors associated with full immunization coverage were identified following bivariate analysis. Independent predictors were investigated by controlling for possible confounders and level of significance was set at p-value of 0.05.

Results: More than three fourths (81.1%) of the children were fully immunized by immunization card-plus history with immunization coverage of 129.4% by review of records, in the urban LGA. In the rural LGA however, only 18.9% of the children were fully immunized by immunization card-plus history and 0% from the review of records. Maternal education level, methods of data cataloging, place of residence, socio-economic class and maternal health care utilization were observed as factors significantly associated with full immunization.

Conclusion: Immunization coverage of infants in the urban community gets improvement towards the WHO target goal of 90% that of the rural community was abysmally poor. Salient areas need improvement and concerted efforts need be made to improve immunization coverage in the rural communities of Imo State, Nigeria.

Keywords: Immunization, Populations, Urban, Rural, Socio-economic class.

Introduction

Immunization has been observed as the most effective and successful public health intervention, averting 2 million-3 million deaths yearly and preventing illnesses and disabilities from Vaccine Preventable Diseases (VPDs). Sequel to the launching of the Expanded Program on Immunization (EPI) in 1974 charged with preventing diseases, disability and death from vaccine preventable diseases by developing and establishing immunization programmes throughout the world, global immunization coverage rate rose from 5% to 84%. 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 19951. By the end of 2011, immunization was estimated to have saved 2-3 million lives. In spite of the benefits and disproportionately too, nearly one in five children still miss out on basic vaccine coverage [1].

Hence, the morbidity and mortality associated with VPDs persist and continue to plaque many regions of the world; especially sub-Saharan Africa. To buttress this assertion, Nigeria loses about 2,300 under-five year olds every single day. This poor record dents Nigeria as the second largest contributor to the under-five mortality rate in the world and more than 70% of these deaths are attributable to VPDs. Underneath these

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statistics lies the psychological pain for thousands of families who have lost their children. Even more devastating is the knowledge that, essential and timely interventions would have averted most of these deaths. Additional evidence has shown that a child dies every 20 seconds from a VPD. These deaths are worse in hard-to-reach areas where parents face multiple barriers to immunizing their children on time [2].

Thus, the world's poorest regions still suffer a heavy toll of premature death and disability from infectious diseases for which vaccines exist or else need to be improved. 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 more equitable access to existing vaccines for people in all communities. However, at the midpoint of the GVAP targeted period (2016), the Strategic Advisory Group of Experts on Immunization (SAGE) was gravely concerned over the slow progress made towards the program despite improvements recorded in some countries and introduction of new vaccines. Unfortunately, Nigeria is amongst the ten countries that still record immunization coverage rates below 50%. Individual, community and systemic factors have been shown to influence the equitable uptake of childhood immunization in Nigeria and the Sub-Saharan African [3].

Whilst much is known 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 communities of developing countries such as Nigeria; much less is known about community-level characteristics on rural-urban inequities in childhood immunization. Nigerian population is largely rural [4]. However, there is a skew in the provision of health facilities in favour of the urban populations. Immunization coverage rates have remained poor in parts of Nigeria irrespective of numerous programs and strategies specifically designed to improve coverage. This study aimed to contribute towards achieving the Global Vaccine Action Plan (GVAP) of preventing millions of deaths through equitable access to existing vaccines for people in all communities by assessing the immunization coverage of eight childhood vaccine preventable diseases and its determining factors among children aged 0-11 months old (under-one) in the urban and rural populations of South-Eastern Nigeria in order to inform effective interventions [5].

Materials and Methods

The study was a cross-sectional; community based descriptive study design conducted between January 2013 and December 2017. Imo State was selected randomly out of the 36 states in Nigeria and has a total of 27 LGAs. These LGAS were grouped into 24 rural and 3 major urban areas. Out of the 27, 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 with their mothers and caregivers [6]. This 0-11 months target group represented 4% of the total population. The 2015 WHO-vaccination coverage cluster sampling method was used for the household selection using a sample design for multiple levels of geographic hierarchy. After adjustment by using finite population correction formula with addition of 10% non-response rate and design effect of 2.3, a minimum sample size of 590 children and their corresponding mothers/caregivers, 295 per LGA was obtained. Data was collected using a pre-tested interviewer administered questionnaire, assessment of the immunization cards and review of existing records in the national programme on immunization units, public health care departments of the LGAs of study. The first child in each zone was selected randomly from the center of the zone and the rest of them were selected from the subsequent household till the required numbers of children had been attained. Households with more than one eligible child had only one child included, by lottery method [7].

Data were entered after checking for completeness. Cleaned, prepared and analysed using Statistical Data Analysis Software (SPSS) version 20. Frequencies and other descriptive statistics were determined. Bivariate and multivariate analysis was conducted to examine association between dependent and independent variables and the significance decided at a P value of 0.05. Phi measure was employed to determine the strength of association. Odds Ratios (ORs) and their 95% CIs were calculated. Observed data were entered and tabulated using Microsoft Word [8].

Measurements/Definition of key words

The following terms were used repeatedly in this study;

Full immunization: A child aged 0-12 months who had received all the immunizations appropriate for age and in accordance with the National Program on Immunization (NPI) Schedule. This invariably implies that, at this age, the child would have received one dose of Bacille Calmette Guerin ((BCG) at birth to one week) four doses of OPV (at birth, 6weeks, 10 weeks or 14 weeks) at least three doses of pentavalent vaccine (at 6 weeks, 10 weeks, 14 weeks) and one dose of measles vaccine (at 9 months). Findings from immunization card plus mother/care-giver's history assisted in the classification [9].

Not fully immunized: A child 0 to 12 months who had missed at least one dose of the above listed vaccines before the study was considered not fully immunized.

Maternal card retension: This is the ability of the mothers/caregivers to keep safely the child's immunization card, for the child's immunization information to be extracted from the immunization card [10].

Coverage by card plus history (Card plus): Coverage calculated with numerator based on child's immunization card and mother/caregiver's 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.

Dropout Rate (DOR): This is the rate difference between the initial vaccines (BCG or Pentavalent[1]) and the final vaccines (Pentavalent[3] or Measles).

% coverage:

$$\frac{\text{Total no immunized}}{\text{The percentage of total numbers immunized over the target population}} \times 100$$

Results

A total of 590 mothers/caregivers of the children 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 [11]. About 2.7% (n=16) of the mothers/caregivers had no formal education, 44.4% (n=262) attained primary level of education; 33.4% (n=197) had completed secondary level of education and 19.5% (n=195) of them had attained tertiary level of education in both LGAs [12]. The married respondents constituted 74.7% (n=441) of the population while 7.5% (n=44) were single. 8.3% (n=49) were divorced/separated, and 9.5% (n=56) were widowed. The age of the mothers/caregivers ranged from 18-45 years. One hundred and fifty-eight (26.8%) respondents belonged to the high socio-economic class, 46.7% (n=227) to the middle socio-economic class and 26.3% (n=155) belonged to the low socio-economic class.

The other variables analysed in this study included; utilization of health facilities/Antenatal Care (ANC), maternal card retension, type of facility where immunization was received and the availability of facilities for data cataloging. The findings show that 484 (82%) of mothers/caregivers utilized health/ antenatal care, 106 (18.0%) did not. Child's immunization card was retained by 393 (66.6%) of the mothers/caregivers. However, 197 (33.4%) did not have their children's immunization card as at the time of contact. Further observations revealed that the children of the respondents received immunization in the following places; district hospitals 421 (71.4%), mission hospitals 117 (19.8%) supplementary immunizations 52 (8.8%). The urban population had technologies for data cataloging while the rural population lacked the technologies. The analysis further showed that 312 (52.9%) of the respondents from both urban and rural areas were fully immunized in accordance (Tables 1 and 2).

Table 1. *Frequencies and socio-demographic characteristics of the respondents, including other variables.*

Variables	Category	Frequency	Percent (%)
Socio-demographic variables 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
Residence	Urban	295	50
	Rural	295	50
Maternal/caregiver's age (in years)	18-21	25	4.2
	22-25	118	20
	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
	6-8	94	15.9
	9-11	146	24.7

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Socio-economic class	High	158	26.8
	Middle	277	46.9
	Low	155	26.3
Other variables technologies for data cataloging	Yes	295	50
	No	295	50
Maternal health care utilization	Yes	484	82
	No	106	18
Immunization card retension	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

Table 2. *Multivariate logistic regression to identify factors associated with full immunization among women with children 0-11 months (under-1).*

Variables	**Category**	**Immunization status**		**Odds ratio**	**P-value**	**Phi**
		Fully immunized (%)	**Not fully immunized (%)**			
Residence	Urban	253 (81.1)	42 (15.1)	24.095 (15.617, 37.175)	0	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	0.659
	No	59 (18.9)	236 (84.1)			
Maternal educational level	No formal education	2 (12.5)	14 (87.5)	0.001 (4.732E-0.05-0.020)	0	0.86
	Primary	19 (7.3)	243 (92.7)	0.001 (0.000, 0.015)		
	Secondary	177 (89.8)	20 (10.2)	0.117 (0.010, 1.340)		
	Tertiary	114 (99.1)	1 (0.9)	0		
Maternal health care utilization	Yes	312 (100.0)	172 (61.9)	0.355 (0.315, 0.401)	0	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	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 retension by mothers/ caregivers	Yes	226 (57.5)	167 (42.5)	1.747 (1.237, 2.467)	0.001	0.131

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	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 (in 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)			
Childs age (in months)	0-2	105 (33.7)	56 (20.1)	0.711 (0.473, 1.069)	0	0.185
	3-5	104 (33.3)	85 (30.6)			
	6-8	43 (13.8)	51 (18.3)			
	9-11	60 (19.2)	86 (30.9)			

Findings from the review of records

Immunization coverage: The immunization coverage was calculated for each vaccine using the formular: Total number immunized/Target population × 100. The coverage for Oral Polio Vaccination (OPV) in the urban LGA recorded 130%, 134%, 128%, 138%, 141%; respectively for the 5 year period of study (2013-2017) while the rural LGA recorded a coverage level of 86%, 97% and 102% for 2015-2017. The records for 2013 and 2014 OPV immunization in the rural LGA (Ideato North) was not found. BCG immunization coverage was calculated. The existing records in the urban area of Imo State over the 5year period of study (2013-2017), showed 222%, 223%, 208%, 199% and 207%. The rural LGA had no record.

Pevtavalent (Penta) vaccination was commenced in the LGAs of study around mid-July, 2013. The urban LGA recorded a coverage of 132%, 132%, 125%, 120%, 138% for the 5 year period of study whereas the rural area recorded 83% for 2013; lacked records showing coverage for 2014 and 86%, 98%, 102% for the rest years. Measles Vaccine coverage in Imo State, south-east Nigeria, for the duration of study showed coverage rates of 127%, 134%, 130%, 125%, 144% for the urban area and 83%, 93% and 91% for 2015, 2016, 2017 respectively for the rural LGA.

Records for the years 2013 and 2014 were not found. Pneumococcal conjugate vaccination was commenced in the LGAs of study in 2016. Coverage level of 117%and 137% in the urban LGA in 2016 and 2017 respectively was recorded. The rural LGA lacked records for 2016; and 98% coverage for 2017.

Immunization drop-out rates: A drop-out rate of 10% and negative dropout rates are considered unacceptable coverage for immunization. The immunization drop-out rates were calculated as the % point difference between successive doses of a vaccine, expressed as a % of the first. In this study, the vaccines used were $Penta_3$ as the last dose, $Penta_1$ as the first dose, likewise other vaccines; as has been adopted by the ministry of the Health, calculated using the formular: DPT_1-DPT_3 × 100/DPT_1. The drop-out rates for Owerri municipal council LGA can be considered acceptable for all the vaccines in the 5 year period besides an isolated negative value (-4.8%) for penta in 2013 and 29% for the then newly introduced PCV in 2016. The rural population on the other hand lacked data for the first doses of the vaccines which hindered the calculation of the drop-out rates except for PCV (Tables 3 and 4).

Table 3. *Record of routine immunization activities/yearly immunization returns in urban population on BCG, OPV, PENTA, PCV, measles for the years 2013- 2017.*

Year	Target population	BCG		OPV				PENTA				PCV				MEASLES	
		Immunized	% coverage	OPV¹ immunized	OPV³ immunized	% Coverage	Drop-out rate	Penta¹ immunized	Penta³ immunized	% Coverage	Drop-out rate	PCV¹ immunized	PCV³ immunized	% Coverage	Drop-out rate	Immunized	% Coverage
2013	6344	14078	222	8301	8210	130	1.1	8189	8589	132	4.8	-	-	-	-	8054	127
2014	6548	14616	223	9251	8334	134	9.9	8889	8333	132	6.1	-	-	-	-	8780	134

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2015	6756	14069	208	9018	8320	128	7.7	9066	7751	125	14.5	-	-	-	-	8945	130
2016	6974	13389	192	9678	9634	138	0.5	9086	8364	120	8	9570	6791	117	2.9	8724	125
2017	7196	14904	207	2552	2552	141	1	9572	10224	138	6.5	9692	10164	137	4.9	2585	144

Table 4. *Record of routine immunization activities/yearly immunization returns in rural population on BG, OPV, PENTA, PCV, measles for the years 2013-2017.*

Year	Target population	BCG		OPV				PENTA				PCV				MEASLES	
		Immunized	% coverage	OPV¹ immunized	OPV³ immunized	% Coverage	Drop-out rate	Penta¹ immunized	Penta³ immunized	% coverage	Drop-out rate	PCV¹ immunized	PCV³ immunized	% coverage	Drop-out rate	Immunized	% Coverage
2013	7872	No record	-	No record	No record	-	-	No record	6534	83	-	-	-	-	-	No record	-
2014	6548	No record	-	No record	No record	-	-	No record	No record	-	-	-	-	-	-	No record	-
2015	8395	No record	-	No record	7254	86	-	No record	7220	86	-	-	-	-	-	6999	83
2016	8648	No record	-	No record	8402	97	-	No record	8451	98	-	-	-	-	-	8022	93
2017	8952	No record	-	2383	2193	102	2370	2370	2205	102	7	2263	2102	98	7.1	2035	91

Discussion

Immunization is one of the most successful and cost effective public health intervention, remains key to prevention of childhood diseases. The outcome of this study showed that 81.1% and 18.9% of children aged 0-11 months were fully immunized in the urban and rural areas respectively by Card-plus history. Findings from the review of records showed a coverage rate of 111% and 0% for urban and rural LGAs. This 0% immunization status was attributed to the No BCG vaccination of majority of the rural children. A study conducted in six health facilities that covered some key slums in Nairobi area, showed immunization coverage of 80% ; a figure higher than that in the rural LGA and slightly lower than that of the urban LGA but somewhat comparable. The low coverage rate in the rural community is in keeping with a low rate of 37% for BCG as reported by a study in the northern part of Nigeria.

The effect of socio-demographic factors on immunization coverage from the study, maternal/caregiver educational status was significantly associated with the increased completion of immunization seen in mothers or caregivers who attained secondary and above level than mothers unable to read and write. Results of this study contrasts the results of a study conducted in Kiandutu slums of Kenya which showed that the literacy level of the mother did not significantly predict the immunization status of the child but is in agreement with the 2008 demography and health survey in Nigeria which had shown that mothers' level of education is strongly related to immunization coverage with mothers with secondary education more than eight times more likely to immunize their children than mothers without education. This could indicate that better education informs better health seeking behavior. The study also indicated that children in urban areas are more than twice as likely as rural children to be fully vaccinated.

Family income rated with social class showed that children from household whose social class is middle and first grade hence with higher income and educational level were three times more likely to be fully immunized than those whose income was low grade. This finding is consistent with the study done in CSA, Maryland. Maternal health care utilization was another factor associated with child immunization completion among 0-11 months; children whose mothers had Antenatal Care (ANC) follow up were more likely to be fully vaccinated than those who did not attend ANC. This finding is consistent with that of northern Nigeria.

In this study, place of immunization service showed no association with immunization coverage. This finding contradicts the study in CSA, Maryland, 2012 which indicated significant association between place of delivery and vaccine completion among 0-11 months old children. The findings from this study showed an association between the marital status of a mother and the immunization status of the child. A study on childhood immunization in slums of Dakar city, India showed a significant association between marital status of mother and immunization coverage where children of mothers who were single, divorced, separated or widowed had lower coverage than that of those who were married.

The results of this study did not show strong association between immunization status of a child and availability of the immunization card. All the mothers who did not have the immunization cards gave information on their children's immunization status by recall method. Although the respondents in this case seemed to have the information on their children's immunization progress and current status, this method has been shown in other studies to have poor sensitivity. A study carried out in India showed a sensitivity of 41.3% in the recall method of obtaining information and concluded that the method was prone to biased result. The use

of immunization cards to assess coverage was necessary in this study in order to verify the immunization status of a child as both overestimation and underestimation are possible depending on the maternal tendencies exhibited with regards to immunization; and mothers might not remember the doses the child took due to the recall bias. It equally goes to validate the claims from the existing records on immunization in the primary health care units of the LGAs of study.

Findings from the review of records on immunization coverage by vaccine going by the existing records in Urban area (Owerri municipal council LGA) of Imo State over the 5 year period of study (2013-2017), showed 222%, 223%, 208%, 199% and 207% for BCG vaccine in that order, this is higher than 90% coverage target set for Africa (now Penta) a using the DPT and contrary to findings in a study in South western Nigeria where coverage for BCG was 75% as it was customary for newly delivered mothers to spend a mandatory six weeks at home with the exception of visits to health facilities. The majority of those mothers who delivered in health facilities availed themselves of the opportunity to immunize their babies.

When we compare immunization coverage of the rural and urban areas, the rural area (Ideato North rural LGA) regrettably lacked records on BCG immunization for the entire duration of study (2013-2017). The effectiveness of the BCG vaccine against TB has however been debated, with a range estimated from 0% to 80%. Most proponents claim that it is effective against TB meningitis, but it is not commonly believed to prevent TB in adults or its transmission. The real impact of BCG may have been confounded by many other improvements in public health that could have contributed to the decrease in disease burden associated with tuberculosis.

Record for 2013and 2014 OPV immunization in the rural LGA was not found. Interviews with the primary health care providers in the rural LGA headquarters laid verbal claims to OPV vaccination for the two years but decried lack of technologies for data cataloging and transfer; whereas the urban area recorded 130%, 134%, 128%, 138% and 141% respectively These findings are above the 79% Polio coverage for Africa. The non-existence of data in the rural area goes further to buttress the poor record keeping by the health professionals in that LGA which they blamed on lack of technologies for data cataloging. Worthy of mention is the fact that at the time of this study, Nigeria had recorded no new case of wild virus type since July 2014.

The urban LGA recorded 132%, 132%, 125%, 120%, 138% for pentavalent vaccine for the 5 year period of study whereas the rural area recorded 83% for 2013; lacked records showing coverage for 2014 and 86%, 98%, 102% for the rest years. The coverage rate in the urban area is comparable to the findings of the rural area. On 7th June 2012, Nigeria with the support of GAVI alliance introduced the pentavelant vaccine which protects against five deadly diseases, into the national immunization programme. This was achieved by notably introducing Hemophilus influenza type b (Hib) and Hepatitis B vaccines into the DPT vaccine thereby converting it from the previously triple vaccine to pentavalent vaccine called Penta. The penta vaccination was commenced in the LGAs of study from mid-July 2013. Hence the record for the year 2013 was that of DPT up till mid-July, and thereafter, that of penta.

Measles vaccine coverage in Imo State, south-east Nigeria, for the duration of study showed coverage rates of 127%, 134%, 130%, 125%, 144% for the urban community; and 83%, 93% and 91% for 2015, 2016, 2017 respectively for the rural LGA. Records for 2013 and 2014 could not be found. Health professionals interviewed attributed it to change of Local immunization officer who keeps the records in that LGA. The finding in the urban LGA is higher than 76% vaccination coverage by vaccine in Africa, and lower but comparable to the findings in the rural LGA of 83%. Comparing the two LGAs the % vaccinated is higher in the urban LGA than in the rural LGA. In 2013, Nigeria experienced a major measles vaccine stock out which resulted in the occurrence of 57,892 measles with 348 deaths, the highest in the last six years.

Pneumococcal conjugate vaccination was commenced in the LGAS of study in 2016 and recorded a coverage rate of 117% and 137% in the urban LGA in 2016 and 2017 respectively. That shows wide acceptance for a vaccine that was barely newly-introduced. The rural LGA lacked records for 2016 and 98% coverage for 2017. There has been several Immunization program from organizations like UNICEF, WHO, ministry of health, such as reaching every ward approach, the acceleration measles campaign, the Immunization-Plus Days (IPD) strategy; which nearly doubled immunization coverage in both urban and rural LGAS and could have resulted in the coverage being high when compared to studies conducted when such interventions have not been adequately implemented.

On the immunization Drop-Out Rates (DOR), a DOR of 10% and negative DORs are considered unacceptable coverage for immunization. The EPI program's success depends on the administration of the full course of the vaccines at the right dose rate of the antigen, and at the right age. The immunization drop-out rates were calculated as the % point difference between successive doses of a vaccine, expressed as a % of the first. In this study, the vaccines used were Penta3 as the last dose, Penta1 as the first dose, likewise other vaccines; as has been adopted by the ministry of the Health, calculated using the formular developed by Bos and Batson: DPT_1-DPT_3 × 100/DPT_1.

From the results of this study, the DOR for the urban LGA coverage is considered acceptable for all the vaccines in the 5 years of study besides an isolated negative value (-4.8%) for DPT in 2013 and 29% for the then newly introduced PVC in 2016. This showed that children who received the DPT_3 outnumbered those that received DPT1; and that one in 3 children was not able to complete the PCV schedule. The rural area on the other hand, lacked data for the first doses of the vaccines which hindered the calculation of the DORs except for 2017 with acceptable rates at 7% for Penta, 8.9% for OPV and 7.1% for PCV. In-depth interview with relevant local immunization officers of that LGA revealed that recording the first vaccine doses was thought to be of no relevance. This

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suggests a knowledge gap. The isolated 'unacceptable' rates could indicate that although concerted efforts on promoting immunization had been put in place, there was shortcoming in the sustainability of routine immunizations programmes. A study on immunization coverage in slums of Urban Bangladesh showed that the DPT_1-DPT_3 drop-out rate was 6.7 times higher in slum children than in children from non-slum households.

Limitations of the Study

An analytical study design (rather than cross-sectional) would have compared immunization status in both settings, more effectively and established a causal relationship between the factors identified as determinants of immunizations and the rate of coverage. The use of caregiver recall in the assessment of immunization coverage in addition to vaccination card could easily introduce bias.

Conclusion

The immunization coverage of both the urban and rural areas of Imo state, Nigeria, did not meet the WHO target, but for the findings in the review of records of the urban population. Worrisome is the abysmal rate recorded in the rural area. Concerted effort thus, need be made to ensure that the GVAP is attained. This is critical in the reduction of childhood morbidity and mortality. It is vital that the PHC in the state and indeed across Nigeria be reactivated and necessary facilities provided. Fully operational Immunization Information System (IIS) need be established in the immunization units across the states and policies strengthened. Local programmatic interventions be implemented to upgrade the awareness of the community together with periodic training and re-training of health workers.

Ethical Consideration

Approvals were obtained from the research ethics review committee of the School of Post graduate studies, Imo State University Owerri, 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.

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