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Original Research Article

Childhood routine immunization coverage in children less than 5 years in Southern Nigeria: A descriptive cross-sectional survey

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Abstract

Background: *The ultimate goal of immunization programmes is to reduce the incidence of vaccine preventable diseases (VPDs) by attaining high levels of routine immunization coverage with potent vaccines. The purpose of this study was to determine the immunization coverage and factors affecting routine childhood immunization coverage in primary health facilities, Benin city Edo state.*
Methods*: Following ethical clearance from the Ethical Committee of the University of Benin Teaching Hospital, Benin City, a descriptive cross-sectional study involving 640 mothers/caregivers with children 0 – 23 months of age was carried out. Data on immunization coverage and factors affecting routine childhood immunization was collected using face-to-face interview with pre-tested interviewer questionnaire. Relationship between dependent and independent variables was determined using logistic regression analysis, at 95% confidence interval and p-values level less than 0.05 were considered significant.*
Results*: Of the 640 participants, 625 (97.7%) presented with their vaccination cards while 15 (2.3%) did not even though they had them. 630 (98.4%) of the children received BCG, first doses of OPV, PENTA and PCV while 118 (72.4%) and 119 (73.0%) received measles and yellow fever vaccines respectively. 545 (85.2%) children were completely immunized for age. The determinants of immunization coverage were child's age (OR 12.58 95% CI 6.481-24.4) and place of delivery OR 19.0 95% CI 10.50- 35.67)*
Conclusion: *Majority of the children were completely immunized for age and immunization coverage. Socio-demographic factors that influenced immunization status included age of the index child, place of delivery and level of education of the caregiver*

Keywords: *Routine immunization, coverage, Primary Health Care center*

Introduction

In developing countries, childhood routine immunization (RI) prevents three million child deaths and avert additional two million deaths yearly, if immunization programmes are expanded and fully implemented [1,2]. The main goal of immunization programmes is to reduce the incidence of vaccine preventable diseases (VPDs) by attaining high levels of routine immunization coverage with potent vaccines administered at the appropriate ages, and at the right intervals [3]. Most countries have established expanded immunization programmes, and in developing countries, children under five years of age are immunized in accordance with the standard World Health Organization (WHO) recommended vaccines that currently protect against eight diseases namely, tuberculosis, diphtheria, tetanus (including neonatal tetanus through immunization of mothers), pertussis, poliomyelitis, measles, hepatitis B, and haemophilus Influenza) [4].

In Nigeria, the Expanded Programme on Immunization (EPI) was initiated in 1979 to ensure that all children had access to routinely recommended vaccines and re-launched in 1984. [2]. This programme led to significant progress in the delivery of immunization services with 8l.5% coverage for all antigens recorded during the Universal Childhood Immunizations (UCI) days (1986-1990s).[2]. However, this achievement was not sustained as periods of fluctuation in EPI performances (interludes of declines and improvements) and a significant decline in immunization coverage were noted in the 1990s. EPI was then restructured and renamed as National Programme on Immunization (NPI) in 1997, in an effort to enhance the effectiveness of the routine immunization programme and to meet the global challenges of immunization. It was subsequently taken over by the National Primary Health Care Development Agency (NPHCDA) in May 2007 for better management, organisation and improved logistics up to the ward /Primary Health Care (PHC) level. [5]

In May 2012, Nigeria commenced expansion of existing children initiatives, with emphasis on polio eradication and strengthening of routine immunization with the replacement of Diphtheria, Pertussis and Tetanus (DPT) vaccine with pentavalent vaccine which contains more antigens (Hepatitis B and Haemophilus type B) [6]. There was introduction of pneumococcal conjugate vaccine (PCV) in 2014, introduction of single dose of inactivated polio vaccine (IPV) in 2015 and switch from trivalent (tOPV) to bivalent OPV (bOPV) in April 2016 in the routine immunization programme [7]. All these were aimed at strengthening the existing initiatives directed at the eradication of vaccine preventable childhood killer diseases.

Immunization can be routine or supplemental (immunization campaign). In Nigeria routine immunization services are provided largely through the primary health care system by the government to the populace [2]. Routine immunizations are nationally scheduled regular administrations of vaccine dosages to infants and require parents/caregivers taking the children to the health facility to receive age-appropriate doses of the antigen specific days of the week to reduce vaccine wastage since most of the vaccines are supplied in multi-dose vials [8]. National Programme on Immunization (NPI) prescribes five visits to the health facility to receive one dose of Bacille Calmette Guerin (BCG) and Hepatitis B at birth, three doses of Oral Polio Vaccine (including one IPV), and three doses of Pentavalent vaccine, at six, ten and fourteen weeks and one dose of measles vaccine and yellow fever given at nine months of age.[9,10]. It is recommended that a child should receive all immunization at the appropriate ages and intervals in order to ensure maximal protection from vaccine preventable diseases [11,12]. The percentage of children who have receive the requisite number of vaccine doses irrespective of the age at receipt of the vaccine is used to determine vaccination coverage [13] and the third dose of pentavalent vaccine is the key indicator to measure immunization programme coverage [14].

The National Demographic and Health Survey (NDHS), 2013 reported that, 25 percent of children were fully vaccinated while 21% of eligible children received no vaccination at all. Fifty-one percent received the BCG vaccine, 42% received the measles vaccine, 51% received the first dose of the DPT vaccine, while only 38% received the third dose of DPT, reflecting a dropout rate of 25% for DPT. Overall, 21% of the children received all the recommended vaccinations before their first birthday. However, in Edo State immunization coverage rate in 2013 was put at 52% [6]. Although immunization coverage in Nigeria has improved over the past 10 years, from 13 % in 2003 to 25% in 2013, it still fell short of the increase needed to achieve the MDG target of more than 90% coverage [6]. Several factors have been implicated as responsible for the low vaccination coverage in Nigeria. These include lack of maternal knowledge of immunization, lack of political will, poor attitude and mal-orientation of health workers, poor health infrastructure, religious insurgency/terrorism, and ignorance, cultural/religious aversion to vaccine acceptance or use, fear of Adverse Effects Following Immunization (AEFI), lack of awareness about availability of vaccination services, inadequate cold chain facilities and vaccine stock-outs [15-19].

Routine immunization (RI) against the childhood vaccine preventable diseases usually requires the child to make five prescribed visits to a static immunization clinic. At each visit the mother or caregivers is given appointment dates (written on the child's registration card) for the next vaccination. [20] Despite this approach, knowledge, education, and religion of mothers have been reported as major contributory factors to low immunization coverage in Nigeria. [21-24]

Although the NPI aims at delivering RI services to at least 90.0% of infants [8] inadequate levels of immunization coverage remain a significant public health challenge in Nigeria despite the fact that immunization is provided free to the people. [1,8] Unimmunized children do not only pose some risks to the immediate family, but also the community through frequent disease breaks (low herd immunity), increased financial burden to the family and early child deaths. [25]

This study measures and determines immunization coverage in Benin City PHCs facilities and provide relevant data for policy makers, program implementers and immunization service providers during planning and evaluation and serve as a baseline for further studies. the study objective was to assess immunization coverage and factors affecting childhood routine immunization coverage in primary health facilities in Benin City.

Methods

The study was carried out in PHC facilities across the three Local Government Areas (LGAs) in Benin City, Edo State, Nigeria namely, Oredo, Egor, and Ikpoba Okha. Oredo, Egor, and Ikpoba Okha. These LGAs have 12, 10 and 10 political wards respectively with 35 PHC facilities where routine immunization activities are carried out.

The study was a cross-sectional descriptive study conducted among mothers/caregivers accessing immunization/child healthcare services at the PHCs with children (0 – 23 months of age). Minimum sample size was determined using the Cochrane formula for studying single proportion and adjusted for non-response [22] using the following equation 1:

$n = (Z)^2pq\ (deff)/d^2 \ldots (1)$

where n is the the minimum sample size when population is greater than 10,000, Z= Z-score = standard normal deviate set at 1.96 corresponding to 95% confidence interval and P is the prevalence in the target population estimated to have a particular characteristic, q = 1.0 – p, *deff* is the design effect; which is 1 for simple random sampling, between 1 and 2 for systematic and stratified sampling and 2 for cluster and multistage sampling techniques. [26,27] and d is the error margin or degree of precision which is set at 5%. In this study, P was considered to be 51.0% based on the proportion of mothers dissatisfied with reception given by healthcare providers in a descriptive cross-sectional study conducted in 2010 in Calabar, Nigeria [28]. Adjustment for 10% non-response was done utilising the formula for non- response: n/(1 - nrr) [26] where; n is calculated sample size, nnr is non-response rate, (10% or 0.1) to obtain the sample size of 640.

Sampling technique

Multistage sampling technique consisting of three stages was used in selecting the mothers /caregivers from the 3 LGA (Oredo, Ikpoba Okha and Egor).

Stage 1: Selection of Wards: Oredo, Egor, and Ikpoba Okha LGAs have 12, 10 and 10 wards, respectively. Two wards were selected from each of the 3 LGAs (Oredo, Egor, and Ikpoba Okha). This was done using simple random sampling technique, by balloting from the list of wards obtained from the PHC department in each LGA, making a total of 6 wards.

Stage 2: Selection of PHCs: All the selected wards had one PHC each thus all the PHCs within the selected 6 wards were used for the study.

Stage 3: Selection of mothers/caregivers: Systematic sampling technique was used to select the mothers/caregivers. This was done by doing proportional allocation to size to obtain the sample size of mothers/caregivers that was selected from each of the selected PHCs and then using a sampling fraction of 0.35 was estimated (Calculated sample size / Total monthly attendance for immunization in all selected PHC). Then every nth number was obtained till sample size was achieved.

Data collection

Data were collected by the primary investigator and five trained Community Health Extension Workers (CHEWs). The research assistants were trained for 2 days to master the act of collecting uniform information from the respondents and filling the questionnaires appropriately. They were also trained on how to obtain informed consent from participants, interview techniques, administering questionnaire and observation techniques. The filled questionnaires were screened for completeness by the researcher, coded and entered into the IBM SPSS statistics 21.0 software.

Scoring and classification

Immunization status

It was categorized as either Incompletely immunized (if the child missed at least one vaccine) or Completely immunized (if the child receives all vaccines due to his/her age). Immunization dropout rate was for each vaccine was defined using measles or Pentavalent III as proxy vaccines as "the percentage of children vaccinated with the vaccine who eventually did not receive measles or Pentavalent vaccine" [29]. Thus BCG/measles dropout rate (over all dropout rates) was given as equation 2 while Pentavalent I to Pentavalent III dropout rate was calculated as in equation 3. Similarly, Pentavalent I to Measles dropout rate was calculated as in equation 4 and immunization coverage rate for antigen was calculated as in equation 5 [29]..

$$\frac{No.\ of\ children\ who\ received\ BCG - No.\ of\ children\ who\ received\ Measles}{No. of\ children\ who\ received\ BCG} x\ 100\% \quad \ldots.. (2)$$

$$\frac{No.\ of\ children\ who\ received\ Pentavalent\ I - No.\ of\ children\ who\ received\ Pentavalent\ III}{No. of\ children\ who\ received\ Pentavalent\ I} x\ 100\% \quad \ldots.. (3)$$

$$\frac{No.\ of\ children\ who\ received\ Pentavalent\ I - No.\ of\ children\ who\ received\ Measles}{No. of\ children\ who\ received\ Pentavalent\ I} x\ 100\% \ldots.. (4)$$

$$\frac{No.of\ doses\ of\ vaccines}{No.of\ target\ population\ of\ infants\ under\ 1\ year\ of\ age} x100\ ....(5)$$

Data analysis

The retrieved questionnaires were screened for completeness by the researcher, coded and entered into the IBM SPSS statistics 21.0 software. Categorical variables (sex, educational status, ethnicity, marital status, etc.) were presented as frequencies and percentages while numerical variables (age, and years in service) that were normal in distribution was expressed as mean (standard deviation). As appropriate, Chi-squared or Fisher's exact test was used to analyse proportional data while binary logistic regression was modelled to explore and identify significant predictors of complete routine immunization at the PHC facilities in the LGAs. At 95% confidence interval, p values less than 0.05 were considered significant

Ethical considerations

Ethical clearance to conduct this research was sought and obtained from the University of Benin Teaching Hospital Ethics and Research Committee. Permission was sought from the Permanent Secretary, Edo State Hospital Management Board and Chairpersons of the Local Government Areas. Institutional permission was sought and obtained from the Primary Health Care Coordinators, and Heads of the health facilities. Written informed consent was obtained from each respondent before conducting interviews, while confidentiality and privacy of each respondent was respected during the interviews. Health education on importance of immunization was given to the mothers/caregivers and healthcare workers, respectively at the end of the interview sessions.

Results

Majority of the children (477, 74.5%) were aged 5 months or less and were males (4.4 ± 3.5 months) with mean age (SD) being 4.2 (3.5) months. Majority (497, 77.7%) were delivered in hospitals, 604 (94.4%) were born to parents who are Christians, and 331 (51.7%) of the children were of the Bini ethnic group (Table 1).

All caregivers reported vaccinating their index child and 545 (85.2%) children were completely immunized for age. Some of the caregivers/mothers (625, 97.7%) presented with their vaccination cards while 15 (2.3%) had immunization cards but the rest did not present their cards even though they had them. Most (98.4%) of the children received BCG, first doses of OPV, PENTA and PCV while 118 (72.4%) and 119 (73.0%) received measles and yellow fever vaccines respectively.

Table 1: Socio-demographic characteristics of the children

Variable	Frequency (n = 640)	Percent
Age (months)		
0 – 5	477	74.5
6 – 11	131	20.5
12 – 17	27	4.2
18 – 23	5	0.8
Mean (+sd) = 4.2±3.5		
Gender		
Male	331	51.7
Female	309	48.3
Place of delivery		
Health facility	497	77.7
Home	120	18.8
TBA's home	23	3.5
Religion of parents		
Christianity	604	94.4
Islam	27	4.2
ATR	6	0.9
Others*	3	0.5
Ethnicity		
Bini	331	51.7
Igbo	76	11.9
Ishan	59	9.2
Yoruba	39	6.1
Urhobo	35	5.5
Owan	18	2.8
Delta Ibo	16	2.5
Afemai	13	2.0
Isoko	10	1.6
Others**	43	6.7

Mean age (Males) = 4.4±3.7months; Mean age (Females) = 3.9±3.2; t = 1.806 (p = 0.071)

Table 2: Vaccination coverage per antigen for the child

Variable	Frequency (n = 640)	Percent
Vaccination coverage due for age*		
BCG (n = 640)	630	98.4
OPV1 (n = 640)	640	100.0
OPV2 (n = 520)	520	100.0
OPV3 (n = 399)	398	99.7
PENTA1 (n = 640)	640	100.0
PENTA2 (n = 520)	520	100.0
PENTA3 (n = 399)	359	90.0
PCV1 (n = 640)	640	100.0
PCV2 (n = 520)	505	97.1
PCV3 (n = 399)	338	84.7
Measles (n = 163)	118	72.4
Yellow fever (n = 163)	119	73.0

*Dropout rate (BCG/Measles) = 26.0%; Dropout rate (PENTA1/Measles) = 19.5%; Dropout rate (PENTA1/PENTA3) = 10.0% *multiple response*.

Table 3: Socio-demographic characteristics of caregivers and child's immunization status

Variable	Immunization status		Test statistic	p value
	Complete immunization (n=545) n (%)	Incomplete immunization (n=95) n (%)		
Child age (months)				
0 – 5	456 (95.6)	21 (4.4)	Fishers exact = 175.386	**< 0.001***
6 – 11	78 (59.5)	53 (40.5)		
12 – 17	10 (37.0)	17 (63.0)		
18 – 23	1 (20.0)	4 (80.0)		
Sex of index child				
Male	281 (84.9)	50 (15.1)	$\chi^2 = 0.037$	0.847
Female	264 (85.4)	45 (14.6)		
Place of delivery				
Hospital	472 (95.0)	25 (5.0)	$\chi^2 = 170.120$	**< 0.001***
Home	60 (50.0)	60 (50.0)		
TBA	13 (56.5)	10 (43.5)		
Age (years)				
< 30	207 (86.6)	32 (13.4)	$\chi^2 = 1.193$	0.755
30 – 39	278 (83.7)	54 (16.3)		
40 – 49	51 (86.4)	8 (13.6)		
≥ 50	9 (90.0)	1 (10.0)		
Marital status				
Ever married	529 (85.0)	93 (15.0)	Fishers exact = 0.204	0.999
Never married	16 (88.9)	2 (11.1)		
Household size				
≤ 4	230 (87.1)	34 (12.9)	$\chi^2 = 1.742$	0.419
5 – 8	300 (84.0)	57 (16.0)		
≥ 9	15 (78.9)	4 (21.1)		
Level of education				
No formal education	72 (84.7)	13 (15.3)	$\chi^2 = 1.403$	0.705
Primary	309 (84.4)	57 (15.6)		
Secondary	139 (85.8)	23 (14.2)		
Tertiary	25 (92.6)	2 (7.4)		
Socioeconomic status				
Class I	2 (100.0)	0 (0.0)	Fishers exact = 1.060	0.880
Class II	20 (90.9)	2 (9.1)		
Class III	113 (86.9)	17 (13.1)		
Class IV	274 (84.3)	51 (15.7)		
Class V	136 (84.5)	25 (15.5)		
Knowledge of immunization				
Poor	214 (86.6)	33 (13.4)	$\chi^2 = 0.793$	0.673
Fair	64 (83.1)	13 (16.9)		
Good	267 (84.5)	49 (15.5)		

**Statistically significant*

Some of the caregivers (86.4%,) aged 40 – 49 years) had index children that were completely immunized for age compared to 278 (83.7%) of those aged 30 – 39 years. There was no statistically significant association between the marital status of the caregivers and the completion of immunization for age (p = 0.670). Two hundred and thirty (87.1%) of the children who had household sizes of 4 or less were completely immunized compared to 15 (78.9%) of those who had sizes of 9 and above.

Seventy-eight (59.5%) of 477 index children aged 6 – 11 months were completely immunized for age compared to one (20.0%) of five aged 18 – 23 months (p < 0.001). There was no statistically significant association between the sex of the index child and their completion of immunization by age (p = 0.847). Majority (472, 95.0%) of the 498 index children who were delivered in hospitals were completely immunized for age compared to 60 (50.0%) of the 120 who were delivered at home (p < 0.001).

There was no statistically significant association between the caregivers' level of education and the immunization status of their wards (p = 0.705). All index children in Social Economic Status (SES) class I were completely immunized for age compared to 136 (84.5%) of those in

Table 4: Bivariate regression analyses of the predictors of complete immunization

Predictors	B (regression coefficient)	p-value	Odd Ratio	95% C.I.for Odd ratio	
				Lower	Upper
Child age (months)					
≤3 months	2.533	**<0.001**	12.588	6.481	24.448
≥4 months*	1				
Delivery place					
Hospitals	2.949	**<0.001**	19.083	10.502	34.675
Others*	1				
Caregivers age (years)					
< 40*	1				
≥ 40	0.084	0.864	1.087	0.419	2.822
Marital status					
Ever married	0.102	0.918	1.108	0.157	7.801
Never married*	1				
Household size					
≤ 4	0.482	0.123	1.619	0.878	2.984
> 4*					
Caregivers level of education					
Primary or less	0.782	0.084	2.185	0.901	5.300
Secondary/tertiary*	1				
Employment					
Yes	0.099	0.827	1.104	0.454	2.681
No*	1				
Socioeconomic status					
Classes I – III	0.839	0.096	2.313	0.862	6.205
Classes IV and V*	1				
Constant	-2.151	0.088	0.116		

*Reference category; Coefficient of determination (R^2) = 28.9% – 50.9%; **Significant**; C.I=confidence interval

SES class V (p = 0.880). There was also no statistically significant association between the caregivers' knowledge of immunization and the completion of immunization in the index child (p = 0.673).

Children aged 3 months or less were 12.588 times more likely to be completely immunized for age compared to their older counterparts. This was statistically significant (p = 0.000). This was also the case for children born in hospitals who were 19.083 times more likely to be completely immunized for age compared to those delivered in other places

Discussion

All the caregivers reported vaccinating the index child and presented their vaccination cards. Most of the index children were completely immunized for age with an immunization coverage of 85%. Similar rates had been reported in India [30] and Ethiopia [31] where majority of the children were completely immunized for age. The current finding is however at variance with the lower immunization rates of less than 25% obtained from some Nigeria studies [32,33] and another carried out in Ethiopia [17]. The discrepancy in coverage rates may be due to social, geographical and cultural factors. Nonetheless the high coverage rate noted among the children in this study is in excess of the goals of the Global Immunization Vision and Strategy (GIVS) which set at least 80% vaccination coverage in every district [33]. The coverage rate of 85% noted in this study is different from values obtained in a study carried out in Edo State where immunization coverage according to the NDHS 2013, was 52% and other studies conducted in the Southern part of Nigeria that also fell short of the GIVS goal [34]. The disparity in immunization coverage within the country may reflect the variation in effectiveness of immunization campaign in various localities outside other influences such as vaccine supplies, level of maternal literacy, employment and poverty.

High immunization coverage rates were recorded for BCG, Pentavalent, OPV3, PCV3, Yellow fever, and measles vaccines in this survey, and these rates are comparable to those obtained in a previous study in Benin City that also had high coverage rates for BCG, OPV3/DPT3, measles, and Yellow fever [34]. The coverage rates for BCG, OPV1, PENTA1 and PCV1 was above 80% with progressive reduction in rates with subsequent doses of OPV, PENTA and PCV. The coverage rates in this study are comparable to the 2015 immunization coverage goals of the Nigeria comprehensive multi-year plan of eighty seven percent for infants for all antigens in the routine schedule [35] and the WHO-UNICEF estimates for Nigeria for BCG, DPT3, OPV3, and measles.[36]Nigeria is among the twelve countries at risk of yellow fever[33] therefore this low coverage rates for yellow fever vaccination could spell potential danger of large scale outbreaks of the disease in the country.

Oral polio vaccine coverage was slightly higher than the coverage rate for pentavalent vaccines. From first to subsequent doses there were reductions in coverage rate for these vaccines this could be due to mother's/caregivers non-compliance with immunization and also the long time interval between the doses may cause mothers to forget the subsequent doses. The dropout rate (Penta-1 to Penta-3) was ten percent, Penta-1 to measles nineteen percent and overall BCG to measles dropout rate was twenty-six percent. These figures are higher than the WHO international dropout rate goal set at 10% [37]. The figure in this study is however less than the 35% Penta-1 to Penta-3 dropout rate obtained in an Ethiopian study [38]. High coverage rate for the first doses of multi dose vaccines may indicate good utilization of primary health care facilities while the high dropout rate between the early and final doses of the vaccine series may be attributable to health system barriers to re-attendance, failure to educate mothers of the need to return, or inadequate tracking of children registered at the health facility. This could be indication that healthcare interventions need to focus not only on initiating immunization, but also concentrating on motivating mothers to complete the immunization schedule. One of such effective ways of improving routine immunization coverage rates is the immunization reminder/recall system which involves following up the caregivers through phone calls/text messages [39]. The improvement can also be achieved through the Reach Every Ward (REW) approach which is expected to develop the capacity of health workers at PHCs to identify and reduce dropouts by ensuring quality and un-interrupted immunization services at fixed outreach and mobile sites [35].

In this study the routine administrative immunization coverage in the health facilities revealed that immunization coverage in some vaccines were greater than 100% and reduction in the immunization coverage of subsequent vaccines given at the end of the NPI schedule. This trend could be due to underestimation of children qualified to receive immunization, paucity of data available for planning immunization sessions, a mid-year change in target age groups, inclusion of children outside the target age group in the numerator, and also non-compliance with the established protocol due to poor training and supervision.

The national immunization policy recommends that all vaccines be made available at immunization centers every day, but this was not the case as observed in this study. About a tenth of the index children surveyed at the health facilities were not vaccinated. This was due to non-availability of immunization services, facilities restriction of administration of certain antigens to certain days and limitation of the number of persons attended to during an immunization session. Similar findings have also been reported in a Nigerian study [40] where about a tenth of the children were not vaccinated due non-availability of vaccines. The implications of frequent non-availability and stock-outs of vaccines in PHCs are delayed vaccination, missed opportunities and incomplete immunization of children. Most outstanding reason for missing scheduled immunization in this study was lack of vaccine, this was also the most reported reason given for missed opportunity in studies carried out in Benin City. [12] and Ibadan [39].. The lack of vaccines may be due to the fact that supplies were not available to the health facilities occasioned by logistic problems (transportation, poor distribution networks) and reduced motivation on the part of the health workers in the PHCs who may be owed salaries. Other reasons would include inability of the health workers to properly forecast the vaccine needs of the health center, since there was no report of vaccine shortage in the country during the period of the study as long waiting time and visit on the wrong day were the other reasons given for missed opportunity for immunization in this study .

Conclusion

Majority of the children were completely immunized for age and immunization coverage was 85 percent. Socio-demographic factors that influenced immunization status included age of the index child, place of delivery and level of education of the caregiver.

List of abbreviations

VPD: vaccine preventable disease, OPV: oral polio vaccine, PENTA: pentavalent vaccine, OR: odds ratio, RI: routine immunization, NPI: national programme on immunization, SES: social economic status.

Declarations

Ethics approval and consent to participate

Approval for the study was obtained from the Ethics

Committee of the University of Benin Teaching Hospital Ethics and Research Committee, Benin City.

Consent for publication

Not applicable.

Availability of data and materials

The data and materials used in this study are available from the corresponding author on request.

Competing interest

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Contribution of authors

We declare that this work was done by authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors.

UNE conceived and designed the study, collected the data and wrote the manuscript, OES read and approved the manuscript for publication.

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