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Demand-side Factors Affecting Routine Immunization Uptake in the Delta of Bayelsa State, Nigeria: A Cross-Sectional Analytical Study

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ABSTRACT

Immunization, a key tool of primary health care and a critical line of defence against many diseases in vulnerable groups, is one of the most cost effective interventions of man. However, suboptimal immunization of children in Bayelsa state has resulted in the outbreak of disease epidemics. This study assessed demand-side factors affecting uptake of routine immunization. A cross sectional analytic study design was employed. Data was collected, using a pilot-tested structured questionnaire, which was retrieved and analysed using multiple logistic regression. Distance from health facility (AOR – 2.564, p value< 0.01) was found to significantly affect uptake of vaccination. This is probably due to the deltaic terrain of Bayelsa State and the long travel time of riverine journeys. There is need to ensure that immunization services are brought closer to the people through investments in systems that ensure easy access to life-saving vaccines by vulnerable groups.

Keywords: *Demand side factors, Immunization completion, Deltaic terrain, Distance from health facility.*

INTRODUCTION

Immunization is considered one of the most cost-effective health care interventions ever devised by man (12, 18, 23). It has been the bed rock of Primary health care and remains a veritable tool for the prevention of many childhood killer diseases (18, 23). It has demonstrated significance in the drive towards disease elimination and/or eradication, worldwide, and is also considered a critical gateway for the delivery of life saving health care programs in an integrated context. It is also quite often volunteered as a backbone upon which health care delivery systems can be built and sustained (18, 23).

Immunization is also considered as the first line of defence against disease and one of the most effective health advantages available to vulnerable groups, particularly children (18). In consonance with the foregoing, it is considered necessary to vaccinate children with certified and recommended antigens, within a given time frame, but even more recently over the life course (21). In this regard, it is estimated that, over the past fifty years, routine immunization against infectious diseases has saved over one hundred and fifty million lives of children, particularly those under five years of age (17, 19).

In Low-and-Middle-Income-Countries, such as Nigeria, administration of vaccines at appropriate ages and specified time periods, as well as, completeness of same, are crucial to the reversal of poor health outcomes for children, especially, and adults as well (22). This is because, in Nigeria, vaccine preventable diseases are noted to be the major contributors to high child morbidity and mortality, accounting for over two hundred thousand deaths per annum and seven hundred thousand deaths, in the year 2018, particularly (8, 17,18).

Furthermore, whereas, in Nigeria, it is recommended that children under two years of age be given one dose of BCG and Hepatitis B vaccines, four doses of Oral Polio Vaccine, three doses of Pentavalent vaccine, three doses of Pneumococcal Conjugate Vaccine, two doses of Inactivated Polio Vaccine, three doses of Rota virus vaccine, two doses of Measles Conjugate Vaccine, one dose of Meningitis A vaccine and one dose of Yellow Fever vaccine; vaccination completion rates continue to remain suboptimal (14). For instance, there were over 2.2 million estimated zero-dose children in the year 2021 and the numbers seemingly do not abate (20). The contextual significance of the foregoing is even more glaring when the contribution of the abysmally poor routine immunization coverage rates of Bayelsa State on the DHIS reporting platform, put at 29% in 2019, 23.3% in 2020, 27.3% in 2021, 37% in 2022, in this regard, is interrogated.

The foregoing context gives impetus for remedial action informed by evidence. This study, therefore, investigated the demand side factors affecting the uptake of routine immunization in the delta of Bayelsa State, Nigeria with a view to providing evidence for informing this action.

Aim of study

The study aims to assess the demand side factors affecting routine immunization uptake in Bayelsa State which is entirely situated within the Niger Delta region.

Objectives

1. To determine the demand-side factors that affect the uptake of routine immunization in Bayelsa State, Nigeria.
2. To determine cross-cutting factors that affect the uptake of routine immunization in Bayelsa State, Nigeria.

MATERIALS & METHODS

Study design

A cross-sectional analytical study design was employed for this study.

Study area

The study was conducted in the central senatorial district of Bayelsa state, Nigeria. The district consists of three Local Government Areas namely: Yenagoa Local Government Area (YELGA), Southern Ijaw Local Government Area (SILGA), and Kolokuma/Opokuma Local Government Area (KOLGA). Each Local Government Area is made up of wards. The total number of wards in the district is forty-three, with the following distribution: YELGA - fifteen wards, SILGA - seventeen wards and KOLGA - eleven wards. The total number of primary health care facilities in the district is ninety-three, with the distribution as follows: YELGA - thirty-five primary health care facilities, SILGA - forty-two primary health care facilities and KOLGA - sixteen primary health care facilities. The total population in the district is 1,250,613 with the following distribution: YELGA – 591, 118, SILGA – 533, 857, KOLGA – 125, 638. The topography of the area is 80 - 90% riverine and is typically deltaic.

The Study Population

The study population comprised caregivers residing in the ward who attend the primary healthcare facility for their children's routine immunizations.

Sample size

The sample size for caregivers was calculated using the following formula:

Sample Size $(n) = \frac{z^2pq}{d^2}$

Where, Z= 1.96 (at 95% confidence interval)

P = 59% {Proportion of children completely vaccinated; (23)}.
q= 1-P
d = 0.05 (Degree of precision).

$$n= \frac{1.96^2 x 0.59(1-0.59)}{0.05^2}$$

$$n= \frac{3.8416 x 0.59(0.41)}{0.0025}$$

n= 371.71 = 372
10% non-response rate = 371 x 0.1 = 37.1
n = 37.1 + 371 = 408

Sampling technique
Multistage sampling technique was used to select the respondents for the study.
Stage 1 - Selection of Sample frame
The central senatorial district of Bayelsa State, Nigeria was selected from the three senatorial districts which make up the total districts in Bayelsa State, using simple random sampling. The central senatorial district thus formed the sampling frame.

Stage 2 – Stratification of Wards and (Primary Health centres) into clusters
The wards of the three Local Government Areas, which make up the central senatorial district were stratified into clusters based on catchment area population of each ward, with KOLGA as the reference and/or base Local Government Area (since it was the one with the least number of wards). The primary health centres were clustered based on the corresponding ward catchment area population. There emerged a total of thirty-three Clusters (eleven clusters per Local Government Area). To effectively do this, use was made of secondary data collected from the public health department of the Local Government Area. The secondary data included the list of wards and their populations, the primary health care facilities in the ward, the catchment area populations of the primary health centres and the communities served by these health facilities.

Stage 3 - Selection of Primary health care centres
An equal number of Primary health care centres were selected for each Local Government Area, from each cluster, using simple random sampling. Thus, eleven primary health care centres were selected from each Local Government Area through this process. The catchment area population for the selected Primary health care centre thus formed the population for the selection of participants for the study. To do this effectively, the secondary data collected in stage 2 above was used.

Stage 4: Selection of participants
Caregivers – Caregivers were selected from the catchment area population of the selected Primary Health Centres using systematic sampling technique. The sampling interval for this was every third household in the selected communities per ward. Where there was more than one caregiver in the household the participant was selected using simple random sampling.

Study instrument
A semi-structured questionnaire was used as the study instrument. The questionnaire comprised of two sections.

a. Section A – Interrogated Sociodemographic characteristics of the study population.
b. Section B - Interrogated demand side factors affecting uptake of routine immunization through assessment of caregivers' perception and knowledge of childhood immunization services (inclusive of recall of child vaccination history and checking of child immunization records/cards).

STATISTICAL ANALYSIS

Data was analysed using SPSS Version 25. Descriptive statistics (means, frequencies and percentages, as appropriate) were computed for all variables. These data were reviewed to check for outliers, missing data, and "cells" with low frequencies that might hinder stable statistical analysis. Unadjusted/Adjusted associations were next assessed using binary logistic regression models with odds ratios at 5% alpha level and 95% confidence interval. The choice of

binary logistic regression was due to the dichotomous nature of the outcome variable.

RESULT

Sociodemographic characteristics of respondents

The Sociodemographic characteristics of respondents (caregivers) are shown in table 1 (n =387). Most (98.7%) of the participants were female {n =382} while the remainder (1.3%) were males {n = 5}. The mean age of the participants was 28.89, with the following age ranges: Age less than 18years {n = 7(1.8%)}, 18-25 years {n = 120(31.0%)}, 26-30 years {n = 117(30.2%)}, 31-40years {n = 128(33.1%)}, 41 years and above {n = 15(3.9%)}. 62.3% {n = 241} of the total number of participants were married, 20.4% {n = 79} were cohabiting, 17.1% {n = 66} were single and 0.3% {n = 1} were widowed. The statistics in respect of parity was 70.5% {n = 273} had 1-3 children, 27.4% {n = 106} had 4-6 children, while 2.1% {n = 8} had 7 or more children. As per educational status, 10.3% {n = 40} had no formal education, 9.0% {n = 35} had primary education, 69.0 % {n = 267} had secondary education, and 11.6% {n = 45} had tertiary education. Furthermore, whilst 72.6% {n = 281} of the participants did not report use of vehicular transport to the health facility, 27.4% {n = 106} reported use of one or other means of transportation to the health facility. For this latter group the specifics are as follows: 11.9% {n = 46} used motorcycles, whilst tricycle, boats and car accounted for 10.3% {n = 40}, 4.9% {n = 19} and 0.3% {n = 1} respectively. See table 1.

Table 1: Sociodemographic characteristics of respondents

Variable	Frequency (n)	Percentage (%)
Sex		
Male	5	1.3
Female	382	98.7
Age		
< 18 yrs	7	1.8
18 - 25 yrs	120	31
26 - 30 yrs	117	30.2
31 - 40 yrs	128	33.1
41 yrs & above	15	3.9
Marital Status		
Married	241	62.3
Cohabiting	79	20.4
Single	66	17.1
Widowed	1	0.3
Educational Level		
None	40	10.3
Primary	35	9
Secondary	267	69
Tertiary	45	11.6
Use of Motorised Transport		
Yes	281	72.6
No	106	27.4
Type of Transport		
Boat	19	4.9
Car	1	0.3
Motorcycle	46	11.9
Tricycle	40	10.3
Number of Children		
1 to 3	273	70.5
4 to 6	106	27.4
7 and above	8	2.1

Occupation of respondents

The respondents were engaged in a wide array of occupations principal among which were the following: 25.8% {n = 100} were businesswomen, 10.3% {n = 40} were farmers, 2.1% {n = 8} were civil servants, 0.8% {n = 3} were patent medicine vendors (PMV), and 0.5% {n = 2} were boat drivers. Furthermore, 5.9% {n = 23} of the respondents were fashion designers and/or tailors, 2.6% {n = 10} were fishers, 5.4% { n = 21}were hair dressers, , 7.2% {n = 28} were house wives, 16.8% {n = 65} were petty traders, 2(0.5%) were self-employed, 21(5.4%) were students, 3(0.8%) were teachers, 0.3% { n = 1} were health workers, and 7.2% { n = 28} were unemployed. There were also respondents engaged in farming and business, farming and fishing as well as farming and trading accounting for 1.6% { n = 6}, 0.3% { n = 1}, 6.2% { n = 24} respectively. See Figure 1.

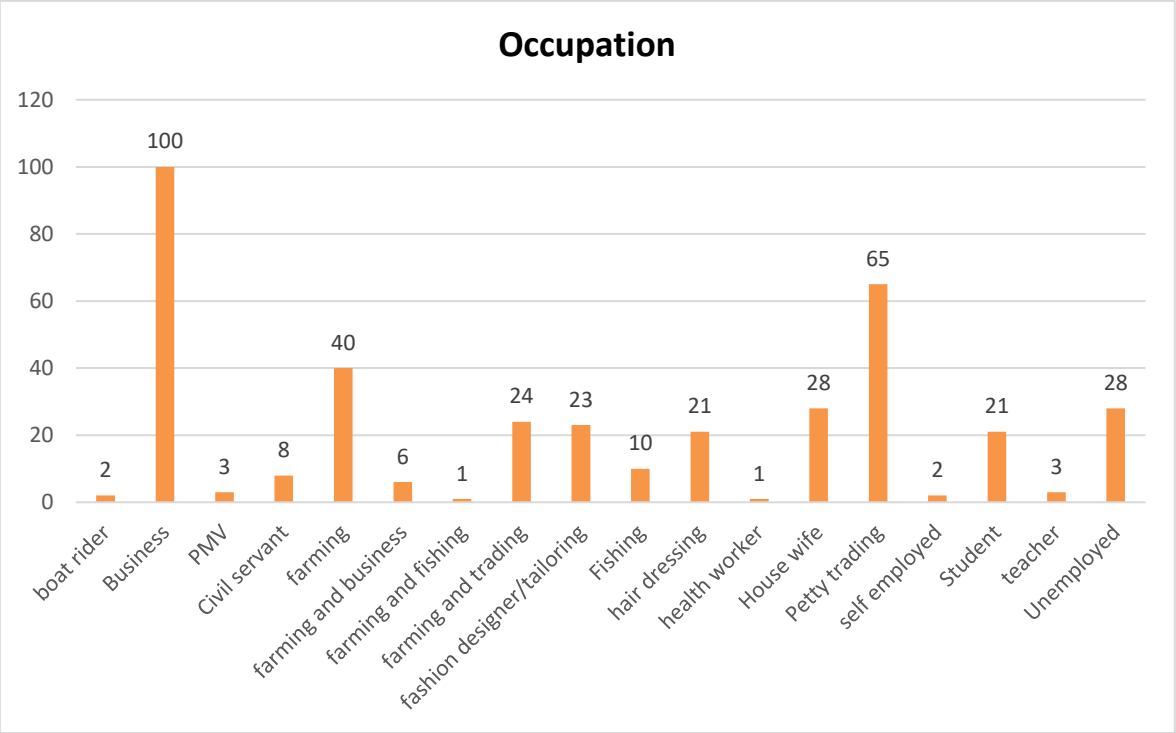

Figure 1: Occupation of participants

Caregivers' Knowledge of Antigen Administered

The data representing knowledge of vaccine antigens administered showed that 71.3% {n = 276} of the respondents had knowledge of the vaccine antigen administered on their child while 28.7% {n = 111} had no knowledge of the antigen administered on their child. The percentage distribution, per antigen, in this regard were as follows: BCG 7.5% {n = 29}, OPV0 7.5% { n = 29}, PENTA1 4.7% {n = 18}, OPV1 4.7% {n = 18}, PENTA2 11.1% {n = 43}, OPV2 11.1% {n = 43}, PENTA3 18.9% {n = 73}, OPV3 18.9% {n = 73}, YF 25.1% {n = 97}, and Measles 29.7% {n = 115}. See Figure 2.

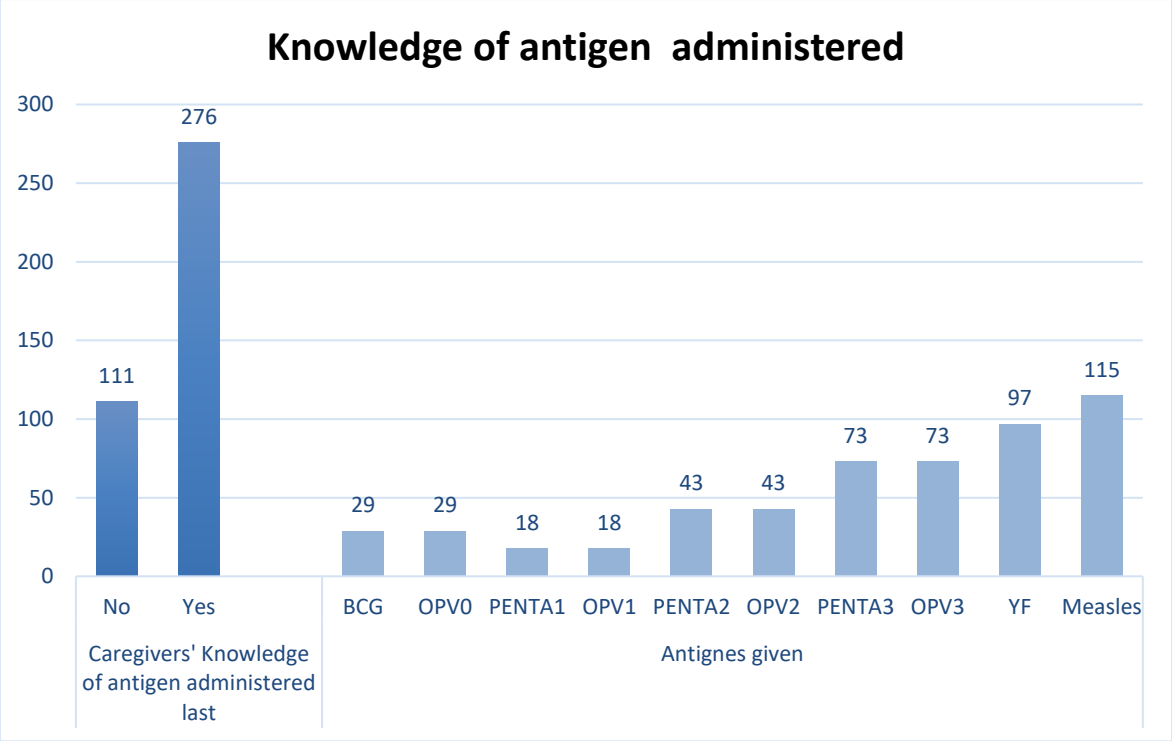

Figure 2: Caregiver knowledge of Antigen administered

Child vaccination information

The results in this respect considered type and place of delivery, age at vaccination, and evidence of vaccination (possession of vaccination card). Of the total number of respondents 62% {n = 240} were delivered by Traditional Birth Attendants (TBA's) while 38.0% {n = 147} were delivered by Skilled Birth Attendants in hospital and/or a health facility. Furthermore, 94.3% {n = 365} of the respondents had evidence of vaccination (possessed a vaccination card), while 5.7% {n = 22} did not. Age at vaccination of child reported by respondents were two weeks 4.7% {n = 18}, four weeks 11.4% {n = 44}, twelve weeks 23.3% {n = 90}, twenty four weeks 19.1% {n = 74}, Thirty- six weeks 15.2% {n = 59}, Forty eight weeks 23.5% {n = 91}. See Table 2.

Table 2: Child vaccination information

Variable	Frequency (n)	Percentage (%)
Place of Birth		
Hospital/Health Facility	147	38
TBA	240	62
Evidence of Vaccination		
Yes	365	94.3
No	22	5.7
Age at Vaccination (Weeks)		
Two	18	4.7
Four	44	11.4
Twelve	90	23.3
Twenty Four	74	19.1
Thirty Six	59	15.2
Forty Eight	91	23.5

Child vaccination status

For this parameter, 81.9% {n = 317} of respondents had their children completely vaccinated while for 18.1% {n = 70} the children were incompletely vaccinated. See figure 3.

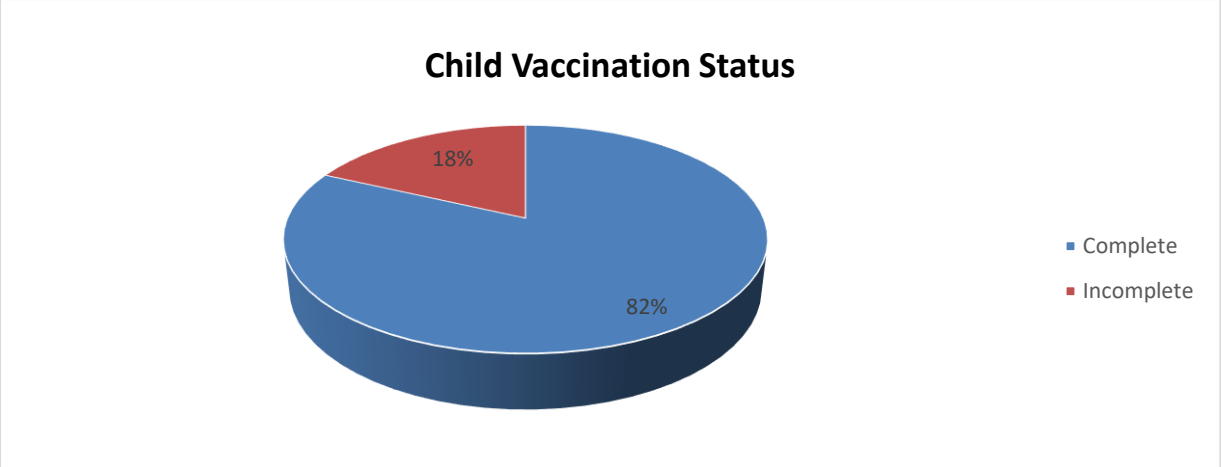

Figure 3: Child Vaccination Status

Factors Affecting completeness of child Vaccination

The results of Binary logistic regression on the association between vaccination completeness and Sociodemographic data revealed that use of transport to health facility was significantly associated with completeness of vaccination (P =0.023). After adjusting for other factors, the odds of completion of vaccination for a child whose attendance at immunization site was not dependent on vehicular transport to the health facility or vaccination site was 0.5 times higher than those that were dependent on transport (AOR: 0.524; 95% CI=0.300-0.917). Similarly, there was a strong association between Local Government Area (LGA) and vaccination status of child (P<0.05). After adjusting for other factors, the odds of a participant in KOLGA to have complete child vaccination status was 2.5 times higher than those in SILGA (AOR: 2.564; 95% CI=1.240-5.299). Also, there was a significant association between Ward and vaccination status of child (P<0.05). After adjusting for other factors, the odds of a participant in Sabagreia ward to have complete child vaccination status was 10.5 times higher than those in Olodiama 1ward (AOR: 10.544; 95% CI=1.0240-846.0). See Table 3.

Table 3: Summary table of Binary logistic regression between vaccination completion and Sociodemographic data

Variable	Category	COR	P value	AOR	P value
Age	Caregiver's age	1.007	0.735	1.043	0.293
Sex	Male (Reference)				
	Female	0	0.999	0	0.999
Marital Status	Married		0.476		0.607
	Cohabiting	1.296	0.45	0.69	0.489
	Single	1.85	0.133	1.673	0.439
	Widowed		1	0	1
Occupation	Boat Driver		1		1
	Business Woman		0.999		0.999
	Petty Trading	2.167	0.396	1.472	0.722
	Patent Medicine Vendor	0.528	0.278	0.309	0.178
	Civil Servant		0		0.999
	Farmer	0.5	0.479	0.262	0.341
	Fashion Designer	0.622	0.439	0.299	0.204
	Fishing	3.667	0.261	3.17	0.398
	Hair Dressing	1.5	0.732		0.999
	Health Worker	0.417	0.227	0.298	0.211
	House Wife		1		1

	Student		0.999		0.999
	Teacher	1	1	0.5	0.518
	Unemployed		0.999		0.999
Educational Level	None (Illiterate)		0.711		0.498
	Primary	0.482	0.243	0.619	0.568
	Secondary	0.636	0.368	1.435	0.612
	Tertiary	0.661	0.502	1.997	0.463
Use of Transport to Health Facility	No (Reference)				
	Yes	0.42	0.002	0.524	0.023
LGA	KOLGA (Reference)	0	0	0	0
	SILGA	2.927	0.003	2.564	0.011
	YELGA	0.577	0.072	0.577	0.075
Ward	Sabagreia (Reference)				0.003
	Odi North		0.997		0.998
	Sampou/Kalama	10.5	0.001	0.565	0.452
	Opokuma North	26.833	0	0.127	0.051
	Olodiama 1	203	0	10.544	0.048
	Olodiama 2	29.273	0	1.809	0.423
	Igbomotoru	28	0	12.571	0.023
	Atissa 2	45.5	0	0.222	0.177
	Epie 3	38.5	0		0.999
	Gbarain 3		0.997		0.998
Key: COR - Cumulative Odds Ratio **AOR -** Adjusted Odds Ratio					

DISCUSSION

Immunization of target groups continues to be a key preventive strategy for the elimination and eradication of deadly vaccine preventable diseases worldwide and is particularly crucial for safeguarding the health of populations, especially children under five years of age, in Nigeria, sub-Saharan Africa, and Africa. To this end, the central foci of investigation in this study, were the demand-side factors that determine the decision to vaccinate and complete same in a delta, using the central senatorial district of Bayelsa state, Nigeria as a focal point. The overall intent being the proposition of remedial actions to any niggling factors identified.

The findings of the study suggest that women are the major caregivers with most of them being married, multiparous, and having secondary level education. They were also mostly attended to, at confinement, by a Traditional Birth Attendant or by relatives at home and had documented evidence of child vaccination (vaccination card). However, whilst place of delivery is considered to have an effect on early entry into the vaccination program and thus vaccination completion rates, in this study, there was no correlation between these parameters. This could be due to the renewed drive for initiation of early entry into the vaccination program in Bayelsa state through line listing and vaccination of new-borns, irrespective of location and circumstance, through the use of community liaison personnel and community vaccination teams. These findings are corroborated by those of the systematic review in Africa and specific studies in Ethiopia, which posit that marital status, number of children, maternal educational level and place of delivery are significant determinants of child vaccination (6, 9).

However, these summary findings, in this study, are in keeping with findings from other studies in Nigeria which reported similar results (19) but are different from those of Ayodele et al, which uphold the significance (AOR = 2.0, 95% C.I: 1.0-4.1) of place of birth and retention of evidence of vaccination (AOR = 18.1, 95% C.I: 8.1-40.7) as a determinant of vaccination completion (5). Also, the results in respect of the relationship between possession and/or retention of evidence of vaccination (vaccination card) and vaccination

completion, in this study, is in keeping with previous studies in Nigeria, Lao People's Republic and Pakistan; though the completion rates in the Lao People's Republic and Pakistan studies were somewhat lower (3, 10, 15).

Furthermore, whereas a similar study in Lao People's Democratic Republic, by Hachiya et al, and the systematic review in Africa, by Galadima et al, provide evidence that full and complete immunization of eligible children was related to maternal and/or paternal level of education as well as parental occupation such that children of those with higher levels of education and better vocations, in terms of job description and remuneration, were more commonly completely vaccinated compared to other groups (9, 10), these findings are not in keeping with those of this study as parental level of education and occupation did not significantly affect child vaccination status. This variation could be due to the scope and location of the comparator studies; the comparator studies being a nationally-oriented population-based studies (9, 10).

Significantly, however, the study by Hachiya et al, in Laos, corroborate the findings in this study that caregiver age was not associated with immunization completion in children; just as did the studies by Umoke et al, in Nigeria and Alabadi et al, in Saudi Arabia which determined that caregiver marital status and occupation (as well as knowledge of administered antigen), respectively, had no correlation with immunization completion rates in their children (4, 10, 18). However, it is pertinent to note that, Alabadi et al, in Saudi Arabia, and Galadima et al, found that caregiver and/or maternal age ($p<0.05$) was a significant factor affecting vaccination completion rates in children (4, 9).

Furthermore, in this study, distance from and access to health facilities emerged as significant factors influencing vaccination completion across all study areas. Vaccination completion rates decreased as the distance to health facilities increased and access became more challenging. This trend may be attributed to the geographical characteristics of the study area, which is predominantly riverine and deltaic. Additionally, the high cost of transportation in these regions could also be a significant contributory factor. These findings are in keeping with those of other studies in Nigeria, Ethiopia, Lao Democratic People's Republic and India where location of caregiver or family residence, the location of vaccination centre, if different from the health facility, and access to healthcare services and/or health facility significantly affected vaccination status and/or completeness rates (6, 7, 9, 10, 16, 18). However, the study by Noh et al in Pakistan reported that caregiver's residence was not associated with completion of basic immunization (15).

The foregoing chronicle teases out distance to, transport to, and access to the health facility as the principal demand side factors bedevilling routine immunization among children, in the delta of Bayelsa State, Nigeria and informs the need for concerted effort aimed at tackling the situation, given the contextual, Sociodemographic and geographical peculiarities.

CONCLUSION

Whereas immunization uptake and completion were deemed optimal, the distance from the health facility and/or vaccination site as well as transportation to same were significantly associated with vaccination completion rates and status. This summary outcome sufficiently gives direction and impetus for guiding stakeholder input concerning the appropriate siting and location of health care facilities so as to afford adequate access as well as reduce distance of travel and cost of transportation to same. Also, provision of affordable means of transportation to and from these sites is critical and important as a means of encouraging caregivers to routinely seek medical attention from professional healthcare personnel, and maintain the practice of complete and routine vaccination of eligible children. These are especially critical concerning the provision of

immunization and other health services in far flung, difficult and hard to reach communities and/or areas that typically abound in the delta of, and not only, Bayelsa State.

Declaration by Authors

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