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Exploring Childhood Immunization Coverage and Associated Factors in Anaocha Local Government Area, Anambra State, Nigeria: A Mixed Methods Study

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ABSTRACT

Immunization is a critical public health intervention that significantly reduces the incidence of infectious diseases and mortality worldwide. Unfortunately, immunization coverage in many low- and middle-income countries, including Nigeria, remains suboptimal due to various systemic and individual-level barriers. This study aimed to determine the immunization coverage and associated factors in a selected local government area in Anambra State, Nigeria. A household survey was conducted among 385 mothers and female caregivers of children aged 0 to 24 months using a semi-structured interviewer-administered questionnaire. Quantitative data were analyzed using SPSS version 25.0. Immunization coverage was 87.5%. Key barriers included transportation costs, distance to health facilities, fear of side effects, and inadequate infrastructure such as lack of electricity and water. Religion and occupational status were significantly associated with immunization coverage. In conclusion, despite relatively high coverage, challenges persist that must be addressed to improve equity and access. Strengthening healthcare infrastructure and addressing socio-demographic disparities are essential to achieving and sustaining high immunization rates.

Keywords: Immunization, immunization coverage, vaccines, childhood, primary health care.

1.Introduction

Immunization is a critical component of public health and primary healthcare, playing a vital role in the prevention of infectious diseases and reduction of mortality rates worldwide. Immunization is key to primary health care, an indisputable human right and a key strategy for preventing child and neonatal deaths and disabilities. It is one of the best health investments money can buy, being estimated to save between 2-3 million lives annually (World Health Organization, 2025b).. Vaccines are critical to the prevention and control of infectious disease outbreaks. They underpin global health security and are a vital tool in the battle against antimicrobial resistance (World Health Organization, 2025a).

Unfortunately, it has been difficult to achieve close to 100% immunization coverage globally and immunization coverage is worse in developing countries compare to developed countries (Chopra et al., 2020). Despite overall improvements in immunisation coverage at the national level (Corsi et al., 2012), geographic variations in the immunisation coverage persists at most subnational and district levels (Mosser et al., 2019). Achieving geographical parity, however, depends on capturing and understanding local patterns of coverage required to provide optimal, child-focused vaccine delivery

services (Mosser et al., 2019). Also, while nationally representative surveys such as the DHS and Multiple Indicator Cluster Survey have a standardised data collection procedures across countries that is also consistent over time, presenting immunisation coverage at national levels fails to capture the all-important local patterns of coverage required to properly fine-tune vaccine delivery services (Corsi et al., 2012). Furthermore, relying on subnational administrative data for assessing immunisation system performance and tracking progress is often fraught with limitations such as missing data and poor data quality.

While immunization is one of the most successful public health interventions, coverage plateaued in the decade prior to COVID-19. The COVID-19 pandemic, associated disruptions, and vaccination efforts strained health systems in 2020 and 2021, resulting in dramatic setbacks. Data from 2023 show that performance has not yet returned to 2019 levels. For example, the World Health Organization reported that in 2023, about 84% of infants worldwide (108 million) received 3 doses of diphtheria-tetanus-pertussis (DTP3) vaccine, protecting them against these infectious diseases that can cause serious illness and disability or be fatal (World Health Organization, 2025a). However, these global figures hide significant disparity among countries of different income strata, with low-income countries lagging behind. For instance, measles, because of its high transmissibility, acts as an early warning system, quickly exposing immunity gaps in the population. Still, 22.2 million children missed their routine first dose of measles, far from the 2019 level of 19.3 million (World Health Organization, 2025b). Global coverage for hepatitis B vaccination within the first 24 hours of life is 45% and is as high as 79% in the WHO Western Pacific Region, while it is estimated at only 17% in the WHO African Region. Rotaviruses are the most common cause of severe diarrhoeal disease in young children throughout the world. The rotavirus vaccine was introduced in 123 countries by the end of 2023. Global coverage is still low at 55%. Regarding polio, a highly infectious viral disease that can cause irreversible paralysis, in 2023, 83% of infants around the world received 3 doses of polio vaccine. In the same year, the coverage of infants receiving their first dose of inactivated polio vaccine (IPV) in countries that are still using oral polio vaccine (OPV) was estimated at 83% as well. However, in these same countries, the coverage of infants receiving their second dose of IPV is estimated at 42%. There is also great variation between regions. The WHO European Region is estimated to have 89% coverage, while it is only 6% in the WHO South-East Asia Region. Targeted for global eradication, poliovirus transmission has been stopped in all countries but remains endemic in Afghanistan and Pakistan (Jorgensen et al., 2025). Until transmission is interrupted in these remaining countries, all countries remain at risk of importation of polio, especially vulnerable countries with weak public health and immunization services and travel or trade links to endemic countries (World Health Organization, 2025b).

In Nigeria, immunization coverage has been a significant concern, with the country accounting for approximately 20% of the global burden of vaccine-preventable diseases (I. I. Eze et al., 2023). The Nigerian government has made efforts to improve immunization coverage through initiatives such as the National Immunization Program and the introduction of new vaccines (National Primary Health Care Development Agency (NPHCDA)., 2021). However, despite these efforts, immunization coverage in Nigeria remains suboptimal with an estimated proportion of fully immunised children of 34.4%, and significant disparities across different regions ranging from 51.5% in the south-south zone to as low as 9.5% in the north-west of the country (Adeloye et al., 2017).

The factors associated with childhood immunization coverage in Nigeria have been described using the social determinants of health model by Williams et al (Williams et al., 2024) in their systematic review of the social determinants of childhood immunisation in low-and middle-income countries and equity impact analysis of childhood vaccination coverage in Nigeria. They developed a conceptual framework for the social determinants of childhood immunization that encompasses factors at the individual, parental, household, environment, and national policy levels that influence inequities in basic vaccination coverage of children in Nigeria (Figure 1). Vaccine equity is referred to | “as unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically, or geographically” (Williams et al., 2024). This conceptual framework aligns with the principles of health equity by the World Health Organization's Commission on Social Determinants of Health. It comprehensively incorporates the multifaceted determinants of health, including social, cultural, political, economic, commercial, and environmental factors that influence the circumstances of individuals' lives, from birth to old age. Furthermore, it acknowledges that these determinants are structurally underpinned by the distribution of wealth, power, and resources (Williams et al., 2024).

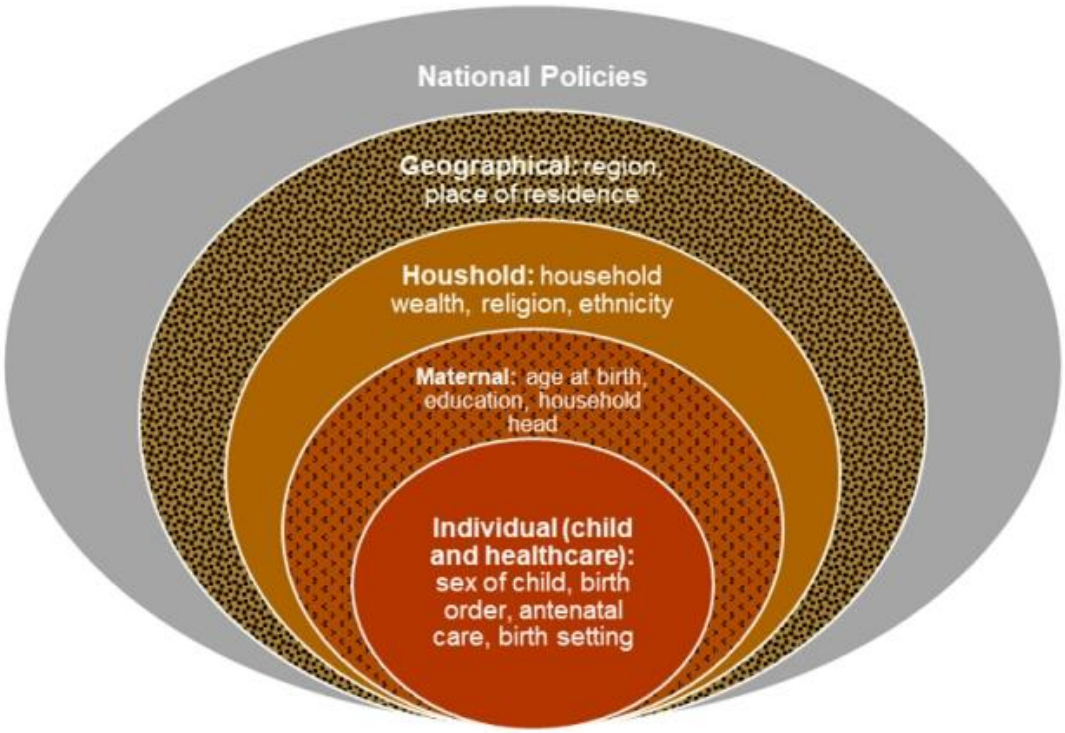

Fig. 1 – A conceptual framework for the social determinants of childhood immunization (Williams et al., 2024)

The District Health Information Software 2 (DHIS2) is a health information system used to collect, analyze, and disseminate health data, including immunization coverage. The Federal Government of Nigeria adopted the DHIS-2 in 2010 and piloted, through the National Primary health Care Development Agency (NPHCDA), a routine immunization (RI) module and dashboard in 2014 (Tchoualeu et al., 2021). Household surveys, such as the National Immunisation Coverage Survey (National Bureau of Statistics (NBS) & United Nations Children's Fund (UNICEF), 2022), provide an additional source of data on immunization coverage, offering insights into factors influencing immunization uptake and disparities in coverage.

There is a need to identify strategies for improving implementation of vaccination programs in the country, particularly at primary health care level in predominantly rural areas and this study aimed to fill this gap. To reduce the number of zero-dose children and decrease the number of vaccine-preventable disease outbreaks (e.g., diphtheria, measles, polio, and yellow fever) will require sustained improvement in immunization coverage and progress toward reaching equity in access across all countries, not only regaining 2019 immunization coverage levels that declined during the pandemic, but also improving immunization coverage beyond 2019 pre-pandemic levels (World Health Organization, 2025b). (World Health Organization, 2025a) Achieving these goals will require targeted, country-specific strategies, because zero-dose and under vaccinated children tend to live predominantly in low- and lower-middle–income countries and underserved communities; this includes the urban poor and those living in remote rural or conflict-affected settings (Chopra et al., 2020). WHO and UNICEF recommend that countries enhance their immunization programs to bolster resiliency against public health events such as the COVID-19 pandemic. Building a resilient program requires actions that include strengthening the health care workforce capacity, ensuring reliable vaccine supply chains, and building community demand and confidence in vaccines.

Given the significance of accurate and reliable data for informed decision-making and policy development, this study aimed to determine immunization coverage of children aged 0-24 months, the sociodemographic and other factors associated with immunization coverage in a selected local government area in Anambra State, south-east Nigeria. Achieving this aim will provide evidence of progress towards achieving vaccination targets in Anambra state, Nigeria. Such evidence is required for continuous support from donor-support initiatives such as the global alliance for vaccine and immunization (GAVI) (World Health Organization, 2025a). Furthermore, identifying the factors associated with un-

immunised and partially immunised children at the ward level could help tailor strategies and operational plans to address immunization gaps and provide actionable information relevant for planning and policy making to improve delivery of childhood vaccines in Anambra state, Nigeria and beyond.

2. Materials and Methods

2.1 Study design and study area

We employed a mixed methods design encompassing a cross-sectional household survey, focus group discussions and key informant interviews using an explanatory sequential approach. The study was conducted in Anaocha local government area in Anambra state, south-east Nigeria. It is situated in the north-central part of the state, with its headquarters in Neni and covers an area of approximately 184 square kilometres. It shares boundaries with Awka North LGA to the north, Idemili North LGA to the south, Dunukofia LGA to the west, and Anambra East LGA to the east. Anambra state has a tropical climate with two distinct seasons: the rainy season (April-October) and the dry season (November-March) and average annual rainfall of 2,000 mm, with temperatures ranging from 18.3°C to 32.7°C (National Bureau of Statistics, 2025). Anaocha has a population of 429,748 projected from the 2006 Nigerian national census figures, based on an annual growth rate of 2.2% (City Population, 2022). The population is predominantly of the Igbo ethnic group and is largely rural, with many communities engaged in agriculture, trade, and small-scale industries. Anambra has a high literacy rate of 92.11%, with several primary, secondary, and tertiary educational institutions present (National Bureau of Statistics, 2025). There are 55 healthcare facilities in Anaocha LGA, comprising 26 public (23 primary and 3 secondary) and 29 private (all primary) facilities (Federal Ministry of Health, 2016).

2.2 Study population and sample

The study population comprised mothers and female caregivers aged 18 years and older, of children under 24 months of age. Those included in the study had to have been residing in the study area for 3 months or more prior to the start of the study. Mothers/caregivers who were unable to understand the study procedures or provide informed consent and those who (or their children) were severely ill were excluded.

A sample size of 385 participants was recruited for the household survey, determined using the Cochran formula (Cochran, 1977) and based on an estimated prevalence of childhood immunization coverage of 34.4% (Adeloye et al., 2017), a 5% significance level, margin of error of 0.05 and a possible non-response rate of 10%. Participants were selected using a multistage sampling technique. First, Anaocha LGA was selected by simple random sampling from the 21 LGAs in Anambra State. Then, two towns, namely Adazi Ani and Neni, were randomly selected from the 10 towns that make up Anaocha LGA. Each town has two political wards, Adazi Ani I, Adazi Ani II and Neni I, Neni II which served as geographic clusters. Following this, cluster sampling using the random walk sampling method (Worrell & Mathieu, 2012) was applied. A central location, such as a market square, was identified within each political ward and a bottle was spun on the ground to determine the initial direction for sampling. Then, moving in a clockwise direction, one mother or female caregiver in each household who met the inclusion criteria was selected until the required sample size was obtained. In households with more than one eligible woman, one respondent-child pair was randomly selected by balloting. A total of 193 and 192 respondents were sampled from Adazi ani and Neni respectively.

For the qualitative part of the study, the purposive sampling method was used to select respondents. Participants in the focus group discussions comprised 80 mothers and female caregivers who met the inclusion criteria but did not participate in the survey. Respondents for the key informant interviews were purposively selected key stakeholders of the national programme on immunization in Anaocha LGA which included the LGA immunization coordinators and heads of primary health care facilities in Anaocha.

2.3 Ethical considerations

Ethical approval was obtained from the Nnamdi Azikiwe University Ethics Committee prior to the start of the study. Written informed consent was obtained from all participants before data collection. They were informed of the purpose, benefits and risks of the study, that participation was voluntary, and they could withdraw at any stage of the research without any penalty. They were also assured of the confidentiality and privacy of their data. The confidentiality of

participants' information was ensured by removing personal identifiers and coding their data to protect their identities. Data privacy was achieved by ensuring that all collected electronic and physical records were protected using passwords and secure storage facilities respectively and only accessible to the research team.

2.4 Data collection

A semi-structured questionnaire was used for the household survey. designed to collect information on the level of access and utilization of immunization, acceptance and noncompliance. Each question was carefully formulated to ensure clarity and precision, allowing for the statistical analysis of the responses. The survey questionnaire was interviewer-administered by six trained research assistants who had at least secondary school level of education and were fluent in both Igbo and English languages. It was pre-tested on 20 respondents from households who are not part of the study in the study area and reviewed using the test-retest method to ensure reliability and accuracy of collected information (Krabbe, 2017). The quantitative data collected provided insights into patterns, trends, and relationships among the key variables of interest.

Key informant interview (KII) and focus group discussion (FGD) guides made up of open-ended questions were used to collect qualitative data needed to understand the underlying factors and perceptions that may not be fully captured by the survey questionnaire. The tools were also pre-tested to establish their validity and reliability. The qualitative data gathered provided context and depth to the findings, enriching the interpretation of the quantitative results. Eight KIIs were conducted and delved deep into the informants' individual experiences, barriers, and practices related to immunization. Each KII was audio-recorded and lasted approximately 30 to 40 minutes. Eight FGDs, four per town were conducted. Each FGD had 10 participants and explored the perceptions, attitudes, and experiences of mothers and female caregivers related to immunization of their children. Each FGD was audio-recorded and lasted approximately 1½ hours.

2.5 Data analysis

Immunisation status of the children was categorised as fully immunised, partially immunised or not immunised (zero-dose). Fully immunised children were those who had received one dose of BCG, three doses of polio vaccine (excluding oral polio vaccine at birth), three doses of pentavalent vaccine and one dose of measles vaccine by their first birthday. Partially immunised children were those who had missed at least any one of the above doses while children not immunised (zero-dose) had not received any vaccine by their first birthday (P. Eze et al., 2021).

Quantitative data were coded and analysed using statistical package for social sciences (SPSS) version 25.0 for descriptive and inferential statistics. The descriptive statistics included frequency distribution, means and proportions. The inferential statistics utilised the Chi-square test for associations and logistic regression analysis. Variables that were significant on bivariate analysis were included into the binary logistic regression model for multivariate analysis and their independent effects determined. Statistical significance was set at p-value ≤ 0.05.

For the qualitative data, verbatim transcripts of the audio recordings were obtained and compared with the written notes. The data was then coded and analysed using the thematic content analysis method with Nvivo software, version 14 and the various themes and sub-themes identified.

3.Results

3.1 Socio-demographic characteristics of the respondents

The socio-demographic characteristics of the respondents are presented in Table 1. The mean age was 30.2 ± 6.2 years and ranged from 18 to 45 years old. Those aged 25 to 29 years had the highest proportion (30.9%) followed by those aged 30 to 34 years (25.7%). Most of the participants were Ibos (93.8%) and Christians (94.5%). The majority of the participants were married (81.6%). About half of the respondents (208, 54.0%) had secondary level education and those with tertiary level education had the next highest proportion (132, 34.3%). Nuclear family type was more common (87.8%) than extended family and most had one to two children (217, 56.4%) followed by those with three to four children (124, 32.2%). 61.6% of respondents had an average monthly income of less than 50,000 naira.

3.2 Immunization access and status of the children

As shown in Table 2, all the study participants were aware of immunization and 87.5% said their children were immunised. Assessment of the selected children showed that 51.2% are males while 48.8% were females; Most of mothers of assessed children (99.0%) had received antenatal care services. One hundred and thirty-eight children (35.8%) were in the second birth position and 79 children (20.5%) were in first birth position. Government hospitals were the most frequent place of delivery (64.4%) and the most frequent site for accessing immunization (76.6%). Majority of the respondents (92.7%) were able to show their child's immunization card as evidence of immunization.

Figure 2 shows the overall immunization status of the children assessed. The proportion of children fully immunised according to their age group was 67.5%, partially immunised 29.6% and not immunised (zero dose) 2.9%.

3.3 Immunization coverage

Immunization coverage was found to be 87.5% determined from affirmative answers to the question, "Are all your children immunised?". Majority of the children had received immunization at birth (97.7%). Immunization at 6 weeks and 14 weeks were 95.3% and 91.2% respectively (Table 3)

3.4 Perceived facilitators and barriers to immunization uptake

The factors perceived by the respondents to encourage and/or limit childhood immunization uptake are shown in Table 4. Most of the mothers (97.4%) agreed that their culture encourages immunization, and 96.4% said immunization services are encouraging overall. Long distance to immunization facility (54.3%) and cost of transportation (23.1%) were some of the barriers identified. Majority paid for immunization (80.8%) however 22.6% identified the cost of immunization as a barrier. Other barriers identified were waiting time (15.6%) and fear of side effects (16.6%).

3.5 Factors associated with immunization status

The association of employment status with immunization status was statistically significant ($\chi2 = 8.969$; P= 0.01) and respondents who were not employed outside the home had the highest proportion of immunised children (93.1%) followed by those self-employed (87.6%) and least by the formal employed (82.7%). Other sociodemographic factors significantly associated with immunization status were ethnicity ($\chi2 = 12.398$; P = 0.002) and religion ($\chi2 = 15.138$; P = 0.001). Participants who had tertiary education had the highest proportion of immunised children (90.2%) and coverage declined with lower educational level however, educational level was not significantly associated with child immunization status in this study ($\chi2 = 4.910$; P = 0.178). Other socio-demographic characteristics, age of respondent, marital status, type of family, number of children and monthly income, were also not significantly associated with child's immunization status (Table 1).

Predictors of child immunization status in the study population are shown in Table 5. Significant predictors were being Christian (adjusted odds ratio (aOR): 6.877, 95% CI: 1.188 – 39.797, P = 0.03) and having formal employment (aOR: 3.470, 95% CI: 1.254 – 9.607, P =0.017).

Table 1 – Survey participants' sociodemographic characteristics and association with immunization status

Variable (N = 385)	Total, n (%)	All Children immunised, n (%)		Chi-square	P-value
		Yes	No		
Age (years)				2.513	0.669
18-24	74 (19.2)	62 (83.8)	12 (16.2)		
25-29	119 (30.9)	103 (86.6)	16 (13.4)		
30-34	99 (25.7)	87 (87.9)	12 (12.1)		
35-39	53 (13.8)	48 (90.6)	5 (9.4)		
>40	40 (10.4)	37 (92.5)	3 (7.5)		
Mean ± Standard deviation	30.2 ± 6.2				
Minimum, Maximum	18, 45				
Ethnicity				12.398	0.002*
Igbo	361 (93.8)	322 (89.2)	39 (10.8)		
Yoruba	16 (4.2)	10 (62.5)	6 (37.5)		
Hausa/Fulani	8 (2.1)	5 (62.5)	3 (37.5)		
Religion				15.138	0.001*
Christianity	364 (94.5)	325(89.3)	39 10.7)		
Islam	15 (3.9)	9(60.0)	6(40.0)		
African Traditional religion	6 (1.6)	3(50.0)	3(50.0)		
Marital status				4.826	0.185
Married	314 (81.6)	280 (89.2)	34 (10.8)		
Single	38 (9.9)	31 (81.6)	7 (18.4)		
Divorced	25 (6.5)	19 (76.0)	6 (24.0)		
Widowed	8 (2.1)	7(87.5)	1(12.5)		
Educational level				4.910	0.178
No formal education	15 (3.9)	11 (73.3)	4 (26.7)		
Primary	30 (7.8)	24 (80.0)	6 (20.0)		
Secondary	208 (54.0)	183 (88.0)	25 (12.0)		
Tertiary	132 (34.3)	119 (90.2)	13 (9.8)		
Type of family				2.138	0.144
Nuclear	338 (87.8)	299 (88.5)	39 (11.5)		
Extended	47 (12.2)	38 (80.9)	9 (19.1)		
Number of children				3.639	0.162
1-2	217 (56.4)	184 (84.8)	33 (15.2)		
3-4	124 (32.2)	114 (91.9)	10 (8.1)		
≥5	44 (11.4)	39 (88.6)	5 (11.4)		
Employment status				8.969	0.01*
Formal employed	104 (27.0)	86 (82.7)	18 (17.3)		
Self employed	194 (50.4)	170 (87.6)	24 (12.4)		
Unemployed	87 (22.6)	81 (93.1)	6 (6.9)		
Monthly income				2.208	0.332
<50,000	237 (61.6)	212 (89.5)	25 (10.5)		
50,000-100,000	95 (24.7)	81 (85.3)	14 (14.7)		
>100,000	53 (13.8)	44 (83.0)	9 (17.0)		

*Statistically significant

Table 2 - **Immunization access**

Variable (N = 385)	**Frequency**	**Percentage**
Heard of Immunization		
Yes	385	100.0
No	0	0.0
Antenatal care for last child		
Yes	381	99.0
No	4	1.0
Sex of assessed child		
Male	197	51.2
Female	188	48.8
Birth position of assessed child		
1st	79	20.5
2nd	138	35.8
3rd	57	14.8
4th	67	17.4
5th	31	8.1
6th	10	2.6
7th	3	0.8
Place of birth of assessed child		
Government health facility	248	64.4
Private health facility	102	26.5
Home	35	9.1
Has the child received immunization?		
Yes	382	99.2
No	3	0.8
Where do you access immunization?		
Government health facility	295	76.6
Private health facility	90	23.4
Evidence of child immunization		
Yes	357	92.7
No	28	7.3

3.6. Key informant interview results

Several themes emerged during the key informant interviews which include the strategies employed to increase uptake of child immunization services and the barriers and challenges at the different primary healthcare centers and the local government area secretariat.

3.7.1 Health education

Key informants emphasized the need for adequate education of mothers and caregivers on the importance of immunization as this will encourage more uptake of the service:

“Even before you give the immunization, we do give health talks to the mothers, telling them that today this immunization, after giving immunization, some will have some little fever, so you tell them, on coming they should give paracetamol and then going back, they can still give paracetamol’’. KII 1 (45yrs, Neni I, Officer in Charge (OIC))

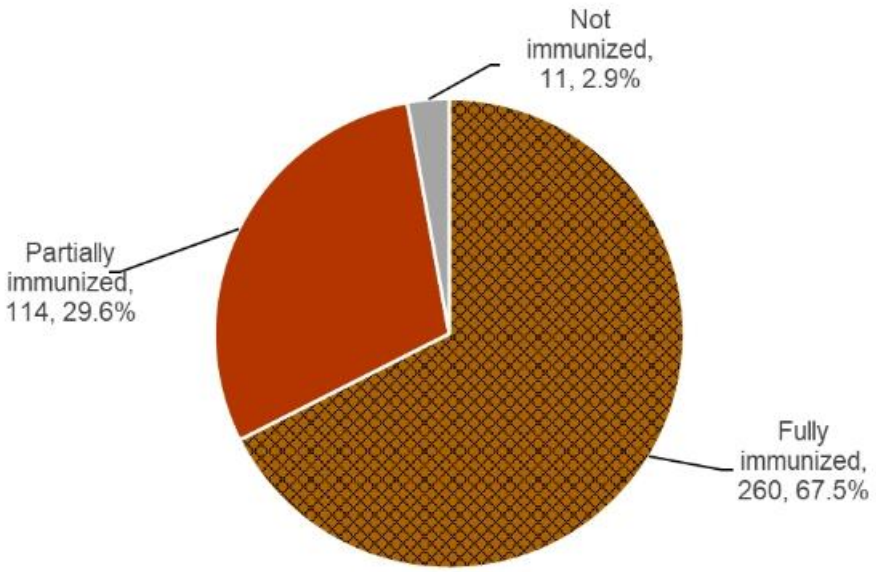

Fig. 2 - Immunization status of the children

"I would teach them the need to immunize their children and then encourage them to see others. When they see that others are doing it, they will join in. You may pick up a healthy child in the clinic to show evidence of immunization and compare with a poorly immunized child., they will be encouraged even more than what you have told them.'' KII 3 (52yrs, Adazi Ani II, Immunization Officer (IO))

3.7.2 Data collection and validation

One of the aspects of childhood immunization is keeping records at every stage of the programme. Before vaccines are disbursed to the PHCs, the previous month's records will be retired and validated.

"My role is that I make sure that all the facilities immunization reports are collected. When the CCO (Cold Chain Officer) is giving facilities drugs according to their targets, staff of the PHCs will submit the previous month report. I will do our monthly validation to know the drugs that are given to the facilities. '' KII 8 (49yrs, Neni I, OIC)

3.7.3 Vaccine administration

"We give BCG, HBV, OPV0 and Penta 1 at birth; at 6 weeks the researchers repeat OPV1 and Penta2 and add PCV1: at 10 weeks….'' KII 1 (45yrs, Neni I, OIC)

3.7.4 Awareness creation and outreaches

Key informants affirmed that awareness creation about childhood immunization was regularly carried out at the health facility, market, in the community, in schools and churches to increase the uptake of immunization:

"We normally go to the community every month with public address system on main market days and create awareness for them to know that immunization is going on in that facility.'' KII 3 (52yrs, Adazi Ani II, IO)

"If our immunization record is poor, we create more awareness in the community. So, it's only awareness you create to improve performance.'' KII 5 (37yrs, Adazi Ani I, OIC)

Table 3 - Immunization coverage

Variable (N = 385)	Frequency	Percentage
Are all your children immunized?		
Yes	337	87.5
No	48	12.5
Immunization at birth		
Yes	376	97.7
No	9	2.3
Immunization at 6 weeks		
Yes	367	95.3
No	18	4.7
Immunization at 10 weeks		
Yes	351	91.2
No	34	8.8
Immunization at 14 weeks		
Yes	339	88.1
No	46	11.9
Vitamin A at 6 months		
Yes	316	82.1
No	69	17.9
Immunization at 9 months		
Yes	286	74.3
No	99	25.7
Immunization at 15 months		
Yes	236	61.3
No	149	38.7

"Normally we go for outreach like once in a month. We do it on market days and we also do outreach during school programmes to create awareness to the students and teachers'' KII 2 (38yrs, Adazi Ani II, IO)

3.7.5 Home visiting

"Home visiting is a day we map out in a week or in a month. We check our register and see mothers who have missed their appointments, then we call them to come. Some of them will not come. We then visit those that will not come. That's when we now meet one-on-one with them know their challenge and to tell them the right thing to do.'' KII 7 (46yrs, Neni II, OIC)

3.7.6 Big catch-up programme

Mass immunization campaigns are targeted in the communities to promote child immunization, reach partially- and unimmunized children:

"We have done the big catch-up program this year. We did one in December last years, the main vaccines the researchers give in the programmes are PENTA, IPV, PCV, OPV. '' KII 2 (38yrs, Adazi Ani II, IO)

"Strategies to promote child immunization is the big catch-up where the researchers go to the community to immunize and target those children who have missed their immunization.'' KII 7 (46yrs, Neni II, OIC)

Table 4 - Perceived facilitators and barriers to immunization uptake

Variable (N = 385)	Frequency	Percentage
Husband/partner encourages immunization		
Yes	333	86.5
No	52	13.5
Culture encourages immunization		
Yes	375	97.4
No	10	2.6
Immunization services encouraging overall		
Yes	371	96.4
No	14	3.6
Travels long distance to immunization facility		
Yes	209	54.3
No	176	45.7
Long distance affects decision to immunize child		
Yes	84	21.8
No	301	78.2
Cost of transportation is a barrier		
Yes	89	23.1
No	296	76.9
Do you pay for immunization?		
Yes	311	80.8
No	74	19.2
Cost of immunization is a barrier		
Yes	87	22.6
No	298	77.4
Experiences long waiting time before immunization		
Yes	148	38.4
No	237	61.6
Waiting Time discourages immunization		
Yes	60	15.6
No	325	84.4
Fear of side effects discourages immunization		
Yes	64	16.6
No	321	83.4

3.7.7 Challenges and barriers

Several challenges and barriers were identified by the key informants such unavailability of the monthly immunization register, lack of funding for their transportation and other logistics, caregivers missing their child's immunization appointments, lack of incentives for immunization staff, vaccines sometimes being out-of-stock, lack of electricity and water supply and so on. The lack of funding for logistics emerged as a serious challenge for all the key informants. According to them, no money is provided for transport to get the vaccines, to track defaulting mothers, and also for outreaches. Reasons given for why mother/caregivers miss appointments include unavailability or cost of transportation, immunization day falling in main market day and fear of the fever the child may have after immunization. Regarding the lack of incentives, all the key informants said that they do not get incentives. Some even bore the costs of carrying out immunization services from their salaries. Sometimes some of the vaccines were out of stock or the staff did not have the transportation to go and get the vaccines from the LGA health department.

Table 5 - **Predictors of immunization status**

Variable	Immunization status		
	aOR	**95% CI**	**p-value**
Ethnicity			
Igbo	3.138	0.891 – 11.057	0.08
Hausa/Fulani	0.929	0.126 – 6.827	0.94
Yoruba (Ref.)	1		
Religion			
Christianity	6.877	1.188 – 39.797	0.03
Islam	2.389	0.277 – 20.642	0.43
African Traditional religion (Ref.)	1		
Employment status			
Formal employed	3.470	1.254 – 9.607	0.02
Self-employed	1.785	0.669 – 4766	0.25
Unemployed	1		

aOR, adjusted odds ratio; CI, confidence interval; Ref., reference category

"Monthly immunization register was not available and it was difficult to get from the local government secretariat- We went there, they said it is not available, that they will soon get it and supply.'' KII 1 (45yrs, Neni I, OIC)

"Government [don't] provide fund to us for going to collect the vaccines from local government and for calling and tracking mothers." KII 2 (38yrs, Adazi Ani II, IO)

"Instead of putting that woman on market day, the appointment can be adjusted. Because she will want to go to market to sell instead of coming for immunization." KII 3 (52yrs, Adazi Ani II, IO)

"Formerly, they used to give us bikes, bicycles, and ambulances, so that we can use it to go and assess drugs. But these days, we have to pay transport, since government doesn't provide us with those amenities to work.'' KII 1 (45yrs, Neni I, OIC)

"These days, for me to assess the vaccines, I use my personal money to pay transport to go to local government to carry the vaccines.'' KII 4 (41yrs, Neni II, OIC)

"The major challenge is out of stock, especially Rotavirus vaccine. Rota vaccine is not always available. For example, I request like 100 doses, they give me 10. So, how do I manage it? Situations where a woman comes with her child and that Rota is supposed to be given and it's not available, it is bad.'' KII 2 (38yrs, Adazi Ani II, IO)

"Money is part of the problem. Because, like now, it is only when salary is paid that the researchers get money to transport and collect vaccine. So, when salary does not come on time, there will be vaccine out of stock.'' KII 6 (41yrs, Adazi Ani II, OIC)

"Water is a big problem; I bought a 25,000 litres tank with my money. We use our personal money to buy water, it is not easy at all.'' KII 7 (46yrs, Neni II, OIC)

"We have not seen NEPA light for some month and yet they bring NEPA bills for the researchers to pay. We go outside to charge the researchers' phones so that the researchers can track mothers.'' KII 2 (38yrs, Adazi Ani II, IO)

"We used to pay for NEPA light but the researchers can't meet up. We have hospital generator but the researchers cannot meet up with the cost of buying fuel. The government can provide solar which can carry bulbs, and everywhere will be bright. So, when a woman wants to give birth, the place should be comfortable for her.'' KII 7 (46yrs, Neni II, OIC)

3.7.8 Collaboration with the community

Key informants emphasized that the immunization programme cannot function effectively without collaboration with the community through the Ward Development Committees and Village Development Committees and the market women association, community leaders and the churches:

"There are some people who are members of the community who make donations such children cloths, baby shoes, sweets, biscuits and so on. So, in every immunization, the researchers will dance, share the researchers' biscuits to children, share snacks to children. So, whenever the mothers, remember they will go to this clinic and they will be giving incentive, it encourages them. Some people will give the researchers clothes. The first three people that come early will be given children clothes, children's shoes, We'll give everybody biscuits, sweets and even soft drink.'' KII 2 (38yrs, Adazi Ani II, IO)

"We have WDC committee, the researchers have a WDC meetings that holds monthly. We discuss the challenges, solutions and way forward regarding the health of the community and how to assist the hospital were necessary. They also health in raising awareness and in the researchers' outreach programmes.'' KII 3 (52yrs, Adazi Ani II, IO)

3.7. Focus group discussion results

Eight focus group discussions were conducted in this study among mothers who accessed child immunization services at eight primary healthcare centres purposively selected from Adazi Ani, Adazi Enu, Adazi Nnukwu, Neni (2 PHCs), Obeledu, Agulu, Ichida wards. In Anaocha LGA routine immunization holds only on Tuesdays in all the PHCs. All the FGDs were held on the immunization days. Five themes emerged from the FGDs: what childhood immunization means, mothers' attitude towards childhood immunization, their experiences from childhood immunization, barriers to childhood immunization, and encouraging factors to childhood immunization.

3.7.1 The meaning of childhood immunization

The mothers defined immunization of the child in different ways, however their responses showed they had a good understanding of concept and objective of childhood immunization:

''Immunization means the medication given to infants during their childbirth to avoid contacting infections, any kind of infection'' FGD 1 (29yrs, Neni I, Trader).

''I can say that immunization is the process that prevent the children from death…. They will give vaccine to children in order to protect them from illness or sickness. '' FGD 3 (27yrs, Adazi Ani I, Housewife)

''Immunization simply means treatment given to children, little children when they are born to the age of 9 months, to avoid any diseases or sickness that may affect them in future'' FGD 4 (32yrs, Neni II, Teacher).

''Immunization is those preventive vaccines given to children to prevent them from attracting infections, mostly airborne diseases '' FGD 7 (26yrs, Neni II, Food Vendor).

3.8.2 Attitude towards childhood immunization

In all the FGDs, the women all agreed that childhood immunization is good and should be encouraged. They attested that it protects their children from diseases and keeps the children healthy:

''Immunization is a good thing. It is the number one good thing that government has given to the people that is almost free'' FGD 2 (35yrs, Adazi Ani II, Farmer)

''…Immunization is very, very nice, which Nigerians have provided provide for all children of Nigeria, and I see the benefit of that immunization'' FGD 3 (27yrs, Adazi Ani I, Housewife)

''Immunization is very good because it protects our children from sickness.'' FGD 4 (32yrs, Neni II, Teacher).

''I will say that immunization is good, because one, it helps a child to be stronger, helps their immune system to increase to avoid the complications and prevent diseases, it protects the child from contracting diseases, such as

measles, diarrhoea and polio…. So, in my own view, immunization is very good.'' FGD 4 (32yrs, Neni II, Teacher).

''I would say that immunization is a very welcome idea and programme for a child, which is very good for them.'' FGD 6 (33yrs, Adazi Ani 11, Petty Trader)

''The immunization helps protect my child from contracting any disease even though she is touching anything that is contaminated and put in her mouth. So, immunization is a very welcome idea. '' FGD5(30yrs, Adazi Ani 1, Seamstress)

''It's helped to improve the researcher's children's health because like the researcher's baby is licking her tongue. Then everybody is touching and putting hand in her mouth. So the immunization will help the child not to contract the disease '' FGD 7 (26yrs, Neni II, Food Vendor).

''Immunization is very important. I do not play with immunization of my children. It is a way of preventing a child from being paralyzed, a way of preventing a child from contacting all this serious infection and from contaminated water and food, then what whatsoever they put in their mouth when they are crawling….. they normally pick many things at their earliest age to put in their mouth. So, in order to prevent the children from the diseases of all those things, immunization is very important.'' FGD 8 (36yrs, Neni I, Teacher).

3.8.3 Experiences from childhood immunization

The experience of most of the mothers were varied. The most common experience was their child having a fever after immunization. Many of the mothers understood to give an antipyretic. For some, their child's fever last longer than anticipated and made them fearful and worried about subsequent immunization:

''My own experience is that after taking the vaccine, the children used to have a hotness'' FGD 1 (29yrs, Neni I, Trader).

''The experience I have is, before you take the child for the injections, you have to give paracetamol to prevent the fever, it will help to calm it down.'' FGD 1 (29yrs, Neni I, Trader).

''My own experience is that after that after the injection, the baby will have hotness of the body, and especially that penta one, two, three, so it's what I experienced.'' FGD 1 (29yrs, Neni I, Trader).

''The experience I had with it is, when my baby is given injection, I think that penta one, because when I first gave my baby the penta one, I didn't have idea that I should give analgesics, so the fever continued, but when I came for the next penta, I gave my baby analgesics before the injection, then after the injection, he didn't get the hotness of body.'' FGD 2 (35yrs, Adazi Ani II, Farmer)

''My experience is that children are no more sick as in the olden days, that children will sick this, sick that, but since that they have started to give the children this immunization, the researcher don't see children fall sick like those days'' FGD 7 (26yrs, Neni II, Food Vendor).

''….Then when I reached home, I gave her panda (paracetamol). We gave her panda because the fever was high. [Exclaims] She couldn't talk throughout that day; I was so scared. I was using wet cloth to be cleaning her body all through the night. '' FGD 4 (32yrs, Neni II, Teacher).

''But after that, his body started to change. It's not funny, that night I have to run to the hospital where my baby was treated. My husband is always worried about immunization since then.'' FGD 8 (36yrs, Neni I, Teacher).

3.8.4 Barriers to childhood immunization

The mothers raised several issues that discouraged them from immunization. Post-immunization fever emerged as a common barrier:

''The obstacle that will stop me not to go for immunization is that after the immunization, the child will start to have hotness, vomiting, even some sleepless nights.'' FGD 2 (35yrs, Adazi Ani II, Farmer)

Sometimes the needle will cause the child's leg to swell up, make them uncomfortable, fever will join and that day I will not rest. It discourages me to come next time for Immunization.'' FGD 7 (26yrs, Neni II, Food Vendor).

''….Most of the time after the immunization, they may be running temperature.'' FGD 3 (27yrs, Adazi Ani I, Housewife)

''This thing is giving me sleepless night because of the fever. So, for that reason, I will be discouraged to go to the next immunization.'' FGD 8 (36yrs, Neni I, Teacher).

For some of the women, their husbands prevented them from immunizing their children:

''When you finish immunizing your baby, the baby will be running temperature. Then the father will say, no, no, stop this immunization.'' FGD 3 (27yrs, Adazi Ani I, Housewife)

''…Sometimes when I finish immunizing my child, my husband will say that I should not go there again because our child cries all through that night and disturbs him a lot in the night.'' FGD 7 (26yrs, Neni II, Food Vendor).

The lack of money for transportation to immunization site and/or money to buy medications especially paracetamol syrup after the immunization was also identified as a frequent barrier.

''The obstacle that sometimes hinders me is that if I don't get the money to buy the medicine for the fever. Because anytime when my children get immunized, their body will be very hot." FGD 4 (32yrs, Neni II, Teacher).

''The clinic where I get the immunization is too far… transportation is needed.'' FGD 5 (30yrs, Adazi Ani I, Seamstress)

The attitude of the nurses or staff and long waiting times were discouraging, according to some mothers:

''And another one is that some nurses, they will start doing Shakara (being arrogant). FGD 3 (27yrs, Adazi Ani I, Housewife)

"If I come to hospital, they will not try to help me to immunize my baby in time. So, it takes a long time.'' FGD 2(35yrs, Adazi Ani II, Farmer)

''…Secondly, the nurses, most of the time will be chatting among themselves; they will not attend to the people that came for immunization'' FGD 3 (27yrs, Adazi Ani I, Housewife)

"They waste time because the health talk takes too long and it is the same thing they are repeating all the time. I am tired of listening to the same talk all the time and it wastes my time a lot.'' FGD 4 (32yrs, Neni II, Teacher).

Other barriers identified were unforeseen emergencies or the mother being too ill to bring her child for their immunization appointment:

''Unless there's an emergency that came up or something unknown that happened, then nothing prevents me from coming to the clinic to immunize my child.'' FGD 6 (33yrs, Adazi Ani II, Petty Trader)

''I could not take my child for injection that day because I was having malaria and I was weak'' FGD 7 (26yrs, Neni II, Food Vendor).

3.8.5 Factors that encourage childhood immunization

In spite of the discouraging factors to childhood immunization, most of the mothers were not deterred because of their awareness and confidence in the importance of immunization. They gave several reasons why they would continue to immunize their children. Reasons include the incentives they received, the group activities that they participated in during their visit, and the fact that immunization helps their children remain healthy:

''When I go for immunization, most of the time they will give us some things as incentives to encourage us. For those mothers that come on time, they may share biscuits, sweets. Or sometimes they will even give the first mother to come for the immunization that day, they will give you, maybe, baby cloth if they have.'' FGD 3 (27yrs, Adazi Ani I, Housewife)

''I enjoy the dancing and singing and reciting some poems about childbearing, reading all those words, singing with it'' FGD 5 (30yrs, Adazi Ani I, Seamstress)

''I was one of the beneficiaries because that time they selected some babies for a competition that time, which was taking place at the end of the year. So, my baby was among the babies they selected for that competition. They called it 'Breastfeeding is good for the baby'. That was the topic and the title of that competition.'' FGD 3 (27yrs, Adazi Ani I, Housewife)

''They give us so much information on how to breastfeed or how to take care of your child from zero, from first stage to the nine months to 12 months so that the baby has a strong immune system.'' FGD 6 (33yrs, Adazi Ani II, Petty Trader)

''They normally give us gifts and we normally dance when we get there.'' FGD 2 (35yrs, Adazi Ani II, Farmer)

''What encourages me is that after giving the child the immunization, he will be free from any sickness or any illness.'' FGD 2 (35yrs, Adazi Ani II, Farmer)

''Sometimes when we finish immunizing our children, doctors normally teach us about healthy living and caring for the children.'' FGD 4 (32yrs, Neni II, Teacher).

''A healthy child is very important. I want my child to be healthy. That is want encourages me the most.'' FGD 8 (36yrs, Neni I, Teacher).

4.Discussion

This study found that majority of the respondents were aged 25 to 29 years and is consistent with results obtained from previous research in Atakumosa-west district and Owerri, in south-west and south-east Nigeria, respectively (Adedire et al., 2016; Duru et al., 2016), where the predominant age groups were also within the 20–29 years range, but higher than observed in Bungudu, northern Nigeria (Gidado et al., 2014), where most participants were 20 to 24 years old. Furthermore, the mean age in the present study was 30.15 ± 6.20 years, similar to the findings in Owerri (Duru et al., 2016), but higher than those reported in Bugundu where early marriage and childbearing are more prevalent (Gidado et al., 2014) and could account for this difference. Most participants were of Igbo ethnicity and Christians, which is reflective of the region's dominant socio-cultural context. The distribution of marital status with majority being married, shows a slightly lower rate compared to other studies (Adedire et al., 2016; Duru et al., 2016; Gidado et al., 2014).

Hospital delivery accounted for 90.9% of births and was notably higher than reported figures in other regions of Nigeria: 81.5% in Atakumosa-west, Osun State (Adedire et al., 2016), and 22.4% in Bugundu, Zamfara State (Gidado et al., 2014), as well as other countries: 32.1% in southeast Ethiopia (Legesse & Dechasa, 2015), and 79.3% in Sindh, Pakistan (Noh et al., 2018). Delivery was higher in government-owned (public) health facilities (64.4%) than in private ones (26.5%) in this study. Most children in this study were second-born, unlike previous studies (Adedire et al., 2016; Legesse & Dechasa, 2015) where third birth order and above were most common.

Immunization remains a key public health intervention that significantly reduces the incidence of vaccine-preventable diseases. High awareness was observed in this study, with all participants (100%) having heard about immunization, consistent with previous research (Duru et al., 2016; Legesse & Dechasa, 2015). This high awareness level may be attributed to effective facility-based awareness campaigns.

The immunization coverage rate was 87.5%, higher than the 33% previously reported by Ataguba et al (Ataguba et al., 2016), possibly due to the use of more recent data in the current study. Gidado et al (Gidado et al., 2014) reported only 7.6% full coverage, likely due to lower education levels and inadequate knowledge of routine immunization. 74.4% coverage based on maternal recall and 57.9% using immunization cards was reported in Osun State, southwest Nigeria (Adedire et al., 2016) and 73.3% in Imo State (Duru et al., 2016), respectively. The immunization coverage rate in this present study, though fair, is below the recommended target as recommended by the World Health Organization (National Bureau of Statistics (NBS) & United Nations Children's Fund (UNICEF), 2022). However, the higher rate in this study in comparison with other regions of Nigeria, may be due to increased awareness over time. At least one dose of

immunization was received by 99.2% of children assessed, comparable to 97.5% reported by Legesse & Dechasa (2015). Government hospitals were the primary point of access (76.6%), exceeding the 64.4% of antenatal care services provided by government hospitals.

Barriers to immunization were multifaceted. At the facility level, lack of funding, transport logistics, and infrastructural inadequacies (e.g., water and electricity) impeded service delivery. The key informant interviews highlighted challenges such as irregular vaccine supply, limited government support for logistics, and poor infrastructure. One of the strategies identified by the key informants as useful in promoting immunization uptake and reaching partially immunized and unimmunized children was the Big Catch-Up (BCU) programme. The BCU is a global initiative led by WHO, UNICEF, GAVI, and key partners set up to restore immunization coverage following disruptions caused by the COVID-19 pandemic. It focuses on reaching Zero-Dose and under-immunized children through catch-up activities and strengthening routine immunization (RI) systems from 2023 and beyond. The success of the BCU initiative in Nigeria is critical given that Nigeria is one of the seven countries that account more than half of the global number of zero-dose children (Sayem et al., 2025).

Findings from the survey showed that at the individual level, key deterrents to child immunization uptake were transportation costs (23.1%), cost of immunization (22.6%), long distances (21.8%), fear of side effects (16.6%), and long waiting times (15.6%). Cultural support and spousal encouragement emerged as positive motivators, reported by 97.4% and 86.5% of women respectively. These findings were supported by the findings of the FGDs. Adverse effects such as fever and swelling discouraged some mothers and concerns over cost and distance were frequently mentioned. The lack of spousal support and the negative attitudes of some health workers were also cited as barriers, corroborated by previous research (Duru et al., 2016; M. Gidado et al., 2019; Gunnala et al., 2016). Repetitive health talks and long waiting periods were additional deterrents. Despite these challenges, non-financial incentives such as gifts and entertainment encouraged participation. Respondents appreciated educational outreach and health talks, further emphasizing the importance of community engagement.

Ethnicity, religion, and employment status were statistically significant factors in this study. Christians were 6.8 times more likely to have full immunization coverage compared to Muslims and practitioners of African traditional religion. Children of whose mothers were formally employed were 3.47 times more likely to be fully immunised than children of unemployed mothers. Similar associations were observed in previous studies (Duru et al., 2016; Gidado et al., 2014; Oleribe et al., 2017). Religion has been linked to disparities in immunization coverage in Nigeria, with predominantly Christian southern region exhibiting higher rates than the north which is predominantly Muslim (Alabi et al., 2024; Mohammed et al., 2024). Furthermore, the finding that children of employed mothers were more likely to be fully immunised is consistent with the findings of a recent scoping review, attributed to the likelihood of employed mothers being better able to afford and cover indirect costs associated with accessing immunization services (Mohammed et al., 2024).

This study has some limitations which may affect the interpretation and generalizability of the findings. There is the possibility of recall bias from the mothers, as some of the mothers may not recall accurately all the events that took place during immunization. This was mitigated by verifying the mother's/caregiver's report with information in their child's vaccination cards. Secondly, this study was constrained by the scarcity of prior research specifically focused on immunization coverage in Anaocha LGA. The limited availability of localized empirical studies made it difficult to conduct comparative analysis or contextualize findings within a broader research framework. Much of the relevant literature referenced was based on studies from other regions or countries, which may not fully reflect the unique socio-cultural and systemic factors in the study area. Security concerns in certain areas within Anaocha LGA restricted access to some communities, thereby limiting the scope of data collection. As a result, the representativeness of the findings may be slightly constrained, particularly in relation to hard-to-reach populations. Despite these limitations, efforts were made to ensure that the data collected were reliable and that the findings contribute meaningfully to the existing body of knowledge on immunization coverage in Nigeria.

Summarily, while socio-cultural and economic barriers persist, targeted interventions such as awareness campaigns, improved healthcare infrastructure, and spousal involvement can significantly improve immunization coverage. The

findings of this study underscore the need for sustained investment in primary healthcare and tailored community engagement strategies.

5.Conclusion

This study was conducted in Anaocha LGA which is one of the 21 local government areas of Anambra State in the southeastern region of Nigeria. The immunization coverage of children from birth to 24 months of age was assessed through the mothers and caregivers. The determinants of immunization coverage and the associations between socio-demographic factors and immunization coverage was assessed. The immunization coverage was 87.5% which is fair but below the recommended target as recommended by the World Health Organization (National Bureau of Statistics (NBS) & United Nations Children's Fund (UNICEF), 2022). Factors affecting immunization identified were cost of transportation, cost to buy paracetamol syrup and pay for immunization, long distance to immunization site, waiting time. The predictors of immunization coverage were religion and employment status of the mothers.

Vaccine preventable diseases continue to contribute significantly to the morbidity and mortality burden in Nigeria. Given the limitations of using administrative vaccination coverage data and the heavy resource demand required to conduct regular household coverage surveys, practical means of gathering high quality routine immunization data are needed to inform program planning at the LGA level.

The immunization completion rate among children aged 0–24 months in Nigeria has increased since the EPI program was initiated by the WHO in 1978, but was still lower than the current target of the WHO and UNICEF. This study provides strong support for further efforts to improve the full basic immunization rate by identifying the key determinants of complete and timely childhood immunization coverage. Low vaccination coverage and delays for immunization results in the loss of herd immunity can lead to the outbreaks of vaccine-preventable diseases in unvaccinated infants. There is need to achieve higher immunization coverage at all levels. This is possible if the determinants that discourage mothers and hospital staff to improving immunization are addressed.

Antenatal care (ANC) is a strategic point where mothers can be captured for awareness and education on childhood immunization. Emphasis at the state, local government and at the ward level on awareness and education of families (fathers and mothers) on antenatal care and immunization is very important. Women who registered for antenatal care in the hospital will likely deliver at the hospital and commence immunization. It is recommended that ANC services and routine immunization should be made completely free to increase ANC attendance and improve immunization coverage.

Basic amenities such as electricity and water supply were lacking in many of the health facilities as reported by the key informants. They also reported the lack of funding for transportation, tracking of defaulting mothers and other logistics. The government needs to address these challenges. Alternative power supply such as solar energy should be explored in order to maintain the cold chain and power water pumps for boreholes. Adequate funding should also be provided in order to ensure timely collection of vaccines at the right time and adequate tracking of defaulting mothers.

Future longitudinal studies are recommended to explore the factors associated with timely and complete full immunization and to determine the effect of consistent campaign and mass immunization campaigns on completing immunizations and on infant mortality rates on a larger scale. We also recommend comprehensive comparative studies among the different local government areas in the state to determine the differences in immunization coverages and specific determinants to immunization that direct more objective policy development.

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