Knowledge Level of Caregivers on Immunization for Children (under-5 years) in Nigeria

ABSTRACT

Background: Families, especially mothers are the major role players with regard to their children's immunization. This study empirically Knowledge Level of Caregivers on Immunization for Children under-5 years in Delta North Senatorial District of Delta State, Nigeria.

Material and methods: A well self-structured questionnaires drawn from caregivers of under-5 children who were disposed to immunization in the nine (9) local government areas in Delta North senatorial district was used. However, the questionnaires were distributed to 3843 caregivers across the Nine (9) local government areas under study but the researcher was able to successfully retrieve 3624, representing 94% of the sample size. Two major hypotheses were tested using analysis of variance (ANOVA) regression analysis with the aid of SPSS.

Results: The data showed that 3030, representing about 85.0% of the respondents were mothers while the remaining 544 (15.0%) were male (fathers) with under-5 children in Delta North Senatorial DistrictThe findings shows that the knowledge level of caregivers, and enablers are respectively statistically significant in the immunization of under-5 children in Delta North senatorial district of Delta State, Nigeria.

Conclusion: It is therefore concluded that for the immunization to becomes successfully performed caregivers must have basic or advanced education and training to avoid the an increased mortality rate of death to children below five (5) years old

INTRODUCTION

Family, particularly mothers, play a crucial role in their children's immunization, as they are the basic unit of society and a child's first point of contact with the world[1]. The family is considered the preparation ground for a child's moral, psychological, and spiritual life, which is essential for their cognitive development and future achievement[2]. Immunization is the first line of action against vaccine-preventable diseases and is one of the most effective health benefits available to children for reducing under-5 mortalities[3]. However, family dispositions can affect immunization decisions for children 0-5 years old. The World Health Organization (WHO) emphasizes that immunization is a cost-effective health investment, but family dispositions may hinder its primary goal of preventing vaccine-preventable conditions. The WHO launched the Expanded Programme on Immunization (EPI) in 1974 to immunize children worldwide, using proven strategies like outreach services[3].

The National Programme on Immunization (NPI) and Oral Rehydration Therapy (ORT) were launched in Nigeria in 1979, with the goal of Universal Childhood Immunization (UCI) 1990. The ORT teaches parents how to rehydrate children dehydrated by diarrhea[4]. The programme is considered one of the leading immunization programs in Africa, collaborating with the Nigerian Federal Ministry of Health, the World Health Organization (WHO), the United Nations Children's Fund, and the Global Alliance for Vaccines and Immunization (GAVI)[5].

The CDC recommends that children before the age of 2 years be fully immunized against 14

potentially deadly diseases, including polio, rubella, hepatitis, measles, yellow fever, tuberculosis, pertussis tetanus, and rotavirus[6]. WHO plans a 9-month vaccine plan for infants at their priming age of life, including Bacilli Calmette Guerin (BCG), Oral Polio Vaccine (OPV), Hepatitis B vaccine (HBV), Haemophilus Influenza B vaccine, Diphtheria, Pertussis and Tetanus (DPT), inactivated polio vaccine (IPV), Measles vaccine, and Yellow fever vaccine[7].

These immunization schedules are administered in five doses from birth to the age of 9 months. The program implements global initiatives such as eradication of poliomyelitis, measles, and neonatal tetanus. However, challenges remain, such as family or caregivers' dispositions, which can hinder the achievement of the primary goal of immunization for children 0-5 years in Africa, particularly in Nigeria and Delta State[8].

Nigeria has made progress in immunization rates, with current coverage at 50.1%. The Federal Government of Nigeria (FGoN) has committed to improving its human capital to reduce under-5 mortality by half by 2030[6]. The proposed Multiphase Programmatic Approach (MPA) includes improving the utilization and quality of immunization, but the immunization coverage of children still lags. Over 20% of Nigerian children are not fully immunized each year, and this study investigates family predispositions of immunization among under-5 year's children in Delta North Senatorial District of Delta State, Nigeria[9].

Globally, more than 2.7 million children die annually, even when existing immunization would have prevented 2 to 3 million deaths. In Africa, under-5 mortality is caused by malaria, pneumonia, diarrhea, and other vaccine-preventable diseases like pertussis, measles, and meningitis. Suboptimal vaccine uptake rates are a significant public health challenge[10].

Vaccine-preventable diseases account for 22% of childhood deaths in Nigeria, with 87% of post-neonatal mortality can be tackled by addressing malaria, pneumonia, and diarrhoea and improving immunization. Immunization has reduced the incidence of disabilities, including mental retardation, hearing loss, meningitis, intellectual disability, and mobility impairment[11].

To guarantee children full protection against vaccine-preventable diseases, there is need to increase the knowledge level of care givers, especially mothers, to ensure they provide their children with the right vaccines at the right time. This research aims to determine Caregivers Immunization Knowledge Level for Children Aged Five (5) belowin Delta North Senatorial District of Delta State, Nigeria and to address family dispositions militating against immunization[12].

Conceptual Framework

The conceptual framework identifies four main components influencing immunization uptake for under-5 year olds: health system, community, interpersonal, and individual characteristics[13]. Health system factors include quality of services, attitudes, vaccine shortages, accessibility, cost, equity, and inadequate resources. Community factors include traditional norms, community mobilization, gender roles, and communication levels. Interpersonal factors include family issues and communication. Individual factors include health belief, socio-economic status, knowledge, and education. Improving immunization coverage requires addressing these factors at different levels Figure 1[14].

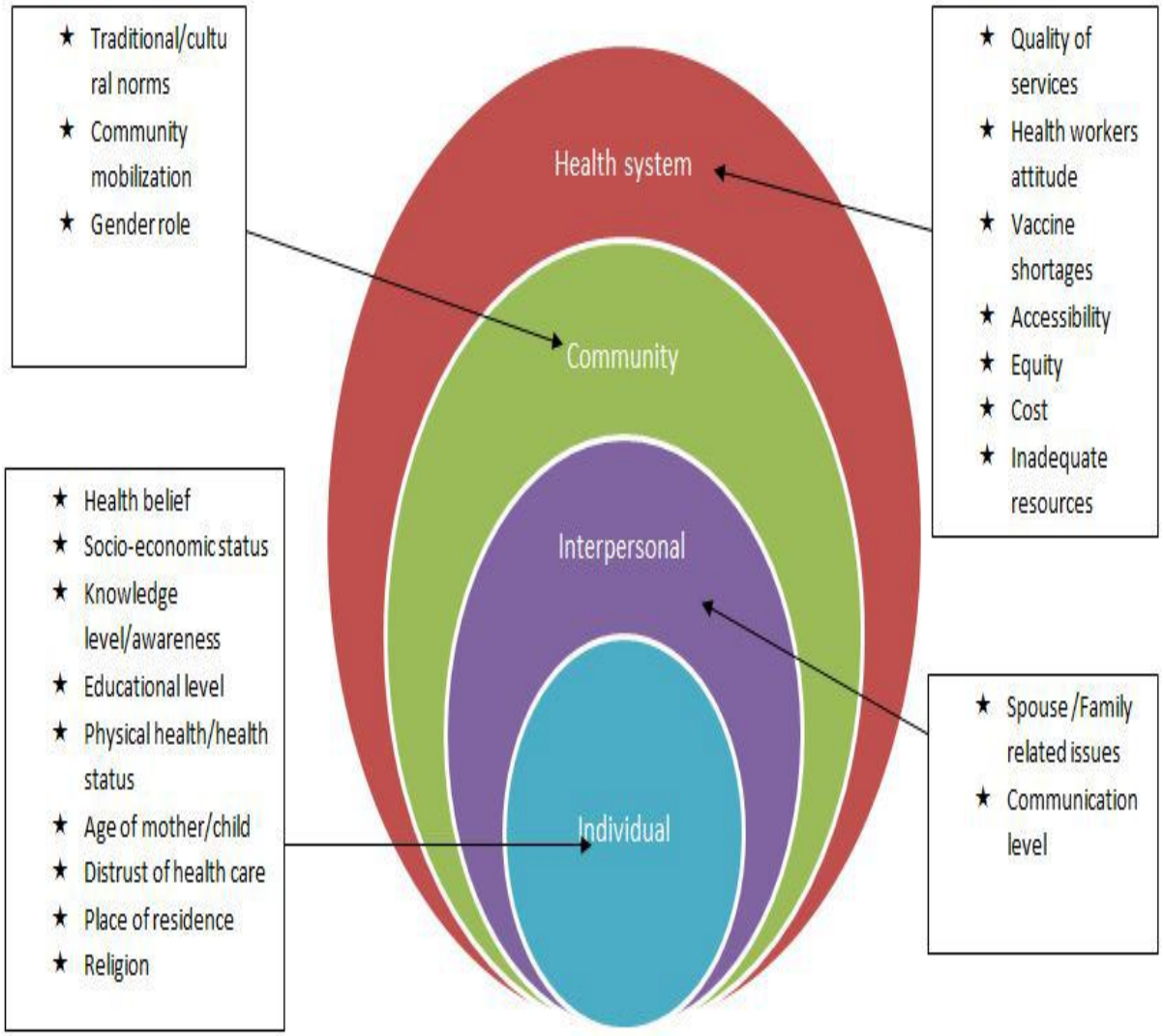

Figure 1
Conceptual framework showing the determinants of
low immunization uptake for under-5 years children in Delta State
Source: [15]

Caregiver's knowledge level of immunization

Research has shown that parental knowledge plays a significant role in the compliance of children aged 0-5 years with childhood immunization. A previous study found that mothers' knowledge about vaccine names and timing of doses was the most correctly timed, followed by paternal education and occupation[16]. Galadima et al. (2021) found that maternal knowledge was a significant modifiable factor influencing childhood immunization uptake[17].

Chiabi et al. (2017) found that paternal education and occupation also affected immunization uptake for children aged 0-5 years[17]. Aregawi et al. (2017) found that maternal knowledge, lack of awareness about vaccines, and not knowing the date to return for second and third doses significantly affected immunization uptake[18].

Animaw et al. (2014) found that maternal educational status can influence immunization uptake for under-5-year-olds[19]. Negussie et al. (2016) found that knowledge on the benefits of immunization, perception about vaccine side effects, and knowledge on the EPI schedule also influenced caregivers' adherence[20].

Lassi et al. (2021) found that immunization was increased by having good knowledge, good practice, and good perception of the vaccine[21]. Hobani et al. (2022) conducted a study on factors influencing mothers' compliance with childhood immunization among 600 mothers of under-five children in Ekiti State. The study concluded that having good knowledge of childhood immunization and a high educational status positively influence a mother's compliance with child immunization[1].

Types of vaccines for the immunization of children under-5years

A cross-sectional survey conducted in three villages in 2016 found that measles and polio were the most correctly named vaccines by mothers of 191 children[22]. Since 2001, Sudan has introduced additional vaccines, including hepatitis B, HepB, Hib, pneumococcal, rotavirus, and meningococcal vaccines. Delta State currently offers seven routine vaccines, including Bacillus Calmette Guerin, oral polio, pentavalent, rotavirus, pneumococcal, measles, and meningococcal vaccines[22].

Immunized Children Aged Five (5) Years Below

Research on immunization compliance among children aged 0-5 years has been a topic of concern for healthcare providers and researchers. A 2016 study by Ali et al. found that most mothers had a positive attitude towards immunization, with 48.7% of children being completely immunized[22]. However, 46% were missing their 'dose 0' due to closed vaccination units on the day of birth. In South Darfur State, Sudan, children from urban areas were more likely to complete their immunization schedule. Umoke et al. (2021) investigated factors associated with immunization incompletion in Ebonyi State, Nigeria, finding low immunization coverage[6]. Mohamed et al. (2020) assessed barriers for complete vaccination coverage among under five-year-olds in Mogadishu, Somalia, finding 45.2% of children fully vaccinated[23]. Konwea et al. (2018) found that factors influencing mothers' compliance with childhood immunization were high, with 80% of mothers achieving compliance. Overall, global vaccination coverage is estimated to be low, with varying levels of immunization coverage and factors influencing compliance[1].

1. MATERIAL AND METHODS

Study Area

This study will be carried out in Delta North Senatorial District of Delta State, Nigeria which covers nine (9) Local Governments Areas namely; Aniocha North, Aniocha South, Ika North East, Ika South, Ndokwa East, Ndokwa West, Oshimili South, Oshimili North and Ukwuani. Delta North Senatorial District is located in the Delta State. It lies between latitudes $50^{o}9$'and $60^{o}3$' North of the Equator and Longitudes $50^{o}30$'and $60^{o}12$' East of the Greenwich Meridian. It is bounded in the North by Edo State, South by Bayelsa and Rivers States, in the East by Warri Central, and to the West by Anambra State (Figure 1). The size of the region is about 3,700km^2. The population is estimated to be 2,032,707 people (Nigeria Population Census, 2007).

Study Design

A well self-structured questionnaires drawn from caregivers of under-5 children who were disposed to immunization in the nine (9) local government areas in Delta North senatorial district was used. The present study will adopt a descriptive cross-sectional survey for the purpose of eliciting information from caregivers of under-5 year's children in the study area. This type of study design helped to investigate or observe the situation the way it was as at the time of data collection. That is, the study design strictly took a quantitative approach and data source of using only questionnaire for data collection. The researcher decided to adopt this study design to enable her quantitatively analyze and determine the variables under study.

Statistical Treatment

The study population will involve the households with women of child-bearing age who have under-5years children in Delta North Senatorial District of Delta State, Nigeria.

Sample size determination

The sample for the study is determined using Cochran formula as stated below [24].

$$\frac{n = Z^2pq}{d^2}$$

Where;

n = Sample size
Z = Z-score which is a constant (1.96) at 95% confidence limit
p = 0.5 (50%) estimated precision.
q = 1-p = 1-0.5 = 0.5
d = accepted margin of error (5% = 0.05)

Therefore;

$$\frac{n = 1.96^2 \times 0.5 \times 0.5}{0.05^2} = \frac{0.9604}{0.0025} = 384$$

Assuming a non-response rate of 10% (0.1)

$$= \frac{n}{1\text{-non-response rate}} = \frac{384}{1 - 0.1} = \frac{384}{0.9} = 427$$

i.e. A total of 427 under-5 years children caregivers (mothers) will be used in each LGA.

Inclusion criteria

This study included all caregivers of under-5 years children in the study area. This included males and females (parents or caregivers who are knowledgeable about the child's immunization status especially mothers if present) who reside in the study area at the time of this study. This also included all respondents who will give their consent to participate in the study.

Exclusion criteria

This study excluded the following: children above five (5) years old; household that don't have children or children age five(5) years old below; respondents that were not present during the immunization or vaccination period; and those respondents who refuse to participate during the process.

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Sampling procedure

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Selection of Local Government Areas

The entire nine (9) Local Government Areas in Delta North Senatorial District of Delta State were sampled. This is an all-inclusive sampling to give a wide coverage for the study.

Selection of communities

All the communities were selected from each Local Government Area in the study area. This again is an all-inclusive sampling to ensure all communities are captured.

Selection of households

A total of 427 households were selected from each Local Government Area. This gave a total of 4,248 households to be sampled from the entire study area. This systematic random sampling where the first household was selected conveniently, thereafter, other households selected were by systematic approach in the interval of 2. This process gave every household in the LGA equal opportunity to be part of the study. In a case where the eligible household do not have under-5 years children, the immediate next household becomes eligible, thereafter the systematic sampling continues.

Selection of respondents

A total of 4,248 children under-5 years were sampled. In a household where there are more than one child under-5 years, data was elicited from all under-5 years children present at the time of data collection. At the end of the study, not less than a total of 4,248 respondents were sampled from the study area.

Instrument for data collection

A 64-items researcher-administered questionnaire was used for data collection. The questionnaire comprises of eight (8) sections: Section-A elicited information on respondents' socio-demographic variables; Section-B elicited information on knowledge level of caregivers on immunization for children under-5years; Section-C elicited information on types of vaccines for the immunization of children under-5years; Section-D elicited information on number of under-5years children immunized; Section-E elicited information on family dispositions militating against the immunization of children under-5years; Section-F elicited information on enablers of immunization of children under-5years; Section-G elicited information on perceptions on immunization of under-5 years children; while Section-H elicited information on attitude to immunization of under-5 years children.

Pre-testing of data collection instrument for reliability and validity

Ten percent (425 copies of the instrument for data collection) of the sample size was used for the pretesting in Delta Central Senatorial District of Delta State that will not be part of the primary study. This was to test for reliability and validity of the instrument to ensure that it is fit for data collection. Face and content validity was ascertained by the student's supervisors and an expert in research/statistics from the Department of Public and Community Health, Novena University, Ogume, Delta State. Data will be collected once, after which the data will be analyzed to find out the reliability of the instrument to ensure there is no discrepancy in it. Data from the respondents will be coded, scored, and analyzed. Items in the questionnaire that the respondents find confusing was ex-punched or modified before the instrument was used for the actual study. The instrument administered was then subjected to reliability test using Cronbach Alpha reliability analysis to determine the reliability estimate of the instrument to check if the values estimates are good enough and can be considered high enough to be used for the study. The values within 0.5-0.9 was considered significant. Thereafter the instrument was used for data collection proper

Data collection procedure

Data was collected within one month using the 35-items investigator-administered questionnaire. To avoid third person infiltration, the questionnaire was retrieved immediately from the respondent after he/she has been done responding to the items in the questionnaire. This was accomplished with the help of four field research assistants who was trained by the student before data collection process commences.

Method of data analysis
The obtained data were checked and analyzed with a ± margin of error utilizing the Statistical Package for Social Sciences (SPSS version 22) application. Formulated and tested using chi-square and a 0.05 simple linear regression analysis significant level.

2. RESULTS

The questionnaires were distributed to 3843 caregivers across the Nine (9) local government areas in Delta North senatorial district but the researcher was able to successfully retrieve 3624, which constituted about 94% of the sample size (see Table1a). The researcher used the 3624 (94%) successfully retrieved questionnaires for analysis because it was considered to be adequate and sufficed for statistical analyses.

Table 1a. Rate of response from survey

Description	Frequency	Percentage
Questionnaires Retrieved	3624	94%
Questionnaire Not Retrieved	219	6%
Total	3843	100

The data showed that 3030, representing about 85.0% of the respondents were mothers while the remaining 544 (15.0%) were male (fathers) with under-5 children in Delta North Senatorial District (Table 1b).

Table 1b. Socio-demographic details of respondents

Social and Demographic Data	Frequencies (N)	Percentages
Gender		

Male	544	15.0%
Female	3030	85.0%
Age		
Below 18 years	109	3.0%
18-25 years	1232	34.0%
26-33 years	1776	49.0%
34-41 years	399	11.0%
Above 41 years	108	3.0%
Marital Status		
Single	399	11.0%%
Married	2573	71.0%%
Widowed	254	7.0%
Divorced	398	11.0%
Level of Education		
No former education	834	23.0%
Primary Education	689	19.0%
Secondary Education	978	27.0%
Tertiary Education	1123	31.0%
Religion		
Christianity	2428	67.0%
Islam	616	17.0%
Others	580	16.0%
Employment Status		
Employed	1051	29.0%
Unemployed	2573	71.0%
Types of Employment Status		
Self-Employed	295	28.0%
Private Sector	350	33.30%
Government Sector	406	38.70%
Monthly Income		
No Monthly Income	1706	47.07%
Below N18,000 (Low)	152	4.19%
N18,000-N30,000 (Middle)	262	7.23%
Above N30,000 (High)	1504	41.51%
Number of Under-5 Children		
None	544	15.0%
1 Child	1486	41.0%
2-3 Children	1123	31.0%
Above 3 Children	471	13.0%

In response to knowledge level of caregivers on immunization for children under-5 years, a good number of the respondents (n= 3153; 87.0%) ticked “Yes” while the remaining (n= 471; 13.0%) ticked “No” (Table 2).

Table 2.Knowledge level of caregivers on immunization for children under-5 years

No. Item	Variable	Yes			No		
11	Have you heard of immunization for children 0-5 years	3153 (87.0%)			471 (13.0%)		
12	If ‘Yes’, where did you hear it from?	Health Facility	Family Member	Friend/colleague	Church/mosque	School	Others
		1292 (35.7 %)	599 (16.5%)	284 (7.8%)	410 (11.3%)	410 (11.3 %)	158 (4.4 %)
		True			False		
13	Under-5 years immunizations are vaccines given to children from day one till when they are five years.	3298 (91.0%)			326 (9.0%)		
14	At the first one week of birth a child needs his/her first immunization	3479 (96.0%)			145 (4.0%)		
15	At one month after first immunization the child also need immunization.	3443 (95.0%)			181 (5.0%)		
16	At three months the child needs another immunization.	3479 (96.0%)			145 (4.0%)		

17	At 6-months the child needs another immunization.	3482 (96.1%)	142 (3.9%)	
18	At 9-months the child needs another immunization,	3482 (96.1%)	142 (3.9%)	
19	At one year the child needs another immunization.	3202 (88.35%)	422 (11.65%)	
20	At every month, the child needs to be taken for post-natal care?	2283 (63.0%)	1341 (37.0%)	
21	Children need immunizations till they get to the age of 5 years.	2066 (57.0%)	1558 (43.0%)	
		Yes	No	Don't think so
22	Apart from the routine 0-5years doses, children are expected to take campaign doses whenever there are campaigns.	3044 (84.0%)	326 (9.0%)	254 (7.0%)

Table 3 disclosed that majority (n= 2972; 82.0%) of the caregivers do not know the type vaccine their under-5 children take for immunization while few of them (n= 652; 18.0%) said yes they know the type of vaccine their under-5 children take for immunization in the senatorial district

Table 3. Types of vaccines for the immunization of children under-5 years

No. Item	Variable	Yes	No
23	Do you know the vaccines your child is to take from 0-5 years?	652 (18.0%)	2972 (82.0%)

		Yes	No	Undecided
24	BCG/OPV_0/HBV_1 are given at birth.	290 (8.0%)	616 (17.0%)	2718 (75.0%)
25	OPV_1/DPT_1/HBV_2 are given at 6 weeks.	556 (15.35%)	652 (17.99 %)	2416 (66.66%)
26	OPV_2/DPT_2 are given at 10 months.	619 (17.1%)	289 (8.0%)	2716 (74.9)
27	OPV_3/DPT_3/HBV_3 are given at 14 weeks.	623 (17.2%)	285 (7.9%)	2716 (74.9)
28	Vitamin-A_1 is given at 9 months.	619 (17.1%)	291 (8,0%)	2714 (74.9)
29	Measles/Yellow Fever are given at 9 months.	2605 (71.88%)	532 (14.67 %)	487 (13.45%)
30	Vitamin-A_2 is given at 15 months (1 year, 3 months).	619 (17.1%)	2711 (74.8%)	294 (8.1%)
31	Two doses of Vitamin-A can be given to children 6-59 months at least 6 months apart at any clinic visit.	319 (8.80%)	1599 (44.12 %)	1706 (52.92%)

Table 4 disclosed that nearly all the caregivers (n= 3515, 97.0%) said yes to taken to their under-5 children for immunization while the remaining few (n= 109; 3.0%) said No

Table 4. Number of under-5 years children immunized

No. Item	Variable	Yes	No	
32	Has your child taken any of the immunizations meant for children 0-5 years?	3515 (97.0%)	109 (3.0%)	
		BCG	OPV_0	HBV_1
33	At birth:	1377 (38.0%)	978 (27.0%)	1269 (35.0%)
		.	DPT_1	HBV_2
34	At 6 week:	1377 (38.0)	978 (27.0)	1269 (35.0)
		OPV_2	DPT_2	
35	At 10 months	2151 (59.4)	1473 (40.6)	
		OPV_3	DPT_3	HBV_3
36	At 14 weeks:	80 (2.2)	35 (1.0)	1269 (35.0)
		Vitamin-A_1	Measles	Yellow Fever
37	At 9 months:	80 (2.2)	35 (1.0)	1269 (35.0)
		Vitamin-A_2	Measles	Yellow Fever

38	At 15 months (1 year, 3 months):	80 (2.2)	35 (1.0)	1269 (35.0)

In this table 5, the table uncovered that most of the respondents (n= 1087, 1377; 30.0%, 38.0%) respectively disagreed and strongly disagreed that with the statement that with or without immunization, their children will still be fine. While the rest of them concurred with the statement

Table 5. Perceptions of caregivers towards immunization of children under-5 years

No. Item	Variable	SA	A	D	SD
46	With or without immunization my child will still be fine.	471 (13.0%)	689 (19.0%)	1087 (30.0%)	1377 (38.0%)
47	Sometimes I get discouraged because of the distance to the facility.	978 (27.0%)	327 (9.0%)	978 (27.0%)	1341 (37.0%)
48	I select the types of immunization I allow to be given to my child.	80 (2.2%)	323 (8.9%)	981 (27.1%)	2240 (61.8%)
49	I use to refuse injectable vaccines for my child because of pains involved.	78 (2.0%)	326 (9.0%)	978 (27.0%)	2242 (62.0%)
50	Some of the vaccines use to make my baby run temperature, so sometimes I feel reluctant going for the next immunization appointment.	906		1160 (32.0%)	1305 (36.0%)
51	The attitude of the healthcare providers sometime keeps me away from bring my child for immunization.	1123 (31.0%)	978 (27.0%)	906 (25.0%)	617 (17.0%)
52	Sometime, the thought of the side effects make me refuse to go for my child's immunization.	320 (8.0%)	603 (17.0%)	1123 (31.0%)	1578 (44.0%)
53	I use to get discouraged bring my child for immunization because of prolonged waiting time.	1123 (31.0%)	978 (27.0%)	906 (25.0%)	617 (17.0%)

Table 6: Attitude of caregivers towards immunization of children under-5 years

No. Item	Variable	SA	A	D	SD
54	Inconvenient schedules of immunization have made me miss my child's immunization appointments.	580 (16.0%)	1015 (28.0%)	906 (22.0%)	1123 (31.0%)
55	I go for my child's immunization when I like.	80 (2.0%)	101 (3.0%	1810 (50.0	1633 (45.0

			)	%)	%)
56	I take my child there when it is most convenient.	580 (16.0%)	906 (25.0 %)	1015 (28.0 %)	1123 (31.0 %)
57	I go for my child's immunization only when the child is ill.	109 (3.0%)	181 (5.0%)	1123 (31.0 %)	2211 (61.0 %)
58	Most time I go late for my child's immunization.	208 (6.0%)	081 (10.0 %)	1429 (31.0 %)	1906 (53.0 %)

The study found that knowledge of immunization improved caregivers' uptake of immunization for under-5 children in the senatorial district. Home visits from immunization agents also improved uptake. Accessibility to health facilities and availability of immunization in work places also enhanced routine check-ups. Caregivers were motivated to ensure regular immunization due to understanding the consequences of not completing it.

Hypotheses Testing

The hypothesis testing was done to find out whether data obtained from caregivers in the sampled nine (9) local governments in Delta North Senatorial District validated the hypotheses of no relationship between the independent variables (knowledge level of caregivers, family dispositions to immunization and enablers of immunization) and dependent variable (immunization of under-5 immunization). The hypotheses were tested using linear regression analysis

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Hypothesis 1 (H_1): There is no significant relationship between knowledge level of caregivers and the immunization of under-5 children in Delta North senatorial district of Delta State.

Table 7a. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.456	.208	.207	.15208

a. Predictors: (Constant), Knowledge level of caregivers

b. Dependent Variable: Immunization of under-5 children in Delta North

Table 7b. Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.947	1	21.947	948.860	.000[a]
	Residual	83.775	3622	.023		
	Total	105.722	3623			

a. Predictors: (Constant), Knowledge level of caregivers

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.947	1	21.947	948.860	.000[a]
	Residual	83.775	3622	.023		
	Total	105.722	3623			

a. Predictors: (Constant), Knowledge level of caregivers

b. Dependent Variable: Immunization of under-5 children in Delta North

Table 7c. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.769	.009		86.774	.000
	Knowledge level of caregivers	.231	.008	.456	30.804	.000

a. Dependent Variable: Immunization of under-5 children

3. DISCUSSION

Analysis of Response Rate

The questionnaires were distributed to 3843 caregivers across the Nine (9) local government areas in Delta North senatorial district but the researcher was able to successfully retrieve 3624, which constituted about 94% of the sample size, The researcher used the 3624 (94%) successfully retrieved questionnaires for analysis because it was considered to be adequate and sufficed for statistical analyses **(Table 1a).**

Respondents' Socio-Demographic Data

The data showed that 3030, representing about 85.0% of the respondents were mothers while the remaining 544 (15.0%) were male (fathers) with under-5 children in Delta North Senatorial District.

The study reveals that the majority of mothers and fathers with under-5 children in Delta North Senatorial District are in their 20s and early 30s, with most being married. Most of these individuals have tertiary education, with a significant number having a secondary education. The majority of respondents are Christian, with 67.0% being Christians. The employment status of the respondents is high, with 71.0% being unemployed, while 29.0% are gainfully employed. The majority of these respondents are employed in the government sector, with 38.70% working in the private sector. The majority of respondents do not earn any monthly salary, with 41.0% having one or more under-5 children. The majority of respondents have one or more under-5

children, with a small percentage having no children and a small percentage having three or more **(Table 1b**).

This study found that most caregivers in Delta North Senatorial District were aware of immunization for children under five years. Most caregivers (87.0%) believed that immunization should begin from day one until five years, with most agreeing that it is true for a child to receive another immunization at six months, nine months, and a year. Most caregivers also agreed that a child should be taken for post-natal care every month. Most caregivers agreed that children should undergo immunization until they reach age five, while the remaining respondents (43.0%) stated otherwise. Most caregivers agreed that children should receive more doses of immunization vaccine during campaigns outside the 0-5 years' routine doses. The majority of caregivers had formal education, which may enhance their knowledge of immunization for under-5 children. This result supports the idea that maternal educational status can influence the knowledge level of caregivers about immunization for under-5 children (**Table 2**).
The majority of caregivers in the senatorial district do not know the type of vaccine their under-5 children take for immunization, with most unsure about the BCG/OPV0/HBV1 types given at birth. They are also indecisive about OPV1/DPT1/HBV2 given to under-5 children at 6 weeks, OPV2/DPT2 given at 10 months, OPV3/DPT3/HBV3 given at 14 weeks, and Vitamin-A1 intake for children at 9 months. Most caregivers are unsure about the measles/yellow fever vaccine given at 9 months, and most caregivers are indecisive about Vitamin-A2 given at 15 months. Most caregivers are indecisive about two doses of Vitamin-A given to children 6-59 months at least 6 months apart at any clinic visit. This data suggests that most caregivers do not know the type of vaccines and vitamins their under-5 children are receiving during routine immunization. The majority of caregivers only have good awareness about the type of vaccine used for measles/yellow fever, which is consistent with a study in Sudan where nearly all mothers were able to correctly name vaccines used for measles (**Table 3**).

Nearly all the caregivers (n= 3515, 97.0%) said yes to taken to their under-5 children for immunization while the remaining few (n= 109; 3.0%) said No. This indicates that nearly all the sampled caregivers did take their under-5 children for immunization in the senatorial district.
Also, some of the caregivers (n= 1377; 38.0%) concurred that their child did take BCG at birth, some of them (n= 1269; 35.05) agreed to given their children HBV_1at birth while the remaining (n= 978; 27.0%) admitted to given their children OPV_0 at birth.
Most respondents (n= 1377; 38.0%) also agreed that OPV_1 vaccinewas given to children at weeks of birth, followed by those (n= 1269; n=35.0%) who admitted to given HBV2while others remaining (n = 978; 27.0%) concurred to given their 6 week old children DPT1 vaccine. In addition, most of the respondents (n= 2151; 59.4%) concurred that their 10-month old children had OPV_2 vaccinewhile others (n= 1473; 40.6%) agreed to given DPT_2 vaccine to their 10-month old children (**Table 4**).
The table showed that most caregivers in Delta North senatorial district disagree with the statement that their children will be fine with or without immunization. They also disagree with the statement that distance to health facilities discourages them from immunization. Most caregivers do not select the type of vaccine for their under-5 children, and they do not refuse injectable vaccines due to pain. They also do not feel reluctant to go for immunization again even when some vaccines make their children run temperature. They also disregarded the side effects of vaccines and the time waste in hospitals during immunization. Overall, caregivers in

Delta North senatorial district have a positive perception towards routine immunization for under-5 children (**Table 5**).

Table 7 reveals caregivers' attitudes towards immunization of under-5 children. Most agree that they have missed their children's immunization due to inconvenient schedules, while others disagree that schedules do not cause missed appointments. Most caregivers do not go for their children's immunization anytime they like, but do take them to health facilities based on appointments. They also do not go late to immunization. The data aligns with findings from Atakumosa West Local Government Area and Alfatih One in Sudan (**Table 6**).

This model has R^2= 0.208 and adjusted R^2 = 0. 207 which indicated that about 21% of the influence in the under-5 children immunizations in Delta North is predicted by knowledge level of caregivers. The F-value of 948.86 and accompanied P-value of 0.00 proved that there is strong linear relationship between the dependent (immunization of under-5 children) and independent variable (knowledge level of caregivers). Thus, it can be confidently said that the overall model is highly significant. However, the individual t-statistic of about 87 and corresponding P-value of 0.00 showed that knowledge level of caregivers is positive and highly significant. Thus, knowledge level of caregivers strongly promoted the immunization of under-5 children in Delta North senatorial district of Delta State. Against this backdrop, the null hypothesis of no relationship between both variables are thus invalidated. This finding however aligns with the findings obtainable in several studies [25].

4. CONCLUSION

This study investigated Knowledge Level of Caregivers on immunization for Children under-5 years in Delta North Senatorial District of Delta State, Nigeria. The research involved self-structured questionnaires distributed to 3843 caregivers across nine local government areas. The data was analyzed using descriptive statistics and regression analyses. The findings showed that the knowledge level of caregivers, family dispositions, and enablers were statistically significant in the immunization of under-5 children in Delta North senatorial district. The study recommends that Nigeria government should stimulate gender equality in educational training, including females being exposed to education up to tertiary level. Health officials should be made aware of the importance of immunization, and it should be included in the curriculum in schools and church/mosque. Health facilities should be decentralized to different local communities and towns for easy access for mothers. Records should be digitalized for complete access at any time and place. Most mothers are not aware of the dangers associated with non-immunization of under-5 children, particularly in rural areas. It is important to create sanitization/awareness policies in rural areas and send health workers to educate people on the importance of immunization.

Recommendation

The following advice is required in light of the study's findings and conclusion: Given that the immunization of children under five is statistically correlated with knowledge level, the Nigerian government ought to prioritize and support gender equality in educational training. Specifically, women expecting to become mothers should have access to education up to the university level. The government should provide funding so that health officials can educate all expectant mothers who visit hospital facilities; it should also be included in school curricula and properly announced in churches and mosques to close the knowledge gap among expectant mothers regarding the significance of immunizing children under five. It is important to appropriately decentralize healthcare facilities to several

Ethical approval
Ethical clearance was obtained from the ethical committee of Novena University, Ogume, Delta State with the number: EC/NU/2024/2/546.

Consent
As per international standards, parental written consent has been collected and preserved by the author(s).

Disclaimer (Artificial intelligence)
Option 1:
Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.
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Details of the AI usage are given below:
1.
2.
3.

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