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Research Article

IMPROVING MATERNAL AWARENESS AND CHILDHOOD VACCINATION UPTAKE IN DELTA STATE, NIGERIA

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ABSTRACT

Background:- Vaccination is globally recognized as one of the most effective public health interventions for reducing child mortality by preventing vaccine-preventable diseases (VPDs) such as measles, polio, tuberculosis, and Haemophilus influenzae. However, in countries like Nigeria, inadequate knowledge about vaccination remains a major barrier to achieving optimal vaccine coverage. Despite the Nigerian government's provision of free routine vaccination for children up to the age of two, many mothers are unaware of the need to complete the full vaccination schedule, which leads to missed vaccination opportunities in later childhood. This study aimed to assess the level of maternal knowledge regarding childhood vaccination in Ughelli North Local Government Area of Delta State, Nigeria.

Methods:- This cross-sectional descriptive study was conducted among 321 mothers in Ughelli, Delta State, Nigeria. Data were collected using a pre-tested, self-administered questionnaire designed to assess knowledge about childhood vaccination. The survey was administered online, and the data were analysed using descriptive and inferential statistics to examine associations between socio-demographic factors and vaccination knowledge. Participants' socio-demographic characteristics, including ethnicity, employment status, and educational background, were recorded and analysed.

Results:- The study sample was predominantly Urhobo (60.7%), with a majority of participants being semi-employed (50.2%) and having attained tertiary education (88.8%). Despite the high educational levels, 87.5% of the respondents demonstrated poor knowledge of the full vaccination schedule, particularly regarding vaccines required after the age

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of two. The study found no statistically significant association between socio-demographic factors such as ethnicity, employment status, and educational level and maternal knowledge of vaccination ($p > 0.05$).

Discussion:- Although previous studies have shown a positive relationship between maternal education and vaccine uptake, this study revealed that socio-demographic variables had no significant impact on knowledge about vaccination schedules. Despite general awareness of the importance of vaccines, the study identified significant gaps in specific knowledge, particularly concerning vaccines required beyond the second year of life. These gaps highlight the need for improved communication strategies to ensure mothers understand the full vaccination process.

Conclusion:- The findings underscore the critical need for targeted health promotion efforts to enhance maternal knowledge of childhood vaccination, particularly regarding vaccines beyond infancy. Comprehensive educational campaigns using mass media, social media, and community platforms are recommended to bridge these knowledge gaps. Healthcare workers should also be trained to deliver clear and consistent information on vaccination during routine maternal and child health visits to ensure timely and complete vaccination coverage.

KEYWORDS

Vaccination, vaccine knowledge, childhood vaccination, maternal awareness, health education, Nigeria.

INTRODUCTION

The global burden of child mortality, particularly among children under the age of five, continues to be a critical issue that requires urgent intervention to reduce preventable deaths (Sharrow et al., 2022; UNICEF, 2024; WHO, 2024). Vaccination plays a pivotal role in combating child mortality by providing protection against life-threatening infectious diseases. Vaccines work by stimulating the immune system to defend against diseases like measles, polio, diphtheria, and tetanus, thus saving millions of lives annually (Oduwole et al., 2022; Milgroom, 2023).

The World Health Organization (WHO) recognizes vaccination as one of the most cost-effective public health interventions, and the Expanded Program on Vaccination (EPI) has been instrumental in delivering vaccines to vulnerable populations, especially children (Mantel & Cherian, 2020). However, despite the global progress achieved through vaccination, many low- and middle-income countries (LMICs), including Nigeria, face significant challenges in reaching adequate vaccination coverage. A key barrier is the widespread gaps in maternal knowledge about childhood vaccination, which contributes to suboptimal vaccine uptake (Musa et al., 2021).

Maternal knowledge is a crucial determinant of health-related decision-making, particularly in the context of childhood vaccination. Research shows that mothers who are well-informed about the benefits, schedule, and importance of vaccines are more likely to fully vaccinate their children (Budu et al., 2021; Abdullahi, 2022; Ariyibi et al., 2023). On the other hand, a lack of knowledge or exposure to misinformation can lead to vaccine delays or refusals, increasing the risk of vaccine-preventable diseases (VPDs) and, subsequently, higher child mortality rates.

This association between maternal knowledge and vaccination coverage is especially important in regions

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like sub-Saharan Africa, where the prevalence of VPDs remains alarmingly high (Mpundu, 2020; Adeyanju, 2022; Otoo, Ahiabor & Abdul-Wahab, 2024). Despite Nigeria's early adoption of the EPI in 1978, vaccination coverage has been inconsistent, with periods of progress frequently interrupted by setbacks. Contributing factors include poor health education, sporadic vaccination campaigns, and widespread misinformation about vaccines (Omoniyi & Williams, 2020; Majekodunmi, Oladele & Greenwood, 2022; Ikwueze, 2023). Furthermore, cultural and religious beliefs, as well as distrust in vaccine safety, significantly influence maternal decisions regarding childhood vaccination (Obohwemu et al., 2022).

Nigeria is among the countries with the highest number of unvaccinated children globally, with approximately three million children missing essential vaccines in 2018 alone (WHO/UNICEF, 2020). While large semi-urban areas like Ughelli have higher vaccination coverage rates than rural regions, gaps in maternal knowledge about vaccines continue to limit overall vaccine uptake (Orofuke et al., 2024). Addressing these knowledge deficits is crucial, as improved maternal awareness has been shown to be directly linked to higher vaccination rates and, consequently, reduced child mortality.

Numerous studies highlight the importance of maternal knowledge in improving childhood vaccination coverage (Kajungu et al., 2020; Adedire et al., 2021; Galadima et al., 2021). This knowledge includes understanding the purpose of vaccines, recognizing the diseases they prevent, and being aware of the appropriate vaccination schedules. In cases where maternal knowledge is poor, misconceptions about vaccines, hesitancy, and non-compliance with vaccination schedules are more prevalent (Adetokunboh et al., 2021; Eze et al., 2022).

A significant challenge in Nigeria is that many mothers remain unaware of the full vaccination schedule. Research by Bangura et al. (2020) found that many mothers in LMICs, including Nigeria, mistakenly believe that vaccination is only necessary during infancy. This lack of awareness leads to incomplete vaccination, particularly regarding booster doses and vaccines administered after the first year of life. Mothers may also be unaware of the specific diseases that vaccines prevent, which can lead to complacency and a failure to complete the full vaccination schedule (Adeyanju & Betsch, 2023; Idowu, Obohwemu & Iyevhobu, 2024).

In Nigeria, maternal knowledge is critical given the high burden of VPDs. Studies indicate that many Nigerian mothers have incomplete knowledge of vaccination schedules, which contributes to the low uptake of vaccines such as those for measles and polio, both of which require multiple doses over time (Inyamuwa, 2021; Ayub et al., 2022; Mahachi et al., 2022). This gap in knowledge plays a significant role in Nigeria's low vaccination coverage rates, with only about 30% of children being fully vaccinated by their first birthday (National Population Commission & ICF, 2019). A 2017 survey in Lagos found that while most mothers knew about routine vaccination, fewer than half could accurately name the vaccines their children needed after age two (Ekoh et al., 2020).

Furthermore, the knowledge gap extends beyond the basic childhood vaccination schedule. Many mothers are unaware of the need for vaccinations beyond the child's first year, including booster doses and newer vaccines such as those for pneumonia and rotavirus. This is particularly concerning, as vaccines like the second dose of the measles vaccine, administered at 18 months, are crucial for full protection (WHO, 2019). The lack of understanding about the need for these

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vaccines contributes to their low uptake, further exacerbating the burden of preventable diseases.

While numerous studies have investigated the determinants of vaccine hesitancy and vaccination uptake in Africa (Adamu et al., 2021; Sabahelzain et al., 2022; Unfried & Priebe, 2024), there has been limited research specifically examining mothers' knowledge and attitudes toward vaccinating their children beyond infancy. This study seeks to address this gap by investigating the factors associated with vaccine hesitancy among mothers, particularly regarding vaccines administered after the first year of life. Additionally, it explores the potential relationship between vaccine hesitancy and child mortality, with a focus on maternal knowledge as a key factor.

This study aims to identify strategies to enhance maternal awareness and improve vaccine uptake, with the ultimate goal of reducing child mortality. By shedding light on the role of informed decision-making in vaccination behaviours, this research will contribute to a better understanding of how to mitigate the impact of poor maternal knowledge on vaccination coverage. The findings from this study will provide valuable insights into vaccine hesitancy and its underlying causes among mothers in Delta State, which can inform the development of targeted public health interventions to improve vaccination rates and reduce child mortality.

METHODOLOGY

This study investigated factors influencing maternal knowledge of childhood vaccination in Ughelli North Local Government Area, Delta State, Nigeria. A semi-structured questionnaire, adapted from an earlier study by Idowu, Obohwemu & Iyevhobu (2024), was administered to a purposively selected sample of mothers in the area. The questionnaire focused on evaluating the mothers' knowledge of vaccination schedules, the benefits of vaccines, and potential side effects. Additionally, demographic data such as ethnicity, education level, and employment status were collected to assess the relationship between these factors and maternal vaccination knowledge.

Research Design

A cross-sectional study design was utilized to collect primary data from mothers with children within the recommended vaccination schedule. The survey gathered demographic information and variables related to vaccination attitudes and perceptions. Descriptive statistics were used to present the characteristics and experiences of the respondents, while bivariate analysis was conducted to identify associations between socio-demographic factors and vaccination knowledge.

Study setting

This study was conducted in Ughelli North Local Government Area (LGA) of Delta State, Nigeria. Ughelli North LGA, the headquarters of Ughelli, is a prominent region in Delta State. The LGA covers approximately 818 square kilometers and has an estimated population of 388,191 according to recent statistics (National Bureau of Statistics, 2023). A semi-urban environment, Ughelli North is one of the 25 LGAs in Delta State (Agaja & Unueroh, 2012).

Ughelli North LGA comprises several towns and villages, including Afiesere, Ododegho, Ofuoma, Agbarha, Owheru, Evwreni, Ogor, Agbarho, and Orogun (Ekeh, 2007). The area is predominantly inhabited by the Urhobo ethnic group, though it also hosts a mixture of other tribes such as the Igbos and

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Edos (Ogbeide, 2016), contributing to its rich cultural tapestry.

The residents of Ughelli North benefit from a range of healthcare services provided by both government and private entities. The LGA is home to several primary healthcare centers distributed across its towns and villages, providing essential health services, including vaccination programs (Agaja & Unueroh, 2012; Delta State Ministry of Health, 2023).

Ughelli North's proximity to Warri, a major commercial hub in Delta State, enhances its accessibility and connectivity (Warri Chamber of Commerce and Industry, 2023). The region's infrastructure includes schools, a general hospital, and a local government secretariat, making it a suitable setting for various research studies (Ekeh, 2007). However, like many other LGAs, Ughelli North lacks comprehensive data on the knowledge, attitude, and practice of mothers regarding childhood vaccination, highlighting the need for further research in this area (NITAG, 2023).

Study Population

The study targeted mothers with children aged 2 years and above, residing in Ughelli North LGA, Delta State. Participants were recruited via online platforms, such as Facebook, Instagram, and YouTube. Inclusion criteria required digital literacy and residency in Ughelli North LGA. Consent was obtained through the data collection tool, which also gathered demographic data and information on vaccination knowledge, including awareness of vaccines sourced "out-of-pocket." These data were then subjected to statistical analysis.

Sampling Approach

The study evaluated the knowledge, attitudes, and practices of mothers in Ughelli North LGA regarding the vaccination of their children aged 2 to 10 years. A purposive non-probability sampling method was employed due to the unique nature of the target population (Ames et al., 2019). Eligible mothers were identified, consented, and administered semi-structured questionnaires. The sample size was calculated beforehand using appropriate statistical methods.

Eligibility Criteria

Inclusion criteria for the study were: mothers whose children met the age range of 2–10 years, who resided in Ughelli North LGA, were digitally literate, and who provided consent. Mothers who did not meet these criteria, such as those outside the study area, with children not within the age range, or lacking digital literacy, were excluded.

Sample Size

A sample size of 420 was calculated using Cochrane's (1977) formula for studying a single proportion. A prevalence rate of 51.0% from a 2019 study on maternal vaccination knowledge in Lagos (Adefolalu et al., 2019) was used, allowing for a 10% non-response rate to account for attrition.

Sample Recruitment

Participants were recruited between April and June 2024, with the survey link, participant information, consent form, and questionnaire distributed through social media platforms and groups. A Google advertisement campaign was launched to further promote the study, and eligible participants were able to access the survey link. Participants had to agree to

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participate by clicking "yes" on the consent form before proceeding to the questionnaire.

Data Analysis

Data analysis was performed using IBM SPSS version 28.0 (IBM Inc., Chicago, USA). Descriptive statistics were used to describe demographic variables and vaccination awareness levels. Inferential statistics, specifically Chi-square tests, were used to examine the relationship between maternal knowledge and demographic variables. The data, categorized into nominal and ordinal responses, were coded numerically and analyzed using Pearson's Chi-square test, with a significance level set at $p < 0.05$.

Data Management

Data collected through Survey Monkey was filtered to remove responses that did not meet the inclusion criteria, coded, and analyzed using SPSS version 28.0. Responses to "Yes" or "No" questions were scored as "1" or "0," respectively, while multiple-choice and open-ended questions were scored accordingly. Knowledge scores were calculated, and knowledge levels were categorized as "poor" (<50%), "fair" (50-69%), or "good" (≥70%). Descriptive statistics, including frequency distributions for categorical variables and means with standard deviations for continuous variables, were computed. Bivariate analyses were conducted using Chi-square or Fisher's Exact Test where appropriate, with a two-tailed p-value < 0.05 considered statistically significant.

RESULTS

Respondents' Sociodemographic Characteristics

A total of 321 respondents (mothers) were included in the analysis, giving a response rate of 76%. The mean age of the respondents was 33.5 ± 5.8 years, with the youngest being 21 years old and the oldest 51 years. The mean age of their children was updated to 5.2 ± 2.1 years.

In terms of the age distribution, 64.2% (n = 206) of the respondents were aged 31–40 years, 25.9% (n = 83) were aged 21–30 years, and 9.9% (n = 32) were aged above 40 years. For the children, 57.3% (n = 184) were 5 years old or younger, while 42.7% (n = 137) were over 5 years old (see Table 1).

Regarding ethnicity, the majority were of Urhobo descent (60.7%, n = 195), Isoko (21.5%, n = 69), Itsekiri (9.6%, n = 31) and Others (8.2%, n = 26). Employment status showed that 50.2% (n = 161) were semi-employed, 43.0% (n = 138) were employed, and 6.8% (n = 22) were unemployed. For education level, 88.8% (n = 285) of the respondents had attained tertiary education, 8.1% (n = 26) had secondary education, and 3.1% (n = 10) had primary education.

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Table 1: Sociodemographic Characteristics of Respondents

Characteristic	Frequency (n)	Percentage (%)	Mean ± SD	Range
Age (years)			33.5 ± 5.8	21-51
21-30	83	25.9		
31-40	206	64.2		
>40	32	9.9		
Child's Age (years)			5.2 ± 2.1	
≤5	184	57.3		
>5	137	42.7		
Ethnicity				
Urhobo	195	60.7		
Isoko	69	21.5		
Itsekiri	31	9.6		
Others	26	8.2		
Employment Status				
Semi-employed	161	50.2		
Employed	138	43.0		
Unemployed	22	6.8		
Education Level				
Tertiary	285	88.8		
Secondary	26	8.1		
Primary	10	3.1		

Respondents' Knowledge towards Childhood Vaccination

The participating mothers demonstrated varying levels of knowledge regarding issues related to childhood vaccination, as shown in Table 2 below.

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Variable	Count	Total (%)
Do you know about vaccination?		
Yes	303	94.4
No	18	5.6
List all the vaccination types for children 0-10 years that you know		
0-8 types: Poor knowledge	281	87.5
9-12 types: Fair knowledge	15	4.7
>13 types: Good knowledge	25	7.8
Which diseases can vaccines prevent?		
<5 diseases: Poor knowledge	194	60.4
5-6 diseases: Fair knowledge	75	23.3
>7 diseases: Good knowledge	52	16.2
Why should a child be given vaccination?		
Correct	279	86.9
Incorrect	42	13.1
Do you know the schedule for childhood vaccination?		
Yes	260	81.0
No	61	19.0
Do you know if your child has been completely vaccinated?		
Yes	260	81.0
No/I don't know	61	19.0
If No, what was the reason for non-completion?		
Specified	32	52.5*
Undefined**	9	3.5
Does vaccination have side effects?		
Yes	129	40.2
No/Don't know	192	59.8

***Calculated with respect to the total number of respondents reporting incomplete vaccinations.**

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**** Refers to those who reported complete vaccination but still provided reasons for non-completion.**

Factors Associated with Respondents' Knowledge of Vaccination

The factors associated with the respondents' knowledge of childhood vaccination were examined using bivariate analyses and cross-tabulation, as summarized in Table 3.

Variable	Good (%)	Poor (%)	χ^2	p-value
Age-group (years)				
21–30	15 (17.6)	68 (82.4)	4.436	0.109
31–40	51 (23.5)	166 (76.5)		
>40	13 (39.1)	20 (60.9)		
Child's age (years)				
≤5	44 (23.9)	140 (76.1)	0.065	0.799
>5	31 (22.7)	106 (77.3)		
Ethnicity			1.686	0.430
Urhobo	55 (21.8)	197 (78.2)		
Isoko	15 (27.1)	40 (72.9)		
Itsekiri	6 (33.3)	12 (66.7)		
Employment status			FET**	0.902
Unemployed	1 (25.0)	3 (75.0)		
Semi-employed	36 (22.4)	125 (77.6)		
Employed	34 (24.4)	105 (75.6)		
Education level			FET**	0.276
Primary	0 (0.0)	5 (100.0)		
Secondary	3 (11.8)	23 (88.2)		
Tertiary	71 (24.6)	218 (75.4)		

Note: FET = Fisher's Exact Test

Age-Group and Knowledge

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The findings showed that 17.6% of mothers aged 21–30 had good knowledge of childhood vaccination, while 82.4% had poor knowledge (Fig. 1). In the 31–40 age group, 23.5% demonstrated good knowledge, and 76.5% had poor knowledge. Among mothers aged above 40, 39.1% exhibited good knowledge, while 60.9% had poor knowledge. A chi-square value of 4.436 with a p-value of 0.109 ($p > 0.05$) indicates that there is no statistically significant association between the respondents' age and their knowledge of vaccination, suggesting the acceptance of the null hypothesis.

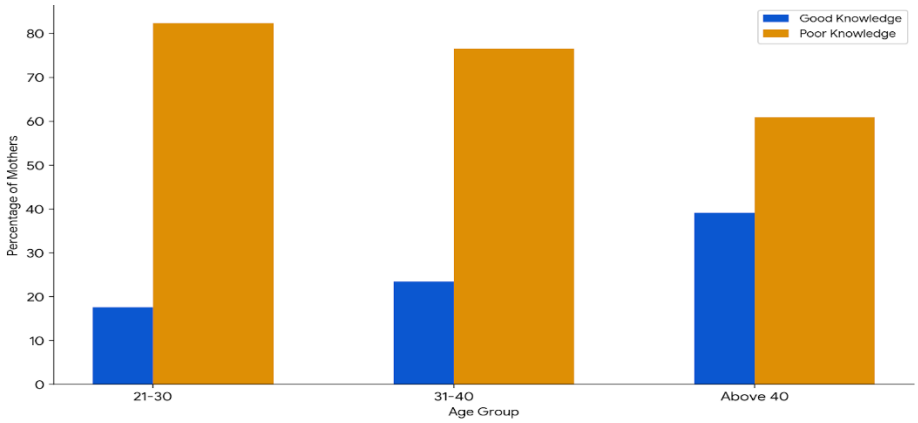

Fig. 1: Knowledge of Childhood Vaccination by Mother's Age Group

Child's Age and Knowledge

For mothers with children aged 5 years or younger, 23.9% had good knowledge, while 76.1% had poor knowledge (Fig. 2). For mothers with children above 5 years old, 22.7% demonstrated good knowledge, and 77.3% had poor knowledge. With a p-value of 0.799, there is no significant association between the child's age and the mothers' knowledge of vaccination.

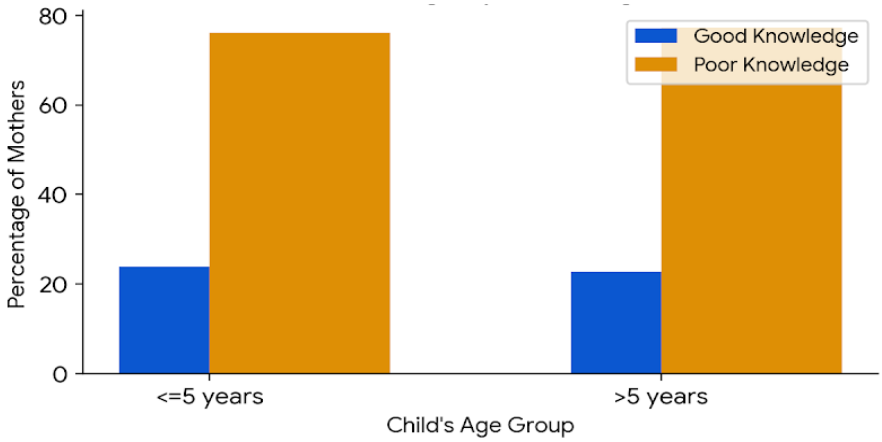

Fig. 2: Knowledge by Child's Age

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Ethnicity and Knowledge

In terms of ethnicity, 21.8% of Isoko mothers had good knowledge of childhood vaccination, compared to 27.1% of Urhobo and 33.3% of Itsekiri mothers (Fig. 3). However, p-value of 0.430 indicates the absence of a statistically significant relationship between ethnicity and vaccination knowledge.

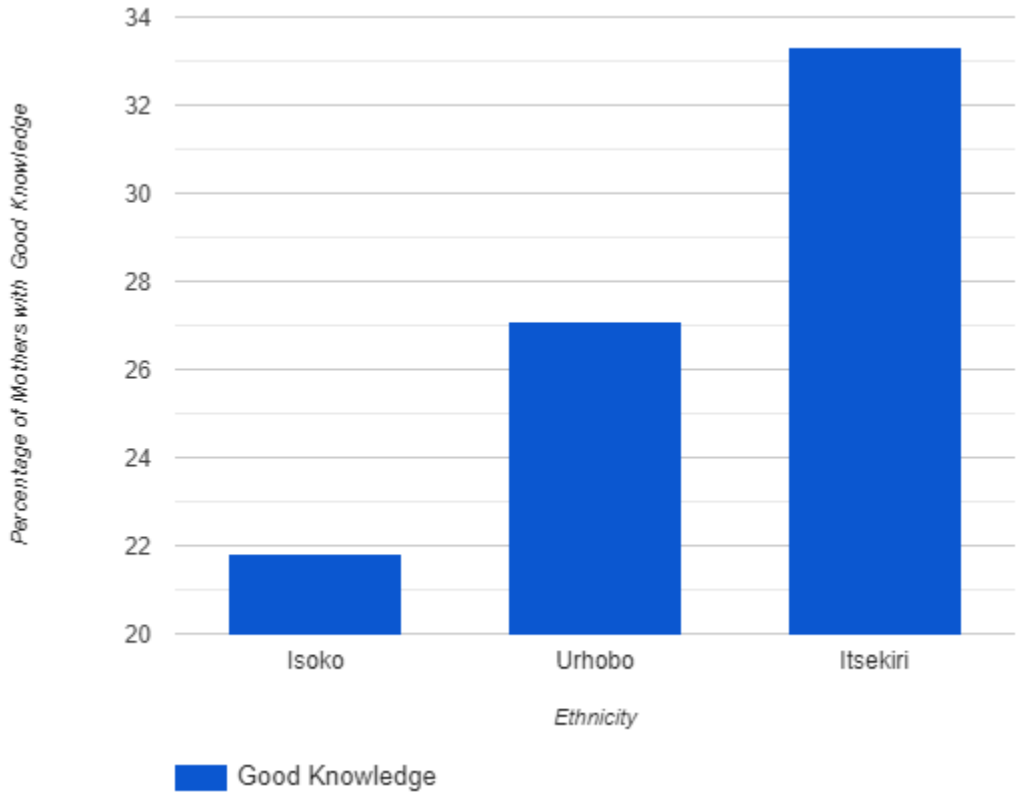

Fig. 3: Knowledge of Childhood Vaccination by Ethnicity

Employment Status and Knowledge

Regarding employment status, 25.0% of unemployed mothers, 22.4% of semi-employed mothers, and 24.4% of employed mothers demonstrated good knowledge of vaccination (Fig. 4). A p-value of 0.902 further supports the conclusion that no statistically significant association exists between employment status and vaccination knowledge.

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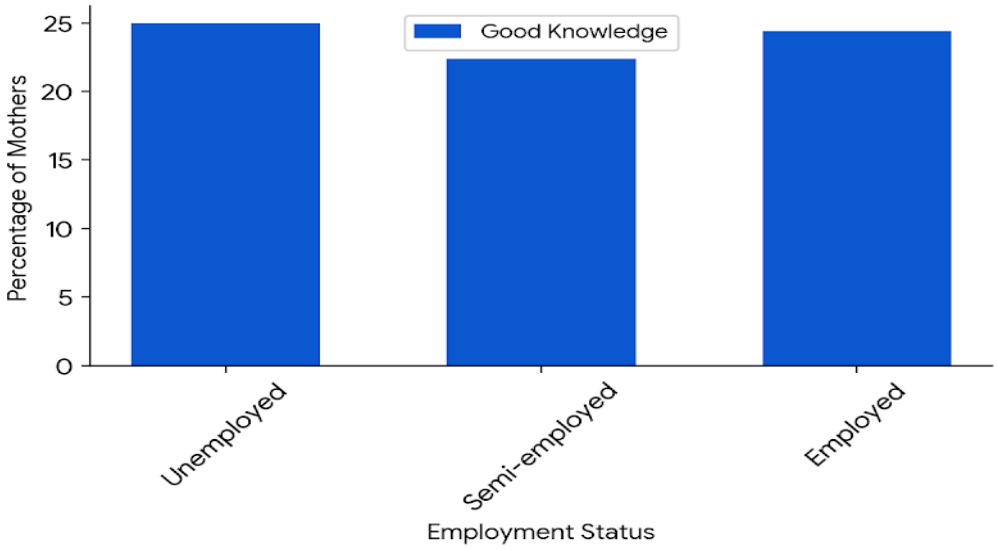

Fig. 4: Knowledge by Employment Status

Education Level and Knowledge

Education levels showed that 0% of mothers with primary education, 11.8% of mothers with secondary education, and 24.6% of mothers with tertiary education exhibited good knowledge (Fig. 5). The p-value of 0.276 suggests no significant association between education levels and knowledge of childhood vaccination.

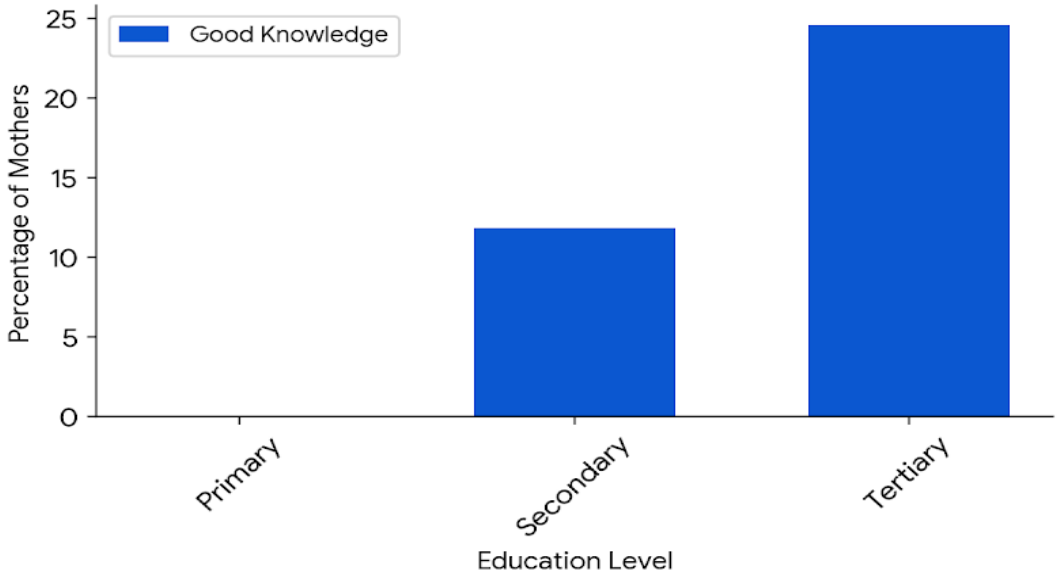

Fig. 5: Knowledge by Education Level

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Summary of Findings

A large proportion of respondents (94.4%, n = 303) indicated that they were aware of childhood vaccination. However, most respondents (87.5%, n = 281) demonstrated poor knowledge of the specific types of vaccines used for children aged 0–10 years. Only a small percentage (7.8%, n = 25) exhibited good knowledge by correctly identifying more than 13 vaccine types.

When asked about the diseases that vaccines can prevent, 60.4% (n = 194) of the respondents could name fewer than five vaccine-preventable diseases, indicating poor knowledge in this area. About 16.2% (n = 52) of mothers demonstrated good knowledge by identifying more than seven vaccine-preventable diseases.

Regarding the rationale behind childhood vaccination, 86.9% (n = 279) of the respondents correctly understood the reason for vaccinating children, while 13.1% (n = 42) provided incorrect reasons. Similarly, 81.0% (n = 260) of mothers were aware of the vaccination schedule and knew whether their child had been completely vaccinated. However, 19.0% (n = 61) of mothers either did not know or were unsure about their child's vaccination status. Among those who did not complete their children's vaccination, 52.5% (n = 32) gave specific reasons for the incomplete vaccination.

Interestingly, the majority of respondents (59.8%, n = 192) were not aware of the potential side effects of vaccines, reflecting a gap in knowledge in this aspect of vaccination.

Overall, a significant proportion of respondents (76.6%, n = 246) demonstrated a low level of knowledge regarding childhood vaccination, particularly on vaccine types and preventable diseases. A fair level of knowledge was displayed by 15.2% (n = 49), while 8.2% (n = 26) of mothers exhibited good knowledge regarding vaccination issues. This highlights the need for targeted educational interventions to improve maternal knowledge on vaccination, especially in terms of understanding the types of vaccines available, the diseases they prevent, and potential side effects.

DISCUSSION

Maternal knowledge plays a critical role in determining childhood vaccination rates and adherence to vaccine schedules. Numerous studies consistently highlight that insufficient maternal awareness is a major contributing factor to low vaccination coverage, particularly in low- and middle-income countries (LMICs) such as Nigeria. Despite the clear benefits of vaccination as one of the most cost-effective public health strategies, limited knowledge about vaccines continues to hinder efforts to improve coverage in many regions (Ahonkhai et al., 2022; Amponsah-Dacosta, Kagina and Olivier, 2022; Obohwemu et al., 2022). While Nigeria's national vaccination program provides free vaccines for children, achieving high coverage remains a challenge, especially in rural and peri-urban areas (Ayub et al., 2022). In Delta State, knowledge gaps persist in areas like Ughelli, where access to healthcare services is relatively high, yet health literacy remains low.

Impact of Knowledge Gaps on Vaccination Uptake

A key finding in this study is the widespread lack of understanding among mothers about the full vaccination schedule. While many mothers are aware of the vaccines needed during infancy, there is a general lack of knowledge about vaccines required beyond the age of two, such as booster doses for

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diseases like measles, tetanus, and diphtheria. This gap is alarming because incomplete vaccination leaves children susceptible to preventable diseases, undermining the benefits of earlier vaccinations (Nguseer, 2021; Isabella, 2022). The failure to administer these follow-up vaccines contributes to the persistence of vaccine-preventable diseases (VPDs), diminishing the progress made through early vaccinations.

Research shows that maternal awareness of the full vaccination schedule is a major determinant of whether children complete their vaccine course. For example, Fatiregun et al. (2021) observed that mothers with incomplete knowledge of vaccine schedules are less likely to bring their children for all required doses. This issue is compounded by the misconception among many mothers that after the first few vaccines given during infancy, their children are fully protected (Inyamuwa, 2021). This misunderstanding highlights the need for improved health communication strategies that can effectively convey the importance of booster doses and vaccines required in later childhood.

Contributing Factors to Knowledge Gaps

Several factors contribute to the observed gaps in maternal knowledge. First, the complexity of the vaccination schedule itself poses a challenge for many mothers, especially those with limited formal education or low health literacy. The schedule involves multiple vaccines given at various stages, which can be confusing without clear guidance from healthcare providers (Adedokun et al., 2017). Without consistent, accessible information, many mothers may lose track of when vaccines are due, leading to missed doses.

Inconsistent communication from healthcare providers is another contributing factor. Health workers are the primary source of information for mothers regarding vaccination, but when they fail to clearly explain the entire vaccination schedule, including the need for booster doses, this often leads to incomplete vaccination. In some cases, healthcare workers may not stress the importance of returning for subsequent doses after infancy, reinforcing the false belief that early vaccinations are sufficient.

Moreover, national vaccination campaigns, though effective in raising general awareness, often lack specific details on vaccines needed beyond infancy. Oyo-Ita et al. (2016) emphasize that while educational interventions have been successful in improving maternal knowledge, they often fail to address the specific needs of different socio-demographic groups. As a result, these campaigns are not fully effective in bridging the knowledge gaps across various segments of the population.

Socio-Demographic Influences on Knowledge

Education is widely recognized as a key factor in improving health outcomes, but this study reveals that even educated mothers in Ughelli may have incomplete knowledge of the vaccination schedule. This finding echoes previous research showing that higher education alone does not necessarily guarantee comprehensive understanding of vaccination requirements (Ohammah, 2020; Sebeh, 2020). Other socio-demographic factors such as ethnicity, employment status, and access to healthcare also influence maternal knowledge.

For instance, mothers working in informal or semi-formal sectors may have limited access to health information or may not be able to attend vaccination

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appointments regularly, resulting in gaps in their knowledge of vaccine schedules. Ethnic and cultural factors further contribute to disparities in vaccination knowledge. In diverse semi-urban settings like Ughelli, differences in health literacy among ethnic groups, combined with language barriers and cultural beliefs, can limit access to accurate vaccination information (Emmanuel et al., 2024). The Urhobo majority in areas like Ughelli may have better access to community health initiatives, while minority groups may face additional challenges in understanding and adhering to the vaccination schedule.

Strategies to Improve Maternal Knowledge

Addressing the knowledge gaps identified in this study requires targeted public health strategies focused on delivering clear, culturally sensitive, and accessible information about vaccination schedules. Given the high mobile phone penetration in semi-urban areas like Ughelli, digital platforms and mobile health (mHealth) interventions are effective tools for delivering timely vaccination information. Health campaigns could use SMS reminders, social media, and mobile apps to send personalized reminders about upcoming vaccines and explain the importance of completing the schedule. Studies have shown that mHealth interventions can significantly improve vaccination rates by providing caregivers with accessible educational content (de Cock et al., 2020; Menzies et al., 2020; Wynn et al., 2021).

Engaging local leaders and healthcare workers in community programs is essential for raising awareness about vaccination. These programs can be tailored to the linguistic and cultural needs of different ethnic groups within Delta to ensure that all mothers have access to accurate and relevant information. Community health workers should provide detailed guidance on the vaccination schedule, including the importance of vaccines after infancy and booster doses.

Incorporating vaccination education into routine maternal and child health visits can ensure that mothers receive ongoing information about vaccination. This approach allows healthcare providers to reinforce the importance of completing the full vaccination schedule and provides opportunities for mothers to ask questions and clarify doubts about vaccine timing and efficacy.

Special attention should be given to vulnerable populations, including mothers with low education, informal workers, and ethnic minorities. Tailored educational materials such as visual aids, simplified brochures, and health talks in local languages should be developed to address the specific barriers faced by these groups. Simplified communication can help overcome literacy and language challenges.

Since healthcare workers are the main source of vaccination information for mothers, it is essential to train them in effective communication techniques. Providers should be equipped with clear, easy-to-understand materials to share with mothers, and regular refresher courses can ensure they remain up to date on the latest vaccination guidelines.

In addition to improving maternal knowledge, systemic barriers that prevent mothers from completing the vaccination schedule must also be addressed. These include inconsistent vaccine supply, long waiting times at healthcare facilities, and transportation costs (Songane, 2018; Academy of Science of South Africa, 2021; Talabi et al., 2023). Public health authorities need to ensure that vaccination services are accessible, reliable, and affordable, particularly for mothers in low-

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income communities. Investment in healthcare infrastructure and workforce training can help reduce waiting times and improve the quality of vaccination services. Providing financial support for transportation costs could further increase vaccine uptake.

CONCLUSION

The findings of this study highlight the critical need for targeted health promotion efforts to enhance maternal knowledge of childhood vaccination, particularly regarding vaccines beyond infancy. While many mothers are aware of the importance of routine vaccinations in early childhood, there is a significant gap in knowledge regarding booster shots and vaccines for older children. This lack of understanding can lead to missed vaccination appointments, incomplete immunization schedules, and increased susceptibility to preventable diseases.

To bridge these knowledge gaps, comprehensive educational campaigns using mass media, social media, and community platforms are recommended. Television and radio advertisements can reach a wide audience and convey important messages about the benefits of childhood vaccination. Social media platforms can be used to share informative content, engage with parents, and address common misconceptions. Additionally, community-based initiatives, such as health fairs and workshops, can provide opportunities for face-to-face interactions and tailored education for parents.

Healthcare workers play a crucial role in ensuring timely and complete vaccination coverage. They should be trained to deliver clear and consistent information on vaccination during routine maternal and child health visits. This includes providing parents with information about the specific vaccines recommended for their child's age, the benefits of vaccination, and the potential risks of vaccine-preventable diseases. Healthcare providers should also address any concerns or questions parents may have, using plain language and avoiding medical jargon.

Furthermore, it is essential to create a supportive environment that encourages parents to vaccinate their children. This includes addressing barriers to vaccination, such as cost, convenience, and vaccine hesitancy. By providing accessible vaccination clinics, flexible appointment scheduling, and financial assistance, healthcare providers can help ensure that all children have the opportunity to receive the necessary immunizations.

CONFLICTS OF INTEREST

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