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Sociodemographic Factors and Maternal Knowledge of Childhood Vaccination in Nigeria

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Abstract: Childhood vaccination is globally recognized as one of the most cost-effective public health interventions to reduce child mortality, particularly in regions burdened by vaccine-preventable diseases (VPDs) such as measles, polio, and tuberculosis. Despite the availability of free routine vaccination services in Nigeria, suboptimal vaccination coverage persists, and maternal knowledge plays a critical role in this challenge. While much attention has been focused on the role of attitudes and practices in influencing vaccine uptake, less is known about the specific impact of socio-demographic factors on maternal knowledge of the vaccination schedule, particularly in urban areas like Ughelli, Nigeria. This study seeks to fill this gap by examining the socio-demographic determinants of maternal knowledge about childhood vaccination in Ughelli North Local Government Area (LGA) of Delta, Nigeria.

A cross-sectional descriptive study was conducted among 321 mothers residing in Ughelli North LGA, utilizing a structured and pre-tested questionnaire designed to assess maternal knowledge of vaccination schedules and key vaccines for children. The study explored the association between socio-demographic factors such as age, educational level, employment status, ethnicity, and the level of maternal knowledge about childhood vaccination. Data were collected using an online survey and analysed with descriptive and

inferential statistics to identify patterns and associations.

The study revealed that, despite high levels of educational attainment among participants (88.8% had tertiary education), 87.5% of the respondents demonstrated poor knowledge of the full vaccination schedule, especially concerning vaccines required beyond the age of two. Socio-demographic variables, including ethnicity, employment status, and education, were not significantly associated with vaccination knowledge ($p>0.05$), indicating that even mothers with higher education levels exhibited gaps in specific vaccination knowledge. These results suggest that maternal education alone is not a sufficient predictor of comprehensive vaccination knowledge in this context.

This study makes an original contribution to the body of knowledge by highlighting the disconnect between general education and specific health knowledge regarding childhood vaccination. While many studies have established positive links between socio-demographic factors and overall vaccine attitudes or practices, this research uniquely focuses on knowledge of the vaccination schedule, identifying critical gaps that exist independently of attitudes or socio-economic status. The findings emphasize the need for tailored health education interventions that go beyond general literacy and target the specifics of vaccine schedules and timing, particularly for vaccines administered after infancy.

Keywords: Maternal knowledge, childhood vaccination, socio-demographic factors, vaccine-preventable diseases, health education.

Introduction: Child mortality, particularly in children under five years, continues to pose a significant public health challenge globally, even with considerable advancements in healthcare and technology. In 2019, around 5.2 million children under five died, with most of these deaths occurring in low- and middle-income countries (LMICs), as reported by the United Nations Inter-Agency Group for Child Mortality Estimation (2020). Many of these deaths are preventable through vaccination, a key intervention that reduces childhood morbidity and mortality by protecting against diseases such as measles, diphtheria, polio, and tetanus (Esposito et al., 2014; Pollard & Bijker, 2020). Recognized as one of the most cost-effective health measures, vaccination initiatives like the Expanded Program on Vaccination (EPI) aim to ensure equitable vaccine access for vulnerable populations in developing countries (WHO, 2021).

Despite the global success of vaccination programs, coverage in sub-Saharan Africa remains inadequate. In Nigeria, with a population exceeding 200 million, under-vaccination rates are among the highest globally. According to WHO/UNICEF estimates, three million Nigerian children missed essential vaccines in 2018 alone (WHO/UNICEF, 2020). In Delta State, efforts to improve vaccination coverage have been ongoing. The Delta State Contributory Health Scheme (DSCHS), established in 2016, aims to achieve universal health coverage (WHO, 2023). As part of the initiative, there have been community outreach programs and educational campaigns aimed at increasing awareness among mothers in Ughelli. However, challenges persist. For instance, in Ughelli, a significant number of children remain unvaccinated due to barriers such as limited healthcare infrastructure and socio-economic constraints (Oxford Business Group (2023).

Recent data highlights some progress. In 2023, over 700,000 children in Nigeria received the third dose of the pentavalent vaccine (Penta3), and more than four million children were reached with immunization services (WHO, 2023). Because of these efforts, the proportion of children receiving at least one dose of the diphtheria, tetanus, and pertussis-containing vaccine (DTP1) in Nigeria increased from 42% in 2000 to 70% in 2023 (Gavi, 2023). However, this still falls short of the desired coverage levels.

The suboptimal coverage is closely tied to gaps in maternal knowledge of childhood vaccination, influenced by socio-demographic factors such as education, income, and healthcare access (Negussie et al., 2016; Ophori et al., 2014).

Maternal knowledge is pivotal for the success of childhood vaccination programs, with studies demonstrating a strong link between maternal awareness and vaccine uptake (Bangura et al., 2020; Obohwemu et al., 2022; Obohwemu, 2024a). Mothers who are informed about vaccine benefits, schedules, and safety are more likely to ensure complete vaccination for their children. Conversely, insufficient knowledge contributes to vaccine hesitancy, delays, or incomplete vaccination schedules, heightening the risk of diseases like measles and polio (Adedire et al., 2021; Ndwandwe et al., 2021).

In Nigeria, many mothers remain unaware of the full vaccination schedule. Obanewa and Newell (2020) noted that some Nigerian mothers believe vaccination is necessary only during infancy, leading to reduced vaccination rates as children grow older. This misconception is concerning since vaccines like those for measles and diphtheria require doses beyond the first year to ensure full immunity (Masresha et al.,

2017).

Socio-demographic factors such as limited access to healthcare facilities, socio-economic constraints, and educational disparities further exacerbate this issue (Adeyemi & Oladipo, 2023). Maternal illiteracy and poverty are linked to lower vaccine awareness, resulting in incomplete vaccination coverage. For instance, Eze et al. (2021) found that educated mothers were more likely to understand the importance of completing vaccination schedules, while less educated mothers had limited knowledge of vaccine benefits and schedules. Even in urban areas like Ughelli, with relatively better healthcare access, maternal knowledge gaps significantly hinder full vaccination coverage. A recent study in Ughelli found that only 65% of children received all recommended vaccines, compared to the national average of 70% (WHO/UNICEF, 2023). This gap is largely attributed to insufficient maternal knowledge about the importance and schedule of vaccination.

Education is a critical factor in shaping maternal knowledge of childhood vaccination. Studies in LMICs, including Nigeria, consistently highlight the correlation between maternal education and better vaccine awareness and coverage (Adeloye et al., 2017; Bangura et al., 2020;). Mothers with limited or no formal education often lack health literacy, making them more susceptible to misinformation about vaccine safety (Salmon et al., 2015). Mbachu et al. (2021) found that mothers with secondary or tertiary education were better informed about vaccine schedules and the risks of incomplete vaccinations. Conversely, mothers with no formal education were less knowledgeable, contributing to the low uptake of booster doses for vaccines like those against measles and polio.

Socioeconomic status (SES) and income also significantly influence maternal vaccine knowledge. In LMICs like Nigeria, lower-income families face barriers such as transportation costs and time constraints, limiting access to vaccination clinics (Adedire et al., 2021). Poverty often correlates with low education levels, further widening the knowledge gap in these communities (Ekoh et al., 2020). For instance, Ophori et al. (2014) observed that mothers from poorer households were less aware of the need for vaccines beyond infancy, contributing to lower coverage for multi-dose vaccines like the measles second dose at 18 months (Gilmour et al., 2011).

Access to healthcare services is another determinant of maternal vaccine knowledge. Urban centres like Ughelli have better healthcare accessibility than rural areas, but disparities persist. Similar to other urban settings across Nigeria, mothers living near healthcare facilities tend to be more informed about vaccine schedules, while those in isolated regions have less accurate knowledge. Quality healthcare and effective communication from healthcare workers also significantly shape maternal knowledge. This highlights the importance of culturally appropriate and detailed health education during vaccination visits, finding that informed mothers adhered better to schedules (Obohwemu, 2024b).

Cultural and religious beliefs also influence maternal vaccination knowledge. In some Nigerian communities, traditional beliefs and religious leaders' influence lead to vaccine misconceptions. For example, Jegede (2014) highlighted how religious leaders' concerns about vaccine safety in northern Nigeria reduced vaccination rates, especially for polio. Similarly, Sanjo-Odutayo and Fadeyi (2023) noted that some mothers believed vaccines were unnecessary if their children appeared healthy, reflecting a lack of understanding about preventive vaccination. In Delta State, these cultural and religious factors also play a significant role in shaping maternal attitudes towards vaccination.

This study addresses the distinct role of maternal knowledge in vaccination outcomes, unlike previous research that conflated knowledge with attitudes and practices. By isolating maternal knowledge, it sheds light on specific barriers to vaccination. Moreover, it focuses on maternal awareness beyond infancy, addressing a gap in research on vaccines administered during the second year and beyond. This study contributes valuable insights into mothers' awareness of booster doses and newer vaccines, such as those for pneumonia and rotavirus, in Ughelli.

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 Isokos and 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 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.

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		
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.

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.

** 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

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.

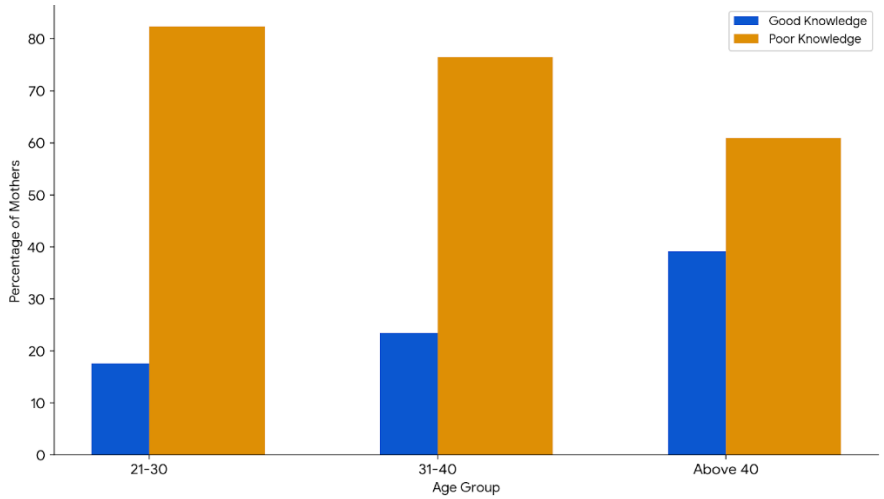

Fig. 1: Knowledge of Childhood Vaccination by Mother's Age Group

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.

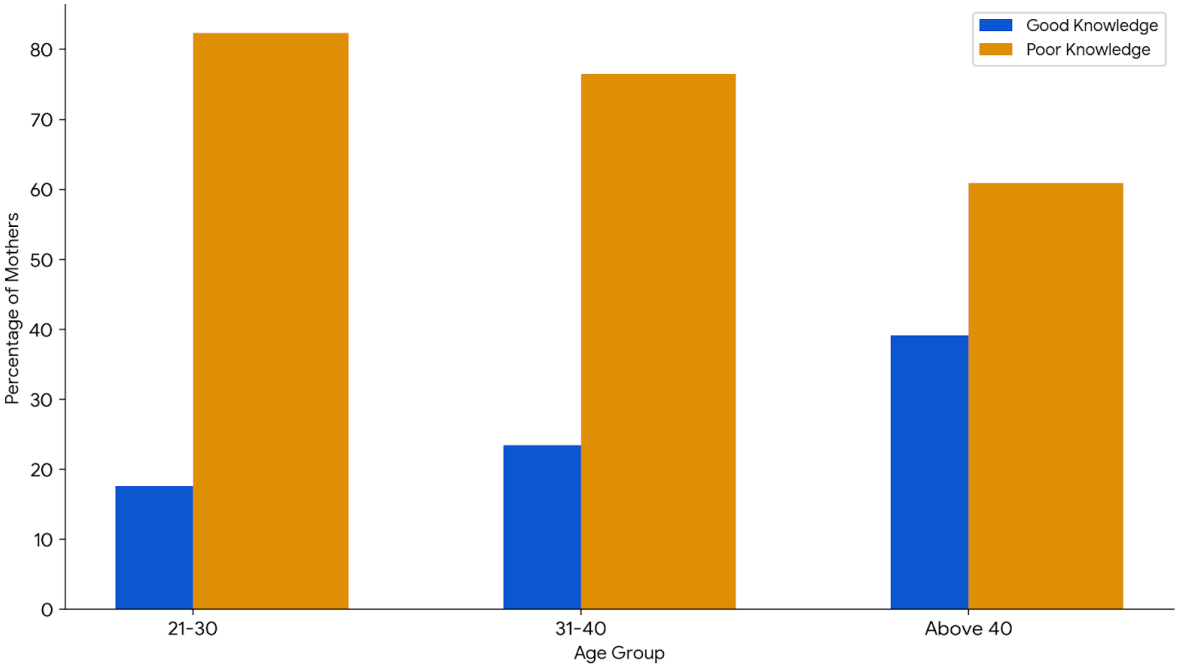

Fig. 2: Knowledge by Child's Age

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.

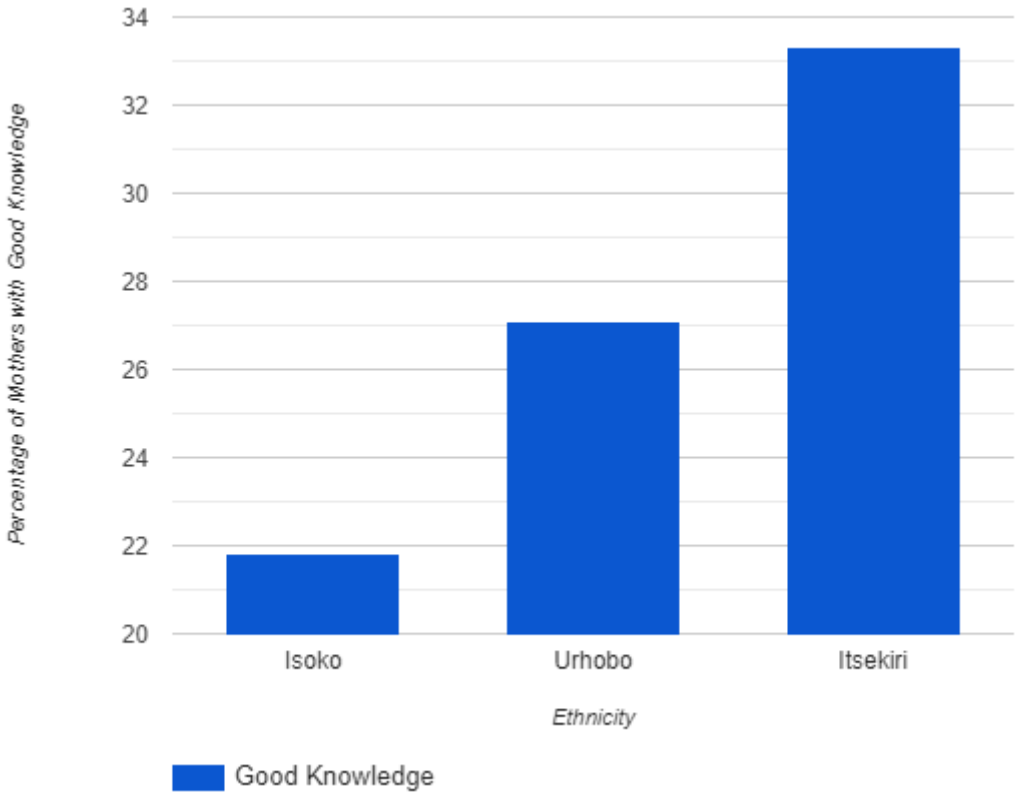

Fig. 3: Knowledge of Childhood Vaccination by Ethnicity

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.

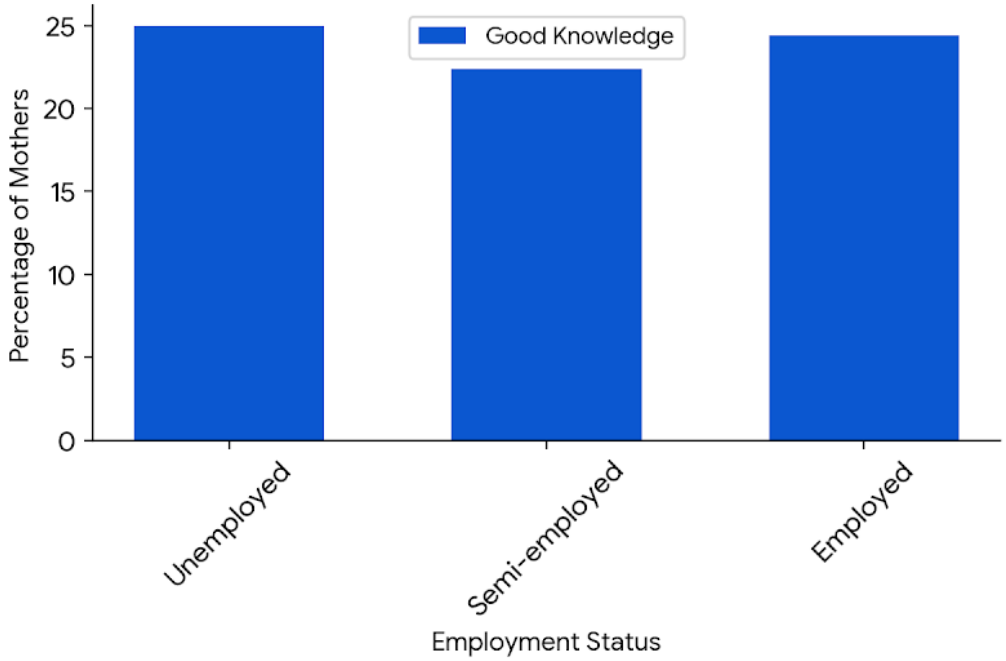

Fig. 4: Knowledge by Employment Status

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.

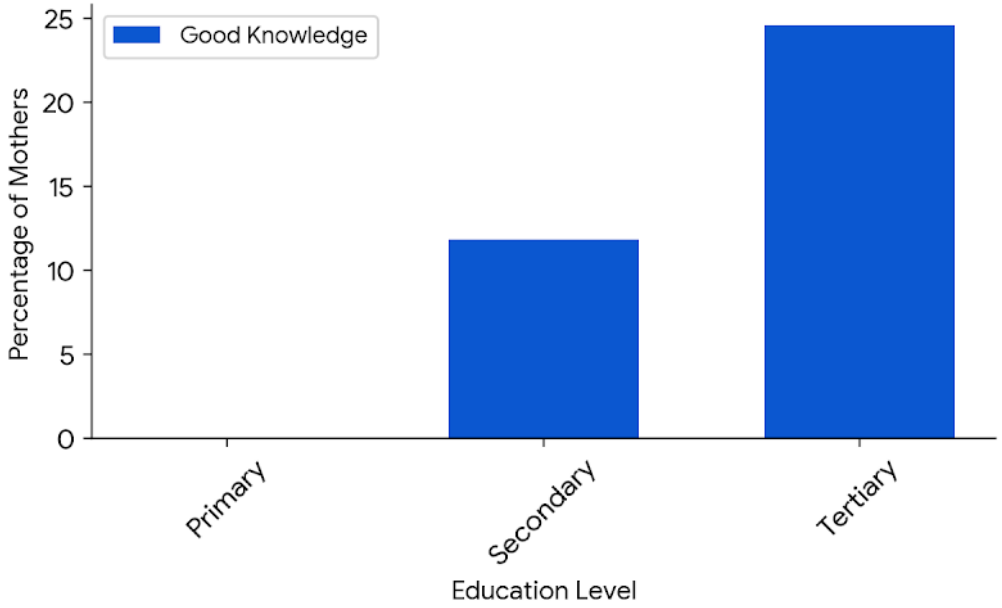

Fig. 5: Knowledge by Education Level

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. Remarkably, most 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 about childhood vaccination is crucial in ensuring that children receive complete immunization, adhere to schedules, and are protected against vaccine-preventable diseases (VPDs). Despite the well-documented benefits of immunization, disparities in maternal knowledge continue to hinder optimal vaccine uptake in many low- and middle-income countries (LMICs), including Nigeria. This study reveals knowledge gaps regarding vaccination schedules, especially booster doses, that contribute significantly to incomplete immunization coverage. Based on the results of this study, the examination of how socio-demographic factors shape maternal knowledge is conducted, and strategies are proposed to address these gaps, with an emphasis on evidence specific to Ughelli.

Knowledge Gaps and Vaccination Uptake

This study has revealed a widespread lack of comprehensive understanding among mothers in Ughelli regarding the full childhood vaccination schedule. While many mothers are informed about vaccines required during the first year of life, a significant gap exists in their knowledge of vaccines needed beyond infancy, such as booster doses for measles, tetanus, and diphtheria (Fatiregun et al., 2021). This shortfall poses a considerable challenge, as incomplete vaccination schedules leave children vulnerable to vaccine-preventable diseases (VPDs), undermining the benefits achieved through early immunizations (Oluwadare et al., 2022).

Evidence suggests that maternal awareness of vaccination schedules is critical for ensuring that children receive complete immunization. A study by Adedokun et al. (2017) conducted in southwestern Nigeria revealed that inadequate knowledge about booster doses among mothers significantly contributed to incomplete vaccination coverage. This study highlights a similar trend, where many mothers erroneously believe that completing the primary vaccination series within the first year suffices to protect their children. Such misconceptions highlight a crucial communication gap within the healthcare system, where the importance of post-infancy vaccinations and booster doses is inadequately emphasized to caregivers (Adedokun et al., 2017; Fatiregun et al., 2021).

Socio-Demographic Factors Influencing Maternal Knowledge

Maternal knowledge about childhood vaccination is influenced by a range of socio-demographic factors, including maternal education, socio-economic status, ethnicity, employment, and access to healthcare. These elements do not act in isolation but often intersect, collectively shaping maternal health literacy and awareness of vaccination schedules. This interplay frequently results in disparities in vaccination coverage, underscoring the necessity for targeted interventions to mitigate these barriers and ensure equitable access to vaccination information and services.

Maternal Education

Maternal education is a fundamental determinant of vaccination knowledge. Research consistently demonstrates that mothers with higher levels of education have a better understanding of vaccination schedules and recognize the importance of adhering to them (Adefolalu & Bamgboye, 2020). As this study has shown, in a populous town like Ughelli, where educational levels vary significantly, mothers with secondary or tertiary education are more likely to comprehend the benefits of vaccination and adhere to the schedule. However, even among educated mothers, gaps in understanding persist, particularly concerning booster doses and newer vaccines such as the pneumococcal and rotavirus vaccines.

Notably, education alone does not guarantee complete knowledge. For instance, Sadoh et al. (2013) found that

while higher educational attainment correlates with improved health outcomes, it does not always ensure adherence to vaccination schedules. This finding emphasizes the importance of tailored health education programs that address the specific informational needs of mothers at varying educational levels.

Socio-Economic Status

Socio-economic status (SES) significantly affects maternal knowledge of childhood vaccination. Mothers from low-income households often encounter greater obstacles to accessing healthcare information, limiting their understanding of vaccination schedules (Adegbola et al., 2021). Financial constraints may prevent these mothers from attending healthcare appointments or seeking reliable sources of information, resulting in incomplete knowledge about the critical role of vaccines, especially booster doses.

As this study has shown, pronounced socio-economic disparities exacerbate these challenges. Mothers from low-income backgrounds frequently exhibit limited health literacy, which hinders their engagement with vaccination programs. These disparities are further compounded by poor healthcare access and limited opportunities for health education in underserved communities.

Ethnicity and Cultural Factors

Ethnic and cultural variations also influence maternal knowledge of vaccination. Ughelli is home to a diverse population, including Urhobo, Isoko, Itsekiri, and other ethnic groups, with varying levels of healthcare access and cultural attitudes toward vaccination (Ogege & Seiyefa, 2021). In some cases, minority ethnic groups face language barriers or adhere to cultural practices that impede their understanding of the need for complete immunization.

This research has shown that mothers from minority ethnic groups are less likely to have comprehensive knowledge of vaccination schedules compared to their Urhobo counterparts. This disparity often stems from inequitable access to health education resources and healthcare services. Addressing these gaps requires culturally sensitive health promotion strategies, particularly in multi-ethnic urban settings (Obohwemu et al., 2022).

Employment and Access to Healthcare

Employment status and healthcare access are additional socio-demographic factors that influence maternal knowledge. Mothers working in informal or semi-formal sectors often have less flexibility in their schedules, making it challenging to attend vaccination appointments and participate in educational sessions about vaccines (Bangura et al., 2020). This issue is particularly evident in Ughelli, where many women are engaged in informal employment and may lack the resources to stay updated on vaccination schedules.

Furthermore, access to healthcare services is a critical determinant of maternal knowledge. In peri-urban and informal settlements of Ughelli, mothers often face significant barriers such as long distances to health facilities, high transportation costs, and prolonged waiting times. As this study has shown, these obstacles not only impede vaccine access but also limit mothers' exposure to essential health education, further widening knowledge gaps.

Health Promotion Strategies to Improve Maternal Knowledge

To address the disparities in maternal knowledge of childhood vaccination, targeted health promotion strategies are necessary. These strategies should be culturally appropriate, easily accessible, and customized to meet the specific needs of various groups. The following approaches have proven effective in improving maternal knowledge and vaccination coverage in Ughelli and similar settings.

Leveraging Digital Media and Mobile Health Platforms

The widespread use of mobile phones in Ughelli offers an opportunity to utilize digital media and mobile health (mHealth) platforms for disseminating vaccination information. Tools such as SMS reminders, social media campaigns, and mobile apps can provide mothers with timely updates about vaccination schedules and emphasize the importance of completing the full schedule (Adeyinka et al., 2022). Studies have demonstrated that mHealth interventions significantly enhance vaccination coverage by delivering personalized reminders and educational content to caregivers (Eze et al., 2021).

Community-Based Health Education Programs

Community-based health education initiatives that involve local leaders and healthcare workers are critical for improving maternal knowledge, particularly in underserved areas. These programs can be adapted to address the specific cultural and linguistic needs of various ethnic groups, ensuring that all mothers have access to accurate information about vaccination (Afolabi et al., 2012). Training community health workers to thoroughly explain the vaccination schedule, including the necessity of booster doses, is crucial for bridging the knowledge gaps identified in this study (Olusola et al., 2021).

Integration of Vaccination Education into Routine Healthcare Visits

Integrating vaccination education into routine maternal

and child healthcare visits provides an effective avenue for reinforcing the importance of adhering to the full immunization schedule. Healthcare providers can use these visits to offer continuous education throughout the child's early years, addressing misconceptions and ensuring that mothers remain informed (Oyo-Ita et al., 2016). This strategy also mitigates the issue of inconsistent healthcare communication, which emerged as a significant barrier in this study.

Targeted Health Promotion for Vulnerable Groups

Specialized health promotion efforts targeting vulnerable populations—such as mothers with low education levels, informal workers, and minority ethnic groups—are essential for improving vaccination knowledge and coverage. Simplified educational materials, visual aids, and health talks conducted in local languages can effectively convey critical information to mothers who might struggle with complex medical terminology (Bangura et al., 2020; Adeyinka et al., 2022). Tailored interventions that prioritize these groups can help overcome barriers to accessing vaccination services and enhance overall health literacy.

CONCLUSION

Maternal knowledge of childhood vaccination plays a vital role in determining vaccination uptake and adherence to schedules. This study highlights how socio-demographic factors such as maternal education, socio-economic status, ethnicity, employment, and healthcare access collectively shape maternal knowledge and influence vaccination behavior. Mothers with higher education levels, for instance, are generally more likely to understand and follow vaccination schedules, although gaps in knowledge persist even within this group. Socio-economic disparities further exacerbate challenges, as lower-income mothers face multiple barriers to accessing healthcare information and services. Ethnic and cultural differences also significantly impact maternal attitudes and understanding of vaccination, necessitating culturally sensitive health promotion strategies. Finally, employment status and proximity to healthcare facilities influence maternal knowledge, with mothers in informal employment or remote areas particularly disadvantaged.

Addressing these gaps requires targeted health promotion strategies that consider the unique needs of different socio-demographic groups. By leveraging digital platforms, community-based programs, routine healthcare visits, and tailored interventions for vulnerable populations, it is possible to improve maternal knowledge and, consequently, vaccination coverage. These efforts will reduce the prevalence of vaccine-preventable diseases and enhance public health outcomes in Ughelli.

CONFLICTS OF INTEREST

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