Research Article

# Acceptance of Childhood Rotavirus Vaccine Among Mothers at The Point of Rotavirus Vaccine Introduction: A case study from Awka Anambra State Nigeria

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**Background: Rotaviruses are the most important cause of severe diarrheal illness in infants and young children worldwide. Nigeria, with a prevalence of 56%, has one of the highest rates of rotavirus sickness in children under five years old, and rotavirus-related deaths were estimated to have caused 31,000 deaths in 2013. On August 22, 2022, aiming for universal immunization, the Nigerian government, through the National Primary Health Care Development Agency (NPHCDA), in collaboration with partners and the World Health Organization (WHO), introduced the rotavirus vaccine into her Routine Immunization (RI) Schedule. This study aimed to assess parents' acceptance of having their children vaccinated against rotavirus.**

**Methods: We conducted a descriptive cross-sectional questionnaire-based study among 217 childbearing mothers attending clinics at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH), Awka, Anambra State. Data analysis was performed with SPSS version 27.**

**Results: One hundred and sixty-six (166/217,76.5%) of respondents had heard of rotavirus infection., while 86.5% (142/166) of them had knowledge that vaccines are the main preventive measure, and 69.3% (115/166) were aware of the recent rotavirus vaccine introduction into the National Programme on Immunization (NPI). Ninety-one percent (91%) (169/217) were ready to accept the rotavirus vaccine because it is safe and useful to the health of their children. Only 3.7% (7/217) of respondents had some safety concerns about the rotavirus vaccine. Fifty percent (50%; 108/217) respondents had given their children rotavirus vaccines (either from private facilities before introduction into NIP or following the introduction). Regarding associated factors, women who had tertiary education were three times more likely than those with lower educational levels to**

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**have knowledge of rotavirus (aOR=2.9; 95%CI=1.425-6.028; p=<0.001). Respondents emphasized the need for more information on vaccine effectiveness and safety, with the medical doctor having the highest confidence to provide information about immunization.**

**Conclusion: Although the present study showed high levels of knowledge and good attitudes towards rotavirus and rotavirus vaccination, there are still some vaccine effectiveness and safety concerns by mothers that need to be addressed through more public awareness and campaigns.**

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## Introduction

Globally, rotaviruses are the primary cause of serious diarrheal disease in newborns and young children [1]. By the age of five, most children, irrespective of socioeconomic setting, will have been infected at least once [2]. In the course of the disease, many children will need medical attention due to extensive fluid loss. The burden of severe rotavirus illness and death is greatest in children from countries with low socioeconomic status, with more than 80% of rotavirus-related deaths estimated to occur in Asia and sub-Saharan Africa [2][3]. In Africa, Nigeria has one of the highest under-5-year rotavirus disease prevalences at 56% [4], and mortality due to rotavirus accounted for an estimated 31,000 deaths in 2013 [4][5].

The WHO position paper stated that rotavirus vaccines should be included in all national immunization programs and considered a priority, particularly in countries with high Rotavirus Gastroenteritis (RVGE)-associated fatality rates, such as in South and South-eastern Asia and sub-Saharan Africa. The introduction of the rotavirus vaccine should be accompanied by measures to ensure high vaccination coverage and timely administration of each dose [6].

Currently available rotavirus vaccines are live, oral, attenuated rotavirus strains of human and/or animal origin that replicate in the human intestine to elicit an immune response. The first two rotavirus vaccines prequalified by WHO were: RotaTeq2 (Merck & Co. Inc., Whitehouse Station, NJ, USA) in 2008 and Rotarix (GlaxoSmithKline Biologicals, Rixensart, Belgium) in 2009. In 2018, two additional vaccines were prequalified by the WHO: Rotavac (Bharat Biotech International Ltd., India) and ROTASIIL (Serum Institute of India, India) [6]. Reports from countries where rotavirus vaccines

were introduced into their immunization programs observed notable drops in morbidity and mortality from rotavirus and diarrhea [6].

On August 22, 2022, targeting universal immunization, the government of Nigeria, through the National Primary Health Care Development Agency (NPHCDA), with support from the World Health Organization (WHO) and partners, introduced the rotavirus vaccine (Rotavac) into the Routine Immunization (RI) Schedule. The introduction of the vaccine into the RI program is in recognition of the magnitude of the rotavirus-related diarrhea disease burden, and the immunization program aims to avert over 50,000 child deaths from the disease annually. With this, the vaccine that costs around $11 USD or more per dose in some healthcare facilities across the country will be given free of charge to all infants at the age of 6, 10, and 14 weeks, along with other vaccines under the RI program [7].

Few studies regarding the acceptability of rotavirus vaccination among parents have been published. Acceptance of health commodities like childhood vaccines is believed to be greatly dependent on awareness and willingness to access such services. It is believed [8] that a low level of acceptance of vaccines may be related to poor awareness and health-seeking behavior among people in a setting. This is strongly supported by Konwea and colleagues, who outlined that acceptance of vaccines is influenced by parents's knowledge of the vaccine and its place in the RI schedule [9].

A study conducted in Canada [10] in 2009 reported that 67% of parents accepted giving childhood vaccines, including rotavirus, to their children. In a US qualitative study [11], a lack of awareness about rotavirus diarrhea and a need for more information about the disease and the vaccine were found to be barriers to receiving the vaccine among parents. Parents generally deemed the vaccine to be acceptable, and most of them reported that they would rely on their health care provider's recommendation for whether their child should receive the rotavirus vaccine.

As we navigate through the post-COVID-19 era, it is important to identify how the COVID experience has changed people's attitudes towards and acceptance of vaccines. This study aimed to assess mothers' acceptance of having their child vaccinated against rotavirus. This research will advance our understanding of vaccine acceptability and help develop evidence-based plans for public health initiatives, vaccination programs, and reduce infectious disease outbreaks in Nigeria.

## Materials and Methods

### *Study Site*

Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH), formerly called Anambra State University Teaching Hospital (ANSUTH), is a state-owned tertiary health care institution located in Awka, Anambra State, Nigeria. It is a teaching hospital for the training of various medical personnel and is affiliated with Chukwuemeka Odumegwu Ojukwu University. It offers the full range of medical services and diagnostics expected of a typical teaching hospital, including the provision of good antenatal care (ANC) and child health care (immunization) services.

### *Study Design*

This is a descriptive cross-sectional study conducted among child-bearing mothers attending antenatal clinics in the General Outpatients Department, presenting their children to the Children Outpatients Department, and immunization clinics at Chukwuemeka Odimegwu Ojukwu University Teaching Hospital, Awka, Anambra State, Nigeria, between February and March 2023.

### *Sample size calculation*

The number of study participants {m/217/} was determined based on the methods of Lwanga et al. [12], considering 10% of the incorrectly filled questionnaires. The confidence interval was set at 95%. A 14% prevalence of awareness of rotavirus from a previous study [8] was used in this calculation.

### *Inclusion and exclusion criteria*

Participation was open to mothers and legal guardians of newborns or young children who were willing to participate, provided informed consent, and shared or held sole responsibility for the health and welfare of the child. Mothers who were not willing to participate or failed to give consent were excluded from participating.

### *Data tools and data collection*

A structured and validated questionnaire was used as a tool to collect data from participants. The interviewers were resident doctors trained in the administration and interpretation of the questionnaires in both English and the local languages, as the case may be. After explaining the

purpose of the study to the participants, their informed consent was obtained, and the questionnaire was administered to them by the resident doctors. Information in the questionnaire collected includes basic demographics of the participants, knowledge and rating of knowledge of rotavirus disease, source of knowledge of rotavirus disease, knowledge of preventive methods, current vaccine, acceptance, and likelihood of recommending these vaccines to other mothers.

### *Determinants of the socio-economic status of participants*

There is no consensus on various socioeconomic classifications in Nigeria because of the unstructured nature of society. However, the system of Ibadin and George [13]—a slight modification of Oyedeji et al. [14]—was used to determine monthly income and individual educational level as independent determinants of socio-economic status. Income included all possible sources of income available to the individual. Therefore, for the purpose of this study, participants were categorized into three classes according to their reported income. Low-income earners received 30,000 Naira (₦) or less per month—the minimum wage in Nigeria. The middle-income class earned ₦100,000 or less per month, which is about the salary level of a newly employed Nigerian graduate. The upper income class earned more than N100,000 per month (one US dollar is equivalent to 876 Naira [July 24, 2023]). Educational level was defined as the highest level of individual education completed and was categorized into four groups: no formal education; primary (1-6 years); secondary (7-12 years); and tertiary (>13 years).

### *Data analysis*

The data was entered and analyzed with SPSS version 27. Discrete variables were summarized using frequency tables and percentages, while quantitative variables were analyzed using the mean and standard deviation. Tests of association between selected variables and respondents' variables were done using Pearson Chi-square and Fisher exact, as appropriate. A multivariable logistic regression using a stepwise model selection was conducted, and the adjusted odd ration (aOR) and its corresponding 95% confidence interval (CI) were calculated to identify risk factors associated with knowledge of rotavirus disease. All tests were two-tailed, and the results were evaluated at a significant level of less than 0.05.

### *Ethical Consideration*

Ethical approval for this study was obtained from the ethics and research committee of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka, Anambra State, Nigeria (COOUTH/CMAC/ETH.CVol.1/FN: 04/251).

## Results

### *Participants Demographics*

All the 217 prospective participants approached in this study responded, yielding a 100% rate. Respondents consist of mothers and women of childbearing age, whose mean age was 31.72±5.65, and 135 (62.2%) of them were aged between 25 and 34 years. The mean age of the mother's index child was 12.6±13.7 months, and 134 (61.8%) of them were < 12 months of age. Eighty-five [85 (39.2%)] study respondents were recruited from immunization clinics; 212 (97.7%) are married, and 211 (97.2%) are Christians. About 106 (48.8%) had between 2 and 3 children; 169 (77.9%) of them were urban dwellers; 167 (77%) had tertiary education; and 165 (76%) of their husbands also had tertiary education. The majority of respondents, 52 (24.5%), earn between 50,000 and 99,000 Naira as average monthly income; 109 (50.2%) of them jointly take action on their child's immunization matters; and 121 (56.5%) and 60 (28.0%) of their index children had up-to-date immunization and fully immunized status, respectively (Table 1).

| Character | Frequency | % |
|---|---|---|
| **Age of Participants (n=217)** | **Mean 31.72 (SD ± 5.65) Range = 34** | |
| <= 24 years | 22 | 10.1 |
| 25 to 34 years | 135 | 62.2 |
| 35 to 44 years | 53 | 24.4 |
| >= 45 years | 7 | 3.2 |
| | | |
| **Age of Index Child (n=217)** | **Mean 12.60 (SD ± 13.7) Range = 86** | |
| < 12 months | 134 | 61.8 |
| 12 to 26 months | 63 | 29 |
| 25 to 41 months | 8 | 3.7 |
| >= 42 months | 12 | 5.5 |
| | | |
| **Clinic from where they were recruited** | | |
| Immunization Clinic | 85 | 39.2 |
| Post-natal Clinic | 5 | 2.3 |
| Children Out Patient | 72 | 33.2 |
| Children Emergency Room | 22 | 10.1 |
| Mother and Child Clinic | 6 | 2.8 |
| Antenatal Clinic | 27 | 12.4 |
| | | |
| **Married Status** | | |
| Married | 212 | 97.7 |
| Single | 4 | 1.8 |
| Divorcee | 1 | 0.5 |
| | | |


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| Character | Frequency | % |
|---|---|---|
| **Religion** | | |
| Christianity | 211 | 97.2 |
| Islam | 2 | 1.0 |
| Others | 4 | 1.8 |
| | | |
| **# of Children** | | |
| 1 child | 67 | 30.9 |
| 2 - 3 children | 106 | 48.8 |
| >= 4 children | 41 | 18.9 |
| Missing Data | 3 | 1.4 |
| | | |
| **Place of Residence** | | |
| Urban | 169 | 77.9 |
| Semi urban | 43 | 19.8 |
| Rural | 4 | 1.8 |
| Missing Data | 1 | 0.5 |
| | | |
| **Mothers Highest Education** | | |
| Primary | 2 | 0.9 |
| Secondary | 48 | 22.1 |
| Tertiary | 167 | 77 |
| | | |
| **Fathers Highest Education** | | |
| None | 1 | 0.5 |
| Primary | 1 | 0.5 |


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| Character | Frequency | % |
|---|---|---|
| Secondary | 45 | 20.7 |
| Tertiary | 165 | 76 |
| Non Applicable* | 5 | 2.3 |
| **Mothers Average Income (N) (n=212)** | | |
| <18,000 | 20 | 9.4 |
| 18,000 to 29,000 | 47 | 22.2 |
| 30,000 to 49,000 | 48 | 22.6 |
| 50,000 to 99,000 | 52 | 24.5 |
| 100,000 to 120,000 | 24 | 11.3 |
| >120,000 | 21 | 9.9 |
| **Who takes decision on Childs Immunizations (n=217)** | | |
| Father | 6 | 2.8 |
| Mother | 102 | 47 |
| Both Parent | 109 | 50.2 |
| **Index Childs Immunization History (n=214)** | | |
| Fully immunized =/>15mths | 60 | 28 |
| Up2Date < 15mths | 121 | 56.5 |
| Unimmunized =/>15mths | 8 | 3.7 |
| Delayed immunization < 15mths | 25 | 11.7 |
| *** Single mothers/ divorcees** | | |

**Table 1.** Main Characters of the subjects


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### *Knowledge of rotavirus among the respondents*

Out of the 166 (76.5%) respondents that had knowledge of rotavirus, 142 (85.5%) knew that vaccination was the main preventative measure, and 144 (84.9%) understood that rotavirus is a major cause of acute gastroenteritis (AGE) among under-5-year-old children. A third of those who had knowledge of rotavirus were aware that the virus can be transmitted by contaminated surfaces (37.35%), and 115 (69.3%) were aware of rotavirus vaccine availability in the national immunization schedule (Table 2).

| Item | Frequency | % |
|---|---|---|
| Have heard about Rotavirus infection | 166/217 | 76.5 |
| Knowledge that Vaccination is the main preventive measure (n= 166)* | 142 | 85.5 |
| Aware rotavirus vaccine is now introduced into Nigeria NPI (EPI) (N=166)* | 115 | 69.3 |
| Happy Rotavirus Vaccine is now introduced (n=166)* | 161 | 97 |
| Rotavirus vaccine prevents all diarrohea diseases among Children (n=166)* | 115 | 69.3 |
| Rotavirus is the major cause of diarrhoea among U5 (n=166)* | 141 | 84.9 |
| Modes of Rotavirus Transmission | | |
| Contaminated surfaces, hands, water and Foods* | 62 | 37.35 |
| Person to person* | 14 | 8.43 |
| Contaminated environment* | 52 | 31.33 |
| Will you Recommend Rotavirus vaccine to other Mothers?* | | |
| Yes | 149 | 89.76 |
| No | 7 | 4.22 |
| May be | 10 | 6.02 |

**Table 2.** Respondents Knowledge about rotavirus

*Calculated only among those (166) participants that had knowledge of Rotavirus*

Table 3 partly shows the multivariable stepwise logistic regression analysis results on the factors affecting mothers' knowledge of rotavirus. The findings demonstrated that only one factor was significantly associated with knowledge of rotavirus. Mothers with tertiary education were about three times (aOR = 2.9; 95% CI = 1.485-6.028; p =<0.001) more likely to have good knowledge of rotavirus infection than mothers with a lower educational level. Mothers whose average monthly income was higher (>N120,000) (aOR = 0.1, 95% CI = 0.107-0.937) and those classified as having higher socio-economic status (aOR = 0.3, 95% CI  0.134-0.995) had lower odds of having good knowledge of rotavirus infection. However, these analyses showed no link between knowledge of rotavirus and the age range, marital status, religion, place of residence, or occupation of the respondents.

| | Knowledge of Rotavirus | | | Maternal Belief about Rotavirus Vaccine | | |
|---|---|---|---|---|---|---|
| | **Yes 166 (76.5%)** | **aOR (95% CI)** | ***p-value*** | | | |
| **Age Range** | | | | **Accept rotavirus vaccine because it is safe (n=198, 91.2%) N(%)** | **Considers rotavirus vaccine useful to the child(n=189, 87%) N(%)** | **Considers rotavirus vaccine harmful to the child (n=8) N(%)** |
| <= 24 years *(Ref)* | 17(7.8) | 1 | _ | 20(10.1) | 18(9.6) | 1 (12.5) |
| 25 to 34 years | 100(46.1) | 1.0 (0.367 -3.001) | 0.928 | 123(62.1) | 119 (63.3) | 6 (75.0) |
| 35 to 44 years | 44(20.3) | 0.6 (0.258-1.334) | 0.209 | 48(24.2) | 45 (23.9) | 0 (0) |
| >= 45 years | 5(2.3) | 1.1 (0.218-6.269) | 0.855 | 7(3.7) | 7 (3.7) | 1 (12.5) |
| | | | | *p=0.913* | *p=0.079* | p=0.270 |
| **Marital Status** | | | | | | |
| Divorced *(Ref)* | 1(0.5) | 1 | _ | 1 (0.5) | 1 (0.5) | 0 (0) |
| Married | 163(74.7) | 1.2 (0.135 - 11.301) | 0.852 | 194 (98.0) | 185 (97.9) | 7 (87.5) |
| Single | 2(1.4) | 1.1 (0.111 - 10.680) | 0.943 | 3 (1.5) | 3 (1.6) | 1 (12.5) |
| | | | | **p=0.001** | p=0.304 | p=0.237 |
| **Educational Level** | | | | | | |
| Secondary *(Ref)* | 29(13.4) | 1 | _ | 43 (21.7) | 43 (22.9) | 2 (25.0) |
| Tertiary | 137(63.1) | 2.9 (1.485 - 6.028) | **<0.001** | 153 (77.3) | 144 (76.6) | 6 (75.0) |


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| | Knowledge of Rotavirus | | | Maternal Belief about Rotavirus Vaccine | | |
|---|---|---|---|---|---|---|
| | **Yes 166 (76.5%)** | **aOR (95% CI)** | ***p-value*** | | | |
| | | | | ***p=0.001*** | *p=0.304* | *p=0.292* |
| **Religion** | | | | | | |
| Others *(Ref)* | 4 (1.8) | 1 | _ | *2 (1.0)* | 2 (1.1) | 0 (0) |
| Christianity | 161 (74.2) | 1.5 (0.177 - 13.605) | 0.691 | *192 (98.0)* | 183 (97.9) | 8(100) |
| Islam | 2 (0.9) | 3.3 (0.203 - 53.717) | 0.402 | *2 (1.0)* | 2 (1.1) | 0 (0) |
| | | | | *p=0.983* | *p=0.962* | *p=0.972* |
| **Place of Residence** | | | | | | |
| Rural *(Ref)* | 4(1.8) | 1 | _ | *4(2.0)* | 3(1.6) | 1(12.5) |
| Semi-urban | 33(15.2) | 1.0(0.476 - 2.311) | 0.906 | 40(20.2) | 37(19.6) | 0(0) |
| Urban | 129(59.4) | 1.0 (0.433 - 2.101) | 0.905 | *154(77.8)* | 149(78.8) | 7(87.5) |
| | | | | *p=0.511* | *p=0.328* | *p=0.409* |
| **Occupation** | | | | | | |
| Unemployed / Housewife *(Ref)* | 17 (7.8) | 1 | _ | 21 (10.6) | 21 (11.1) | 1 (12.5) |
| Artisan | 14 (6.5) | 2.3 (0.942 - 5.748) | 0.067 | 17 (8.6) | 17 (9.0) | 0 (0) |
| Trading | 42 (19.4) | 1.0 (0.491-2.076) | 0.978 | 50 (25.3) | 49 (25.9) | 2 (25.0) |
| Students | 2 (0.9) | 0.8 (0.691- | 0.233 | 4 (2.0) | 2 (1.1) | 0 (0) |

| | Knowledge of Rotavirus | | | Maternal Belief about Rotavirus Vaccine | | |
|---|---|---|---|---|---|---|
| | **Yes 166 (76.5%)** | **aOR (95% CI)** | ***p-value*** | | | |
| | | 1.102) | | | | |
| Civil Servants | 19 (8.8) | 0.6 (0.213 - 2.032) | 0.458 | 22 (11.1) | 18 (9.5) | 2 (25.0) |
| Other Professionals | 72 (33.2) | 0.5 (0.277-1.070) | 0.078 | 84 (42.4) | 82 (43.4) | 3 (37.5) |
| | | | | ***p=0.001*** | ***p=0.001*** | *p=0.069* |
| **Average Monthly Income (n=212)** | | | | | | |
| <18,000 *(Ref)* | 20(9.4) | 1 | _ | 19(9.6) | 3(0.7) | 0(0) |
| 18,000 to 29,000 | 47(22.2) | 0.8 (0.283 - 2.335) | 0.7 | 45(22.7) | 8(4.4) | 1(12.5) |
| 30,000 to 49,000 | 48(22.6) | 1.0 (0.386 - 2.984) | 0.908 | 43(21.4) | 16(8.8) | 0(0) |
| 50,000 to 99,000 | 52(24.5) | 0.3 (0.125 - 1.194) | 0.099 | 48(24.2) | 41(22.7) | 2(25.0) |
| 100,000 to 120,000 | 24(11.3) | 0.5 (0.153 - 2.041) | 0.379 | 22(11.0) | 50(27.0) | 3(37.5) |
| >120,000 | 21(9.9) | 0.1 (0.107 - 0.937) | **0.044** | 21(10.6) | 59(32.6) | 2(25) |
| | | | | *p=0.234* | *p=0.445* | *p=0.897* |
| **Socio-Economic Status (n=212)*** | | | | | | |
| Low *(Ref)* | 67(31.6) | 1 | _ | 63 (32.0) | 53 (28.6) | 4 (50.0) |


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| | Knowledge of Rotavirus | | | Maternal Belief about Rotavirus Vaccine | | |
|---|---|---|---|---|---|---|
| | **Yes 166 (76.5%)** | **aOR (95% CI)** | ***p-value*** | | | |
| Middle | 100(47.2) | 0.7 (0.374 - 1.473) | 0.334 | 91 (46.2) | 89 (48.1) | 4 (50.0) |
| High | 45(21.2) | 0.3 (0.134 - 0.995) | **0.049** | 43 (21.8) | 43 (23.2) | 0 (0) |
| **aOR: Adjusted Odd Ratio; CI: Confidence Interval;** | | | | ***p=0.049*** | *p=0.095* | *p=0.516* |

**Table 3.** Multivariate regression analysis of factors associated with knowledge of rotavirus and maternal belief about rotavirus vaccine among the study participants.

## *Beliefs of mothers about the Rotavirus vaccine*

Table 3 also assessed the maternal belief about the rotavirus vaccine, and it was observed that 91.2% (198/217) of the mothers would be willing to accept the rotavirus vaccine for their children, and among those women, being married (p = 0.001), being educated (p = 0.001), and having a job (p = 0.049) were significant factors in their accepting the vaccine for their children. No difference between mothers age range, place of residence, religion, or socio-economic status (p > 0.05) was found. We also observed that 87% (189/217) of the mothers believed the vaccine was useful to their children, while 3.7% (8/217) of the mothers thought that the rotavirus vaccine was harmful to their children. The majority (87.5%, 7/8) of these women had some safety concerns, and 12.5% (1/8) "did “not want the vaccine for their children now” was their reason for refusing rotavirus vaccines for their children.

## *Attitude towards Vaccines Generally*

On a scale of one to five, with one being ‘not likely at all’ and five being' most likely’, the mean score for those that responded that they would prefer to get information about vaccines from medical doctors was 5, and for those that would prefer from their child nurses was 4, the least mean [2] obtained was from those that would prefer a traditional birth attendant (TBA), school teachers, or traditional rulers. (Figure 1). Of the 214 (98.6%) participants who gave immunization

information about their index child's immunization status, 56.6% (60/214) were up to date, 3.7% (8/214) children were under immunized, 11.7% (25/214) children had delayed immunization, and 28% (60/214) were fully immunized (Table 4). Using respondents index child as a reference on the issue of who takes decisions concerning a child's immunization in the family, about half (50.2%; 109/214) of the respondents replied that both parents were responsible for this decision, while 47% of mothers answered they take charge of issues concerning child immunization matters. Another important piece of information from this study is the general immunization status of the index child. It was observed that 56.6% (121/214) of the index children of respondents had their immunization up to date, 28% (60/124) index children were fully immunized, 11.7% of them had delayed immunization, and 3.7% (8/124) were under immunized (Table 4). We also asked if the index child had received the rotavirus vaccine, and 49.8% (108/217) children had received the vaccine, 32.7% had not, 5.5% (12/217) of them were not sure if the child received it, and 12% (26/217) children had no information and therefore were classified as missing data. Further evaluation of the 71 children that had not received the vaccine was done, and it showed that 45.07% (32/71) children were outside the recommended age window, and 29.58% (21/71) mothers lacked knowledge of the vaccine and its availability in the country's routine immunization. While 9.86% of mothers did not want their children to receive the vaccine, 15.46% said their child's doctor had yet to recommend the vaccine for their children (Table 4).

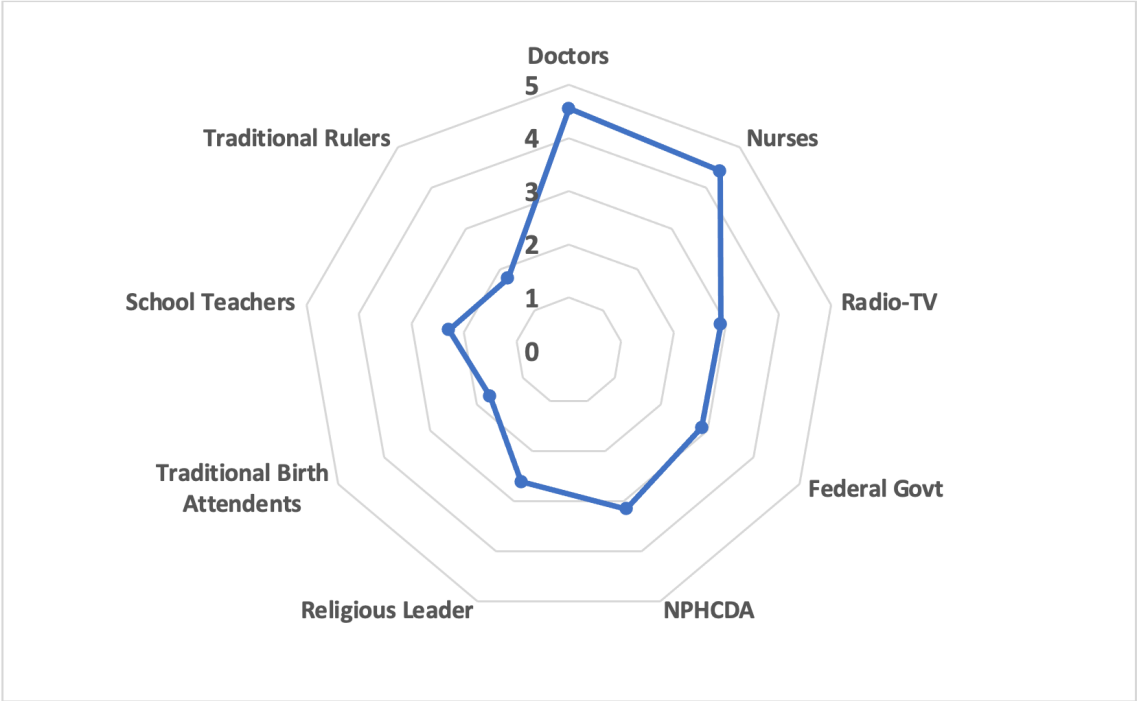


**Figure 1.** Scale rate of different media to communicate information on vaccines

*NPHCDA= National Primary Health Care Development Agency*


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| Belief | n | % |
|---|---|---|
| **Who takes decision on Childs immunization (n=217)** | | |
| Father | 6 | 2.8 |
| Mother | 102 | 47 |
| Both Parents | 109 | 50.2 |
| | | |
| **Index Child Immunization History (n=214)** | | |
| Child fully immunized (age = or above 15months) | 60 | 28 |
| Child immunization upto date (age < 15 months) | 121 | 56.6 |
| Child under immunized (age= or greater than 15 months) | 8 | 3.7 |
| Child had delayed immunization (age < 15 months) | 25 | 11.7 |
| | | |
| **Have your Child already received rotavirus vaccines (n=217)** | | |
| Yes | 108 | 49.8 |
| No | 71 | 32.7 |
| Not Sure | 12 | 5.5 |
| Missing data | 26 | 12 |
| **Reason for not giving your child rotavirus vaccine (n=71)** | | |
| Child outside age bracket | 32 | 45.07 |
| Lacked knowledge of the vaccine | 21 | 29.58 |
| Do not want the vaccine for my child | 7 | 9.86 |
| Not yet recommended by child Doctor | 11 | 15.49 |

**Table 4.** Attitude about Vaccines and Rotavirus Vaccine


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## Discussion

This study assessed mothers' acceptance to have their children vaccinated against rotavirus at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka, Anambra State, Nigeria. The majority (76.5%) of participants had knowledge of rotavirus disease, and 84.9% knew that the virus is the major cause of under-five years of age. About eighty-four percent (84%) were aware that vaccination was the main preventative measure against the virus. Our findings agree with those of Ajeagu et al. [15] in their earlier work in Anambra, where 61.6% of mothers investigated were aware of rotavirus, and also with the report of some other investigators, Pratiwi et al. [16] in Indonesia, with 76.92% awareness, >80% awareness from mainland Europe by Bennnghoft et al. [17], and 82.6% good knowledge about rotavirus reported in Italy by Di-Martino et al. [18]. Similarly, some other researchers in Nigeria, Babatola et al. [8], reported poor awareness of rotavirus and the AGE caused by it, as only 14% of their study participants had knowledge. Our finding is also in contrast with that of an Indian study [19], where only 25% of participants had knowledge of rotavirus and the majority of them were not aware of the availability of the vaccine, and 84% of participants by Ullah et al. [20] had poor knowledge of the virus in Perhawar, Pakistan. In areas where knowledge of the virus and rotavirus vaccine was poor, it could be as a result of limited dissemination of the correct health education and health promotion, where issues centered on the availability of lifesaving vaccines were not made public. This could be corrected by urgent improvement in the knowledge of people through effective recommendation of vaccines and general health education during hospital visits, especially during antenatal and postnatal visits by mothers and women of reproductive age.

An important observation made in this study is the high level of knowledge of how the virus can be transmitted and vaccination as the main preventive measures against the virus. This level of knowledge of the participants indicates a good degree of health education and health promotion about rotavirus in the study environment, more so in a tertiary health facility. This finding was in keeping with an earlier study in the same Anambra state by Ajeagu et al. [15]. The respondent's knowledge of the virus and vaccination significantly increased with educational level, and this finding is in keeping with a study by Zaidi et al. [21] in Karachi, Pakistan, and also that of Angelillo et al. [22] in Italy, where knowledge and attitude toward rotavirus vaccination increased with an increase in educational level. This could be a result of a high literacy level, leading to more exposure to information. When parents have good knowledge of a vaccine, especially a newly introduced one, it would mean that children born

of such parents might have good access to and uptake of the vaccine and other childhood vaccines, thereby resulting in better health for their children.

Regarding socioeconomic factors associated with willingness to accept the rotavirus vaccine, being married (p = 0.001), having education (p = 0.001), having employment (p = 0.001), and socio-economic status (p = 0.049) were significantly related to accepting the vaccine because it is safe. This is in keeping with the work done in Nigeria by Ajeagu et al. [15] and Oleribe et al. [23] who reported educational level, average household income, and being employed as predictors of mothers accepting rotavirus and newly introduced vaccines. It also agrees with a study in Turkey [19] where significant factors in parents accepting rotavirus vaccines included level of education of respondents, information from a pediatrician, cost or availability of the vaccine, parents job types, and timely information on the need for the vaccine. This is, however, in contrast to the work in Ekiti State, Nigeria [8], where none of the studied socioeconomic factors of the mother was a significant factor in accepting the rotavirus vaccine by mothers. It is also in contrast with the Italian work of Di-Martino et al. [18], where socioeconomic characteristics were not significantly associated with the willingness to vaccinate against rotavirus. The reason for this discrepancy could be attributed to the fact that the Ekiti state study respondents, unlike this present study, had very poor knowledge of the virus, the disease it causes, and the availability of vaccines.

Though the majority of respondents (91.2%) agreed that they are willing to accept the vaccine for their children because it is safe, 8 (3.7%) considered the newly introduced vaccine dangerous to their children, and the majority (87.5%) of these said they would not be willing to accept the vaccine due to concerns related to safety, while the reminder 12.5% expressed strong desires to get more information about the vaccine considering safety based on what was said in their community about COVID-19 vaccines. Similar findings were reported by Babatolu et al. [8] in Nigeria, where 28% of respondents were not willing to accept the vaccine; Napolitano et al. [24] in Italy, with 11% of parents not willing to accept the vaccine; and Sitaresmi et al. [25] in Indonesia. The most common issue raised was that the vaccine was not included in the Indonesian NPI; therefore, parents perceived it as not important. "If [a vaccine] is not obligatory, it means it is not important, right?" Besides, for most Muslims in Indonesia, halal status is a significant factor influencing their decision not to vaccinate. The respondents in the current study were mostly Christians, and religious beliefs were not a major factor. In all these studies, many of the respondents who were not willing to accept the vaccine expressed a very strong desire to receive more information about the vaccine. This was consistent with the report

of Wu et al. [26] from Connecticut, USA, and a study in Sudan [27] where misconceptions about vaccines led to hesitancy and very low acceptance by parents. Misconceptions about vaccines generally (like in Polio and COVID-19) have led to poor acceptance of these vaccines in Nigeria [28] and African countries [29] respectively. In the Nigeria study, parents said they preferred to suffer the disease over adverse effects following immunization (AEFI), and in the other African country study, the myths surrounding COVID-19 vaccines had an impact on their acceptance.

Like in most countries, one-on-one conversations with health care workers (HCWs) were regarded as the most preferred source of information on vaccination. The majority (73.15%) of study respondents reported medical doctors as the first of their top five sources of information on matters relating to vaccinations, followed by nurses (62.33%). This is in line with a finding in Yagyakarta, Indonesia [25] where participants reported receiving information on vaccination from their HCWs, and this helped them have better uptake of the rotavirus vaccine for their children. The Italian study by Napolitino et al. [24] and Marchetti et al. [30] and a Canadian survey [10] showed that 95.2% of parents who vaccinated their children were regularly informed by their HCWs (doctors), and this practice has brought about vaccine uptake for their children. In Sweden [31], the success recorded in the immunization of children was also attributed to the role played by HCWs in having face-to-face conversations on the need for vaccine uptake for their children.

Another important finding from this study was that half of the parents (father and mother) who participated in this study jointly took decisions on matters concerning their children. This is in line with previous publications from Ghana [32] and Nigeria [33] and a survey from six countries [34] that documented that in settings where fathers joined their wives in taking decisions on the child's immunizations, it could lead to a greater probability of accepting and completing all RI vaccines. In the Ghana study [32], it was noted that a father's involvement in decisions concerning a child's immunization led to five times higher chances of completing all RI vaccines. The same can be seen in our study, where the majority of these children either completed their immunizations or were up-to-date. This can also be explained further by the 49.8% of the index child(ren) that have received the rotavirus vaccine and the 89.76% of mothers who were willing to recommend the rotavirus vaccine to other mothers.

### *Study strengths and limitations*

This study's strength is that it provides, to the best of our knowledge, the first assessment of rotavirus vaccine acceptance by mothers after introducing Rotavac in Nigeria. However, there are some limitations to this study. First, this study was conducted at a single tertiary health institution in Anambra State, and its findings cannot be generalized to the rest of Nigeria. However, we are confident that the findings of this study may be similar and applicable to other southern Nigerian states where vaccine coverage is generally high, as in Anambra State [35]. Again, mothers' information on their child's immunization status was obtained verbally without seeing the immunization cards, so mothers' responses can be subjected to recall bias. The inclusion of very young mothers who were also educated up to tertiary level may have reduced the possibility of this bias, and we believe this would not have an impact on the conclusions of this study.

## Conclusion

In Awka, Anambra State, Nigeria, acceptance of the newly introduced rotavirus vaccine was high, and awareness of the severity of rotavirus disease and the availability of the vaccine in NPI was also high. Though many respondents were ready to accept the vaccine for their children, there are still some effectiveness and safety concerns that need to be addressed through more public awareness and campaigns.

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