

RESEARCH PAPER



Maternal level of awareness and predictors of willingness to vaccinate children against COVID 19; A multi-center study

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ABSTRACT

Background: Several controversies surround mothers' willingness to vaccinate against the COVID-19 pandemic especially when mortality is not frequently reported in children.

Objectives: This study aimed to ascertain the willingness of mothers of children attending two institutions in Southeast Nigeria to accept the COVID-19 vaccine and factors that may be associated with their choices.

Methodology: This was a cross-sectional study carried out among 577 mothers who presented with their children in two tertiary health institutions in southeast Nigeria.

Results: Majority of the respondents (93.9%) were aware of the COVID-19 vaccine. Majority of the respondents, 89.4%, noted that children were not in high priority groups for COVID-19 vaccination in Nigeria. Only 6.9% of the respondents intend to receive the COVID-19 vaccination. Also, a minor proportion of the respondents (4.9%) were willing to vaccinate their children with the COVID-19 vaccine. The odds of receiving the Covid-19 vaccine were four times greater in those who believed that they could be infected than in those who believed that they could not be infected (AOR = 4.0, 95% CI:1.8–8.7). The odds of receiving the Covid-19 vaccine were six times greater in those who were aware of someone that died from COVID-19 than in those who did not know anyone who died from COVID-19 (AOR = 5.7, 95% CI: 2.1–15.8).

Conclusion: A high level of awareness but low acceptance level for COVID-19 vaccination for mothers and their children was noted. Socioeconomic class, maternal age, and level of education did not influence the willingness of the mother to receive COVID vaccination. Having a belief of possibility of infection with the COVID-19 as well as being aware of someone who died from the disease were important positive variables that could predict vaccine acceptance from this study.

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Introduction

Vaccines against childhood diseases represent some of the most important applications of twentieth century pediatric research.¹ The National Academy of Medicine has documented four phases of vaccine distribution. The third phase includes all children and young adults younger than 30 y of age. However, the American Academy of Pediatrics has also done some advocacy for the inclusion of children in pediatric SARS-CoV-2 vaccine testing.²

As of today, the 30th April 2021, 149, 910, 744 cases of COVID-19 disease had been confirmed with 3, 155, 168 deaths over 223 countries with Nigeria contributing about 164,993, cases and 2063 deaths.^{3–5} The number of children whose parents have died of COVID-19 is bewildering, with approximately 37,300 to 43, 000 already affected.^{6,7}

Pediatric COVID-19 hospitalization rates have increased drastically and new strains of SARS-CoV-2 are emerging which could be deleterious to the health of the children.^{2,3} The COVID-19 pandemic has afflicted millions of people since it was identified in December 2019. Children account for 1–3%

of diagnosed COVID-19 cases worldwide and have less severe disease with deaths being very rare. This menace mainly affects adolescents and those with serious underlying comorbidities.^{8,9}

Although children with SARS-CoV-2 infection are usually asymptomatic, some children have, however, developed pediatric inflammatory multisystem syndrome (PIMS-TS). This is also called multisystem inflammatory syndrome in children. These features present the same way with Kawasaki disease and toxic epidermal necrolysis syndrome.⁶ A study in the United Kingdom has reported neurological conditions as the most prevalent underlying condition in children admitted for COVID-19.⁸

Similarly, analysis of a national UK cohort study subjects with COVID-19 showed Down syndrome, children with immunocompromising conditions such as malignancies (this represents 8% of COVID-19 hospitalizations in the UK) and cerebral palsy to be the most important risk factors for admission and death from COVID-19 infection.^{9,10}

Given the well-described characteristics of children at risk of severe disease stated above, vaccination against COVID-19 has

now become necessary in the UK, and the world in general. Although vaccination in children against COVID-19 may not be clamored for, some potential groups may be at increased risk of severe or fatal COVID-19 and will need vaccination. These include the immunocompromised transplant recipients and children with hemoglobinopathies, such as sickle cell disease.¹⁰

Children must get vaccinated against COVID-19 not only for their protection against the pandemic but also to help the communities achieve herd immunity.^{11–14} Though vaccination is mainly targeted at adults, several COVID-19 vaccine trials for children are underway.

Though available data showed that COVID-19 infection does not pose much risk to children, the benefits of a vaccine should outweigh its potential risks.^{15–17} The American Academy of Pediatrics has recommended all eligible adults and teens 16 y and older be vaccinated against COVID-19, as well as the inclusion of children of all ages in clinical trials.¹⁷

Clinical trials for COVID-19 vaccines have been held for children just like any other childhood vaccines. For instance, the rotavirus vaccine, first used in the U.S. in 1998, was developed for infants and young children to prevent severe diarrheal complications after several clinical trials.^{16–18} Besides, several companies have stated some safety levels of vaccine for children. For instance, Pfizer began testing its vaccine in children aged 6 months to 12 y in late March 2021 and has stated that the vaccine is 100% effective in adolescents aged 12–15 y.¹⁷ Moderna,¹⁸ is conducting clinical trials for children aged 6 months to 12 y, while Johnson & Johnson¹⁹ had also expanded its COVID-19 vaccine trial to include children aged 12–17 y. AstraZeneca has also conducted clinical trials in children aged 6–17 y.^{20, 21}

Current evidence supports the safety of the vaccines. However, given the relatively short experience with the vaccines, it may be true to observe that “long-term safety” is still in doubt.

A careful literature search on this topic has shown little or no information on mothers’ willingness to vaccinate their children against COVID-19 infection. Several studies abound on the adult population, but few were found on children. This study is aimed to ascertain the willingness of mothers of children attending two institutions in Southeast Nigeria to accept the COVID-19 vaccine. This will be the first time this study is carried out in the country. This study could therefore form a template for future studies as well as assist in educating mothers and making policy on COVID-19 vaccination in Nigerian children.

Materials and methods

Study population

A total of 577 mothers were drawn from two health institutions in southeast Nigeria, namely Alex Ekwueme Federal University Teaching Hospital Abakaliki, Ebonyi State and Enugu State University Teaching Hospital (Parklane) Enugu, Nigeria. The hospitals are tertiary health institutions and designated as centers for vaccination against COVID-19 infection. Mothers who presented with their children to the children’s wards, emergency ward and outpatient clinics were recruited into the study.

Study design

This was a health facility-based cross-sectional study.

Sample size estimation

In order to attain a 95% confidence level and 5% precision for a population >100,000, a minimum sample size of 400 was estimated from the tables of sample sizes by Glenn’s¹⁹ et al. that would be necessary for given combinations of precision, confidence level, and variability for different population sizes. However, to increase the precision of the estimate, a sample size of 577 was used for the study.

Sampling technique

A systematic sampling technique was used to select the respondents for inclusion in the study. These were mothers who presented in the children’s wards, emergency ward and outpatient clinics of the two hospitals, which are open on all the working days of the week. An average of 2000 mothers present in the three clinics in Enugu every month, while 1600 present in the clinics at Abakaliki. Sampling interval was determined by dividing the sample frame by the sample size. This was obtained separately for each of the hospitals. The index client was selected in the two hospitals by a simple random sampling method of balloting.

Data collection

The study was executed using a validated interviewer-administered questionnaire. The questionnaire has been previously used by several authors and research groups.²⁰ The questionnaire is subdivided into three main categories, namely, Theory of Planned Behavior (intention, attitude and knowledge); Health Belief Model variables (perceived susceptibility, perceived benefits, perceived barriers), and demographic variables (age, gender, employment status, and marital status).^{1,20,21} However, the questionnaire was modified by adding some variables like socioeconomic correlates.

Socio-economic status of respondents

The socio-economic status index of the respondents was developed using Principal Component Analysis, (PCA) in STATA statistical software version 12. The input to the PCA included family ownership of eleven household items that included gas cooker, television, electric iron, refrigerator, cable television, electric fan, air conditioner, motor vehicle, generator, microwave oven and washing machine. For calculation of distribution cut points, quartiles were used. Each respondent was assigned the wealth index score of his/her family. The quartiles were Q1 = Poorest, Q2 = The Very Poor, Q3 = The Poor, and Q4 = The Least Poor. The quartiles were further dichotomized into low socio-economic class comprising the poorest and very poor and high socio-economic class made up of the poor and least poor groups.

Data analysis

IBM Statistical Package for Social Sciences (SPSS version 21; Chicago) was used for entry of data and analysis. Frequencies and proportions were used to summarize categorical data, while mean and standard deviation were used for continuous variables. Frequency tables and cross-tabulations were generated. Chi-square tests of statistical significance and binary logistic regression were used in the analysis. The level of statistical significance was determined by a *p*-value of <.05.

Knowledge of COVID-19 vaccination was assessed using eight variables. Each correct answer attracted a score of one, while an incorrect answer was scored zero. Good knowledge of COVID-19 vaccination was determined by the proportion of respondents that scored $\geq 60\%$ of the eight variables used to assess COVID-19 vaccination.

Intention to receive COVID-19 vaccine was assessed using a single variable; 'Do you intend to receive COVID-19 vaccine?' The response to the variable was a five-point Likert scale that included Strongly disagree, Disagree, not sure, Agree, and Strongly Agree. The responses of the respondents were categorized into two, yes (for Agree and Strongly agree) and No (for strongly Disagree, Disagree and Not sure).

Ethical approval

This was obtained from the research and ethics committee of both Alex Ekwueme Federal University Teaching Hospital Abakaliki, Ebonyi State and Enugu State University Teaching Hospital (Parklane) Enugu, Nigeria.

Consent

Verbal informed consent was obtained from the respondents participating in this study.

Results

Table 1 shows the socio-demographic characteristics of the respondents. The mean age of the respondents was 33.2 ± 10.0 y.

Table 2 shows awareness of the COVID-19 vaccine among the respondents. Majority of the respondents, 93.9% were aware of the COVID-19 vaccine. The major source of information on the COVID-19 vaccine was the internet/social media, 74.0%. A minor proportion of the respondents, 8.3% were aware of someone who died from COVID-19.

Table 3 shows the knowledge of COVID-19 vaccination among the respondents. Majority of the respondents, 89.4% correctly observed that children were not in high priority groups for COVID-19 vaccination in Nigeria. Majority of the respondents, 77.6% had good knowledge of COVID-19 vaccination.

Table 4 shows the willingness of the respondents to receive the COVID-19 vaccination. A minor proportion of the respondents, 6.9% intend to receive the COVID-19 vaccination. Also, a smaller proportion of the respondents, 4.9% were willing to vaccinate their children with the COVID-19 vaccine.

Table 5: Factors affecting willingness to receive the COVID-19 vaccine among the respondents. The respondents who

Table 1. Socio-demographic characteristics of respondents.

Variable	Frequency (n=577)	Percent (%)
Age of respondents in years		
Mean \pm (SD)	33.2 \pm 10.0	
Age of respondents in groups		
<30 y	213	36.9
30–34 y	148	25.6
35–39 y	101	17.5
≥ 40 y	115	19.9
Marital status		
Single	21	3.6
Married	556	96.4
Educational attainment of Respondent		
No formal education	3	0.5
Primary education	7	1.2
Secondary education	136	23.6
Tertiary education	431	74.7
Employment status of Respondent		
Unemployed	50	8.7
Self-employed	229	39.7
Salaried employment	298	51.6
Family socio-economic class		
Low socio-economic class	297	51.5
High socio-economic class	280	48.5

Table 2. Awareness of COVID-19 vaccine among the respondents.

Variable	Frequency (n=577)	Percent (%)
Awareness of COVID-19 vaccine		
Yes	542	93.9
No	35	6.1
**		
Source of information**		
Internet/social media	427	74.0
Friends	365	63.3
Television	321	55.6
Newspaper	194	33.6
Radio	170	29.5
Health workers	139	24.1
Family sources	91	15.8
Religious gatherings	83	14.4
Posters and banners	78	13.5
Community meetings	59	10.2
Perceived susceptibility to COVID-19		
Yes	67	11.6
No	510	88.4
Aware of someone infected with COVID-19		
Yes	37	6.4
No	540	93.6
Aware of someone that died from COVID-19		
Yes	48	8.3
No	529	91.7

**multiple responses encouraged.

believed they could be infected with the COVID-19 were four times more likely to receive the COVID-19 vaccine when compared with those who believe they did not have that susceptibility (AOR = 4.0, 95% CI:1.8–8.7). The respondents who were aware of someone that died from COVID-19 were about six times more likely to receive COVID-19 vaccine when compared with those who did not know anyone who died from COVID-19 (AOR = 5.7, 95% CI: 2.1–15.8).

Discussion

This article is aimed at determining maternal factors and predictors of willingness to vaccinate children against COVID-19. The study showed that 6.9% of mothers intend to receive COVID-19

Table 3. Knowledge of COVID-19 vaccination among the respondents.

Variable	Frequency (n=577)	Percent (%)
Inclusion in high priority group for COVID-19 vaccination in Nigeria		
Yes	61	10.6
No (Correct)	516	89.4
Vaccination is a good measure to prevent diseases		
Yes (Correct)	493	85.4
No	84	14.6
Covid-19 vaccine will help in the fight against the disease		
Yes (Correct)	479	83.0
No	98	17.0
All vaccines are beneficial to man except COVID-19 vaccine		
Yes	117	20.3
No (Correct)	460	79.6
Covid-19 vaccine is false as there is no disease like that		
Yes	95	16.5
No (Correct)	482	83.5
There is no COVID-19 in Nigeria hence no need for the vaccine		
Yes	119	20.6
No (Correct)	458	79.4
Some side effects of COVID-19 vaccine have been reported since administration of the vaccine		
Yes (Correct)	78	13.5
No	499	86.5
There is no approved vaccine for COVID-19 at present		
Yes	116	20.1
No (Correct)	461	79.9
Nigeria is not interested in COVID-19 vaccination		
Yes	97	16.8
No (Correct)	480	83.2
Knowledge of COVID-19 vaccination		
Good	448	77.6
Poor	129	22.4

Table 4. Willingness to receive COVID-19 vaccination.

Variable	Frequency (n=577)	Percent (%)
Intend to receive COVID-19 vaccine		
Yes	40	6.9
No	537	93.1
Intend to vaccinate baby with COVID-19 vaccine		
Yes	28	4.9
No	549	95.1
Approved COVID-19 vaccination for mother and baby		
Yes	27	4.7
No	550	95.3

vaccination, while 4.9% were willing to vaccinate their children. Furthermore, 4.7% of mothers are willing to accept COVID-19 vaccination for both themselves and their babies. The finding from this study strongly contrasts that of Gelernter²² et al. who noted that 65% of caregivers intended to vaccinate their children against COVID-19, once a vaccine is available. Karafillakis²³ et al., however, noted a low prevalence rate of mothers' willingness to vaccinate their children; (11.9%) with 9.9% of the mothers showing concern of hesitancy to be due to adverse drug reaction.

Vaccine hesitancy is becoming a serious concern to pediatricians and public health workers.²⁴ Even during influenza pandemics, it was noted in a recent study on parental attitudes toward influenza vaccination that about one out of every five children in the United States has a parent who is vaccine-hesitant. It was concluded in that study that vaccine hesitancy is negatively associated with childhood influenza vaccination.^{25,26}

Vaccine hesitancy is multi-faceted and highly interwoven. This phenomenon is strongly associated with some psychosocial

factors. This includes prior beliefs about vaccinations, perceived benefits of vaccines, previous experiences with vaccinations, socioeconomic status, attitudes toward vaccines, whether the child has been previously vaccinated, number of children, and marital status.²⁷

Several measures were introduced to combat vaccine hesitancy, but these proved unsuccessful. To address vaccine hesitancy, factors associated with parents' decisions on vaccination need to be identified and investigated.²⁷⁻³⁴

The controversy trailing the acceptance of COVID-19 vaccination has made the development of national policies for vaccination of children, a tool to curb this menace, an uphill task. It is known that though children could be asymptomatic or carriers, they can transmit the infection to their mothers and adult population.^{35,36}

Majority of the respondents noted that children were not in high priority groups for COVID-19 vaccination in Nigeria, though they still believe that the COVID-19 vaccine will be of relevance in the fight against the disease.

Several factors affect mother's views of their children being in a low priority group for vaccination against COVID-19. Fear brought by the illness, children not showing symptoms of COVID-19 and parental level of education had been adduced as possible reasons for this assertion.³⁷⁻³⁹ Besides, concerns regarding adverse effects from vaccination are reported as the most common reason why mothers were hesitant to vaccinate their children.⁴⁰⁻⁴²

Furthermore, 4.7% of mothers are willing to accept COVID-19 vaccination for both themselves and their babies. This mother-child dyad is very crucial as it will help policymakers and governmental organization to intensify dissemination of

Table 5. Factors affecting willingness to receive COVID-19 vaccine among the respondents.

Variable	Willingness to receive COVID-19 vaccine (n=577)		p-Value on bivariate analysis	AOR (95% CI on multivariate analysis**
	Yes N (%)	No N (%)		
Age of respondents in groups				
<30 y	20 (9.4)	193 (90.6)	.184	1.6 (0.7- 3.5)
30–34 y	7 (4.7)	141 (95.3)		0.7 (0.3- 1.8)
≥35 y	13 (6.0)	203 (94.0)		
Marital status				
Single	1 (4.9)	20 (95.2)	.690	NA
Married	39 (7.0)	517 (93.0)		
Educational attainment of respondent				
Tertiary education	25 (5.8)	406 (94.2)	.066	0.5 (0.2- 1.2)
Others*	15 (10.3)	131 (89.7)		
Employment status of Respondent				
Unemployed	5 (10.0)	45 (90.0)	.554	NA
Self-employed	17 (7.4)	212 (92.6)		
Salaried employment	18 (6.0)	280 (94.0)		
Family socio-economic class				
Low socio-economic class	26 (8.8)	271 (91.2)	.076	1.3 (0.6- 2.8)
High socio-economic class	14 (5.0)	266 (95.0)		
Perceived susceptibility to COVID-19				
Yes	15 (22.4)	52 (77.6)	<.001	4.0 (1.8- 8.7)
No	25 (4.9)	485 (95.1)		
Aware of anyone infected with COVID-19				
Yes	8 (21.6)	29 (78.4)	<.001	0.8 (0.3- 2.6)
No	32 (5.9)	508 (94.1)		
Aware of someone that died from COVID-19				
Yes	13 (27.1)	35 (72.9)	<.001	5.7 (2.1-15.8)
No	27 (5.1)	502 (94.9)		
Knowledge of COVID-19 vaccination				
Good	32 (7.1)	416 (92.9)	.711	NA
Poor	8 (6.2)	121 (93.8)		

*Secondary education and below NA Not applicable.

**Adjusted odds ratio (95% confidence interval on multivariate analysis).

information on COVID-19 vaccination and improving coverage among all women as vaccinating the mothers increases the chance that their children will likely be vaccinated.

Maternal age, level of education of parents, socio-economic status of parents, and knowledge of vaccine did not affect the willingness of mothers to vaccinate their children in this study. This is similar to a study in Ethiopia that revealed no association between caretakers' educational level and vaccination.⁴³ Anokye et al.⁴⁴ noted that maternal age is not a predictor of hesitancy; some studies in Mozambique and Australia had also shown that mothers' age had no significant relationship with immunization of their children.^{45–47} We could not hazard any reason for these similar findings.

Notwithstanding, several studies did not align with our reportage. For instance, a study had shown that maternal education helps in health-seeking behaviors that enhance child vaccination.⁴⁸ A survey in Eritrea among children aged 24–35 months revealed that 92% of children of mothers with middle or higher education were fully immunized compared with 78% of children whose mothers had no education.⁴⁸ Studies in Nigeria and all over the world also showed that children of educated mothers were more likely to get immunized than children of uneducated mothers.^{49–52}

Some studies have also shown that marital status influences mother's willingness to vaccinate their children. For instance, Anokye et al.⁴⁴ noted that being divorced has a significant and positive association with immunization hesitancy. They observed that women who were divorced or single were 3 times less likely to complete immunization when compared with their married counterparts. Furthermore, Jeffery et al.⁵³

had reported that parents in a higher socio-economic class and higher income were more willing to vaccinate than those with a lower income. The discrepancy in findings noted in the study above and our study could be due to differences in geographical location and socio-demographic variables of the study population.

Mothers who believed they could be infected with COVID-19 were four times more likely to receive the COVID-19 vaccine when compared with those who did not have that susceptibility. In addition, mothers who were aware of someone that died from COVID-19 were about six times more likely to receive the COVID-19 vaccine when compared with those who did not know of anyone that died from the pandemic. However, it is not expedient to wait for someone to die or get infected with COVID-19 before getting vaccinated for COVID-19.

This study also showed that 93.9% of mothers were aware of the COVID-19 vaccine. Their sources of information on the COVID-19 vaccine included the internet/social media, friends, and television. The result obtained in this study was much higher than that of a study⁵⁴ that noted that 39.0% of their subjects were aware of COVID-19 Vaccine availability. The high level of awareness from this study could partly be explained by the mothers' high level of education and socio-economic class. Most importantly is that there is an interval of almost 1 y between the two studies during which the awareness of COVID-19 vaccine increased significantly.

An important limitation of this study is that the responses by the respondents on whether they were willing to receive

COVID-19 vaccine may be different when the vaccine becomes available. Thus, there could be a tendency by the respondents to give socially desirable responses as it relates to the acceptability of the vaccine. The respondents were, however, assured of confidentiality and they were informed that the data as obtained from the study is for research purposes only.

Conclusion

A high level of awareness but low acceptance level for COVID-19 vaccination for mothers and their children was noted. Socioeconomic class, maternal age, and level of education did not influence the willingness of the mother to receive COVID vaccination. Having a belief of the possibility of infection with the COVID-19 as well as being aware of someone who died from the disease were important positive variables that could predict vaccine acceptance from this study.

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Area of further study

A nationwide study to cut across all cultures and socio-economic status would be worthwhile.

Author contributions

JMC, ENO and EAA, ON, CPN conceived the study, drafted the manuscript, and gave final approval of the version to be published. ENO, EAA, and JMC collected and interpreted the data and gave final approval of the current version. ENO analyzed the data. ATA and VOO edited the article.

Availability of data and materials

We have attached the questionnaire and the Excel sheets/SPSS of the work.

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

Funding

We bore all the cost that arose from this study.

Recommendation

Mass enlightenment campaign and dissemination of accurate information on COVID vaccine, targeting mothers, may help put vaccine hesitancy at bay.

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