



Acceptability rate and barriers to COVID-19 vaccination among healthcare workers in Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Amaku-Awka, Nigeria

Ngozi Nneka Joe-Ikechebelu, Uche Marian Umeh, George Uchenna Eleje, Emeka Philip Igbodike, Emmanuel Okwudili Ogbuefi , Angela Oyilieze Akanwa, Sylvia Tochukwu Echendu, Williams Onyeka Ngene, Augusta Nkiruka Okpala, Onyinye Chigozie Okolo, Chidubem Ekpereamaka Okechukwu, Josephat Chukwudi Akabuike, Helen Obioma Agu, Vincent Ogochukwu Okpala, Onyinye Chinenye Nwazor, Anthony Obiajulu Ugochukwu Nnedum, Chinyere Celestina Esimone, Hephzibah Ngozi Agwaniru, Ethel Ifeoma Ezebasili  and Belusochi Blessing Joe-Ikechebelu

Abstract

Background: Healthcare workers were at the forefront of the COVID-19 pandemic. The acceptability and uptake of COVID-19 vaccines among healthcare workers was an important strategy in halting the spread of the virus as well as the antecedent implications on global health and the world economy.

Objectives: This study aims to determine the acceptability rate and barriers to COVID-19 vaccination of frontline healthcare workers in Awka, Nigeria.

Design: This is an analytical cross-sectional study.

Methods: An online cross-sectional survey was conducted from February 2022 to April 2022 to obtain the data for this study. One hundred healthcare workers were studied. Acceptability rate and barriers to uptake of COVID-19 vaccination were outcome measures.

Results: The COVID-19 vaccination rate was 45.0% among healthcare workers in study area of Awka metropolis. Ages 30–39 years had the highest acceptance rate of COVID-19 vaccination, 19 (47.5%; $p=0.262$) with a more female preponderance of COVID-19 vaccine acceptance compared to males [26 (41.3%) vs 16 (42.2%), $p=0.721$]. The place of residence of respondents (urban vs rural) and their marital status (married vs single) appeared not to influence the acceptance of COVID-19 vaccination [(38 (42.2%) vs 3 (33.3%); $p=0.667$; 25 (36.8% vs 17 (54.8%); $p=0.433$)]. Years of work experience (<10 years vs >10 years) significantly affected COVID-19 vaccine acceptance [27 (45.8%) vs 12 (52.2%); $p=0.029$]. Educational status and monthly income appeared not to influence vaccine uptake ($p>0.05$, for both). A significant number of respondents were not sure why they should or should not take the COVID-19 vaccine [49 (92.5%) vs 35 (83.3%); $p=0.001$].

Conclusion: The COVID-19 vaccination rate is still poor among healthcare workers in Awka metropolis. The majority of respondents do not know why they should or should not take COVID-19 vaccine. We therefore recommend robust awareness campaigns that will explain in clear terms the essence and efficacy of COVID-19 vaccination in order to improve vaccine acceptance.

Keywords: Vaccine hesitancy, COVID-19, healthcare workers, side effects

Received: 24 June 2022; revised manuscript accepted: 21 April 2023.

Ther Adv Infect Dis

2023, Vol. 10: 1–12

DOI: 10.1177/
20499361231174776

© The Author(s), 2023.
Article reuse guidelines:
sagepub.com/journals-
permissions

Correspondence to:

Ngozi Nneka Joe-Ikechebelu
Department of
Community Medicine and
Primary Health Care,
Chukwuemeka Odumegwu
Ojukwu University,
Amaku-Awka, Anambra
State 420110, Nigeria
nn.ikechebelu@coou.edu.ng

Uche Marian Umeh
Department of
Community Medicine and
Primary Health Care,
Chukwuemeka Odumegwu
Ojukwu University, Awka,
Nigeria

George Uchenna Eleje Josephat Chukwudi Akabuike
Department of Obstetrics
and Gynecology, Nnamdi
Azikiwe University, Awka,
Nigeria

Emeka Philip Igbodike
Department of Obstetrics
and Gynecology, Nnamdi
Azikiwe University, Awka,
Nigeria
Evercare Hospital, Lagos,
Nigeria

Emmanuel Okwudili Ogbuefi
Department of
Parasitology and
Entomology, Faculty of
Biosciences, Nnamdi
Azikiwe University, Awka,
Nigeria

Angela Oyilieze Akanwa
Department of
Environmental
Management, Faculty of
Environmental Sciences,
Chukwuemeka Odumegwu
Ojukwu University, Uti,
Nigeria

Sylvia Tochukwu Echendu
Department of Paediatrics,
Nnamdi Azikiwe University
Teaching Hospital, Nnewi,
Nigeria

Williams Onyeka Ngene
Chukwuemeka Odumegwu
Ojukwu University Teaching
Hospital, Awka, Nigeria

Augusta Nkiruka Okpala
Department of Family
Medicine, Faculty of
Medicine, Nnamdi Azikiwe
University Teaching
Hospital, Nnewi, Nigeria

Onyinye Chigozie Okolo
Nigeria Coalition for
Ecosocial Health Research
(NCEHR), Awka, Nigeria

**Chidubem Ekperemaka
Okechukwu**
University of British
Columbia, Vancouver, BC,
Canada

Helen Obioma Agu
Department of Food Science
and Technology, Nnamdi
Azikiwe University, Awka,
Nigeria

Vincent Ogochukwu Okpala
Anambra State Ministry of
Health, Awka, Nigeria

Onyinye Chinenye Nwazor
Department of Community
Medicine and Primary
Health Care, Chukwuemeka
Odumegwu Ojukwu
University Teaching
Hospital, Awka, Nigeria

**Anthony Obiajulu
Ugochukwu Nnedum**
Department of Psychology,
Nnamdi Azikiwe University,
Awka, Nigeria

**Chinyere Celestina
Esimone**
Department of Music,
Faculty of Arts, Nnamdi
Azikiwe University, Awka,
Nigeria

Hephzibah Ngozi Agwaniru
Shekinah Love Assembly
Int'l, Onitsha, Nigeria

Ethel Ifeoma Ezeabasili
Department of Political
Science, Chukwuemeka
Odumegwu Ojukwu
University, Igbariam,
Nigeria

**Belusochi Blessing
Joe-Ikechebelu**
Benjamin S. Carson (Snr)
College of Health and
Medical Sciences, Babcock
University, Ilishan-Remo,
Nigeria

Introduction

Coronavirus is caused by a novel coronavirus [severe acute respiratory syndrome corona virus 2 (SARS-CoV-2)] which has the same veiled RNA structure resembling SARS-CoV-1 that caused the severe acute respiratory syndrome (SARS) outbreak.¹ This virus was first identified in the respiratory tract of patients with pneumonia in Wuhan, Hubei China, at the end of December 2019, which was then indicated as a newly identified β -coronavirus (nCoV).^{2,3} As of March 11, 2020, coronavirus (COVID-19) was declared a pandemic by the World Health Organization (WHO), as it had spread to other parts of the globe and the fatality of the cases continued to rise.⁴

The first case of COVID-19 was reported in Nigeria on February 27, 2020, and this led to researchers' forecast that Nigeria would likely be the focal point of Africa's pandemic.^{5,6} In the face of the many deaths from the COVID-19 virus, many countries around the globe put up cogent and strict measures to curb the pandemic, which included social distancing and compulsory use of face masks among others.^{7,8}

It was however noted that the preventive measures on the ground were not adequate to stop the spread of COVID-19, and this led to the development and use of vaccines as one of the preventive strategies deployed to halt the spread of the virus.^{9,10} Due to the inadequacy of the measures on the ground to flatten the epidemic curve, the COVID-19 vaccine was developed and approved for use within a short period of time. This raised concerns and anxieties about the unknown side effects that could result from such a vaccine.^{11,12}

COVID-19 vaccines have become available in many countries including Nigeria. On 2 March 2021, the country received the long-awaited vaccine, its first shipment of 4 million Oxford-AstraZeneca COVID-19 vaccine doses.¹³ Subsequently, the vaccination was rolled out in phases following the approval of the vaccine in Nigeria. Health workers, support staff in health institutions, frontline workers, and first responders were the first group of people on the priority list.^{14,15} Vaccination has been opined to be the most effective way of controlling infectious diseases, though its success is often challenged by

people who choose either to delay the uptake or refuse to get vaccinated.¹⁶

Immunization coverage could be negatively affected by a wide range of side effects, which are often associated with vaccinations. These side effects may be scientifically based, in some cases, may be coincidental or mere speculations, and are often not substantiated.¹⁷ In most viral outbreaks, COVID-19-inclusive healthcare workers (HCWs) are proactive agents of change whose skills and experience have been proven to contribute significantly to the protection of the populace.¹⁸ HCWs were considered as a group at high risk of SARS-CoV-2 infection, and as such, candidates for early vaccination. This has become so important, such that in Italy, data showed an early decrease of the SARS-CoV-2 circulation among HCWs in the first 50 days of vaccination campaign, during which most HCWs had not yet achieved the state of full protection, since immunized persons are not considered protected against COVID-19 until at least 7 days after receiving the second dose.¹⁹ Similarly, a study examining HCWs working in publicly funded hospitals in the United Kingdom revealed that the COVID-19 vaccine can prevent both symptomatic and asymptomatic infection in among adult HCWs.²⁰

It is noteworthy, that the success of any vaccination programme is highly dependent on the vaccine acceptance and uptake,^{20,21} while the main setback lies on getting the population to trust the emergent-release vaccine. Vaccine hesitancy is imminent in the presence of mistrust and lack of confidence in the vaccine.^{22,23} In the light of this, it is pertinent to look at the real-time acceptability rate and barriers to COVID-19 vaccination, as their acceptability would help address the barriers to wide acceptability among the populace.

Methods

Study design

A cross-sectional analytical study was employed to determine the acceptability and effects of the COVID-19 vaccine among HCWs at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH).

Study population

The study was conducted among HCWs in COOUTH, Amaku, Nigeria.

Study site

COOUTH, Amaku-Awka, Anambra State Nigeria was the study site. The hospital is a tertiary healthcare institution responsible for postgraduate medical training and boasts of numerous consultant obstetricians and resident doctors (registrars and senior registrars). It is the only state teaching hospital in Anambra State and subserves the state and parts of Delta, Imo, and Enugu states of the country.

Eligibility criteria

Inclusion criteria. The participants include all HCWs aged between 18 and 60 years who received the COVID-19 vaccine between 18 April 2021 and 25 July 2021 at COOUTH, Amaku, Awka, Anambra State, Nigeria. They signed an informed consent form, and only HCWs such as medical doctors, nurses, physiotherapists, laboratory scientists, cleaners, and administrative personnel in any department of the Hospital were sampled.

Exclusion criteria. Non-HCWs were excluded.

Sample size determination

The minimum sample size was calculated using the formula

$$N = \frac{Z^2 PQ}{d^2}$$

where N = sample size;

Z = standard normal deviation at 95% confidence interval which is 1.96;

d = degree of precision set at 0.05;

P = proportion of the target population;

*In this case, corona vaccine acceptance rate in a Congo study

$$= 27.7\% \text{ (Kabamba et al.}^{24})$$

$$= 0.277$$

$$Q = \text{alternate proportion } (1 - P)$$

$$= 1 - 0.277$$

$$= 0.723.$$

Therefore

$$N = \frac{1.96^2 \times 0.277 \times 0.723}{0.05^2}$$

$$N = 94.0$$

$$= 94 \text{ subjects for each group.}$$

To account for attrition:

New sample size N^1 was then

$$N^1 = \text{calculated sample} \times (100 / (100 - x))$$

where $x = 10\%$ attrition

$$N^1 = 94 \times \frac{100}{90}$$

$$N^1 = 94 \times 1.1$$

$$N^1 = 104.4 = 105 \text{ subjects}$$

Hence, a total of 105 subjects were used as the minimum sample size for the study.

Sample technique. A non-random sampling approach was used and all available case files or data from all the personnel vaccinated were also considered in the study.

Data collection and management

A structured questionnaire was used to collect socio-demographic and clinical data of the participants.

The participants were duly informed about the study protocol using an information sheet, which was written in a plain language. They also signed informed consent forms prior to the commencement of the study. They were later interviewed in private by the researcher in the vaccination clinic, and information on socio-demographic characteristics as well as relevant history was obtained using a questionnaire which was number-coded

to ensure confidentiality. Data collected were analysed using SPSS 26.0 IBM Corporation. Fisher's exact test was performed for categorical data, Student's *t*-test, or Mann–Whitney *U*-test was applied to continuous variables depending on their distribution, and a *p* value < 0.05 was considered statistically significant.

Result

From February to April 2022, the COVID-19 vaccine questionnaires were completed for 100 HCWs in Awka, Nigeria. Table 1 presents the participants' socio-demographic characteristics. Most of the participants were in the age group 30–39 years and were educated, with 65.66% of the participants having obtained a bachelor's degree. None of the participants was illiterate. The majority (63.0%) of the participants were females.

Table 2 describes the specific occupations of the study participants. Overall, majority (19.19%) of the participants were nurses, followed by medical doctors (16.16%) and pharmacists (13.13%).

Table 3 presents data about the sources of information on COVID-19 of the study participants. Overall, 97.98 % of participants stated that they had heard of the novel COVID-19 virus.

Table 4 shows the HCWs status in relation to COVID-19 among the study participants. Nearly 80% of the participants were frontline health workers. Table 5 describes the gender barriers preventing the study participants from receiving/accepting the COVID-19 vaccine. Pregnancy (2.00%) and breastfeeding (2.00%) were identified as gender-specific barriers, but the majority (87.0%) of participants did not report being affected by any gender-specific barriers.

Table 6 presents the level of risk posed by the study participants to others. Up to 24.74% of the participants were greatly concerned about infecting others with COVID-19 and getting infected with COVID-19 (42.27%).

Table 7 describes the COVID-19 status of the family members of the study participants. Up to 75.76% of participants revealed that none of their family members had COVID-19, and none of

their family members were currently infected with COVID-19 (89.00%).

Table 8 described the test of association between socio-demographics and acceptability of COVID-19 vaccine among the study participants. Ages 30–39 years had the highest acceptance rate of COVID-19 vaccination 19 (47.5%; *p* value = 0.262) with a more female preponderance of COVID-19 vaccine acceptance compared to males [26 (41.3%) vs 16 (42.2%), *p* = 0.721]. However, the *p* value for both these confrontations are > 0.05, thus rendering them statistically non-significant. The place of residence of respondents (urban vs rural) and their marital status (married vs single) appeared not to influence the acceptance of COVID-19 vaccination [(38 (42.2%) vs 3 (33.3%); *p* = 0.667; 25 (36.8% vs 17 (54.8%); *p* = 0.433)]. Years of work experience (< 10 years vs > 10 years) significantly affected COVID-19 vaccine acceptance [27 (45.8%) vs 12 (52.2%); *p* = 0.029].

Discussion

At the time of this study, 45.0% of the studied HCWs had received the COVID-19 vaccine, while the barriers to vaccination of frontline health workers in Awka, Nigeria was relatively unknown. This acceptability rate is less than the 67% quoted by Di Gennaro *et al.*²⁵ in their Italian HCW correspondents and even lesser than the 80.9% reported by Dzieciolowska *et al.*²⁶ in their Canadian study among health workers. Similarly, in a recent systematic review and meta-analysis aimed at estimating the proportion of HCWs in Italy who expressed COVID-19 vaccine hesitancy, it was revealed that the vaccine hesitancy rate among HCWs was 13.1%.²⁷ The systematic review further revealed that the vaccine hesitancy rate among HCWs investigated before and during the vaccination campaign was 18.2% and 8.9%, respectively.²⁷

The mean age of participants was 35.5 ± 7.971 and was higher than figures obtained by Germann *et al.*²⁸ which was 29.5 ± 5.10 years. Germann believed that older, parous employed and individuals with higher educational attainment were more likely to be vaccinated, but this was not so in our findings. The age of the individual, sex, and educational status appeared to influence uptake of vaccination. Dzieciolowska *et al.*²⁶

Table 1. Showing the socio-demographics of the study participants (N= 100).

Socio-demographics	Frequency	Percentage
Age category ^a		
20–29 years	16	19.51
30–39 years	40	48.78
40–49 years	20	24.39
50–59 years	6	7.32
Mean ± SD	35.5 ± 7.971	
Sex		
Female	63	63.0
Male	37	37.0
Gender		
Gender-diverse	1	1.0
Man/boy	37	37.0
Woman/girl	62	62.0
Ethnicity ^b		
Igbo	86	100.0
Place of residence		
Rural	9	9.00
Urban	91	91.00
Years of working experience ^c		
Less than 10 years	59	71.95
More than 10 years	23	28.05
Marital status		
Married	68	68.0
Separated	1	1.0
Single	31	31.0
Educational status		
Bachelor’s degree	65	65.00
FSLC ^d	2	2.00
Postgraduate qualification	29	29.00
SSCE	4	4.00

(Continued)

Table 1. (Continued)

Socio-demographics	Frequency	Percentage
Monthly income		
<N50,000	5	5.00
50,000–100,000	23	23.00
101,000–150,000	5	5.00
151,000–120,000	2	2.00
>200,000	9	9.00
Don’t know	56	56.00
FSLC, First School Leaving Certificate; SD, standard deviation; SSCE, senior school certificate. ^a 18 participants did not specify their age. ^b Only 86 reported their ethnicity. ^c 82 participants specified their years of working experience. ^d Nigeria students are awarded this certificate on taking the FSLC examination after completing the grade six elementary class.		

reported that male gender and age above 50 years were independently associated with vaccine acceptance, while Zammit *et al.*²⁹ reported that female gender, working in the capital, and having concerns about the vaccine components predicted more hesitancy among participants. However, what was obvious in our study was the effect of years of work experience on uptake of vaccination. It appeared as if the lesser the years of work, the better the uptake of vaccination. The explanation may be due to the enforcement of vaccination as a measure of employment by different parastatals. Alyu *et al.*³⁰ showed that there was higher vaccine uptake in higher monthly income earners and in HCWs working in the non-governmental sector. Nevertheless, participants aged 30–39 years reported the highest acceptance rate of COVID-19 vaccination, and the increase in female preponderance of COVID-19 vaccine acceptance compared to males did not reach a significant level in this study.

Income, place of residence, marital status, and educational status appear not to influence the uptake of COVID-19 vaccination. For better coverage of vaccination, the distribution of vaccination was per local government while observing strict vaccine cold chain. A high-quality cold chain allows health workers to deliver life-saving vaccines to every patient who needs it. The cold

Table 2. Showing the occupation of the study participants.

Occupation	Frequency	Percentage (%)
Medical doctor	16	16.00
Medical laboratory scientist	13	13.00
Medical records	7	7.00
Nurse	19	19.00
Other	21	21.00
Pharmacist	13	13.00
Physiotherapist	3	3.00
Radiographer	3	3.00
Technician	5	5.00
Total	100	100.0

Table 3. Showing sources of information on COVID-19 of the study participants.

Information on COVID-19	Total frequency		
	No	Yes	
Heard about the novel coronavirus, COVID-19, <i>m</i> = 1	2 (2.02)	97 (97.98)	99 (100.0)
Attended any lecture/discussion about COVID-19, <i>m</i> = 2	17 (17.35)	81 (82.65)	98 (100.0)
Willing to take the available COVID-19 vaccine, <i>m</i> = 5	50 (52.63)	45 (47.37)	95 (100.0)

Table 4. Showing the healthcare workers status in relation to COVID-19 among the study participants. *m* = 8.

Healthcare worker status in relation to COVID-19	Frequency	Percent (%)
Frontline	72	78.26
Not in healthcare	1	1.09
Other	19	20.65
Total	92	100.0

Table 5. Barriers against COVID-19 vaccination among the study participants.

Gender barriers	Frequency	Percent
Afraid	1	1.0
Breast feeding	2	2.0
I have taken the vaccine	1	1.0
Illness	1	1.0
Infertility among men	1	1.0
Life barriers	1	1.0
None	87	87.0
Pregnancy	2	2.0
Pregnancy, breast feeding, and childcare	1	1.0
Pregnancy and lactation	1	1.0
Reproductive age	1	1.0
Time	1	1.0
Total	100	100.0

chain acts to preserve biological product quality from the time of manufacture until the point of administration by ensuring that the vaccines are stored and transported within the recommended temperature ranges.³¹ Establishing a secure cold chain management of global vaccine chain supply is critical. As a result, innovative technologies and techniques are needed to simplify vaccine distribution, by minimizing the need for a cold chain.³¹ Improvements in the stringent cold chain storage requirements can be made by improving vaccine formulation. One approach is to eliminate the cold chain altogether by making vaccines that can withstand more natural temperatures.³¹ Another method would be to stabilize vaccines through improved formulation, such as excipient innovation, protein engineering, and lyophilization if suitable.³¹

There was no premium placed on different local government areas or income of individuals per say during COVID-19 vaccination. The higher the educational attainment, the more likely the

Table 6. Showing the level of risk posed by the study participants to others.

Variable	Frequency					Total frequency
	Greatly concerned	Concerned	Neutral	Not greatly concerned	Somewhat concerned	
To what extent are you concerned about infecting others with COVID-19? <i>m</i> =3	24 (24.74)	21 (21.65)	23 (23.71)	15 (15.46)	14 (14.43)	97 (100.0)
To what extent are you concerned about getting infected with COVID-19? <i>m</i> =3	41 (42.27)	21 (21.65)	7 (7.22)	13 (13.40)	15 (15.46)	97 (100.0)

individual is to be vaccinated according to Germann *et al.*, in their study done in Ohio, USA. It may be possible that the varied ethno-cultural and religious plurality of Nigeria may have had an affect on the decision making process in individuals with an average education. The reason for acceptability and non-acceptability of COVID-19 vaccine intake was spread across the following reasons/statuses: breast feeding, previous COVID-19 vaccination, illness, infertility among men, life barriers, pregnancy, and lactation. There were different conspiracy theories on COVID-19 vaccination that possibly delayed the uptake world wide.³¹ Dzieciolowska *et al.*²⁶ identified factors that led to vaccine hesitancy as vaccine novelty, wanting others to receive it first, and insufficient time for decision making. Germann *et al.*, found 93% COVID-19 vaccine hesitancy in the pregnant population.²⁸ This may follow the initial restrictive recommendation of COVID-19 vaccination in pregnancy.

The findings of our study are generally consistent with another study conducted in a non-health worker population in Awka, Nigeria, a city with similar incidence of COVID-19 cases. This study found that the COVID-19 hesitancy rate was 65.04%, and the strongest predictors related to vaccine acceptance were marital status, age, and Christian denominational affiliation.³² Conversely, in this previous study in the non-health worker population, gender, occupation, previous vaccination experience, awareness of COVID-19, and previous symptoms of COVID-19 did not significantly ($p=0.05$) influence respondents' willingness to be vaccinated.³³

Based on the findings of this study, there is a need to strengthen the importance of information, communication, and organizational and educational strategies to reduce vaccine hesitancy. For example, in a recent cross-sectional descriptive study, Tomietto *et al.*³⁴ aimed at determining COVID-19 vaccination hesitancy in healthcare professionals and healthcare students in Italy across four generations. The results showed that worries about unforeseen future effects accounted for the higher vaccination hesitancy factor across generations. The results suggest that public health campaigns should consider the generational differences in COVID-19 vaccination hesitancy to achieve higher levels of vaccine acceptance, including among healthcare professionals and students.³⁴ Vaccination remains the utmost operational strategy to tackle the COVID-19 pandemic. The advice of health professionals strongly influences vaccination willingness in the general population. A consideration of the generational patterns in the COVID-19 vaccination hesitancy of HCWs and students may increase vaccination uptake in these populations, which in turn may lead to greater public acceptance of the vaccine. In addition, Toth-Manikowski *et al.*³⁵ adapted a survey using the Health Belief Model framework to evaluate HCWs vaccine hesitancy and reasons for choosing for or against COVID-19 vaccination. The results showed that HCWs were less likely to receive COVID-19 vaccination if they were Black, Republican, or allergic to any vaccine component and more likely to receive if they believed people close to them thought it was important for them to receive the vaccine. The study concluded that a sizable number of

Table 7. Showing the COVID-19 status of the family members of the study participants.

COVID-19 status of relatives	Frequency			Total frequency
	Don't know (because they were not tested)	No	Yes	
Has any of your family members had COVID-19? <i>m</i> = 1	17 (17.17)	75 (75.76)	7 (7.07)	99 (100.0)
Is any of your family members currently infected with COVID-19?	10 (10.0)	89 (89.0)	1 (1.0)	100 (100.0)
Variable	Frequency			Total frequency
	No	Yes	Maybe	
Do you support that the COVID-19 vaccine should be made compulsory for all residents and citizens of Nigeria?	69 (69.0)	31 (31.0)	0	100 (100.0)
Do you have a chronic illness that makes you clinically vulnerable to serious illness from COVID-19?	95 (95.0)	5 (5.0)	0	100 (100.0)
Have you vaccinated for seasonal flu before?	61 (61.0)	26 (26.0)	13 (13.0)	100 (100.0)
Have you ever refused vaccine recommended by a physician because of doubts about it?	74 (74.0)	25 (25.0)	1 (1.0)	100 (100.0)
Is social distancing an effective way to reduce the spread of the virus? <i>M</i> = 1	9 (9.09)	89 (89.90)	1 (1.01)	99 (100.0)
Is the isolation and treatment of people who are infected with COVID-19 effective to reduce the spread of virus? <i>M</i> = 2	6 (6.12)	92 (93.88)	0	98 (100.0)
Would you take the COVID-19 vaccine? <i>M</i> = 4	53 (55.21)	42 (43.75)	1 (1.04)	96 (100.0)

M, missing values.

HCWs remain vaccine hesitant 1 year into the COVID-19 pandemic.³⁵ As HCWs are positively influenced by colleagues who believe in COVID-19 vaccination, development of improved communication across HCW departments and roles may improve vaccination rates.³⁵

Our study has some limitations and some strengths. Among the strengths are the hospital population-based data from the study site as well as the standard data collection protocol used in the study site. One of the weaknesses is the single site nature of the study, which may have affected the observed findings of the barriers and acceptability of COVID-19 vaccination. Another limitation is the lack of available data about the status of the pandemic in the study site, the ongoing educational efforts at the each site, and our limited knowledge of how each of these factors influences the participants' acceptability of COVID-19 vaccination. In addition, the presence of missing

data affects the quality of the data set, which impacts on the analysis and interpretation of the data. Therefore, our findings should be taken with caution due to the missing data. In addition, in this study, technical and economic limitations occurred, which drastically affected the sample size of participants included in the study. Therefore, the sample size was built keeping into consideration the feasibility of the study itself in a difficult researching context.

Conclusion

At the time of this study, the uptake of COVID-19 vaccination was suboptimal among HCWs working in Awka metropolis in Nigeria. The majority of HCWs were unsure about the efficacy of this vaccine. There is a need for more scientific research and further public health education among healthcare workers to encourage larger vaccine uptake.

Table 8. Test of association between socio-demographics and acceptability of COVID-19 vaccine among the study participants.

Socio-demographics	Would you take the COVID-19 vaccine			Total frequency	χ^2 value	p value
	Maybe	No	Yes			
Age category <i>m</i> = 18						
20–29 years	0	6 (37.5)	10 (62.5)	16 (100.0)		
30–39 years	0	21 (52.5)	19 (47.5)	40 (100.0)	7.7	0.262
40–49 years	2 (10.0)	10 (50.0)	8 (40.0)	20 (100.0)		
50–59 years	0	3 (50.0)	3 (50.0)	6 (100.0)		
Sex						
Female	4 (6.3)	33 (52.4)	26 (41.3)	63 (100.0)	0.7	0.721
Male	1 (2.7)	20 (54.1)	16 (43.2)	37 (100.0)		
Place of residence <i>m</i> = 1						
Rural	0	6 (67.7)	3 (33.3)	9 (100.0)	2.4	0.667
Urban	5 (5.6)	47 (52.2)	38 (42.2)	90 (100.0)		
Years of working experience <i>m</i> = 18						
Less than 10 years	1 (1.7)	31 (52.5)	27 (45.8)	59 (100.0)	10.8	0.029
More than 10 years	1 (4.3)	10 (43.5)	12 (52.2)	23 (100.0)		
Marital status						
Married	4 (5.9)	39 (57.4)	25 (36.8)	68 (100.0)		
Separated		1 (100.0)		1 (100.0)	3.8	0.433
Single	1 (3.2)	13 (41.9)	17 (54.8)	31 (100.0)		
Educational status						
FSLC	0	2 (100.0)	0	2 (100.0)		
SSCE	0	4 (100.0)	0	4 (100.0)	6.2	0.624
Bachelor's degree	3 (4.6)	34 (52.3)	28 (43.1)	65 (100.0)		
Postgraduate qualification	2 (6.9)	13 (44.8)	14 (48.3)	29 (100.0)		
Monthly income ^b						
<N50,000	0	2 (40.0)	3 (60.0)	5 (100.0)		
50,000–100,000	1 (4.3)	9 (39.1)	13 (56.5)	23 (100.0)		
101,000–150,000	0	3 (60.0)	2 (40.0)	5 (100.0)	17.3	0.068
151,000–120,000	0	2 (100.0)	0	2		
>200,000	0	1 (11.1)	8 (88.9)	9 (100.0)		

FSLC, First School Leaving Certificate; SSCE, senior school certificate.
^a18 participants did not specify their age.
^b56 participants don't know.

Declarations

Ethics approval and consent to participate

This study was approved by Ethics Review Committee Board of Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH) (COOUTH), Amaku-Awka, Nigeria, with approval number of COOUTH/CMAC/ETH.C/VOI.1/FN:04/0080 (Approval date: 14 April 2021). Written informed consent was obtained from all individual participants included in the study.

Consent for publication

All the participants gave consent for publication.

Author contributions

Ngozi Nneka Joe-Ikechebel: Conceptualization; Investigation; Methodology.

Uche Marian Umeh: Conceptualization; Writing – original draft; Writing – review & editing.

George Uchenna Eleje: Data curation.

Emeka Philip Igbodike: Formal analysis; Writing – original draft.

Emmanuel Okwudili Ogbuefi: Writing – original draft; Writing – review & editing.

Angela Oyilieze Akanwa: Validation.

Sylvia Tochukwu Echendu: Validation.

Williams Onyeka Ngene: Validation.

Augusta Nkiruka Okpala: Validation.

Onyinye Chigozie Okolo: Validation.

Chidubem Ekpereamaka Okechukwu: Validation.

Josephat Chukwudi Akabuike: Validation.

Helen Obioma Agu: Validation.

Vincent Ogochukwu Okpala: Validation.

Onyinye Chinenye Nwazor: Validation.

Anthony Obiajulu Ugochukwu Nnedum: Validation.

Chinyere Celestina Esimone: Validation.

Hephzibah Ngozi Agwaniru: Validation.

Ethel Ifeoma Ezeabasili: Validation.

Acknowledgements

The authors thank the study participants for their involvement in the study.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.


Competing interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Availability of data and materials

All relevant data are within the manuscript and its Supporting Information files. The data sets used and/or analysed during this study are available from the corresponding author upon reasonable request.

ORCID iDs

Emmanuel Okwudili Ogbuefi  <https://orcid.org/0000-0001-8322-4891>

Ethel Ifeoma Ezeabasili  <https://orcid.org/0000-0003-2415-5616>

References

1. Li Q, Guan X, Wu P, *et al.* Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med* 2020; 382: 1199–1207.
2. Guo Y-R, Cao Q-D, Hong Z-S, *et al.* The origin, transmission, and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak—an update on the status. *Mil Med Res* 2020; 7: 1–10.
3. Tian X, Li C, Huang A, *et al.* Potent binding of 2019 novel coronavirus spike protein by a SARS coronavirus-specific human monoclonal antibody. *Emerg Microbes Infect* 2020; 9: 382–385.
4. WHO director-general's opening remarks at the media briefing on COVID19, 2020. <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>
5. Bowale A, Abayomi A, Idris J, *et al.* Clinical presentation, case management and outcomes for the first 32 COVID-19 patients in Nigeria. *Pan Afr Med J* 2020; 35(Suppl. 2): 24.

6. NCDC website, <https://covid19.who.int/region/afro/country/ng>
7. Al-Hanawi MK, Angawi K, Alshareef N, *et al.* Knowledge, attitude, and practice toward COVID-19 among the public in the kingdom of Saudi Arabia: a cross-sectional study. *Front Public Health* 2020; 8: 217.
8. Sherman SM, Smith LE, Sim J, *et al.* COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. *Hum Vaccin Immunother* 2021; 17: 1612–1621.
9. Lurie N, Saville M, Hatchett R, *et al.* Developing COVID-19 vaccines at pandemic speed. *N Engl J Med* 2020; 382: 1969–1973.
10. Yang Y, Peng F, Wang R, *et al.* The deadly coronaviruses: the 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. *J Autoimmun* 2020; 109: 102434.
11. Kochhar S and Salmon DA. Planning for COVID-19 vaccines safety surveillance. *Vaccine* 2020; 38: 6194–6198.
12. Alexandrova R, Beykov P, Vassilev D, *et al.* The virus that shook the world: questions and answers about SARS-CoV-2 and COVID-19. *Biotechnol Equip* 2021; 35: 74–102.
13. Akyala AI, Muhammad L, Akabe E, *et al.* Person to person transmission of pneumonia associated with the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): a familial cluster analysis in North Central Nigeria. *Pan Afr Med J* 2020; 37: 99.
14. Harry AM, Edet CK, Ekanem NE, *et al.* Adverse events following COVID-19 vaccination in Rivers State, Nigeria: a cross-sectional study. *Niger Postgrad Med J* 2022; 29: 89–95.
15. Emeka C, Edu B, Ekpennyong J, *et al.* COVID-19 vaccine roll-out at the community level in developing countries: lessons learnt from Cross River State, Nigeria. *Public Health Pract* 2022; 4: 100273.
16. Omaka-Amari LN, Aleke CO, Obande-Ogbuinya NE, *et al.* Coronavirus (COVID-19) pandemic in Nigeria: preventive and control challenges within the first two months of outbreak. *Afr J Reprod Health* 2020; 24(s1): 87–97.
17. Dubov A and Phung C. Nudges, or mandates? The ethics of mandatory flu vaccination. *Vaccine* 2015; 33: 2530–2535.
18. Enabulele O and Mobolaji A. COVID-19 pandemic: an assessment of risk perception and the implementation of precautionary measures in a group of primary care workers in Nigeria. *J Prev Med Hyg* 2022; 62: E822–E829.
19. Stefanizzi P, Martinelli A, Ferorelli D, *et al.* Rapid decrease of SARS-CoV-2 circulation in a large Italian hospital six weeks after the start of the immunization program. *J Hosp Infect* 2021; 112: 42–44.
20. Hall VJ, Foulkes S, Saei A, *et al.* COVID-19 vaccine coverage in health-care workers in England and effectiveness of BNT162b2 mRNA vaccine against infection (SIREN): a prospective, multicentre, cohort study. *Lancet* 2021; 397: 1725–1735.
21. Antwi-Berko D, Bakuri AZ, Otabil KB, *et al.* Determinants and variations of COVID-19 vaccine uptake and responses among minority ethnic groups in Amsterdam, The Netherlands. *Front Public Health* 2022; 10: 761987.
22. Paterson P, Paterson P, Meurice F, *et al.* Vaccine hesitancy and healthcare providers vaccine hesitancy and healthcare providers. *Vaccine* 2016; 34: 6700–6706.
23. Rhodes A, Hoq M, Measey MA, *et al.* Intention to vaccinate against COVID-19 in Australia. *Lancet Infect Dis* 2020; 21: e110.
24. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G, *et al.* Acceptability of vaccination against COVID-19 among healthcare workers in the Democratic Republic of the Congo. *Pragmat Obs Res* 2020; 11: 103–109.
25. Di Gennaro F, Murri R, Segala FV, *et al.* Attitudes towards Anti-SARS-CoV2 vaccination among healthcare workers: results from a national survey in Italy. *Viruses* 2021; 13: 371.
26. Dzieciolowska S, Hamel D, Gadio S, *et al.* COVID-19 vaccine acceptance, hesitancy, and refusal among Canadian healthcare workers: a multicenter survey. *Am J Infect Control* 2021; 49: 1152–1157.
27. Bianchi FP, Stefanizzi P, Brescia N, *et al.* COVID-19 vaccination hesitancy in Italian healthcare workers: a systematic review and meta-analysis. *Expert Rev Vaccines* 2022; 21: 1289–1300.
28. Germann K, Kiefer MK, Rood KM, *et al.* Association of initial COVID-19 vaccine hesitancy with subsequent vaccination among pregnant and post-partum individuals. *BjOG* 2022; 129: 1352–1360.
29. Zammit N, Gueder AE, Brahem A, *et al.* Studying SARS-CoV-2 vaccine hesitancy among

- health professionals in Tunisia. *BMC Health Serv Res* 2022; 22: 489.
30. Alya WA, Maraqa B, Nazzal Z, *et al.* COVID-19 vaccine uptake and its associated factors among Palestinian healthcare workers: expectations beaten by reality. *Vaccine* 2022; 40: 3713–3719.
31. Fahrni ML, Ismail IA, Refi DM, *et al.* Management of COVID-19 vaccines cold chain logistics: a scoping review. *J Pharm Policy Pract* 2022; 15: 16.
32. Ikwuka DC, Nwobodo E, Anyaehie UB, *et al.* SARS-CoV-2: current perspective on control, prevention, and therapeutic promise. *Sud J Med Sci* 2020; 15: 80–84.
33. Uzochukwu IC, Eleje GU, Nwankwo CH, *et al.* COVID-19 vaccine hesitancy among staff and students in a Nigerian tertiary educational institution. *Ther Adv Infect Dis* 2021; 8: 20499361211054923.
34. Tomietto M, Simonetti V, Comparcini D, *et al.* A large cross-sectional survey of COVID-19 vaccination willingness amongst healthcare students and professionals: reveals generational patterns. *J Adv Nurs* 2022; 78: 2894–2903.
35. Toth-Manikowski SM, Swirsky ES, Gandhi R, *et al.* COVID-19 vaccination hesitancy among health care workers, communication, and policymaking. *Am J Infect Control* 2022; 50: 20–25.