Original Research Article

Healthcare Heroes and COVID-19: Understanding Vaccine Perception and Practice in a Nigerian Tertiary Care Centre

ABSTRACT

Background: The COVID-19 pandemic underscored the critical role of vaccination in mitigating transmission and severe outcomes, particularly among high-risk groups like healthcare workers (HCWs). Healthcare workers have an important role to play in the success of COVID-19 vaccination programs as their practice and recommending the vaccines to the public is dependent on their perceptions towards the vaccine.

Methodology: This cross-sectional study assessed the perceptions, practices, and determinants of COVID-19 vaccination among HCWs at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nigeria, a pivotal site for national vaccination efforts. A stratified sampling method was used to recruit 260 HCWs, including doctors, nurses, paramedics, and administrative staff. Data were collected via validated questionnaires and analyzed using descriptive and inferential statistics.

Results: This survey revealed high awareness (98.8%) of COVID-19 vaccines, with 66.9% demonstrating a good perception of vaccine safety and efficacy. However, only 39.6% had received at least one vaccine dose, highlighting a stark perception-practice gap. Vaccination rates varied by profession. Doctors had the highest uptake (54.5%), while nurses exhibited the lowest (26.8%). Key motivators included civic responsibility (55.3%) and fear of COVID-19 (48.5%), whereas barriers centered on safety concerns (53.1%), perceived inadequate clinical trials (48.8%), and mistrust in institutions (50.4%). Some socio-demographic disparities were significant ($p \leq 0.05$), with older, male, and tertiary-educated HCWs more likely to vaccinate.

Conclusion: Despite accessibility at NAUTH (71.5% availability), hesitancy persisted due to misinformation and fear of adverse effects. The findings advocate for targeted interventions addressing profession-specific concerns, enhanced public health communication, and community-driven advocacy to bridge the uptake gap. Strengthening transparency in vaccine development and addressing systemic mistrust are vital for achieving global immunization targets in resource-limited settings.

Keywords: COVID-19 vaccination, healthcare workers, vaccine hesitancy, perception-practice gap, Nigeria.

INTRODUCTION

The outbreak of coronavirus disease (COVID-19) in December 2019 caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2), had its index case in Wuhan City, Hubei province, China, and was declared a Pandemic by the WHO on March 11th, 2020, as a result of its severity and rate of spread.[1] COVID-19 primarily affects the respiratory system and has been associated with a wide spectrum of illnesses ranging from asymptomatic, mild to severe, or fatal. Common clinical symptoms include fever, fatigue, dry cough, shortness of breath, pneumonia, anosmia, ageusia, and other severe respiratory syndrome.[2] Studies done in the past have shown a lot of potential late complications consequent of COVID-19 infection and they include lung fibrosis, venous thromboembolism (VTE), arterial thrombosis, cardiac thrombosis and inflammation, stroke, brain fog, dermatological complications, and overall mood dysfunctions.[3]

In a bid to slow down the spread of SARS-CoV-2 infection and mitigate its health effects, countries worldwide implemented different control measures such as social distancing, partial and comprehensive lockdowns, closing schools and businesses, and/or wearing face masks in public; however, these measures had little effects as the resurgence of COVID-19 has been reported as societies and economies reopened calling attention to an urgent need for long-term preventive measures like vaccination and others.[1] Nigeria being a third-world country is among the vulnerable countries in Africa predicted to experience accelerated spread of the COVID-19 virus mainly because of the weak state of health infrastructure and health systems;[4] recorded 264,933 confirmed cases, 257,954 discharged cases, and 3155 deaths as at September 2022. The COVID-19 Pandemic has affected many aspects of human lives and in desperation, mass vaccination and herd immunity seem promising to get rid of the virus. Vaccination appears to be paramount to achieving a level of population immunity that will help to further prevent the COVID-19 spread.

Vaccine hesitancy, misinformation, and conspiracy theories are the challenges influencing vaccine uptake. Studies by the United Nations International Children's Emergency Fund (UNICEF) confirmed that the vaccines are safe for people with co-morbidities or immune-compromised thus debunking misinformation that is circulating that COVID-19 vaccines pose a great risk to people with underlying health conditions. They further confirmed that all vaccines have been rigorously tested, examined, and found to be efficacious at preventing serious illness, hospitalization, and death amongst a majority of people with co-morbidities.[5] It is worthy of note that some medical personnel also raised concerns regarding the safety and long-term effects of these vaccines due to their rapid development.[6]

Seven vaccines were approved for use in Nigeria including AstraZeneca-Oxford: Vaxzevria, Pfizer-BioNTech: Comirnaty, Janssen (Johnson & Johnson): Jcovden, Moderna: Spikevax, Gamaleya: Sputnik V, Sinopharm (Beijing):

Covilo, and Serum Institute of India: Covishield. However, AstraZeneca-Oxford carried out clinical trials for their COVID-19 vaccine in Nigeria. From the onset of COVID-19 vaccination in Nnamdi Azikiwe University Teaching Hospital (NAUTH) in 2021, AstraZeneca-Oxford: Vaxzevria, Pfizer- BioNTech: Comirnaty, and Janssen (Johnson & Johnson): Jcovden are the vaccines available and administered to people even as at the time of conducting this study, according to the Immunization Clinic at NAUTH.[7]

With the arrival of the COVID-19 vaccine to Nigeria on 2nd of March, 2021, healthcare workers (HCWs) were defined as a priority group in receiving this vaccine because HCWs at the front lines of the pandemic have an increased risk of contracting the virus compared to the general population and they can subsequently suffer from significant morbidity and mortality.[8] Healthcare workers have an important role to play in the success of COVID-19 vaccination programs as their practice and recommending the vaccines to the public is dependent on their perceptions towards the vaccine. If healthcare workers have bad perceptions and practices towards COVID-19 vaccination, they will transfer such intuition and practice to the public and decline the frequency of vaccination, thereby delaying the World Health Organization (WHO) and Independent Allocation Vaccine Group (IAVG) global target of achieving 70% COVID-19 Immunization Coverage in all countries.[9] Because of the paucity of scholarly literature on COVID-19 vaccine uptake amongst healthcare workers in our locality, this study aimed to fill this gap. Therefore, the objective of this study was to determine the perceptions and practice of COVID-19 vaccination among healthcare workers in Nnamdi Azikiwe University Teaching Hospital (NAUTH) and also to determine the factors associated with the practice of COVID-19 vaccination among them.

METHODOLOGY

Study Area

This study was conducted at NAUTH, a federal government teaching hospital located in Nnewi town of Nnewi North local government area, Anambra State, Nigeria. NAUTH provides a wide range of medical, surgical, diagnostic, outpatient, rehabilitative, and support services to a catchment population of about 30,994,559.[10] It is one of the super-sites for the ongoing COVID-19 vaccination in Nigeria.

Study Design

This study was a hospital-based descriptive cross-sectional study that assessed the perception and the practice of COVID-19 vaccination among healthcare workers.

Study Population

The study incorporated the following group of health workers: Doctors, Nurses, Para-medicals: (Pharmacists, Radiographers, Medical Laboratory Scientists, Physiotherapists), Administrative and Housekeeping Staff (Medical Record Officers, Wardens/Porters, Hospital cleaners, Hospital security) who are fully employed at NAUTH.

Inclusion Criteria

The study participants included the groups of healthcare workers listed above, who are fully employed by NAUTH and up to 18 years old and above.

Exclusion Criteria

This study excluded the trainee health workers on attachment (healthcare workers doing their internship) in the hospital, those absent at the time of the study, and those who did not consent.

Sample Size Determination

The sample size was determined using the Cochrane's formula.[11]

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

where:

N is the minimum sample size.

Z is the standard normal deviate (1.96) at 95% confidence level.

P is the practice of COVID-19 Vaccination taken at 79%.[12]

Q is the proportion of people in the population without factors under study;

q = 1-p

q =1-0.79 = 0.21

d is degree of precision = 5% (0.05)

$$n = \frac{1.96^2 \times 0.79 \times 0.21}{0.05^2}$$

$$n = \frac{0.6373}{}$$

0.0025

n = 255

As the population of healthcare workers is less than 10,000 the desired sample size (n_f) was calculated using the formula:

$$n_f = \frac{n}{1 + n/N}$$

Where n =the minimum sample size (255)

N = population of health workers in NAUTH (2580)[13]

n_f =255/(1+(255/2580))

n_f = 232

Anticipating a non-response rate (f) of 2.5% the adjusted sample size(Ns) is;

$N_s = n_f/1-f$

N_s= 232/(1-0.025) = 238

Sampling Method

A stratified sampling technique was used. The study respondents were drawn from each cadre of the NAUTH healthcare workers aged from 18 and above into the study and proportionate allocation was done using the numerical strength of each level. The formula used to calculate the number of respondents per cadre of healthcare workers is:

(Total number of healthcare workers in a cadre / Total number of healthcare workers in NAUTH) X Sample size after attrition is corrected.

For Doctors: 581/2580 X 238 = 54 Doctors

For Nurses: 601/2580 X 238 = 55 Nurses

For Para-medicals: 303/2580 X 238 = 28 Para-medicals

For Others: 1095/2580 X 238 = 101 Other healthcare workers in NAUTH

Afterward, a simple random sampling through balloting was used to determine respondents enrolled in this study for the different classes. The balloting was done by folding the papers with **"YES Or NO"** and the respondents were instructed to pick, respondents who picked **"YES"** were administered the questionnaire.

Study Instrument

Data were collected using a pre-tested semi-structured, self-administered, validated, and anonymous questionnaire. The questionnaire was designed to meet the objectives of the study with guidance from several similar works already done on the subject and subsequently verified by experts. The questionnaire had 4 sections. The first section ascertained the respondent's bio-data and socio-demographic characteristics. The second section contained ten perception-based questions that assessed the respondent's perception of COVID-19 vaccination, with each item carrying a mark for a correct answer. The respondents' answers to those ten perception-based questions about COVID-19 vaccination were graded to over 10 and then the perception score of each respondent was converted to 100%; with this established, the respondents that scored ≥70.0% were classified to have good perception about COVID-19 vaccination, the respondents with scores from 50% to 69.9% were classified to have moderate perception about covid-19 vaccination and the respondents that scored <50.0% were classified to have poor perception about COVID -19 vaccination. The third section contains three COVID-19 vaccination practice-based questions that assessed the respondents' practice of COVID-19 vaccination. These were graded and converted to a percentage with the respondents who scored <70.0% being classified as having poor practice of the COVID-19 vaccination while respondents who scored ≥70% were classified as having good practice of the COVID-19 vaccination. The fourth section assessed the factors (motivation and barriers) associated with the practice of COVID-19 vaccination among NAUTH Healthcare workers.

Training of Research Assistants

Two (2) research assistants were recruited and trained to help with carrying out this survey in record time. These research assistants were 5th year medical students undergoing clinical rotations in the hospital at the time of the survey. They were trained on the contents of the questionnaire.

Data Analysis

Data collected were cleaned, coded and analyzed using IBM Statistical Product and Service Solutions (SPSS) Version 24. Descriptive and inferential statistics were applied where necessary. Numerical variables were reported as mean and standard deviation, while categorical data were reported using proportions and percentages. Tables were used in the representation of the results of the data collected.

RESULTS

About 260 healthcare workers from NAUTH were sampled; the results are presented below.

Table 1 shows the demographic characteristics of the respondents. The table shows that 42.7% of the respondents were males while 57.3% were females. The highest occurring age group was 30.0 - 39.0 years (37.3%) while the least occurring age group was < 20.0 years (0.4%). 21.2% of the respondents were doctors, 21.5% were nurses 13.5% were Para-medicals, and 43.8% were other groups of healthcare workers. 78.5% of the respondents received tertiary education.

Table 1: The Socio-Demographic Characteristics of the Respondents

Variable	Frequency	Percentage
Age (years)		
< 20.0	1	0.4
20.0 - 29.0	48	18.5
30.0 - 39.0	97	37.3
40.0 - 49.0	62	23.8
50.0 - 59.0	47	18.1
≥60.0	5	1.9
Mean Age in years	***39.08±10.15***	
Sex		
Male	111	42.7
Female	149	57.3
Marital Status		
Single	93	35.8
Married	167	64.2
Religion		
Christianity	256	98.5
Muslim	2	0.8
Traditionalist	1	0.4
Judaism	1	0.4
Educational Status		
No Formal Education	1	0.4
Primary	12	4.6
Secondary	43	16.5
Tertiary	204	78.5
Occupation		
Doctor	55	21.2
Nurse	56	21.5
Paramedical	35	13.5
Others	114	43.8

Table 2 shows the respondents' perception of COVID-19 Vaccination; 98.8% of the respondents have heard about the COVID-19 vaccine, 78.1% say the COVID-19 vaccine is safe, 20% believe that one can get infected with COVID-19

disease through COVID-19 vaccination and 76.2% agrees that it is possible to reduce and control the spread and burden of COVID-19 with COVID-19 vaccination. 86.2% say getting vaccinated against COVID-19 is protective of them, their family, and others against the disease. 59.6% say that their immune system is sufficient to protect them against the disease, 26.9% say taking the vaccine can worsen any health conditions they have, and 54.2% do not believe that the risks of harmful side effects and reactions of getting injected with the COVID-19 vaccines outweigh the protective benefits of the vaccine.

The respondents (66.9%) that scored ≥70.0% were classified as having a good perception of COVID-19 vaccination, the respondents (18.8%) that scored between 50-69.9% were classified as having fair perception while 14.2% of the respondents that scored <50% were classified as having poor perception about the COVID-19 vaccination.

Table 2: The Perception of the Respondents about COVID-19 Vaccination.

Variable		Frequency	Percentage
Heard of the COVID-19 vaccine	Yes	257	98.8
	No	3	1.2
If COVID-19 vaccine is safe	Yes	203	78.1
	No	57	21.9
If one can get infected with COVID-19 disease through COVID-19 vaccination	Yes	52	20.0
	No	205	78.8
	No response	3	1.2
If it is possible to reduce and control the spread and burden of COVID-19 with COVID-19 vaccination	Yes	198	76.2
	No	58	22.3
	No response	4	1.5
If getting yourself vaccinated against COVID-19 is a good way to protect yourself, your family, and other people against the disease	Yes	224	86.2
	No	34	13.1
	No response	2	0.8
If my immune system is sufficient to protect me against COVID-19	Yes	155	59.6
	No	96	36.9
	No response	9	3.5
If taking the COVID-19 vaccine can worsen any health conditions you have	Yes	70	26.9
	No	170	65.4
	No response	20	7.7
If the development of COVID-19 vaccines by pharmaceutical companies was properly carried out to make them safe.	Yes	176	67.7
	No	69	26.5
	No response	15	5.8
If COVID-19 vaccination necessary in Nigeria	Yes	195	75.0
	No	57	21.9
	No response	8	3.1
If believe that the risks of harmful side effects and reactions of getting injected with the COVID-19 vaccines outweigh the protective benefits of the COVID-19 vaccines?	Yes	107	41.2
	No	141	54.2
	No response	12	4.6
Perception score of the respondents in percentage	<50.0% (Poor)	37	14.2
	50.00 - 69.99% (Fair)	49	18.8
	≥70.00% (Good)	174	66.9

Table 3 revealed that only 39.6% of the healthcare workers have received at least one dose of the COVID-19 Vaccine. This table also gives a rough assessment of the vaccination rate among the various cadres of occupation, Doctors (54.5%) had the highest vaccination rate while nurses were the lowest (26.8%). 65.0% of the healthcare workers received their vaccine at NAUTH while 23.3% received their vaccine at a peripheral Primary healthcare center in Nigeria. 62.1% of the HCWs had received the first and second doses only, 35.9% had received the first dose only while 14.5% of the respondents are up-to-date with the COVID-19 vaccination having received the booster dose of the Covid-19 vaccine. 81.1% of the HCWs who received the first dose only plan to receive the second dose. Of the Nigerian-approved COVID-19 vaccines made available in NAUTH, in descending order AstraZeneca-Oxford: Vaxzevria (68.0%) was the highest received, followed by Moderna: Spikevax **(**18.5%), then Pfizer-BioNTech: Comirnaty **(**7.8%) and Janssen (Johnson and Johnson): Jcovden (2.9%). 57.7% of the HCWs have received other adult vaccines with the tetanus vaccine (81.3%) being the highest followed by the Hepatitis B vaccine (73.3%) in second place.

The respondents (66.9%) who scored < 70.00% were classified as having poor practice, while 33.1% who scored ≥70.00% were classified as having good practice about the COVID-19 vaccination.

Table 3: The Respondents' Practice of COVID-19 Vaccination

Variable		**Frequency (N=260)**	**Percentage**
If Received COVID-19 Vaccine	Yes	103	39.6
	No	154	59.2
	No response	3	1.2
The distribution of the respondents that have received COVID-19 vaccine			
Doctor	Yes	30	54.5
	No	25	45.5
Nurse	Yes	15	26.8
	No	41	73.2
Paramedical	Yes	17	48.6
	No	18	51.4
Others	Yes	41	36.0
	No	70	61.4
	No Response	3	2.6
Where the COVID-19 vaccine was received (N=103)	In NAUTH	67	65.0
	At a peripheral Primary Healthcare (PHC) Center	24	23.3
	Others	16	15.5
Dose or doses of the COVID-19 vaccine you received (N=103)	First Dose only	37	35.9
	Two Doses(First and Second Doses)	64	62.1
	Booster Dose	15	14.5
If only the first dose of vaccine was received, reasons for not receiving the second dose yet? (N=37)	My next vaccination appointment is not due yet	17	46.0
	I had adverse reactions like injection site pain, redness, swelling, and systemic reactions like Fever, headache, body aches, fatigue, vomiting, itching, etc. to the COVID-19 vaccine within hours or several days after taking the first dose of the COVID-19 vaccine and that discouraged me from receiving other doses.	15	40.5

	Inconvenience of the immunization process(long clinic hours and long waiting times)	6	16.2
	Unavailability of the vaccine at the health institution	2	5.4
If plan to receive the second dose (N=37)	Yes	30	81.1
	No	7	18.9
Reasons if you have never received any dose or doses of the COVID-19 vaccines at all (N=154)	My immune system is sufficient to protect me against COVID-19	78	50.7
	I want to see what happens to those vaccinated before I take the vaccine	62	40.3
	The vaccines we have in Nigeria and Africa are substandard and unsafe	48	31.2
	There are other forms of treatment for COVID-19	29	18.8
	I have had COVID-19 before	5	3.3
	Fear of adverse side effects	4	2.6
	I haven't had the chance to get vaccinated	4	2.6
	Fear of unknown	3	1.9
	Others	20	19.4
COVID-19 Vaccines Received. (N=103)	AstraZeneca-Oxford: Vaxzevria	70	68.0
	Moderna: Spikevax	19	18.5
	Pfizer-BioNTech:Comirnaty	8	7.8
	Janssen(Johnson and Johnson): Jcovden	3	2.9
	Gamaleya:Sputnik V	0	0.0
	Sinopharm (Beijing): Covilo	0	0.0
	Serum Institute of India: Covishield	0	0.0
Reasons if you took the COVID-19 vaccine (N=103)	Fear of the COVID-19 disease	50	48.5
	My employer recommended/demanded that I get vaccinated	22	21.4
	It is my civic responsibility to take the COVID-19 vaccines	57	55.3
	COVID-19 vaccines are free of charge	26	25.2
	Myself or my relatives got sick with COVID-19	10	9.7
	I am confident that the pharmaceutical industries produced safe and effective COVID-19 vaccines	17	16.5
	COVID-19 vaccine will help us achieve herd immunity	53	51.5
If any chronic illness (comorbidity)?	Yes	25	9.6
	No	210	80.8
	No Response	25	9.6
If Yes, what are they? (N=25)	Hypertension	15	60.0
	Diabetes Mellitus	5	20.0
	Asthma	4	16.0
	Others	1	4.0
If received any adult vaccination apart from childhood immunization	Yes	150	57.7
	No	51	19.6
	No response	59	22.7
If Yes, what are they?	Tetanus vaccine	122	81.3
	Hepatitis B vaccine	110	73.3
	Hepatitis A vaccine	9	6.0
	Yellow fever vaccine	99	66.0
	Meningococcal(Meningitis) vaccine	43	28.7
	Measles, Mumps, Rubella(MMR) vaccine	8	5.3
	DPT(whooping cough) vaccine	4	2.7
	Varicella (chicken-pox) vaccine	5	3.3
	Zoster (Herpes zoster/Shingles) vaccine	1	0.7
	Influenza(Flu) vaccine	3	2
	Pneumococcal conjugate vaccine	3	2
Practice scores of the respondents in percentage	< 70.00% (Poor Practice)	174	66.9
	≥70.00% (Good Practice)	86	33.1

Table 4 shows the factors (motivators and barriers) associated with the practice of COVID-19 vaccination. The majority attested to the vaccine being readily available at the teaching hospital (71.5%), however less than half of the respondents attested to it being readily available in their community (45.8%), and about 1.9% claimed to have paid to receive the COVID-19 vaccine. The respondents' reasons for the low uptake of the COVID-19 vaccine include: not having enough credible information on the vaccines (66.9%), clinical trials of the COVID-19 vaccines inadequate (48.8%), clinical sequelae of adverse effects may result (53.1%), having medical conditions and getting COVID-19 vaccine injection can worsen the medical co-morbidity (31.9%), etc. Suggested measures for improving the practice of COVID-19 vaccination include more publicity, advocacy, and education at the grassroots (33.8%), adequate clinical trials with proven no adverse effect above the benefit (3.1%), more studies on the adverse effects should be carried out (2.0%), Government sincerity in handling health issues (1.6%), making it readily available in the rural area community where they can take it for free without any surcharge (0.8%), etc.

Table 4: The Factors (motivators and barriers) Associated with the Practice of COVID-19 Vaccination.

Variable		**Frequency (N=260)**	**Percentage**
If the COVID-19 vaccine is readily available at the Teaching Hospital	Yes	186	71.5
	No	59	22.7
	No response	15	5.8
If COVID-19 is readily available in your community	Yes	119	45.8
	No	118	45.4
	No response	23	8.8
If you paid any amount to receive the COVID-19 vaccine	Yes	5	1.9
	No	148	56.9
	No response	107	41.2
If you think you are at high risk of becoming infected with COVID-19	Yes	141	54.2
	No	94	36.2
	No response	25	9.6
Reasons for the low uptake of the COVID-19 vaccine	Not having enough credible information on the vaccines	174	66.9
	Clinical trials of the COVID-19 vaccines are inadequate	127	48.8
	Clinical sequelae of adverse effects may result	138	53.1
	New virus strains are emerging	104	40.0
	Having medical conditions and getting the COVID-19 vaccine can worsen the medical co-morbidity	83	31.9
	The COVID-19 vaccines are not safe	102	39.2
	Getting approval of family, friends, religious leaders, etc. before taking the COVID-19 Vaccine	74	28.5
	Availability of other forms of treatment for COVID-19	58	22.3
	Being pregnant (pregnancy)	72	27.7
	People have reservations about healthcare institutions, pharmaceutical companies, and the government not taking the COVID-19 vaccines seriously.	131	50.4
	More publicity, advocacy, and education at the grassroots	88	33.8

Suggested measures for improving the practice of COVID-19 vaccination	Adequate clinical trial with proven no adverse effect above the benefit	8	3.1
	More studies on the effects should be carried out	5	2.0
	Make a rule mandatory to get vaccinated	3	1.2
	Government sincerity in handling health issues	4	1.6
	Making it readily available in rural areas/communities where they can take it for free without any surcharge	2	0.8
	Suspected COVID-19 cases should not be isolated until patients have been diagnosed with the condition	1	0.4
	It should not be made compulsory in an organization	1	0.4
	Ensure adequate workforce to administer the vaccine to reduce waiting time in getting the vaccine.	1	0.4

Table 5 gives more detailed insight into the perception and practice of the COVID-19 vaccines among the various HCWs with, Doctors having the highest mean perception and practice scores of 77.27 ± 24.45% and 50.18 ± 47.75% respectively; while nurses had the least mean perception and practice scores of 67.68 ± 24.27% and 24.64 ± 39.82% respectively.

Table 5: Distribution of the mean perception and practice scores for the various classes of HCWs

Healthcare Workers (HCWs)	Perception Score (Mean ± SD)	Practice Score (Mean ± SD)
Doctor	77.27 ± 24.45	50.18 ± 47.75
Nurse	67.68 ± 24.27	24.64 ± 39.82
Paramedical	72.00 ± 24.47	43.43 ± 46.90
Others	69.56 ± 20.41	30.70 ± 42.59
Total	71.11 ± 22.85	35.23 ± 44.52

Table 6 shows the association between the socio-demographics and respondents' perception of the COVID-19 vaccination. It revealed that those ≥60.0 years of age, female, those who have completed a secondary level of education, and doctors had a better perception of COVID-19 vaccination. However, these were not statistically significant.

Table 6: The Relationship between the Respondents' Socio-Demographics and Perception of the COVID-19 Vaccination

	Respondents' Perception of COVID-19 Vaccination					
		Poor Perception	**Moderate Perception**	**Good Perception**	**Chi-square (x^2)**	**p-value (≤0.05)**
Age(years)	< 20.0	1(100.0%)	0(0.0%)	0(0.0%)	10.71	0.38
	20.0 - 29.0	4(8.3%)	10(20.8%)	34(70.8%)		
	30.0 - 39.0	16(16.8%)	18(18.6%)	63(66.3%)		
	40.0 - 49.0	8(12.9%)	12(19.4%)	42(67.7%)		
	50.0 - 59.0	8(17.0%)	9(19.1%)	30(63.8%)		

	≥60.0	0(0.0%)	0(0.0%)	5(100.0%)		
Sex	Male	19(17.1%)	18(16.2%)	74(66.7%)	1.85	0.40
	Female	18(12.1%)	31(20.8%)	100(67.1%)		
Educational status	No Formal Education	0(0.0%)	1(100.0%)	0(0.0%)	6.93	0.33
	Primary	3(25.0%)	3(25.0%)	6(50.0%)		
	Secondary	7(16.3%)	6(14.0%)	30(69.8%)		
	Tertiary	27(13.2%)	39(19.1%)	138(67.6%)		
Occupation	Doctor	7(12.7%)	6(10.9%)	42(76.4%)	4.75	0.58
	Nurse	10(17.9%)	13(23.2%)	33(58.9%)		
	Paramedical	5(14.3%)	6(17.1%)	24(68.6%)		
	Others	15(13.2%)	24(21.1%)	75(65.8%)		

**Statistically significant*

Table 7 shows the relationship between the respondents' socio-demographics and practice of COVID-19 vaccination. It was observed that those ≥60.0 years of age, male, and doctors had a better practice towards COVID-19 vaccination, and these were statistically significant. Those with tertiary education had a better practice of COVID-19 vaccination, however these were not statistically significant.

Table 7: The Relationship between the Respondents' Socio-Demographics and Practice of COVID-19 Vaccination.

	Respondents' Practice of COVID-19 Vaccination				
		Poor Practice	**Good Practice**	**Chi-square (x^2)**	**p-value (≤0.05)**
Age(years)	< 20.0	1(100.0%)	0(0.0%)	22.04	0.001*
	20.0 - 29.0	21(43.8%)	27(56.3%)		
	30.0 - 39.0	72(74.2%)	25(25.8%)		
	40.0 - 49.0	39(62.9%)	23(37.1%)		
	50.0 - 59.0	39(83.0%)	8(17.0%)		
	≥60.0	2(40.0%)	3(60.0%)		
Sex	Male	64(57.7%)	47(42.3%)	7.51	0.006*
	Female	110(73.8%)	39(26.2%)		
Educational status	No Formal Education	1(100.0%)	0(0.0%)	3.40	0.33
	Primary	9(75.0%)	3(25.0%)		
	Secondary	33(76.7%)	10(23.3%)		
	Tertiary	131(64.2%)	73(35.8%)		
Occupation	Doctor	29(52.7%)	26(47.3%)	11.63	0.009*
	Nurse	45(80.4%)	11(19.6%)		
	Paramedical	20(57.1%)	15(42.9%)		
	Others	80(70.2%)	34(29.8%)		

**Statistically significant*

DISCUSSION

Socio-Demographics of the Participants.

This study surveyed 260 healthcare workers (HCWs) at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria, to assess their perceptions and practices regarding COVID-19 vaccination. Among the recruited participants, male and female made up about 42.7% and 57.3% respectively, of which their age ranged from 18-67 years with an average age of about 39.08±10.15 years. About 1/5th of the participants were doctors and nurses respectively. Similar socio-demographics were reported in similar studies in Ghana and Lagos, Nigeria where there were more female participants; and Egypt where females comprised about 58.1% of the respondents.[14-16] This study also mirrors the age distribution observed in Ghana and Egypt, where the majority of HCWs were in their 30s and early 40s.[14,16] This aligns with a working-age population actively engaged in clinical and supportive roles. Based on occupational distribution, this study includes a more diverse occupational breakdown than a similar study in Egypt, where nurses dominated with a prevalence of about 65.4%.[16]

Perception of COVID-19 vaccination among healthcare workers in NAUTH, Nnewi.

This study showed an awareness level of about 98.8% which is consistent with expectations for HCWs who are frequently exposed to public health campaigns and resources. Similarly, studies done by Mbele et al in Ghana reported an awareness level of about 85.9%.[14] Similar findings were also noted in the survey from Lagos, Nigeria.[15] Despite the high awareness recorded, perceptions of safety and efficacy were mixed. Approximately 78.1% believed the vaccine was safe, while 20% incorrectly thought it could transmit the virus. Notably, 41.2% expressed concerns about side effects, which aligns with global studies identifying vaccine safety concerns as a primary barrier.[14-16] In the Egypt study, safety concerns were prevalent, as only 32.8% of HCWs believed the vaccine was safe, and 67.8% doubted its efficacy.[16] Despite these, 66.9% of the participants demonstrated a good perception of the vaccine where 86.2% agree that getting vaccinated against COVID-19 is a good way to protect oneself, family, and other people against the disease; 76.2% believed that COVID-19 vaccination is an effective way to control and prevent COVID-19; and 78.1% felt that the COVID-19 vaccines are safe. This is higher compared to the findings from a study amongst medical students at a Nigerian University by Orok et al, which demonstrated that most of the participants (51.1%) had a positive perception of COVID-19 vaccines and that 41.6% agreed that COVID-19 vaccination is an effective way to control and prevent COVID-19, while 30.4% felt COVID-19 vaccines are safe.[17] Similarly in Ghana, it was reported that about 73.4% of HCWs had positive perceptions of the vaccine's effectiveness.[14] The Lagos study also identified safety concerns, mistrust of vaccine development, and doubts about efficacy as major barriers.[15] This is similar to that found in a survey done by Adejumo et al where it was found that slightly more than half (53.5%) of the healthcare workers had positive perceptions of the COVID-19 vaccine.[18] This therefore indicates that targeted education campaigns are needed to address these concerns, particularly among nurses and younger HCWs.

Cumulatively the respondents had an average perception score of 71.12±*22.85%*, however, it was observed that there was no statistically significant relationship between the respondents' socio-demographics (age, sex, educational status, occupation) and the respondents' perception of COVID-19 vaccination (p-value ≥ 0.05). From this study, the most perceived risks among the health workers who have not received any of the doses of the vaccines were the perceived risk and fear that clinical sequelae of adverse effects may result (53.1%); the perception that people's reservations about the COVID-19 vaccines not being taken seriously by healthcare institutions, pharmaceutical companies and the government (50.4%); the fear that clinical trial of the COVID-19 vaccines was inadequate (48.8%); and the fear that getting COVID-19 vaccine injection can worsen a pre-existing medical co-morbidity (31.9%). Similar findings were reported in a survey by Obidile et al conducted in Nigeria; in which the most common perceived risk identified was that clinical sequelae might result (54.6%), that clinical trials were inadequate and vaccine affects the immune system (13.3%).[4]

Practice of COVID-19 vaccination among healthcare workers in NAUTH, Nnewi.

This study demonstrated that only 39.6% of HCWs had received at least one dose of the COVID-19 vaccine, with doctors having the highest vaccination rate (54.5%) and nurses the lowest (26.8%). This pattern mirrors the perception scores, where doctors had the highest scores. This is in tandem with the findings from another study from Egypt where it was found that only 40.8% of HCWs accepted COVID-19 vaccination, with higher uptake among doctors (55.1%) than nurses (33.2%).[16] A similar trend was noted in the survey done in Lagos, Nigeria where only 18.0% of the participants (including HCWs) had received one dose due to barriers such as access, misinformation, and mistrust.[15] In another survey in a Nigerian Tertiary Care Centre amongst patients, it was noted that about 66.8% of the patients knew of COVID-19 vaccine availability in Nigeria, however only about 8.8% had taken the vaccine.[19]

In a survey carried out in Ghana, uptake was higher with 85.9% of HCWs vaccinated.[14] Factors like positive attitudes (73.4%) and strong cues to action (AOR =5.7) were strong predictions of vaccine uptake.[14] In another study, a 2022 cross-sectional descriptive survey carried out among medical doctors who were member staff at the Niger-Delta University Teaching Hospital (NDUTH), Nigeria contrasted with the findings from this study, in which they reported that as many as 70.6% of medical doctors in the study refused to take the vaccine when it was made available to health workers at the hospital.[20] These discrepancies highlight that vaccine uptake may depend on local determinants such as availability, trust in government, and healthcare infrastructure. Occupational disparities are consistent across studies, with doctors showing higher uptake and perceptions. Nurses' lower uptake highlights a need for targeted interventions addressing specific concerns within this group.

Within the group of Healthcare workers that have received the vaccine, 35.9% of these HCWs have received only the First Dose of the COVID-19 Vaccine, 62.1% have received the first and second doses of COVID-19, while 14.5% of the

respondents are up-to-date with the COVID-19 vaccination having received the booster dose of the Covid-19 vaccine. This is similar to a 2022 study by Njoga et al in which only 29.2% of those surveyed were vaccinated at the time of their response, and 35.7%, 61.4%, and 2.9% of respondents had received one, two, and three or more inoculations, respectively.[21] With regards to the relationship between the respondents' socio-demographics and practice of COVID-19 vaccination, it was observed that participants ≥60.0 years of age, male and doctors had better practice of the COVID-19 vaccination when compared to their counterparts respectively, which was statistically significant (p-value ≤0.05). Of the COVID-19 vaccines received by the NAUTH HCWs, the AstraZeneca-Oxford: Vaxzevria ranked the highest at 27.1%, followed at second place by the Moderna: Spikevax(7.4%), and then the Pfizer-BioNTexh: Comirnaty (3.1%).

Among the respondents that received the COVID-19 vaccine, their key reasons for receiving the vaccine were that: it was their civic responsibility to take the COVID-19 vaccine (55.3%), COVID-19 vaccine will help them achieve herd immunity (51.5%), Fear of the COVID-19 disease (48.5%), COVID-19 vaccines were free of charge (25.2%), their employer recommended/demanded that they get vaccinated (21.4%), they were confident that the pharmaceutical industries produced safe and effective COVID-19 vaccines (16.5%), and that they or their relatives got sick with COVID-19 (9.7%). Notable reasons from the respondents for not receiving any of the doses of the COVID-19 vaccines were that their immune system alone was sufficient to protect them (50.7%) against COVID-19, they want to see what happens to those vaccinated before they take the vaccine (40.1%), that the vaccines in Nigeria and Africa were substandard and unsafe (31.2%), that there are other forms of treatment for COVID-19(18.8%), and several others. Similar reasons were also reported in a similar survey carried out among medical doctors at NDUTH, Nigeria, where of the 72 participants who did not take the vaccine, the most attributed reasons for hesitation included that the vaccine had not gone through sufficient clinical trial (40.3%), the vaccine has fearful side effects (23.6%) and the vaccine was not safe (18.1%).[20] The majority (80.8%) of the respondents have no chronic illness while 9.6% of the respondents indicated to have a chronic illness such as hypertension (60.0%), Diabetes Mellitus (20.0%), and Asthma (16.0%). In the bid to get the practice of the respondents to vaccination generally, 57.7% of the respondents indicated to have willingly received other adult vaccines they are eligible for apart from the routine childhood vaccines. Some of the indicated vaccines included Tetanus vaccine (81.3%), Hepatitis B vaccine (73.3%), Yellow fever vaccine (66.0%), Meningococcal vaccine (28.7%), hepatitis A vaccine (6.0%), and Human Papilloma Virus (HPV) vaccine (5.3%) amongst several others.

Factors Associated with the Practice of COVID-19 Vaccination among Healthcare Workers in NAUTH, Nnewi

It was observed that the majority of the respondents attested that the COVID-19 vaccines were readily available at the teaching hospital (22.7%) and in the community (45.4%), and also that they did not pay to receive the vaccines. Other

motivators for COVID-19 vaccine uptake noted in this study were civic responsibility (55.3%) and fear of COVID-19 (48.5%). However surveys in Ghana and Lagos, Nigeria highlighted the importance of trusted influencers such as religious and healthcare leaders in promoting vaccine acceptance.[14,15] Findings from the study by Obidile et al showed that good knowledge of the vaccine, and proven vaccine efficacy and safety, were motivators and enablers of the COVID-19 vaccine uptake.[4] This contrasted a multi-centre prospective cohort study of essential workers by Lutrick et al, where they noted that first responders (42%) were less likely to believe in COVID-19 vaccine effectiveness (AOR = 0.58, 95% CI 0.40-0.84). [22]

Some of the noted key barriers to COVID-19 vaccine uptake were not having enough credible information on the vaccines (66.9%), the perceived risk and fear that Clinical sequelae of adverse effects may result (53.1%), Peoples' reservations about the COVID-19 vaccines not being taken seriously by healthcare institutions, pharmaceutical companies and the government (50.4%), fear that Clinical trial of the COVID-19 vaccines was inadequate (48.8%), New virus strains emerging (40.0%), and the fear that getting COVID-19 vaccine injection can worsen pre-existing medical co-morbidity(31.9%). This was also similar to a study in Nigeria by Ekwebene et al; in which the most identified perceived barrier to COVID-19 vaccine uptake was the fear of side effects, followed by those who felt that the vaccine was unsafe 262(58.9%), those who do not trust the vaccine 187(42.0%), and those who felt they were not exposed to potential Covid-19 patients 141(31.7%).[23,24] The Ghana study reported lower barriers compared to NAUTH, with positive attitudes and high trust levels, however, hesitancy still existed due to safety concerns and misinformation. The barriers reported in this study closely mirror those reported in Lagos and Egypt, particularly mistrust and safety concerns.

CONCLUSION

This study noted a good level of perception about the COVID-19 vaccination among the NAUTH healthcare workers. However, this did not translate to a better practice of vaccine uptake. The findings from this study align with trends in Egypt and Lagos, particularly regarding low uptake among nurses and significant barriers like safety concerns and mistrust. However, Ghana demonstrates the transformative impact of effective public health strategies, including leveraging positive attitudes, and trusted voices. Tailored interventions that address local barriers and disparities are essential to improving vaccine uptake in Nigeria and similar contexts.

There is therefore need for more and continued advocacy and awareness campaigns to improve people's perception and practice of the COVID-19 vaccination in NAUTH, various communities, states, and nationwide.

RECOMMENDATIONS

Based on the findings from this survey, it is recommended that there's a great need for grassroots advocacy, improved rural availability of vaccines, and addressing vaccine quality concerns. As was highlighted in the Lagos and the Ghana

studies, focus on community-based education led by trusted figures could help address safety myths, while improving vaccine access. It is also recommended that transparency in vaccine safety and efficacy and targeted campaigns to build trust among nurses.

ETHICAL APPROVAL

This research work was done with approval from the Ethics Committee of the Nnamdi Azikiwe University Teaching Hospital, Nnewi (NAUTHEC) with approval number, NAUTH/CS/66/VOL.15/VER.3/165/2022/128. The respondents were well-informed about the study and the objectives of the study. Confidentiality and anonymity of the participants were assured as their responses were only strictly used for academic/research purposes and oral consent was obtained from the respondents before the questionnaires were administered to them.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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