Predictors of COVID-19 Vaccine Hesitancy in North -Central Nigeria

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Abstract

COVID-19 vaccine hesitancy has emerged as a major challenge to global efforts to control the pandemic, particularly in Nigeria, where hesitancy to other effective vaccines such as polio and measles has been widely reported. Several individual, societal, and structural factors contribute to this behaviour and prevent the effectiveness of COVID-19 prevention efforts.

Objectives

This study sought to identify the predictors of COVID-19 vaccine hesitancy in the seven states of North-Central, Nigeria.

Methods

A population-based cross-sectional online survey was conducted among residents using a semi-structured questionnaire adapted from the WHO SAGE vaccine hesitancy scale and distributed via social media networks over 8-weeks.

Results

A total of 1,429 responses met the inclusion criteria and were analysed. Among the respondents, 60.7% were males, 47.5% were between the ages of 26 and 45, and 80.1% had postsecondary education. A total of 421 respondents (29.5%) were hesitant and unwilling to receive the vaccine. The reasons for hesitancy were concerns about side effects (37.1%), doubt about the existence of COVID-19 (11.0%), and the perception of time required to receive the vaccine (9.6%). Post-secondary education (AOR: 0.49, 0.36-0.66) and people of the Islamic faith (AOR: 0.68, 0.52-0.90) were found to be associated with lower levels of hesitancy.

Conclusion

The study found that vaccine hesitancy is a complex problem that is linked with multiple social determinants of health as lower educational attainment, lower

income and Christian faith were found to be predictors of vaccine hesitancy. Confidence, Complacency and Convenience factors were expressed by respondents as concerns about side effects, doubt about the existence of COVID-19 and time required to receive the vaccines were the most prominent reasons for unwillingness to receive the vaccine. In order to protect the public health of communities, targeted interventions are required to increase vaccine acceptance by cultivating trust in vaccines, disseminating accurate information, and engaging with community stakeholders including religious groups.

Introduction

The COVID-19 pandemic resulted globally in more than 769 million cases and 6.9 million deaths.[1] Nigeria reported 256,028 confirmed cases and 3,143 confirmed deaths due to COVID-19 disease.[2] The rapid spread of COVID-19 and associated mortality, especially among the elderly and people with comorbidities spurred efforts to develop vaccines for controlling the epidemic. Conventional vaccine development from the preclinical phase to licensing could take an average of over 10 years.[3] However, epidemics in the last decade have accelerated the development of novel platforms that have shortened the time for vaccine sequencing from years to weeks.[4] Leveraging these platforms and multisectoral collaborations, several vaccines were rapidly produced and approved for distribution to curb the scourge of the COVID-19 pandemic.

Within the first year of the COVID-19 pandemic, Janssen completed phase 3 trial of a potential COVID-19 vaccine[5], and multiple options became globally available with greater access to vaccines in the developed countries compared to other nations.[6] With availability of effective vaccines, overcoming hesitancy assumed priority. Vaccine hesitancy defined as delay in the acceptance or complete refusal of vaccines despite the availability of vaccines has been identified as one of the top 10 global public health problems.[7] It is complex phenomenon that is influenced by factors such as age, culture, socio-economic status, and trust in the healthcare system.[8,9]

The World Health Organization SAGE working group identified three barriers to vaccine uptake known as the 3C's: Confidence/lack of confidence (in vaccines and lack of trust in the system that delivers them), complacency, (when perceived risks of vaccine-preventable diseases are low or when vaccination is considered secondary to other responsibilities at a given point in time) and convenience (which denotes the extent to which physical availability, affordability, and access to information and other immunization services exist).[10] Research estimates suggest that herd immunity to COVID-19 would require more than 60% of the population to be vaccinated or infected naturally.[11]

As of June 18, 2022, only 13% of Nigerians had completed all recommended COVID-19 vaccines despite the widespread availability of the vaccines[12] This fell significantly short of the goal of vaccinating 40% of the population by December 2021. Suboptimal uptake of vaccines is not uncommon in Nigeria due to vaccine unavailability, lack of confidence in vaccines or complacency factors.[13]

This study is designed to identify the predictors of COVID-19 vaccine hesitancy in the seven states of North-Central, Nigeria.

Methods

Study Design

We utilized a descriptive cross-sectional research design. The data was collected through an online

survey between the 7th of March to the 30th of April 2022 in the six states of North Central Nigeria and the Federal Capital Territory.

Study Population

The study population sampled individual aged 18 years and above who resided in the North-Central region of Nigeria: Federal Capital Territory (FCT), Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau states. The Federal Capital Territory (FCT), ranks as the state with the second-highest number of COVID-19 infections, comprising 12.7% of the confirmed cases nationwide.[14] With a combined adult population of 18, 074, 045 representing 14.9% of Nigeria's adult population, the region is characterized by a rich diversity of cultures and socio-economic indices that are similar to most other regions of Nigeria.

Sampling Techniques

A non-probability sampling involving purposive sampling techniques was used. This involved the distribution of an online questionnaire to participants using the major social media platforms (WhatsApp, Telegram, LinkedIn, Instagram, and Facebook). The questionnaire contained instructions for respondents to further share it with others on their social media who were willing to participate in the study, thereby utilizing a snowball sampling approach to expand the survey research.

Sample Size Determination

The minimum sample size was 1,770 using StatCalc, based on the assumption of an estimated retention rate of 80%, 2.5% acceptable margin of error, design effect (Deff = 1.8), and a 95% confidence interval using the North Central regional adult population of 18, 074, 045 persons according to the National Population Commission (NPC) 2021 population estimation.

Inclusion Criteria

1. Persons older than 18 years

2. Persons living in any of the six North-Central states and FCT in Nigeria.

Exclusion Criteria

Persons meeting the inclusion criteria who do not consent or withdraw consent while completing the study.

Data Collection

Data was obtained through a population-based cross-sectional online survey conducted among residents in the seven North-Central states in Nigeria; Federal Capital Territory (FCT), Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau states. The semi-structured survey questionnaire was adopted from the WHO SAGE vaccine hesitancy scale and refined through a literature review to identify factors critical to vaccine hesitancy.[10]

The questionnaire consists of 52 questions. The questions include information on socio-demographic characteristics, knowledge of the COVID-19 vaccines that were available in Nigeria which were the Oxford/Astrazeneca vaccine and the Moderna vaccine, influences arising from personal perception of the willingness to take the COVID-19 vaccine, and factors contributing to vaccine hesitancy. The study was deployed as an online survey and distributed via social networks in all media platforms, including, but not limited to private messaging, electronic mail, social networking sites, and groups through platforms such as WhatsApp, Telegram, Facebook, Instagram, and LinkedIn. The questionnaire was administered on a survey platform; RedCap with validation checks to curtail the incidence of missing

data. Participants were directed to the entry page of the survey by clicking on a hyperlink on their mobile devices or computers and were asked to tick the agreement checkbox on the questionnaire form if they were able and willing to participate in the study. The tick served as informed consent and a click on the submit button marks the end of the survey. Each entry into the survey was assigned a unique ID consisting of the time and date stamp at which the response was submitted. No personally identifiable information was collected from the participants. Data collection was conducted for 8 weeks from the 7th of March to the 30th of April 2022. After the completion of data collection, meticulous validation and cleaning procedures were conducted to uphold the integrity and accuracy of the survey results. These procedures include identifying and excluding responses from individuals who did not meet the inclusion criteria; state of residency, and age within the designated states of the North-Central region of Nigeria.

In this study, the outcome variable, COVID-19 vaccine hesitancy, was defined based on participants' responses to: “Have you received the COVID-19 vaccine and are you willing to receive the COVID-19 vaccine if made available to you within the next six months”. Participants who responded “Yes” were categorized under the acceptance group and considered vaccine acceptance, indicating their willingness to accept, or had received at least one dose of the COVID-19 vaccine. Conversely, participants who responded “No” were classified under the vaccine hesitancy group and considered vaccine hesitancy, indicating their reluctance or hesitation to receive the COVID-19 vaccine.

Statistical Analysis

The statistical analysis approach utilized was descriptive statistics including frequencies and percentages. A chi-square test was used to examine the association of sociodemographic characteristics with attitudes toward COVID-19 vaccination. The analysis to examine the socio-demographic factors associated with vaccine hesitancy was carried out using logistic regression. The level of significance was set at $p < 0.05$, with a 95% confidence interval as a threshold for determining statistically significant findings. The analysis was performed using Stata version 15.0 and Microsoft Excel (2016), to ensure accuracy and reliability of the data interpretation.

Informed consent

The survey's entry page provided details about the study's objectives, eligibility criteria, data privacy, and researchers' disclaimers. Participants provided informed consent by ticking the "I agree" checkbox. Entries lacking this agreement were not processed for data analysis. Additionally, participants failing to meet the inclusion criteria were excluded from the analysis.

Confidentiality

No personally identifiable information about the participants was collected because all entries were anonymously registered. The privacy of the subjects' information was assured.

Risks and benefits

There were no negative impacts that affected the subjects' rights or welfare that were noted. Similarly, there were no direct benefits linked to participation in the study.

Ethical clearance

The survey was conducted after obtaining Georgetown University Institutional Review Boards (IRB).

Results

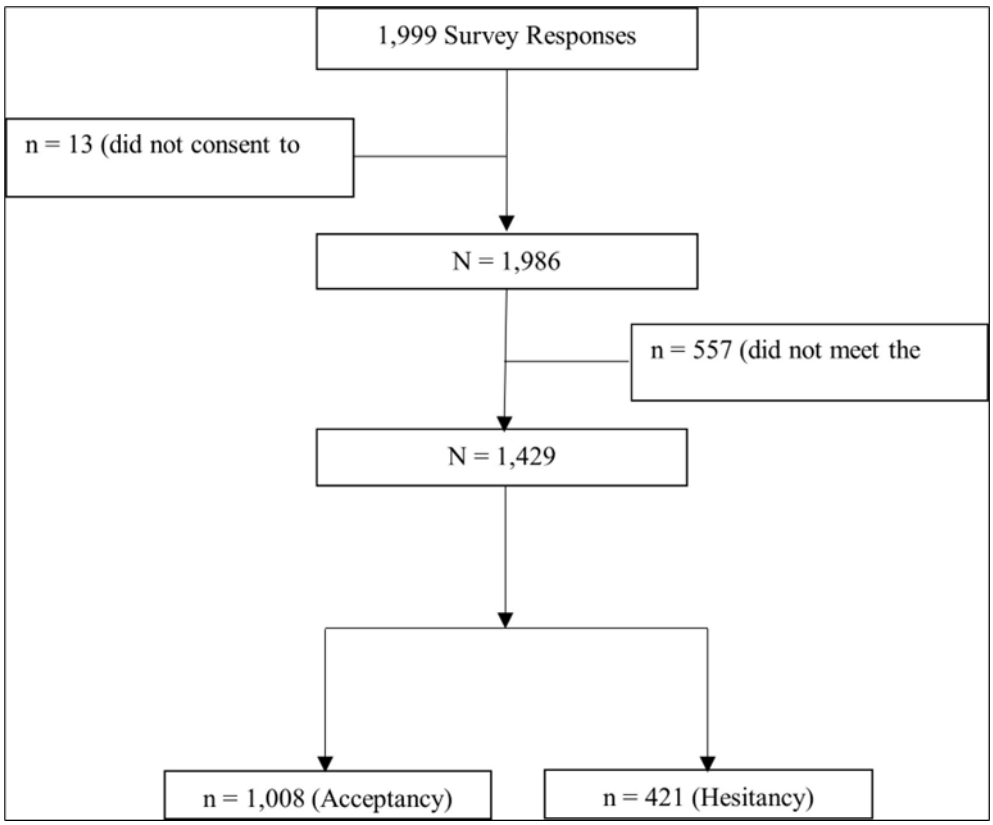

Figure 1. Flow diagram of the study sample size

The study recorded a total of 1,999 survey entries, of which 13 did not consent to participate in the survey, yielding a response rate of 99.3%. We excluded 557 responses for not meeting the inclusion criteria. Thus, the final sample size for this study was 1,429. Out of the 1,429 responses included in the study analysis, 1,008 (70.5%) were willing to accept or had received at least one dose of the COVID-19 vaccine while 421 (29.5%) were unvaccinated and hesitant as shown in Figure 1.

Demographic characteristics of the respondents

As shown in Table 1, more than a third (36.7%) of the respondents were residents of the Federal Capital Territory (FCT) while the rest resided in Benue (5.5%), Kogi (10.3%), Kwara (3.2%), Nasarawa (15.6%), Niger (16.7%), and Plateau States (12.0%). The majority of respondents were male (60.7%), 18 – 25 years old (43.3%), single (64.1%), Christian faith (57.2%), holders of post-secondary educational qualifications (80.1%), and employed (56.1%). Nearly half of the respondents (46.2%) had a monthly income between N30,000 and N150,000.

Distribution of the sample by the socio-demographic characteristics and attitudes toward COVID-19

According to Table 2, 29.5% of the participants were unwilling to receive the COVID-19 vaccine. The hesitancy was significantly associated with participants' religious beliefs, post-secondary educational status, and monthly income ($p < 0.05$). Hesitancy was higher among the "Others" religious belief (participants with traditional beliefs and non-religious affiliations), participants with no post-secondary educational status, and participants who earned less than N30,000 monthly.

Reasons for Unwillingness to Receive COVID-19 Vaccine

Table 1. Demographic characteristics of all respondents, N=1,429

Variable	N=1,429	%
State of residence		
FCT	524	36.7
Benue	79	5.5
Kogi	147	10.3
Kwara	46	3.2
Nasarawa	223	15.6
Niger	238	16.7
Plateau	172	12.0
Gender		
Female	562	39.3
Male	867	60.7
Age group (years)		
18–25	618	43.3
26–45	678	47.5
>45	133	9.3
Marital status		
Single	916	64.1
Married	404	28.3
Previously married	109	7.6
Religion		
Christianity	817	57.2
Islam	577	40.4
Others[a]	35	2.5
Post Secondary education		
No	285	19.9
Yes	1,144	80.1
Employment Status		
Unemployed	628	43.9
Employed	801	56.1
Monthly Income		
Less than #30, 000	523	36.6
#30,000 - #150,000	660	46.2
Above #150, 000	246	17.2

a. Traditional and Non-religious

Table 2. Socio-demographic characteristics and Association with Vaccine Hesitancy

Variable	Hesitancy (N = 421, % = 29.5)	Acceptance (N=1,008, % = 70.5)	Total N = 1,429	p-value
State of residence				0.12
FCT	28 (35.4%)	51 (64.6%)	79	
Benue	149 (28.4%)	375 (71.6%)	524	
Kogi	53 (36.1%)	94 (63.9%)	147	
Kwara	11 (23.9%)	35 (76.1%)	46	
Nasarawa	52 (23.3%)	171 (76.7%)	223	
Niger	75 (31.5%)	163 (68.5%)	238	
Plateau	53 (30.8%)	119 (69.2%)	172	
Gender				0.52
Female	171 (30.4%)	391 (69.6%)	562	
Male	250 (28.8%)	617 (71.2%)	867	
Age group (years)				0.31
18 – 25	195 (31.6%)	423 (68.4%)	618	
26 – 45	190 (28.0%)	488 (72.0%)	678	
Above 45	36 (27.1%)	97 (72.9%)	133	
Marital status				0.25
Single	274 (29.9%)	642 (70.1%)	916	
Married	109 (27.0%)	295 (73.0%)	404	
Previously married	38 (34.9%)	71 (65.1%)	109	
Religion				0.00*
Christianity	258 (31.6%)	559 (68.4%)	817	
Islam	147 (25.5%)	430 (74.5%)	577	
Others[a]	16 (45.7%)	19 (54.3%)	35	
Post Secondary Education				0.00*
No	124 (43.5%)	161 (54.5%)	285	
Yes	297 (26.0%)	847 (74.0%)	1, 144	
Employment status				0.91
Unemployed	184 (29.3%)	444 (70.7%)	628	
Employed	237 (29.6%)	564 (70.4%)	801	
Monthly Income				0.00*
Less than #30, 000	185 (35.4%)	338 (64.6%)	523	
#30,000 - #150,000	177 (26.8%)	483 (73.2%)	660	
Above #150, 000	59 (24.0%)	187 (76.0%)	246	

*p < 0.05

a. Traditional and Non-religious

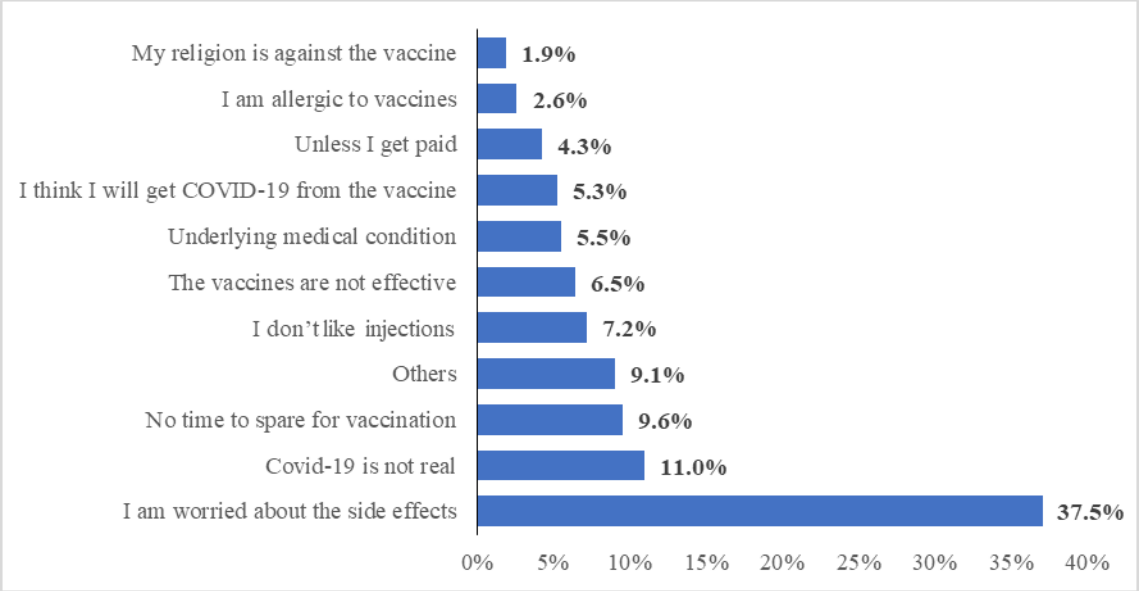

Figure 2. Reasons among the COVID-19 Vaccine Hesitant Participants

Concerns about side effects were the most common reasons for vaccine hesitancy (37.1%). Others expressed reasons such as doubt about the existence of COVID-19 (11.0%), the perception of time required to receive the vaccine (9.6%), dislike or fear of needles (7.2%) and possible complications caused by underlying medical conditions (5.5%). A few believed that the vaccines were not effective (6.5%) (Fig. 2)

Sociodemographic Predictors of COVID-19 Vaccine Hesitancy

According to Table 3, 29.5% of the participants were unwilling to be vaccinated now and when the vaccine becomes available. Religious belief and post-secondary educational attainment were found to be significantly associated with COVID-19 vaccination attitudes. Higher hesitancy rates were observed among Christians and religious beliefs classified as "others" compared to those of Islamic religious beliefs ($p < 0.05$). Respondents of Islamic faith were 32% less likely to be hesitant (OR 0.68, CI: 0.52-0.90) compared to respondents of Christian beliefs. Respondents with post-secondary education were found to be 51% less likely to be hesitant in comparison with those without post-secondary education (OR 0.49, CI: 0.36-0.66).

Source of Information about the COVID-19 vaccine

Table 3. Sociodemographic Predictors of COVID-19 Vaccine Hesitancy

Variable	Hesitant (n = 421, % = 29.5	Acceptance (n = 1008, % = 70.5	Total (N = 1,429)	Crude OR (95% CI)	P Value	Adjusted OR (95% CI)	P value
State of Residence							
FCT	149 (28.4)	375 (71.6)	524	Ref		Ref	
Benue	28 (35.4)	51 (64.6)	79	1.38 (0.84-2.27)	0.20	1.19 (0.71-2.00)	0.52
Kogi	53 (36.1)	94 (63.9)	147	1.42 (0.96-2.09)	0.08	1.21 (0.81-1.81)	0.35

Kwara	11 (23.9)	35 (76.1)	46	0.79 (0.39-1.60)	0.51	0.77 (0.38-1.59)	0.48
Nasarawa	52 (23.3)	171 (76.7)	223	0.77 (0.53-1.10)	0.15	0.68 (0.46-1.00)	0.05
Niger	75 (31.5)	163 (68.5)	238	1.16 (0.83-1.62)	0.39	1.09 (0.76-1.55)	0.64
Plateau	53 (30.8)	119 (69.2)	172	1.12 (0.77-1.63)	0.55	1.07 (0.73-1.57)	0.74
Gender							
Female	171 (30.4)	391 (69.6)	562	Ref		Ref	
Male	250 (28.8)	617 (71.2)	867	0.93 (0.73-1.17)	0.52	1.00 (0.78-1.28)	0.98
Age group (Years)							
18-25	195 (31.6)	423 (68.5)	618	Ref		Ref	
26-45	190 (28.0)	488 (72.0)	678	0.84 (0.67-1.07)	0.17	0.92 (0.69-1.22)	0.58
>45	36 (27.1)	97 (72.9)	133	0.81(0.53-1.22)	0.31	0.84 (0.49-1.47)	0.55
Marital Status							
Single	274 (29.9)	642 (70.1)	916	Ref		Ref	
Married	109 (27.0)	295 (73.0)	404	0.87 (0.67-1.12)	0.28	0.99 (0.72-1.36)	0.94
Previously married	38 (34.9)	71 (65.1)	109	1.25 (0.83-1.91)	0.29	1.42 (0.84-2.40)	0.20
Religion							
Christianity	258 (31.6)	559 (68.4)	817	Ref		Ref	
Islam	147 (25.5)	430 (74.5)	577	0.74 (0.58-0.94)	0.01	0.68 (0.52-0.90)	0.01*
Others	16 (45.7)	19 (54.3)	35	1.82 (0.92-3.61)	0.08	1.65 (0.81-3.33)	0.17
Post-Secondary Education							
No	124 (43.5)	161 (56.5)	285	Ref		Ref	
Yes	297 (26.0)	847 (74.0)	1,144	0.46 (0.35-0.60)	0.00	0.49 (0.36-0.66)	0.00*
Employment Status							
Unemployed	184 (29.3%)	444 (70.7%)	628	Ref		Ref	
Employed	237 (29.6%)	564 (70.4%)	801	1.01 (0.81-1.28)	0.91	1.00 (0.79-1.26)	0.99
Monthly Income							
Less than #30, 000	185 (35.4)	338 (64.6)	523	Ref		Ref	
#30,000 - #150,000	177 (26.8)	483 (73.2)	660	0.67 (0.52-0.86)	0.00	0.77 (0.59-1.01)	0.06
Above #150, 000	59 (24.0)	187 (76.0)	246	0.58 (0.41-0.81)	0.00	0.66 (0.44-0.99)	0.05

*p < 0.05

a. Traditional and Non-religious

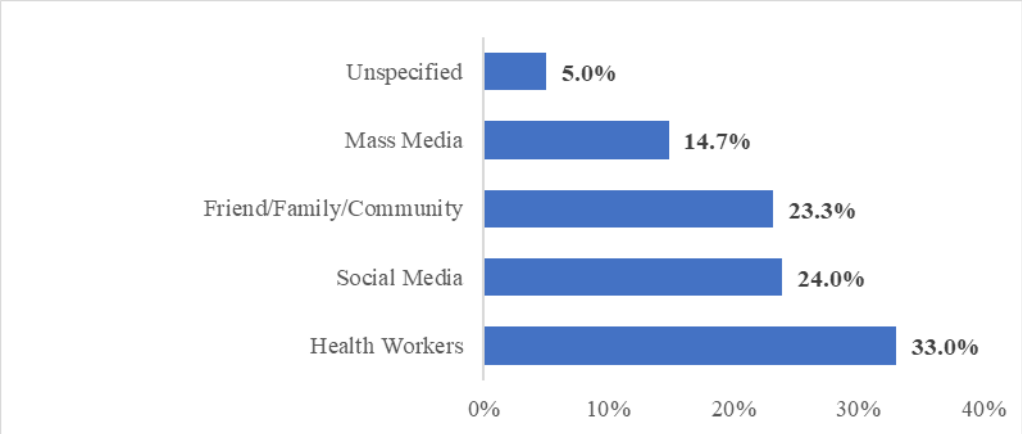

Figure 3. The most trusted source of information about the COVID-19 vaccine and Vaccination

As shown in Figure 3 below, healthcare providers were the predominant source of trusted information about the COVID-19 vaccine in 33.0% of the respondents. Others include social media (24%), friends, family, and/ or community members (23.3%) and the mass media (14.7%).

Perceptions about the COVID-19 Vaccine among Hesitant Respondents

The majority of respondents reported support for vaccination from community and religious leaders (85.5%). However, 68.8% of them expressed unwillingness to follow the advice of leaders.

The majority lacked trust in the government's ability to procure the highest quality vaccine (71.5%), 66.3% perceived the COVID-19 vaccine as unsafe while 62% perceived it as non-essential for

Table 4. Perceptions about the COVID-19 Vaccine among Hesitant Respondents

Factors	**No**	**Yes**
Leaders, gatekeepers, and pro-vaccination		
Do religious leaders in your community support taking the COVID-19 vaccine?	61 (14.5%)	360 (85.5%)
Do politicians, teachers, and health workers in your community support vaccination?	29 (6.9%)	392 (93.1%)
Do you follow the advice of your religious/cultural leaders about the COVID-19 vaccination?	289 (68.6%)	132 (31.4%)
Does your religion/culture recommend against the COVID-19 vaccination?	355 (84.3%)	66 (15.7%)
Political influences		
Do you trust that your government is deciding in your best interest concerning the COVID-19 vaccine	265 (62.9%)	156 (37.1%)
Are you convinced that your government purchases the highest quality of the COVID-19 vaccine	301 (71.5%)	120 (28.5%)

Do you trust that the government is making the best efforts to store the vaccines in the right conditions?	288 (68.4%)	133 (31.6%)
Geographical barriers		
Does distance limit you from getting the vaccine?	264 (62.7%)	157 (37.3%)
Does clinic time or waiting at the clinic prevent you from getting the COVID-19 vaccine?	239 (56.8%)	182 (43.2%)
Pharmaceutical industry		
Do you think governments are pushed by the pharmaceutical industries to recommend vaccines?	106 (25.2%)	315 (74.8%)
Do you trust the pharmaceutical companies that produce the COVID-19 vaccine?	303 (72.0%)	118 (28.0%)
The Vaccines/Vaccination issues		
Do you think the vaccine is safe	279 (66.3%)	142 (33.7%)
The COVID-19 vaccine is essential for us	261 (62.0%)	160 (38.0%)
Do you trust the healthcare workers to safely administer the vaccine to you?	221 (52.5%)	200 (47.5%)
Is the vaccination process convenient, i.e., is it easier for you to get vaccinated	262 (62.2%)	159 (37.8%)
Do you think that if everyone in society maintains preventive measures (face masks, social distancing, etc.), COVID-19 can be eradicated without vaccination?	136 (32.3%)	285 (67.7%)

preventing the COVID-19 virus. More than 40% expressed a lack of trust in health workers to safely deliver the vaccine (47.5%) and unfavourable clinic waiting time for vaccination as factors that discourage them from taking the COVID-19 vaccine. (43.2%), (Table 4).

Discussion

The COVID-19 pandemic resulted in significant disruption in the health and livelihoods globally. Despite the evidence that vaccines offer viable protection against the disease, achieving universal acceptance remains an uphill task. Nigeria has reported challenges with the uptake of several vaccines in different parts of the country including vaccines that were aimed at the prevention of infant mortality[10,11,17,18]. In this study, 29.5% of the respondents in the North-Central region were unwilling to receive the COVID-19 vaccine. A similar study in South West Nigeria reported a vaccine hesitancy rate of 25.5%,[15] and an African survey of 34 countries reported a hesitancy rate of 37% among the general population.[16]

On a global level, vaccine hesitancy rates above 50% have been reported in China, Malaysia, Australia, Pakistan and Italy.[8,17–19] Some sociodemographic factors such as education, religion and income were found to be significantly associated with vaccine hesitancy in our study. this shows that the lack of post-secondary education was associated with a 51% higher risk of hesitancy. Our findings are consistent with other studies that have established the value of education in influencing health-seeking behaviours.[20] Reliable sources of such information such as educational and health institutions are important in shaping knowledge and attitudes that increase uptake of vaccines, and other health-seeking activities such as social distancing, usage of masks and other proven health interventions that prevent the spread of the COVID-19 virus. Half of the hesitant respondents indicated reliance on social media and friends or family as their trusted sources of information about the COVID-19 vaccine. These sources are often prone to information biases, particularly during a period of massive anti-vaccine

campaigns and misinformation. The study also found that higher household income above the national minimum wage with respondents that earning significantly above the minimum demonstrating a 42% reduction in risk. This is consistent with the likelihood of attainment of post-secondary education among higher-earning respondents.

Respondents of the Islamic faith had a 32% lower risk of hesitancy compared to the Christians. The impact of faith on health and social behaviours is very profound in Nigeria. Many adopt mannerisms or practices that conform to the teachings of religious leaders or community leaders. The notable anti-vaccine messaging that emanated from some prominent Christian leaders at the beginning of the pandemic may have contributed to vaccine hesitancy among some members of the faith.[21] The majority of religious and community leaders supported COVID-19 vaccination efforts but over two-thirds of hesitant persons were unswayed by the support of their religious or community leaders to accept the vaccine.

Our study identified a combination of confidence, convenience, and complacency factors as influencers of vaccine hesitancy. Nearly half of the vaccine-hesitant respondents cited a lack of confidence in the safety and side effect profile of the vaccines as the reasons for their unwillingness to be vaccinated. Other studies have documented similar findings.[22–24] More than two-thirds of respondents expressed a lack of trust in both the government of Nigeria and pharmaceutical companies to deliver the vaccine with the sole purpose of improving quality of life. Similar attitudes to vaccines have been demonstrated with the polio vaccination drive where citizens in Northern Nigeria perceived the vaccines to contain compounds with sterilization properties that will prevent childbearing.[13] The unprecedented speed in the development of COVID-19 vaccines and perceived inequalities in vaccine distribution contributed in fuelling vaccine hesitancy. The Oxford/AstraZeneca vaccine that was initially delivered to Nigeria through COVID-19 Vaccines Global Access (COVAX) initiative was perceived as inferior to the Moderna and Pfizer vaccines that were available in the high income countries. These findings are consistent with the findings of Lar son et al.[23] that a lack of trust in the healthcare system, government, and economic systems has a profound effect on vaccine acceptance. Nomhwange, et al., (2022) similarly reported that the COVID-19 vaccine hesitancy was attributed to uncertainties about the safety of the vaccine, and the negative information that was circulated about COVID-19 vaccines on social media[26].

Complacency factors were demonstrated by those who expressed that the COVID infection was not real, the vaccine was not required and those who felt the use of universal precautions and personal protective equipment were adequate to address the epidemic. This may be potentiated by the high risk of misinformation among hesitant respondents as more than 50% of them relied on sources that are prone to biases such as social media, friends, and others for information about the vaccine. Examples of pervasive misinformation about the COVID-19 vaccine include rumours of the vaccine as a means of inoculating tracking chips into humans, the COVID-19 epidemic is a punishment from God, the illness is an effect of 5G technology deployment, while some believed it was just the regular flu.[25]

Convenience factors were expressed by more than a third of the respondents who indicated that distance from homes to vaccination centres, the perceived waiting time required to complete the vaccination, and the process of vaccination were unfavourable for them. These factors are likely associated with the cost of transportation or the opportunity costs of vaccination over other activities of priority such as work.

This study provides a perspective on the COVID-19 vaccine hesitancy in a large region of Nigeria.

Though similar studies have been conducted in other states or regions of the country, this adds to the body of knowledge about the magnitude of vaccine hesitancy and the factors that drive them in a large region of Northern Nigeria. We acknowledge some limitations of the study which may have affected the generalizability of its findings. This includes online survey methodology with possible selection and response biases. Participants were those with access to internet, computers or smartphones. In addition, the inferences from this study relate to the COVID-19 vaccine and may not apply to vaccines for other diseases.

Conclusion

This study's findings reaffirm vaccine hesitancy as a threat to COVID-19 prevention efforts in the North Central region of Nigeria. It enhances our understanding of the predictors of vaccine hesitancy and the reasons why people refuse to be vaccinated with the COVID-19 vaccine. The study found that vaccine hesitancy is a complex problem that is linked with multiple social determinants of health as lower educational attainment and Christian faith were found to be predictors of vaccine hesitancy. Confidence, Complacency and Convenience factors were expressed by respondents as concerns about side effects, doubt about the existence of COVID-19 and the time required to receive the vaccines were the most prominent reasons for unwillingness to receive the vaccine. The study highlights the importance of leveraging trusted sources of information, such as healthcare workers and social media, to disseminate accurate and timely information about COVID-19 and the vaccine. To protect the public health of communities, targeted interventions are required to increase vaccine acceptance by cultivating trust in vaccines, disseminating accurate information, and engaging with community stakeholders including religious groups.

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