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Research Article

Prevalence and Predictors of COVID-19 Vaccine Hesitancy among Health Care Workers in Tertiary Health Care Institutions in a Developing Country: A Cross-Sectional Analytical Study

Chinedu Anthony Iwu,[1] **Pius Ositadinma**,[2] **Victor Chibiko**,[3] **Ugochukwu Madubueze**,[4] **Kenechi Uwakwe**,[5] **and Uche Oluoha**[5]

[1]*Community Medicine Department, Imo State University, Imo State University Teaching Hospital, Owerri, Nigeria*
[2]*Community Medicine Department, Rivers State University, Port Harcourt, Nigeria*
[3]*Community Medicine Department, Imo State University Teaching Hospital, Orlu, Nigeria*
[4]*Community Medicine Department, Alex-Ekwueme Federal University Teaching Hospital, Abakaliki, Nigeria*
[5]*Community Medicine Department, Imo State University, Owerri, Nigeria*

Correspondence should be addressed to Chinedu Anthony Iwu; iwuchinedu@yahoo.com

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Background. The coronavirus disease 2019 (COVID-19) pandemic highlighted the challenges and impact of vaccine hesitancy and the role of health care institutions in mounting an effective pandemic response. The study objective was to determine the prevalence and predictors of COVID-19 vaccine hesitancy among health care workers in tertiary health care institutions in Nigeria. *Methods*. A cross-sectional analytical design that used convenience and snowballing techniques to enroll 347 health care workers from tertiary health care institutions in Imo State, Nigeria, from September 28 to October 14, 2021. Data was collected using a structured online questionnaire and bivariate and multivariate analyses were done using SPSS at a level of significance set at $p \leq 0.05$. *Result*. The prevalence of vaccine hesitancy was 35.4%. HCWs of the Pentecostal faith (aOR: 2.52) and males (aOR: 2.72) were significantly more likely to be COVID-19 vaccine hesitant. About 30% of the respondents reported that they trusted information from the Internet and social media relating to COVID-19 and its vaccine. However, respondents who felt there was enough information about the vaccine and its safety were more than two and a half times more likely to be vaccine-hesitant (aOR: 2.77). About 20% and 31% of the respondents, respectively, stated that the government has an ulterior motive and that they did not trust the vaccine manufacturers. However, respondents who do not trust the government were more than two and a half times more likely to be COVID-19 vaccine hesitant (aOR: 2.69). *Conclusion*. The issues of vaccine hesitancy among health care workers in a developing country appear to be fundamental and very challenging to resolve. Therefore, the approach of instituting government vaccine uptake mandates for health care workers may be the solution for tackling vaccine hesitancy in health care institutions.

1. Introduction

The advent of vaccination has been one of the most significant historical public health achievements that have resulted in the reduction of vaccine-preventable infectious disease burden globally. Despite the successes achieved by vaccines in its prevention of childhood diseases, there is a growing reluctance and refusal in the uptake of vaccines that appear to be contributing to the less than optimal coverage of maternal and childhood vaccinations especially in developing countries [1]. This general reluctance and refusal of vaccine uptake appear to have magnified, with the introduction of COVID-19 vaccines, and the most worrying is that this behaviour is being observed among health care workers (HCWs) in the face of a pandemic that does not seem to be showing any progress towards elimination [2, 3].

This reluctance and refusal of vaccine uptake can be simply described as vaccine hesitancy and according to the WHO Sage working group, it is the "delay in acceptance or refusal of vaccination despite the availability of vaccination services" [4]. Understanding vaccine hesitancy is not simple, as it is caused by complex and context-specific factors which vary across time, place, and vaccines, with issues of complacency, convenience, confidence, and sociodemographic and cultural factors affecting its outcome [5–7].

The key factors influencing people's decision to accept, delay, or reject vaccinations were developed into a matrix of determinants by the WHO SAGE working group comprising contextual, individual and group, and vaccine-specific categories forming the basis for assessing vaccine hesitancy [4, 5]. Variability in the perception of vaccination safety and effectiveness across regions has been reported as an important issue for vaccine hesitancy [8]. However, it becomes a bit more complicated with respect to COVID-19 vaccines and within the African context especially in developing countries like Nigeria, where some still deny the existence of COVID-19 despite the morbidity and mortality that have been linked to it; some others believe it is a ploy for corruption within the government while some also believe that they have a natural immunity to the virus [9, 10]. All these are occurring in an environment plagued by structural factors such as health inequalities, socioeconomic disadvantages, and barriers to health care access. In many parts of Nigeria, there is anecdotal evidence that COVID-19 protocols are either minimally observed or nonexistent despite the relatively low vaccination coverage and associated morbidity and mortality. This observed behaviour of flaunting the protocols amid a ravaging pandemic highlights the different perceptions people have, which range from the nonexistence of COVID-19 to the existence of natural immunity. We cannot overemphasize the influence of religion and social media in the varying perceptions; nevertheless, these misconceptions pose a significant threat to the effectiveness of the pandemic response [10].

HCWs, irrespective of their environment, appear to have a significant proportion at varying levels who are COVID-19 vaccine-hesitant [11–13]. They can act both as barriers and promoters of COVID-19 vaccine uptake, and depending on their area and level of influence, they can have a significant impact on the local pandemic response. A strong association has been reported between vaccination of HCWs in each health region and the population coverage, suggesting that they could be central to a successful pandemic response [13]. Apart from patient care being provided by the HCWs at the tertiary level, training of future HCWs is an integral part of their services.

Therefore, it becomes critical that HCWs especially at the tertiary level of care have no doubts about the safety, effectiveness, and usefulness of the vaccines. Furthermore, in addition to the fact that HCWs are likely role models for vaccine uptake or refusal, they have a higher risk of exposure to COVID-19 infections in the health care environment and can be a source of further spread of infection. Therefore, this study aims to assess the prevalence and predictors of COVID-19 vaccine hesitancy among health care workers in tertiary health care institutions in Nigeria.

2. Methods

2.1. Study Area. The study was carried out in Imo State, which is located in the South-Eastern part of Nigeria within longitude 5°29′06″N and latitude 7°02′06″E occupying an area between the lower River Niger and the upper and middle Imo River [14]. It occupies an area of 5289 square kilometres with a total population of 3.93 million (2.03 million males and 1.9 million females) according to the 2006 census with an annual growth rate of 3.2% [15]. The State is delineated into three senatorial geopolitical zones: Owerri, Orlu, and Okigwe, each comprising 9, 12, and 6 local government areas, respectively, with varying levels of social development and cultural and traditional beliefs. There are two tertiary health care institutions in the state: Imo State University Teaching Hospital and Federal Medical Centre in Orlu and Owerri zones, respectively. Health care services are predominantly out of pocket; however, immunization services are free.

2.2. Study Population/Study Design/Selection Criteria. The study population comprised of health care workers in tertiary health care institutions in Imo State. The study design was a cross-sectional analytical survey. The inclusion criteria included all health care workers and there were no exclusion criteria.

2.3. Sample Size Estimation. The minimum sample size was calculated using the Cochrane formula [16], where n = minimum sample size, Z = standard normal deviate corresponding to 5% significant level, $p = 0.72$ (proportion of health care workers who are COVID-19 vaccine hesitant as reported in a previous related study) [17], and d = tolerable error of margin set at 0.05. Therefore, $Z = 1.96$, $p = 0.72$, $q = 0.28$, and the minimum sample size (n) was calculated as 310. However, the sample size used for the survey was 347 to take into account any incomplete and nonresponse data.

2.4. Sampling Technique. The two tertiary health care institutions in the state were purposively selected: Imo State University Teaching Hospital and Federal Medical Centre. Using convenience and snowballing sampling techniques, health care workers when identified were enrolled into the study after informed consent. Subsequently, they were sent the questionnaire link to their WhatsApp platform or e-mail address.

2.5. Data Collection and Analysis. Data was collected using a structured, self-administered online questionnaire from September 28 to October 14, 2021. The questionnaire was adapted by the researchers using the matrix of determinants developed by the WHO SAGE working group comprising contextual, individual and group, and vaccine-specific

categories. See the questionnaire in the Supplementary Material (available here) file. The questionnaire was pretested among a small diverse group of health care workers outside the sampling area, and the content validity was qualitatively established by assessing each question against the intended construct. The data output from the online questionnaire (Survey Heart) was saved in Excel format. The data was validated and exported to the software Statistical Package for Social Sciences (IBM-SPSS) version 22 and was analysed. Descriptive statistics (frequency tables and summary indices) were generated. Bivariate and multivariate analyses were done, and the level of significance was set at $p \leq 0.05$ with a 95% confidence interval.

2.6. Ethical Consideration. Ethical approval (IMSUTH/CS/EA/122) was obtained from the Ethics Committee of Imo State University Teaching Hospital, Orlu. Verbal consents as approved by the ethics committee were given by the participants. All authors hereby declare that the study was performed in accordance with international ethical standards.

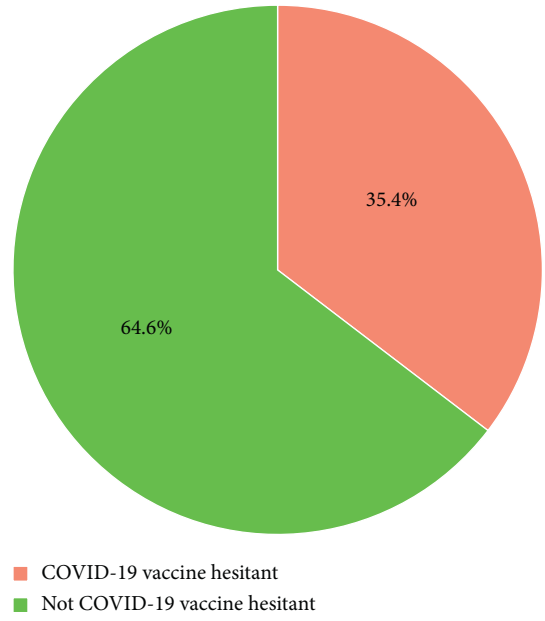

Figure 1: Prevalence of COVID-19 vaccine hesitancy among HCWs in Imo State, Nigeria.

3. Results

Three hundred and forty-seven participants received the online version of the questionnaire and all returned a correctly and filled form with a response rate of 100%.

Figure 1 shows that the prevalence of COVID-19 vaccine hesitancy among health care workers in Imo State Tertiary Health Care Institutions was 35.4%.

Table 1 shows the religious denomination and work category of health care workers that appeared to be significantly associated with COVID-19 vaccine hesitancy ($p \leq 0.05$). However, even though within the categories of age, gender, marital status, and educational levels, it was observed that those health care workers within the 20–29 years age group, males, married, and having a diploma as the highest level of education had the major proportion of vaccine-hesitant HCWs within their respective categories; these observations were not significant ($p > 0.05$).

Table 2 shows health care workers' intention to encourage hospital patients, stop family and relatives, and discourage friends and neighbours from taking the vaccine and encourage government mandate appeared to be significantly associated with vaccine hesitancy ($p \leq 0.05$).

Figure 2 shows that close to one-third of the health care workers (32%) despite their belief that COVID-19 is real were vaccine hesitant.

Table 3 shows health care workers' perception of their confidence in the government to provide the right vaccines, the manufacturer to develop safe and effective vaccines, and the information communicated through the Internet/social media appeared to be significantly associated with vaccine hesitancy. Similarly, their perception of their experience of a past event that could reduce confidence in the vaccine also appeared to be significantly associated with vaccine hesitancy ($p \leq 0.05$).

Table 4 shows that issues of individual perceptions regarding vaccine uptake among health care workers appeared to be significantly associated with vaccine hesitancy ($p \leq 0.05$). Such issues include their attitude towards vaccination when friends have taken the vaccine or hearing that someone had an alleged reaction or the likelihood of self-reacting, as well as the feeling that there are better treatments instead of vaccines or the adequacy of the information regarding vaccine and its safety, or that the Government has an ulterior motive in encouraging vaccine uptake.

Table 5 shows that the perception of vaccine-specific issues such as vaccine type, dosing, safety, length of testing, cost, and country of origin among health care workers appeared not to be significantly associated with vaccine hesitancy ($p > 0.05$).

Table 6 shows that HCWs were significantly more likely to be COVID-19 vaccine hesitant when they were of the Pentecostal faith compared to those of the Catholic faith (OR: 2.519; 1.113–5.701, $p = 0.027$); have experienced a past event compared to those who have not (2.563; 1.161–5.658, $p = 0.020$); have heard of someone with an alleged reaction compared to those who have not (3.901; 1.256–12.113, $p = 0.019$); have felt there is enough information about the vaccine and its safety compared to those who have not (2.769; 1.033–7.419, $p \leq 0.05$); or have felt worried that the vaccine will give them a reaction compared to those who have not (4.493; 1.578–12.795, $p = 0.005$).

However, HCWs were significantly less likely to be COVID-19 vaccine hesitant when they were female (OR: 0.368; 0.151–0.899, $p = 0.028$); were those who would encourage patients to take vaccine compared to those who would not (0.181; 0.041–0.795, $p = 0.024$); were those who trust the government to provide the right vaccines compared to those who do not (0.372; 0.156–0.888, $p = 0.026$); or were

Table 1: Sociodemographic characteristics and vaccine hesitancy among HCWs in Imo State, Nigeria.

Variable	Hesitant (%)	Nonhesitant (%)	Total (%)	χ^2	Df	p-value
Age (yrs)						
20–29	77 (38.9)	121 (61.1)	198 (100)			
30–39	27 (29.3)	65 (70.7)	92 (100)			
40–49	16 (34.0)	31 (66.0)	47 (100)	2.691	3	0.442
50 and above	3 (30.0)	7 (70.0)	10 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Gender						
Male	58 (36.5)	101 (63.5)	159 (100)			
Female	65 (34.6)	123 (65.4)	188 (100)	0.136	1	0.712
Total	123 (35.4)	224 (64.6)	347 (100)			
Marital status						
Married	58 (36.3)	102 (63.7)	160 (100)			
Single	65 (34.8)	122 (65.2)	187 (100)	0.084	1	0.772
Total	123(35.4)	224 (64.6)	347 (100)			
Religion						
Catholic	49 (29.3)	118 (70.7)	167 (100)			
Anglican	17 (26.6)	47 (73.4)	64 (100)			
Pentecostal	54 (50.5)	53 (49.5)	107 (100)	15.496	3	0.001*
Other religion	3 (33.3)	6 (66.7)	9 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
HCW						
Doctor	36 (26.3)	101 (73.7)	137 (100)			
Nurse/midwife	21 (36.8)	36 (63.2)	57 (100)			
Pharmacists	3 (25.0)	9 (75.0)	12 (100)	10.916	4	0.028*
Lab scientist	10 (45.5)	12 (54.5)	22 (100)			
Others	53 (44.5)	66 (55.5)	119 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Educational level						
Diploma	16 (53.3)	14 (46.7)	30 (100)			
First degree	83 (33.7)	163 (66.3)	246 (100)	4.592	2	0.101
Postgraduate	24 (33.8)	47 (66.2)	71 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Mode of usual transport to work						
Private transport	35 (32.4)	73 (67.6)	108 (100)			
Public transport	88 (36.8)	151 (63.2)	239 (100)	0.633	1	0.426
Total	123 (35.4)	224 (64.6)	347 (100)			
Type of residence						
Self-owned house	12 (33.3)	24 (66.7)	36 (100)			
Self-rented house	83 (33.7)	163 (66.3)	246 (100)	2.037	2	0.361
Family house	28 (43.1)	37 (56.9)	65 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			

*Statistical significance $p \leq 0.05$.

those that feel they would receive the vaccine if their friends have all been vaccinated compared to those who do not (0.237; 0.096–0.588, $p = 0.002$).

4. Discussion

This study determined the prevalence and predictors of COVID-19 vaccine hesitancy among health care workers in tertiary health care institutions in Imo State, Nigeria.

The prevalence of COVID-19 vaccine hesitancy was 35.4% among health care workers, and this was similar to a study done in India [18] but lower than the study done in Ethiopia [19] among HCWs between May and June 2021 reporting a vaccine hesitancy of 45.9%. The prevalence observed in our study remains quite worrying because the data was collected between September and October 2021 when vaccines and a significant amount of evidence-based data encouraging vaccination were available. Nevertheless, it appears that the available evidence-based information did not significantly influence vaccine uptake among the HCWs in these tertiary institutions where research and training are central to their services. Probably, other factors were playing a more significant role in vaccine uptake decisions. According to Browne et al. [7], using evidence-based reasoning as a strategy for encouraging vaccine uptake is inconsistent with one of the key facts of cognitive psychology where humans are said to be biased information processors who often engage in motivated reasoning; and therefore, their willingness to engage with scientific evidence is primarily based on their cultural and psychological orientation.

Internet and social media, known to influence culture and behaviour [20], appeared to be a significant factor in the

Table 2: Vaccine uptake intention to practice and vaccine hesitancy among HCWs in Imo State, Nigeria.

Variable	Hesitant (%)	Nonhesitant (%)	Total (%)	χ^2	Df	p-value
Would you encourage hospital patients to take the vaccine?						
Yes	63 (22.8)	213 (77.2)	276 (100)			
No	27 (87.1)	4 (12.9)	31 (100)	94.056	2	<0.001*
I do not know	33 (82.5)	7 (17.5)	40 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Would you stop your family/relatives from taking the vaccine?						
Yes	34 (73.9)	12 (26.1)	46 (100)			
No	69 (25.1)	206 (74.9)	275 (100)	62.181	2	<0.001*
I do not know	20 (76.9)	6 (23.1)	26 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Would you discourage friends/neighbours from taking vaccines?						
Yes	30 (76.9)	9 (23.1)	39 (100)			
No	79 (27.5)	208 (72.5)	287 (100)	46.134	2	<0.001*
I do not know	14 (66.7)	7 (33.3)	21 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Would you encourage the government to mandate its workers to take the vaccine?						
Yes	16 (14,2)	97 (85.8)	113 (100)			
No	107 (45.7)	127 (54.3)	234 (100)	33.185	1	<0.001*
Total	123 (35.4)	224 (64.6)	347 (100)			

*Statistical significance $p \leq 0.05$.

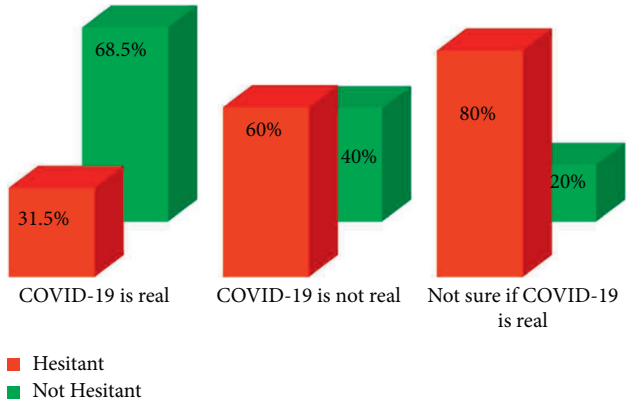

Figure 2: Perception of COVID-19 existence and vaccine hesitancy among HCWs in Imo State, Nigeria.

Table 3: Contextual perception factors and vaccine hesitancy among HCWs in Imo State, Nigeria.

Variable	Hesitant (%)	Nonhesitant (%)	Total (%)	χ^2	Df	p-value
Do you trust information from the Internet/social media about COVID-19 and the vaccines?						
Yes	24 (23.3)	79 (76.7)	103 (100)			
No	99 (40.6)	145 (59.4)	244 (100)	9.443	1	0.002*
Total	123 (35.4)	224 (64.6)	347 (100)			
Has information from the internet/social media made you worry about taking the vaccine?						
Yes	80 (37.9)	131 (62.1)	211 (100)			
No	43 (31.6)	93 (68.4)	136 (100)	1.433	1	0.231
Total	123 (35.4)	224 (64.6)	347 (100)			
Have you heard your priest/pastor/imam speaking against COVID-19 vaccinations?						
Yes	42 (42.0)	58 (58.0)	100 (100)			
No	81 (32.8)	166 (67.2)	247 (100)	2.637	1	0.104
Total	123 (35.4)	224 (64.6)	347 (100)			
Have you experienced any past events that could reduce your trust in vaccines?						
Yes	50 (50.0)	50 (50.0)	100 (100)			
No	73 (29.6)	174 (70.4)	247 (100)	13.004	1	<0.001*
Total	123 (35.4)	224 (64.6)	347 (100)			

Table 3: Continued.

Variable	Hesitant (%)	Nonhesitant (%)	Total (%)	χ^2	Df	p-value
Does your religion or culture discourage vaccinations?						
Yes	9 (47.4)	10 (52.6)	19 (100)			
No	114 (34.8)	214 (65.2)	328 (100)	1.249	1	0.264
Total	123 (35.4)	224 (64.6)	347 (100)			
Do you trust the government to provide the right vaccines?						
Yes	35 (18.3)	156 (81.7)	191 (100)			
No	88 (56.4)	68 (43.6)	156 (100)	54.432	1	<0.001*
Total	123 (35.4)	224 (64.6)	347 (100)			
Would distance, transport cost, or clinic wait time discourage you from getting the vaccine?						
Yes	48 (38.1)	78 (61.9)	126 (100)			
No	75 (33.9)	146 (66.1)	221 (100)	0.606	1	0.436
Total	123 (35.4)	224 (64.6)	347 (100)			
Would having a chronic illness discourage you from getting the vaccine?						
Yes	69 (39.0)	108 (61.0)	177 (100)			
No	54 (31.8)	116 (68.2)	170 (100)	1.975	1	0.160
Total	123 (35.4)	224 (64.6)	347 (100)			
Do you trust the vaccine producers to develop safe and effective vaccines?						
Yes	60 (25.1)	179 (74.9)	239 (100)			
No	63 (58.3)	45 (41.7)	108 (100)	35.894	1	<0.001*
Total	123 (35.4)	224 (64.6)	347 (100)			

*Statistical significance $p \leq 0.05$.

Table 4: Individual perception factors and vaccine hesitancy among HCWs in Imo State, Nigeria.

Variable	Hesitant (%)	Nonhesitant (%)	Total (%)	χ^2	Df	p-value
Do you feel that hearing of someone with an alleged reaction would stop you from taking the vaccine?						
Yes	82 (55.4)	66 (44.6)	148 (100)			
No	15 (14.2)	91 (85.8)	106 (100)	49.054	2	<0.001*
Not sure	26 (28.0)	67 (72.0)	93 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Do you feel there are better ways to treat COVID-19 infection instead of using the vaccine?						
Yes	37 (51.4)	35 (48.6)	72 (100)			
No	31 (22.3)	108 (77.7)	139 (100)	19.975	2	<0.001*
Not sure	55 (40.4)	81 (59.6)	136 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Do you feel there is enough information about the vaccines and their safety?						
Yes	32 (26.9)	87 (73.1)	119 (100)			
No	67 (41.1)	96 (58.9)	163 (100)	6.149	2	0.046*
Not sure	24 (36.9)	41 (63.1)	65 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Do you feel the government has an ulterior motive to encourage you to take COVID-19 vaccination?						
Yes	36 (50.0)	36 (50.0)	72 (100)			
No	42 (24.7)	128 (75.3)	170 (100)	17.755	2	<0.001*
Not sure	45 (42.9)	60 (57.1)	105 (100)			
Total	123 (35.4)	224 (64.6)	347 (100)			
Do you feel worried that you may get a reaction if you take the vaccine?						
Yes	109 (45.0)	133 (55.0)	242 (100)			
No	14 (13.3)	91 (86.7)	105 (100)	32.175	1	<0.001*
Total	123 (35.4)	224 (64.6)	347 (100)			
Do you feel you will take the vaccine if all your friends have taken the vaccine?						
Yes	23 (14.4)	137 (85.6)	160 (100)			
No	100 (53.5)	87 (46.5)	187 (100)	57.612	1	<0.001*
Total	123 (35.4)	224 (64.6)	347 (100)			

*Statistical significance $p \leq 0.05$.

uptake of vaccines among health care workers. In this study, the level of trust in the Internet and social media information relating to COVID-19 and its vaccine was independently associated with vaccine hesitancy. The Internet and social media during this pandemic continue to serve as tools for the amplification of misinformation and the spread of vaccination fear, therefore posing a threat to vaccine uptake. It was observed that respondents who felt there was enough

Table 5: Vaccine-specific perception factors and vaccine hesitancy among HCWs in Imo State, Nigeria.

Variable	Hesitant (%)	Nonhesitant (%)	Total (%)	χ^2	Df	p-value
Does your consideration for the vaccine depend on how safe it is perceived?						
Yes	99 (34.4)	189 (65.6)	288 (100)			
No	24 (40.7)	35 (59.3)	59 (100)	0.850	1	0.357
Total	123 (35.4)	224 (64.6)	347 (100)			
Does your consideration for the vaccine depend on how long it has been tested?						
Yes	86 (34.0)	167 (66.0)	253 (100)			
No	37 (39.4)	57 (60.6)	94 (100)	0.864	1	0.353
Total	123 (35.4)	224 (64.6)	347 (100)			
Does your consideration for the vaccine depend on the vaccine cost?						
Yes	26 (29.2)	63 (70.8)	89 (100)			
No	97 (37.6)	161 (62.4)	258 (100)	2.032	1	0.154
Total	123 (35.4)	224 (64.6)	347 (100)			
Does your consideration for the vaccine depend on which country it was produced in?						
Yes	64 (37.6)	106 (62.4)	170 (100)			
No	59 (33.3)	118 (66.7)	177 (100)	0.705	1	0.401
Total	123 (35.4)	224 (64.6)	347 (100)			
Does your consideration for the vaccine depend on the type of COVID-19 vaccine available?						
Yes	64 (33.3)	128 (66.7)	192 (100)			
No	59 (38.1)	96 (61.9)	155 (100)	0.839	1	0.360
Total	123 (35.4)	224 (64.6)	347 (100)			
Does your consideration for the vaccine depend on how many doses are required?						
Yes	40 (33.1)	81 (66.9)	121 (100)			
No	83 (36.7)	143 (63.3)	226 (100)	0.463	1	0.496
Total	123 (35.4)	224 (64.6)	347 (100)			
Does your consideration for the vaccine depend on vaccine usage by your colleagues?						
Yes	28 (29.2)	68 (70.8)	96 (100)			
No	95 (37.8)	156 (62.2)	251 (100)	2.287	1	0.130
Total	123 (35.4)	224 (64.6)	347 (100)			

Table 6: Predictors of COVID-19 vaccine hesitancy among HCWs in Imo State, Nigeria.

Variable	aOR (estimate)	95% CI	p-value
Gender			
Male	1.000	—	—
Female	0.368	0.151–0.899	0.028
Religion			
Catholic	1.000	—	—
Other religion	0.731	0.051–10.377	0.817
Anglican	0.961	0.333–2.767	0.941
Pentecostal	2.519	1.113–5.701	0.027
Would you encourage hospital patients to take the vaccine?			
No	1.000	—	—
I do not know	0.633	0.102–3.916	0.622
Yes	0.181	0.041–0.795	0.024
Have you experienced any past events that could reduce your trust in vaccines?			
No	1.000	—	—
Yes	2.563	1.161–5.658	0.020
Do you trust the government to provide the right vaccines?			
No	1.000	—	—
Yes	0.372	0.156–0.888	0.026
Do you feel that hearing of someone with an alleged reaction would stop you from taking the vaccine?			
No	1.000	—	—
Not sure	0.824	0.252–2.691	0.748
Yes	3.901	1.256–12.113	0.019
Do you feel there is enough information about the vaccine and its safety?			
No	1.000	—	—
Not sure	1.302	0.464–3.648	0.616
Yes	2.769	1.033–7.419	0.043
Do you feel worried that you may get a reaction if you take the vaccine?			
No	1.000	—	—
Yes	4.493	1.578–12.795	0.005
Do you feel you will take the vaccine if all your friends have taken the vaccine?			
No	1.000	—	—
Yes	0.237	0.096–0.588	0.002

information about the vaccine and its safety were more than two and a half times more likely to be vaccine hesitant. This could imply that those likely to be vaccine hesitant readily trusted and were satisfied with the misinformation and rumours about COVID-19 vaccines in the media especially social media, despite their knowledge and training. This could be a significant cause of vaccine hesitancy among the HCWs as close to one-third of the respondents reported trusting information from the Internet and social media relating to COVID-19 and its vaccine. This group of HCWs continues to be at risk of being trapped within the cycle of misinformation and vaccination fear as more than 60% of the respondents reported that they were worried about taking the vaccine because of the information received from the Internet and social media.

Among the categories of HCWs, it was observed that laboratory scientists had the highest proportion of vaccine

hesitancy (45.5%). Also, nurses and midwives (36.8%) when compared to doctors (26.3%) had a higher proportion of vaccine hesitancy. Studies in Greece, Canada, Ghana, and Nigeria among health care workers similarly observed a lower vaccine acceptance among nurses compared to doctors [12, 13, 21, 22]. Health care workers especially nurses in our local communities are influencers. They are usually the first contact with patients in the hospital and usually more accessible and available within the communities; and as a result, they could be contributing significantly to the relatively poor COVID-19 vaccine uptake observed within the communities in the region.

Religious denomination appeared to be a significant factor in vaccine hesitancy; HCWs of the Pentecostal faith compared with those of the Catholic faith were two and a half times more likely to be COVID-19 vaccine hesitant. It was also observed that 29% of the HCWs had heard their priest or pastor speaking against COVID-19 vaccinations, of which, those of Pentecostal faith had the highest proportion who heard anti-COVID-19 vaccination sermons. However, about 95% of the respondents still reported that their religion or culture does not discourage vaccinations. A similar study in Ghana [23] among health care workers reported that spiritual and religious beliefs are reasons for their unwillingness to take the vaccine. The priests and pastors are influencers and could significantly impact the uptake of COVID-19 vaccines and this probably explains to a large extent the low uptake of vaccines in the communities.

Although, in the present study, gender was not observed to be independently associated with vaccine hesitancy as observed in another study in Nigeria [22]. However, on further analysis, gender appeared to be a predictor of vaccine hesitancy within the regression model, where male HCWs were more than two and a half times more likely to be COVID-19 vaccine hesitant. This was similarly observed in a study among junior doctors in Ghana where the males were less likely to take the COVID-19 vaccines [24]. However, this was not consistent with other studies among health care workers in Ghana and the United Kingdom [21, 23, 25], where vaccine hesitancy was more likely in women.

Trust in the government and vaccine manufacturers were significant issues associated with vaccine hesitancy where HCWs, who do not trust the government to provide the right vaccines, were more than two and a half times more likely to be COVID-19 vaccine hesitant with up to 20% of the HCWs stating that the government has an ulterior motive in encouraging vaccinations. Similarly, close to one-third of the respondents did not trust the vaccine producers to develop safe and effective vaccines. These perceptions of distrust in the government and vaccine producers may have had a greater impact on their vaccine uptake decisions despite their access to evidence-based data supporting vaccinations, even though, close to half of the respondents felt that there was not enough information about the vaccine and its safety. Nevertheless, more than 70% of the respondents reported that their consideration for the vaccine depended on its safety and duration of testing.

The impact of vaccine-hesitant health care workers on community vaccine uptake cannot be overemphasized as it was observed in this study that HCWs who would stop or discourage the uptake of COVID-19 vaccines among immediate family members, relatives, friends, neighbours, and hospital patients were significantly more likely to be vaccine-hesitant. Therefore, vaccine-hesitant HCWs pose a threat to the global public health response in respect to the COVID-19 pandemic.

4.1. Study Limitations. The selection of participants was based on convenience and snowballing sampling which are nonprobability techniques with the associated challenges of generalization.

4.2. Implication for Practice and Future Research. The higher the level of vaccine hesitancy among the HCWs, the more challenging it becomes to mount effective COVID-19 vaccination campaigns, as HCWs are usually at the forefront of such campaigns.

Therefore, it is important to further understand in depth why HCWs are COVID-19 vaccine hesitant despite their access to evidence-based information; as a result, targeted focal group discussion and in-depth interview studies are advocated in future research among HCWs, especially in developing countries.

5. Conclusion

This study highlights that the issues of vaccine hesitancy among health care workers in tertiary health care institutions are generally fundamental, ranging from communication and technology to religion and confidence in the private and public institutions. Addressing these issues will be very challenging and therefore, we advocate government mandates for vaccine uptake among the health care workers, even though we expect resistance as more than two-thirds of respondents in this study would not encourage a government mandate. Nevertheless, this will be much less challenging to address.

Abbreviations

COVID-19: Coronavirus disease 2019
HCWs: Health care workers
aOR: Adjusted odds ratio.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Ethical Approval

Ethical approval (IMSUTH/CS/EA/122) was obtained from the Ethics Committee of Imo State University Teaching Hospital, Orlu, Nigeria. All authors hereby declare that the study was performed in accordance with the international ethical standards.

Consent

Verbal consents as approved by the ethics committee were given by the participants.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this paper.

Authors' Contributions

CAI contributed to the study design, literature review, data acquisition, analysis, and write-up of the first and final draft. PO and VC contributed to result interpretation, discussions, and final draft. KU and UO contributed to study design, result interpretation, and final draft. All authors read and approved the final manuscript before submission.

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Supplementary Materials

The questionnaire was adapted by the researchers using the matrix of determinants of vaccine hesitancy developed by the WHO SAGE working group. (*Supplementary Materials*)

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