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Applying the Health Belief Model to COVID-19 Vaccine Hesitancy Among Health Care Workers in Nigeria: A Comparative Study

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Abstract

Though health care workers (HCW) are central to the COVID-19 pandemic response, they face a higher risk of infection in the course of their duties, and vaccine hesitancy exists among them. This study aimed to compare the barriers and drivers of hesitancy among medical doctors with other HCWs to COVID-19 vaccination in two health facilities in Abuja, Nigeria (April-May 2022), with a view to designing interventions to mitigate the problem. A cross-sectional study was undertaken using a self-administered questionnaire for data collection. 316 HCPs completed the questionnaire, comprising 49.7% doctors and 50.3% other HCWs. Descriptive and inferential statistics were applied in the analysis. Among the hesitant HCWs, more doctors were unwilling to receive the COVID-19 vaccine though the finding was not statistically significant nor was the proportion of the two groups who received COVID-19 vaccination. However, other HCWs (22%) believed that their chances of serious complications and hospitalization if they contracted COVID-19 were higher than those of doctors (8.3%), and the difference was statistically significant (χ^2=11.609, p=0.003). Some of the perceived barriers in both groups included uncertainty of the safety and efficacy of the vaccines, perceived absence of scientific assurances, religious belief and lack of trust in the government. HCWs' confidence plays a critical role in patient vaccination behaviour. Therefore, it is highly recommended to implement effective awareness campaigns, educational initiatives, and continuous medical training for healthcare workers, supported by strong leadership endorsement. Additionally, policymakers should avoid adopting a one-size-fits-all communication approach to better address the specific needs and barriers among frontline providers.

Keywords: *Barriers, COVID-19, Health Care Workers, Health Belief Model, Vaccine Hesitancy.*

Introduction

COVID-19 was first reported in December 2019 by Chinese Health Authorities and rapidly spread globally within 3 months. On January 30, 2020, the WHO declared the novel coronavirus a Public Health Emergency of International Concern (PHEIC) and thereafter declared COVID-19 a pandemic. Kwok et al. [1] stated that health care workers in hospitals are a high-risk group during epidemics, and their risk is amplified due to various factors that include continuous exposure to patients, shortages of personal protective equipment, and inadequate infection control training. According to WHO [2], people who are vaccinated are very likely to be protected against the targeted disease.

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Vaccination is one of the most potent preventive strategies against diseases. 75% vaccination rate is needed to achieve herd immunity among the population [3]. However, the proportion of the population that must be vaccinated against COVID-19 to begin inducing herd immunity is unknown but will likely vary by variant, community, vaccine, populations prioritized for vaccination, and other factors [4]. High and equitable coverage reduces severe disease and transmission potential.

The COVID-19 vaccines can prevent most people from getting infected, but not everyone. Despite taking all recommended doses and waiting a few weeks for immunity to build, there is still a chance of infection [5].

Though vaccination of a large proportion of the population is considered essential to establish herd immunity, multiple potential COVID-19 vaccines have been developed at unprecedented speed [6-8], raising concerns about vaccine safety [9-11]. As noted by Alsubaie et al. [12], the WHO Strategic Advisory Group of Experts on Immunization (SAGE) describes vaccine hesitancy as a delay in accepting or refusing vaccines despite the availability of vaccination services. Vaccine hesitancy leads to disease outbreaks and deaths from vaccine-preventable diseases. This situation poses a threat to COVID-19 and control of all vaccine-preventable diseases and has been considered one of WHO's top 10 global health threats in 2019 [13-14]. Vaccine hesitancy includes outright refusals to vaccinate, delays in vaccination, accepting vaccines but remaining uncertain about their use, or using certain vaccines and refusing others.

Addressing low vaccination rates among specific groups requires an adequate understanding of the problem's determinants, tailored, evidence-based strategies to improve uptake, and monitoring and evaluation to assess the impact and sustainability of the interventions. Glanz et al. [15] posit that the health belief model (HBM) is by far the most commonly used theory in health education and promotion. This model was developed in the 1950s by a group of psychologists (Hochbaum, Kegeles, Leventhal, and Rosenstock) to explain why the medical screening programmes done by the US Public Health Service, especially for Tuberculosis, were not very successful. The HBM has been extensively used in vaccination research to study vaccination behaviours and identify participants perception towards disease and vaccination [16-17]. The HBM posits that health behaviours can be optimized as long as constructs such as perceived barriers, benefits, self-efficacy and threats are addressed [18-19].

Perceived severity is about the belief of an individual in the seriousness of a disease on their own health, while perceived susceptibility is about an individual's assessment of their chances of getting the disease. The perceived benefits speak to an individual's conclusion whether the new behaviour is better than what he is already doing, and the perceived barriers are an individual's opinion on what will stop him from adopting the new behaviour. It is an individual evaluation of the obstacles in the way of adopting new behaviour [16, 20-23]. It is therefore necessary for a new behaviour to be adopted, a person needs to believe that the benefits of the new behaviour outweigh the consequences of continuing the old behaviour. Furthermore, Wong et al. [24] stated that trust in the healthcare system and vaccine manufacturer was positively associated with COVID-19 vaccine acceptance. Other constructs have been included to the HBM and these are Cues to Action, Motivating factors and Self-efficacy. Cues to action are factors that prompt a person to change behaviour. Modifying factors are personal and affect whether a new behaviour is adopted. The Self-efficacy construct is the personal belief in one's ability to perform a task. These other constructs affect our perception of

susceptibility, severity, benefits, and barriers, and consequently our behaviour.

Hence, identifying factors associated with acceptance of the COVID-19 vaccine is required to formulate context-specific education and policy implementation. Eze et al. [3] quoting the Johns Hopkins University - Nigeria vaccine tracker highlighted a growing body of anecdotes about many Nigerians not believing in the existence of the pandemic which is due in part to low levels of trust in government and burgeoning conspiracy theories concerning the virus and vaccines.

There are substantial implications on public health interventions during epidemics with respect to health care workers' vaccine hesitancy. Nosocomial infections among healthcare workers during epidemics would reduce the available healthcare workforce. They are usually at the frontline fighting with epidemics, and some of them are required to routinely perform procedures with high risks of contracting the pathogens. Therefore, the key role of health care workers cannot be overemphasized. Protecting healthcare workers from infection is pivotal in controlling nosocomial transmission [1, 25]. Also healthcare workers can convey the message of vaccination benefits and address the worries and concerns of the patients on a newly developed vaccine. These frontline workers are major influencers in vaccination, therefore their acceptance or hesitancy to the COVID-19 vaccine would either aid its acceptance or refusal among the populace [26-27]. However, prior research indicated that vaccine uptake among nurses was low, with the influenza vaccination rate slightly above 30% in Hong Kong [1]. A low vaccination acceptance rate among nurses could negatively affect individuals' vaccination compliance, given their engagement with this healthcare cadre. In the study by Eze et al. [3], more than 60% of Nigerians were willing to take the COVID-19 vaccines if recommended by health care workers. Another Nigerian study among HCWs showed that 45.7% of respondents had no confidence in the vaccine and 39.7% rejected it [26]. The main reasons for hesitancy were concerns about effectiveness, side effects, safety and fear of the unknown. In a study by Ekwebene et al. [28] among HCWs in Nigeria, 92% had a good knowledge of COVID-19 vaccination although only 53.5% were willing to get vaccinated against the disease. Even if the vaccine is proven safe, 48.1% of respondents remain unwilling to accept it. A multicentre study [29] on perceptions to COVID-19 vaccines and willingness to receive was also conducted among HCWs in Ondo state Nigeria which reported only 53.5% of HCWs with positive perception of the vaccine and 55.5% being willing to receive the vaccine. Another multicentre study conducted among HCWs in Democratic Republic of Congo by Kabamba et al. [30] to estimate the acceptability of COVID-19 vaccine revealed significant association with willingness to be vaccinated among doctors primarily and also having positive attitude towards the vaccine. Using the health belief model construct, an Ethiopian study [22] among employees had 62.3%, 53.7%, 49.7%, 79.1%, 48.2% and 52.4% of the respondents with high perceived susceptibility, severity, benefit, barrier, cues to action, and self-efficacy to COVID-19 prevention practices, respectively.

As at the time of this study, very few comparative studies between doctors and other health care workers had been done. This study was undertaken to comparatively determine the barriers and hesitancy among the doctors and other HCWs, associated with accepting the COVID-19 vaccination in the Federal Capital Territory, Nigeria and make appropriate recommendations for interventions.

Materials and Methods

Description of Study Area

Abuja is Nigeria's capital city and is located within the Federal Capital Territory. As of 2016, the metropolitan area of Abuja is estimated at six million people. The Federal Capital Territory is administered by the Federal Capital Territory Administration, under which is the Health and Human Services Secretariat (HHSS). The FCT Hospitals Management Board is an agency under the HHSS and is responsible for delivering secondary health services to the FCT populace. There are four public secondary health facilities in the city of Abuja, of which two facilities were randomly selected for the study. The two health facilities were Asokoro District Hospital and Maitama District Hospital. Asokoro District Hospital also serves as the undergraduate medical training facility for the Nile University College of Health Sciences, Abuja.

Study Design

This is a comparative (quantitative), cross-sectional study to assess the hypothesis that barriers to COVID-19 vaccination differ among the doctors and other health care workers at public secondary health facilities in Abuja in Nigeria's Federal Capital Territory.

Study Population

The study population comprised of doctors and other health care workers who are involved in the management of patients/clients in the selected health facilities. All these populations manage COVID cases, as the hospitals are a high-risk environment even before diagnosis is made.

Sample Size

The sample size for the study was determined by the formula for estimation of two independent proportions, as shown below;

$$N = 2\frac{\left(Z_{\alpha} + Z_{1-\beta}\right)^2 x\,[P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2}$$

where,

N= Minimum sample size

$Z\alpha$ = Percentage point of standard normal deviate (2 sided) set at 95% confidence level =1.96 (from Z table)

$Z_{1-\beta}$ = Power of the test set at 80% (20% B error) = 0.84 (from Z table)

P_1 = Proportion of the first group

P_2 = Proportion of the second group

assuming a 5% margin of error, a 95% confidence interval and power of study at 80% and a 15% non-response rate. From a Nigerian study by Agha et al. [31], the proportion of doctors who accepted the vaccine was 50.6% (P1), and using the proportion of nurses who received the vaccine to represent others, 34.1% (P_2). The minimum sample size required for this study was therefore 275.

Inclusion Criteria

Doctors and other HCWs who are involved in the management of patients/clients in the selected health facilities and agreed to participate in the study. All participants were aged 18 years and above.

Exclusion Criteria

Doctors and other HCWs who are involved in the management of patients in the selected health facilities who declined consent or were absent at the time of data collection were excluded from the study.

Sampling Technique

According to records from the FCT Hospitals Management Board, four public secondary healthcare facilities are managed in Abuja. The following sampling stages were applied.

In stage I: Simple random sampling was used to select two general hospitals by balloting. Asokoro and Maitama District Hospitals were randomly chosen from the four health facilities.

In stage II, based on the calculated sample size, 50% of the sample (138) was allocated to each hospital.

In stage III: In each hospital, half of the sample size was allocated to the doctors (69), and the remaining half (69) was proportionately allocated to the remaining categories of health workers.

In stage IV: The staff strength of the two hospitals were obtained from their medical records units. Asokoro District Hospital had 412 health care workers, while Maitama District Hospital had 340 health care workers. Consecutive sampling was subsequently used to recruit respondents at the hospitals where the questionnaires were handed over to them.

Data Collection Tool

The tool was adapted from two studies carried out by Angelo et al. [32] and Costa [19]. An orientation training on the questionnaire was conducted for six research assistants to ensure good understanding of the variables and the expectations. A pre-test of the tool was conducted at a general health facility outside the study sites. Based on the pre-test findings and observations, the data collection tool was adjusted accordingly. The questionnaire achieved a reliability score of 75% for the HBM constructs. All research assistants adhered strictly to COVID-19 safety prevention protocols during the survey

Data Collection

A semi-structured, self-administered questionnaire was used to collect data. The survey questionnaire consisted of 8 sections and 57 variables. The first section consisted of the participants' socio-demographic variables, such as age, sex, marital status, professional cadre, etc. The second section assessed knowledge of COVID-19 infection, while the third section assessed medical history and perceived COVID-19 susceptibility. The fourth and the fifth sections assessed participants' perceived benefits of COVID-19 prevention practices and perceived severity respectively. The sixth section consisted of perceived barriers to COVID-19 vaccination and the seventh section evaluated vaccine hesitancy. The seventh section provided the cues to action that may lead to change of behaviour towards vaccination for those who were not vaccinated. The level of statistical significance was pre-determined at a p-value of <0.05, two-sided.

Data Analysis

Data was entered into SPSS (Statistical Package for Social Sciences) statistical software version 22.0 after a manual check for completeness. Descriptive and inferential statistics was applied in the analysis. Frequency tables and cross tabulations were generated for the variables: Qualitative data was summarized using percentages, while quantitative data was summarized using means and standard deviations. The pairwise deletion method was used to handle missing data.

Results

Out of the 389 questionnaires given out to the health care workers in the two hospitals, 316 participants completed the questionnaires given a response rate of 81.2%. Doctors made up 49.7% of the participants, while 50.3% were other HCWs, who comprised nurses, pharmacists, laboratory scientists, community health workers, and other allied staff. The nurses made up the highest proportion (31%) among the other HCWs.

Table 1 below shows the other socio-demographic characteristics of health workers. There was a statistically significant difference in the age groups of respondents, as a higher proportion of doctors (41.4%) was in the age group of 30-39 years, while a higher proportion of other HCWs (44.7%) was in the age group of less than 30 years (χ^2=8.007, p=0.044). Similarly, higher proportions of doctors had Bachelor's and Master's degrees (66.2% & 21%) than other HCWs (62.3% &

15.1%), and the difference was statistically significant (χ^2=11.532, p=0.021).

Table 1. Socio-demographic Characteristics of Health Workers

Variables	**Categories of health workers**		**χ^2 p-value**
	Doctors (n=157) N (%)	**Other workers (n=159) N (%)**	
Mean Age ± SD (years)	34.2±8.4	33.6±9.4	0.578* 0.564
Age groups (years)			
< 30	51 (32.5)	71 (44.7)	
30 – 39	65 (41.4)	43 (27.0)	8.007 0.044
40-49	29 (18.5)	33 (20.8)	
50 And Above	12 (7.6)	12 (7.5)	
Marital Status			
Married	68 (43.3)	75 (47.2)	0.475 0.491
Single**	89 (56.7)	84 (52.8)	
Religion			
Islam	52 (33.1)	40 (25.2)	2.428 0.119
Christianity	105 (66.9)	119 (74.8)	
Educational Qualification			
Diploma	5 (3.2)	20 (12.6)	
Bachelor's degree	104 (66.2)	99 (62.3)	11.532 0.021
Master's degree	33 (21.0)	24 (15.1)	
PhD	0 (0.0)	1 (0.6)	
Others***	15 (9.6)	15 (9.4)	

**t-value ; ** Never married, separated, or divorced.; ***Other educational qualifications (Fellowship, SSCE, Pharm.D, etc.)*

Table 2. Medical History and Perceived COVID-19 Susceptibility

Variables	**Doctors (n=157) N (%)**	**Other workers (n=159) N (%)**	**χ^2 p value**
Do you have a known medical condition?			
Yes	17 (10.8)	14 (8.8)	0.365 0.546
No	140 (89.2)	145 (91.2)	
If yes, specify	**n=17**	**n=14**	
Asthma	4 (23.5)	4 (28.6)	
Hypertension	13 (76.5)	5 (35.7)	8.343 0.080
Cancer	0 (0.0)	1 (7.10)	
Diabetes	0 (0.0)	2 (14.3)	
Hepatic disease	0 (0.0)	2 (14.3)	
Perceive risk to COVID-19 infection	**n=157**	**n=159**	
High	62 (39.5)	37 (23.4)	
Medium	47 (29.9)	54 (34.2)	9.934 0.007
Low	48 (30.6)	67 (42.4)	

Has personal history of COVID-19 infection	**n=157**	**n=159**	
Yes	48 (30.6)	19 (11.9)	16.400 < 0.001
No	109 (69.4)	140 (88.1)	
Knows anyone sick (now or before) with COVID-19 in your immediate network	**n=157**	**n=159**	
Yes	84 (53.5)	74 (46.5)	
No	66 (42.0)	69 (43.4)	4.209 0.122
Not Sure	7 (4.5)	16 (10.1)	

Table 2 shows a higher proportion of doctors (39.5%) perceived that they were at high risk of COVID-19 infection than the other category of HCWs (23.4%) and the difference was statistically significant, (χ^2=9.934, p=0.007). In addition, a higher proportion of doctors (30.6%) had a personal history of COVID-19 infection than the other category of health care workers (11.9%), and the difference was also statistically significant (χ^2=16.400, p<0.001).

Table 3. Perceived Benefits of COVID-19 Prevention Practices

Variables	**Doctors (n=157) N (%)**	**Other workers (n=159) N (%)**	**χ^2 p value**
Do you wash your hands or sanitize your hands regularly?			
Yes	149 (94.9)	156 (98.1)	2.421 0.120
No	8 (5.1)	3 (1.9)	
If No is your response to 401, why?	**n=8**	**n=3**	
Laziness	0 (0.0)	1 (33.3)	
Tiredness	0 (0.0)	1 (33.3)	6.519 0.038
No reason	8 (100)	1 (33.3)	
Do you regularly use facemask at point of care (when rendering service to sick patients)			
Yes	144 (91.7)	142 (89.3)	0.535 0.465
No	13 (8.3)	17 (10.7)	
Do you use a facemask when you have flu-like symptoms?			
Yes	137 (87.3)	147 (92.5)	2.340 0.126
No	20 (12.7)	12 (7.5)	
In recent times, have you worn a face mask when leaving your home?			
Yes	119 (75.8)	117 (73.6)	0.204 0.651
No	38 (24.2)	42 (26.4)	
If No is your response to 405, why?	**n=17**	**n=19**	
No need/Govt. asked us to stop	8 (47.1)	8 (42.1)	
COVID-19 has reduced	3 (17.6)	2 (10.5)	
Makes me uncomfortable/Don't like it	0 (0.0)	2 (10.5)	2.430 0.787
I am vaccinated	1 (5.9)	2 (10.5)	

I usually forget/carelessness	2 (11.8)	2 (10.5)	
I wear it when I get to my destination/hospital	3 (17.6)	3 (15.8)	
Missing values (non-responses) = 43			
Do you believe that the COVID-19 vaccine can prevent infection?	**n=157**	**n=159**	
Yes	125 (79.6)	117 (73.6)	1.603 0.205
No	32 (20.4)	42 (26.4)	
Are you ready to participate in sensitization on COVID 19 vaccination?	**n=157**	**n=159**	
Yes	124 (79.0)	125 (78.6)	0.006 0.937
No	33 (21.0)	34 (21.4)	

Table 3 shows perceived benefits of COVID-19 prevention practices among healthcare providers. A slightly higher proportion of other HCWs wash and sanitize their hands regularly than the doctors, but the difference was not statistically significant. However, there was a statistically significant difference in the reasons given by the HCWs for not washing/sanitizing their hands regularly (χ^2=6.519, p=0.038). It is pertinent to note that 79% of health care providers (doctors and other HCWs) expressed willingness to participate in COVID-19 sensitization.

Table 4. Perceived Severity of COVID-19 Infection

Variables	**Doctors (n=157) N (%)**	**Other workers (n=159) N (%)**	**χ^2 p value**
If I got infected with COVID-19, the intensity of my symptoms will be			
High	16 (10.2)	28 (17.6)	
Medium	65 (41.4)	71 (44.7)	5.407 0.067
Low	76 (48.4)	60 (37.7)	
If I got infected with COVID-19, I believe the chances of having serious complications and being hospitalized is			
High	13 (8.3)	35 (22.0)	
Medium	47 (29.9)	42 (26.4)	11.609 0.003
Low	97 (61.8)	82 (51.6)	
If I got infected with COVID-19, the chances of getting too compromised to do my daily activities is			
High	22 (14.0)	27 (17.0)	
Medium	64 (40.8)	69 (43.4)	1.163 0.559
Low	71 (45.2)	63 (39.6)	
I believe that most people with COVID-19 will have severe symptoms			
Yes	17 (10.8)	44 (27.7)	
No	132 (84.1)	97 (61.0)	21.135 <0.001
Don’t Know	8 (5.1)	18 (11.3)	

As shown in Table 4, higher proportion of other HCWs (22%) believed that their chances of having serious complications and being hospitalized if they caught COVID-19 infection was high than the doctors (8.3%) and the difference in proportions was statistically significant, (χ^2=11.609, p=0.003). Also, a higher proportion of other HCWs (27.7%) believed that most people with COVID-19 infection will have severe symptoms than the doctors (10.8%), and the difference in proportions was also statistically significant (χ^2=21.135, p<0.001).

Table 5. Perceived Barriers to COVID-19 Vaccination

Variables	**Doctors (n=157) N (%)**	**Other workers (n=159) N (%)**	**χ^2 p value**
COVID-19 vaccines are not readily available			
Yes	44 (28.0)	38 (24.1)	0.646 0.421
No	113 (72.0)	120 (75.9)	
Going to the vaccination point will take up too much of my time			
Yes	64 (40.8)	61 (38.4)	0.190 0.663
No	93 (59.2)	98 (61.6)	
My job is more important than going to receive the vaccine			
Yes	32 (20.5)	30 (19.0)	0.115 0.734
No	124 (79.5)	128 (81.0)	
The side effects of COVID-19 vaccination is too much to bear, so will not take the vaccine			
Yes	73 (46.5)	67 (42.1)	0.608 0.435
No	84 (53.5)	92 (57.9)	
Other perceived barriers	**n=17**	**n=24**	
Uncertainty of vaccine safety/efficacy	9 (52.9)	13 (54.2)	
Perceived absence of scientific assurances	0 (0.0)	2 (8.3)	4.963 0.175
Religion/Ignorance/Lack of trust in the Govt.	8 (47.1)	6 (25.0)	
Believe COVID-19 is a mild disease	0 (0.0)	3 (12.5)	

The perceived barriers to COVID-19 vaccination among the health workers are shown in Table 5. A higher proportion of doctors (28%) perceived that COVID-19 vaccines were not readily available than the other category of HCWs (24.5%), but the difference in proportions was not statistically significant. Furthermore, there was no statistically significant difference in the proportion of those in the two groups who believed that going to the vaccination point would take up too much of their time, as well as among those who believed that the side effects of COVID-19 vaccination were too much to bear. Lastly, the uncertainty of the vaccine safety, religion, ignorance and lack of trust in government are other mutually perceived barriers.

Table 6. Vaccine Hesitancy among Health Care Workers

Variables	**Doctors (n=157) N (%)**	**Other workers (n=159) N (%)**	**χ^2 p-value**
i Have you ever refused a vaccine for yourself or a child because you considered it useless or dangerous?			
Yes	7 (4.5)	14 (8.8)	2.406 0.121
No	150 (95.5)	145 (91.2)	
ii If yes to question i, why?	n=7	n=11	
Need to confirm efficacy/safety	0 (0.0)	2 (14.3)	
Previous side-effects	1 (14.3)	5 (35.7)	4.1366 0.388
Fear or trust on vaccines	3 (42.9)	4 (28.6)	
Peer-pressure	1 (14.3)	0 (0.0)	
Perceived uncertainties of vaccines	2 (28.6)	3 (21.4)	
iii Have you ever had a vaccine for a child or yourself despite doubts about its efficacy?			
Yes	104 (66.2)	103 (64.8)	0.075 0.785
No	53 (33.8)	56 (35.2)	
iv Have you received COVID-19 vaccine?			
Yes	116 (73.9)	118 (74.2)	0.004 0.947
No	41 (26.1)	41 (25.8)	
v If yes to question iv, which vaccine were you given?	**N=116**	**N=118**	
Astra Zeneca	86 (74.1)	83 (70.3)	
Pfizer/Bio Tech	10 (8.6)	14 (11.9)	11.401 0.010
Moderna	10 (8.6)	20 (16.9)	
Johnson and Johnson	10 (8.6)	1 (0.8)	
vi If yes to question iv, how many doses have you taken?	**N=116**	**N=118**	
1	10 (8.6)	7 (5.9)	
2	75 (64.7)	92 (78.0)	5.123 0.077
3	31 (26.7)	19 (16.1)	
vii If no to iv, are you willing to receive the vaccine?	**N=41**	**N=41**	
Yes	12 (29.3)	20 (48.8)	3.280 0.070
No	29 (70.7)	21 (51.2)	

As shown in Table 6, higher proportion of other category of HCWs (8.8%) refused vaccination in the past than doctors (4.5%), but the difference was not statistically significant. Similarly, there was no statistically significant difference in the proportion of the two groups who received COVID-19 vaccination, as well as in the number of the vaccine doses they received.

On the other hand, there was a statistically significant difference in the vaccine types received by the two groups: a higher proportion of doctors (74.1% & 8.6%) received the AstraZeneca and Johnson &

Johnson vaccines, respectively, than the other HCW category (70.3% & 0.8%).

While a higher proportion of other HCWs received the Pfizer/BioNTech and Moderna vaccines (11.9% and 16.9%) than the doctors (8.6% and 8.6%), (χ^2=11.401, p=0.010).

Table 7. Predictors of Willingness to Receive COVID-19 Vaccination among Doctors who were not vaccinated

Variables	**Willingness to receive the COVID-19 vaccination**		**p[a]**	**AOR[b] (95% CI)[c]**	**p[d]**
	Yes (n=12) N (%)	**No (n=29) N (%)**			
Perceived susceptibility					
High	4 (30.8)	9 (69.2)		0.25 (0.01-4.71)	0.354
Medium	4 (36.4)	7 (63.6)	0.759	0.88 (0.60-13.59)	0.927
Low	4 (23.5)	13 (76.5)		1	
Perceived benefits					
Yes	8 (32.0)	17 (68.0)	0.631	0.24 (0.02-2.30)	0.214
No	4 (25.0)	12 (75.0)		1	
Perceived severity					
High	2 (40)	3 (60.0)	0.851	1.38 (0.63-30.06)	0.838
Medium	4 (28.6)	10 (71.4)		3.534 (0.25-50.53)	0.927
Low	6 (27.3)	16 (72.7)		1	
Perceived barriers					
Yes	7 (38.9)	11 (61.1)	0.231	0.13 (0.01-1.89)	0.140
No	5 (21.7)	18 (78.3)		1	
Age groups (years)					
< 30	7 (53.8)	6 (46.2)		0.0 (0.0-0.0)	0.999
30 – 39	4 (20.0)	16 (80.0)	0.108	0.0 (0.0-0.0)	0.999
40 – 49	1 (20.0)	4 (80.0)		0.0 (0.0-0.0)	0.999
≥ 50	0 (0.0)	3 (100)		1	
Sex					
Male	3 (23.1)	10 (76.9)	0.553	1.61 (0.11-22.82)	0.725
Female	9 (32.1)	19 (67.9)		1	
Educational Status					
Diploma	0 (0.0)	0 (0.0)		0.80 (0.02-43.11)	0.913
Bachelors	11 (36.7)	19 (63.3)	0.175	0.0 (0.0-0.0)	0.999
Masters	0 (0.0)	6 (100)		1	
PhD	0 (0.0)	0 (0.0)			
Others[e]	1 (20.0)	4 (80.0)			
Personal history of COVID-19 infection					
Yes	3 (37.5)	5 (62.5)	0.568	0.81 (0.08-8.18)	0.857
No	9 (27.3)	24 (72.7)		1	

Has a known medical condition?					
Yes	2 (28.6)	5 (71.4)	0.965	0.44 (0.02-8.17)	0.581
No	10 (29.4)	24 (70.6)		1	
Health Facility					
Asokoro	10 (41.7)	14 (58.3)	0.038	0.34 (0.00-0.81)	0.040
Maitama	2 (11.8)	15 (88.2)		1	

[a]P-value in bivariate analysis; bAOR=Adjusted Odds Ratio; c95% CI=95% Confidence Interval:

[d]P-value on logistic analysis; eOther educational qualifications (Fellowship, SSCE, Pharm. D, etc.).

Table 7 shows the predictors of willingness to receive the COVID-19 vaccine among doctors who had not been vaccinated. Doctors working at Asokoro Hospital were three times less willing to receive the COVID-19 vaccine compared to those at Maitama Hospital (AOR = 0.34, 95% CI = 0.00–0.81, p = 0.040). No statistically significant association was observed between the HBM constructs and doctors' willingness to receive the COVID-19 vaccine.

Table 8. Predictors of Willingness to Receive COVID-19 Vaccination among other categories of Health workers who were not vaccinated

Variables	**Willingness to receive Covid-19 vaccination**		**p[a]**	**AOR[b] (95% CI)[c]**	**p[d]**
	Yes (n=20) N (%)	**No (n=21) N (%)**			
Perceived susceptibility					
High	3 (50.0)	3 (50.0)		3.39 (0.07-169.42)	0.541
Medium	6 (37.5)	10 (62.5)	0.484	49.88 (1.25-1993)	0.038
Low	11 (57.9)	8 (42.1)		1	
Perceived benefits					
Yes	13 (59.1)	9 (40.9)	0.155	0.09 (0.01-1.30)	0.076
No	7 (36.8)	12 (63.2)		1	
Perceived severity					
High	3 (100)	0 (0.0)	0.164	0.00 (0.00-0.00)	0.999
Medium	11 (47.8)	12 (52.2)		0.11 (0.00-3.02)	0.188
Low	1 (8.3)	4 (13.8)		1	
Perceived barriers					
Yes	10 (66.7)	5 (33.3)	0.082	0.40 (0.05-3.38	0.403
No	10 (38.5)	16 (61.5)		1	
Age groups (years)					
< 30	11 (55.0)	9 (45.0)		11.95 (0.19-0.773)	0.244
30 – 39	5 (50.0)	5 (50.0)	0.791	6.94 (0.08-589)	0.393
40 – 49	2 (33.3)	4 (66.7)		38.78 (0.21-7160)	0.169
≥ 50	2 (40.0)	3 (60.3)		1	
Sex					
Male	4 (36.4)	7 (63.6)	0.336	2.154 (0.14-34.09)	0.586
Female	16 (53.3)	14 (46.7)		1	

Educational Status					
Diploma	2 (50.0)	2 (50.0)		0.83 (0.00-6.15)	0.257
Bachelors	14 (60.9)	9 (39.1)	0.257	0.129 (0.00-4.13)	0.247
Masters	2 (22.2)	7 (77.8)		1.475 (0.03-63.77)	0.840
PhD	0 (0.0)	0 (0.0)		0.179 (0.00-9.34)	0.394
Others[e]	2 (40.0)	3 (60.0)		1	
Personal history of COVID-19 infection					
Yes	2 (66.7)	1 (33.3)	0.520	0.18 (0.00-9.34)	0.394
No	18 (47.4)	20 (52.6)		1	
Has a known medical condition?					
Yes	2 (66.7)	1 (33.3)	0.520	0.02 (0.00-20.76)	0.258
No	18 (47.4)	20 (52.6)		1	
Health Facility					
Asokoro	12 (54.5)	10 (45.5)	0.427	0.65 (0.09-4.67)	0.665
Maitama	8 (42.1)	11 (57.9)		1	

[a]P-value in bivariate analysis; bAOR=Adjusted Odds Ratio; c95% CI=95% Confidence Interval;

[d]P-value on logistic analysis; eOther educational qualifications (Fellowship, SSCE, Pharm. D, etc.)

Table 8 presents the predictors of willingness to receive the COVID-19 vaccine among other category of health workers who were not vaccinated. The other health workers with a medium level of perceived susceptibility were found to be 50 times more likely to accept vaccination compared to those with a low level of perceived susceptibility. (AOR; 49.88, 95% CI=1.25-1993, p=0.038). There was no statistically significant association between the remaining HBM constructs and the willingness to receive the COVID-19 vaccine among the other categories of health workers.

Discussion

Vaccination is one of the most potent preventive strategies against COVID-19 infection. It is therefore pertinent to state that a successful COVID-19 response depends on the availability of a fully vaccinated health workforce capable of responding to the pandemic and the availability of the vaccines. In this study, the Health Behaviour Model (HBM) was adopted as a theoretical framework to comparatively determine the barriers and hesitancy to COVID-19 vaccination among doctors and the other health care workers (HCWs) with a view to further elucidate the interventions to overcome barriers and hesitancy to getting COVID-19 vaccination. It is pertinent to further state that at the time of this study, only about 20% of the national population target had been vaccinated with the second dose.

In this study, the mean age of the doctors and the other HCWs were not statistically significant. However, higher proportion of doctors were aged above 30 years, compared to other HCWs within the same age range. Conversely, there were more other HCWs below 30 years of age compared to the doctors. Furthermore, more doctors had Bachelor's or Master's degrees when compared with other HCWs. These observations are not unexpected in view of the fact that you can only qualify to be a doctor with a university degree while among the other HCWs, there are cadres with much lesser qualifications.

The study by Robinson et al. [26] did not dis-aggregate the health workers, however, majority of respondents were within the age group of 30-39 years with most having a Bachelor's degree. This is also similar to the

finding in a study by Aemro et al. [33] in Ethiopia where the average age of the health workers (not disaggregated) was 30 years. Oriji et al. [34] in their study of other health care workers (excluding doctors) had almost 50% less than 35 years of age which is close to finding of this study.

The results in this study observed that though the knowledge level in both groups was very high, only 73.9% and 74.2% of doctors and other HCWs, respectively, had received the COVID-19 vaccine, with around a quarter of respondents showing hesitancy in both groups. The study by Aemro et al. [33] in Ethiopia reported a hesitancy rate of 45.9%, which may have been partly attributed to the limited availability of vaccines in the country at that time. This was not the case in the Nigerian study, as the hospitals where data were collected in Abuja also served as vaccination sites.

Among the respondents that refused to receive the COVID-19 vaccine, the other health care workers (HCWs) indicated more willingness to receive the vaccine as compared to the doctors (48.8% vs 29.3%) even though the doctors signified a higher perceived risk to COVID-19 infection. This finding warrants further investigation, given that the present study revealed a significantly higher proportion of doctors with a personal history of COVID-19 infection and a heightened perception of risk of contracting the virus. Some of the perceived barriers in both groups included uncertainty of the safety and efficacy of the vaccines, perceived absence of scientific assurances, religion, fear or lack of trust in the government on vaccines and ignorance.

Just like the current study, Adedeji-Adenola et al. [35] also elucidated trust issues as to whether the COVID-19 vaccines produced were safe and effective and also fear of the side effects of the vaccines. Luma et al. [36], in their study of health care workers in Iraq, cited fear of side effects and a lack of confidence in using the vaccine as the most common perceived barriers among the 27.9% of respondents who were vaccine-hesitant. Here the midwives were more hesitant than the physicians and their study affirmed that higher educational level increased vaccine acceptance.

Even though this study elaborated a significantly perceived susceptibility to the virus among the doctors compared to other HCWs (Table 2), it is important to note that among the health care providers expressing hesitancy, a higher proportion of the doctors were unwilling to receive the COVID-19 vaccine though the finding was not statistically significant. The explanation here could be due to the fact that the doctors complied more with prevention practices and had low severity perception of COVID-19 symptoms if they contract the virus than other HCWs. This probably could be due to the doctors being more educated than the other HCWs which gives them a higher level of confidence in taking care of themselves. Costa [19] alluded to this in his study where respondents with lower schooling levels showed more concern about possible symptoms because of their perceived severity being much higher than those with higher educational levels. Conversely, in a Malaysian study [11], people with higher level of education (tertiary education) were more willing to consider receiving the vaccine than those with lower education level. A systematic review and meta-analysis conducted by Rahbeni et al. [37], revealed global vaccine hesitancy necessitating credible information dissemination and culturally sensitive interventions to foster vaccine acceptance

As stated earlier, more than 70% of the doctors and other HCWs had received the vaccine as at the time of collecting this data. This is an indication of perceived benefit outweighing perceived barrier. More encouraging is the fact that 79% of respondents in both groups indicated willingness to participate in sensitization on COVID-19 vaccination. Ensuring that all

healthcare providers are vaccinated against COVID-19 will significantly boost their confidence in engaging with clients and offering informed guidance on immunization. This is particularly crucial given the emergence of new COVID-19 variants circulating in the country, underscoring the importance of everyone receiving the recommended vaccine doses.

Conclusion

This study reveals similar perceived benefits and barriers to COVID-19 vaccination in the two groups with significant differences to perceived severity and susceptibility. It also indicates how these four central HBM constructs are modified by educational level, past experiences, and motivation.

COVID-19 infection is no longer classified as a public health emergency of international concern (PHEIC). However, it remains a global health threat in view of the lives that are being lost due to the disease. Therefore, health care providers should not let their guard down but should continue to manage the disease with utmost precautions.

Policymakers are also encouraged to consider the following specific recommendations:

1. Provide tailored, cadre-specific messaging to health care workers to ensure that information is relevant and addresses their unique roles and concerns.
2. Allocate dedicated and protected vaccination times at health facilities specifically for health care workers to encourage uptake without disrupting service delivery.
3. Ensure strong leadership endorsement of vaccinations to build trust and set a positive example for all staff in the health facility.
4. Develop and disseminate a set of frequently asked questions on adverse events following immunization (AEFI) to support health care workers with accurate, evidence-based responses.
5. Integrate contemporary issues, such as vaccine hesitancy, into continuing medical education (CME) modules to strengthen health workers' knowledge and communication skills.
6. Establish monitoring dashboards to track progress, identify gaps, and provide real-time feedback on vaccination coverage among health care workers.

This study is among the limited number of comparative analyses in the literature that examine COVID-19 vaccine uptake among health care workers. The application of the Health Belief Model (HBM) framework is particularly appropriate, as it provides valuable insights into vaccination behaviors, elucidates participants' perceptions of disease and immunization, and helps inform relevant interventions.

However few limitations should be acknowledged. These include the use of non-probability sampling so cannot be used to infer causality, the inability to assess health care workers' exposure to various media content, data collection based on self-reports with potential influence of social desirability bias, as well as instances of missing data in some responses.

Ethical Consideration

Ethical approval was obtained from the FCT Health Research Ethics Committee of the Department of Health and Human Services Secretariat, Federal Capital Territory Administration, Abuja.

Asokoro District Hospital further requested the submission of the research proposal to their own facility ethics committee, which was done and an approval was thereafter received to go ahead with the survey. A written informed consent was included in the questionnaire for the participants with assurance of confidentiality of their information. The return of a completed

questionnaire indicated voluntary participation in the study. Participants also had the right to withdraw from the study at any time, this was clearly stated to the participants.

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Conflict of Interest

The author confidently declares that there was no conflict of interest before, during and after the research study was carried out. The study's costs were borne entirely by the principal investigator.

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