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# Prevalence of COVID-19 Vaccine Hesitancy and Its Associated Factors among Health Care Workers in Imo State, Nigeria

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Background:** Vaccine hesitancy is an important public health concern which leaves healthcare workers at a high risk of getting infected with COVID-19. The lack in acceptance of COVID-19 vaccine sets the stage for increased morbidity and mortality among every age group globally.

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Therefore, acceptance of the vaccine is an effective strategy and major role in combating COVID-19 pandemic.

**Objectives:** To determine the prevalence of COVID-19 vaccine hesitancy among Health Care Workers in Imo state, Nigeria.

**Methodology:** The study was a descriptive cross-sectional study on the prevalence of COVID-19 vaccine hesitancy and its associated factors among HCWs in Federal Medical Centre, Owerri and Imo State University Teaching Hospital, Orlu. An electronic survey heart questionnaire was used to collect data. Data was analyzed using IBM Statistical Package for Social Science v23 and the result was presented using frequencies and proportions.

**Results:** The overall prevalence of hesitant among HCWs in Imo state is 35.4%. The majority of the participants are female (54.2%) single (53.6 %) and with a first degree as the highest level of education (70.9%) A higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that COVID 19 infection is real, (96.9%, 81.3%); A higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that they do not trust information from the internet/social media about COVID-19 and vaccine, (80.5%, 64.7%); that information from internet/social media made them worry about taking vaccine, (65.0%, 58.5%); that they feel there isn't enough information about vaccine and its safety, (54.5%, 42.9%); A higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that their consideration for the vaccine depend on how safe it is perceived, (84.4%, 80.5%); that their consideration for the vaccine depend on how long it has been tested, (74.6%, 69.6%); A higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that their consideration for the vaccine does not depend on the vaccine cost, (78.9%, 71.9%).

**Conclusion:** In this study approximately 1 out of every 3 HCWs surveyed reported being vaccine hesitant. Having hesitant among HCWs is a drawback to the success of the ongoing mass vaccination and COVID-19 eradication.

*Keywords: COVID-19 vaccine; health care workers; HCWs; hesitancy.*

## ACRONYMS

*HCWs : Health Care Workers*
*WHO : World Health Organization*
*COVID :Corona Virus Disease*
*CoV :Corona Virus*
*SARS-CoV-2 : Severe Acute Respiratory Syndrome Corona Virus 2*
*PHEIC :Public Health Emergency of International Concern*
*NPHCDA :National Primary Health Care Development Agency*
*SAGE : Strategic Advisory Group of Experts*

## 1. INTRODUCTION

### 1.1 Background of Study

The COVID-19 pandemic has placed enormous strain on countries around the world, the Coronavirus Disease of 2019 (COVID-19) pandemic gripped the globe with a shock at a time no economy of the world was ready. This led to the overwhelming of the various health systems of many nations. On January 30, 2020; World Health Organization declared it a Public Health Emergency of International Concern (PHEIC). (World Health Organization, 2011). This happened after WHO China country office made her announcement about the emergence of this novel viral disease on December 8, 2019. With the record of over 4 million deaths, and 185 million cases globally as of June 7 (2021). Following the WHO declarations on COVID-19; a preparedness group was constituted on January 31, 2020, in Nigeria. It is worthy of note that Nigeria is categorized as one of the 13 high-risk African countries with respect to COVID-19 spread according to WHO (Marbot, 2021).

COVID-19 as a pandemic, led multiple groups to swiftly go into the production of safe and effective vaccines to alleviate the problems coming from this pandemic. Several vaccines have received approval by the regulating authorities and are being sent to various countries (including Nigeria). This is a strategy to put an end to this pandemic. A lot of experts believe that large

scale vaccination of vast majority of people is the best strategy to gain control of the pandemic through sufficient 'herd immunity'. However, if people are not willing or delay in getting vaccinated, the strategy to gain control of the pandemic will be very challenging. Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite its availability and has been encountered since the invention of vaccines in 1796 by Edward Jenner (Jacobson et al., 2015). This could pose a problem for COVID-19 vaccinations as the rate of vaccine hesitancy globally has not changed or reduced regardless of the scientific advancements in vaccine development, improved education and communication strategies in recent times. In 2014, WHO Strategic Advisory Group of Experts (SAGE) on vaccine produced a report on vaccine hesitancy. This document categorized vaccine hesitancy into three broad factors: Confidence (trust in healthcare professionals, vaccines and their effectives); Complacency (low awareness of the risks of vaccine preventable diseases and vaccine importance); and Convenience (availability of vaccines, accessibility to vaccine and healthcare services) (MacDonald, 2015).

Different types of vaccines exist, and they work in different ways to offer protection. According to the National Primary Health Care Development Agency (NPHCDA), the AstraZeneca/Oxford COVID-19 vaccine is available in Nigeria and being used for vaccinations. The vaccine comes as a ready to use, liquid formulation and does not require dilution. It is a 10-dose vial with 0.5ml dose given intra muscularly. The vaccine is discarded 6 hours after being uncapped and the withdrawal of the first dose. It has a different shelf life for different temperatures; at 2$^{o}$c to 8$^{o}$c and 25$^{o}$c it is 9 months and 30days respectively. This vaccine is given at 2 doses schedule, with 28 days interval between the first and second doses. Other vaccines that are available in different parts of the world include Morderna COVID-19 vaccines, mRNA Pfizer-BioNTech COVID-19 vaccine, Johnson and Johnson COVID-19 vaccine, Sinovac, Sinopharm, Novavax etc (National Primary Health Care Development Agency, 2021).

As of May 14, 2021, just 1% of the 1.3 billion COVID-19 vaccines given globally have been administered in Africa. In most African countries, there are limited doses available which are reserved for the most vulnerable populations. Despite the limited supply of vaccines, many African countries stopped their vaccine rollouts due to safety concerns even among Health Care Workers (HCWs). The concern is not far from the fear of adverse effects as grossly reported in Europe and the United States of America.

AstraZeneca vaccine use among younger adults in Europe was suspended while this is the only vaccine available in most African countries (Nigeria inclusive). This affected the uptake of the vaccine among younger HCWs in Nigeria and other African states. Great concerns were raised regarding the safety and efficacy of COVID-19 vaccines, as well as myths and misinformation (infordemics) spreading on social media. All these have contributed to vaccine hesitancy in Nigeria (Stefania et al., 2021).

New evidence suggests that the drive for vaccine hesitancy is delaying vaccine delivery in certain countries and is also affecting advanced purchase agreement (APAs) for vaccines.[7] The fear of not knowing when the second dose of vaccine (for AstraZeneca vaccine) will be available is a driving force towards accepting or rejecting the available doses to HCWs.

## 1.2 Statement of Problem

HCWs and public are exposed to lots of conspiracy theories (especially on social media) such as claims that COVID-19 was intentionally created by the government or that the health organizations are exaggerating COVID-19's lethality for pharmaceutical and political gain. The social media has been a tool to spread false information and how resistant the vaccines are when received by Africans.

Negative perceptions towards vaccine sometimes are propagated by Community Engagement Frameworks, who are poorly informed about the Risk Communications and right ways to engaging the community members. The Risk Communication and Community Engagement (RCCE) activities are mostly championed by allied healthcare workers as frontline responders in communities.

The rapid pace of vaccine development may undermine vaccination confidence and increase complacency about the vaccine (Paterson et al., 2016). In Africa, Nigerian people believe that they are 'immune' to COVID-19 due to the climatic conditions in the African continent thereby aggravating COVID-19 vaccine hesitancy among HCWs too (Verger et al., 2021).

Vaccine hesitancy in retrospect is also contributory of the recent COVID-19 vaccine hesitancy. Historically, Northern Nigeria has been plagued with challenges of vaccine hesitancy due to reasons like; unmet needs, oral polio vaccine safety and political differences (Nzaji et al., 2020). The polio vaccine refusal in Northern Nigeria in 2003/2004 multiplied polio incidents and contributed to outbreak across three continents; this was driven by rumors and distrust (Martin et al., 2021).

Religion and culture in most parts of Nigeria believe that death is ascribed to God who is supreme in all even if apparent causation like vaccine preventable diseases can be identified as a probable cause. Therefore, any vaccine coming from the Western world is seen to be demonic (to some religious sect) or as a tool to undermine their religious belief or a tool of cultural appropriation.

## 1.3 JUSTIFICATION OF STUDY

The World Health Organization has identified vaccine hesitancy as a leading global health threat. Shekhar et al., 2021). The concern about the side effects which are being reported during the vaccine rollouts globally is an issue of great concern. In many developing countries especially in Africa, there are challenges with cold chain management and uncertainties over viability of vaccines at point of administration and this contributes to the disinformation about effectiveness of vaccination.

Similarly, the actions by some European governments in restricting, or stopping the use of AstraZeneca vaccine has further fueled the disinformation machinery and increased the distrust level on vaccine safety. Notwithstanding, AstraZeneca vaccine is still the only vaccine officially available and being administered in Nigeria at the time of this study.

News from other African countries have also contributed to the distrust levels of vaccine safety; it was reported that the Democratic Republic of Congo received 1.7 million AstraZeneca doses from COVAX but delayed their rollout after several European countries suspended the vaccine to investigate rare blood clots and now, the government is returning 1.3 million doses to COVAX before they expire. World Health Organization, 2019).

Disease prevention and control becomes a significant challenge if HCWs reject vaccination, as this, not only increases their risk of contracting and transmitting diseases, but they also have a potentially powerful influence on patient vaccination decisions. Vaccinated HCWs are more likely to recommend vaccination to others (Vaccine hesitancy slows Africa's COVID-19 inoculation drive, 2021).

A key factor in acceptance and uptake of a new vaccine in particular, COVID-19 vaccine is trust, and with a significant load of media misinformation and reportage of COVID-19 vaccine issues, some health care workers could become victims and develop vaccine hesitancy. These vaccines' hesitant if any, needs to be identified and addressed urgently as this could lead to poor vaccine uptake and coverage; and invariably, an uncontrollable spread of COVID-19. So, it becomes important to determine the prevalence of COVID-19 vaccine hesitancy and its associated factors among HCWs in Imo State, Nigeria.

## 1.4 Objectives of Study

To determine the prevalence of COVID-19 vaccine hesitancy and the associated factors among Health Care Workers in Imo state.

## 2. METHODOLOGY

## 2.1 Study Area

The study was carried out in Imo state; it is in the Southeastern region of Nigeria, with Owerri as its capital. The state is located at $5^{o}29$N latitude and $7^{o}25^{1}$E longitude coordinates. Imo state is part of the Igbo tribe with original inhabitants as Igbos. The state is bordered by Anambra, River Niger on the North, Rivers to the south, Delta on the West and Akwa Ibom to the East. Imo state has 3 senatorial zones; Owerri, Orlu and Okigwe with the total of 27 LGAs (Imo State, 2021).

Imo state has a population of 4928 million (2017 estimated); the population comprise 1,976,471 (2006 census) male and 1,951,092 (2006 census) female; 1,415,929 are age 0 to 14 years, 2,341,505 persons within 15 to 64 years and 170,069 above 65 years (Population census of Imo state, 2021).

Imo state is rich in fertile, arable agricultural land. Agriculture is the primary occupation, but due to over farming and high population density, the soil has greatly degraded. Other occupations include artisans, labourers, pharmaceutical manufacturers, marketers and unemployed (Imo State, 2021, Population census of Imo state, 2021). The socioeconomic class of Imo state is

that of the low and high socio-economic class categories. Imo state has primary, secondary and tertiary hospitals; and two tertiary hospitals were used for the study.

## 2.2 Study Design

The study was a descriptive cross-sectional design used to determine the prevalence of COVID-19 vaccine hesitancy and its associated factors among HCWs in Federal Medical Centre, Owerri and Imo State University Teaching Hospital, Orlu.

## 2.3 Study Population

The study population comprised of health care workers in Federal Medical Centre, Owerri and Imo state University Teaching Hospital Orlu, Imo state. The categories of health care workers enrolled in this study were Doctors, Nurses/midwives, pharmacists, medical laboratory scientists, Optometrist, radiographers, physiotherapist, lab technicians, and Community Health Extension workers.

### 2.3.1 Inclusion criteria

This study included all health care workers at Federal Medical Centre, Owerri and Imo State University Teaching Hospital, Orlu. There were no exclusion criteria.

## 2.4 Sample Size Estimation

The sample size was determined using Cochran's formula (Marbot et al., 2020)

$$n = \frac{z^2 \mathrm{pq}}{d^2} \quad (1)$$

Where n = minimum sample size

z = constant, standard normal deviate = 1.96 at 95% confidence interval

p = the population of HCWs that are COVID-19 vaccine hesitant

Established as 72.0% = 0.6.

d = margin of error/ level of precision - 5 % (0.05)

q = 1- p = 0.28

Substituting for the formula above

$$n = \frac{1.96^2 \times 0.72\ X\ 0.28}{0.05^2}$$

$$n = \frac{3.8416 \times 0.72 \times 0.28}{0.0025}$$

$$n = \frac{0.7745}{0.0025}$$

n = 309.8

10% attrition = 10/100 x 309.8 = 30.98

= 309.8 + 30.98

= 340.78

Minimum sample size will approximately be 341.

n = 341 ≈ (minimum sample size)

## 2.5 Sampling Methods

Imo State University Teaching Hospital, Orlu and Federal Medical Centre, Owerri were purposively selected.

Subsequently, convenient and snowball sampling techniques were used to select and enroll 173 health care workers each from the respective health institutions after informed consents.

## 2.6 Data Collection

An online structured questionnaire developed using the Survey Heart questionnaire template was administered to the study participants through a link sent to their email or WhatsApp platform. The questionnaire comprised of section A; Socio-demographic Characteristics of Health Care Workers in Imo State, section B; Vaccine Uptake Factors among Health Care Workers in Imo State**.**, section C; Contextual Perception Factors on Vaccine Uptake among Health Care workers in Imo State, Section D; Individual Perception Factors on Vaccine Uptake among Health Care Workers in Imo State, and section E; Vaccine Specific Perception Factors on Vaccine Uptake among Health Care Workers in Imo State. Each questionnaire took about 30 minutes to administer, and data collection took place over six months between February and July 2021.

## 2.7 Data Analysis and Presentation

The database of the online questionnaire was saved in Excel format. Data was cleaned, validated and subsequently exported to SPSS format where it was analyzed using IBM Software Package for Social Sciences (IBM-SPSS) version 22. Descriptive statistics (frequency tables, charts, proportions and summary indices) were generated.

Data was validated, imputed using survey heart electronic application and analyzed using IBM-SPSS version 23. Descriptive statistics (frequency tables, charts, proportions and summary indices) were generated. All variables were considered statistically significant at 95% confidence interval ($p < 0.05$).

## 2.8 Ethical Consideration

Permission to conduct this study was sought from participants through informed consent and ethical approval for this study was requested from the ethics committee of Imo State University Teaching Hospital, Orlu and Federal Medical Centre, Owerri.

## 3. RESULTS

Three hundred and forty-seven copies of the questionnaire were administered. All were filled giving a return rate of 100%.

**Table 1. Socio-demographic characteristics of health care workers in Imo State**

| Variables | Frequency (n=347) | Percentage |
|---|---|---|
| **Age Groups** | | |
| 20 – 29 | 198 | 57.1 |
| 30 – 39 | 92 | 26.5 |
| 40 – 49 | 47 | 13.5 |
| 50 and above | 10 | 2.9 |
| **Gender** | | |
| Male | 159 | 45.8 |
| Female | 188 | 54.2 |
| **Marital Status** | | |
| Single | 186 | 53.6 |
| Married | 160 | 46.1 |
| Divorced/Separated | 1 | 0.3 |
| **Religion** | | |
| Catholic | 167 | 48.1 |
| Anglican | 64 | 18.4 |
| Pentecostal | 107 | 30.8 |
| Traditional | 2 | 0.6 |
| Muslim | 7 | 2.0 |
| **Educational Level** | | |
| Diploma | 30 | 8.6 |
| First degree | 246 | 70.9 |
| Postgraduate | 71 | 20.5 |
| **Health Care Worker** | | |
| Doctor | 137 | 39.5 |
| Nurse/Midwife | 57 | 16.4 |
| Pharmacist | 12 | 3.5 |
| Lab Scientist | 22 | 6.3 |
| Others | 119 | 34.5 |
| **Usual Mode of Transport to work** | | |
| Private transport | 108 | 31.1 |
| Public transport | 239 | 68.9 |
| **Type of Residence** | | |
| Self-owned | 36 | 10.4 |
| Self-rented | 246 | 70.9 |
| Family house | 65 | 18.7 |
| **Vaccine Hesitancy** | | |
| Hesitant | 123 | 35.4 |
| Not Hesitant | 224 | 64.6 |

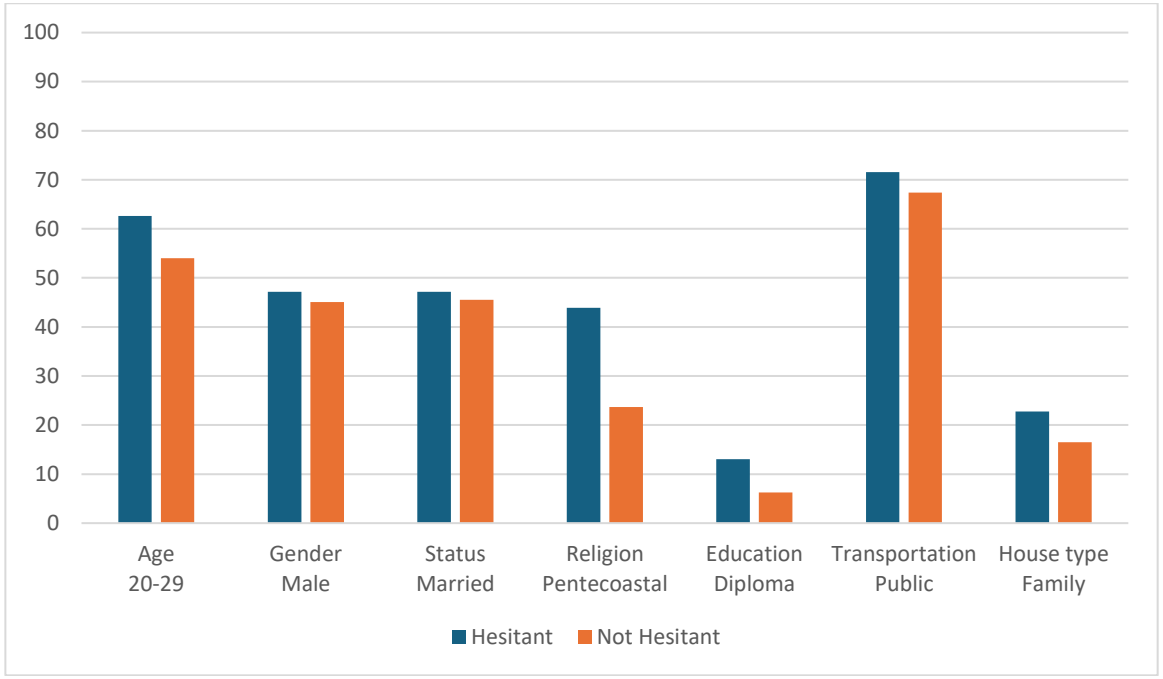


**Fig. 1. Sociodemographic Characteristics of HCWs in Imo State with higher proportion of Hesitant**

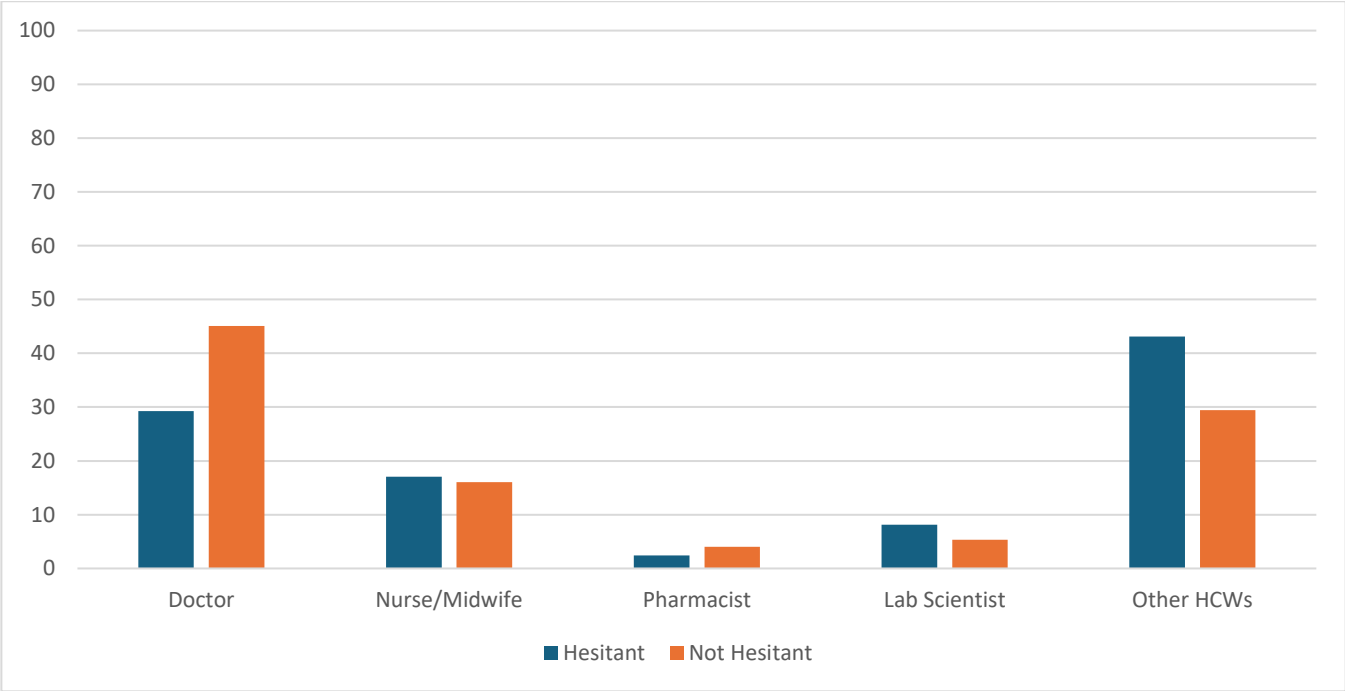


**Fig. 2. Categories of HCWs in Imo State and their level of Vaccine Hesitancy**

More than half of the study participants were female (54.2%), within the ages of 20-29 years (57.1%), single (53.6%) with a first degree as the highest level of education (70.9%) with public transportation being the usual mode of transport to work (68.9%) and living in a rented house (70.9%) (Table1).

More than one third of the study participants were COVID 19 vaccine hesitant (35.4%) (Table 1).

There were a higher proportion of hesitant compared to non-hesitant in the following sociodemographic sub-categories of the study participants; 20-29 years, male, married, Pentecostal religion, diploma education, public transportation and living in a family house (Fig. 1).

Doctors who constituted a majority of the study participants (39.5%) (Table1), had a higher proportion of non-hesitant compared to hesitant unlike the Nurse/Midwives, Lab Scientists and other HCWs who had a higher proportion of hesitant compared to Non-hesitant (Fig. 2).

A higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that COVID 19 infection is real, (96.9%, 81.3%); that they would encourage hospital patients to take the vaccine (95.1%, 51.2%); that they would not stop their family/relative from taking the vaccine (92.0%, 56.1%); that they would not discourage friends/neighbours from taking vaccine, (92.9%, and 64.2%); and a higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that they would not like the Government to mandate its workers to take the vaccine, (87.0%, 56.7%), (Table 2).

A higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that they do not trust information from the internet/social media about COVID-19 and vaccine, (80.5%, 64.7%); that information from internet/social media made them worry about taking vaccine, (65.0%, 58.5%); a higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that they have not heard their priest/pastor/imam speaking against COVID-19 vaccinations (74.1%, 65.9%); that they have not experienced any past event that could reduce their trust in vaccines, (77.7%, and 59.3%); that their religion or culture do not discourage vaccinations, (95.5%, 92.7%); that they trust the Government to provide the right vaccines, (69.6%, 28.5%); that the distance, transport cost or clinic wait time will not discourage them getting vaccine, (65.2%, 61.0%); that having a chronic illness would not discourage them from getting the vaccine, (51.8%, 43.9%) and that they trust the vaccine producers to develop safe and effective vaccines, (79.9%, 48.8%), (Table 3).

A higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that they feel that, hearing of someone with an alleged reaction would not stop them taking the vaccine, (40.6%, 12.2%); that they feel there are no ways to treat COVID-19 infection instead of using the vaccine, (48.2%, 25.2%); A higher proportion of Vaccine hesitant compared to non- vaccine hesitant reported that they feel there isn't enough information about vaccine and its safety, (54.5%, 42.9%); that they feel the Government has no ulterior motive to encourage you take COVID-19 vaccination, (57.1%, and 34.1%);a higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that they feel worried that they may get reaction if they take the vaccine, (88.6%, 59.4%); and a higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that they feel they will take the vaccine if all their friends have taken the vaccine, (61.2%, 18.7%), (Table 4).

A higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that their consideration for the vaccine depend on how safe it is perceived, (84.4%, 80.5%); that their consideration for the vaccine depend on how long it has been tested, (74.6%, 69.6%); A higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that their consideration for the vaccine does not depend on the vaccine cost, (78.9%, 71.9%); A higher proportion of Non-Vaccine hesitant compared to vaccine hesitant reported that their consideration for the vaccine does not depend on which country it was produced in, (52.7%, and 48.0%); that their consideration for the vaccine depend on type of COVID vaccine available, (57.1%, 52.0%); A higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that their consideration for the vaccine does not depend on how many doses are required (67.5%, 63.8%); and a higher proportion of Vaccine hesitant compared to non-vaccine hesitant reported that their consideration for the vaccine does not depend on vaccine usage by your colleagues, (77.2%, 69.6%), (Table 5).

**Table 2. Vaccine Uptake Factors among Health Care Workers in Imo State**

| Variables | Vaccine Hesitant (%) n=123 | Not Vaccine Hesitant (%) n=224 | Total (%) N=347 |
|---|---|---|---|
| Is COVID 19 Infection real? | | | |
| **Yes** | 100(81.3) | 217(96.9) | 317(91.4) |
| **No** | 3(2.4) | 2(0.9) | 5(1.4) |
| **I don't know** | 20(16.3) | 5(2.2) | 25(7.2) |
| Would you encourage hospital patients to take the vaccine? | | | |
| **Yes** | 63(51.2) | 213(95.1) | 276(79.5) |
| **No** | 27(22.0) | 4(1.8) | 31(8.9) |
| **I don't know** | 33(26.8) | 7(3.1) | 40(11.5) |
| Would you stop your family/relative from taking the vaccine? | | | |
| **Yes** | 34(27.6) | 12(5.4) | 46(13.3) |
| **No** | 69(56.1) | 206(92.0) | 275(79.3) |
| **I don't know** | 20(16.3) | 6(2.7) | 26(7.5) |
| Would you discourage friends/neighbours from taking vaccine? | | | |
| **Yes** | 30(24.4) | 9(4.0) | 39(11.2) |
| **No** | 79(64.2) | 208(92.9) | 287(82.7) |
| **I don't know** | 14(11.4) | 7(3.1) | 21(6.1) |
| Would you like Government to mandate its workers to take the vaccine? | | | |
| **Yes** | 16(13.0) | 97(43.3) | 113(32.6) |
| **No** | 107(87.0) | 127(56.7) | 234(67.4) |

**Table 3. Contextual Perception Factors on Vaccine Uptake among Health Care workers in Imo State**

| Variables | Vaccine Hesitant (%) n=123 | Not Vaccine Hesitant (%) n=224 | Total (%) N=347 |
|---|---|---|---|
| Do you trust information from the internet/social media about COVID-19 and vaccine? | | | |
| **Yes** | 24(19.5) | 79(35.3) | 103(297) |
| **No** | 99(80.5) | 145(64.7) | 244(70.3) |
| Has information from internet/social media made you worry about taking vaccine? | | | |
| **Yes** | 80(65.0) | 131(58.5) | 211(60.8) |
| **No** | 43(35.0) | 93(41.5) | 136(39.2) |
| Have you heard your priest/pastor/imam speaking against COVID-19 vaccinations? | | | |
| **Yes** | 42(34.1) | 58(25.9) | 100(28.8) |
| **No** | 81(65.9) | 166(74.1) | 247(71.2) |
| Have you experienced any past event that could reduce your trust in vaccines? | | | |
| **Yes** | 50(40.7) | 50(22.3) | 100(28.8) |

| Variables | Vaccine Hesitant (%) n=123 | Not Vaccine Hesitant (%) n=224 | Total (%) N=347 |
|---|---|---|---|
| **No** | 73(59.3) | 174(77.7) | 247(72.2) |
| Does your religion or culture discourage vaccinations? | | | |
| **Yes** | 9(7.3) | 10(4.5) | 19(5.5) |
| **No** | 114(92.7) | 214(95.5) | 328(94.5) |
| Do you trust the Government to provide the right vaccines? | | | |
| **Yes** | 35(28.5) | 156(69.6) | 191(55.0) |
| **No** | 88(71.5) | 68(30.4) | 156(45.0) |
| Would distance, transport cost or clinic wait time discourage you getting vaccine? | | | |
| **Yes** | 48(39.0) | 78(34.8) | 126(36.3) |
| **No** | 75(61.0) | 146(65.2) | 221(63.7) |
| Would having a chronic illness discourage you from getting the vaccine? | 69(56.1) | 108(48.2) | 177(51.0) |
| **Yes** | 54(43.9) | 116(51.8) | 170(49.0) |
| **No** | | | |
| Do you trust the vaccine producers to develop safe and effective vaccines? | 60(48.8) | 179(79.9) | 239(68.9) |
| **Yes** | 63(51.2) | 45(20.1) | 108(31.1) |
| **No** | | | |

**Table 4. Individual Perception Factors on Vaccine Uptake among Health Care Workers in Imo State**

| Variables | Vaccine Hesitant (%) n=123 | Not Vaccine Hesitant (%) n=224 | Total (%) N=347 |
|---|---|---|---|
| Do you feel that hearing of someone with an alleged reaction would stop you taking the vaccine? | | | |
| **Yes** | 82(66.7) | 66(29.5) | 148(42.7) |
| **No** | 15(12.2) | 91(40.6) | 106(30.5) |
| **Not sure** | 26(21.1) | 67(29.9) | 93(26.8) |
| Do you feel there are ways to treat COVID-19 infection instead of using the vaccine? | | | |
| **Yes** | 37(30.1) | 35(15.6) | 72(20.7) |
| **No** | 31(25.2) | 108(48.2) | 139(40.1) |
| **Not sure** | 55(44.7) | 81(36.2) | 136(39.2) |
| Do you feel there is enough information about vaccine and its safety? | | | |
| **Yes** | 32(26.0) | 87(38.8) | 119(34.3) |
| **No** | 67(54.5) | 96(42.9) | 163(47.0) |
| **Not sure** | 24(19.5) | 41(18.3) | 65(18.7) |
| Do you feel the Government has ulterior motive to encourage you take COVID-19 vaccination? | | | |
| **Yes** | 36(29.3) | 36(16.1) | 72(20.7) |
| **No** | 42(34.1) | 128(57.1) | 170(49.0) |
| **Not sure** | 45(36.6) | 60(26.8) | 105(30.3) |
| Do you feel worried that you may get a reaction if you take the vaccine? | | | |
| **Yes** | 109(88.6) | 133(59.4) | 242(69.7) |
| **No** | 14(11.4) | 91(40.6) | 105(30.3) |
| Do you feel you will take the vaccine if all your friends | | | |

| Variables | Vaccine Hesitant (%) n=123 | Not Vaccine Hesitant (%) n=224 | Total (%) N=347 |
|---|---|---|---|
| have taken the vaccine? | | | |
| **Yes** | 23(18.7) | 137(61.2) | 160(46.1) |
| **No** | 100(81.3) | 87(38.8) | 187(53.9) |

**Table 5. Vaccine Specific Perception Factors on Vaccine Uptake among Health Care Workers in Imo State**

| Variables | Vaccine Hesitant (%) n=123 | Not Vaccine Hesitant (%) n=224 | Total (%) N=347 |
|---|---|---|---|
| Does your consideration for the vaccine depend on how safe it is perceived? | | | |
| **Yes** | 99(80.5) | 189(84.4) | 288(83.0) |
| **No** | 24(19.5) | 35(15.6) | 59(17.0) |
| Does your consideration for the vaccine depend on how long it has been tested? | | | |
| **Yes** | 86(69.9) | 167(74.6) | 253(72.9) |
| **No** | 37(30.1) | 57(25.4) | 94(27.1) |
| Does your consideration for the vaccine depend on the vaccine cost? | | | |
| **Yes** | 26(21.1) | 63(28.1) | 89(25.6) |
| **No** | 97(78.9) | 161(71.9) | 258(74.4) |
| Does your consideration for the vaccine depend on which country it was produced in? | | | |
| **Yes** | 64(52.0) | 106(47.3) | 170(49.0) |
| **No** | 59(48.0) | 118(52.7) | 177(51.0) |
| Does your consideration for the vaccine depend on type of COVID vaccine available? | | | |
| **Yes** | 64(52.0) | 128(57.1) | 192(55.3) |
| **No** | 59(48.0) | 96(42.9) | 155(44.7) |
| Does your consideration for the vaccine depend on how many doses are required? | | | |
| **Yes** | 40(32.5) | 81(36.2) | 121(34.9) |
| **No** | 83(67.5) | 143(63.3) | 226(65.1) |
| Does your consideration for the vaccine depend on vaccine usage by your colleagues? | | | |
| **Yes** | 28(22.8) | 68(30.4) | 96(27.7) |
| **No** | 95(77.2) | 156(69.6) | 251(72.3) |

## 4. DISCUSSION

The study assessed the prevalence of COVID-19 vaccine hesitancy and its associated factors among health care workers in Imo State and it revealed that 35.4% of the respondents were hesitant (which is more than one third of the participants). This is consistent with the study done in DRC, where a systematic review of vaccine hesitancy among HCWs observed a hesitancy rate of more than 70% as only 27.1% accepted to be willingly vaccinated, similar with 21.9% of HCWs accepting vaccination in Israel (Bostan et al., 2021, Sallam et al., 2021). In a contrary study done in Abia state Nigeria, half of the respondents were reported to be COVID-19 vaccine hesitant (Chidinma et al., 2021). Also in contrast with the study done in the USA were 50% among HCWs from the South of the United States were hesitant (Thomas, 2021). Further study in Sub-Saharan Africa was found to have the prevalence of COVID-19 vaccine hesitancy among HCWs to be 46% which shows a slight increase in hesitancy rate among HCWs (Kigongo et al., 2023, Christodoulakis, 2024).

The study shows that the age group 20 – 29 (57.1%) has the highest frequency. For the younger age range of 20 – 29 years having the highest frequency could be as a result of the fact that, most of the participants used in that category were House Officers (doctors) and

Intern nurses. The present study shows that acceptance of the vaccine increases with the age of the respondents, which is why the highest proportion of hesitant are those in 20 – 29 years age group. In a study done in Abia State Nigeria, age was a predictor of COVID-19 vaccine hesitancy among HCWs (Chidinma et al., 2021). In contrast with several studies, it was observed that respondents of older age group were less likely to accept the COVID-19 vaccine (El-Elimat et al., 2021, Ali and Hossain, 2021).

From the study population, there were more females (54.2%) that participated in the survey compared to the males (45.8%). Based on the finding from the study, the general populations of the non-hesitant participants were female. Contrary to previous study which shows that gender had no influence on the rate of vaccine acceptance (Hospital Survey on Patient Safety Culture, 2021, Persad et al., 2021). and another contrary study shows that males were two times more willing to accept the vaccine than females (Chou et al., 2020). This suggests that gender does not exert a definite rate of influence on COVID-19 vaccine acceptance rather from different studies the hesitant gender differs from one survey to another.

From the present study, majority of the participants are single (53.6%) this could be because most persons selected for the study were still young and not married yet. For the religion, the study shows that two third of the hesitant are Pentecostal Christians. This could mean that some religious indoctrination or previous believe system in those churches limit their acceptance of COVID-19 vaccine. The hesitant makes up all the traditional believers' populations which shows that cultural belief and traditional norms could be a factor to such finding. The numbers of hesitant among the catholic, Anglican and Muslim participants are less. Most of them either have taken the vaccine or are willing to take the vaccine. A few participants had reservations with their religious group not included in the study survey.

The educational level of the HCW is an essential determinant of hesitancy as more non-hesitant appear to have postgraduate and first-degree educational levels in the present study, while a higher proportion of hesitant is revealed among those with diploma. But in contrary to these studies, country-level analysis observed that in Spain, the UK and Canada, the highly educated were linked to higher hesitancy (Lazarus et al., 2020).

The study shows that out of all the hesitant, the proportions of hesitant that are doctors (39.5%) compared with other HCW is relatively less. Similar with a recent study, vaccine hesitant were less among clinical staff consisting of doctors and nurses compared to non-clinical staff, (Lazarus et al., 2020) also finding has been documented doctors reported high willingness to be vaccinated than other categories of HCWs (Kabamba et al., 2021, Biswas et al., 2021).

HCWs that usually go to work with private transport have a higher proportion of non-hesitant compared with the high proportion of hesitant that uses public transport. This could mean that senior staff among HCWs who are the majority of the population that uses private transport are properly informed and understands the implications of not accepting the COVID-19 vaccine. The younger staff among HCW are much younger by age and experience with lesser family responsibilities as most of them are still single, so they don't see the importance of accepting the vaccine or maybe they are less informed or due to lack of trust. Recent studies show that trust issues in the safety of the vaccine and its novelty are parts of the most rate limiting factors that affect successful vaccination (Gadoth et al., 2021).

The level of vaccine hesitant HCWs is less than 50% as observed in this present study. Similar to recently published studies on HCW vaccine hesitancy, the result suggests that workers who are hesitant were likely to be younger in age; not doctors or had concerns surrounding adverse side effects affecting their bodies on taking the vaccine (Sallam, 2021). In this study, the non-hesitant respondents are higher compared to the hesitant respondents.

A vast majority of the non-hesitant HCW attest that COVID-19 is real (96.9%). This could be because of the people that have seen manifest symptoms of COVID-19 in the past or because of the nature of awareness and information made available concerning the disease. This shows that a higher proportion of non-hesitant HCWs would encourage hospital patients to take the vaccine (95.1%) and will not stop their family/relative from taking the vaccine (92.0%). The data from this present study reveals that the decision to vaccinate was least influenced by colleagues and their choices does not affect the

professional advice they give to hospital patients, friends and neighbours. Therefore, in terms of confidence, HCWs are with more knowledge about the vaccine and are likely recommending it to patients, family and friends, but it's still important to provide them with the support to manage difficult conversation with a reluctant patient or relative (Gadoth et al., 2021). This as well reveals that most hesitant among the HCWs may not have enough knowledge about the vaccine and that is why they may stop their patients and relatives from accepting the vaccine. Relatively, from the study, small proportion of the hesitant (27.6%) and non-hesitant (5.4%) participants will stop their family and relatives from taking the vaccine.

In the present study, majority of the respondents reported that they would not like the government to mandate its workers to take the vaccine (87.0%). Similar study shows that hospital health care systems and state government are increasingly mandating vaccination against COVID-19 for health care workers across the United States (Biswas et al., 2021). The effort of government mandating its workers to take the vaccine comes with harm and the potential to exacerbate issues of hesitancy, communication and inequities in agency (Biswas et al., 2021). Government mandating citizens to take the vaccine may not be effective if the conspiracy theories are not first handled. In a recent study in Nigeria, people think the vaccine contains 'mark of the beast'; while others believe that there are alternative drugs other than COVID-19 vaccine (Gadoth et al., 2021). Another study shows that one-fifth of the participants were not willing to take the vaccine due to lack of trust about the safety of the COVID-19 vaccine (Hospital Survey on Patient Safety Culture, 2021).

The data in the present study suggests that the issue of mistrust and communication is high thereby information from the internet/social media about COVID-19 and vaccine is not trusted (80.5%) and over a half of the participants (65.0%) reported that the information from the internet/social media made them worry for taking the vaccine. Trust building is very important and increases confidence among HCWs and this is essential for instilling acceptance in the community at large (Persad and Emanuel, 2021). The study shows that in other Contextual Perception Factors on vaccine uptake among health care workers that religion and culture; lived experience from past events; and clinic wait time, transport cost or distance does not directly contribute to vaccine hesitancy (95.5%; 77.7% and 65.2%). The majority of the respondents never had any past event that could reduce their trust in vaccines; this suggests that the hesitancy was not based on lived experience from past events.

Furthermore, the present study shows that a higher proportion of vaccine hesitant reported that they feel there is not enough information about vaccine and its safety (54.4%). This suggests that poor information on safety could be contributory to the level of vaccine hesitant. But non-hesitant (57.1%) feels that the government has no ulterior motive to encourage HCWs to take COVID-19 vaccination. In as much as a higher proportion of non-vaccine hesitant compared to vaccine hesitant feel they will take the vaccine if all their friends have taken the vaccine (61.2%) but a higher proportion of vaccine hesitant feel worried that they may get reaction if they take the vaccine (88.6%).

The study has much strength, including its survey of a large diverse healthcare population in Imo state. By using a framework that captures both HCW's individual perception factors and vaccine specific perception factors on vaccine uptake among health care workers in Imo state. This can be used to improve vaccination rate in the HCWs population.

The present study reveals that the state of health of the respondents is not a determinant as presence of chronic illnesses did not affect the hesitant nature of the participants knowing that COVID-19 infection is a risk factor for morbidity and mortality. From the present study, a high proportion of non-hesitant (51.8%) compared with the hesitant (43.9%) responded that chronic illness will not discourage them from getting the vaccine. In line with the study, another study shows high hesitancy with HCWs who are with co-morbid illnesses (Gadoth et al., 2021, Gagneux-Brunon et al., 2021, Dror et al., 2020). In contrast to the present study, another study shows that co-morbidities and prior diagnosis of COVID-19 may influence individual's perceived risk of COVID-19 and hence need for vaccination (Adeniyi et al., 2021).

The considerations made in the present study for the vaccine depends on how safe it is perceived; how long it has been tested; the vaccine cost; the country it was produced in; type of vaccine available and number of doses required. In all, a higher proportion of non-vaccine hesitant

compared to the vaccine hesitant shows that safety, and clinical test (84.4%; 74.6%) was an essential factor. Same with the country it was produced in and type of vaccine available (52.7%; 57.1%). A higher proportion of vaccine hesitant considers the vaccine depending on the cost (78.9%) and doses required (67.5%).

The consideration of the safety of the vaccine is important to hesitant in their decision in getting the vaccine. A study done in South Africa shows that respondents were hesitant on vaccine due to safety, but prior to the pandemic era, state sector HCWs were offered routine Hepatitis B and annual influenza vaccine, though they were voluntary. The test duration the vaccine passes through is another vaccine specific perception factor on vaccine uptake and majority of vaccine hesitant among HCWs revealed that the test duration informed their hesitancy. The short duration is a worry to hesitant as other vaccines took longer time before they were certified for use. A higher proportion of hesitant participants (78.9%) revealed that the vaccine cost is not a consideration for them to take the vaccine. This could be that they are aware that the vaccine is given without pay now, so even at the point of being hesitant, their lack of accepting the vaccine is not cost related.

Slightly above half the proportion of the hesitant among HCWs (52.1%) consider the country in which the vaccine is produced in before they can accept it. This means that the level of vaccine uptake will be dependent on how much trust a respondent has on a particular country. It suggests that some hesitant among HCWs are not okay with the countries or companies that manufactured the COVID vaccines currently available in the country. A majority of the hesitant among HCWs consider the type of vaccine available (52.0%) thereby, the low level of uptake among them maybe because. they do not like the types of vaccines available in the country at the time this study was done.

The present study reveals that 63.3% of non-hesitant among HCWs do not consider the number of doses required for the vaccine. This could be because the two COVID vaccines available in Nigeria require double doses. And everyone willing to take either AstraZeneca or Moderna vaccines will take two doses of any. Similar with the hesitant among the respondents, they do not consider the number of doses required which means that the doses are not the reason for their hesitancy. In a contrary study, about 78% of non-hesitant participants preferred a single dose vaccine if presently available. This is in countries where vaccines administered at a single dose are readily available for HCWs population.

Finally, in the present study, the majority of the hesitant (77.2%) does not have consideration for the vaccines based on vaccine usage by their colleagues. Therefore, peer and colleague pressure is not a major vaccine specific perception factor on vaccine uptake among health care workers in Imo state.

## 5. CONCLUSION

This study has established that the prevalence of COVID-19 vaccine hesitancy and its associated factors among health care workers in Imo state is 35.4%. Approximately 1 out of every 3 HCWs surveyed reported being vaccine hesitant. HCWs are not influenced by colleagues' decision but they still believe that COVID-19 vaccination is important which may support trust and communication across departments and roles with the mindset of improving vaccination rates. Other HCWs (excluding doctors, nurses and lab scientists) have low likelihood of receiving vaccination against COVID-19 and should be a targeted group to improve communication regarding COVID-19 vaccination.

To improve on the study on COVID-19 hesitancy among health workers it is important to do the following;

- Research works need to be carried out on each category of health care workers to improve vaccine acceptance among health workers.
- Efforts are needed to promote intention to get hesitant HCWs vaccinated against COVID-19, as the vaccine is available in the state and a regulatory approval is given for both AstraZeneca and Moderna vaccines.
- Public health intervention programmes should focus on increasing the perception of the benefits of COVID-19 vaccination among health workers, and to reduce the perceived adverse effect and inefficacy barriers revolving around COVID-19 vaccine conspiracy theories.
- Clinical evidence of the safety and efficacy of COVID-19 vaccines are key messages to enhance rates of vaccine coverage

among health care workers, especially those outside the subcategory of doctors.

- Promoting COVID-19 vaccination in the forms of advertorials and testimonials may prompt vaccination decision and promote discussions on the negative impacts of vaccine hesitancy among health care workers during joint clinical meetings of HCWs.
- Further measures are needed to identify and restore confidence in COVID-19 vaccines made in some countries among certain individuals and group of HCWs.
- HCWs that chose not to accept the vaccines need further engagements targeting their fears about adverse events and myths surrounding the COVID-19 vaccine.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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

## CONSENT

All participants signed consent forms for participation and publication as part of the consent process at enrolment.

## ETHICAL APPROVAL

Ethical approval was obtained from the Federal Medical Center, Owerri Research Ethics Committee, as well as that of the Imo State University Teaching Hospital, Orlu, Imo State Nigeria.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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