

## Original Research Article

# HERD IMMUNITY, THE BEST WAY OUT OF SARS COV-2 PANDEMIC. PREACHING THE GOOD NEWS ABOUT COVID-19 VACCINE AND VACCINE EFFICACY

## ABSTRACT

**Aims:** To investigate vaccine efficacy amongst the vaccinated population and also to investigate the willingness to be vaccinated among the unvaccinated population of Oke-Ogun region of Oyo State, Nigeria.

**Study design:** A snowball sampling approach was used.

**Place and duration of study:** Samples were collected randomly from the general populace of Oke-Ogun, Oyo State, between 20<sup>th</sup> of January to 20<sup>th</sup> of April, 2022. Analysis of samples was carried out at the medical laboratory unit of Adeniyi Memorial Hospital, Igbobe.

**Methodology:** 500 consenting adults were recruited to participate in the study (250 health workers and 250 non health workers, aged 18 years and above) vaccinated or unvaccinated with SARS-CoV-2 vaccine. A standard questionnaire was administered to the participants and consenting adults were sampled and tested using a SARS-CoV-2 rapid diagnostic antigen test kit. A 2 x 2 contingency table (chi-square method, 2-tailed with 1 degree of freedom test) was used to determine the efficacy of SARS-CoV-2 vaccine.

**Results:** Among the 500 participants, 328 (65.6%) participants have been vaccinated, although 214 (42.8%) participants accounted for full vaccination. Higher vaccination rate 220 (88%) occurred among the health workers compared to 153 (61.2%) among the other participants. From the non-immunized participants, only 32 (18.6%) are willing to get vaccinated immediately, 95 (55.23%) were not willing to get the vaccination unless they know more about the virus and the vaccines. Infection rate was seen to be higher among the unvaccinated population (10.24%) compared to the vaccinated population (2.6%). Furthermore, infection among the unvaccinated health worker (13.3%) was seen to be higher than the unvaccinated non-health workers participants (9.2%).

**Conclusion:** Covid-19 vaccine has proved to be efficient with high degree of immunity conferred on fully-immunized individuals. This will help in the reduction of the severity, mortality of the disease and reduction of the impact of the pandemic on the National Health System and economy of countries.

**Keywords:** [SARS-CoV-2, Vaccination, Covid-19, Infection, Vaccine efficacy, vaccine acceptability, Rapid diagnostic test kit].

## 1. INTRODUCTION

Coronavirus (SARS-CoV-2) is a pandemic that has destabilized human life, health, family and country's economy. The pandemic was declared in March 2020 (1) after it was first discovered in Wuhan, China. The first confirmed case in

Nigeria was announced on 27 February 2020, when an Italian national in Lagos tested positive for the virus (2,3). On 9 March 2020, a second case of the virus was reported in Ewekoro, Ogun State, a Nigerian citizen who came into contact with the Italian national (4,5). The number of confirmed cases as at 13<sup>th</sup> of June, 2022 is 256,246. However, there has been far less testing for the virus in Nigeria than other countries (6). In Oyo state, 10,219 cases have been reported (7). On 17 March, 2020, Oyo State recorded her first case of COVID-19 through a returnee from the United Kingdom (8).

Several measures have been taken against the disease in order to control its transmission these include hand hygiene, physical distancing, avoidance of large gathering and the use of face mask; all these are targeted at reducing the rapid spread of the disease. In response to the pandemic, the global efforts to develop multiple vaccines to protect against COVID-19 disease have been unrivalled in the history of public health. The greatest success will rely on successful vaccination plan against the SARS-CoV-2 virus to bring an end to the epidemic. A herd immunity of the population must be achieved as this can prove greatly successful in the campaign against SARS-CoV-2 outbreak and to further prevent the emergence of new variants of the virus. Until we reach herd immunity, COVID-19 will remain a public threat and the next mutation could be more lethal (9). In a study, vaccine acceptance rate is 74.5% in Nigeria (10). But this high rate is accounted for mostly by the health practitioners.

Covid-19 vaccine has proved to be efficient with high degree of immunity conferred on fully-immunized individuals (11). The vaccine also helps in the reduction of the severity, mortality of the disease and reduction of the impact of the pandemic on the National Health System and economy (12). However, vaccine hesitancy had been a major dilemma in the achievement of SARS-CoV-2 vaccination plan. To date various surveys have been developed to assess individual attitudes as well as concerns around the risks and benefits of immunization (13, 14).

The population's perception of SARS-CoV-2 vaccine has most likely influenced by their knowledge about the health consequences of SARS-CoV-2 infection and the importance of the vaccine to prevent these consequences (15) has really determined the vaccine acceptability by the population. There has been little COVID-19 testing and vaccination carried out in the Oke-ogun axis of Oyo State, major COVID-19 testing and vaccination has been done in the capital city, Ibadan and this necessitated the reason for this study. The vaccine type used in Oyo state, Nigeria as at when this study was conducted was AstraZeneca and Pfizer though no specification of vaccine type was collected for this study. This survey is conducted to investigate vaccine efficacy amongst the vaccinated population and also to investigate the willingness to be vaccinated among the unvaccinated population of Oke-Ogun region of Oyo State, Nigeria as this is important for planning the COVID-19 vaccination campaign and programme. It is also aimed to determine vaccine efficacy among the participants which can serve as a tool to preach the good news about the vaccine.

## 2. MATERIAL AND METHODS

### Study Setting and Design

A cross-sectional study was conducted from 20<sup>th</sup> of January to 20<sup>th</sup> of April, 2022 among the general population of Oke-Ogun, Oyo State. Oyo state is situated in the South-Western part of Nigeria. The State has 33 local government areas (LGAs) while 10 of these are located in the Oke-Ogun axis of the state. These LGAs has varying incidence of COVID-19. As at 11 June 2020, a total of 34 confirmed cases were identified all within the capital city of Oyo State (8). Oyo State has a projected population of 8,929,410 with annual growth rate of 3.2% (16). Oyo State is predominantly populated by the Yoruba ethnic group with a sparse presence of other ethnic nationalities. The inhabitants are majorly engaged in farming, trading and some of them are artisans and civil servants.

**Study type:** A snowball sampling approach. 500 consenting adults were recruited (250 health workers and 250 non health workers) were tested using a SARS-CoV-2 rapid diagnostic test kit after appropriately filling a questionnaire.

### Data Collection

Individuals aged 18 years and above who gave consent participated in the survey. We collected general information and vital information about the research participants was collected using a well-structured questionnaire. The data include; demographic data, anthropometric data, medical histories, acceptability of the COVID-19 vaccine and a consent on SARS-CoV-2 antigen test. Vaccinated participants who were tested are participants with 3-month old first vaccination history. Other information collected includes major reasons for vaccine hesitancy. All responses were collected and collated anonymously both manually and, on a password-protected laptop until the day for analysis.

The specimen collected was nasopharyngeal swab. A sterile swab was inserted into the nostrils of participants so that it reaches the depth equal to the distance from nostrils to the outer opening of the ear. It was rotated 3-4 times against the surface of the nasopharyngeal and then withdrawn. The swab was then inserted into an extraction buffer tube, the buffer tube was squeezed and the swab was stirred for more than 5 times. The specimen was then mix with extraction buffer.

The extracted specimen was dropped on the specimen well of the test device through the nozzle cap and result was read in 15-30minutes.

## INTERPRETATION OF TEST RESULT

1. To show that the test is working properly, a purple colored band appears on the band of the control line (C).
2. A purple colored band either faint or non-uniform or clear line appearing on the SARS-COV-2 antigen (T) band shows a positive test.
3. Invalid test are results that show no colored line on the band of the control line (C).

## Data analysis

Data collected from this study was analysed using the statistical software statistical package for social sciences (SPSS 16). Age, being a continuous variable was categorized into age groups. For all categorical variables, descriptive statistics were presented as percentages (%). Age and gender were included in the study to show the population's demographics. 2 x 2 contingency table (chi-square method, 2-tailed test) was used to determine the efficacy of SARS-CoV-2 vaccine (17) and values was considered as statistically significant at  $p < 0.05$  at 95% confidence level.

## 3. RESULTS AND DISCUSSION

### RESULTS

#### Socio-Demographic Characteristics of the Participants

The responses of 500 participants were included in the analysis. Most respondents were male (65%), the majority were in the 30-50 age group (58.3%), also major respondents are into agriculture (18.2%) other than health workers which was planned to include 50% of respondents and also most respondents have tertiary education (60%).

Socio demographic characteristics	Number of sample (%) N=500
<b>Age group</b>	
18-30	104 (20.8%)
31-50	298 (59.6%)
51-65	84 (16.8%)
>65	14 (2.8%)
<b>Gender</b>	
Male	323 (64.6%)
Female	177 (35.4%)
<b>Educational status</b>	
Primary education	25 (5%)
Secondary education	93 (18.6%)
Tertiary education	300 (60%)
No education	82 (16.4%)
<b>Employment industry</b>	
Agriculture	91 (18.2%)
Construction	9 (1.8%)
Manufacturing	27 (5.4%)
Trading	67 (13.4%)
Health care	250 (50%)
Art and Entertainment	22 (4.4%)
Finance	6 (1.2%)
Education	10 (2%)
Not working	18 (3.6%)

Table 1. Socio-demographic characteristics of the participants

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**PARTICIPANTS' health status**

Of the 500 participants, 163 (32.6%) participants reported to have a chronic disease. Amongst the health worker participants, 65 (26%) reported to have a chronic disease compared to 98 (39.2%) in the other participants. The number of positive SARS-CoV-2 test was 21 (4.2%) overall. In the immunized health workers, 5 (2.27%) results were positive while 4 (13.3%) was positive from the non-immunized health workers. In other participants, 3 (1.96%) results were positive from the immunized while 9 (9.2%) results were positive from the non-immunized participants. Co-morbidity, with  $P = .50$ , is not significant to COVID-19 test results of participants.

<b>PARTICIPANTS' characteristics</b>	<b>health</b>	
<b>Health worker</b>		
Immunized	Positive	5 (2.27%)
	Negative	215 (97.73%)
Non-immunized	Positive	4 (13.33%)
	Negative	26 (86.67%)
<b>Co-morbidity</b>	<b>Cancer</b>	<b>4 (1.6%)</b>
	<b>Obesity</b>	<b>8 (3.2%)</b>
	<b>Diabetes</b>	<b>10 (4%)</b>
	<b>Hypertension</b>	<b>20 (8%)</b>
	<b>Others</b>	<b>23 (9.2%)</b>
<b>Other participants</b>		
Immunized	Positive	3 (1.96%)
	Negative	150 (98.04%)
Non-immunized	Positive	9 (9.2%)
	Negative	88 (90.72%)
<b>Co-morbidity</b>	<b>Cancer</b>	<b>5 (2%)</b>
	<b>Obesity</b>	<b>14 (5.6%)</b>
	<b>Diabetes</b>	<b>18 (7.2%)</b>
	<b>Hypertension</b>	<b>23 (9.2%)</b>
	<b>Others</b>	<b>38 (15.2%)</b>

Table 2: Health history of participants; COVID-19 vaccination status and COVID-19 infection status.

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## Bar Chart

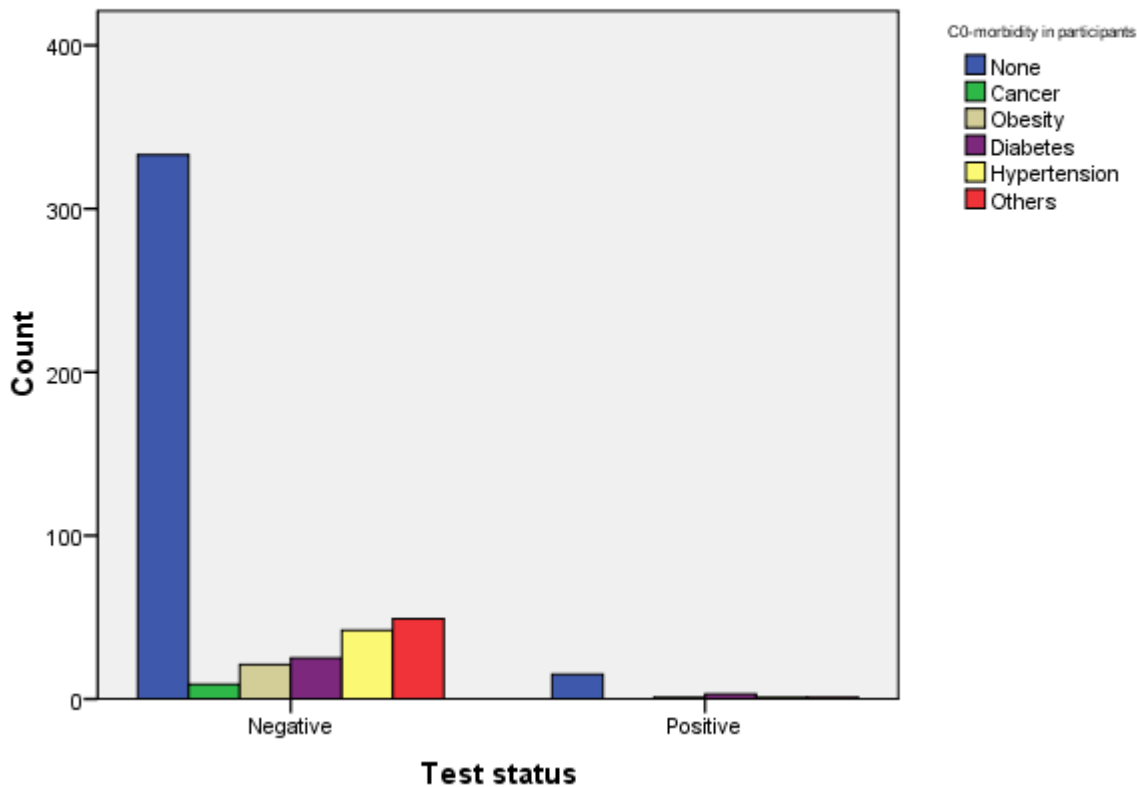


Figure 1: Test results of participants with different chronic disease.

### SARS-CoV-2 vaccine acceptability

Overall, 373 (74.6%) participants have been vaccinated, although 214 (42.8%) participants accounted for full vaccination. There is higher vaccination rate 220 (88%) among the health workers compared to 153 (61.2%) among the other participants. From the non-immunized participants, only 32 (18.6%) are willing to get vaccinated immediately if made readily available while others, 95 (55.23%) were not willing to get the vaccination unless they know more about the virus and the vaccines. The reason for vaccine hesitancy include: the vaccine is not safe and was made to depopulate human, religious belief, past experiences with other vaccines and some believed there is nothing true about SARS-CoV-2 outbreak. Another vital reason for vaccine hesitancy is 'older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness' (18) if given the vaccine. It was observed that some participants from the group who wouldn't get vaccinated even if vaccine is made available would reconsider getting vaccinated if they can be ascertained of getting maximal protection from the vaccine and wouldn't be liable to contracting other diseases from the vaccine.

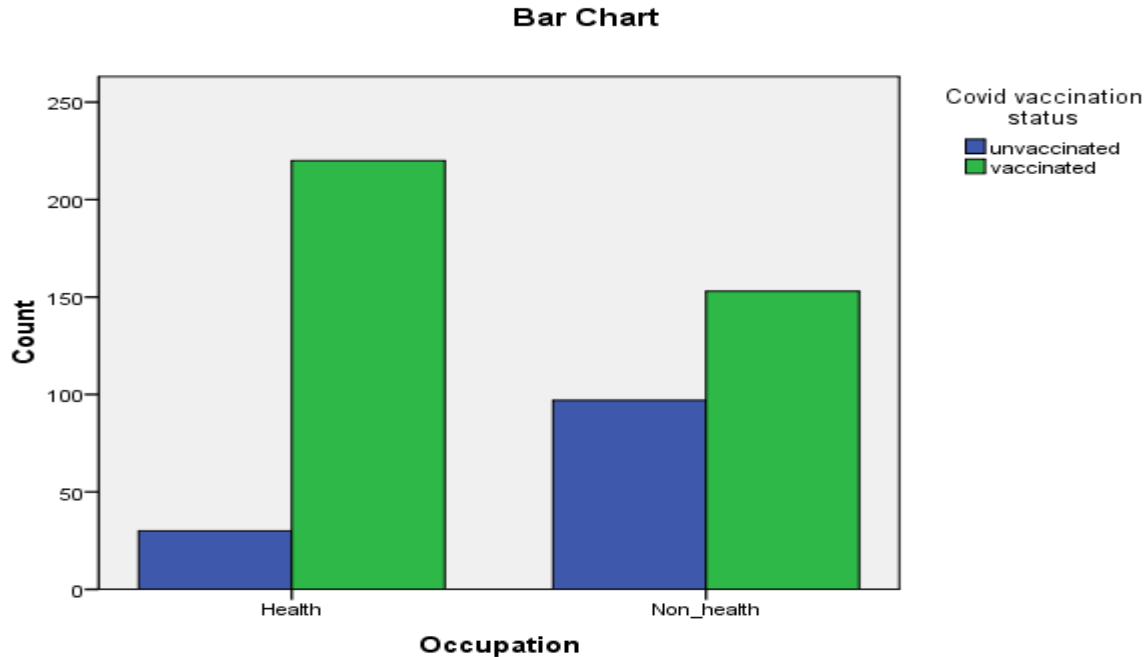


Figure 2: COVID-19 vaccination rate based on occupation of the participants.

#### SARS-CoV-2 vaccine efficacy

Covid-19 infection prevention was seen to be high among the vaccinated population as only 2.14% are positive. Statistical analysis has a  $P$  value  $> .000$  and hence association of vaccine and COVID-19 status is considered to be extremely statistically significant. Also, among the health workers, 5 (2.27%) was seen to test positive among the vaccinated population compared to 4 (13.3%) in the unvaccinated population. Statistically,  $P = .002$  and hence, the association between vaccinated population among the health workers and their COVID-19 status is also considered to be statistically significant. 3(1.96%) non-health workers were positive. Statistically,  $P = .000$  and association between vaccine status and Covid-19 status was considered very statistically significant. The results also support several reports such as Covid-19 tests carried out in the middle-east (17) and further helps to boost population trust in SARS-CoV-2 vaccine.

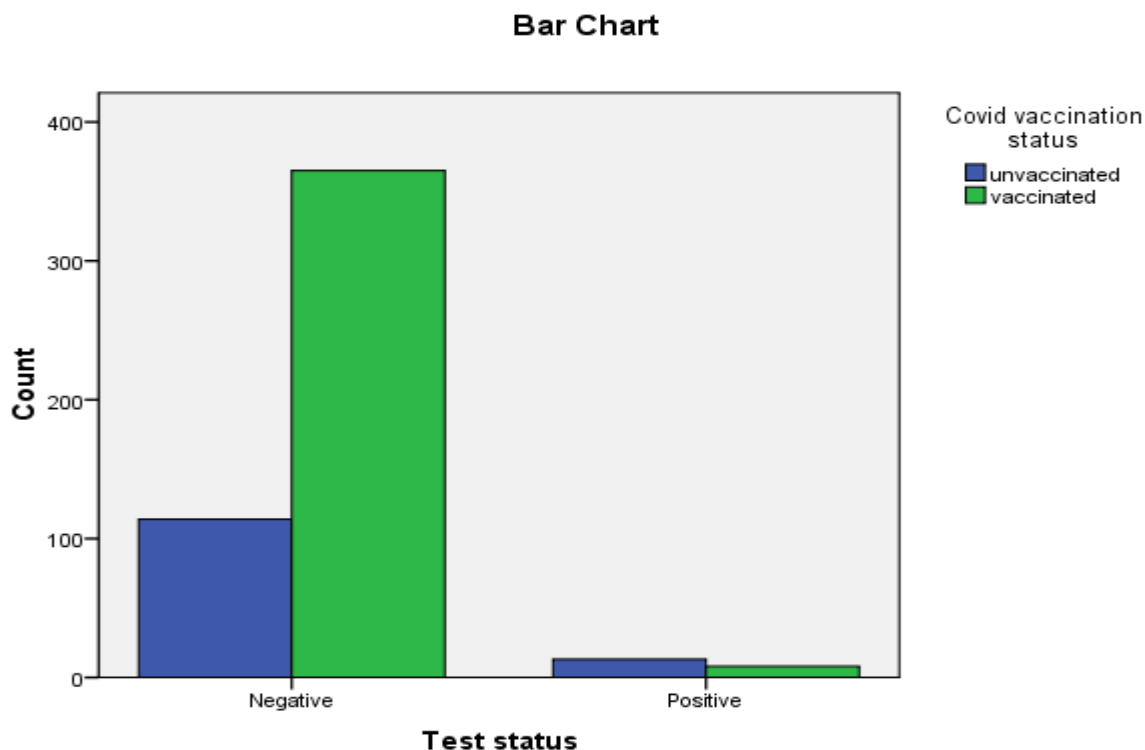


Figure 3: COVID-19 infection rate among the vaccinated and unvaccinated participants.

## DISCUSSION

“Herd immunity” is essential as this would help to prevent the spread COVID-19 virus. As seen from the results above, infection rate among the vaccinated population was reduced as compared to unvaccinated population. 50% efficacy threshold was set for COVID-19 vaccines because COVID-19 was deemed such a severe disease, that if a vaccine is only 50% effective, it’s still worth using (18). The emerging data on COVID-19 vaccines suggests that the vaccines are very safe with high efficacy, at least against some of the variants. Acceptance of the vaccine was relatively high among healthcare workers (88%) but lower in the other participant group (61.2%). This high vaccine acceptance among healthcare workers has also been reported in Somalia (19), Mozambique (15) and South Africa (20), but a contrasting report was obtained from Democratic Republic of Congo (20).

From our study, it was shown that more participants would reconsider getting vaccinated if they can be ascertained of getting maximal protection from the vaccine and wouldn’t be liable to contracting other diseases from the vaccine. Also, if vaccine efficacy is high and proven statistically, most would get vaccinated. This suggests that the more people are educated about the importance and efficacy of vaccination against COVID-19, their willingness to be vaccinated will increase. This was also reported in a study in Mozambique (15).

From our study, age is also a major factor affecting the population decision to accept COVID-19 vaccine. The actively working group who considered their day-to-day activities necessary especially with physical meetings is the highest vaccinated group, aged 31-50 (59.6%) who are majorly traders (13.4%) and farmers (18.2%), the elderly, >65 years of age (2.8%) are the least vaccinated group. This is because of their believe that they are less prone to contacting the disease as they are majorly indoor and also because of the statement ‘older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness’ (15) if given the vaccine. However, in a study in Ghana, populations with 36–45 years of age were less likely to accept being vaccinated compared to those aged 18–25 years (21). In a study in Mozambique (15), it was shown that the lower the age, the lower the vaccine acceptability. This was also found in Saudi Arabia (22) and South Africa (23). These results show that acceptability varies based on country, region, culture, and believe of different age-group bracket as to how important is COVID-19 vaccine.

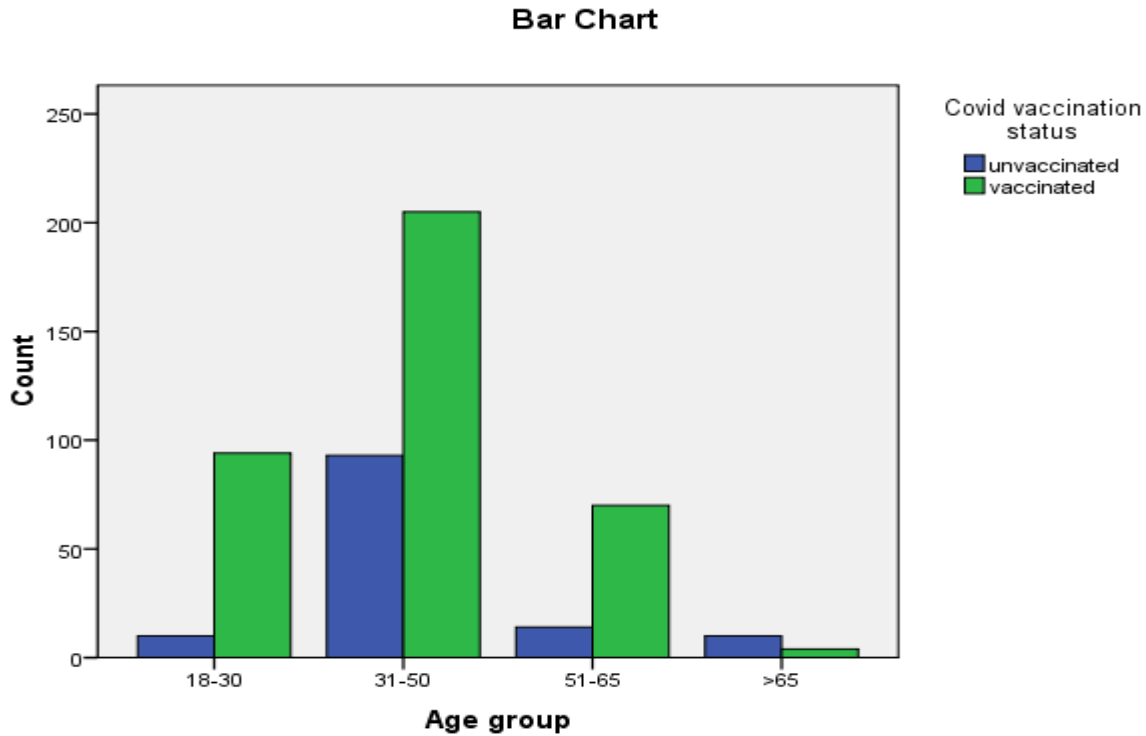


Figure 4: COVID-19 vaccination rate based on age-group.

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Education also plays a major role in vaccination. From our report, Participants who have fore-knowledge and considered vaccination important for their own health or for the health of the community were more willing to accept vaccination. This was proved as the highest population of those vaccinated has tertiary education, 300 (60%). Statistically,  $P = .000$ , hence, the association between education level of participants and COVID-19 vaccination is extremely statistically significant. This suggests that if more people are educated about the importance of vaccination against COVID-19, their willingness to be vaccinated will increase.

To reach the greater population of Nigeria at large, a cultural and believe barrier would have to be broken as this is another major dilemma against COVID-19 vaccination plan. Some participants believe that COVID-19 pandemic isn't real while some believed that the vaccine was made to reduce human population.

Bar Chart

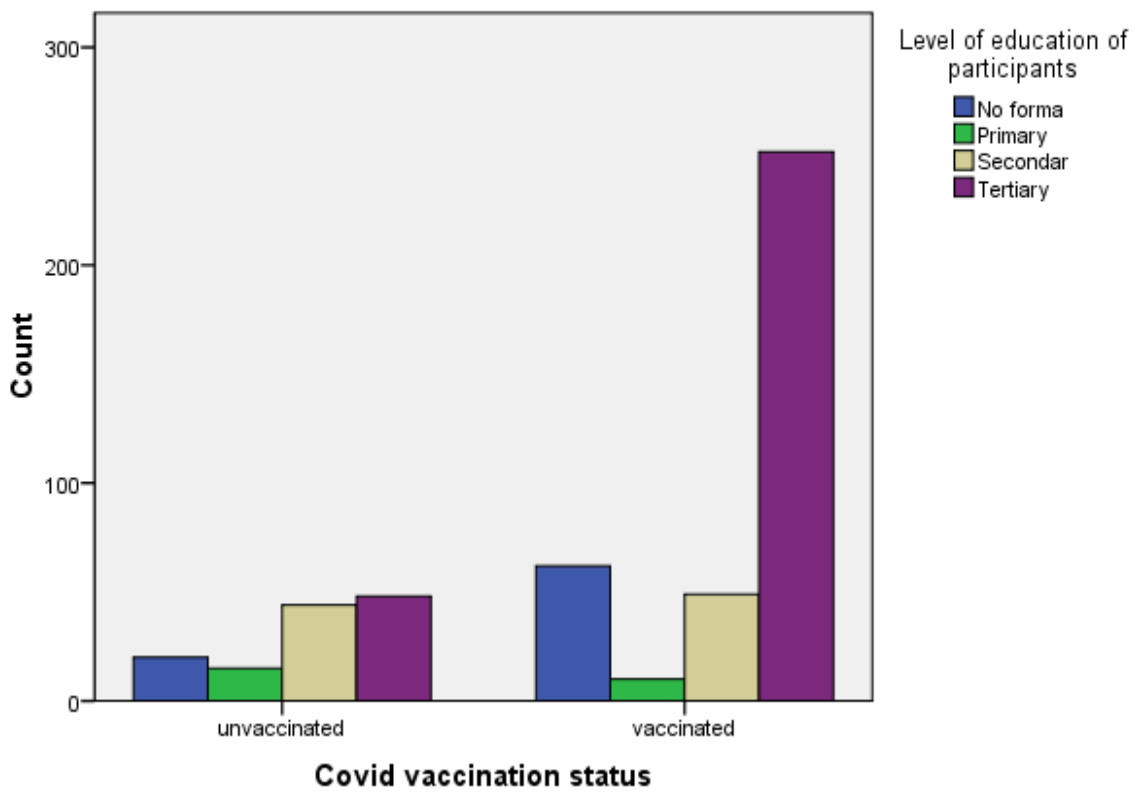


Figure 5: COVID-19 vaccination rate based on the level of education of participants

#### 4. CONCLUSION

The results from our study show a strong relationship between SARS-CoV-2 vaccine and immunity against COVID-19. This survey shows that there is a high vaccination rate among the participants with tertiary education, the actively working group (age 31-50) and health professionals and COVID-19 among these groups was greatly reduced compared to the other groups in their respective categories. This implies that SARS-CoV-2 vaccine can confer great immunity on vaccinated individuals especially the fully vaccinated. With more education about vaccine safety and more proven statistical analysis, vaccination rate is expected to increase and governmental and societal efforts are to be directed towards sensitizing the community on COVID-19 vaccination. Once herd immunity is attained in a population, this will help to minimize the rapid spread of the disease, stabilize human life, health, family, country's economy and also prevent the occurrence of other variants of the virus.

198 **CONSENT**

199 "All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication  
200 of this case report and accompanying images. A copy of the written consent is available for review by the Editorial  
201 office/Chief Editor/Editorial Board members of this journal."  
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204 **ETHICAL APPROVAL**

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206 "All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee  
207 and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of  
208 Helsinki."  
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213 **QUESTIONNAIRE**

214 Dear respondent, I am **Ademola, Opeyemi Shadrach**, a tutor at the Adventist College of Health Technology,  
215 Igbobe and a master's student of Chemical Pathology, University College Hospital, University of Ibadan. I am  
216 leading a group of researchers in carrying out a research on **HERD IMMUNITY, THE BEST WAY OUT OF**  
217 **SARS COV-2 PANDEMIC. PREACHING THE GOOD NEWS ABOUT COVID-19 VACCINE AND**  
218 **VACCINE EFFICACY** in Oke-Ogun region of Oyo State, Nigeria. Your participation is strictly voluntary.  
219 Your kind consideration and honest answers would be very much appreciated. Thanks.

220 Serial number \_\_\_\_\_

221 **SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS**

- 222 1. Age \_\_\_\_\_
- 223 2. Gender \_\_\_\_\_
- 224 a) Male [ ] b) Female [ ]
- 225 3. Marital status \_\_\_\_\_
- 226 a) Single [ ] b) Married [ ] c) Divorced/separated [ ] d) Widowed [ ]
- 227 4. Educational status \_\_\_\_\_
- 228 a) Primary education [ ] b) Secondary education [ ]
- 229 c) Tertiary education [ ] d) Postgraduate education [ ] e) None [ ]
- 230 5. Employment status \_\_\_\_\_
- 231 a) Working in person [ ] b) Working remotely [ ] c) Not working-temporarily laid off [ ]
- 232 d) Not working-Student [ ] e) Not working-others \_\_\_\_\_
- 233 6. Industry \_\_\_\_\_
- 234 (a) Agriculture [ ] b) Construction [ ] c) Manufacturing [ ] d) Trading [ ]
- 235 e) Health care [ ] f) Art and Entertainment [ ] g) Finance [ ]
- 236 h) Education [ ] i) Others [ ].
- 237 If others, please specify: \_\_\_\_\_
- 238 7. How would you define your family income?
- 239 a) Lower than average [ ] b) On average [ ] c) Higher than average [ ]

240 **SECTION B: CO-MORBIDITY**

- 241 8. Do you have any of the following disease?
- 242 a) Cancer [ ] b) Obesity [ ] c) Diabetes [ ] d) Hypertension[ ] e) Others \_\_\_\_\_
- 243 If others, please specify: \_\_\_\_\_

244 **SECTION C: COVID-19 PREVENTION PRECAUTIONS**

- 245 9. Do you wear a mask? a) Yes [ ] b) No [ ] c) Not always [ ]
- 246 d) I don't need to [ ]
- 247 10. Do you practise social distancing? a) Yes [ ] b) No [ ] c) Not always [ ]
- 248 d) I don't need to [ ]
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- 250 11. Do you often wash your hands and use a sanitizer?  
251 a) Yes [ ] b) No [ ] c) Not always [ ] d) I don't need to [ ]

252 **SECTION D: DOMAIN; COVID-19 VACCINATION**

- 253 12. Have you tested for COVID-19 previously? a) Yes [ ] b) No [ ] c) Not sure [ ]  
254 If yes, what was the test result? a) Positive [ ] b) Negative [ ]  
255 13. Have you received COVID-19 vaccine? a) Yes [ ] b) No [ ] c) Not sure [ ]  
256 If yes, at what dose of vaccination are you? a) First dose [ ] b) second dose [ ]  
257 Date of vaccination: 1<sup>st</sup> dose..... 2<sup>nd</sup> dose.....  
258 14. How likely are you to recommend getting the COVID-19 vaccine to others?  
259 a) Not at all likely [ ] b) Somewhat likely c) Extremely likely  
260 15. Has all your immediate family members been vaccinated?  
261 a) Yes [ ] b) No [ ] c) I don't know [ ]

262 **SECTION E: FOR THOSE WHO ARE UNVACCINATED**

- 263 16. What makes it difficult for you to get a COVID-19 vaccine?  
264 a) I'm not eligible [ ] b) I can't go alone [ ] c) I don't know where to get vaccinated [ ]  
265 d) The waiting time is too long [ ] e) Always busy at work  
266 [ ] f) Others.  
267 If others, please specify: \_\_\_\_\_  
268 17. How concerned are you about getting COVID-19 vaccine?  
269 a) Not at all concerned [ ] b) A little concerned [ ] c)  
270 Moderately concerned [ ] d) Very concerned [ ]  
271 18. How safe do you think a COVID-19 vaccine would be for you?  
272 a) Not at all safe [ ] b) A little safe [ ] c) Moderately safe [ ]  
273 d) Very safe [ ]  
274 19. If a COVID-19 vaccine were available to you, would you get it?  
275 a) Yes [ ] b) No [ ] c) Not sure [ ]  
276 20. What would be important for you to know about to become confident in the COVID-19 vaccine?  
277 a) My risk of getting sick with COVID-19 is bigger than the risk of side effects  
278 from the vaccine [ ]  
279 b) The vaccine cannot cause any immediate or long term injury [ ]  
280 c) It is impossible to get COVID-19 or any other disease from the vaccine itself or its  
281 components [ ]  
282 d) The vaccine works in protecting me from COVID-19 [ ]  
283 e) The vaccine works in stopping the transmission of COVID-19 from one person to another [ ]  
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286 *Your kind participation and honest answers are very much appreciated. Thanks.*

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