Journal of Community Medicine and Primary Health Care. 34 (2) 128-151
https://dx.doi.org/10.4314/jcmphc.v34i2.9

JOURNAL OF COMMUNITY MEDICINE AND PRIMARY HEALTH CARE

ORIGINAL ARTICLE

A Comparative Study of COVID-19 Vaccine Acceptability and its Determinants among Urban and Rural Community Residents in Ogun State

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Keywords

Acceptability; Attitude; Knowledge; COVID-19 vaccines; Urban-Rural

ABSTRACT

Background: The success of any COVID-19 vaccination programme will depend on public willingness to receive the vaccination. This is important to tailor public health messaging appropriately. This study aimed to determine and compare COVID-19 vaccine acceptability and factors influencing it among rural and urban community members in Ogun State.

Methods: The study was a comparative cross-sectional study. Multistage sampling technique was utilized to select 404 and 396 adult residents from the urban and rural communities, respectively. Data collection was by structured interviewer-administered questionnaire. Descriptive and inferential statistics were done. Level of significance was set at p<5%.

Results: More respondents in urban area 186 (46.0%) were willing to accept COVID-19 vaccine compared to rural respondents 90 (22.7%) (p<0.001). Acceptance that COVID-19 is real (AOR=2.98; 95%CI=1.61-5.51 p<0.001) versus (AOR=2.17; 95CI=1.06- 4.44 p=0.035) predicted acceptability in both urban and rural areas, respectively. In urban area, being a male (AOR=1.58; 95%CI=1.02-2.44 p=0.041) while in rural area, completion of immunization (AOR=3.47; 95%CI=1.79-6.72 p<0.001) and fair perceived risk of contracting COVID-19 (AOR=3.05; 95CI:1.55-6.01 p= 0.001) were predictors of acceptability.

Conclusion: The study showed there was overall poor acceptability of COVID-19 vaccine among urban and rural residents. Urban residents were more likely to accept the vaccines compared to rural residents. Therefore, government should do more in terms of health education and promotion for a right attitude to COVID-19 vaccination.

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INTRODUCTION

The coronavirus disease, known as COVID-19, caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) is currently a global pandemic causing a major threat to people worldwide.[1] It has become a major global threat

inflicting unimaginable harm on life, health and economy of many nations.[2] Since its outbreak in Wuhan city, China in December 2019, 71,554,018 cases and 1,613,671 deaths have been recorded across 213 countries and five regions of the globe as of 23rd December, 2020.[2] On the African continent, 2,831,003 COVID-19 cases and 56,342 deaths have been recorded, with South Africa, Morocco, Egypt, Ethiopia, and Tunisia taking the lead.[3]

The increasing number of morbidities and mortalities has been due to the non-availability of any COVID-19 vaccine. At the early period of the COVID-19 pandemic when there was no known COVID-19 vaccine or treatment, herd immunity was suggested as a possible remedy for tackling SARS-CoV-2, the COVID-19 virus. It was however estimated that herd immunity cannot be reached until 66.7% of the total population, vulnerable or healthy, gets exposed to SARS-CoV-2. [3]Estimates from a study conducted across the West African sub-region revealed that for herd immunity to be achieved, 261 billion cases and nearly 5 million deaths would be recorded (at a case fatality rate of 2%).[3,4]

To reduce the morbidity and mortality due to COVID-19, research have been conducted for the development of a COVID-19 vaccine, and COVID-19 vaccines are currently available in some countries.[4]There is an intense global effort in developing a safe and effective COVID-19 vaccine, with an estimate of over 200 candidate vaccines currently in different development stages and several candidate vaccines already in clinical trials.[4, 5]

Several new technologies are used as COVID-19 vaccine development platforms. Conventional techniques for the development of vaccines such as inactivated, deactivated with adjuvant and live attenuated are still being used. However, reversed vaccinology approaches are also being employed, such as a recombinant subunit vaccine, and a more advanced approach using vector delivery systems, along with RNA- and DNA-based vaccines.[5, 6]

Presently, four vaccines (Pfizer, AstraZeneca, Moderna and Janseen) have undergone phase 3 clinical

trials and are being rolled out for vaccination against COVID-19.[7]

While vaccination is the most effective medical intervention ever recorded in human history; recently there has been growing concerns about vaccine hesitancy.[8] Vaccine hesitancy is defined as a delay in acceptance or refusal of vaccines despite availability of vaccination services.[9]

Vaccine hesitancy is a behavior, influenced by a number of factors including issues of confidence (do not trust vaccine or provider), complacency (do not perceive a need for a vaccine, do not value the vaccine), and convenience (access). Vaccine hesitant individuals are a heterogeneous group who hold varying degrees of indecision about specific vaccines or vaccination in general. Vaccine hesitant individuals may accept all vaccines but remain concerned about vaccines, some may refuse or delay some vaccines, but accept others; some individuals may refuse all vaccines.[10]

Vaccine confidence defined as trust in the effectiveness and safety of vaccines, the system that delivers the vaccines, trust in the reliability and competence of the health services and health professionals and policy makers that decides when vaccine is very important. Vaccination confidence is only one of a number of factors that affect an individual's decision to accept a vaccine.[10]

Also worthy of note is vaccine complacency which exists where perceived risks of vaccine-preventable diseases are low, and vaccination is not deemed a necessary preventive action. Besides perceptions of the threat of disease severity and/or transmission, complacency about a particular vaccine or about vaccination in general can be influenced by under-appreciation of the value of vaccine (effectiveness and/or safety profile) or lack of knowledge. The success of Immunization programme may be underscored by complacency and hesitancy, as individuals weigh risks of vaccines against risks of diseases that are no longer common because of immunization.[10.]

The quality of the service (real and/or perceived) and the degree to which vaccination services are delivered at a time and place and in

a way that is considered appealing, affordable, convenient and comfort-table, also affects the decision to vaccinate. Vaccination convenience and complacency are also deter-mined by the priority that an individual places on vaccination.[10.]

There is existing evidence of resistance to vaccine uptake in Africa. Recent survey suggests that vaccine confidence has dropped between 2015 and 2019, including in Nigeria.[11] Some factors have been highlighted as militating against vaccine acceptability. These include concerns about unnatural medical interventions, concerns about safety of vaccines, misinformation on the internet or mistrust of the motivations of pharmaceutical companies or others who promote vaccines.[8] Others are personal risk perception, fear of side effects, access to media, information sources, religious/ cultural beliefs, the convenience of getting to a health facility, level of trust for the healthcare system, household wealth, residence, ethnicity, and other demographic variables, as well as other social influences.[8]

Therefore, exploring the acceptability and factors influencing acceptability is necessary to guide the implementation of COVID-19 vacci-nation programme in Nigeria.[8] A study done in United States reported mass uncertainty regarding the COVID-19 vaccines due to the fast-tracked vaccine development and approval process known as Operation Warp Speed.[12] The public is worried that politics rather than science might be driving the vaccines to the market.[12] This has implications for coronavirus vaccine acceptance. The success of any COVID-19 vaccination programme will depend on public willingness to receive the vaccination. There is an urgent need for a more updated and better understanding of attitudes towards vaccines and factors determining vaccine acceptability in relation to the COVID-19 pandemic to tailor public health messaging appropriately.[13]

Exploring predictors of vaccine acceptability in general terms whilst multiple vaccine candidates are still being tested has the potential to help policymakers to identify and adapt interventions that increase vaccine confidence.[13] This study aimed to

determine and compare COVID-19 vaccine acceptability and factors influencing it among rural and urban community members in Ogun State. With a view to providing evidence-based guidance in the administration and policy making for the acceptance of COVID-19 among the community members in Ogun State in particular and the country in general.

METHODOLOGY

Study Area: This study was conducted in Ogun State between January and April 2021. It lies within the southwestern region of the country. Ogun State covers a total land area of 16,980.55 sq. km. According to the 2006 national census, the total population of the State is 3,751,140 disaggregated into 1,864,907 males and 1,886,233 females. The pro-jected population of Ogun State was 6,184,564 by 2021 at an annual growth rate of 3.4%per year.[14]

The state has twenty Local Government Areas (LGAs), with each headed by an executive chairman. The people of the state belong to the Yoruba ethic group of south-west Nigeria. The industries and manufacturing base are located at Abeokuta, Ota and Agbara. Ogun State has two federal tertiary hospitals, one state tertiary health facility, 39 public secondary health facilities, 450 primary health facilities, 1 private tertiary health facility and 904 private health facilities.[14]

The study was conducted in two LGAs in the state. Yewa-North and Abeokuta South (rural and urban LGAs, respectively). Yewa-North was created through the Local Government edict NO 9 of 1976, with land mass area 2,087km^2. It also has the largest expanse of land in the state with a size of 200,213.5 hectares, with headquarters in Ayetoro. Yewa-North has a total population of 281, 820 and projected to 402,226 in 2021 at a growth rate of 2.4%. The main occupation is farming which is largely subsistence in scale. Abeokuta South Local Government has a landmass of about 71 square kilometers, with a population of 250,295 and projected to 400,782 in2021 at a growth rate of 2.4%. The main occupation includes petty trading and white-collar jobs.

As at 18th October 2021, Yewa-North LGA recorded 78 laboratory confirmed cases of COVID-19 with no death. At the same time, Abeokuta South LGA had 941 laboratory confirmed cases of COVID-19 and 19 deaths. Overall, the state recorded 5,370 laboratory confirmed cases of COVID-19 with 80 deaths. [15] Ogun State in March 2021 became the first in the country to receive COVID-19 vaccines from the Federal Government, with the receipt of 126,717 doses of Oxford AstraZeneca brand. Out of this, no fewer than 88,585 persons were successfully vaccinated, with both first and second doses in the state. More recently, the state took another delivery of 187,426 doses of Moderna COVID-19 vaccines and 29,019 have been vaccinated with the first and second doses.[15]

Study Population: Those included in this study were male and female community members' ≥18 years residing in rural and urban communities of Ogun State who were not health workers. Health workers were excluded due to another study being conducted to assess acceptability of COVID-19 vaccines among health workers alongside this study.

Sample Size: The number of respondents sampled was determined using the formula for estimating sample size two proportions.[16]

$$n = (Z1_{-\alpha/2} + Z_{1-\beta)\,2}[P1\,(1-P_1) + P_2\,(1-P_2)}{(P_1-P_2)^2}$$

Where n = Minimum sample size for each group

$Z_{1-\alpha/2}$ =Standard normal deviate corresponding the probability of making type 1 error (α) at 5% =1.96

$Z_{1-\beta}$ = Standard normal deviate corresponding to the probability of making a type II

Error (β) of 10%. Power at 80% = 0.84

P_1= Prevalence of reported negative attitude towards COVID-19 in an urban LGA (Onitsha, Anambra State) (37.1%).[17]

P_2= Prevalence of reported negative attitude towards COVID-19 in a rural LGA (Kano, North-west) (27.1%).[18]

After a 10% adjustment for non-response, a minimum sample size of 374 per LGA (748 for the two LGA) was calculated. However, 404 and

396 respondents participated from urban and rural LGAs, respectively.

Sampling method: The multistage sampling method was adopted to select the participants. The LGAs were stratified into urban and rural. Ogun State has 14 urban and 6 rural LGAs. From the list of rural and urban LGAs, two local government areas, one rural and one urban were selected by simple random sampling technique (balloting). Abeokuta South LGA (urban) and Yewa North LGA (rural) were selected. Abeokuta South LGA has 15 wards while Yewa North LGA has 11 wards. A simple random sampling technique by balloting was used in selecting one third of the wards in each LGA. Four wards were selected in the rural LGA while five wards were selected in the urban LGA.

A proportional allocation of samples was done for all the selected wards from the LGAs. The existing National Programme on Immunization (NPI) house to house numbering was used to have an objective number of houses within the selected wards. A systematic sampling technique was used in selecting the houses. Subsequent houses were selected using a predetermined sampling interval. One consenting respondent per household aged 18 years and above was selected for interview using simple random sampling by balloting.

Study Instrument: A structured interviewer-administered questionnaire was employed to obtain the knowledge, attitude, acceptance, and factors influencing the acceptance of COVID-19 vaccine from the respondents. It was developed with adaptation of the relevant section on knowledge, attitude and practice (KAP) studies on COVID-19. [8,9,11]

The questionnaire was translated to Yoruba, the local language of the study area. It was then back translated to English Language to make sure the questions maintained their original meaning. Six research assistants with Ordinary National Diploma (OND) assisted the community members with the questionnaire. They were trained for two days on the use of the data collection instrument and maintenance of ethical standard. This training also assisted in reducing inter-observer variation in data

collection. This questionnaire was pretested among respondents in Abeokuta North LGA.

Data management and analysis: Data collected were checked daily for errors and omissions. Data were analyzed using Statistics Package for Social Science (SPSS) version 22 software packages. Data collected were presented in frequency distribution tables, charts, and cross tabulation. COVID-19 related knowledge assessed their awareness of COVID-19 and its prevention methods. Eight questions were used in assessing the respondent's knowledge on COVID-19. Participants were required to answer "yes" or "no" for each question. Each correct response was scored "1" and incorrect scored "0". The total scores for knowledge were generated by adding all the correct responses on knowledge of COVID-19 disease. Total obtainable score was eight. The mean knowledge score was used as a reference to categorize participants as having good or poor knowledge. Participants with scores at the mean and above were categorized as having good knowledge while those below the mean score were said to have poor knowledge.

Ten statements were used in assessing attitude towards COVID-19 vaccine. The questions were based on a 3-point Likert-type (Agree, Neutral, and Disagree) scale. Participants were expected to indicate their level of agreement or disagreement to each statement. For attitude, Agree scored "1", Neutral scored "0", and Disagree scored "0". The total obtainable score on the scale was 10 and the mean score was employed to categorize participants as having positive or negative attitude. Participants with score at the mean and above were categorized as having positive attitude while scores below the mean represented negative attitude. The least score was 0, no negative score. Vaccine acceptability was assessed with this question "Are you willing to accept COVID-19 vaccine if available". Participants were required to answer "yes" or "no" to the question. Respondents whose response was "yes" were classified as accepting the vaccine

Chi-square was used to test for the association between acceptability of vaccines and factors influencing acceptability of vaccine (socio-demographic characteristics, know-

ledge of COVID-19 infection, attitude to COVID-19 vaccine, perceived risk of COVID-19 infection, history of chronic illness, completion of child vaccination, self-rated health). Level of significance was set at p <0.05. However, factors with p<0.05 from chi-square analysis were entered into logistic regression model at 10% level of significance. Predictor of acceptability was set at p<0.05level of significance.

Ethical Considerations: Ethical approval with protocol number FMCA/470/HREC/02/202 1/07 was obtained from the Ethical Review Committee of Federal Medical Centre, Abeokuta. A copy of the approval was submitted to the Ethical Review Committee of Ogun State. Respondents were provided with informed consent forms explaining the study aims and objectives and voluntary nature of the study. They were also briefed that information provided would be treated with confidentiality. The interviews were conducted in privacy and anonymously. Strict con-fidentiality of all information and results of findings were maintained throughout the study.

RESULTS

A total of 800 respondents were surveyed; 404 and 396 respondents completed their questionnaire from urban and rural LGA, respectively, with response rate of 89.8% and 88.0%, respectively. The mean age of the respondent was 36.1±13.8 and 34.3±11.05 years in urban and rural areas, respectively. Both settings had respondents aged 35-44years in the highest proportion, 131 (32.4%) and 131 (33.1%) in urban and rural respectively, p=0.011. A higher proportion of respondents were males 142 (35.1%) in urban area compared to rural area p<0.001. Both populations had respondents with secondary school education, respondents who were Christians and traders in the highest proportion p<0.001. The rural area had respondents 306 (77.3%) whose income ranged from 11,000-30,000 naira in the highest proportion compared to the urban area. This difference was statistically significant p<0.001. (Table 1)

Most of the respondents 374 (92.6%) urban and 343 (86.6%) rural were aware of COVID-19 disease. The highest source of information was

radio 249 (61.6%) for urban and 307 (77.5%) for rural. This was closely followed by television 229 (56.7%) urban and 299 (75.5%) for rural. When asked whether COVID-19 is real, a higher proportion of the urban respondents 317 (78.5%) believed that COVID-19 is real compared to rural respondents 233 (58.8%). Regarding knowledge on COVID-19, a higher proportion of rural respondents 170 (42.9%) had poor knowledge of the disease compared to urban respondents 148 (36.6%). However, this was not statistically significant p= 0. 069. With respect to awareness on COVID-19 vaccines, a higher proportion of respondents in urban area 251 (62.1%) were aware of vaccine compared to the rural respondents 232 (58.6%) but this was not significant p=0.306 (Table 2)

Table 3 shows the attitude of respondents to COVID-19 vaccine by location. When asked whether COVID-19 vaccines were harmful, more respondents in rural area 211 (53.3%) were neutral compared to urban respondents 149 (36.9%). A similar proportion of respondents in urban 183 (45.3%) and rural 180 (45.5%) were concerned about the side effects of the vaccines. A higher proportion of respondents in the rural area 166 (41.9%) were undecided about their trust in the vaccines supplied by the government compared to urban respondent 99 (24.5%). Another opinion that featured more among the rural respondents 202 (51.0%) is the belief that use of face mask and sanitizers is enough for the prevention of COVID-19. Overall, more rural respondents 254 (64.1%) had a negative attitude to COVID-19 compared to urban respondent 173 (42.8%) p<0.001.

Table 4 shows the acceptability and reasons for refusal of COVID-19 vaccines. More respondents in urban area 186 (46.0%) are willing to accept COVID-19 vaccine compared to rural respondents 90 (22.7%) p<0.001. More people in the rural area 59 (65.6%) are not willing to pay for COVID-19 vaccine compared to urban area 99 (53.2%) p=0.052. When asked for reasons for refusal of COVID-19, a higher proportion of people in urban 71 (32.6%) compared to rural 76 (24.8%) believed that COVID-19 disease is not real therefore would not want to receive the vaccines. Also, a higher proportion of those in rural area 116

(37.9%) compared to urban area 45 (20.6%) believed that the vaccine will not work.

When asked for the sources that the respondents trust in providing information on COVID-19 vaccines, the responses included personal physician 203 (50.2.0%) World Health Organization 95 (23.5%) and Primary Health Care Centre 71 (17.6%) for urban and comprised of personal physician 210 (53.0%), World Health Organization 116 (41.9%) and Primary Health Care Centre 186 (47.0%) for rural.

Table 5 showed association between selected factors and acceptability of COVID-19 vaccines. In the urban area, respondents who were males 116 (51.1%) (p=0.021), those who completed their child's immunization 116 (52.0%) (p=0.007) and those who accept COVID-19 is real 167 (52.7%) (p<0.001), those with good knowledge of COVID-19 134 (52.3%) (p= 0.001), those who are aware of COVID-19 vaccines 129 (51.4%) (p=0.006) and those with positive attitude to COVID- 19 vaccines 128 (55.4%) (p<0.001) were more likely to accept the vaccine. In rural area, males 27 (28.7%) (p=0.018), those who rated their health poor 1 (33.8%) (p = 0.002), those with income ≥ 61,000 naira 18(60.0%) (p<0.001), those with fair risk of contracting COVID-19 35 (39.3%) (p <0.001), those who completed their child's immunization 66 (28.2%) (p = 0.002), those who accept COVID-19 is real 67 (28.8%) (p=0.001), those who are aware of COVID-19 vaccines 65 (28.0%) (p=0.003) and those with positive attitude to COVID-19 vaccines 60 (42.3%) (p<0.001) were more likely to accept COVID -19 vaccines.

Table 6 shows the predictors of acceptability in urban and rural LGAs. In urban LGA, respondents who are males (AOR: 1.58; 95% CI: 1.02 – 2.44, p= 0.041) and those who accept that COVID-19 is real (AOR:2.98; 95% CI: 1.61 – 5.51, p <0.001) were more likely to accept COVID-19 vaccines while in the rural area, respondents who completed child's immunization (AOR:3.469; 95%CI: 1.79 – 6.72, p<0.001), those who accept COVID-19 is real (AOR: 2.17; 95% CI: 1.06 – 4. 44, p=0.035) and those with fair perceived risk of contracting COVID-19 (AOR:3.05; 95% CI:1.55 – 6.01, p=0.001) were

more likely to accept COVID-19 vaccines.

DISCUSSION

The study revealed a significant difference in the awareness of COVID-19 vaccination among rural and urban communities in favour of urban. The higher level of knowledge among the urban than rural community members is most probably due to the higher media exposure in the urban cities than rural communities since mass media broadcast dominated the sources of information about COVID-19 during the pandemic. This observation is in agreement with similar studies in other African countries.[19-21]The knowledge level would be a major factor for the acceptance of vaccination with COVID-19 vaccine among the rural and urban communities in Nigeria and other African countries.

Attitude to vaccination is significantly associated with earlier vaccine administration experience and perception of government immunization programme. Importantly, the majority of participants in this study showed generally negative attitude towards COVID-19 vaccine, with the rural community being worse compared to urban participants. This finding is similar to a study in Bangladesh, which also demonstrated negative attitude to COVID-19 vaccine.[22] Most of the respondents in this study in both settings stated that they are concerned about the serious adverse effects of the vaccine and majority said that they would rather delay being vaccinated to see the effects on other people. Furthermore, both the rural and urban respondents agreed that they do not necessarily need to be vaccinated since they would still be using their facemasks and hand sanitizers.

In this study, we found that COVID-19 vaccine acceptability was generally poor across board both in rural and urban communities. There was, however, a preponderance of acceptability in the urban compared to rural communities with statistical significance. This is slightly different from the results obtained in a study done in Ghana, where it was noted that a little above half (54.1%) of the respondents opted to accept COVID-19 vaccines, [23] but similar to a study in Bangladesh which also reported a higher acceptability among people

who live in urban areas and have higher incomes.[24] The acceptance that COVID-19 is real, the safety and efficacy of the vaccine, arising from higher media exposure in the urban setting could account for this disparity. Low acceptance in the rural communities, on the other hand may be because of the spread of misinformation about the poor quality of COVID-19 vaccine and the intended extermination of the black race, as well as poor media exposure. Determining the factors of acceptability of vaccine or immediate vaccination are complex and context-specific and the factors vary with time, place, and type of vaccines.[25, 26] Another study in Bangladesh study found a statistically significant association between vaccine acceptability and age, gender, higher educational qualification, and employment status. [27] This study also showed that gender and socioeconomic status determines the acceptability of COVID-19 vaccine among the respondents.[27] These socio-demographic factors were similarly found as significant factors for vaccine acceptability in the UK, US, France, and Japan.[28-31] Reasons cited in this study for unwillingness to accepting COVID-19 vaccination included doubt on the reality of COVID- 19 disease, the potential vaccine only meant to reduce the world population, distrust in the efficacy of the COVID-19 vaccine and the needlessness of the vaccine since the infection itself is harmless. It was also noted in a US study that 20% of the US population would decline the vaccine due to distrust of vaccine safety and vaccine novelty.[29]

To ensure equitable distribution of COVID-19 vaccine, it is crucial to make a projection of the acceptance in public and identify the predictors associated with vaccine acceptance.[32,33] A strong belief in the effectiveness of a vaccine is the strongest predictor of people's willingness to take a vaccine. [32,33]

This study showed diverse factors as predictors of willingness to take COVID-19 vaccine among the rural and urban participants. These factors are acceptance that COVID-19 is real is twice more likely to predict the acceptance of COVID-19 vaccines, history of chronic illness which was two times less likely to predict acceptance of COVID-19

vaccines; completion of childhood immunization is three times more likely to accept COVID- 19 vaccines; negative attitude is five times less likely to predict acceptance of COVID-19 vaccine. The urban/rural dynamics in this study revealed that despite the influence of certain predictors' urban population are more likely to accept COVID-19 vaccine compared with the rural inhabitants irrespective of the predictors.

A Nigerian study showed that vaccine safety was a major predictor of the willingness to accept COVID-19 vaccine, which appears to stem from skepticism about the safety of the potential vaccine. It was observed that majority were unsure if the potential vaccine is 'a mark of the beast' or if the motive is 'to reduce the world population'.[8] These myths and misinformation were also observed in our study, although urban respondents were more willing to accept the COVID-19. Furthermore, this study found that males are about two times more likely to accept COVID-19 vaccines compared with females in urban area. Also, respondents whose income ranged between 11,000-30,000 naira were four times less likely to accept COVID-19 vaccine in rural area. This was comparable to a similar study in Nigeria where five factors namely, gender, religion, occupation, knowledge of COVID-19, 'perception that vaccines generally are good', and previous vaccination(s) were shown to have a statistically significant association with 'willingness to take vaccine'.[8] However, male gender and 'perception that vaccines generally are good' were found to be the only independent significant predictors of uptake of a potential COVID 19 vaccine. Another study in China[34] found that being male increased the probability of accepting the vaccine. This is contrary to a study in Saudi Arabia where it was reported that there was no association between gender and willingness to take a COVID-19 vaccine.[35]

Limitations of the study: This was a cross-sectional study as such inference cannot be drawn. Although some factors predicted outcome, the causal relations between these factors cannot be ascertained.

Conclusion: Our study found an overall poor attitude and

acceptability of COVID-19 vaccines among the residents in both communities, but worse among rural residents. While it is recognized that hypothetical choices may not always reflect real-life behavior/decision, it is imperative for stakeholders such as government agencies, policymakers, non-governmental organizations, and health care workers to still do more in terms of health education and promotion especially in addressing these misconceptions about a potential COVID-19 vaccine.

Acknowledgement: We would like to thank Joga-Orile Community, The Oba of Joga-Orile in Council, and the entire staff of Comprehensive Health Centre, (Federal Medical Centre, Joga-Orile Annex), for their support during data collection.

Source of funding: Self-funded

Conflict of interest: The authors declare no conflict of interest

Authors' contributions:

Conceptualization of the study – AOK; Design – ST, AOR, MSN, OMO; Data collection – OMO, AOR, MSN; Data collation and analysis – ST, AAR, OMO, EAM; Data Interpretation- AAK, IGB, AOI; Manuscript draft – All Authors; Review of manuscript - All Authors

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Table 1: Socio-demographic characteristics of respondents by location

Variable	Urban (n=404) n (%)	Rural (n=396) n (%)	x2	p-value
Age(years)				
≤ 24	86 (21.3)	71 (17.9)	11.173	0.011
25-34	96 (23.8)	130 (32.8)		
35-44	131 (32.4)	131 (33.1)		
≥45	91 (22.5)	64 (16.2)	T-test	
Mean age±SD	36.1 ± 13.8	34. 3 ± 11.05	2.101	0.036
Sex				
Male	227 (56.2)	164 (41.4)	17.469	<0.001
Female	177 (43.8)	232 (58.6)		
Marital Status				
Single	142 (35.1)	105 (26.5)	16.666	<0.001
Married	221 (59.7)	242 (61.1)		
Others	41 (5.2)	49 (12.4)		
Religion				
Islam	135 (33.4)	150 (37.9)	23.535	<0.001
Christian	263 (65.1)	214 (50.4)		
Traditional	6 (1.5)	32 (8.1)		
Educational Level				
None	3 (0.7)	44 (11.1)	58.491	<0.001
Primary	58 (14.4)	89 (22.5)		
Secondary	175 (43.3)	160 (40.4)		
Tertiary	168 (41.6)	103 (26.0)		
Occupation				
Trading	151 (37.4)	128 (32.3)	64.252	<0.001
Students	76 (18.8)	64 (16.2)		
Civil Servants	71 (17.6)	92 (23.2)		
Artisans	51 (12.6)	25 (6.3)		
Unemployed	38 (9.4)	23 (5.8)		
Farming	8 (2.0)	62 (15.7)		
Retiree	9 (2.2)	2 (0.5)		
Monthly Income				
≤10,000	43 (10.6)	19 (4.8)	264.577	<0.001
11,000-30,000	88 (21.8)	306 (77.3)		
31,000-60,000	231 (57.2)	41 (10.4)		
≥61,000	42 (10.4)	30 (7.6)		

Table 2: Knowledge of respondents on COVID-19 by Location

Variable	Urban (n=404) n (%)	Rural (n=396) n (%)	x2	p-value
Awareness of COVID-19				
Yes	374 (92.6)	343 (86.6)		
No	30 (7.4)	53 (13.4)		
Do you think COVID-19 is real				
Yes	317 (78.5)	233 (58.8)		
No	87 (21.5)	163 (41.2)		
Possibility of Contracting COVID-19				
Yes	257 (63.6)	244 (61.6)		
No	147 (36.4)	152 (38.4)		
Knowledge on Prevention of COVID-19				
Regular washing of hands				
Yes	315 (78.0)	358 (90.4)		
No	89 (22.0)	38 (9.6)		
Use of Hand Sanitizers				
Yes	272 (67.3)	335 (84.6)		
No	132 (32.7)	61 (15.4)		
Use of Face Mask				
Yes	301 (74.5)	336 (84.4)		
No	103 (25.5)	60 (15.2)		
Use of Garlic and Ginger				
Yes	81 (20.0)	189 (47.7)		
No	323 (80.0)	207 (52.3)		
Use of COVID -19 Vaccines				
Yes	111 (27.5)	128 (32.8)		
No	293 (72.1)	268 (67.7)		
Use of Anti-malarial				
Yes	13 (3.2)	68 (17.2)		
No	391 (96.8)	328 (82.8)		
Use of Herbal Concoction				
Yes	35 (8.7)	85 (21.5)		
No	369 (91.3)	311 (78.5)		
Overall Knowledge on COVID-19				
Poor	148 (36.6)	170 (42.9)	3.310	0.069
Good	256 (63.4)	226 (57.1)		
Awareness of COVID-19 Vaccines				
Yes	251 (62.1)	232 (58.6)	1.049	0.306
No	153 (37.9)	164 (41.4)		

Table 3: Attitude of respondents to COVID-19 Vaccines by Location

Variable	Urban (n=404) n (%)	Rural (n=396) n (%)	x2	p-value
COVID-19 Vaccine is an effective way to prevent and control COVID-19				
Agree	226 (55.9)	193 (48.7)		
Neutral	105 (26.0)	108 (27.3)		
Disagree	73 (18.1)	95 (24.0)		
COVID-19 Vaccine is harmful				
Agree	116 (28.7)	93 (23.5)		
Neutral	149 (36.9)	211 (53.3)		
Disagree	139 (34.4)	92 (23.2)		
I am concerned about serious adverse effects of the vaccine				
Agree	183 (45.3)	180 (45.5)		
Neutral	142 (35.1)	191 (48.2)		
Disagree	79 (19.6)	25 (6.3)		
I trust vaccines from government officials				
Agree	152 (37.6)	116 (29.3)		
Neutral	99 (24.5)	166 (41.9)		
Disagree	153 (37.9)	114 (28.8)		
I think the vaccine is the solution to COVID-19				
Agree	175 (43.3)	125 (31.6)		
Neutral	133 (32.9)	163 (41.2)		
Disagree	96 (23.8)	108 (27.3)		
I will delay my vaccination to see the effect on other people				
Agree	205 (50.7)	222 (56.1)		
Neutral	79 (19.6)	141 (35.6)		
Disagree	120 (29.7)	33 (8.3)		
I am confident about COVID-19 vaccine importance, self-protection, and community health				
Agree	211 (52.2)	138 (34.8)		
Neutral	107 (26.5)	161 (40.7)		
Disagree	86 (21.3)	97 (24.5)		
I do not need the vaccine since I am going to still be using facemask and Hand sanitizers				
Agree	174 (43.1)	202 (51.0)		
Neutral	80 (19.8)	142 (35.9)		
Disagree	150 (37.1)	50 (13.1)		
It does not offer complete protection				
Agree	152 (37.6)	193 (48.7)		
Neutral	116 (28.7)	142 (35.9)		
Disagree	136 (33.7)	61 (15.4)		
The vaccines they are bringing to Africa is different				
Agree	133 (32.9)	169 (42.7)		
Neutral	139 (34.4)	152 (38.4)		
Disagree	132 (32.7)	75 (18.9)		
Overall attitude				
Negative	173 (42.8)	254(64.1)	36.525	<0.001
Positive	231 (57.2)	142(35.9)		

Table 4: Acceptability of COVID-19 vaccines by location

Variable	Urban (n=404) n (%)	Rural (n=396) n (%)	x2	p-value
Acceptability of COVID-19 Vaccines				
Yes	186 (46.0)	90 (22.7)	48.095	<0.001
No	218 (54.0)	306 (77.3)		
Willingness to pay for COVID-19 vaccine				
Yes	87 (46.8)	31 (34.4)	3.767	0.052
No	99 (53.2)	59 (65.6)		
Reasons for Refusal of COVID-19 vaccines				
COVID-19 is not real.				
Yes	71 (32.6)	76 (24.8)		
No	147 (67.4)	230 (75.2)		
COVID-19 vaccine is a mark of a beast				
Yes	17 (7.8)	61 (19.9)		
No	201 (92.2)	245 (80.1)		
I do not believe COVID-19 vaccine will work				
Yes	45 (20.6)	116 (37.9)		
No	173 (79.4)	190 (62.1)		
Concerns about affordability				
Yes	30 (13.8)	84 (27.5)		
No	188 (86.2)	222 (72.5)		
Getting paid for vaccines				
Yes	14 (6.4)	68 (22.2)		
No	204 (93.6)	238 (77.8)		
Presence of Co-morbidities				
Yes	6 (2.8)	42 (13.7)		
No	212 (97.2)	264 (86.3)		
Too many vaccines already				
Yes	7 (3.2)	42 (13.7)		
No	211 (96.8)	264 (86.3)		
Vaccines are only for children				
Yes	9 (4.1)	65 (21.2)		
No	209 (95.9)	241 (78.8)		

Table 5: Association between selected factors and acceptability of COVID-19 vaccine by Location

Variables	Urban Acceptability Yes n (%)	No n(%)	x2	P value	Rural Acceptability Yes n (%)	No n (%)	x2	P value
Sex								
Male	116(51.1)	111(48.9)	5.343	0.021*	47(28.7)	117(71.3)	5.608	0.018*
Female	70 (39.5)	107(60.5)			43(18.5)	189(81.5)		
Marital Status								
Single	68(47. 9)	74(52.1)	4.600	0.100	23(21.9)	82(78.1)	3.953	0.139
Married	104(43.2)	137(56.8)			61(25.2)	181(74.8)		
Others	14(66.7)	7(33.3)			6(12.2)	43(87.8)		
Self-rated Health								
Excellent	110(48.5)	117(51.5)	3.313	0.346	51(32.7)	105(67.3)	15.255	0.002*
Good	64(45.4)	7 (54.6)			34(15. 7)	183(84.3)		
Fair	11(35.5)	20(64.5)			4(20.0)	16(80.0)		
Poor	1(20.0)	4(80.0)			1(33.3)	2(66.7)		
Income								
<10,000	16(37.2)	27(62.8)	2.631	0.452	8(42.1)	11(57.9)	33.281	<0.001*
11,000-30,000	45(51.1)	43(48.9)			53(17.3)	253(82.7)		
31,000-60,000	104(45.0)	127(55.0)			11(26.8)	30(73.2)		
≥61,000	21(50.0)	21(50.0)			18(60.0)	12(40.0)		
Perceived risk of COVID-19								
High	56(51.9)	52(48.1)	2.471	0.291	14(38.9)	22(61.1)	28.225	<0.001*
Fair	60(46.2)	70(53.8)			35(39.3)	54(60.7)		
Low	70(42.2)	96(57.8)			41(15.1)	230(84.9)		
Complete NPI for Child								
Yes	116(52.0)	107(48.0)	7.161	0.007*	66(28.2)	168(71.8)	9.773	0.002*
No	70(38.7)	111(61.3)			24(14.8)	138(85.2)		
Do you think COVID is real								
Yes	167(52.7)	150(47.3)	26.139	<0.001*	67(28.8)	166(71.2)	11.713	0.001*
No	19(21.8)	68(78.2)			23(14.1)	140(85.9)		
Knowledge on COVID-19								
Poor	52(35.1)	96(64.9)	11.179	0.001*	34(20.0)	136(80.0)	1.262	0.261
Good	134(52.3)	122(47.7)			56(24.8)	170(75.2)		
Awareness on COVID-19 vaccines								
Yes	129(51.4)	122(48.6)	7.650	0.006*	65(28.0)	167(80.0)	8.926	0.003*
No	57(37.3)	96(62.7)			25(15.2)	139(84.8)		
Attitude to COVID-19 vaccine								
Negative	58(33.5)	115(66.5)	19.071	<0.001*	30(11.8)	224(88.2)	48.063	<0.001*
Positive	128(55.4)	103(44.6)			60(42.3)	82(57.7)		

*****Significant at 5% level of significance*

Table 6: Predictors of Acceptability of COVID-19 Vaccine among Urban and Rural Communities

Variables	Urban			Rural		
	Odds ratio	95% confidence interval	p value	Odds ratio	95% confidence interval	p value
Sex						
Male	1.576	1.018 – 2.441	0.041*	1.380	0.745 – 2.556	0.305
Female(ref)						
History of Chronic illness						
Yes	0.418	0. 184 – 0.951	0.038*	1.954	0.679 – 5.625	0. 215
No(ref)						
Complete NPI Schedule for Child						
Yes	1.529	0.992 – 2.357	0.054	3.469	1.791 – 6.717	<0.001*
No(ref)						
Accepts COVID-19 is real						
Yes	2.984	1.616 – 5.511	<0.001*	2.165	1.057 – 4.435	0.035
No(ref)						
Knowledge on COVID-19						
Poor	0.687	0.430 – 1.098	0.117			
Good (ref)						
Awareness of COVID-19 vaccine						
Yes	1.426	0.905 – 2.248	0.126	1.604	0.769 -3.345	0.208
No(ref)						
Attitude to COVID-19						
Poor	0.481	0.309 – 0.747	0.001	0.190	0.100 – 0.360	<0.001*
Good(ref)						
Income						
≤10,000				0.691	0.158 – 3.009	0.622
11,000 -30,000				0.249	0.095 – 0.653	0.005*****
31,000 -60,000				0.414	0.127 – 1.357	0.146
≤ 61,000(ref)						
Perceived risk of COVID-19						
High				0.988	0.367 – 2.658	0.981
Fair				3.051	1.548 – 6.011	**0.001***
Low(ref)						
Self- rated health						
Excellent				0.169	0.10 -2.776	0.213
Good				0.057	0.003 – 0.959	0.047*
Fair				0.175	0.09 – 3.556	0.257
Poor(ref)						

**Significant at 5% level of significance. (Please note knowledge was significant on bivariate analysis in urban area only. Income, perceived risk of COVID-19 and self- rated health were significant on bivariate analysis in rural area only, hence the spaces in the table)*