Risk Perception and Acceptability of COVID-19 Vaccine in Nigeria

Short title: Risks of COVID-19 and vaccine acceptance

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Abstract
Objectives: Vaccines are anticipated to control the ongoing COVID-19 pandemic, however their acceptance is critical for the desired benefit. This study assessed risk perceptions of COVID-19, acceptability of its vaccine and socio-demographic associations of its acceptability in Nigeria.
Materials and Methods: A cross-sectional web-based study was conducted among 410 participants in Nigeria's six geo-political regions, using a three-part questionnaire. The questionnaire link was distributed via snowball method to consenting participants through online platforms. Study outcome measures were acceptance of a COVID-19 vaccine, and risk perception of COVID-19 by study participants. Descriptive and inferential statistics were performed using Microsoft Excel and SPSS version 24. P-values≤0.05 were considered statistically significant.
Results: A total of 410 respondents participated in the study and high risk perception of SARS-CoV-2 infection (COVID-19) was seen in 127(66.1%) of respondents. Vaccine acceptance was high in 233(56.8%) of respondents and was significantly associated with geo-political region (P=0.028). Moderate positive relationship (r = 0.3) was found between risk perception and acceptability of COVID-19 vaccine, and the correlation was statically significant (P = 0.000).
Conclusion: High risk perception of COVID-19 was found in over half of the respondents, and COVID-19 vaccine acceptance rate was a little over 50%. However, the study noted regional association with vaccine acceptance among study participants. Therefore, strategic and targeted messaging on vaccine acceptance should be prioritised by stakeholders, to ensure successful vaccine implementation.
Keywords: COVID-19, Acceptability of vaccine, Nigeria, Risk perception, Infection

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has been a major public health issue since its initial report in Wuhan, China.[1] Its associated negative effects on the economy and human socialisation have impacted on quality of life and psycho-social health of individuals.[2] Originating from a novel coronavirus, Severe Acute Respiratory Syndrome Coronavirus - 2 (SARS-CoV-2),[1] specific drug treatment has remained a challenge, although several drugs have been associated with improved outcomes of the disease.[3,4] Therefore, the wide availability and acceptance of safe and effective vaccines against SARS-CoV-2 have become a major public health priority.

Several types of potential COVID-19 vaccines are currently being developed, with a good number of them at the clinical trial phase, and some already rolled out.[5,6] Some of these include, inactivated viral vaccines, non-replicating viral vector vaccine, protein subunit vaccine, replicating viral vector vaccine, Ribonucleic Acid (RNA) based vaccine, virus-like particle, among others.[7] Major concerns of COVID-19 vaccines are efficacy and adverse reactions, especially in vulnerable groups of the populations.[5] A vaccine is potentially sufficient to confer herd immunity in communities and a subsequent control of the pandemic, but this requires high immunisation coverage.[8] and a rate of 55 % to 82 % has been estimated for SARS-CoV-2 herd immunity threshold.[9]. Therefore, for effective control of COVID-19 through vaccination, it is critical to ensure the readiness of the populace and acceptance of the vaccine by a large proportion of the population. Risk perception of the disease could also appreciably determine the acceptability of a vaccine [10].

About 160, 000 confirmed cases of COVID-19 have been recorded in Nigeria as of 3 April 2021, since its first confirmed case on 27 February 2020.[11] Although COVID-19 remains an ongoing pandemic with significant morbidity and mortality, low mortality and high recovery rates has been recorded in Nigeria.[11] Irrespective of the highly infectious nature of SARS-CoV-2, only a few persons appear to be aware of the possibility of contracting the disease in a Nigerian population, with a good number regarding the disease to be exaggerated.[12] Denial and misplaced 'religious zealotry' are also perceived to be negatively associated with COVID-19 – related behaviour in Nigeria.[13] Vaccination is critical to the prevention and control of infectious diseases, and previous studies have reported varying rates of vaccine acceptance.[14,15] Low rates of vaccine acceptance was observed in Nigeria, during poliomyelitis vaccination.[16] and this prevented the early eradication of wild polio in Nigeria. Meanwhile, vaccine hesitancy is a potential public health threat which is associated with the behavioural attributes of a people.[17]

It is evident that acceptance of a COVID-19 vaccine is a major public health need in the effective control of the disease. Lower risks perceptions of COVID-19 may influence the potential willingness to accept it. This study assessed the risk perception of COVID-19, and acceptability of a COVID-19 vaccine among the Nigerian population. Also studied were associations between respondents' socio-demographic characteristics and vaccine acceptability. It is hoped that findings from this study will equip public health professionals and policy makers with insights and relevant information that can be used for optimal COVID-19 vaccine rollout.

Materials and Methods

Study design and study setting

A cross-sectional web-based study was conducted from 20 November 2020 to 28 December 2020 to ascertain the risk perception of COVID-19 and the acceptance of the vaccine in Nigeria. Nigeria is located in West Africa with over 250 ethnic groups and is divided into six geopolitical zones and the Federal Capital Territory (FCT). Each geo-political region is made up of 6 States,

except the northwest and southeast regions which consist 7 and 5 states respectively. It is the most populous Black Country with a population of over a 200 million [19]. The country had an average life expectancy of 54 years as at 2018,[18] and has been previously faced with several disease outbreaks.

Study population

Using a vaccine acceptance of 50 % and margin of error of 5 % (95 % CI), we calculated a sample size of 385 individuals [20] for the study, but 10% was added to account for potential non-responses or attrition, and the study was then conducted among 420 participants.

The study included both male and female Nigerians who resided in Nigeria, who had access to internet facilities, and who belonged to online groups. It however excluded persons who did not give informed consent for the study and persons who were less than 18 years of age. State of residence was included among the variables measure, to exclude non-Nigerian residents.

Survey Instrument

The questionnaire included questions that explored the respondents' risk perceptions of COVID-19 and their willingness to accept the vaccine.

A three-part questionnaire which required about 3 minutes to complete was designed using Google forms. The constructs measured by the questionnaire were the respondents' risk perception of COVID-19 and the acceptability of a COVID-19 vaccine. Responses were required for all questions in the Google form. Section A of the questionnaire had 7 questions which obtained information on respondents' basic socio-demographic characteristics. Section B consisted of 5 questions and elicited information on respondents' risk perception of COVID-19. Section C was composed of 5 questions which assessed respondents' acceptability of a COVID-19 vaccine respectively. The questions were anchored on a 5-point Likert scale that ranged from strongly agree to strongly disagree. "SARS-CoV-2 infection" was not used in the questionnaire, "COVID-19" was rather used to facilitate comprehensibility.

The questionnaire was validated by expert evaluations and preliminary tests. Three public health experts who are colleagues of the authors and had over 10 years of practice, assessed their suitability by face validity. The preliminary testing was conducted among twenty adults who were randomly selected within the six geopolitical regions of Nigeria. Three adults comprising one male and 2 females were sampled from each region except the Northwest region where 5 adults were sampled following a larger number of states as compared to others. The selected respondents comprised persons with tertiary education, less than tertiary education and no formal education. This enabled the verification of proper understanding of the questions, and modifications were made to questions that were deemed to be ambiguous. Modifications included restructuring of such questions to suite the understanding of respondents. Only questions one and two, under risk perception of SARS-CoV-2 needed such modification. The reliability of the survey tool was also assessed using Cronbach's alpha.

Data collection and study outcome measures

The internet link was distributed to consenting participants through online platforms. Snowball approach was adopted in the distribution of the internet link via social media platforms and the survey was closed after 6 weeks of data collection. Reminders were sent to participants at intervals. The outcome measures for the study were acceptance rates of a COVID-19 vaccine by the study participants and risk perception of COVID-19.

Data analysis

Online survey data were downloaded into Microsoft Excel spreadsheet for data cleaning, validation, and descriptive analysis. Determination of the survey sample characteristics was

performed by descriptive statistics (frequencies, percentages). The assessment of perceived risk and vaccine acceptability which both had a 5-point Likert scale was interpreted as: "Strongly disagree", "Disagree" and "Undecided" = 0, while "Strongly agree" and "agree" for each question on risk perception and potential vaccine acceptability, was scored as 1 and the scores were added together. Weighted analyses for COVID-19 risk perception and COVID-19 vaccine acceptability were performed. Weighted scores were totaled over 5, and higher scores (≥ 3) denoted "high risk perception" and "vaccine acceptance" (pro-vaccination) respectively. Low scores (≤ 2) represented "low risk perception" and "vaccine unacceptance" (anti-vaccination). Data were imported to SPSS version 24 where Pearson's Chi Square analysis was conducted to determine associations between socio-demographics and vaccine acceptability. Pearson's correlation coefficient test was used to determine the relationship between risk perception and acceptability of a COVID-19 vaccine. $P \leq 0.05$ was considered to be statistically significant.

Ethical statement

Ethics approval was obtained from the Ethical unit of the Kwara State Ministry of Health and had the reference number MOH/KS/EU/777/455. Informed consent was obtained from the study participants prior to the study. The first part of the online survey instrument had a clear statement to show that participation in the study was completely voluntary. As also stated on the first part of the survey, consent for study participation was implied by clicking on the link and submitting the completed form. Forms were filled and submitted anonymously, and confidentiality of the participants' information was ensured during and after the study.

RESULTS

A total of 420 respondents participated in the survey, but 10 were excluded as the participants did not reside in Nigeria. The Cronbach's alpha showed a reliability of 0.82.

Socio-demographic characteristics of the respondents is shown in Table 1. Majority of the study participants were male 241 (58.8 %), aged between 26 – 35 years old 175 (42.7 %), single 240 (58.5 %), employed 301 (73.4 %), had tertiary education 371 (90.5 %) and from the North-central region of Country 133 (32.4 %).

Details of respondents' risk perception of SARS-CoV-2 infection are summarised in Table 2. Majority agreed that COVID-19 is a severe disease 358 (87.3 %), associated with stigma 284 (69.3 %) and will affect many Nigerians 247 (60.2 %). Meanwhile, less than half 165 (40.2 %) perceived themselves to be susceptible to SARS-CoV-2 infection (COVID-19) and over half 225 (55.1 %), perceived their close relative may get infected with SARS-CoV-2. Respondents' total weighted risk perception of SARS-CoV-2 infection was 127 (66.1 %). This implied that 66.1% of the study participants had high risk perception of COVID-19.

Table 3 shows acceptability of COVID-19 vaccine by respondents, where the total weighted acceptance of the vaccine was 233 (56.8 %), therefore almost half 177 (43.2 %) would not accept it. Majority would accept a COVID-19 vaccine if substantial information accompanied it 260 (63.4 %) if it were recommended by their healthcare provider 283 (69.3 %) and if it was provided at no financial cost 239 (58.3 %). Conversely, less than half 173 (42.2 %) would accept it irrespective of its novelty, and only about a one third of the population 134 (32.7 %) will readily accept the vaccine regardless of its potential adverse effects.

Details of the socio-demographic association of COVID-19 vaccine acceptability is given in Table 4. Acceptability of the vaccine was not significantly associated with gender (P = 0.846), age (P = 0.073), marital status (P = 0.105), employment status (P = 0.293) and educational qualification (P = 0.556) but was associated with geo-political region (P = 0.028). Over half of the males 136 (56.4 %) and females 97 (57.4 %) would accept the COVID-19 vaccine in Nigeria.

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Meanwhile, more than half of persons between 36 - 45 years old 49 (54.4%) and persons above 55 years old 5 (62.5%), would not accept the vaccine. Similarly, about half 83 (49.7%), of the married respondents would not accept the COVID-19 vaccine, while majority 147 (61.3%) of the single respondents would accept it. Findings from the study show the region with the highest acceptance rate to be the North-east 11 (73.3%) and the region with the least acceptance rate to be the North-west 6 (37.5%). Over half of persons from the South-east 22 (57.9%), South-west 49 (55.1 %), North-central 85 (63.9 %), and almost half of persons in the South-south 55 (48.2 %), would accept the vaccine.

The result of the Pearson correlation coefficient test showed a moderate positive (correlation $r = 0.3$) between risk perception and acceptability of a COVID-19 vaccine among the study participants. The correlation was statistically significant ($P = 0.000$).

Table 1: Socio-demographic characteristics of respondents.

Variables	Frequency (n=410)	Percentage (%)
Gender		
Male	241	58.8
Female	169	41.2
Age		
18 - 25 years	117	28.5
26 - 35 years	175	42.7
36 - 45 years	90	22.0
46 - 55 years	18	4.4
> 55 years	8	2.0
N/A	2	0.5
Marital status		
Married	167	40.7
Single	240	58.5
Widowed	1	0.2
Divorced	1	0.2
Separated	1	0.2
Employment status		
Employed	301	73.4
Unemployed	3	0.7
Student	86	21.0
Retiree	3	0.7
N/A	17	4.2
Highest educational qualification		
None	1	0.24

Primary	0	0.0
Secondary	34	8.3
Tertiary	371	90.5
Informal	1	0.2
N/A	3	0.7
Geo-political zones		
North-east	15	3.7
North-west	16	3.9
North-central	133	32.4
South-east	38	9.3
South-west	89	21.7
South-south	114	27.8
N/A	5	1.2

Table 2: Risk perception of SARS-Cov-2 infection (COVID-19) among respondents.

Variables	Risk code (Strongly agree and agree = 1, not sure, disagree and strongly disagree = 0)	Frequency (n = 410)	Percentage (%)
COVID-19 is a severe disease			
	1	358	87.3
	0	52	12.7
COVID-19 prevents regular associations			
	1	284	69.3
	0	124	30.2
	No response	2	0.5
I may likely get COVID-19 in the course of the pandemic			
	1	165	40.2
	0	244	59.5
	No response	1	0.2
There's a chance that my close relative may contract COVID-19			
	1	226	55.1
	0	181	44.2
	No response	3	0.7
COVID-19 will affect many Nigerians			
	1	247	60.2
	0	161	39.3
	No response	2	0.5
Total weighted risk perception			
	High risk	271	66.1
	Low risk	139	33.9

weighted risk perception (high risk ≥ 3, low risk ≤ 2)

Table 3: Acceptability of COVID-19 vaccine among respondents.

Variables	Acceptability (strongly agree and agree = 1, not sure, disagree and strongly disagree = 0)	Frequency (n = 410)	Percentage (%)
If I am offered a COVID-19 vaccine with substantial information on the vaccine, I will accept it			
	1	260	63.4
	0	144	34.1
	No response	6	1.5
I will accept to take COVID-19 vaccine if my healthcare provider recommends it			
	1	284	69.3
	0	123	30.0
	No response	3	0.7
If the vaccine is provided at no financial cost, I will accept it			
	1	239	58.3
	0	169	41.2
	No response	2	0.5
Despite the fact that COVID-19 vaccine is new, I will accept it once it is made available			
	1	173	42.2
	0	234	57.1
	No response	3	0.7
I will accept COVID-19 vaccine regardless of my fears of potential adverse effects			
	1	134	32.7
	0	273	66.6
	No response	3	0.7
Total weighted acceptability of COVID-19 vaccine			

| | | Pro-vaccination | 233 | 56.8 |
| | | anti-vaccination | 177 | 43.2 |

weighted acceptability (Pro-vaccination ≥ 3, anti-vaccination ≤ 2)

Table 4: Associations between vaccine acceptability and respondents socio-demographic characteristics.

Variables	Total (n=410)	Anti-vaccination n(%)	Pro-vaccination n(%)	χ2	p-Value	Phi	Cramer's V
Gender				0.038	0.846	0.010	0.010
Male	241	105 (43.6%)	136 (56.4%)				
Female	169	72 (42.6%)	97 (57.4%)				
Age				10.086	0.073	0.157	0.157
18 - 25 years	117	42 (35.9%)	75 (64.1%)				
26 - 35 years	175	73 (41.7%)	102 (58.3%)				
36 - 45 years	90	49 (54.4%)	41 (45.6%)				
46 - 55 years	18	8 (44.4%)	10 (55.6%)				
> 55 years	8	5 (62.5%)	3 (37.5%)				
N/A	2	0 (0.0)	2 (100%)				
Marital status				7.65	0.105	0.137	0.137
Married	167	83 (49.7%)	84 (50.3%)				
Single	240	93 (38.8%)	147 (61.3%)				
Widowed	1	1 (100%)	0 (0.0)				
Divorced	1	0 (0.0)	1 (100%)				
Separated	1	0 (0.0)	1 (100%)				
Employment status				4.948	0.293	0.110	0.110
Employed	301	137 (45.5%)	164 (54.5%)				
Unemployed	3	1 (33.3%)	2 (66.7%)				
Student	86	33 (38.4%)	53 (61.6%)				
Retiree	3	2 (66.7%)	1 (33.3%)				
N/A	17	4 (23.5%)	13 (76.5%)				
Educational qualification				3.012	0.556	0.080	0.086
None	1	0 (0.0)	1 (100%)				
Primary	0	0 (0.0)	0 (0.0)				
Secondary	34	16 (47.1%)	18 (52.9%)				
Tertiary	371	158 (42.6%)	213 (57.4%)				
Informal	1	1 (100%)	0 (0.0)				
N/A	3	2 (66.7%)	1 (33.3%)				
Geo-political				**14.173**	**0.028***	**0.186**	**0.186**

zones			
North-east	15	4 (26.7%)	11 (73.3%)
North-west	16	10 (62.5%)	6 (37.5%)
North-central	133	48 (36.1%)	85 (63.9%)
South-east	38	16 (42.1%)	22 (57.9%)
South-west	89	40 (44.9%)	49 (55.1%)
South-south	114	59 (51.8%)	55 (48.2%)
N/A	5	0 (0.0)	5 (100%)

*Statistically significant

DISCUSSION

High risk perception of COVID-19 was observed in majority of the respondents. The impact of an infectious disease may be dependent on perceptions about the disease. Risk perception of COVID-19 is expected to enhance the uptake of precautionary behaviours including vaccine acceptance. Meanwhile, weak correlation was found between COVID-19 risk perception and practice of preventive measures in Nigeria.[12] Therefore, following the high infectivity, and associated morbidity and mortality of SARS-CoV-2, improving its risk perception by health education measures is essential. In an Iranian and a Nigerian study, socio-demographic factors were reported to be determinants of COVID-19 risk perception,[21,22] which re-enforces the need for targeted messaging by stakeholders.

Findings from this study indicate that almost half of the study participants will not likely accept a COVID-19 vaccine, which is in congruence with previous studies in Nigeria.[23,24]. This level of the vaccine acceptance may not be sufficient for COVID-19 herd immunity. COVID-19 vaccine acceptance in United States of America had higher acceptance rate than ours,[25] and high risk perception of the disease was associated with vaccine acceptance.[26] Perception of risks of COVID-19 is expected to enhance the uptake of precautionary behaviours[27] including vaccine acceptance. Therefore, the difference in findings may be associated with varying levels of risk perceptions among the populace, and the overall COVID-19 associated morbidities and mortalities in the two countries. Nigeria has recorded only about one hundred and sixty thousand confirmed cases, majority of whom had been discharged, with very few deaths.[11] Previous studies observed that potential acceptance of the vaccine varied among countries, with China the highest acceptance rates.[14,15] Meanwhile, available studies show high effectiveness of COVID-19 vaccines against SARS-CoV-2 infection and COVID-19 related illness and death.[28]

Our study suggests that majority of persons may be cautious of the potential adverse effects of a COVID-19 vaccine. This may be a major limiting factor to its acceptance, although positive beliefs about COVID-19 vaccine was previously reported among the Nigerian population.[29] Similarly, almost half of the persons who would accept the vaccine in China also considered confirmation of vaccine safety as a necessity for receiving a dose of it.[15] China's high vaccination rate has been attributed to several implemented strategies which are technical and non-technical, involving adequate local production of vaccines, free vaccination and trust in vaccine effectiveness, among others.[30] These strategies may also help in promoting vaccination in other settings. Meanwhile, considering that healthcare providers may have a positive influence on the vaccine acceptance through their recommendation as seen in our study, it is pertinent to seek their total commitment regarding information on potential adverse reactions of the vaccine. This may build trust in the public and enhance vaccine acceptance.

In this study, acceptance of COVID-19 vaccine was not significantly associated with gender, age, marital status, employment status and educational qualification, but was associated with geo-political region. Similarly, a recent study in Nigeria did not observe associations between age/gender with COVID-19 vaccine acceptance.[24] In contracts, it was reported that gender and marital status could enhance the likelihood of COVID-19 vaccine acceptance in China.[15] Significant differences in socio-demographic associations with COVID-19 vaccine acceptance were also observed in the United States.[25] In our study, vaccine acceptance was majorly noted to be associated with geographic regions, this is suggestive of the need for targeted educational interventions in the regions, with effective COVID-19 vaccine-acceptance detailing, via various media. As a result of varying educational levels in the regions, this significant association is not unexpected. However, without adequate interventions, this could impair the formation of herd immunity threshold for SARS-CoV-2 [9] in the country. Basic interventions may include building trust on the vaccine, through consistent thoughtful and targeted public health information. Findings from the study showed a positive relationship between risk perception and acceptability of COVID-19 vaccine among study participants. Vaccine acceptability moderately increased with increase in risk perception. This corroborates with findings China.[31] Therefore, increase in public enlightenment on effects of COVID-19 is likely to enhance acceptance of the vaccine. This suggests targeted interventions that will improve knowledge and risk perception of COVID-19 among persons of various demographics, for improved vaccine acceptance.

Study limitations

The study was faced with some limitations among which may be selection bias, following the online method of data collection which may have excluded persons in rural communities with no internet facility and older adults who may not be friendly with social media applications. Therefore, this may have over-estimated the rate of acceptability of the vaccine, thereby limiting the generalisation of our findings. Also, low response rate recorded in the North-east and North-west regions may limit the generalisation of the findings in this region. Lastly, merging the "undecided" group with the "disagree" and "strongly disagree" groups may have caused losses of some statistical outcomes during dichotomisation of COVID-19 vaccine acceptance. However, the study buttressed the probability of vaccine acceptance from high risk perception of COVID-19, across socio-demographic variables.

CONCLUSION

High risk perception of COVID-19 was found in over half of the respondents. Similarly, COVID-19 vaccine acceptance rate was found to be a little over 50 %. However, the study noted regional association with vaccine acceptance among the study participants. Therefore, more targeted, and strategic educational interventions is necessary to improve risk perception and acceptance of COVID-19 vaccine, in other to break the disease transmission dynamics.

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