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COVID-19 Vaccine Uptake and its Determinants: Findings From A Web-Based Survey in Nigeria

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ABSTRACT

COVID-19 vaccination was identified as a major effort to curb the global challenge of this highly infectious disease. However, the coverage rate is an essential factor that decides successful vaccination. As vaccines are being distributed around the world, there is a debate on their acceptability, accessibility, and barriers to receiving them despite the availability of the vaccine. This study was conducted to assess the uptake of the COVID-19 vaccination, and its determinants among internet users in Nigeria. An online survey was conducted between February and April 2022 using a semi-structured questionnaire. It was set up using Google Forms and data were collected via online method. Relevant data collected were analyzed using STATA version 14. A total of 378 respondents participated in the study, with a mean age of 32 years (± 8.50) years. Majority of the respondents are young adults between the age range of 25-35 years. 74.9% of the respondents are Christians. All the respondents have heard of the COVID-19 vaccine while about one-third of them had taken the COVID-19 vaccine (62.2%). The uptake of the vaccine had a significant positive association with the level of education and level of monthly income (p =0.004 and 0.002 respectively) aORs =0.386, 95% (CI=0.184-0.810). Two out of three Nigerian respondents had taken the coronavirus vaccine. However, the long distance to get to vaccination centers was the leading barrier to vaccine uptake. Hence, this calls for key stakeholders to ensure that COVID-19 vaccination centers are close to residents in Nigeria and for leaders at all levels to be involved in public education based on sound evidence and the discouragement of the spread of conspiracy theories to eliminate the negative associated factors will reduce vaccine hesitancy and thereby increase COVID-19 vaccination uptake in Nigeria.

Keywords: Barriers, COVID-19, determinant, uptake, vaccine.

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I. Introduction

Coronavirus disease (COVID-19) is a novel disease pandemic that emerged in late 2019 in China and spread to other regions of the world, including Nigeria [1], [2]. This pandemic is considered a major global challenge [3]. Efforts and campaigns on prevention, early diagnosis, and medical management are being led by the World Health Organization (WHO) and numerous research teams, clinical experts, and institutions worldwide [3]. More than 40 new vaccines have undergone clinical evaluation, a few of them obtained the Food and Drug Administration's (FDA) Emergency Use Authorization (EUA), and are now used in many countries, for example, Pfizer BioNTech and Moderna vaccines [3]-[5].

As vaccines are being distributed around the world, there is a debate on their acceptability, accessibility, and barriers to receiving them [6]. While aiming for herd immunity, there are reports showing hesitancy in accepting the vaccine among diverse communities [7]. This has also been seen in the past, whereby vaccine acceptability has been influenced by factors such as gender, knowledge, safety, and importance of the vaccine, and mistrust in sources relaying information about the vaccine [6], [8], [9].

Lessons learned from the previous pandemics of influenza when the vaccine was introduced, and the acceptance rate in many countries to understand the vaccine hesitancy problem was sparse [10]. According to a study conducted in Malaysia using an online survey, it showed that about two-thirds of the respondents (64.5%) indicated a willingness to get vaccinated [5]. In Nigeria, according to another study among university health sciences students [11], the proportion of the respondents who accepted to take the COVID-19 vaccine was 40%, this is in tandem with a study conducted in tertiary institutions in Nigeria which showed that only 34.67% are willing to take the vaccine [1]. Also, the study by [2] showed that over one-third (66.2%) of all respondents are willing to take the vaccine.

Generally, uptake of vaccines can be hindered by several barriers such as access to the vaccine, cost of the vaccine, the convenience of getting to a health facility, level of trust for the healthcare system, personal risk perception, information sources, religious/cultural beliefs, household wealth, residence, ethnicity, and other demographic variables, as well as other social influences [6], [7], [10].

As low and middle-income countries are receiving COVID-19 vaccines, it is imperative to assess the uptake of the vaccine on the population, both in the short and long term. Several studies have revealed the effects of vaccine determinants on the uptake of already existing vaccines [2], [3], [6]. However, there is still a paucity of data on the determinants of the COVID-19 vaccine, especially in Nigeria. It is against this backdrop that we sought to explore the barriers and drivers influencing the uptake of the COVID-19 vaccine in Nigeria. Pertinent findings from this study serve as baseline data for longitudinal research and predictors for other disease vaccination coverage and mitigate barriers to vaccine uptake to efficiently eradicate diseases.

II. Methodology

A. Study Setting

The study was carried out across Nigeria between February to April 2022.

B. Study Design

A descriptive cross-sectional, online population-based study design was used for this study.

C. Sample Population

The study participants were Nigerian adults aged 18 years and above.

D. Sample Size and Sampling Technique

The study sample size was estimated Prevalence estimates of sample size were calculated based on the findings from a similar study which showed a prevalence of 67.2% [3]. Using a 95% confidence level and 5 % margin of error A single population proportion formula was used to generate the required minimum sample size of 373.

E. Data Collection Tool & Procedure

Quantitative data was collected from the participants using a semi-structured self-administered questionnaire that was purposely adapted and designed based on an adequate literature review [5], [10]. The instrument comprises four sections: Section A on the Socio-Demographic characteristics of the participants, Section B on the Knowledge of vaccine and uptake of COVID-19 vaccine, Section C on existing barriers, and Section D on factors hindering vaccine uptake.

The instrument was set up via Google Forms and pretested for reliability and tested for ambiguity among 20 respondents before data collection. The access link was then shared via online platforms including Facebook and WhatsApp, initiated by all project members. The sharing was escalated by our family members, friends, colleagues, and acquaintances. The inclusion criteria for respondents' eligibility include those more than 18 years old, and an understanding of the English language. The respondents were requested to take part in the survey by completing the questionnaire without any time restrictions.

F. Data Analysis

The data were analyzed using STATA version 14.0 and relevant analyses were done using univariate analysis by frequency and percentages e.g., Tables for socio-demographics, knowledge, barriers and uptake. Bivariate analysis by chi-square e.g., the association between socio-demographics and uptake of COVID-19 vaccine. Multivariate analysis was done using logistics regression to identify statistically significant variables for vaccine uptake.

G. Ethical Consideration

Ethical approval was obtained from the Nigerian Institute of Medical Research (NIMR) institutional review board with the project number IRB/22/032 before the commencement of the study.

The subjects consented to participate in this survey by volunteering to complete and submit the questionnaire. Respondents were informed that participation was voluntary and that they will not suffer any consequences if they chose not to participate. In the same vein, they were assured of strict anonymity as their name or address were not collected nor extracted and confidentiality, as the data collected, is only meant for research purposes. All the ethical protocols were observed before proceeding with the data collection.

III. Result

Table I below shows the demographics of the respondents where the mean, modal age range and standard deviation of respondents was 32 years, 18-59 years and 8.50 respectively. Respondents that are females were 49.50% and 50.50% were males. Majority of our respondents (63.8%) said that their family members or friends have been infected with COVID-19 while 36.2% said that their family members or friends have not been infected with COVID-19. Respondents that live with someone who is at higher risk of getting severe COVID-19 were 29.6% while 70.4% do not live with someone who is at higher risk of getting severe COVID-19.

In Table II below, all our respondents have heard of COVID-19 vaccines. We found out that 62.2% of our respondents have taken the COVID-19 vaccine while 37.8% have not taken the COVID-19 vaccine. Among the 235 respondents that have taken the COVID-19 vaccine, 21.3% have taken only one dose, 68.5% have taken 2 doses, and 10.25% have been fully vaccinated with a booster. The

leading reasons for not taking the COVID-19 vaccine were lack of trust in its effectiveness (24.5%), busy schedule (13.3%), long-distance to healthcare center (11.2%), lack of access to the COVID-19 vaccine (7.0%), belief 4.9% and 39.2% had no reason for not taking the COVID-19 vaccines.

TABLE I: SOCIO-DEMOGRAPHICS CHARACTERISTICS OF THE RESPONDENTS (N=378)

Variables	Frequency (N= 378)	Percentage (%)
Age -group (Mean = 32, SD = 8.50, Min = 18, Max = 59)		
Youths	71	18.8
Young adult	232	61.4
Middle-aged group	75	19.8
Sex		
Male	191	50.5
Female	187	49.5
Marital status		
Single	142	37.6
Married	208	55.0
Cohabiting	5	1.3
Separated	11	2.9
Divorced	8	2.1
Widowed	4	1.1
Religion		
Christian	283	74.9
Islam	95	25.1
Highest Level of education		
No formal education	2	0.5
Primary education	5	1.3
Secondary education	34	9.0
Tertiary education	337	89.2

The relationship between socio-demographic, family, work-related, and other factors and uptake of the COVID-19 vaccine were analyzed in Table III above. Level of education and monthly income were associated with the uptake of the COVID-19 vaccine as they both showed statistically significant differences. With regards to the level of education, 65.3% of those with tertiary education took the vaccine, compared to 38.2%, 20%, and 50% of those with secondary, primary, and no formal education respectively (p=0.004). Regarding monthly income, 79.3% of that earning between 51,000 - 99, 999 Naira took the vaccine, compared to 60%, 56.1%, and 55.4% of those earning between 100,000-150,000 Naira, <50, 000 Naira and >150, 000 Naira respectively (p=0.002).

TABLE II: KNOWLEDGE AND UPTAKE OF COVID-19 VACCINE AMONG RESPONDENTS (N=378)

Variables	Frequency (N= 378)	Percentage (%)
Have you heard of the COVID-19 vaccine		
Yes	378	100
No	0	0
Have you taken COVID-19 Vaccine?		
Yes	235	62.2
No	143	37.8
If yes, how many doses have you taken? (n=235)		
One dose	50	21.3
Two doses	161	68.5
Fully vaccinated with booster	24	10.2
I don't know	12	5.1
If not, what are the reasons for not taking the vaccine? (n=143)		
Belief	7	4.9
Busy schedule	19	13.3
No reason	56	39.
Lack of access to the vaccine	10	7.0
Lack of trust in its effectiveness	35	24.5
Long distance to the healthcare centre	16	11.2

TABLE III: THE RELATIONSHIP SOCIO-DEMOGRAPHICS AND UPTAKE OF COVID-19 VACCINE

Variables	Sub- variables	Uptake of COVID-19 vaccine		Statistical indices
		YES (%) n=235	NO (%) n=143	
Age-group	Youths	45 (63.4)	26 (36.6)	$\chi2 = 0.555$ p = 0.758
	Young adults	141 (60.8)	91 (39.2)	
	Middle-aged group	49 (65.3)	26 (34.7)	
Sex	Male	118 (61.8)	73 (28.2)	$\chi2 = 0.025$ p = 0.875
	Female	117 (62.6)	70 (37.4)	
Marital Status	Single	95 (66.9)	47 (33.1)	$\chi2 = 6.949$ p = 0.224
	Married	122 (58.7)	86 (41.3)	
	Cohabiting	2 (40.0)	3 (60.0)	
	Separated	8 (72.7)	3 (27.3)	
	Divorced	4 (50.0)	4 (50.0)	
	Widowed	4 (100)	0 (0)	
Religion	Christian	177 (62.5)	106 (37.5)	$\chi2 = 0.067$ p = 0.795
	Islam	58 (61.1)	37 (38.9)	
Highest level of education	No formal education	1 (50)	1 (50)	$\chi2 = 13.200$ p = 0.004*
	Primary education	1 (20.0)	4 (80.0)	
	Secondary education	13 (38.2)	21 (61.8)	
	Tertiary education	220 (65.3)	117 (34.7)	
Level of monthly income	<50, 000 Naira	64 (56.1)	50 (43.9)	$\chi2 = 14.575$ p = 0.002*
	51,000 - 99, 999 Naira	69 (79.3)	18 (20.7)	
	100,000- 150,000 Naira	51 (60.0)	34 (40.0)	
	>150, 000 Naira	51 (55.4)	41 (44.6)	

TABLE IV: BINARY LOGISTIC REGRESSION MODEL FOR THE OUTCOME VARIABLE "UPTAKE OF COVID-19 VACCINE" AND SELECTED POTENTIAL PREDICTORS

Variables	Sub- variables	P-value	Adjusted Odd's ratio	95% Confidence Interval	
				Lower	Upper
Education	Tertiary education (Reference)	0.012*	0.386	0.184	0.810
Monthly income	>150, 000 Naira (Reference)	0.775	1.093	0.594	2.013

We also tested the association using the binary logistic model for the outcome of variable uptake of COVID-19 vaccination in the table 4 above. Our findings showed that the level of education was statistically significant with p-value =0.012 (< 0.05) (95% CI = 0.184-0.810), suggesting that those who have lower education such as those with no formal education, primary and secondary education are approximately three times (1/0.386=2.59) less likely to take the COVID-19 vaccine.

IV. Discussion

The major findings from the study are divided into four subsections namely: Socio-demographic characteristics of respondents, Knowledge of the COVID-19 vaccine, Uptake of COVID-19 vaccine, and factors predicting the Uptake of COVID-19 vaccine. The demographics study showed that there was a greater number of young adults that responded to the COVID-19 Vaccine uptake. There was a slightly symmetrical distribution of gender respondents which was akin to findings obtained from a similar study which showed a slightly greater proportion of the male respondent [3]. Majority of the respondents interviewed with advanced Knowledge and exposure was about 89.2% while 1.3% had primary education and 0.50% had no formal education. Our study further shows that the majority of our respondents with health insurance accounted for were about two times higher than non-health insurance holders.

In terms of knowledge of the COVID-19 vaccine among respondents, all of the respondents in the study have heard of the COVID-19 vaccine (100%) this could be a result of the widespread advocacy and awareness by different stakeholders on social media, outreaches, and well as health facilities. In the same vein, little below half of the respondents heard about the vaccine through Media (Radio/ Television) (45.2) followed by almost one-third of health worker (31.2%). This pattern conforms with a study that showed that more of the respondents heard about the vaccine through healthcare providers (45.4%) [12]. This parallel similarity in both studies was accounted for by a major source of information which is media (Television/Radio) [5]. Similarly, almost two-thirds of the respondents believed that the COVID-19 vaccine protects the receiver from getting COVID-19 infection (62.2%), (60.1%) disagree that COVID-19 vaccination protects other people who do not receive the vaccine while over one-third of the respondents believe that the COVID-19 vaccine protects from common flu (70.1%).

Overall, it is safe to say more of the respondents have good knowledge of the vaccine, which is variance with findings from a study conducted in Malaysia which showed a total of 872 (62.0%) of the respondents had poor knowledge of the COVID-19 vaccine [5]. The difference in these results could be a result of the time given that the study was conducted in 2021 and recently more people are now aware of the vaccine as against then. Another reason could be due to location, more people are probably aware of the vaccine in this part of the world.

With regards to the uptake of the COVID-19 vaccine among all respondents, almost two-thirds of the respondents had received it (62.2%), this finding is greater than the result gotten from a study that showed data from Chinese surveys indicating fairly stable vaccine acceptance rates across different time-points of 77% and above, except for one survey conducted in February/March 2020 that included nurses (who reported an acceptance rate around 40%) [13]. Additionally, the percentage is greater than the results obtained from a study in Nigeria which showed that the proportion of the respondents who accepted to take the COVID-19 vaccine was 40% [11].

With regards to the determinant of vaccine uptake, using the bivariate analysis i.e., chi-square we also found consistent associations between the uptake of vaccines and the level of education of Nigerians as well as the income status of the respondents. With regards to the level of education, 65.3% of those with tertiary education took the vaccine, compared to 38.2%, 20%, and 50% of those with secondary, primary, and no formal education respectively (p=0.004). Regarding monthly income, 79.3% of that earning between 51,000-99, 999 Naira took the vaccine, compared to 60%, 56.1%, and 55.4% of those earning between 100,000- 150,000 Naira, <50, 000 Naira and >150, 000 Naira respectively (p=0.002). This discovery is akin to an earlier report projecting monthly income and other demographic variables as perceived barriers to the uptake of vaccines in Nigeria [11]. We went further to test using the binary logistic model for the outcome of variable uptake of COVID-19 vaccination and level of education and discovered that the p-value = 0.012 which is less than 0.05. This simply means that those who have lower education such as those with no formal education, primary and secondary education are approximately thrice less likely to uptake the COVID-19 vaccine, aORs =0.386 (1/0.386=2.59) 95% (CI=0.184-0.810). In the same vein, the outcome of variable uptake of COVID-19 vaccination and level of monthly income, the p-value =0.775 which is greater than 0.05. This means that the level of monthly income is not statistically significant to the uptake of COVID-19 vaccinations.

One plausible implication of these results is that the uptake of the vaccine is good as over one-third of the respondents had taken the vaccine. Furthermore, this study provided the needed context-specific variations in COVID-19 vaccine uptake across the different socio-demographics and other factors in Nigeria. Hence, it is evident that more of those who have lower education such as those with no formal education, primary and secondary education are less likely to uptake the COVID-19 vaccine.

V. Conclusion

In conclusion, we have shown that the uptake level of the COVID-19 vaccine in Nigeria is largely multi-influential with pre-disposable factors across socio-demographic characteristics of Nigerians, but dependent on the level of education and the income level of Nigerians. In light of the findings from this study, thus, it could be recommended that key stakeholders and leaders at all levels to be involved in public education based on sound evidence and the discouragement of the spread of conspiracy theories to eliminate the negative associated factors will reduce vaccine hesitancy and thereby increase COVID-19 vaccination uptake in Nigeria. Further research should investigate large-scale surveillance and monitoring of the health status of

Nigerians that took the COVID-19 Vaccine and also formulate implementation models that will encourage nationwide coverage above 90%.

LIMITATIONS

This study has its limitations which cannot be overlooked; however, future studies should look into improving on the limitations of this study. This study was online-based hence, this study needs replication with physical data methodology to allow longitudinal inferences. Moreover, there is also a need to conduct this study among healthcare professionals, e.g., doctors and pharmacists as well, to broaden the scope covered.

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CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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