ORIGINAL ARTICLE

Awareness, perceptions and acceptance of the Covid-19 vaccine in South-eastern Nigeria

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ABSTRACT

Effective planning and sustainable implementation of vaccination activities require a good understanding of how much a population is aware, perceives and willing to accept the vaccines. A cross-sectional study was carried out between February 22 to April 14, 2021, which assessed 400 participants to ascertain their level of awareness, perception and acceptance of the COVID-19 vaccine in south-eastern Nigeria. Data was collected using a structured pre-tested questionnaire and analysed using IBM-SPSS statistics version 21. The mean age of the participants was 36.15 years. About 4% of the participants had tested positive for COVID-19 and 12.5% had a perceived experience of COVID-19 without a test. Overall, 53.5% of the participants had a positive perception of the COVID-19 vaccine, while 55.5% accepted the COVID-19 vaccine. A significant association was not found between awareness and the acceptance of the COVID-19 vaccine ($X^2 = 1.071$, $p = 0.475$). No statistical relationship was established between perception of the COVID-19 vaccine and the acceptance of the COVID-19 vaccine ($X^2 = 0.024$, $p = 0.877$). Factors including awareness about the vaccine, economic and social status as well as high literacy level may have contributed to the acceptance of the vaccine among study participants. Major concerns relating to vaccine hesitancy were related to the safety and effectiveness of the vaccine. There is a need for continuous public health enlightenment and sensitization on vaccine safety, effectiveness, availability and accessibility by involving all stakeholders in the communities in order to achieve a safe population.

Key words:
covid-19 vaccine; knowledge; perceptions; acceptance; South-eastern Nigeria

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INTRODUCTION

COVID-19 emerged in late 2019, resulting in a global pandemic[1]. Multiple COVID-19 variants have been found, and the threat of disease transmission is still present[2]. Economic, health, and societal issues are among the negative consequences of the novel coronavirus disease 2019 for countries and individuals globally[3]. COVID-19 infection and mortality continue to be a major concern worldwide. In Nigeria, 255,296 confirmed cases of COVID-19 and 3,142 deaths have been recorded so far as of the time of writing[4]. Thankfully, advances in the prevention of the spread of coronavirus disease have been achieved through the development of the COVID-19 vaccine.

The use of vaccines is an effective way to curb the spread of COVID-19[5, 6]. Vaccines have been proven to be effective in eradicating, eliminating, and reducing to the lowest minimum of other viral diseases such as Smallpox, Poliomyelitis, Hepatitis viruses, Human papillomavirus, Ebola virus, etc.[7]. Although vaccination has successfully reduced the global burden of illness and death, public lack of confidence in vaccines can lead to vaccine hesitancy, leading to delays and refusal to get vaccinated and sometimes contributing to disease outbreaks[8].

Unprecedented global collaboration among governments, vaccine manufacturers, and researchers amounted to the development of the COVID-19 vaccines[9]. However, the mere availability of the vaccine is insufficient to guarantee broad immunological protection[10]; the vaccine must also be acceptable to both the health community and the general public. While the focus is on the distribution of COVID-19 vaccines, less attention has been paid to the acceptance of the vaccine. Uptake of vaccine can be influenced by the awareness and perception of the population about the disease[11]. Also, some cultural, religious, and social factors have hindered previous vaccination intervention programs in Nigeria due to perceptions and beliefs about the causation of diseases and how they should be controlled.[12]

Vaccination uptake has been a challenge for almost all countries throughout the world. It is recommended that at least 70% to 80% of the population should be vaccinated to contain the pandemic effectively, given the introduction of more contagious variants[13]. Even though the proportion of people who have been vaccinated is steadily increasing[14-16], some people are nevertheless hesitant to receive a vaccine. As of April 14, 2021, only 54,385 (0.12%) of the southeastern Nigerian population have received at least a single dose of the COVID-19 vaccine[17]. This could be owing to the public's low willingness to comply with the vaccine. Trust issues between the people and the healthcare system or the government due to vaccination safety concerns and increased apathy towards personal protection behaviors[18] are possible causes for poor compliance. Still, these reasons may differ between countries and regions. Vaccine inequity is also a major concern. The current method of global vaccine distribution is based on financial competition for limited vaccine supplies, resulting in high-income countries getting first access to vaccines and low-income countries being forced to rely on voluntary donations through schemes like COVAX, resulting in a limited supply of the vaccine[19].

The attitudes toward the COVID-19 vaccine uptake have been assessed using various behavior theories, including the Protection Motivation Theory[20, 21], a type of social cognition theory that explains the underlying factors for individuals' behavioral intention to accept the COVID-19 vaccine; the health belief Model[22, 23], a

theory that uses health perceptions to explain human health behaviors toward the acceptance of the COVID-19 vaccine; and the theory of planned behavior[24, 25], which provides attitude, subjective norm, and perceived behavioral control as crucial psychological factors for explaining why an individual performs a particular behavior, and these tools are used to assess COVID-19 vaccine acceptance.

This study aims to critically investigate the perception regarding COVID-19 vaccines and the willingness to accept the COVID-19 vaccine among the South Eastern Nigerian population. The findings of this study could help policymakers implement proactive campaigns and well-designed tactics by emphasizing the importance of vaccination in the community and increasing vaccine uptake to prevent more deaths and contain the pandemic's spread.

MATERIALS AND METHODS

Study design

The study adopted a population-based cross-sectional approach and was carried out between February 22 to April 14, 2021, to ascertain the level of knowledge, awareness, and acceptance of the COVID-19 vaccine in southeastern Nigeria.

Area of the Study

This study was carried out in South-eastern Nigeria. South-eastern Nigeria is an area covering about 76,358km2 east of the lower Niger and south of the Benue valley. The region is between latitudes 4 and 7 degrees north of the Equator and between longitudes 7 and 9 degrees east. In geopolitical terms, it contains five out of the 36 states of the nation, namely Abia, Anambra, Ebonyi, Enugu, and the Imo States. The majority of the people are traders, artisans, civil servants, and students. The area is one of the most populous regions in the country. As of 2021, it is estimated to be around 50,000,000, approximately 25 percent of the population of Nigeria. The study was carried out in the states' capital cities. Commercial, religious, educational, and social activities (activities that support the spread of corona-virus disease) are the major activities in the study area; these activities place the residents at higher risk of contracting the corona-virus disease (COVID-19). As of April 14, 2021, southeast Nigeria has recorded a total of 9558 COVID-19 cases[17,] and only 54385 (0.12%) of the population was vaccinated.[26]

Sample size determination

A sample size of 400 participants was estimated using the Taro Yamane formula:

$$n = \frac{N}{1 + N(e^2)}$$

Where; n =sample population
N= total study population
e= error margin set at 5% which is 0.05

Sampling

A multi-stage technique was used in the sampling of households for the study. Two states (Imo and Enugu state) were randomly selected from the five states making up southeast Nigeria in the first stage. In stage two, two local government areas (LGA) each, were selected through balloting from the capital cities of the states selected. At stage three, one community was selected randomly from each of the selected LGA through balloting. Simple random sampling was then used to select 400 households (100 households from each LGA) from which the study participants were drawn. The heads or the representatives of a household who are 18 years and above were eligible for the study. Those people who are not the head of the household or not representing a household and are not up to 18 years and above were excluded from the study.

Data Collection

Data for the study were collected from February 22 to April 14, 2021, using a structured pretested questionnaire adapted from published literature[10,12], and was scrutinized by an expert statistician. It comprised four sections: the socio-demographic characteristics of respondents, respondents' awareness of COVID-19 and COVID-19 vaccine, respondents' risk perception of COVID-19 vaccine, and the acceptance of the COVID-19 vaccine. The test-retest method was used for the reliability check of the questionnaire. The questionnaire was administered face to face to the respondents, who were heads or representatives of the households at the time of entry after informed consent was obtained from each respondent. The literate respondents completed the questionnaire by themselves under supervision. For the non-educated respondents, the questionnaire was interpreted in Igbo language or 'pidgin English'; their responses were then filled into the questionnaire. Each questionnaire took about 10-15 minutes to be completed.

Data Analysis

Data obtained from the questionnaires were entered into Microsoft Excel and analyzed using IBM-SPSS statistics version 21. A descriptive statistical method that includes frequencies and percentages of distribution was used to describe data collected; tables were constructed for all class variables and expressed as the distribution percentage. Chi-square was used to test the association between the level of awareness and perception about the COVID-19 vaccine, awareness and the acceptability of the COVID-19 vaccine, and the level of perception and the acceptability of the COVID-19 vaccine.

Analysis was performed at a 95% confidence interval; probability value was used to determine the level of associations such that the values less than 0.05 were considered significant.

Ethical Approval

Ethical approval for this study was obtained from the research and ethics committee of the School of Health Technology, Federal University of Technology, Owerri Imo State, Nigeria (FUTO/SOHT/REC 017). Informed written consent was also sought and obtained from all study participants.

RESULTS

Characteristics of Study Participants

The characteristics of study participants are depicted in Table 1. The mean and standard deviation of the ages of the participants is 36.15 + 11.299 years. The majority of the participants, 28.3%, fell within the age groups of 21-30. Most participants (49.3%) had tertiary education, while 2.5% had no formal education. A majority (93.0%) of the respondents were Christians. The monthly family income structure of the respondents was such that 27.8% of them earned between N51, 000 and N80 000. (411 Naira is equivalent to 1USD)

Table 1: Characteristics of Study Participants

Variable	Frequency (n=400)	Percent (%)
Age group		
Less than 21	37	9.3
21 – 30	113	28.3
31 – 40	111	27.8
41 – 50	92	23.0
51 and above	47	11.8
Level of Education		
Non formal education	10	2.5
Primary education	18	4.5
Secondary education	175	43.8
Tertiary education	197	49.3
Religion		
Christianity	372	93.0
Islam	8	2.0
African traditional religion	14	3.5
Others	6	1.5
Occupational		
Unemployed	20	5.0
Farming	37	9.3
Trading	60	15.0
Artisan	54	13.5
Civil servant	75	18.8
Public servant	36	9.0
Student	110	27.5
Others	8	2.0
Family monthly income		
Above N100,000	51	12.8
N81,000 - N100,000	104	26.0
N51,000 - N80,000	111	27.8
N31,000 - N50,000	60	15.0
N18,000 - N30,000	45	11.3
Less than N18,000	29	7.3
Tested positive for COVID-19		
Yes	16	4.0
No	384	96.0
Perceived experience of COVID-19 (without test)		
Yes	50	12.5
No	350	87.5

**411 Naira (N) is equivalent to one USD*

Awareness of COVID-19 and the COVID-19 Vaccine

Table 2 shows study participants' responses to awareness of COVID-19 and the COVID-19 vaccine. All the participants (100%) had heard about COVID-19. The majority of the participants (71.0%) were aware of the cause of COVID-19. About 4% had tested positive for COVID-19, while 12.5% had perceived experience of

COVID-19 without a test. The majority (98.0%) were aware of the COVID-19 vaccine. Television (39%) was the primary source of information for most of the participants. The majority (82.5%) submitted that health workers are responsible for administering the COVID-19 vaccine. Most of the respondents (68.0%) had no idea of the number of vaccine doses to be received. Some (40.3%) chose vaccination cards as evidence of vaccination.

Table 2: Awareness of COVID-19 and the COVID-19 Vaccine

Variable	Frequency (400)	Percent (%)
Heard about COVID-19		
Yes	400	100.0
Awareness of the cause COVID-19		
Yes	284	71.0
No	9	2.3
No idea	107	26.8
Awareness of the COVID-19 vaccine		
Yes	392	98.0
No	8	2.0
Primary source of information		
Television	156	39.0
Radio news	115	28.8
Newspaper	7	1.8
Internet/social media	86	21.5
Health workers	7	1.8
Family and friends	23	5.8
Others	6	1.5
Awareness of who is responsible for the administering the vaccine		
Health workers	330	82.5
Drug vendors	3	0.8
Family members	2	0.5
No idea	65	16.3
Awareness of the required number of doses to receive		
One dose	65	16.3
Two doses	56	14.0
Three doses	7	1.8
No idea	272	68.0
Awareness of the evidence of vaccination		
Vaccination record card	161	40.3
Vaccination passport	6	1.5
Mark on the finger nail	14	3.5
No idea	219	54.8

Perception of the COVID-19 Vaccine

Participants' perceptions about the COVID-19 vaccine are shown in table 3. About 53.5% of the participants had a positive perception of the COVID-19 vaccine, and 47.0% agreed that the COVID-19 vaccine would prevent the spread of COVID-19. Also, 42.8% agreed

that everyone should receive the COVID-19 vaccine. A majority (64.8%) agreed that taking the COVID-19 vaccine was not against their religion, while 53.5% agreed it was not against their cultural belief. About 47.3% agreed that COVID-19 is a global health problem that requires a vaccine. About half (50.8%) disagreed that the COVID-19 vaccine would not have adverse health effects, while 48.8% agreed that the COVID-19 vaccine would stop mortality due to the Coronavirus. About 46.8% agreed that there is a need to adhere to preventive measures after being vaccinated, while 46.3% of the respondents agreed that the COVID-19 vaccine does not alter human genetic information (DNA).

Table 3: Perceptions about the COVID-19 Vaccine

Variable	Frequency (n=400)	Percent (%)
Overall positive perception	214	53.5
Overall negative perception	186	46.5
COVID-19 vaccine will prevent the spread of COVID-19		
Strongly agree	102	25.5
Agree	188	47.0
Disagree	76	19.0
Strongly disagree	34	8.5
Everyone should receive the COVID-19 vaccine		
Strongly agree	75	18.8
Agree	171	42.8
Disagree	106	26.5
Strongly disagree	48	12.0
Taking the COVID-19 vaccine is not against my religious belief		
Strongly agree	76	19.0
Agree	259	64.8
Disagree	40	10.0
Strongly disagree	25	6.3
Taking the COVID-19 vaccine is not against my cultural belief		
Strongly agree	133	33.3
Agree	214	53.5
Disagree	31	7.8
Strongly disagree	22	5.5
COVID-19 is a global health problem that requires vaccine		
Strongly agree	106	26.5
Agree	189	47.3
Disagree	82	20.5
Strongly disagree	23	5.8
COVID-19 vaccine will not have adverse health effect		
Strongly agree	29	7.3
Agree	140	35.0
Disagree	203	50.8
Strongly disagree	23	5.8
Indifferent	5	1.3

Variable	Frequency (n=400)	Percent (%)
COVID-19 vaccine will stop mortality due to Corona virus		
Strongly agree	47	11.8
Agree	195	48.8
Disagree	120	30.0
Strongly disagree	38	9.5
There is need to adhere to preventive measures after being vaccine		
Strongly agree	131	32.8
Agree	187	46.8
Disagree	63	15.8
Strongly disagree	19	4.8
COVID-19 vaccine does not alter DNA		
Strongly agree	51	12.8
Agree	185	46.3
Disagree	134	33.5
Strongly disagree	25	6.3
Indifferent	5	1.3

***Overall positive and negative perceptions were determined by scoring the responses in the perception section of the questionnaire as follows **strongly agree = 1, agree = 2, disagree =3, strongly disagree = 4**. The overall average of the scores was calculatedto determine the cut-off point = (**2.28**). Each participant average score was also calculated. Scores below the cut-off point were deemed to be positive perceptions about the COVID-19 vaccine while those above the cut-off point were deemed to be negative perceptions.*

Acceptance of the Covid-19 Vaccine

Overall, 55.5% of the participants are willing to accept the COVID-19 vaccine (Table 4). The majority (65.3%) of the participants accept the idea of a COVID-19 vaccine, while 34% do not accept the idea of a COVID-19 vaccine. About 50.5% accept completing the vaccine dosage, and 50.5% accept allowing their children and household to be vaccinated. The majority (62.3%) of the participants reported they would rather wait for others to be vaccinated before getting theirs. About 47.8% will encourage others to take the vaccine. The majority of the participants (84.5%) are not willing to pay for the COVID-19 vaccine, and only 15.5% of the participants are willing to pay for the vaccine.

Table 4: Participants' acceptance of the COVID-19 vaccine

Variables	Frequency (n=400)	Percent (%)
Overall acceptance	222	55.5
Overall non-acceptance	178	44.5
Accept the idea of the COVID-19 vaccine		
Yes	261	65.3
No	139	34.3
Will complete the COVID-19 vaccine dosage		
Yes	202	50.5
No	198	49.5
Will allow household to be vaccinated		
Yes	202	50.5
No	198	49.5

Variables	Frequency (n=400)	Percent (%)
Will wait for others before receiving mine		
Yes	249	62.3
No	151	37.8
Will encourage others to take the vaccine		
Yes	191	47.8
No	209	52.3
Accept to pay for the vaccine		
Yes	62	15.5
No	338	84.5

Overall acceptance and non-acceptance was determined by scoring **1 to all the **yes** responses and **2** to all the **no** responses in the acceptance section of the questionnaire. The overall average score was calculatedto determine the cut-off point = (**1.61**). Each participant average score was also calculated.Scores lower than the cut-off point represented acceptance of the COVID-19 vaccine while those below the cut-off represented non-acceptance.*

Association between characteristics of respondents and awareness, perceptions, and acceptance of the COVID-19 vaccine

Table 5 shows the relationship between the characteristics of respondents and awareness about the COVID-19 vaccine. A significant relationship was established between occupation and the awareness of the COVID-19 vaccine (p = 0.019) and between family monthly income and the awareness of the COVID-19 vaccine (p = 0.007). No association was found between age group, educational attainment, religion, a positive test for COVID-19 and perceived test for COVID-19 without test and the awareness of the COVID-19 vaccine.

No statistical relationship was found between the characteristics of the respondents and their perception of the COVID-19 vaccine (Table 6). There was no statistical relationship between the characteristics of respondents and acceptance of the COVID-19 vaccine (Table 7).

Table 5: Participants' characteristics and awareness of the COVID-19 vaccine

Variable	Awareness of COVID-19 vaccine		Total	X^2	p-value
	No (%)	Yes (%)			
Age group					
Less than 21	1(2.7)	36(97.3)	37	5.287	0.151
21-30	5(4.4)	108(95.6)	113		
31-40	2(1.8)	109(98.2)	111		
41-50	0(%)	92(100)	92		
51 and above	0(0)	47(100)	47		
Educational attainment					
Non formal education	0(0)	10(100)	10	4.118	0.172
Primary	0(0)	18(100)	18		
Secondary	1(0.6)	174(99.4)	175		
Tertiary	7(3.6)	190(96.4)	197		
Religion					
African Traditional	0(0)	14(100)	14	4.935	0.177
Christianity	7(1.9)	365(98.1)	372		
Islam	1(12.5)	7(87.5)	8		
Others	0(0)	6(100)	6		

Variable	Awareness of COVID-19 vaccine		Total	X^2	p-value
	No (%)	Yes (%)			
Occupation					
Artisan	1(1.9)	53(98.1)	54	12.407	0.019
Civil servant	0(0)	75(100)	75		
Farming	0(0)	37(100)	37		
Public servant	1(2.8)	35(97.2)	36		
Student	2(1.9)	108(98.1)	110		
Trading	1(1.7)	59(98.3)	60		
Unemployed	1(5.0)	19(95.0)	20		
Other	2(25.0)	6(75.0)	8		
Family monthly income (N)					
Less than 18,000	2(6.7)	27(93.3)	29	11.569	0.007
18,000-30,000	3(6.7)	42(93.3)	45		
31,000-50,000	0(0)	60(100)	60		
51, 000-80,000	1(0.9)	110(99.1)	111		
81,000-100,000	0(0)	104(100)	104		
Above 100,000	2(3.9)	49(96.1)	51		
Tested positive for COVID-19					
Yes	0(0)	16(100)	16	0.340	0.560
No	8(2.1)	376(97.9)	384		
Perceived experience of COVID-19 (without test)					
Yes	1(2.0%)	49(98.0%)	50	0.000	1.000
No	7(2.0%)	343(98.0%)	350		

Table 6: Participants' characteristics and perceptions of the COVID-19 vaccine

	Perception			X^2	p-value
	Positive; n (%)	Negative; n (%)	Total		
Age group					
Less than 21	21(56.8)	16(43.2)	37	1.663	0.797
21-30	55(48.7)	58(51.3)	113		
31-40	60(54.1)	51(45.9)	111		
41-50	51(55.4)	41(44.6)	92		
51 and above	21(56.8)	20(43.2)	37		
Educational attainment					
Non formal education	4(40.0)	6(60.0)	10	2.203	0.531
Primary	9(50.0)	9(50.0)	18		
Secondary	89(50.9)	86(49.1)	175		
Tertiary	112(56.9)	85(43.1)	197		
Religion					
African Traditional	3(21.4)	11(78.6)	14	6.563	0.087
Christianity	202(54.3)	170(45.7)	372		
Islam	5 (62.5)	3(37.5)	8		

	Perception			X^2	p-value
	Positive; n (%)	Negative; n (%)	Total		
Others	4(66.7)	2(33.3)	6		
Occupation					
Artisan	24(44.4)	30(55.6)	54	13.979	0.052
Civil servant	46(61.3)	29 (38.7)	75		
Farming	18(48.6)	19(51.4)	37		
Public servant	26(72.2)	10(27.8)	36		
Student	57 (51.8)	53 (48.2)	110		
Trading	28(46.7)	32(53.3)	60		
Unemployed	13(65.0)	7(35.0)	20		
Other	2(25.0)	6(75.0)	8		
Family monthly income (N)					
Less than 18,000	20(69.0)	9(31)	29	4.054	0.542
18,000-30,000	24(53.3)	21(46.7)	45		
31,000-50,000	34(56.7)	26(43.3)	60		
51, 000-80,000	58(52.3)	53(47.7)	111		
81,000-100,000	54(51.9)	50(48.1)	104		
Above 100,000	24(47.1)	27(52.9)	51		
Tested positive for COVID-19					
Yes	8(50.0)	8(50.0)	16	0.082	0.775
No	206(53.6)	178(46.4)	384		
Perceived experience of COVID-19 (without test)					
Yes	25(50.0)	25(50.0)	50	0.281	0.596
No	161(46.0)	189(54.0)	350		

Table 7: Participants' characteristics and acceptance of the COVID-19 vaccine

Variable	Acceptance n(%)	Non acceptance n(%)	Total	X^2	p-value
Age group					
Less than 21	23(62.2)	14(37.8)	37	3.363	0.499
21-30	58(51.3)	55(48.7)	113		
31-40	59(53.2)	52(46.8)	111		
41-50	57(62.0)	35(38.0)	92		
51 and above	25(67.6)	22(32.4)	37		
Educational attainment					
Non formal	3(30.0)	7(70.0)	10	3.536	0.316
Primary	11(61.1)	7(38.9)	18		
Secondary	94(53.7)	81(46.3)	175		
Tertiary	114(57.9)	83(42.1)	197		
Religion					
African traditional	8(57.1)	6(42.9)	14	5.141	0.150
Christianity	202(54.3)	170(45.7)	372		
Islam	7(87.5)	1(12.5)	8		
Others	5(83.3)	1(16.7)	6		

Variable	Acceptance n(%)	Non acceptance n(%)	Total	X^2	p-value
Occupation					
Artisan	29(53.7)	25(46.3)	54	8.187	0.316
Civil servant	41(54.7)	34(45.3)	75		
Farming	22(59.5)	15(40.5)	37		
Public servant	23(63.9)	13(36.1)	36		
Trading	32(53.3)	28(46.7)	60		
Student	61(55.5)	49(44.5)	110		
Unemployed	13(65.0)	7(35.0)	20		
Others	1(12.5)	7(87.5)	8		
Family monthly income(N)					
Less than 18,000	16(55.2)	13(44.8)	29	6.355	0.273
18,000-30,000	24(53.3)	21(46.7)	45		
31,000-50,000	35(58.3)	25(41.7)	60		
51, 000-80,000	52(36.8)	59(53.2)	111		
81,000-100,000	66(63.5)	38(36.5)	104		
Above 100,000	29(56.9)	22(43.1)	51		
Tested positive for COVID-19					
Yes	12(75.0)	4(25.0)	16	2.566	0.109
No	210(54.7)	174(45.3)	384		
Perceived experience of COVID-19 (without test)					
Yes	30(60.0)	20(40.0)		0.469	0.494
No	192(54.9)	158(45.1)			

Association between Positive tests for COVID-19, the perceived experience of COVID-19, awareness of the COVID-19 vaccine, perception of the COVID-19 vaccine, and participant's acceptance of COVID-19 vaccine.

Participants who tested positive for COVID-19 will accept the COVID-19 vaccine more than those who did not test positive for COVID-19 (75% vs. 54.7%) (Table 8). However, this was not found to be statistically significant (p = 0.109). The majority of participants with perceived experience of COVID-19 (without test) will accept the COVID-19 vaccine more than those who did not report any perceived experience of COVID-19 (without test) (60.0% vs. 54.9); this was also not found to be statistically (p = 0.494). The majority of the participants who are aware of the COVID-19 vaccine will accept the vaccine more than those who are not aware (55.9% vs37.5%), without a significant statistical association established (p = 0.475). The level of acceptance among participants who had a positive perception about the vaccine is negligibly lesser than those with negative perceptions (55.1% vs. 55.9%), without a significant statistical association (p = 0.877).

Table 8: Association between positive test for COVID-19, perceived experience of COVID-19, awareness of the COVID-19 vaccine, perception of the COVID-19 vaccine, and participant's acceptance of COVID-19 vaccine.

Variables			Total	X^2	p-value
	Acceptance n(%)	Non acceptance n(%)			
Positive test for COVID-19					
Yes	12(75.0)	4(25.0)	16	2.566	0.109
No	210(54.7)	174(45.3)	384		
Perceived experience of COVID-19(*without test*)					
Yes	30(60.0)	20(40.0)	50	0.469	0.494
No	192(54.9)	158(45.1)	350		
Awareness of COVID-19 vaccine					
Yes	219(55.9)	173(44.1)	392	1.071	0.475
No	3(37.5)	5(62.5)	8		
Perception about COVID-19 vaccine					
Positive perception	118(55.1)	96(44.9)	214	0.024	0.877
Negative perception	104(55.9)	82(44.1)	186		

DISCUSSION

The problem of COVID-19 vaccine hesitancy is an important issue that must be addressed because a larger percentage of the population must have COVID-19 immunity, through vaccination, to achieve a safe population[13, 27].

The majority of the respondents are aware of the COVID-19 vaccine; this could be due to the high literacy levels. The study shows that majority of them had received formal education and had access to sources of health information such as television, radio, and social media/internet, which are the major sources of information as found from the survey. These sources are the most available ways for the government and health authorities to provide critical information on COVID-19 vaccine[28, 29].

Our study provides essential insight into the perception of COVID-19 vaccines, acceptability, hesitancy, and factors associated with hesitation in the vaccine uptake. Almost half of the participants believed that vaccination effectively prevents and controls COVID-19 and would accept COVID-19 vaccines when they become available; perceptions of people can significantly impact whether or not the COVID-19 vaccination is acceptable to them, and this has been demonstrated among health workers in Nepal[30].

A significant number of the respondents expressed their hesitancy to receive the COVID-19 vaccines; this may have been a result of multiple rumors, conspiracy theories, and misinformation that have been spreading, as well as the degree of community involvement and social standards, which may have influenced people's perceptions of the COVID-19 vaccine resulting to hesitancy[31].

About half of the study participants would accept the COVID-19 vaccine; however, this is quite low, given the scale of the COVID-19 pandemic; this is because around 70% of the population will need to be vaccinated to achieve a safe population[32]. As a result, the proportion of acceptance found in this study shows that public health efforts to boost COVID-19 vaccination adoption in the general community are urgently needed. A study shows that the global acceptance of COVID-19 vaccines ranges from as low as 55% in Russia to as high as 88.6% in China[20]. The acceptance level of vaccinations in our study area is comparable to what is found in parts of

Poland and Russia[33], where low rates of acceptance have been reported.

We have identified several socio-demographic factors associated with hesitancy in COVID-19 vaccine uptake. The older age group will be more likely to accept the COVID-19 vaccine than any other age group. This observation is similar to the findings from previous studies, which also indicated a higher acceptance rate among the older population [34]. Higher acceptance among people in the older age group may be influenced by the increased risk of mortality after infection among the older population; younger persons may believe that they are healthy and do not need vaccination yet. However, this finding contrasts with a study conducted among adults in the United States, which showed that respondents between 18-29 years had higher acceptability (71%) than those aged 50-64 years (64%) [35]; the different age distribution can explain this result among different studies in various parts of the world as well as health perceptions among different age categories. In this study, the difference in the populations' perceptions and beliefs about vaccination, which cuts across age groups, is another factor that could affect the acceptance of the COVID-19 vaccine .

Consistent with other studies, the safety and effectiveness of the vaccine are the participants' major concerns, which may lead to hesitancy in the uptake of the vaccine[36,37]. Respondents' concern about side effects could reflect the rapid pace of vaccine development[38] and the limited information available about potential COVID-19 vaccine safety during the period of data collection. These concerns could also reflect worries about mild yet common and transient side effects, such as fatigue, muscle pain, joint pain, and headache. Concerns about vaccine efficacy may also reflect a lack of information about vaccines during our surveys.

Our study also assessed respondents who had tested positive for COVID-19 and those who had perceived experience of having the disease. The majority of the respondents who had tested positive for COVID-19 and those who believed they experienced it without confirming the experience with a test are more likely to accept the vaccine than those who had not experienced it, whether confirmed or not. Even though these associations were not statistically significant (probably due to the small number of participants who tested positive and those who had perceived experience), it is still important. It points to the possible influence that experience of a disease may have on preventative behavior. A plausible reason may be the fear of experiencing the disease a second time, described as grueling.

The majority of the participants were unwilling to pay for the COVID-19 vaccine if required to do so. Cost and affordability have been associated with non-compliance with some health interventions in the past, especially in low-income countries, leading to limited success in combating the spread of diseases[39]. Interventions that required no cost have been found to achieve better results for people in the past times. Consideration of the cost of the vaccine should be put in place, as any cost attached to receiving the vaccine may affect people's acceptance of the vaccine.

Limitation of the study

The study has several limitations that may restrict the generalizability of the study findings. First, our data are not representative of all the southeast population. They instead represent a sample from urban areas of the southeastern state where our organizations could quickly and safely mobilize coordinated data collection. The study population was highly literate. Therefore, the study's findings may not

represent similar outcomes in the less literate population. The study assessed individuals' acceptance of the COVID-19 vaccine when vaccines were nonexistent in the country due to early vaccine availability and disbursement. Hence, as more information becomes available on the safety and effectiveness of COVID-19 vaccines, individuals might change their stance regarding vaccination acceptance. The study did not also account for psychological factors and their influence on vaccine acceptance, such as trust in science and the government, which may also affect the rate of acceptance during the COVID-19 pandemic.

RECOMMENDATIONS

Vaccines are an effective tool available for preventing infectious diseases with their associated morbidities and mortalities[13]. Awareness about the COVID-19 vaccine among participants in this study is high; however, the level of acceptance is low compared to required standards. Continuous advocacy for acceptance of the vaccine is very important in the study area, particularly in dispelling misconceptions and inculcating adequate vaccine confidence in the people. Concerns relating to vaccine safety and effectiveness should also be dealt with as much as possible. Strategies for rolling out the COVID-19 vaccine in Southeastern Nigeria should build on the findings of this study to target groups at high risk of hesitancy. There is also a need for continuous public health enlightenment and sensitization on the vaccine effectiveness, accessibility, and cost by involving all relevant stakeholders in the communities.

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