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Factors Influencing The Acceptance Of Covid-19 Vaccination Among Adults In Rivers State: A Comparison Between Urban And Rural Areas

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Abstract
The importance of vaccines and vaccination cannot be overemphasized but, there is some resistance to vaccination uptake by some groups of people owing to the wrong perception of vaccines (side effects or negative motives of vaccines). These perceptions sometimes lead to vaccine hesitancy or low acceptance and uptake. This studyaccessedCOVID-19 knowledge, perception and determinants of COVID-19 vaccine acceptance between adults in urban and rural areas of Rivers State. The study adopted a comparative based cross-sectional and analytical design. The study population was estimated at 10,000 frontline personnel (medical practitioners, military personnel, task force agents, elderly people, and the general public) adults in the urban and rural areas of Tai and Port Harcourt Local Government Areas of Rivers State. Individuals aged 18 years or older, currently living in urban areas (Port Harcourt LGA) or rural areas (Tai LGA) in Rivers State who consented to participate, were included. Data were obtained through a self-structured questionnaire by the researchers titled "COVID-19 Vaccine Acceptance Questionnaire (C-VAQ)." The questionnaire was made up of items designed to get information from the respondents. The study also adopted a multi-stage sampling technique. Findings showed the majority of 171 (91.4%) and 101 (54.0%) respondents in urban and rural areas respectively had good knowledge that COVID-19 is a virus. There was a wrong perception of COVID-19 and COVID-19 vaccines. There was fair acceptance of COVID-19 vaccines 46.5% among respondents in urban areas while there was poor acceptance 28.6% in rural areas. The majority 81.0% and 72.9% of respondents among those who have not been vaccinated in urban and rural areas were ready to take the COVID-19 vaccine in the near future while the minority 19.0% and 27.1% of respondents in urban and rural areas were not ready to take COVID-19 vaccine in the nearest future. Determinants of COVID-19 vaccine acceptance were good knowledge, perception, educational level, religion and occupation. In conclusion,the negative perceptionof COVID-19 vaccine is a major reason for poor vaccine acceptance in the study areas. The study recommended amongst others thatthe government should introduce an evidence-based community messaging strategy.

Keywords:*COVID-19 Vaccination, Acceptance, Adults, Urban and Rural Areas, Rivers State*

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I. Introduction

Vaccines have existed for a long time on earth. It has done a lot of good in fighting diseases and, in some cases, eradicating some killer diseases known to man. According to World Health Organisation WHO, (2021), vaccines reduce the risks of getting a disease by working with one's body's natural defenses to build protection. When one gets a vaccine, their immune system responds. At present time, we now have vaccines to prevent more than 20 life-threatening diseases, helping people of all ages live longer, healthier lives all around the world (WHO, 2021). Vaccination has currently prevented 2-3 million deaths every year from diseases like diphtheria, tetanus, pertussis, influenza and measles. Vaccines are also critical to the prevention and control of infectious disease outbreaks. They underpin global health security and will be a vital tool in the battle against antimicrobial resistance (WHO, 2021).

The importance of vaccines and vaccination cannot be over-emphasized but, there are some resistances to vaccination uptake by some groups of people owing to wrong perception of vaccines (side effects or negative motives of vaccines). These perceptions sometimes lead to vaccine hesitancy or low acceptance and uptake. The United States once faced a growing anti-vaccine movement, and a corresponding reduction in acceptance of vaccine, a population-level threshold that limits the likelihood of epidemic transmission in a susceptible group. In the year 2019, vaccine hesitancy towards the measles vaccine, in particular, corresponded with 1249 reported measles cases, the highest annual number since 1992. Of those cases, 89% were unvaccinated or had an unknown vaccination status, and 86% were associated with outbreaks in under-immunized, tight-knit communities with shared belief systems that do not encourage vaccination (Patel et al., 2019). Globally, the World Health Organization's (WHO) vaccine advisory group has attributed low acceptance of vaccine to a complicated set of factors cantered on "complacency, inconvenience in accessing vaccines, and lack of confidence" (WHO, 2019).

Recently, the world experienced an outbreak of a particular strain of a virus called Coronavirus Disease 2019 (COVID-19). The outbreak was declared a Public Health Emergency of International Concern (PHEIC) on 30th January 2020 and a pandemic on 11th March 2020. The World Health Organisation (WHO) Director General requested all countries to adopt a "Whole-of-Government, Whole-of-Society" approach built around a comprehensive strategy to prevent infections, save lives and minimize the impact. The said virus became a burden globally, affecting all sectors of the society – health, security, political, economic and social - continue to be negatively impacted by the pandemic. In the health sector, the pre-existing fragile health systems were overwhelmed with the surge in cases at the peak of the outbreak. The continuity of essential health services has also been disrupted in many African countries resulting from an imbalance of the demand and supply factors. The most common services affected include routine immunization, facility-based services for non-communicable diseases, antenatal care, family planning and contraception, among others. The size and evolution of the virus, expanding knowledge on its transmissibility and the countries' gradual return to the 'new normal' signals a reinforcement and sustenance of the efforts to contain the pandemic.

The Coronavirus disease 2019 (COVID-2019) epidemic was said to have originated from China remains active in Nigeria and other African countries and continues to cause unprecedented socio-economic disruptions. As of 25 February 2021, cumulatively, over 111.7 million laboratory confirmed cases and over 2.4 million deaths had been reported globally from over 190 countries, areas or territories (WHO, 2021). In the WHO African Region, all 47 countries had reported a total of 2,789,965 confirmed cases and 71,204 deaths with case fatality rate of 2.6%. South Africa (1,507,448); Ethiopia (155,234); Nigeria (153,842) Algeria (112,461); Kenya (104,780); Ghana (81,245); Zambia (76,484); and Mozambique (56,920) have reported over 50,000 confirmed cases. A total of 2,473,939 patients have recovered from COVID-19 since the importation of the pandemic in the Region, representing a regional average recovery rate of 88.7%. An exponential increase in the number of healthcare workers infections from 307 (as of 24 April 2020) to 95,587 (as of 25 February 2021) has been observed.

In parallel, several COVID-19 vaccines have been developed and approved at an unprecedented speed, while holding rigorous regulatory processes (Johns Hopkins Coronavirus Resource Centre, 2020). These vaccines, however, cannot mitigate the epidemic without widespread acceptance. Assuming a basic reproductive number of 4, the community immunity level needs to reach at least 75% to stop the COVID-19 pandemic. Therefore, we must consider vaccine delivery strategies and determine the vaccine acceptance needed for society to return to pre-pandemic conditions (Bloom, Nowak & Orenstein, 2020). The World Health Organization (WHO) has listed vaccine hesitancy or delay in acceptance or refusal of vaccines, as one of the top ten threats to global health, even prior to the current COVID-19 pandemic (WHO, 2020). Early COVID-19 vaccine surveys on vaccine acceptance foreshadow global challenges to COVID-19 vaccine distribution (Perlis et al., 2020).

But a survey conducted by Lazarus et al, (2021) on potential acceptance of a COVID-19 vaccine in 13,426 randomly selected individuals across 19 countries, most with a high COVID-19 burden. Of these, 71.5% responded that they would take a vaccine if it were proven safe and effective, and 48.1% said that they would get vaccinated if their employer recommended it. However, the study observed high heterogeneity in responses between countries. Furthermore, reporting one's willingness to get vaccinated might not be necessarily a good predictor of acceptance, as vaccine decisions are multifactorial and can change over time. Therefore, this study will look into COVID-19 knowledge, perception and determinants of Covid-19 vaccine acceptance in Nigeria.

Vaccines are the highest public health strategy to prevent disease. However, vaccine effectiveness is contingent on their use. Vaccine programs can be a victim of their own success: as the number of persons who receives a vaccine increase, perceptions of the risk and impacts of the disease may, as a direct consequence, decrease. Adverse health effects which may arise from the vaccine may also become more familiar to the public than the disease itself. Thus, causing low acceptance and negative perception of vaccines. The rising incidence of vaccine preventable diseases across the world has raised new concerns about strategic ways to effectively

combat the anti-vaccination movement, reduce vaccine hesitancy, and consequently, enhance vaccine acceptance. According to Al-Mohaithef and Padhi (2020) vaccine acceptability is determined by three factors: confidence, convenience, and complacency. Therefore, there is a need to study the determinants of COVID-19 vaccine acceptance in the rural and urban communities of Rivers State, Nigeria.

II. Methodology

The study adopted a comparative-based cross-sectional and analytical design between adults in urban and rural areas of Rivers State. The study area is Port Harcourt City and Tai Local Government Area of Rivers State, Nigeria. Rivers State is one of the major oil-producing states which is located in the south-south area of the country. It has a population of about 7,043,800. Rivers State is a multicultural, multitribal state with multiple languages. The state is also made of up both riverine and upland communities and has various ethnic groups. There are 23 local government areas in Rivers State of which two are urban while the rest are majorly rural.

Population and Sample of the Study

The study population is estimated at 10,000 frontline personals (medical practitioners, military personnel, task force agents, elderly people, and the general public) adults in the urban and rural areas of Tai and Port Harcourt Local Government Areas of Rivers State. Individuals aged 18 years or older, currently living in urban areas (Port Harcourt LGA) or rural areas (Tai LGA) in Rivers State who consented to participate, were included while Individuals aged below 18 years and Individuals aged 18 years and above, living outside the study areas and those currently living in urban areas (Port Harcourt LGA) or rural areas (Tai LGA) in Rivers State who did not consent to participate, were excluded. The minimum sample size for the study was calculated using the statistical sample size formula estimating 'n' in comparison of two proportions (Kirkwood, 1998). This yielded a sample size of 346 for the two groups (i.e., a rural community versus an urban community); giving a minimum sample of 173 for each group. But, when an adjustment is made for non-response by assuming a response rate of 90%, the minimum sample size required increased thus:

n = 346 x (100% ÷ 90%)

n = 384 (192 per group).

This study adopted a multi-stage sampling technique. Multi-stage sampling is applied in this study because of the considerable large geographical area. The first stage used a purposive sampling technique to choose frontline personnel(medical practitioners, military personnel, task force agents, elderly people, and the general public) who were administered the COVID-19 vaccines in rural and urban areas. The second stage, selected 192 respondents from the rural and urban areas (42 medical practitioners, 30 military personnel, 40 elderly people, 40 task force agents and 40 respondents from the general public) using sequential sampling. Finally, participants who fulfilled the criteria of the study were selected from the following urban communities of Port Harcourt City LGA Tombia Street GRA, D-Line, Odili Road, Golf Estate and Aggrey Road while rural communities selected from Tai LGA were Ban-Ogoi, Bara-Ale, Bara-Alue, Barayira, and Borobara.

Instrumentation

Data were obtained through a self-structured questionnaire by the researcher titled "COVID-19 Vaccine Acceptance Questionnaire (C-VAQ)." The questionnaire was made up of items designed to get information from the respondents. The instrument was used to determine and compare differences in knowledge, and perception about COVID-19, rate of COVID-19 vaccine acceptance as well as determinants of COVID-19 vaccine acceptance between adults in urban and rural in Rivers State. The questionnaire was divided into four (4) sections. Section A contains items to elicit socio-demographic characteristics of the respondents, Section B has items on respondent's knowledge of COVID-19, Section C has items to get respondent perception about COVID-19 and Section D has items on the determinant of COVID-19 vaccine acceptance among respondents. The instrument was validated through face validity by the project supervisor and two other lecturers in the Department of Epidemiology University of Port Harcourt. The reliability of the instrument was determined using the test-retest method. The researcher administered 25 copies of the questionnaire to respondents on two different occasions within two-weeks interval and the coefficient of stability was determined using the Pearson-moment correlation coefficient between the scores obtained on the two administrations of the instrument. The Pearson-moment correlation coefficient yielded a coefficient of stability of 0.88 which was considered reliable enough.

Data Collection and Analysis

An introductory letter was attached to the instrument (copies of questionnaire) with the address of the School of Public Health, University of Port Harcourt, explaining the purpose of the research in order to gain access to the respondents. The instrument (copies of questionnaire) was duplicated to cover the sample size that

is 384 copies. The 384 copies of questionnaire were administered to the respondents and collected from them immediately when they were done filling it. Copies of questionnaire filled properly and complete were accepted while those that are not properly filled were excluded after sorting. This is in one in order to avoid bias in the data analysis and results. A total of 364 copies of questionnaire was use for the data entry purposes and analysis. The data collated were analysed on Statistical Package for Social Sciences (SPSS) version 20 with a confidence interval of 95% using descriptive statistics and Chi–square test of association. The procedures used in this research study followed all guidelines of the Ethical Review Committee of University of Port Harcourt. Procedures performed involving human participant were in accordance with the ethical standards of the Ethical Review Committee of University of Port Harcourt. The consent of respondents was sought and they were informed about the purpose of the study. They were also assured that information collected from them were to be used only for academic purpose and their identity were to be kept confidential and private.

III. Results

Knowledge about COVID-19

Knowledge about COVID-19 was acquire from urban and rural areas the results is shown as in Figure 1 below.

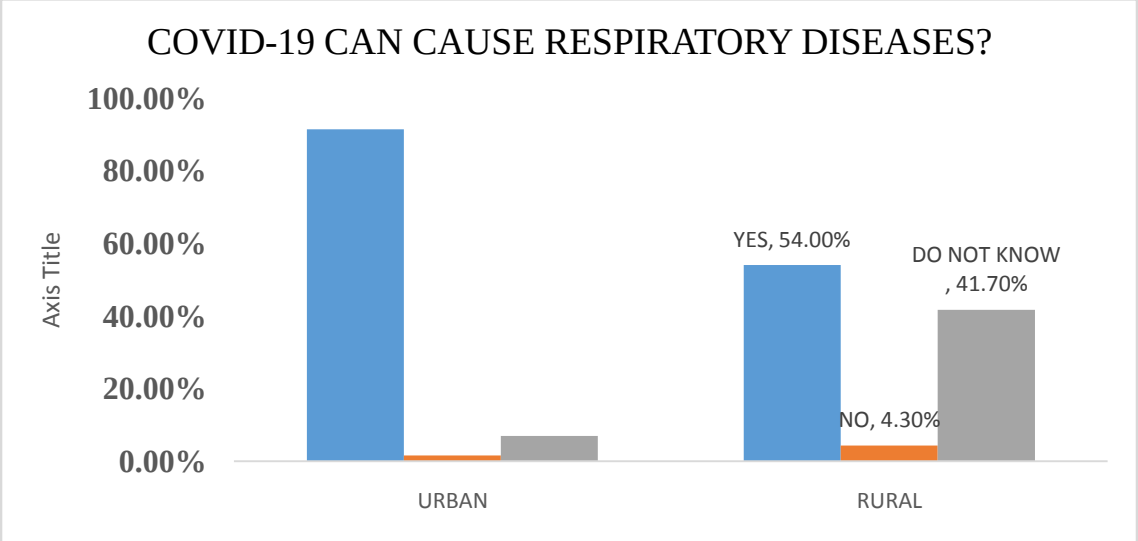

Figure 1 knowledge about COVID-19

All 187 (100.0%) of urban and rural participant in this study have heard of COVID-19. Majority 171 (91.4%) and 101 (54.0%) in urban and rural areas respectively had correct knowledge that COVID-19 is a virus that causes respiratory diseases while 3 (1.6%) an 8 (4.3%) in urban and rural areas respectively had wrong knowledge about COVID-19 as a virus that causes respiratory diseases. Minority 13 (7.0%) and 78 (41.7%) in urban and rural areas respectively had no knowledge about COVID-19 as a virus that causes respiratory diseases. Statistical results showed that there was no significant difference (Chi-square (4) = 6.00; p-value = 0.199) between urban and rural knowledge about COVID-19 diseases complications (risk factor for respiratory diseases).

Knowledge about COVID-19 Symptoms

Table 4.3 Knowledge about COVID-19 Symptoms

From Table 4.3 the overall knowledge was good at 65.78% which is over average. A total of 123 urban respondents and 102 rural respondents have good knowledge about Covid-19 symptoms. While 24.6% and 31.6% from the urban and rural areas respectively had average knowledge about

Covid-19 symptoms. Furthermore, 9.62% and 13.9% from the urban and rural areas respectively had poor knowledge about Covid-19 symptoms. This implies that there is good knowledge of Covid-19 among rural and urban residents in the study areas. Statistical results (Chi-square (100) = 110.0; p-value = 0.213) showed that there was no significant difference between urban and rural knowledge about COVID-19 diseases symptoms.

Knowledge of Covid-19 transmission

Table 2: Knowledge of COVID-19 Mode of transmission

From Table 2 results showed that the overall knowledge on COVID-19 mode of transmission was good at 55.2% and 72.2% which is over average. A total of 109 urban respondents and 135 rural respondents has good knowledge about Covid-19 mode of transmission. While 37.8% and 16.6% from the urban and rural areas respectively had average knowledge about Covid-19 symptoms. Furthermore, 7.0% and 11.2% from the urban and rural areas respectively had poor knowledge about Covid-19 transmission. The knowledge about COVID-19

Scores	**Remarks**	**Urban** Frequency (%)	**Rural** Frequency (%)	(χ^2)	df	p-value
0 – 4	Poor Knowledge	13 (7.0)	21(11.2)	1820	30	0.000
5 – 7	Average Knowledge	65 (37.8)	31 (16.6)			
8 – 10	Good Knowledge	109 (55.2)	135 (72.2)			

can be said to be average among urban and rural residents covered in this study. Statistical results showed that there was a significant difference (Chi-square (30) = 1820; p-value = 0.000) between urban and rural knowledge about COVID-19 diseases transmission.

Knowledge about covid-19 prevention

Table 3: Knowledge of COVID-19 prevention

From Table 3 results showed that the overall knowledge on COVID-19 mode of transmission was good at 77.5% and 71.1% which is over average. A total of 145 urban respondents and 133 rural respondents has good knowledge about Covid-19 mode of transmission. While 16.6% and 20.3% from the urban and rural areas respectively had average knowledge about Covid-19 symptoms. Furthermore, 5.9% and 8.6% from the urban and rural areas respectively had poor knowledge about Covid-19 prevention. Statistical results showed that there

Variable		Urban (f/ %)	Rural (f/ %)	(χ^2)	df	p-value
Sex	Male Female	68 (70.1) 57 (63.3)	71 (63.4) 61 (81.3)	728.1	4	0.0000
Highest Level of Education	No formal Education Primary Secondary Polytechnic/NCE/ND University	3 (60.0) 8 (80.0) 51 (87.9) 52 (96.3) 58 (96.7)	9 (52.9) 16 (64.0) 78 (78.0) 18 (90.0) 22 (88.0)	1820	25	0.0000

was a significant difference (Chi-square (72) = 2548; p-value = 0.000) between urban and rural knowledge about COVID-19 diseases prevention. Figure 5 shows the comparison between urban and rural knowledge about COVID-19 prevention measures.

Knowledge about COVID-19 with respect to Gender and Education Level

Table 4: Knowledge about COVID-19 with respect to Gender and Education Level

From Table 4 Chi-square (χ^2) association test was conducted with cross-tabulation between gender, education level and knowledge of COVID-19 (prevention, transmission, and symptoms) using SPSS version 20. The result for gender and knowledge of COVID-19 (prevention, transmission, and symptoms) showed a Pearson Chi-square (χ^4) = 728.1, p-value= 0.000. Which implies that gender is significant with knowledge of COVID-19 (prevention, transmission, and symptoms) in this study. Also, the result for highest level of education and knowledge of COVID-19 (prevention, transmission, and symptoms) showed a statistical significance with Pearson Chi-square (χ^{25}) = 1820.0, p-value= 0.000. This implies that level of education is significant with knowledge of COVID-19 (prevention, transmission, and symptoms) in this study.

Scores	**Remarks**	**Urban** Frequency (%)	**Rural** Frequency (%)	(χ^2)	df	p-value
0 – 4	Poor Knowledge	18 (9.62)	26 (13.9)	111.0	100	0.213
5 – 7	Average Knowledge	46 (24.6)	59 (31.6)			
8 – 10	Good Knowledge	123 (65.78)	102 (54.5)			

Perception of COVID-19 among Urban and Rural Residents

Table 5 Beliefs on COVID-19 Pandemic

From Table 5 majority 121 (64.7%) of respondent's from urban area belief COVID-19 only affects the rich people that travelled abroad, 89 (47.6%) belief that COVID-19 is a disease from China, 78 (41.7%) belief that COVID-19 is not in Nigeria as it was alerted, 47 (25.1%) belief that COVID-19 is about Mark of the Beast (Anti-Christ), 42 (22.5) belief that COVID-19 is a political propaganda, 35 (18.7%) belief that COVID-19 is cause by 5G Network, 18 (9.60%) belief that COVID-19 pandemic is not real. Results from the rural residents showed that majority 161 (86.1%) belief that COVID-19 is a disease from China while 137 (73.3%) belief COVID-19 only affects the rich people that travelled abroad, 103 (55.1%) %) belief that COVID-19 is about Mark of the Beast (Anti-Christ), 88 (47.1%) belief that COVID-19 is not in Nigeria as it was alerted, 71 (37.9%) belief that COVID-19 is the End of the World, 58 (31.0%) belief that COVID-19 is cause by 5G Network, 48 (25.7%) belief that COVID-19 pandemic is not real and 21 (11.2%) belief that COVID-19 is a political propaganda. Statistical results showed that there was a no significant difference (Chi-square (49) = 56.0; p-value = 0.229) in the belief of COVID-19 pandemic between urban and rural respondents in the study. Figure 4.2 shows the comparison between urban and rural belief of COVID-19 pandemic.

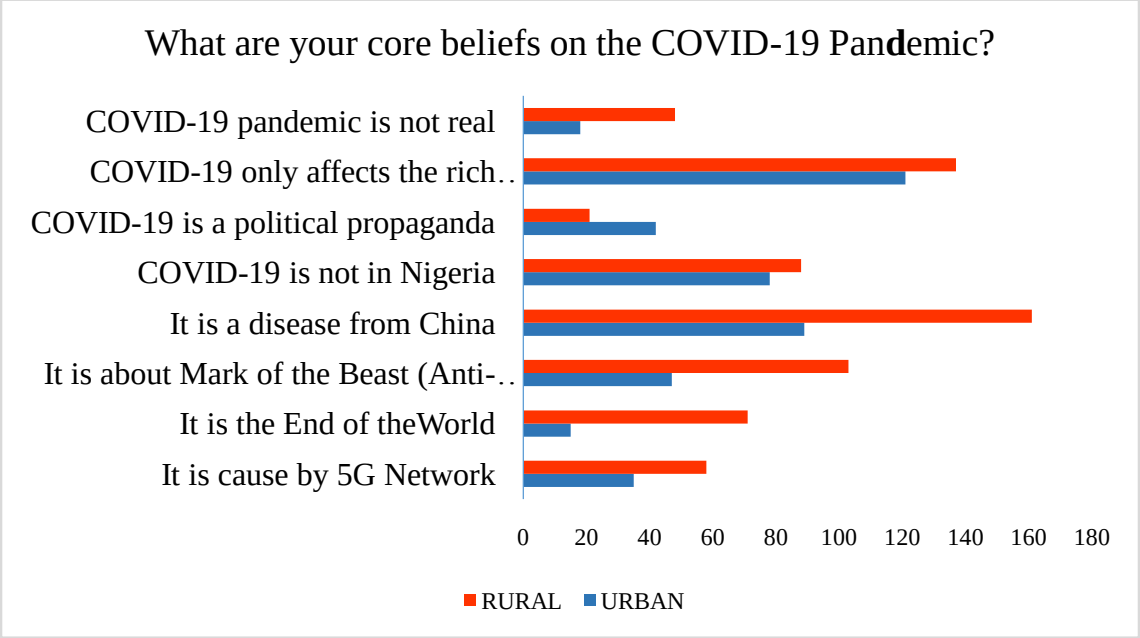

Figure 2 comparison between urban and rural belief of COVID-19 Vaccine

Scores	**Remarks**	**Urban** Frequency (%)	**Rural** Frequency (%)	(χ^2)	df	p-value
0 – 4	Poor Knowledge	11 (5.9)	16 (8.6)	2548	72	0.000
5 – 7	Average Knowledge	31 (16.6)	38 (20.3)			
8 – 10	Good Knowledge	145 (77.5)	133 (71.1)			

Table 6: Perception on COVID-19 Vaccine

Beliefs	**Urban** Frequency (%)	**Rural** Frequency (%)	(χ^2)	df	p-value
COVID-19 vaccine is mark of the beast (Anti-Christ)	Yes 47 (25.1) No 143 (74.9)	Yes 103 (55.1) No 84 (44.9)			
COVID-19 vaccine is to reduce world population.	Yes 12 (6.4) No 175 (93.6)	Yes 78 (41.7) No 109 (58.3)			

Variable		Urban (f/%)	Rural (f/%)	(χ^2)	df	p-value
Sex	Male Female	97 (51.9) 90 (48.1)	112 (59.9) 75 (40.1)	2.0	1	0.317
Highest Level of Education	No formal Education Primary Secondary Polytechnic/NCE/ND University	5 (2.70) 10 (5.30) 58 (31.0) 54 (28.9) 60 (32.1)	17 (9.10) 25 (13.4) 100 (53.5) 20 (10.7) 25 (13.3)	20	16	0.220
Religion	Christianity Muslim Traditional belief Others	120 (64.2) 15 (8.0) 30 (16.0) 22 (11.8)	134 (71.6) 9 (5.8) 45 (24.1) 4 (2.1)	12.0	9	0.213
COVID-19 vaccine has potentials to make one sick.	Yes 18 (9.6) No 169 (90.4)	Yes 78 (41.7) No 109 (58.3)		18.0	15	0.263

From the Table 6 results showed that 143 (74.9%) an 84 (44.9%) of urban and rural areas respectively believed that COVID-19 vaccine is not mark of the beast (Anti-Christ) while 47 (25.1%) and 103 (55.1%) believed that COVID-19 vaccine is mark of the beast (Anti-Christ). Also, majority from urban and rural areas respectively believed that COVID-19 vaccine is not to reduce world population while 12 (6.4%) and 78 (41.7%) from urban and rural areas respectively believed that COVID-19 vaccine is to reduce world population. Finally, majority 169 (90.4%) and 109 (58.3) from urban and rural areas respectively believed that COVID-19 vaccine has potentials to make one sick while 18 (9.6%) and 78 (41.7%) from urban and rural areas respectively believed that COVID-19 vaccine does not have potentials to make one sick. Statistical results showed that there was a no significant difference (Chi-square (15) = 18.0 and p-value = 0.63) in the belief of COVID-19 vaccine between urban and rural respondents in the study.

Perception of COVID-19 with respect to Gender, Religion and Education

Table 7: Perception of COVID-19 versus Gender, Religion and Education

From Table 7 shows a Chi-square (χ^2) association test cross-tabulation between gender, education level and perception of COVID-19 pandemic and vaccines. The result for gender and perception of COVID-19 gave a Pearson Chi-square (χ^1) = 2.0, p-value= 0.317. Which implies that gender not significantly associated with perception of COVID-19 in this study. Also, the result for highest level of education and perception of COVID-19 showed a statistical non-significant association with Pearson Chi-square (χ^{16}) = 20.0, p-value= 0.220. This implies that level of education is not significant with perception of COVID-19 in this study. Religious belief was found to be non-significant (with Pearson Chi-square (χ^9) = 12.0, p-value= 0.213) also with perception of COVID-19 pandemic and vaccines in this study.

Assessment of COVID-19 vaccines acceptance

Table 8 Assessment of COVID-19 vaccines acceptance

	Urban Frequency (%)	**Rural** Frequency (%)	(χ^2)	df	p-value
In general, COVID-19 vaccines are safe.	Yes 137 (73.8) No 49 (26.2)	Yes 140 (74.8) No 47 (25.2)			
Have you or someone you know ever had a bad reaction to a vaccine.	Yes 66 (35.3) No 121 (64.7)	Yes 36 (19.3) No 151 (80.7)			
Do you think you might have been exposed to or infected with COVID-19 (without testing)	Yes 5 (2.7) No 182 (97.3)	Yes 9 (5.5) No 178 (94.5)			
Do you think it is important to get a vaccine to protect the people from COVID-19?	Yes 97(51.9) No 90 (48.1)	Yes 58 (31.0) No 129 (69.0)	90	81	0.231

Pharmaceutical companies will produce safe and effective COVID-19 vaccines	Yes 102 (54.5) No 85 (45.5)	Yes 148(79.1) No 39 (20.9)			

Table 8 showed the assessment of COVID-19 vaccines acceptance among urban and rural residents. Majority 137 (73.8%) and 140 (74.8%) of urban and rural areas respectively indicated that COVID-19 vaccines are safe to be taken while 49 (26.2%) and 47 (25.2%) from urban and rural areas respectively were on the opposite view. Majority 121 (64.7%) and 151 (80.7%) from the urban and rural areas respectively also indicated that they have seen or someone they knew had seen a bad reaction of a vaccine while 66 (35.3%) and 36 (19.3%) in urban and rural areas respectively indicated that they have seen a bad reaction of a vaccine. Majority 182 (97.3%) and 178 (94.5%) from the urban and rural areas respectively think that they have not been exposed to or infected with COVID-19 (without testing) while 5 (2.7%) and 9 (5.5%) in urban and rural areas respectively indicated that they might have been exposed to or infected with COVID-19 (without testing). Majority 182 (97.3%) and 178 (94.5%) from the urban and rural areas respectively think that it is not important to get a vaccine to protect the people from COVID-19 while 5 (2.7%) and 9 (5.5%) in urban and rural areas respectively indicated that it is important to get a vaccine to protect the people from COVID-19. Most of the respondents 102 (54.5%) and 148 (79.1%) believe that pharmaceutical companies will produce safe and effective COVID-19 vaccines while 85 (45.5%) and 39 (20.9%) in urban and rural areas respectively believed that pharmaceutical companies will produce safe and effective COVID-19 vaccines.

Figure 3 showed a bar chart of the responses of respondents from urban and rural areas about incidents of COVID-19 positive cases around their vicinity and close associates. Results showed that majority 143 (76.5%) and 178 (95.2%) respondents from urban and rural areas respectively were never tested positive to COVID-19 neither did anyone related to them while 21 (11.2%) and 2 (1.1%) had some of their colleagues tested positive to COVID-19, 11 (5.1%) an 2 (1.1%) ha neighbours who tested positive to COVID-19, 8 (4.3%) and 3 (1.6%) had family members who tested positive to COVID-19, 2 (1.1%) and 1 (0.5%) tested positive to COVID-19 themselves as well as 2 (1.1%) and 1 (0.5%) who had friends that tested to COVID-19 in urban and rural areas respectively.

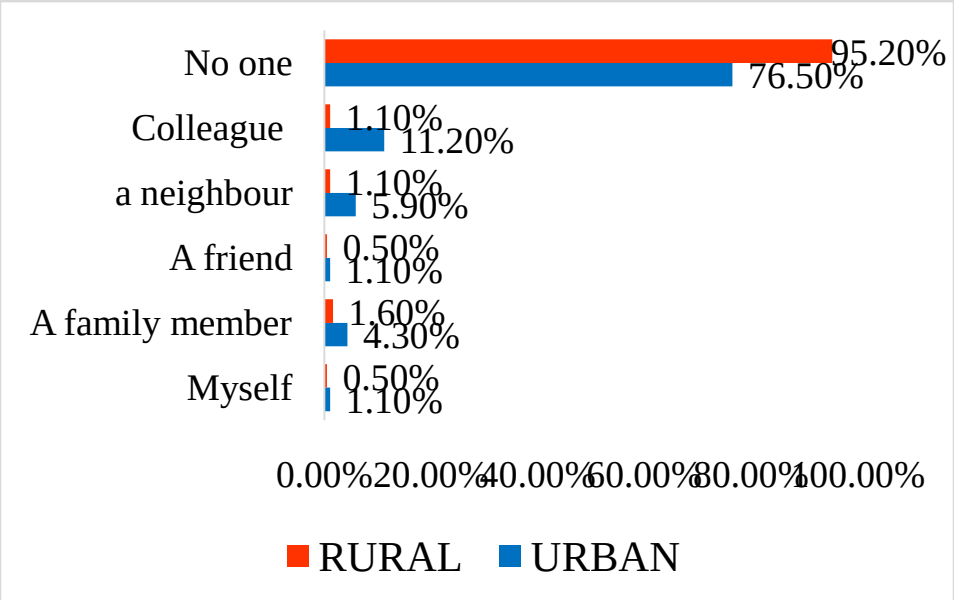

Figure 3 Bar chart areas showing incidents of COVID-19 positive cases

Figure 4 shows the top three worries of respondents in urban and rural areas respectively were foo insecurity, financial, job, and COVID-19 conspiracy were the highest worries.

Variable	(χ^2)	df	p-value
Sex	0.113	1	0.737
Age	15.60	1	0.409
Highest Level of Education	12.0	9	0.213
Marital Status	28.312	25	0.294
Main occupation	55.275	42	0.082
Household Size	13.457	9	0.143
Income per month	11.382	6	0.077
Religion	9.129	9	0.425
History of Travel	0.554	1	0.457

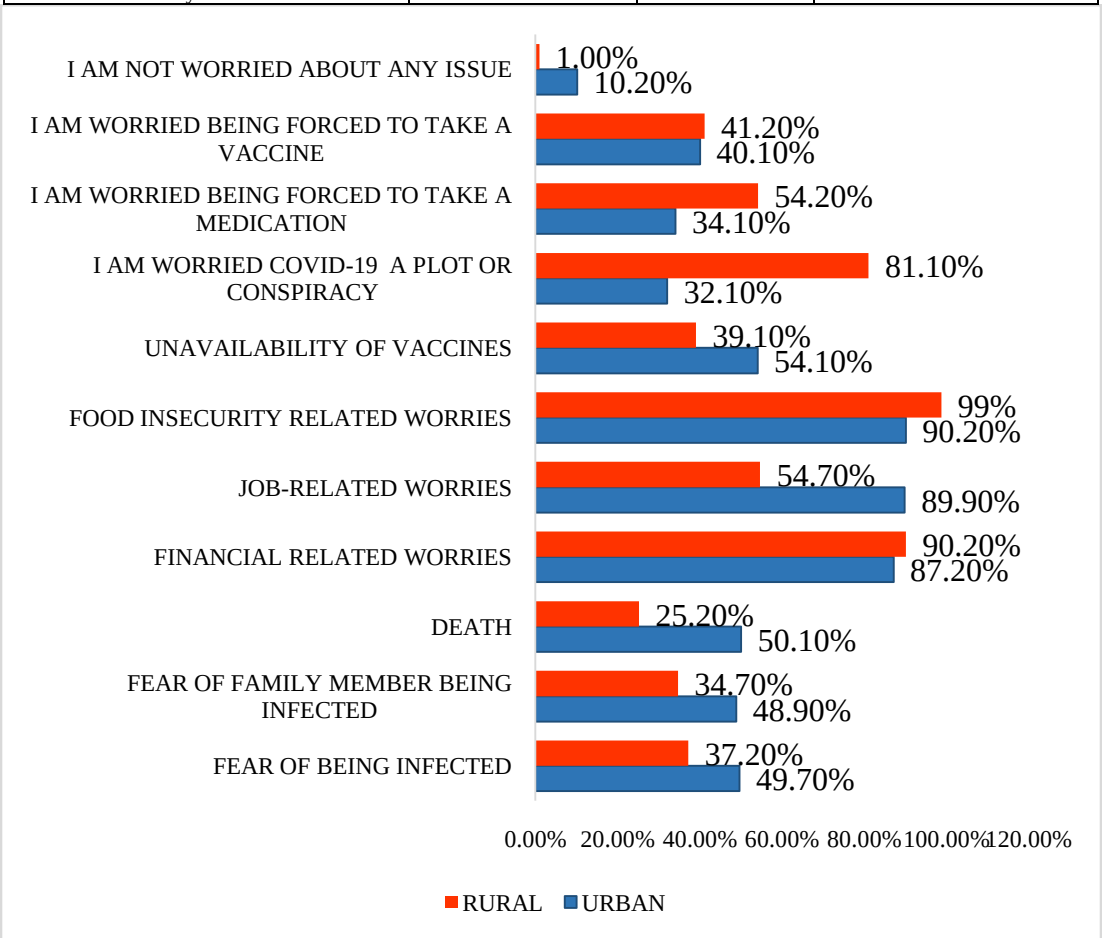

Figure 4.4 Bar chart showing COVID-19 pandemic worries of respondents

Table 9 COVID-19 vaccines acceptance

From Table 9 majority 100 (53.5%) and 133 (71.1%) of respondents from the urban and rural areas respectively have not taken COVID-19 vaccine whereas 87 (46.5%) and 54 (28.9%) of respondent's had taken COVID-19 vaccine. This shows that there is very fair COVID-19 vaccine acceptance in the urban areas while there is a poor COVID-19 vaccine acceptance among respondents in the rural areas covered in this study. Majority 81 (81.0%) and 97 (72.9%) respondents in urban and rural areas were ready to take COVID-19 vaccine in the nearest future while minority 19 (19.0%) and 36 (27.1%) of respondents in urban and rural areas were not ready to take COVID-19 vaccine in the nearest future. This can be seen in the urban areas because majority 71 (75.4%) in the urban areas were more concern about the side effects of COVID-19 vaccine which prevented them from taking the vaccine while 89 (66.9%) from the rural areas also refuse COVID-19 vaccine because of the fears of side effects. Others 46 (24.6%) and 98 (52.4%) from urban and rural areas respectively have different concern other than COVID-19 vaccine side effects. Majority 121 (64.7%) and 151 (80.7%) from urban and rural areas responded that majority in Rivers State will not accept COVID-19 vaccine in various centres in

their LGAs while 66 (35.3%) and 36 (19.3%) from urban and rural areas respectively responded that majority in Rivers State accept COVID-19 vaccine in various centres in their LGAs. Most respondents 144 (77.0%) and 166 (88.8%) have not received any vaccine at adult age whereas 43 (23.0%) and 21 (11.2%) had receive vaccine at adult age. Majority 123 (65.8%) and 111 (59.4%) both urban and rural areas knew people who took the COVID-19 vaccine while 64 (34.2%) and 76 (40.6%) in both urban and rural areas knew no one who took the COVID-19 vaccine.

COVID-19 vaccine acceptance with respect to Knowledge

Table 11: Knowledgeand COVID-19 vaccine acceptance

Variable	**(χ^2)**	**df**	**p-value**
Knowledge on transmission	23.7	4	0.091
Knowledge on safeness of vaccine	58.34	9	0.078
Knowledge on symptoms	36.43	12	0.445
Knowledge on prevention	88.4	25	0.234

Table 11 showed a chi-square test of association results between knowledge about COVID-19 disease, symptoms, transmission, prevention as well as knowledge on vaccine and COVID-19 vaccine acceptance in the urban and rural areas. Results showed that there is no statistical significance of COVID-19 vaccine acceptance across socio- knowledge about COVID-19 disease, symptoms, transmission, prevention as well as vaccine in the urban and rural areas considered in this study.

COVID-19 vaccine acceptance with respect to Perception

Table 12: Knowledgeand COVID-19 vaccine acceptance

Variable	**(χ^2)**	**df**	**p-value**
Belief on COVID-19 vaccine safety	23.7	4	0.001**
COVID-19 pandemic is not real	45.00	9	0.021**
COVID-19 vaccine is mark of the beast	23.22	9	0.000***
COVID-19 vaccine is to reduce world population.	163.8	12	0.378
Potential vaccine can make one sick.	208.4	12	0.0012***

** Significant at 1%, ** significant at 5%.

Table 12 showed a chi-square test of association results between perception about COVID-19 disease and COVID-19 vaccine acceptance in the urban and rural areas. Results showed that belief on COVID-19 vaccine safety, perception that COVID-19 pandemic is not real, perception that COVID-19 vaccine is mark of the beast and perception that potential COVID-19 vaccine can make one sick were statistically significant to COVID-19 vaccine acceptance urban and rural areas considered in this study while perception that COVID-19 vaccine is to reduce world population was not statistically significant to COVID-19 vaccine acceptance. This negative perception of COVID-19 vaccine can be said to be the major reason of low vaccine acceptance in the study areas.

IV. Discussion of Findings

The study accessed COVID-19 knowledge, perception and determinants of COVID-19 vaccine acceptance. The study also found existing knowledge and perceptions about COVID-19 between adults in urban and rural area as well as COVID-19 vaccine acceptance rate and the association between determinants of COVID-19 vaccine acceptance (demographic factors, knowledge and perception) and actual vaccine uptake among adults in urban and rural area Rivers State. The study findings are discussed below.

Knowledge about COVID-19

All 187 (100.0%) participant from urban and rural areas in this study have heard of COVID-19. Majority 171 (91.4%) and 101 (54.0%) of respondents in urban and rural areas respectively had good knowledge that COVID-19 is a virus that causes respiratory diseases. This is in line with the study of Makemjio et al., (2020) disclosed that approximately all participants in their study were aware or have knowledge of the world emergency state due to COVID-19. Majority 187 (100%) of urban resident's had good knowledge that covid-19 can be transmitted through body contact with an infected person and also coming in contact with a droplet of an infected person while 95 (50.8%) had knowledge that COVID-19 can be transmitted through fomite, 45 (24.1%) had knowledge that COVID-19 can be transmitted through faecal-oral, 21(11.2%) had knowledge that COVID-19 can be transmitted through animal to human while majority 171 (91.4%) of the rural respondent's had knowledge that covid-19 can be transmitted through body contact with an infected person,

151 (80.7%) also respondent's had good knowledge that coming in contact with a droplet of an infected persons can transmit covid-19, 31 (16.6%) had knowledge that COVID-19 can be transmitted through fomite, 15 (8.0%) had knowledge that COVID-19 can be transmitted through faecal-oral, 13 (7.0%) had knowledge that COVID-19 can be transmitted through animal to human. This is also in line with the study of Makemjio et al., (2020) which disclosed that most of the participants knew respectively that having close contacts, kissing and touching the face with the hands could favour the transmission of the virus.

Majority 187 (100.0%) of respondents in urban areas had knowledge that COVID -19 can be prevented through the use of hand sanitizers, vaccination and isolation followed by 185 (98.9%) had knowledge that COVID-19 can be prevented through the use of hand-washing, 182 (97.3%) had knowledge that maintaining social distance is a preventive measure, 181 (96.8%) had knowledge wearing face mask is a preventive measure while majority 181 (96.8%) of rural respondent's had knowledge that COVID-19 can be prevented through the use of hand sanitizers, 171 (91.4%) had knowledge that maintaining social distance is a preventive measure, 170 (90.9%) had knowledge that wearing face mask is a preventive measure, 112 (59.9%) had knowledge that hand-washing is a preventive measure, 102 (54.5%) had knowledge that vaccination is a preventive measure, and 101 (54.0%) had knowledge that isolation is a preventive measure. All 187 (100.0%) of urban and rural responds had knowledge that attending burial was not a preventive measure. This is similar to Siddiqui et al., (2020) who found that most respondents have knowledge of some preventive methods of COVID-19 (hand washing, safe distance of at least one meter and staying at home). They also have knowledge of some transmission medium (shaking hands, overcrowded places). It was found that the level of education of the respondents influenced their choice of practice to protect themselves from the effects of COVID-19.

The study also found that 3 (1.6%) and 8 (4.3%) respondents in urban and rural areas respectively had wrong knowledge about COVID-19. Minority 13 (7.0%) and 78 (41.7%) respondents in urban and rural areas respectively had no knowledge about COVID-19 as a virus that causes respiratory diseases. It was also found that 35 (18.7%) and 89 (47.6%) respondents in the urban and rural areas respectively cannot identify more than two or three symptoms. The knowledge about COVID-19 can be said to be average among urban and rural residents covered in this study. Makemjio et al., (2020) also had similar results were most respondents are not aware of the clinical symptoms of the disease. The level of awareness varied significantly according to the occupation and the educational level of the participants.

The result for gender and knowledge of COVID-19 prevention, transmission, and symptoms was significant. Also, the result for level of education was significant with knowledge of COVID-19 prevention, transmission, and symptoms) in this study. Similar result was found in the study of Zhong et al., (2020) they disclosed that predominantly female and well-educated population, were found to have overall correct rate of 90% on the knowledge questionnaire, indicating that most respondents are knowledgeable about COVID-19.

Perception of COVID-19 among Urban and Rural Residents

Majority 121 (64.7%) of respondent's from urban areas belief that COVID-19 only affects the rich people that travelled abroad, 89 (47.6%) belief that COVID-19 is a disease from China, 78 (41.7%) belief that COVID-19 is not in Nigeria as it was alerted, 47 (25.1%) belief that COVID-19 is about Mark of the Beast (Anti-Christ), 42 (22.5) belief that COVID-19 is a political propaganda, 35 (18.7%) belief that COVID-19 is cause by 5G Network, 18 (9.60%) belief that COVID-19 pandemic is not real. Results from the rural residents showed that majority 161 (86.1%) belief that COVID-19 is a disease from China while 137 (73.3%) belief that COVID-19 only affects the rich people that travelled abroad, 103 (55.1%) %) belief that COVID-19 is about Mark of the Beast (Anti-Christ), 88 (47.1%) belief that COVID-19 is not in Nigeria as it was alerted, 71 (37.9%) belief that COVID-19 is the End of the World, 58 (31.0%) belief that COVID-19 is cause by 5G Network, 48 (25.7%) belief that COVID-19 pandemic is not real and 21 (11.2%) belief that COVID-19 is a political propaganda. Statistical results showed that there was a no significant difference (Chi-square (49) = 56.0; p-value = 0.229) in the belief of COVID-19 pandemic between urban and rural respondents in the study. The results also showed that individuals who would not accept a COVID-19 vaccine were more likely to agree that the threat of COVID-19 and the danger of this virus is not legitimate and has been exaggerated, similar to the findings of Dodd et al. (2021). Perception is an important variable to consider because have people have negative perception as shown they will likely not accept the COVID-19 vaccine. This is supported by Lazarus et al., (2021) who opine thatperception around the safety of the vaccine and socio-demographic characteristics also influence acceptance rates in their study. For instance, if a vaccine is demonstrated to be safe and effective, people are more likely to accept it (Lazarus et al., 2021).

From Table 7 shows a Chi-square (χ^2) association test cross-tabulation between gender, education level and perception of COVID-19 pandemic and vaccines. The result for gender and perception of COVID-19 gave a Pearson Chi-square (χ^1) = 2.0, p-value= 0.317. This implies that gender not significantly associated with perception of COVID-19 in this study. Also, the result for highest level of education and perception of COVID-

19 showed a statistically non-significant association with Pearson Chi-square (χ^{16}) = 20.0, p-value= 0.220. This implies that level of education is not significant with perception of COVID-19 in this study. Religious belief was found to be non-significant (with Pearson Chi-square (χ^{9}) = 12.0, p-value= 0.213) also with perception of COVID-19 pandemic and vaccines in this study. Malik et al., (2020) found that males are more likely to accept COVID-19 vaccines than females.

Assessment of COVID-19 Vaccine Acceptance

From Table 9 majority 100 (53.5%) and 133 (71.1%) of respondents from the urban and rural areas respectively have not taken COVID-19 vaccine whereas 87 (46.5%) and 54 (28.9%) of respondents had taken COVID-19 vaccine. This shows that there is very fair COVID-19 vaccine acceptance in the urban areas while there is a poor COVID-19 vaccine acceptance among respondents in the rural areas covered in this study. Majority 81 (81.0%) and 97 (72.9%) respondents in urban and rural areas were ready to take COVID-19 vaccine in the near future while minority 19 (19.0%) and 36 (27.1%) of respondents in urban and rural areas were not ready to take COVID-19 vaccine in the nearest future. This can be seen in the urban areas because majority 71 (75.4%) in the urban areas were more concern about the side effects of COVID-19 vaccine which prevented them from taking the vaccine while 89 (66.9%) from the rural areas also refuse COVID-19 vaccine because of the fears of side effects. Others 46 (24.6%) and 98 (52.4%) from urban and rural areas respectively have different concern other than COVID-19 vaccine side effects. Majority 121 (64.7%) and 151 (80.7%) from urban and rural areas responded that majority in Rivers State will not accept COVID-19 vaccine in various centres in their LGAs while 66 (35.3%) and 36 (19.3%) from urban and rural areas respectively responded that majority in Rivers State accept COVID-19 vaccine in various centres in their LGAs. Most respondents 144 (77.0%) and 166 (88.8%) have not received any vaccine at adult age whereas 43 (23.0%) and 21 (11.2%) had receive vaccine at adult age. Majority 123 (65.8%) and 111 (59.4%) both urban and rural areas knew people who took the COVID-19 vaccine while 64 (34.2%) and 76 (40.6%) in both urban and rural areas knew no one who took the COVID-19 vaccine.

COVID-19 vaccine acceptance with respect to demographic variable

Results showed that there was no statistical significance of COVID-19 vaccine acceptance across socio-demographic characteristics in the urban and rural areas. That is to say that sex, age, highest level of education, marital status, main occupation, household size, income per month, religion and history of travel does not have a great influence in COVID-19 vaccine acceptance in the urban and rural areas covered by this study. Religious factors, and belief in natural or traditional remedies were considered barriers by only few participants, in agreement with Neumann-Böhme et al. (2020).

COVID-19 vaccine acceptance with respect to Knowledge

Table 11 showed a chi-square test of association results between knowledge about COVID-19 disease, symptoms, transmission, prevention as well as knowledge on vaccine and COVID-19 vaccine acceptance in the urban and rural areas. Results showed that there is no statistical significance of COVID-19 vaccine acceptance across socio- knowledge about COVID-19 disease, symptoms, transmission, prevention as well as vaccine in the urban and rural areas considered in this study.

COVID-19 vaccine acceptance with respect to Perception

Table 12 showed a chi-square test of association results between perception about COVID-19 disease and COVID-19 vaccine acceptance in the urban and rural areas. Results showed that belief on COVID-19 vaccine safety, perception that COVID-19 pandemic is not real, perception that COVID-19 vaccine is mark of the beast and perception that potential COVID-19 vaccine can make one sick were statistically significant to COVID-19 vaccine acceptance urban and rural areas considered in this study while perception that COVID-19 vaccine is to reduce world population was not statistically significant to COVID-19 vaccine acceptance. This negative perception of COVID-19 vaccine is a major reason of low vaccine acceptance in the study areas.

V. Conclusion

The study found high knowledge about COVID-19 among urban and rural areas in Rivers State yet the vaccine acceptance rate was poor among the study sample. The belief, perception an assessment of the COVID-19 vaccine was above average which would have encouraged many to participate in vaccinating their selves against subsequent outbreak of the novel COVID-19 disease. Many variables such as socio-demographic, knowledge, assessment and perception were found not to be significant. Therefore, this study concludes that the negative rumours about COVID-19 disease and vaccine as Mark of the Beast, carrying a magnetic chip, can

cause diseases has a negative effect on the people of Rivers State directly or indirectly. The study also stated that religious organisations not supporting the acceptance of vaccines by their member also indirectly affecting the vaccine acceptance rate in Rivers State.

VI. Recommendations

Vaccination is an effective preventive healthcare solution to many diseases around the world. Knowledge of vaccine safeness significantly influenced the acceptance rates. Based on the findings and conclusion of this study, the following recommendations are made:

1. Policymakers and stakeholders in various sectors of the population need to strive to improve vaccination rates by media campaign.
2. Government should introduce an evidence-based community messaging strategy, together with an education program focusing on the threat of virus, the benefits of vaccination, assessment of efficacy, and any side effects.
3. Religious bodies should be approach to discuss the make-up of the COVID-19 vaccine and to clarify the myth of "mark of the beast" conspiracy behind it.
4. Lastly, since intent to be vaccinated was associated with trust in the healthcare system, it is also important to increase the quality of services provided in the medical sector.

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