International Journal of Public Health Science (IJPHS)
Vol. 14, No. 4, December 2025, pp. 1857~1865
ISSN: 2252-8806, DOI: 10.11591/ijphs.v14i4.26130

Likely uptakers of the COVID-19 vaccinations in Cross River South Senatorial District, Nigeria

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Article Info

Article history:

Received Oct 22, 2024
Revised Sep 6, 2025
Accepted Nov 3, 2025

Keywords:

COVID-19
Nigeria
Socio-demographic
Uptakers
Vaccination

ABSTRACT

The COVID-19 outbreak resulted in widespread concern and disruption globally. The development of vaccines was a significant focus in mitigating the impact of the deadly virus. However, vaccine uptake in many regions has been challenging, including the Cross River South Senatorial District. This study examines the socio-demographic variables influencing the adoption of the COVID-19 vaccine. Data was collected from 750 respondents through the questionnaire. Bivariate analysis using Chi-square statistics was used to evaluate the association between COVID-19 vaccination and covariates, including age, sex, location, occupation status, religion, educational status, and availability of COVID-19 vaccination sites. A logistic regression model was used to ascertain this connection. Based on the findings, COVID-19 uptake was 32.3%. Employment status was the only variable statistically significant with the uptake of the COVID-19 vaccine. When promoting the use of vaccines, consideration should be given to variables other than personal characteristics. With the low uptake of the COVID-19 vaccines, continued efforts are needed to improve the vaccination uptake rate by all segments of the study population.

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1. INTRODUCTION

The COVID-19 related global health emergency has emphasized the significance of vaccination as a vital instrument for preventing the spread of infectious illnesses [1]. The COVID-19 outbreak has demonstrated notable inequalities in health across different demographic groups, particularly concerning adopting COVID-19 vaccinations. Despite the widespread availability of vaccines, uptake rates have been uneven among various age groups, genders, and ethnicities. Many nations experience vaccine hesitancy, with acceptance levels varying both in advanced industrialized countries and low-income countries [2]. The World Health Organisation (WHO) ranks vaccination reluctance among the top ten significant challenges to global health. Since the administration of the first vaccination more than 200 years ago, there has been vaccine hesitancy [3]. With the WHO's initial target of administering 20% of the COVID-19 vaccines to 20% of the population in every country, as of early September 2021, just 12 nations with low and moderate incomes out of 47 had achieved the 20% target, while the vast majority of high-income countries (HICs) had exceeded it [4]. No low-income country (LIC) has done so either [4]. As of 21 September 2022, only 15% of the population of Nigeria had completed the COVID-19 vaccination [5]. At the present pace, Nigeria is unlikely

to reach its COVID-19 vaccination targets [6]. More than 15% of Nigeria's target population is unlikely to receive vaccinations [6]. This observation is not unconnected with vaccine hesitancy in Nigeria.

Vaccine hesitancy is a significant area of interest within public health. There has always been vaccine hesitancy (VH) in Nigeria over the years [7]. Of the 9.0 million zero-dose diphtheria- pertussis- and tetanus toxoids (DPT) children in 2019, around two-thirds (65%) were in ten different countries: Nigeria, India, Brazil, Ethiopia, the Philippines, Indonesia, Angola, the Democratic Republic of the Congo (DRC), Pakistan, and Mexico [8]. Recent evidence suggests that many factors, such as knowledge, educational attainment, ethnicity, sociocultural influences, religious beliefs, personal risk perception, social media access, fear of side effects, accessibility to medical facilities, information sources, and degree of faith in the healthcare system, may have an impact on vaccination uptake [9]. Sociodemographic factors, such as age, gender, and ethnicity, are among the most significant factors in accepting different medical interventions [10]. Data from a previous study have shown that the country has different vaccination rates, with the southern states having higher rates than the northern states and higher rates in urban compared to rural areas within states, according to the experiences of the GAVI-sponsored routine immunization program [11].

Factors affecting the adoption of the COVID-19 vaccination have been explored in several studies. Demographic characteristics such as sex, place of residence, marital status, age, education, and religious affiliation are often linked to the adoption of the COVID-19 vaccination [12]. Acceptance was more accurately predicted by respondents' confidence in the safety and effectiveness of the vaccination than by their socioeconomic status [13]. Religious and cultural beliefs greatly influence how people seek health care [14]. Further, some populations in Nigeria may be reluctant to get vaccines because of past experiences with medical research or government health initiatives [15]. Many factors, such as knowledge, educational attainment, ethnicity, sociocultural influences, religious beliefs, personal risk perception, social media access, fear of side effects, accessibility to medical facilities, information sources, and degree of faith in the healthcare system, could affect the uptake of vaccinations [9]. In addition, vaccine reluctance may also be influenced by false information, conspiracy theories, and a lack of faith in the government and medical establishments [16].

Several studies [9], [17], [18] have identified the factors affecting the knowledge, attitude, and desire to receive the COVID-19 vaccination. However, there is a lack of information regarding whether these projected acceptance percentages and campaigns correspond to actual vaccine acceptance [19]. Most studies have only been carried out on vaccine reluctance rather than those on COVID-19 vaccine uptake [20]. The main worry is that if nothing is done, reluctance to get an immunization could turn into outright refusal or continue to be passive avoidance [21]. What is less clear is our knowledge of the traits of prospective uptakers and how to customize interventions to fit behavioral and demographic profiles.

This study contributes to the expanding body of research in this field by examining the likely uptakers of COVID-19 vaccines - those most likely to accept vaccination in an urban and rural population have emerged as a crucial area of focus for enhancing vaccine uptake and optimizing outreach tactics. For a vaccination program to be successful, it is essential to know who will receive the vaccine, who does not or is unsure, and why [22]. We hypothesized that the location of residence, age, sex, employment status, educational level, religious affiliation, marital status, health condition, and availability of COVID-19 vaccination sites are major predictors of COVID-19 vaccination uptake.

2. METHOD

2.1. Study design and population

The study was conducted as a survey with data gathered via questionnaire in Cross River State, located in South-south Nigeria, to assess the demographic predictors of COVID-19 vaccine uptake. The survey was carried out in March and April 2023. The study examined the connections between the independent variables (age, sex, educational attainment, marital status, place of residence, employment status, availability of COVID-19 vaccination sites, and having a chronic medical condition) and the dependent variable (vaccine uptake) using a cross-sectional approach. Eligibility criteria required individuals to be at least 18 years old, eligible to receive the COVID-19 vaccine, and reside in these urban and rural communities in the state. Adults who gave their consent were eligible for inclusion in the study; those who refused were not.

2.2. Sample size

The Leslie Kish formula was used to estimate the sample size (1965) for cross-sectional studies, with a standard normal deviation set at 1.96, or a 95% confidence level, an estimated COVID-19 vaccine utilization of 33% as reported by [23], and the desired level of precision of 5%. The estimated minimum sample size for each local government area was 373, and 746 for the two local government areas.

2.3. Sampling procedure

Participants were selected for the study using a multi-stage sampling procedure. To ensure all relevant subgroups are represented in the sample, the stratified sampling technique was adopted in the first stage. The population was divided into subgroups or strata based on the study variables such as place of residence (urban, rural), age, sex, and employment status. The simple random sampling technique was employed in the second stage to select two (an urban and a rural area) of the seven local government areas (Calabar Municipal and Odukpani) from the Southern Senatorial district of Cross River State. Thereafter, six communities (each constituting a cluster from six political wards) were selected from the two local government areas using the simple random method. While preserving sample diversity, this method streamlines data collection by focusing efforts on particular geographic regions. Following the identification of clusters, respondents were selected from households in each community using convenience sampling. Combining these methods provides a strong, varied, and representative sample for the study of the drivers influencing the uptake of COVID-19 vaccination in Cross Rivers South senatorial district.

2.4. Data collection/study variables

Skilled and seasoned field data collectors used a pre-tested questionnaire to conduct in-person interviews to gather data. Demographic factors like place of residence, age, religion, and sex were included to determine their impact on vaccination uptake. Also, socioeconomic and structural factors were captured by asking about medical conditions, work status, and access to immunization locations. To make sure the questionnaire was clear, valid, and reliable, 50 individuals from a population similar to the study sample were used for pre-testing. Based on the pre-test results, the necessary changes were effected. The data collectors received a two-day orientation and training to familiarize them with the study goals, the design, and the tool for data collection. The dependent variable was COVID-19 vaccine uptake, defined by whether participants had been immunized or not. The independent variables were the place of residence (Calabar Municipal and Odukpani), sex (male and female), age (categorized as less than 24 years, 25–34 years, 35– 44years, 45 years or more), marital status (single, married, and divorced/separated/widowed), education level (no formal education, primary, secondary, and tertiary), religious affiliation (Christianity, Islam, Traditional religion, others), employment status (employed with government, employed in the private sector, self-employed, and unemployed), and availability of COVID-19 vaccination site (yes or no), and having a health condition (yes, no, and unknown).

2.5. Data analysis

All analyses were carried out using Stata version 18. Descriptive statistics was used to summarize participants' demographic characteristics. Bivariate analysis using chi-square statistics was used to explore the association between COVID-19 vaccination and predictors, including age, sex, location, employment status, religion, educational status, and availability of COVID-19 vaccination sites. A logistic regression model was used to determine this association. The best-fit option was used for predictor selection, and the model was checked for consistency using the Hosmer-Lemeshow goodness of fit test, $p = 0.41$. Adjusted odds ratios (AOR) with 95% CI were used to report the results.

3. RESULTS AND DISCUSSION

3.1. Results

The results, as shown in Table 1, indicate that just over half of the sample, 394 (52.53%) were female, of whom 51.87% were rural residents. Also, 345 (46%), 130 (17.33%), and 171 (22.8%) had tertiary, secondary, and primary levels of education, respectively. 429 (56.8%) were aged 45 and above, 409 (54.53%) were government employees, married were 519 (69.2%). Table 2 reveals that 637 (84.93%) had no medical condition, and 600 (80%) had a COVID-19 vaccination site within their locality. Most respondents ($n = 508$, $\% = 67.7$) had never received a COVID-19 vaccine.

Table 2 shows the outcomes of the association between the respondent's socio-demographic characteristics and COVID-19 vaccine utilization. The unemployed (42%), privately employed (36.6%), or self-employed (40.7%) responded better to COVID-19 vaccination uptake compared with government workers (27.1%), which was significant at $p = 0.009$. This was also reflected in the regression model as shown in Table 3. The adjusted odds ratio of vaccination uptake in self-employed individuals (using government-employed as a reference) is 1.79 (95% CI:1.09-2.94; $p<0.022$). Similarly, the adjusted odds ratio of vaccination uptake in the unemployed (using government-employed as reference) is 1.90 (95% CI:1.03-3.49; $p<0.04$). All the adjusted odds ratios are adjusted for age, sex, location, educational status, concurrent medical condition, and availability of COVID-19 vaccination sites.

Table 1. Socio-demographic characteristics of the study participants and COVID-19 vaccination status [N = 750]

Variable		Frequency	Percentage (%)
Place of residence	Urban	361	48.13
	Rural	389	51.87
Sex	Female	394	52.53
	Male	356	47.47
Age	<24	104	13.87
	25-34	81	10.8
	35-44	139	18.53
	>45	426	56.8
Educational level	No formal education	104	13.87
	Primary	171	22.8
	Secondary	130	17.33
	Tertiary	345	46.00
Employment status	Employed with the government	409	54.53
	Employed in the private sector	205	27.33
	Self-employed	86	11.47
	Unemployed	50	6.67
Marital status	Single	185	24.67
	Married	519	69.2
	Divorced/separated/widowed	46	6.13
Religious affiliation	Christianity	316	42.13
	Islam	279	37.2
	Traditional religion	100	13.33
	Others	55	7.33

Table 2. Factors associated with COVID-19 vaccine uptake [N = 750]

Variable		Number		Uptake of COVID-19 vaccination				X^2	p-value
				Vaccinated		Not vaccinated			
		N	%	N = 242	32.3 (%)	N = 508	67.7 (%)		
Place of residence	Urban	361	48.13	112	46.28	249	49.02	0.4910	0.483
	Rural	389	51.87	130	53.72	259	50.98		
Sex	Female	394	52.53	138	57.02	256	50.39	2.8904	0.089
	Male	356	47.47	104	42.98	252	49.61		
Age	<24	104	13.87	32	13.22	72	14.17	1.8906	0.595
	25-34	81	10.8	29	11.98	52	10.24		
	35-44	139	18.53	50	20.66	89	17.52		
	>45	426	56.80	131	54.13	295	58.07		
Educational level	No formal education	104	13.87	34	32.69	70	67.31	2.1936	0.533
	Primary	17	22.8	59	34.50	112	65.50		
	Secondary	130	17.33	35	26.92	95	73.08		
	Tertiary	345	46.00	114	33.04	231	66.96		
Employment status	Employed with government	409	54.53	111	45.87	298	58.66	11.6337	0.009*
	Employed in the private sector	205	27.33	75	30.99	130	25.59		
	Self-employed	86	11.47	35	14.46	51	10.04		
	Unemployed	50	6.67	21	8.68	29	5.71		
Marital status	Single	185	24.67	60	24.79	125	24.61	2.5164	0.284
	Married	519	69.2	172	71.07	347	68.31		
	Divorced/separated/widowed	46	6.13	0	4.13	36	7.09		
Religious affiliation	Christianity	316	42.13	103	42.56	213	41.93	3.2775	0.351
	Islam	279	37.20	81	33.47	198	38.98		
	Traditional religion	100	13.33	38	15.70	62	12.20		
	Others	55	7.33	20	8.26	35	6.89		
Have medical condition	Yes	17	2.27	7	2.89	10	1.97	3.4927	0.174
	No	637	84.93	197	81.40	440	86.61		
	Unknown	96	12.8	38	15.70	58	11.42		
Availability of COVID-19	Yes	600	80.00	190	31.67	410	68.33	0.4942	0.482
Vaccination site	No	150	20.00	52	34.67	98	65.33		

3.2. Discussion

In assessing COVID-19 vaccine adoption, the chi-square test did not show any significant differences between location, educational attainment, age, sex, having a medical condition, and the availability of immunization sites. Out of all the variables examined in this study, there was a significant difference between employment status and COVID-19 vaccination uptake. These findings may be taken to indicate how important socioeconomic considerations are in determining public health outcomes, and the possibility that psychological or social impacts, and other unexamined variables, may be more critical in determining vaccine uptake in the study area.

Table 3. Multivariate logistic regression analysis to determine the factors influencing the use of the COVID-19 vaccine

Variable		Adjusted OR 95% CI	p-value
Location	Urban	Reference	
	Rural	1.15 (0.84-1.57)	0.385
Sex	Male	Reference	
	Female	0.08 (0.58-1.10)	0.171
Age	<24	Reference	
	25-34	1.22 (0.65-2.29)	0.530
	35-44	1.26 (0.72-2.18)	0.417
	>45	1.05 (0.66-1.69)	0.830
Educational level	No formal education	Reference	
	Primary	1.10 (0.65-1.86)	0.726
	Secondary	0.95 (0.53-1.72)	0.874
	Tertiary	1.15 (0.53-1.72)	0.563
Employment status	Employed with government	Reference	
	Employed in the private sector	1.45 (0.99-2.12)	0.056
	Self-employed	1.79 (1.09-2.94)	0.022*
	Unemployed	1.90 (1.03-3.49)	0.040*
Have medical condition	No	Reference	
	Yes	1.21 (0.97-1.51)	0.098
Availability of COVID-19	No	Reference	
Vaccination site	Yes	0.90 (0.61-1.33)	0.603

The results of this study show that the COVID-19 vaccination uptake was 32.3% indicating a low level in the uptake. Following the release of the COVID-19 vaccine only approximately one in three adults had been vaccinated in Calabar and Odukpani Local Government Areas of Cross River State. Our study showed a higher rate of vaccine uptake than the 29% uptake rate observed among academics, healthcare professionals, and postsecondary students surveyed in Nigeria [24]. This finding is consistent with the rate of 31.1% in the general public and medical staff in a general hospital in Nigeria [25]; also, two-thirds of the participants (67%) among Nigerians in a nationally representative sample, were not vaccinated against COVID-19 [26]. An estimated pooled prevalence for the COVID-19 acceptance rate among Nigerians which ranges from 20.0% to 58.2% was also reported [6]. However, the finding of the current study is much lower compared to the value reported in a geriatric center in Nigeria where over 50% of the individuals were classified as not hesitant, having had the COVID-19 vaccination [27]. This result is encouraging, especially among elderly individuals at higher risk of COVID-19 infection. The low uptake rate of the vaccines in Nigeria reflects the public's perception of the virus and attitude towards the vaccination. A prior study in Nigeria reported that one explanation offered for the lack of interest in testing for COVID-19 was that there was widespread "disbelief" regarding COVID-19's existence [28]. The acceptance of vaccination has always been met with hesitancy in Nigeria. These can be deduced from previous vaccine hesitance [29]. The generality of the populace did not believe in the existence of the disease due to several myths surrounding COVID-19's existence in Nigeria [30].

The most obvious finding to emerge from the analysis is that employment status and COVID-19 vaccine uptake are significantly correlated, with self-employed and unemployed people showing higher vaccination likelihood than government employees. In particular, the likelihood of receiving the immunization was 1.79 times higher for self-employed people and 1.90 times higher for unemployed people. These findings indicate that vaccine decision-making may be influenced by occupational and socioeconomic factors, and they also show significant variations in vaccine behavior across employment groups. Workplace limitations or schedules may be less of a barrier for the unemployed to visit immunization locations. The results are consistent with earlier research that highlights how socioeconomic factors influence vaccination behavior. For example, in a study among civil servants in Nigeria, respondents had a high degree of awareness of the COVID-19 virus and vaccination, two-fifths of them were not fully vaccinated, even though vaccination was required in several of the states where the survey was conducted [31]. The result differed with a review [32] which reported a lower acceptance rate for individuals without jobs and those with lower incomes. These results support a previous study conducted in Nigeria, which demonstrated that when compared to respondents in other occupations, individuals who were self-employed or whose monthly income was above the 30,000 Naira national minimum salary were more likely to be immunized [19]. This may be due to the nature of their jobs which frequently involve direct contact with clients or consumers and, might also indicate more freedom in making immunization appointments as opposed to workers constrained by company rules. To ensure successful adherence to COVID-19 immunization, the Nigerian government has been known to impose mandatory vaccinations on its populace through directives [33]. This result is contrary to a previous study conducted in Nigeria, which reported that self-employed respondents accepted vaccines

much less with a 0.68 times likelihood of accepting vaccination compared to government employees [11]. A possible explanation for this might be because of the self-employed person's high out-of-pocket medical expenses due to a lack of health insurance and the possibility that the vaccine has a cost [11].

Contrary to expectations, this study did not find a significant difference between place of residence, age, sex, marital status, educational attainment, religion, availability of COVID-19 sites, and having a medical condition with the adoption of the COVID-19 vaccine in both the bivariate and multivariate analysis. A strong relationship between demographic factors like sex, age, marital status, religion, and place of residence and vaccination uptake has been reported in the literature [11], [26], [34], [35]. This study's results, however, deviate from these conclusions by identifying employment status as the most important factor. This inconsistency may be due to the population's unique socioeconomic background, as employment may have a greater influence on access to resources and healthcare services than other variables. This lack of a strong correlation emphasizes how complex and situation-specific vaccine adoption behavior are. What is curious about this result is that age and educational attainment are two factors that have been repeatedly found to be significant predictors of vaccination uptake in previous research. This outcome is contrary to a study in Nigeria, which reported that those who were 60 years of age or older and had higher levels of education were more likely to have received a COVID-19 vaccination [26]. Reports of sex-based differences in vaccination uptake in the state of Arkansas in the United States found that women were more likely than men to be hesitant about getting COVID-19 immunization [36].

In contrast to earlier findings which, highlighted that religion, male gender, tribe/ethnicity, place of residence, and education were significantly correlated with vaccine acceptance or uptake [34], [37], however, this does not appear to be the case in the current study. Age, sex, race, and education all significantly influenced respondents' attitudes toward COVID-19 and general vaccines; younger respondents and those with lower incomes and levels of education expressed more hesitancy [36]. In contrast, in a study in a university community in Nigeria, COVID-19 vaccine reluctance was substantially correlated with three factors: age, marital status, and membership in the Christian faith [35]. Younger members of the university community were found to be more likely than older members to receive the vaccination, ever married members exhibited greater hesitancy than the community's never married members, and compared to Pentecostals and Sabbatharians, the COVID-19 vaccine was more likely to be accepted by Roman Catholics and Protestants [35]. These findings further support the idea of [38], [39] who found no correlation between religion and vaccine acceptance in United States and Canada. Also, this aligns with the position of [40] who reported that marital status and gender were not significantly related to COVID-19 uptake in Russia.

A major limitation of the study is the use of the convenience sampling technique in selecting eligible respondents, which was also pointed out in a study [41], results in sample selection bias. Causal relationship inference is limited by cross-sectional design. Also, social desirability bias and recollection bias may affect responses. Despite its limitations, the study certainly adds to our understanding of the socio-demographic factors influencing the uptake of the COVID-19 vaccine.

4. CONCLUSION

This study set out to examine the relationship between socio-demographic variables and the uptake of COVID-19 vaccination. With the low uptake of the COVID-19 vaccines, the evidence from this study suggests that continued efforts are needed to improve the vaccination uptake rate by all segments of the study population. Also, the information from the study can be used by the government and other relevant stakeholders to develop targeted interventions aimed at ensuring future vaccine uptake. When promoting the use of vaccines, consideration should be given to variables other than personal characteristics. Further studies, which adopt the Intersectional methods to examine how individual characteristics interact with the societal, economic, and environmental factors to influence vaccine uptake will need to be undertaken.

FUNDING INFORMATION

Authors state no funding involved.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

Before data collection, the participants received an explanation of the study. After obtaining oral informed consent from the respondents, the questionnaire was administered. Responses were anonymized to ensure confidentiality, and there were no financial incentives for participation; it was voluntary.

ETHICAL APPROVAL

Ethical approval was obtained from the University of Calabar Research Ethical Review Board, Directorate of Research and Development (UC/DR&D/RERB/56).

DATA AVAILABILITY

Derived data supporting the findings of this study are available from the corresponding author, [VAU], on request.

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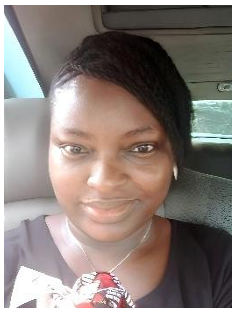

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