An Assessment of the Dynamics of Knowledge, Attitudes, and Perceptions Regarding COVID-19 Vaccine Uptake among Adults in Kogi State, Nigeria

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ABSTRACT

Understanding the factors influencing vaccine acceptance is essential for developing effective public health strategies in response to the global COVID-19 pandemic. This study explores factors associated with COVID-19 vaccine uptake among the adult population in Kogi State, Nigeria, within the broader context of the global pandemic's impact on public health and economies. Emphasizing the importance of vaccination in reducing disease incidence, the study assesses knowledge, attitudes, and perceptions of individuals using the Health Belief Model and Theory of Planned Behavior as theoretical frameworks. The findings aim to address the low vaccination rates in Kogi State and provide evidence-based insights to inform strategies that promote vaccine acceptance and improve public health outcomes. A community-based cross-sectional study was conducted among adults aged 18 and older, employing a validated self- and interviewer-administered questionnaire to collect data on demographic characteristics, knowledge, attitudes, and perceptions. Multi-stage cluster random sampling was utilized to select 484 participants, and the data were analyzed using IBM SPSS version 23 to identify variables that significantly predicted COVID-19 vaccination uptake at a 5% significance level. Ethical approval was secured from the Kogi State Ministry of Health ethics committee, and verbal informed consent was obtained from all participants. The sample demonstrated a balanced gender distribution (50% male, 50% female) and was predominantly composed of middle-aged individuals; with 31% aged 35-44 years and a high vaccination initiation rate of 95%.

Participants exhibited moderately high levels of knowledge (mean = 8.53/13, 65.6%), positive attitudes (mean = 23.14/32, 72.3%), and perceptions (mean = 73.38/108, 67.9%), alongside a very high rate of vaccine uptake (mean = 0.95/1, 95.0%). Analysis revealed significant associations between vaccine uptake and age, with the 35-44 age group demonstrating the highest uptake rates. Multiple regression analysis indicated that positive attitudinal disposition was a significant predictor of higher vaccine uptake ($p = 0.045$, $B = 0.008$), whereas increased knowledge was negatively associated with vaccine uptake ($p = 0.038$, $B = -0.014$), this suggests that knowledge alone is insufficient to drive vaccination, highlighting the complexity of vaccine uptake behavior. These findings underscore the importance of targeted educational interventions to combat misinformation and improve vaccine acceptance. This study has limitations, including restricted generalizability and self-reporting biases. To mitigate vaccine hesitancy, clear communication campaigns and social network advocacy are recommended. The study contributes to the body of knowledge by integrating behavioural models and providing regional insights, highlighting attitudes' role in vaccine acceptance, and offering empirical data on demographic factors for targeted public health strategies. Future research should explore geographic disparities and socioeconomic factors.

Key words: COVID-19 uptake, Knowledge, Attitude, Perception, Kogi State

INTRODUCTION

The COVID-19 pandemic, which originated in Wuhan, China, in December 2019, has led to over 606 million cases and nearly 6.5 million deaths worldwide by August 30, 2022, with Africa facing significant challenges,

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including 8.7 million cases and 173,244 deaths.[1] In Nigeria, there have been 263,407 confirmed cases and 3,148 deaths.[2] Despite the rapid development and administration of vaccines, with over 3.19 billion doses distributed globally by June 2022, vaccine hesitancy remains a critical issue. [1]

As of June 20, 2023, COVID-19 vaccine uptake in Kogi State, Nigeria, has been notably low compared to national averages. While over 75% of eligible individuals in Nigeria have received at least one dose and 65.9% have completed the primary vaccination series, Kogi State lags significantly behind, with only 18% of the eligible population having received their first dose and just 6% fully vaccinated. This disparity highlights the challenges in achieving widespread vaccination in the region, despite the overall progress made in Nigeria's vaccination efforts [3].

The COVID-19 pandemic has presented unprecedented challenges globally, necessitating rapid and widespread vaccination to control its spread and mitigate its impacts. In Nigeria, the success of the vaccination campaign depends largely on public knowledge, attitudes, and perceptions towards the COVID-19 vaccine. This paper explores these dimensions, providing a comprehensive review of existing literature on vaccine knowledge, attitudes, and perceptions in Nigeria, while drawing comparisons with global perspectives.

The variability in vaccine knowledge and acceptance among different demographic groups in Nigeria is notable. For instance, a study in Abuja, primary healthcare workers exhibited suboptimal knowledge about COVID-19, revealing significant knowledge gaps within crucial segments of the healthcare workforce.[4] Among patients with chronic medical conditions, good knowledge of COVID-19 transmission correlated significantly with education and occupation, underscoring the role of socio-economic factors in shaping health literacy.[5]

Public willingness to accept the COVID-19 vaccine also shows significant regional and demographic variability. In urban areas, older adults, and individuals with higher education levels, vaccination uptake is notably higher.[6] However, in Jere LGA, Maiduguri, a majority of residents exhibited poor knowledge of the vaccine, coupled with moderate fear of COVID-19, leading to low vaccination rates and high levels of vaccine hesitancy.[7] This pattern is further evidenced by Ojo et al. (2023), who found that only 32.8% of respondents were vaccinated, with younger individuals and those without formal education being less likely to receive the vaccine.[8]

Attitudinal barriers to vaccine acceptance are particularly pronounced among specific groups. Temitope et al. (2022) found that despite high levels of COVID-19 knowledge among undergraduate students in Southern Nigeria, only 16.5% expressed willingness to receive the vaccine.[9] The impact of intervention strategies on public attitudes and practices has been mixed. Ihua et al. (2023) noted that during the pandemic, a significant proportion of respondents demonstrated adequate knowledge and adherence to COVID-19 guidelines.[10] However, a study revealed low acceptance rates across all thirty-six Nigerian states, indicating widespread vulnerability to the virus due to insufficient vaccine coverage. [11] Globally, the acceptance and uptake of COVID-19 vaccines are influenced by a complex interplay of factors, including socio-economic status, education, and trust in health authorities. Studies from Indonesia, Iran, South Africa, and Bangladesh highlight similar patterns of vaccine hesitancy driven by safety concerns and mistrust in government and pharmaceutical industries.[12][13][14] Systematic reviews and meta-analyses underscore the need for targeted educational efforts to address these barriers and enhance vaccine uptake. [15][16][17]

This study aims to fill the knowledge gap regarding COVID-19 vaccine acceptance in Kogi State, Nigeria, where no known research has been conducted since the introduction of the vaccines. It investigates individuals' intentions to accept COVID-19 vaccines and explores their knowledge, attitudes, and perceptions towards vaccine acceptance in the context of Kogi State. Understanding these dynamics is essential for developing effective public health strategies to increase vaccine coverage and mitigate the ongoing impact of the COVID-19 pandemic. The following sections will delve deeper into these aspects, offering insights into potential interventions to address vaccine hesitancy and improve public health outcomes.

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Research Questions

1. What are the personal levels of COVID-19 vaccine uptake, knowledge, attitudes, and perceptions among study participants?
2. What is the distribution of personal-level dispositions of knowledge, attitudinal dispositions, and perceptions of COVID-19 and its vaccination across the demographic characteristics of the participants in this study?
3. What are the relative contributions of knowledge, attitudinal disposition, and perception to COVID-19 vaccine uptake, and which of these predictor variables has the most significant impact on vaccine uptake?

Objectives

1. To assess the personal levels of COVID-19 vaccine uptake, knowledge, attitudes, and perceptions among study participants.
2. To examine the distribution of participants' knowledge, attitudes, and perceptions regarding COVID-19 and its vaccination across various demographic characteristics.
3. To evaluate the relative contributions of knowledge, attitudes, and perceptions to COVID-19 vaccine uptake and identify which predictor variable has the most significant impact on vaccine uptake.

Hypotheses

1. Participants will demonstrate varying levels of COVID-19 vaccine uptake, knowledge, attitudes, and perceptions, indicating differences in engagement with the vaccination process.
2. There will be significant differences in the levels of knowledge, attitudes, and perceptions of COVID-19 vaccination among participants based on their demographic characteristics (e.g., age, gender, education level and occupational status).
3. Knowledge, attitudes, and perceptions will positively correlate with COVID-19 vaccine uptake, with knowledge expected to have the most significant impact on vaccine uptake among the predictor variables.

RESEARCH METHODOLOGY

Study Design

This study employed a community-based cross-sectional design to investigate factors associated with COVID-19 uptake. A cross-sectional study was chosen to provide a snapshot of the population's characteristics and outcomes at a specific point in time. The study was conducted in all the 3 senatorial zones in Kogi State.

Study Population

The study population consisted of adults aged 18 years and above, residing in Kogi State, Nigeria. This age range was selected because they are considered legal adults eligible for vaccination in Nigeria and can provide informed consent.

Sampling Techniques

A multistage cluster sampling method, recommended by the World Health Organization (WHO, 2018), was employed. Kogi State was divided into three senatorial zones: West, East, and Central. In the first stage, six Local Government Areas (LGAs) were selected from these zones. In the second stage, one political ward was randomly selected from each LGA. In the third stage, five communities were randomly chosen from each ward using the Microsoft Excel random selection formula (RAND). A total of 30 communities were selected. Within each community, 16 households with eligible participants (18 years and above) were interviewed. If a household had more than one eligible participant, one was chosen at random. The sampling method, as recommended by the WHO, was used to ensure a representative and manageable sample across Kogi State's

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geographic and administrative divisions, thereby capturing a diverse and balanced perspective on vaccine uptake from various localities within the state.

Selection of Households and Respondents

In settlements with 35 houses or fewer, the first household was chosen at random using a table of random numbers. In larger settlements, the area was divided into four sectors, and one sector was randomly selected. The survey team started at the center of the selected sector, using a bottle spin to determine direction, and chose the first house in that direction as the starting point. The survey continued to the right, skipping one or two houses depending on the settlement size, until 16 individuals were surveyed. If necessary, the team moved to the nearest settlement within the same ward and LGA. Random selection within households was ensured using a table of random numbers. Dividing larger settlements into 4 sectors enables a manageable and systematic approach to random sampling, striking a balance between thoroughness and feasibility, and providing a representative selection of households while minimizing complexity and potential biases.

Variables

- Dependent Variable: COVID-19 vaccine uptake.
- Explanatory Variables: Demographic characteristics (age, gender, religion, education, occupation), knowledge, attitudes, and perceptions about COVID-19 and vaccination.

Sample Size Estimation

The minimum sample size was calculated using the Cochrane formula, $n = \frac{Z^2\, p(1-p)}{d^2}$, [18] based on a 5% significance level, a 58% [19] vaccine uptake prevalence rate, and a precision of 0.05, resulting in a calculated sample size of 384. Considering an attrition rate of 15%, the sample size was increased to approximately 450 households.

Data Collection Instrument

Data were collected through face-to-face interviews using a structured questionnaire, administered via Kobo toolbox by trained research assistants. The questionnaire covered:

- Section A: Demographic characteristics.
- Section B: Knowledge about COVID-19 and vaccination.
- Section C: Attitudinal dispositions towards vaccination.
- Section D: Perceptions of COVID-19 and vaccination.
- Section E: Motivation to take the vaccine.
- Section F: COVID-19 vaccination uptake.

Data Analysis

Data analyses were performed using IBM SPSS (version 23). Descriptive statistics (frequencies, percentages, means, standard deviations) were used to assess personal characteristics, knowledge, attitudes, perceptions, motivation, and vaccination behaviors. Chi-square tests, correlation coefficients, and multiple logistic regression analyses were conducted to assess associations and adjust for confounding variables. Significance was set at $p<0.05$.

Validity and Reliability

The validity of the questionnaire was tested through a pilot study, and necessary corrections were made. The internal consistency reliability of the questionnaire was determined using Cronbach's Alpha (0.6 for 51 items). Data were double-entered and cross-validated during analysis to minimize errors.

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Ethical Considerations

Ethical approval was obtained from the Kogi State Ministry of Health. Participation was voluntary, and informed consent was obtained. Confidentiality was maintained throughout the research process.

Inclusion-Exclusion Criteria

- Inclusion: Individuals aged 18 years and older, Nigerian by birth or nationality, residing in Kogi for more than 6 months.
- Exclusion: Individuals under 18 years, not Nigerian by birth or nationality, residing in Kogi for less than 6 months.

RESULTS

Table 1: Frequency Distribution of Demographic Characteristics of Study Participants

Variables	Frequency N=484	Percent (%)
Educational attainment		
Non-Formal	68	14
Primary School	29	6
Secondary school	154	31.8
Post-Secondary	233	48.1
Total	484	100
Nature of Occupation		
Civil Servant	77	15.9
Business Person	155	32
Self-Employed	151	31.2
Professional	58	12
House wife	26	5.4
Retired	17	3.5
Total	484	100
Senatorial Zone		
Kogi Central	183	37.8
Kogi East	157	32.4

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Kogi west	144	29.8
Total	484	100
Religious Affiliation		
Christianity	226	46.7
Islam	247	51
Traditional	6	1.2
Others	5	1
Total	484	100

Table 1 presents the demographic characteristics of the 484 study participants. The gender distribution was evenly split with 50% identifying as male and 50% as female, ensuring equitable gender-related insights. Age-wise, most participants (31%) were aged 35-44 years, followed by those 25-34 years (24.4%), and 45-54 years (21.3%). Smaller age groups included 18-24 years (5.2%), 55-64 years (11.4%), and those 65 years and above (6.8%), highlighting a predominantly middle-aged sample with diverse age representation. Ethnic diversity was notable, with Yoruba participants the largest group at 33.7%, followed by the Igala at 31.6%, and Ebira at 20.5%. Other ethnic groups included Hausa (5.8%), Igbo (2.3%), Gwari (4.8%), and other minorities (1.4%). This broad ethnic representation allows comprehensive ethnic-related insights. Occupational status varied, with 44.6% unemployed constitute the largest group, 33.3% employed, 13% students, 4.3% health workers, and 4.8% retired. Educational background showed that 48.1% had post-secondary education, 31.8% had secondary education, 14% had non-formal education, and 6% had primary education, indicating relatively high educational attainment. This distribution indicates a significant portion of the sample is currently unemployed or high level of education. Occupational roles included business persons (32%), self-employed individuals (31.2%), civil servants (15.9%), professionals (12%), housewives (5.4%), and retired individuals (3.5%). Geographically, participants were distributed across senatorial zones with Kogi Central having the highest representation at 37.8% (183). Kogi East followed with 32.4% (157), and Kogi West comprised 29.8% (144). ensuring regional coverage. Participants' religious affiliations were predominantly Muslim (51%), followed by Christianity (46.7%). A small number practiced traditional religion (1.2%) or other religions (1%), reflecting the group's religious diversity.

Variables	Frequency N=484	Percent (%)
Gender		
Male	242	50
Female	242	50
Total	484	100
Age Category		
18 - 24	25	5.2
25 - 34	118	24.4
35 - 44	150	31
45 - 54	103	21.3
55 - 64	55	11.4
65 and above	33	6.8
Total	484	100
Ethnicity		
Yoruba	163	33.7

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Igala	153	31.6
Ebira	99	20.5
Hausa	28	5.8
Igbo	11	2.3
Gwari	23	4.8
Othe Minority tribe	7	1.4
Total	484	100
Occupational Status		
Student	63	13
Employed	161	33.3
Unemployed	216	44.6
Health Worker	21	4.3
Retired	23	4.8
Total	484	100

Table 2 shows the relationships between demographic characteristics and COVID-19 vaccine uptake. While gender shows no significant association (p=0.675), age category reveals a notable correlation (p=0.019), with the 35-44 group having a higher vaccination rate. No significant associations are found between occupational status, educational attainment, and vaccine uptake (p=0.239 and p=0.861). However, a significant relationship exists between senatorial zone and vaccine uptake (p=0.003), with Kogi East having a higher rate. No association is found between religion and vaccine uptake (p=0.889).

Table 2: Association between participants demographics status and COVID-19 vaccine-uptake

Variables	COVID-19 Vaccine Uptake			Statistic		
	Vaccinated	Not vaccinated	Total	χ^2	df	P-value
Gender						
Male	229(94.6)	13(5.4)	242(100.0)			
Female	231(95.5)	11(4.5)	242(100.0)			
Total	460(95.0)	24(5.0)	484(100.0)	0.175	1	0.675
Age category						
18 – 24	21(84.0)	4(16.0)	25(100.0)			
25 – 34	111(94.1)	7(5.9)	118(100.0)			
35 – 44	147(98.0)	3(2.0)	150(100.0)			
45 – 54	99(96.1)	4(3.9)	103(100.0)			
55 – 64	53(96.4)	2(3.6)	55(100.0)			
≥ 65	29(87.9)	4(12.1)	33(100.0)			
Total	460(95.0)	24(5.0)	484(100.0)	13.539	5	0.019*
Occupational Status						
Student	57(90.5)	6(9.5)	63(100.0)			
Employed	152(94.4)	9(5.6)	161(100.0)			
Unemployed	207(95.8)	9(4.2)	216(100.0)	5.505	4	0.239

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Health Worker	21(100.0)	0(0.0)	21(100.0)			
Retired	23(100.0)	0(0.0)	23(100.0)			
Total	460(95.0)	24(5.0)	484(100.0)			
Educational attainment						
Non-Formal Education	65(95.6)	3(4.4)	68(100.0)			
Primary School	27(93.1)	2(6.9)	29(100.0)			
Secondary School	145(94.2)	9(5.8)	154(100.0)			
Post Secondary School	223(95.7)	10(4.3)	233(100.0)			
Total	460(95.0)	24(5.0)	484(100.0)	0.75	3	0.861
Senatorial Zone						
Kogi Central	173(94.5)	10(5.5)	183(100.0)			
Kogi East	156(99.4)	1(0.6)	157(100.0)			
Kogi West	131(91.0)	13(9.0)	144(100.0)			
Total	460(95.0)	24(5.0)	484(100.0)	11.381	2	0.003*
Religion						
Christianity	214(94.7)	12(5.3)	226(100.0)			
Islam	233(95.1)	12(4.9)	246(100.0)			
Traditional	6(100.0)	0(0.0)	6(100.0)			
Others	7(100.0)	0(0.0)	7(100.0)	0.632	3	0.889
Total	460(95.0)	24(5.0)	484(100.0)			

*Statistically significant at $P < 0.05$

Knowledge about COVID-19 and its Vaccination

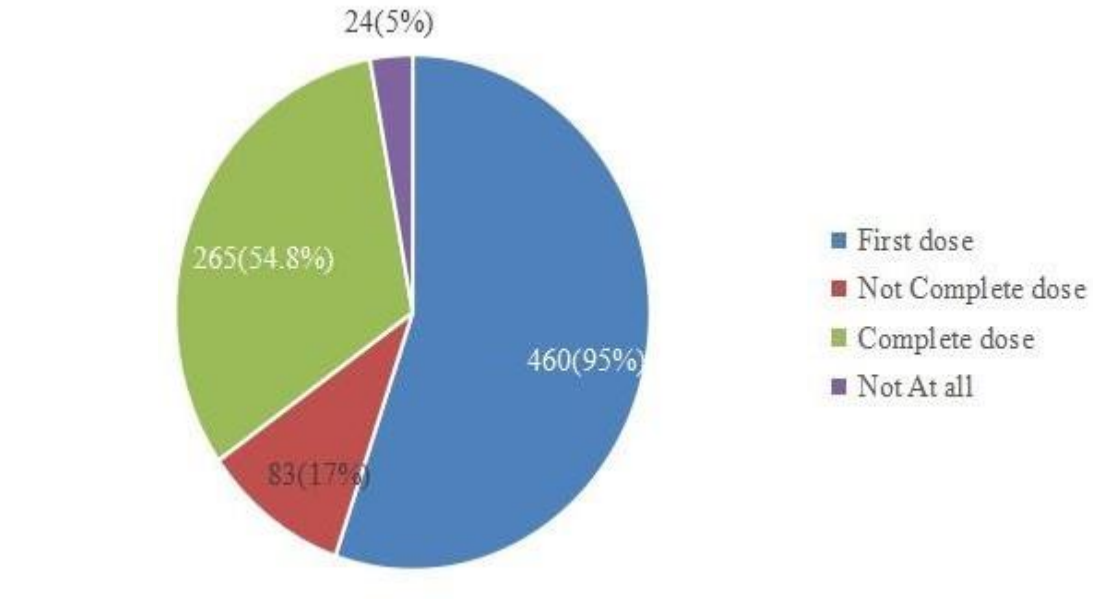

Figure 1: Level of COVID-19 vaccine uptake among the respondents

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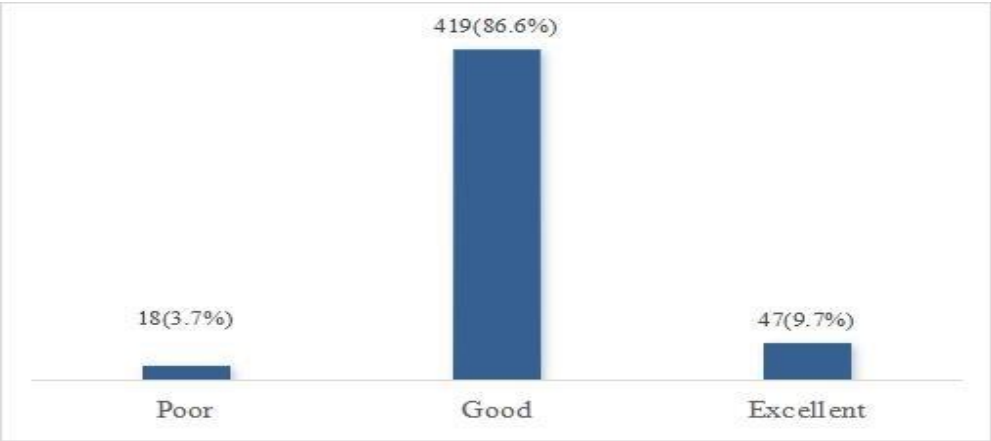

Figure 2: Respondents' level of knowledge of COVID-19 and Vaccination

The pie chart (fig 1) shows that a minimal percentage (5%) of the respondents has not received the COVID-19 vaccine, while 95% began with the first dose. Also, 17% started but didn't complete the vaccine doses, and the majority (54.8%) completed the required COVID-19 vaccine doses.

The level of uptake of the COVID-19 vaccines among the respondents is approximately 95%. This indicates a substantial proportion of the sampled population has at least started the vaccination process.

The data from fig 2 showed participants' knowledge levels of COVID-19 and its vaccination reveals that 86.6%(n=419) have a good knowledge, 9.7%(n=47) have an excellent knowledge, and 3.7%(n=3.7%) have a poor knowledge. This indicates that the majority of participants possess a good understanding, with a small proportion having either excellent or poor knowledge of COVID-19 and its vaccination.

Table 3: Summary of descriptive statistics regarding the response variables for the participants

Variables	Maximum Points on Scale of Measure	Mean and Std. Deviation		Overall
		$\bar{x}$	± SD	(%)
Knowledge	13	8.53	1.55	65.6
Attitudinal disposition	32	23.14	2.79	72.3
Perception	108	73.38	4.56	67.9
COVID-19 Vaccine Uptake	1	0.95	0.22	95.00

Table 3 provides an overview of participants' knowledge, attitudes, perceptions, and COVID-19 vaccine uptake. The mean knowledge score is 8.53 out of 13 (65.6%) with a standard deviation of 1.55, indicating moderate variability. Attitudes scored an average of 23.14 out of 32 (72.3%), with a standard deviation of 2.79. Perceptions averaged 73.38 out of 108 (67.9%), with a standard deviation of 4.56. The mean vaccine uptake score was 0.95 out of 1 (95.0%) with a standard deviation of 0.22, showing high uptake. Overall, participants demonstrated moderately high knowledge, positive attitudes, and perceptions, with very high vaccine uptake, and moderate variability in responses.

Table 4 examines the association between participants' knowledge about COVID-19 issues and vaccine uptake. No significant differences in vaccination rates were found based on beliefs regarding the effectiveness of vaccines in preventing severe illness and death ($\chi2 = 0.885$, df = 1, $p = 0.347$), the purpose of vaccines in preventing disease establishment ($\chi2 = 0.447$, df = 1, $p = 0.504$), and symptoms associated with COVID-19 infection ($\chi2 = 0.437$, df = 1, $p = 0.508$). However, beliefs that COVID-19 is similar to the common cold and catarrh were associated with lower vaccination rates ($\chi2 = 5.045$, df = 1, $p = 0.025$). No significant associations were observed between vaccination status and beliefs that everyone, including children, can receive vaccination ($\chi2 = 1.008$, df = 1, $p = 0.315$), the safety of vaccines ($\chi2 = 0$, df = 1, $p = 0.987$), and the

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sufficiency of a single vaccine dose for full protection ($\chi 2 = 0.1$, df = 1, p = 0.920). These findings highlight the in-depth relationship between COVID-19 knowledge and vaccine acceptance.

Table 4: Association between participants' knowledge about COVID-19 issues and vaccine-uptake

Variables	COVID-19 Vaccine Uptake			Statistic		
	Vaccinated	Not vaccinated	Total	χ^2	df	P-value
COVID-19 vaccines are highly effective in preventing severe illness, and death associated with the disease						
Yes	414(94.7)	23(5.3)	47(100.0)	0.885	1	0.347
No	46(97.9)	1(2.1)	437(100.0)			
Total	460(95.0)	5(5.0)	484(100.0)			
COVID-19 vaccines are not for treating the disease but preventing the disease from establishing its presence in						
Yes	378(94.7)	21(5.3)	399(100.0)	0.447	1	0.504
No	82(96.5)	3(3.5)	85(100.0)			
Total	460(95.0)	5(5.0)	484(100.0)			
A person infected with COVID-19 germs will have high blood pressure and not be able to be active.						
Yes	336(94.6)	19(5.4)	355(100.0)	0.437	1	0.508
No	124(96.1)	5(3.9)	129(100.0)			
Total	460(95.0)	5(5.0)	484(100.0)			
COVID-19 is just like common cold and catarrh						
Yes	324(93.6)	22(6.4)	346(100.0)	5.045	1	0.025*
No	136(98.6)	2(1.4)	138(100.0)			
Total	460(95.0)	5(5.0)	484(100.0)			
Everyone including children can receive COVID-19 vaccination						
Yes	240(96.0)	10(4.0)	250(100.0)	1.008	1	0.315
No	220(94.0)	14(6.0)	234(100.0)			
Total	460(95.0)	5(5.0)	484(100.0)			
COVID-19 vaccines are safe						
Yes	403(95.0)	21(5.0)	242(100.0)	0	1	0.987
No	57(95.0)	3(5.0)	60(100.0)			
Total	460(95.0)	5(5.0)	484(100.0)			
Only one injection of COVID-19 vaccine is sufficient for full protection against an infection by the germs that						
Yes	254(95.1)	13(4.9)	267(100.0)	0.1	1	0.920
No	206(94.9)	11(5.1)	217(100.0)			
Total	460(95.0)	5(5.0)	484(100.0)			

*Statistically significant at $P < 0.05$

Table 5: Comparing Knowledge, Attitude, Perception and COVID-19 Vaccine Uptake scores across Gender of participants in the study using Analysis of Variance (ANOVA)

Variables	Scale	Male		Female			
		$\bar{x}$	± SD	$\bar{x}$	± SD	F	*Sig.
Knowledge	13	8.27	1.74	8.79	1.29	13.565	0.000
Attitudinal Disposition	32	22.80	2.99	23.48	2.55	7.210	0.007
Perception	108	73.12	4.65	73.64	4.47	1.527	0.217
COVID-19 Vaccine	1	0.95	0.23	0.95	0.21	0.175	0.676

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*Statistically significant at P < 0.05

The results show significant differences between males and females in knowledge and attitudinal disposition towards COVID-19 vaccination, with females scoring higher in both (knowledge: mean ± SD = 8.79 ± 1.29 vs. 8.27 ± 1.74, F = 13.565, p < 0.001; attitudinal disposition: mean ± SD = 23.48 ± 2.55 vs. 22.80 ± 2.99, F = 7.210, p = 0.007). There were no significant differences between males and females in perception (F = 1.527, p = 0.217) and COVID-19 vaccine uptake (F = 0.175, p = 0.676).

Table 6 Comparing Knowledge, Attitude, Perception, and COVID-19 Vaccine Uptake scores across Age Group of participants in the study using Analysis of Variance (ANOVA)

		18 - 24		**25 - 34**		**35 - 44**		**45 - 54**		**55 - 64**		**65 and above**			
Variables	**Scale**	**$\bar{x}$**	**± SD**	**$\bar{x}$**	**± SD**	**$\bar{x}$**	**± SD**	**$\bar{x}$**	**± SD**	**$\bar{x}$**	**± SD**	**$\bar{x}$**	**± SD**	**F**	**Sig.**
Knowledge	13	8.44	1.53	8.79	1.37	8.49	1.37	8.52	1.44	8.07	2.18	8.64	1.88	1.695	0.134
Attitudinal	32	22.96	2.91	23.49	2.60	23.44	2.73	22.83	2.79	22.69	2.95	22.39	3.25	1.770	0.117
Perception	108	72.84	6.67	72.94	4.71	74.07	3.63	73.50	4.80	73.44	4.20	71.76	5.43	1.846	0.102
COVID-19 Vaccine	1	0.84	0.374	0.94	0.24	0.98	0.14	0.96	0.19	0.96	0.19	0.88	0.33	2.751	0.018

*Statistically significant at P < 0.05

Table 6 showed that the study found no significant differences in COVID-19 knowledge, attitudinal dispositions, and perceptions across various age groups (p-values: 0.134, 0.117, and 0.102, respectively). However, there was a significant difference in COVID-19 vaccine uptake among these age groups (p = 0.018), with the 35-44 years age group showing the highest vaccine uptake (mean = 0.98, SD = 0.1

Table 7 Comparing Knowledge, Attitude, Perception and COVID-19 Vaccine Uptake scores across Educational Attainment of participants in the study using Analysis of Variance (ANOVA)

Variables		Non-Formal		Primary School		Secondary school		Post-Secondary			
	Scale	$\bar{x}$	± SD	$\bar{x}$	± SD	$\bar{x}$	± SD	$\bar{x}$	± SD	F	Sig.
Knowledge	13	7.69	1.95	8.45	1.48	8.45	1.53	8.83	1.34	10.309	0.000
Attitudinal disposition	32	20.93	2.05	22.72	2.67	23.06	2.60	23.89	2.77	22.853	0.000
Perception	108	72.49	3.89	73.14	5.21	73.12	4.16	73.85	4.88	1.887	0.131
COVID-19 Vaccine Uptake	1.00	0.96	0.207	0.93	0.258	0.94	0.235	0.96	0.20	0.248	0.862

*Statistically significant at P < 0.05

Table 7 shows an ANOVA analysis to compare mean scores across educational attainment levels for with knowledge, attitudes, perception and COVID-19 vaccine uptake. Significant differences were found in knowledge (F (3, 482) = 10.309, p = 0.000), attitudes (F (3, 482) = 22.853, p = 0.000), with post-secondary education associated with higher scores. No significant differences were found in perception, and vaccine uptake across educational levels.

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Table 8 Comparing Knowledge, Attitude, Perception COVID-19 Vaccine Uptake scores across Occupation Status of participants in the study using Analysis of Variance (ANOVA)

Variables		Student		Employed		Unemployed		Health Worker		Retired			
	Scale	x̄	± SD	x̄	± SD	x̄	± SD	x̄	± SD	x̄	± SD	F	Sig.
Knowledge	13	8.51	1.45	8.79	1.33	8.29	1.67	8.9	1.84	8.7	1.61	2.868	0.023
Attitude	32	23.3	2.77	23.65	2.71	22.61	2.79	24	3.07	23.3	2.48	3.952	0.004
Perception	108	72.4	6.19	73.81	4.81	73.42	3.74	73.71	3.68	72.39	5.18	1.391	0.236
COVID-19 Vaccine Uptake	1.00	0.9	0.296	0.94	0.23	0.96	0.20	1.00	0.00	1.00	0.00	1.378	0.241

*Statistically significant at $P < 0.05$

An ANOVA analysis compared mean scores across employment statuses for knowledge, attitudes, perception and COVID-19 vaccine uptake. Significant differences were found in knowledge ($F(4, 482) = 2.868$, $p = 0.023$) and attitudes ($F(4, 482) = 3.952$, $p = 0.004$), with health workers scoring highest in all two categories (table 8). No significant differences were found in perception and vaccine uptake across employment statuses.

Table 9 Associations Between COVID-19 Vaccine Uptake, Knowledge, Attitudinal Disposition, Perception and Perceived Motivation

Variables	x̄	± SD	1	2	3
COVID-19 Vaccine Uptake	0.95	0.22	1.00**		
Knowledge	8.53	1.55	-0.06**	1.00**	
Attitudinal Disposition	23.14	2.79	0.09**	0.31**	1.00**
Perception	73.38	4.56	0.10**	0.06**	0.27**

**Correlation is significant at the 0.01 level (2-tailed).

Table 9 presents the means, standard deviations, and correlation coefficients among the study variables. COVID-19 vaccine uptake (mean = 0.95, SD = 0.22) is positively correlated with attitudinal disposition ($r = 0.09$, $p < 0.01$) and perception ($r = 0.10$, $p < 0.01$) and negatively correlated with knowledge ($r = -0.06$, $p < 0.01$). Knowledge (mean = 8.53, SD = 1.55) is positively correlated with attitudinal disposition ($r = 0.31$, $p < 0.01$) and perception ($r = 0.06$, $p < 0.01$). Attitudinal disposition (mean = 23.14, SD = 2.79) is positively correlated with perception ($r = 0.27$, $p < 0.01$). Perception has a mean of 73.38 (SD = 4.56).

Table 10: Logistic Regression Model to test the antecedent variables that most significantly predict COVID-19 vaccine uptake

		Coefficients(a)						
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		Beta	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	0.614	0.166		3.689	0		
	Knowledge	-0.014	0.007	-0.099	-2.084	0.038	0.902	1.108

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	Attitudinal	0.008	0.004	0.099	2.009	0.045	0.837	1.194
	Perception	0.004	0.002	0.079	1.689	0.092	0.924	1.082

a. Dependent Variable: COVID-19 Vaccine Uptake *Statistically significant at $P < 0.05$

A multiple regression analysis (Table10) revealed that Knowledge ($p = 0.038$) and Attitudinal Disposition ($p = 0.045$) significantly influence COVID-19 Vaccine Uptake, while Perception ($p = 0.092$) does not. A unit increase in Knowledge is associated with a decrease in Vaccine Uptake by 0.014 units, while a unit increase in Attitudinal Disposition is associated with an increase in Vaccine Uptake by 0.008 units. The lack of multicollinearity among predictors strengthens the reliability of the results, indicating that each predictor contributes independently to explaining vaccine uptake.

DISCUSSION

Research question 1&2:

Knowledge Regarding COVID-19 and Vaccination

The findings of this study reveal critical insights into public knowledge about COVID-19 and vaccination, as well as prevalent misconceptions among the population. High awareness of COVID-19 was reported at 87.2%, which is consistent with the global recognition of the virus's impact.[20] However, a significant misconception was found, with 79.3% of respondents believing that there is no effective treatment for COVID-19. This highlights a gap in public education efforts, despite ongoing campaigns aimed at improving knowledge.[20]

The study also noted a high recognition of vaccine effectiveness at 90.3%, aligning with scientific consensus and public health messaging. Nevertheless, varying levels of understanding reported in other surveys indicate ongoing challenges in educational outreach.[20] A noteworthy finding was the prevalence of misconceptions about COVID-19 symptoms, with 73.3% believing that the virus causes high blood pressure and inactivity—claims that lack evidence and contrast with recognized symptoms like fever and cough.[21][22][23] While understanding of droplet transmission was high at 88.8%, misconceptions regarding surface transmission (87.6%) persist despite evidence indicating a reduced risk. [24] Comparisons between COVID-19 and other illnesses, such as the common cold (71.5%) or attributing allergic reactions to COVID-19 (81.8%), reflect significant misunderstandings observed in other studies.[25] Conversely, high recognition of loss of smell and taste (83.1%) was consistent with documented COVID-19 symptoms.[26]

The study categorized respondents' knowledge into three levels: poor (8.7%), moderate (67.8%), and good (23.6%), resulting in an overall average knowledge score of 65.6%, indicating a moderate yet satisfactory level of understanding. This finding aligns with similar studies [9], although some researchers, such as Sljivo et al. (2023) [27], reported higher average knowledge scores, suggesting more robust understanding among their participants.[27] Conversely, AI Tulaihi et al. (2023) [28] identified a greater proportion of respondents with good knowledge, while Yisaks et al. (2022) noted a slightly lower percentage, highlighting variations in knowledge levels across different studies.[29]

Demographic Variations in Knowledge

Significant differences in COVID-19-related knowledge were found between male and female participants (Table 5). ANOVA results indicated that female participants scored higher (mean = 8.79, SD = 1.29) than males (mean = 8.27, SD = 1.74), ($F(1, 482) = 13.565$, $p = 0.000$). This finding is consistent with Olu-Abiodun et al. (2022), who noted that women generally have higher vaccine acceptance due to better knowledge levels.[19] Similarly, Adedeji-Adenola et al. (2022) reported significant gender differences in COVID-19 knowledge, corroborating the current study's results.[30] However, some studies in Tamil Nadu, India [31], and Ghana found no significant differences, suggesting that gender disparities may vary across regions.[32]

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The ANOVA results also indicated no significant differences in knowledge scores across age groups (Table 6) ($F(5, 482) = 1.695$, $p = 0.134$). The 25-34 age group had the highest mean knowledge score (mean = 8.79, SD = 1.37), while the 55-64 age group had the lowest (mean = 8.07, SD = 2.18). Other studies, such as Agbede and Adenitire (2022) and Sakunee et al. (2021), found no significant correlation between age and vaccine knowledge, aligning with these findings.[33][34] However, Sibongga (2023) observed a positive correlation between knowledge and vaccine acceptance among older adults.[35]

Impact of Education and Occupation on Knowledge

The study found significant differences in knowledge scores based on education levels (Table 7) ($p = 0.000$), with individuals holding post-secondary education achieving the highest scores (mean = 8.83, SD = 1.34) compared to those with non-formal education (mean = 7.69, SD = 1.95). This finding aligns with several studies that emphasize the influence of educational attainment on COVID-19 knowledge. AlGethami et al. (2021) noted associations between occupation, education, income, previous COVID-19 infection, and knowledge about the disease and its vaccination.[36] Collectively, these studies suggest that higher educational attainment is linked to a greater understanding of COVID-19 and its vaccination, likely due to enhanced access to information.

The cross-sectional study also revealed significant differences in knowledge scores based on occupation (Table 8) ($F (4, 482) = 2.868$, $p = 0.023$), with health workers scoring the highest (mean = 8.90, SD = 1.84) and unemployed participants scoring the lowest (mean = 8.29, SD = 1.67). This aligns with findings from Hassan et al. (2020) and Olanrewaju et al. (2023), who observed that knowledge of COVID-19 was significantly correlated with education and occupation.[37][5] Overall, these findings underscore the multifaceted nature of factors influencing COVID-19 knowledge and vaccination awareness across different populations.

Demographic distribution and the level of attitudinal dispositions towards COVID-19 vaccination among a selected sample from the population.

The findings presented in Table 3 illustrate a moderate level of favorable attitudes towards COVID-19 vaccination within the surveyed population, with an aggregate score of 72.3% (mean score = 23.14, SD = 2.79). This indicates a general inclination towards vaccine acceptance, although notable individual variability exists. Demographic factors such as gender, educational attainment, and occupational status are significant predictors of vaccine acceptance (Tables 5, 6, 7, and 8). Specifically, the study corroborates previous research by Temitope et al. (2022) [9], Al Tulaihi et al. (2023),[28] James et al. (2022),[38] which reported positive attitudes towards vaccination among over 72%, 50% and 60.2% of respondents, respectively. In contrast, Yisak et al. (2022) reported a lower percentage (43.4%), highlighting variability across populations.[29] The analysis reveals a positive correlation between higher educational attainment and favorable attitudes towards vaccination, suggesting that individuals with advanced education levels are more likely to embrace vaccination. However, age did not significantly influence attitudes towards vaccine acceptance, which contrasts with findings by Malik et al. (2020) and Supremo et al. (2022), indicating a need for further exploration of age-specific attitudes.[39][40] Importantly, a significant correlation between positive attitudes and actual vaccine uptake is observed (Table 9). These results emphasize the need for tailored interventions that address specific demographic concerns, reinforcing the importance of continued public health communication to mitigate vaccine hesitancy and promote acceptance.

Demographic distribution and the level of perception, and the correlation between perception and demographic characteristic among participants in the study

The study's findings provide valuable insights into participants' perceptions regarding COVID-19 and its vaccination. The perception score of 67.9% (see Table 3) indicates a moderate understanding of COVID-19, consistent with studies in Indonesia, [41] and Nigeria, [30] although some research reports lower favorable perceptions.[42] A study in Turkey by Sonmezer et al. (2022) found that 62.7% of participants had positive perceptions of COVID-19 vaccines.[43]

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Using Analysis of Variance (ANOVA), the study assessed perception across demographic groups (see Tables 5, 6, 7, & 8). The analysis showed no significant difference in perception scores between males and females ($F(1, 482) = 1.527$, $p = 0.217$), which contrasts with global research suggesting women may perceive health risks differently. [44] In Nigeria, a systematic review by Babatope et al. (2023) indicated that vaccine acceptance rates varied widely,[45] with over half of the studies reporting acceptance below 60%. Olu-Abiodun et al. (2022) noted that non-acceptance was often due to propaganda and concerns about adverse effects.[19]

Globally, Lazarus et al. (2021) found that cues to action and health motivation positively predicted intentions to vaccinate, although perceived susceptibility and vaccine benefits did not.[44] Educational attainment and employment status did not significantly impact perceptions ($F(3, 482) = 1.887$, $p = 0.131$; $F(4, 482) = 1.391$, $p = 0.236$), indicating limited variations across these demographics.

Research question 3: The Correlation between Knowledge, Attitudinal Dispositions, Perceptions, and COVID-19 Vaccine Uptake

This study examined the correlation between knowledge, attitudes, perceptions, and COVID-19 vaccine uptake across various demographic groups. The findings reveal that COVID-19 vaccine uptake exhibited a weak negative correlation with knowledge ($r = -0.06^*$, $p < 0.01$), suggesting that higher knowledge levels do not necessarily lead to increased vaccine uptake (Table 9). Conversely, vaccine uptake showed weak positive correlations with attitudinal disposition ($r = 0.09$, $p < 0.01$) and perception ($r = 0.10$, $p < 0.01$). These correlations indicate that more favorable attitudes and perceptions are associated with higher vaccine uptake.

This aligns with Oyekale (2021), who noted that trust in government and health authorities predicted vaccine acceptance more strongly than knowledge alone.[46] Similarly, Cooper et al. (2021) found that vaccine acceptance in Africa is more closely linked to trust in health systems and perceived risk than to knowledge.[47] Global research, including Karlsson et al. (2021) and Lin et al. (2021), further emphasizes that trust and attitudes significantly influence vaccine uptake, rather than knowledge alone.[48][49]

In conclusion, while knowledge about COVID-19 is important, attitudes and perceptions play a more significant role in predicting vaccine uptake. Targeted communication strategies addressing concerns and building trust in vaccination are essential to enhance vaccine acceptance.

Research question 3

The Relative Contributions of Knowledge, Attitudinal Dispositions, and Perceptions to COVID-19 Vaccine Uptake: Identifying the Most Significant Predictor Variable.

The current study's multiple regression analysis found that Knowledge ($p = 0.038$) and Attitudinal Disposition ($p = 0.045$) are significant predictors of COVID-19 Vaccine Uptake. Specifically, Knowledge negatively predicted vaccine uptake ($B = -0.014$), suggesting increased knowledge may correlate with greater hesitancy, while Attitudinal Disposition positively predicted uptake, indicating that favorable attitudes towards vaccination are associated with higher acceptance. This finding contrasts with Ekwebelem et al., (2021) in Nigeria, where higher knowledge levels positively correlated with vaccine acceptance, although both studies agree on the positive impact of attitudes.[50] Similarly, Solís Arce et al. (2021) found that knowledge and attitudes were crucial for vaccine acceptance across several African countries, again showing a positive correlation between knowledge and acceptance, which diverges from the current study.[51] Globally, Lazarus et al. (2021) [44] across 19 countries, Huka et al., (2023),[52] and Genovese et al., (2022)[53] in Europe, and Paul, Steptoe, and Fancourt (2021)[54] in the UK all reported that higher knowledge and positive attitudes significantly predict vaccine uptake. The divergence in knowledge's impact highlights the need for public health interventions to address misinformation and specific concerns, while the consistent finding on attitudes underscores the importance of fostering positive perceptions through community engagement and transparent communication to enhance vaccine uptake.

In contrast, the current study found that perception does not significantly impact COVID-19 Vaccine Uptake ($p = 0.092$), suggesting its limited predictive power in this model. This result contrasts with Adeniyi et al.,

(2021) in South Africa,[55] where concerns about vaccine safety and efficacy were significant predictors of vaccine uptake. Similarly, Uchechukwu et al., (2021) found that perception of vaccine safety and trust in healthcare systems significantly influenced uptake across several African countries,[56] including Ghana, Kenya, and South Africa. Globally, studies by Murphy et al., (2021) [57] in Ireland and the UK, and Fisher et al., (2020) in the United States,[58] also highlighted those positive perceptions of vaccine safety and efficacy are critical determinants of vaccine acceptance. These discrepancies underscore the context-specific nature of perception's role in vaccine uptake, emphasizing the need for tailored public health interventions to address perceptual barriers effectively. The consistent finding across studies that positive attitudes significantly boost vaccine uptake emphasizes the importance of fostering a positive public perception of vaccines through community engagement, trust-building, and transparent communication about the benefits and safety of vaccines.

CONCLUSION

The study revealed that a positive attitudinal disposition significantly predicts higher COVID-19 vaccine uptake ($p = 0.045$), while increased knowledge negatively predicts uptake ($p = 0.038$, $B = -0.014$), suggesting a potential correlation with greater hesitancy. Perception, however, did not show a significant impact on vaccine uptake ($p = 0.092$).

This study investigated COVID-19 vaccination knowledge, attitudes, and perceptions among 484 participants in Kogi State, Nigeria, revealing a 95% vaccination initiation rate. Despite widespread knowledge, a negative correlation emerged between knowledge and vaccine uptake ($r = -0.23$, $p = 0.012$), suggesting that knowledge alone is insufficient to drive vaccination. Conversely, positive attitudes significantly predicted higher uptake ($p = 0.045$), highlighting the crucial role of favorable attitudes in vaccine acceptance. These findings underscore the complex interplay of cognitive and affective factors in vaccine decision-making, emphasizing the need for targeted communication campaigns, community engagement, healthcare worker training, and ongoing evaluation to address emotional and attitudinal barriers and promote vaccine acceptance.

Study Limitation

This study has some limitations. Firstly, its generalizability is limited to Kogi State, and may not be applicable to the entire country. Secondly, self-reported data may affect the study accuracy and makes it susceptible to biases like social desirability bias and recall bias. Thirdly, the cross-sectional design prevents the inference of causality and the observation of changes over time, highlighting the need for longitudinal studies. Lastly, the study's narrow scope of variables related to COVID-19 vaccine uptake overlooks potential influences like cultural, socio-economic, and political factors, which could provide a more comprehensive understanding of vaccine hesitancy and acceptance.

Ethical Consideration

Ethical approval was obtained from the Kogi State Ministry of Health, ensuring compliance with ethical standards. Participation was voluntary, and informed consent was obtained from all respondents prior to data collection. Confidentiality of responses was strictly maintained throughout the study.

Conflict of Interest

The authors declare no conflict of interest.

REFERENCES

1. WHO 2022; https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines/advice. Accessed August 23, 2022.
2. NCDC 2022: https://covid19.ncdc.gov.ng/ Till date, 258874 cases have been confirmed, 250456 cases have been discharged and 3,144 deaths have been recorded in 36 states and the Federal Capital Territory Retrieved 13 July 2022.

3. National Primary Health Care Development Agency [@NphcdaNG] (12 July 2022) ("COVID-19 Vaccination Update: July 11th 2022, in 36 States + the FCT. 24,675,659 of total eligible persons targeted for COVID-19 vaccination, fully vaccinated while 11,873,847 of total eligible persons targeted for COVID-19 vaccination, partially vaccinated (Tweet). Retrieved 12 July 2022 - via Twitter.
4. Abdurrahman, S., Olubunmi, A., Gadzama, D., Kefas, I. B., Dominguez, J., et al. (2023). Knowledge, perceived risk, and willingness for vaccine uptake of COVID-19 among primary health care workers in Abuja, Nigeria. J Case Rep Med Hist, 3(4). https://doi.org/10.54289/JCRMH2300120.
5. Olanrewaju, K., Adebimpe, J. R., Tosin, A. C., Faloye, A., Ikenna, N. C., Abayomi , O. P., Ayodeji, O. V., Osayande, A. H., Anani , S. J., Akinola, A. O., Beatrice , A. K., & Mary, D. A. (2023). Knowledge of COVID-19 Vaccine and Factors that Influence Its Acceptance among Patients Living with Chronic Medical Conditions in Nigeria. International Journal of TROPICAL DISEASE & Health, 44(3), 43–53. https://doi.org/10.9734/ijtdh/2023/v44i31394.
6. Ndejjo, R., Chen, N., Kabwama, S. N., Namale, A., Wafula, S. T., Wanyana, I., Kizito, S., Kiwanuka, S. N., Sambisa, W., Tsai, L. L., & Wanyenze, R. K. (2023). Uptake of COVID-19 vaccines and associated factors among adults in Uganda: a cross-sectional survey. BMJ open, 13(3), e067377. https://doi.org/10.1136/bmjopen-2022-067377.
7. Habu, H., Alpha, M., Likki, H., Tukur, B. M., Babaji, M., Hamina, D., Inuwa, A., Abdulraheem, A., & Kellu, U. B. (2023). Knowledge, fear, and willingness to accept COVID-19 vaccine among residents of Jere LGA, Borno State, Nigeria. Kanem Journal Medical Sciences, 16(2), 124-131. https://doi.org/10.36020/kjms.2022.1602.007
8. Ojo, T. O., Ojo, A. O., Ojo, O. E., Akinwalere, B. O., & Akinwumi, A. F. (2023). Determinants of COVID-19 vaccine uptake among Nigerians: evidence from a cross-sectional national survey. Archives of public health 81(1), 95. https://doi.org/10.1186/s13690-023-01107-1
9. Temitope, A.L., Akin, O., Oshineye, A., & Atolagbe, J. (2022). COVID-19 related knowledge, attitude and practice of students of Adeleke University, Ede Osun State, Nigeria. International Journal of Health Sciences, 12, 137. https://doi.org/10.52403/ijhsr.20220820.
10. Ihua, N., Nwankwo, C., Orudukobipi, T.-O., Affia, A., & Aaron, U. (2023). Epidemiological survey of knowledge, attitudes and practices: a preventive intervention strategy against COVID-19 pandemic in Nigeria. International Journal of Scientific Reports, 9(131-136). https://doi.org/10.18203/issn.2454-2156.IntJSciRep20231095.
11. Odunsi, O., Onanuga, M., Adeleke, O., Sowole, P., & Owolabi, O. (2022). Regional Analysis of Acceptance of COVID-19 Vaccines in Nigeria. Journal of Applied Health Sciences, 8(2), 251-259. https://doi.org/10.24141/1/8/2/12
12. Djauhari, T., & Rindradi, R. S. (2023). Overview of Knowledge Levels of People Who Are Willing to Vaccinate Against COVID-19 in the COVID-19 Vaccination Program at RSUMM. In 2nd International Conference on Medical Health Science, KnE Medicine (pp. 290–295). https://doi.org/10.18502/kme.v3i2.13062.
13. Piltch-Loeb, R., Mazibuko, L., Stanton, E., Mngomezulu, T., Gareta, D., et al. (2023). COVID-19 vaccine uptake, confidence, and hesitancy in rural KwaZulu-Natal, South Africa between April 2021 and April 2022: A continuous cross-sectional surveillance study. PLOS Global Public Health, 3(6), e0002033. https://doi.org/10.1371/journal.pgph.0002033
14. Islam, M. S., Siddique, A. B., Akter, R., & et al. (2021). Knowledge, attitudes and perceptions towards COVID-19 vaccinations: A cross-sectional community survey in Bangladesh. BMC Public Health, 21, 1851. https://doi.org/10.1186/s12889-021-11880-9
15. Kanyanda, S., Markhof, Y., Wollburg, P., et al. (2021). Acceptance of COVID-19 vaccines in sub-Saharan Africa: Evidence from six national phone surveys. BMJ Open, 11, e055159. https://doi.org/10.1136/bmjopen-2021-055159.
16. Nnaemeka, V. C., Okafor, N. A., Orababar, O. Q., et al. (2023). COVID-19 Vaccine Acceptance in Nigeria: A Rapid Systematic Review and Meta-Analysis. medRxiv. https://doi.org/10.1101/2023.02.16.23286008
17. Ackah, B. B. B., Woo, M., Stallwood, L., Fazal, Z. A., Okpani, A., Ukah, U. V., & Adu, P. A. (2022). COVID-19 vaccine hesitancy in Africa: a scoping review. Global health research and policy, 7(1), 21. https://doi.org/10.1186/s41256-022-00255-1

18. Naing, L., Winn, T., & Nordin, R. (2006). Practical issues in calculating the sample size for prevalence studies. Archives of Orofacial Sciences, 1, 9-14.
19. Olu-Abiodun O, Abiodun O, Okafor N (2022) COVID-19 vaccination in Nigeria: A rapid review of vaccine acceptance rate and the associated factors. PLoS ONE 17(5): e0267691. https://doi.org/10.1371/journal.pone.0267691. 20.Centers for Disease Control and Prevention. (2023) - 7. Omnibus vaccination surveys. https://www.cdc.gov/vaccines/ed/downloads/omnibus-vaccination-surveys-2023-5.pdf.
20. Mohamed, N. A., Solehan, H. M., Mohd Rani, M. D., Ithnin, M., & Che Isahak, C. I. (2021). Knowledge, acceptance and perception on COVID-19 vaccine among Malaysians: A web-based survey. PLoS ONE, 16(8), e0256110. https://doi.org/10.1371/journal.pone.0256110
21. Li, R., Pei, S., Chen, B., Song, Y., Zhang, T., Yang, W., & Shaman, J. (2020). Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV-2). Science, 368(6490), 489-493.
22. FactCheck.org. (n.d.). Misconceptions about COVID-19. https://www.factcheck.org/covid-misconceptions/. Retrieved June 1, 2024.
23. Mayo Clinic Health System. (2023). COVID-19 vaccine myths debunked. https://www.mayoclinichealthsystem.org/hometown-health/featured-topic/covid-19-vaccine-myths-debunked(Access 6, May 2024)
24. Annenberg Public Policy Center of the University of Pennsylvania. (2022, October 3). Misinformation about vaccine safety drives reluctance to vaccinate children, study finds. ScienceDaily. Retrieved May 31, 2024 from www.sciencedaily.com/releases/2022/10/221003090602.htm
25. Adane, M., Ademas, A. & Kloos, H. Knowledge, attitudes, and perceptions of COVID-19 vaccine and refusal to receive COVID-19 vaccine among healthcare workers in northeastern Ethiopia. BMC Public Health 22, 128 (2022). https://doi.org/10.1186/s12889-021-12362-8
26. Šljivo, A., Abdulkhaliq, A., Granov, N., et al. (2023). COVID-19 vaccination knowledge, attitudes and practices among the general population of Romania during the third wave of COVID-19 pandemic. SAGE Open Medicine, 11. https://doi.org/10.1177/20503121231165670.
27. Al Tulaihi, A., Salamah, G. M., Alshahrani, T. M., Haikel, K. A. B., Al Eraij, S. M., Alsaeed, R. R., Alilaj, M. O., & Alzaid, T. A. (2023). Knowledge, attitudes, and perceptions toward COVID-19 vaccinations in the Saudi population. Open Access Macedonian Journal of Medical Sciences, 11(E), 176-181. https://doi.org/10.3889/oamjms.2023.11369
28. Yisak, H., Ambaw, B., Belay, E., Desalegn, T., Getie, A., Asrat, M., Guangul, A., Seid, T., Zewde, E. A., Assefa, M., & Ewunetei, A. (2022). Knowledge, attitude, acceptance, and practice of COVID-19 vaccination and associated factors complemented with constructs of the health belief model among the general public in South Gondar, Ethiopia: A community-based study. Frontiers in Public Health, 10, 914121. https://doi.org/10.3389/fpubh.2022.914121.
29. Adedeji-Adenola H, Olugbake OA, Adeosun SA (2022) Factors influencing COVID-19 vaccine uptake among adults in Nigeria. PLoS ONE 17(2): e0264371. https://doi.org/10.1371/journal. pone.0264371
30. Subramani, P., James, J., Saikia, K., D., A., B., A., & S., A. (2021). Awareness on COVID-19 vaccination among public: A questionnaire survey. International Journal of Community Medicine and Public Health, 9(1), 288. https://doi.org/10.18203/2394-6040.ijcmph20215012.
31. Owusu, E., Debrah-Wiafe, E., Appaw, E., Apreh-Siaw, N., Ahwireng, F., Amoah, C., & Amoah, B. (2024). Gender discrepancies in sources of information and COVID-19 pandemic knowledge: Insight from some districts and municipalities in Ghana. GSC Biological and Pharmaceutical Sciences, 26, 275-282. https://doi.org/10.30574/gscbps.2024.26.1.0022
32. Agbede, C. O., & Adenitire, G. S. (2022). Knowledge and COVID-19 vaccine uptake among elderly in Ogun State, Nigeria. Open Journal of Medical Research, 3(1). https://doi.org/10.52417/ojmr.v3i1.378
33. Sakunee, L., Khorprasert, N., Noumtong, N., Tangguay, T., & Yeesin, P. (2021). The relationship between age groups and knowledge and understanding of COVID-19 vaccine. International Journal of Advanced Research, 9(6), 482-486. https://doi.org/10.21474/IJAR01/13293
34. Sibongga, G., Degollado, J., Escaran, F., Mina, N., Sison, C., & Reantillo, E. (2023). Perceived level of knowledge and acceptance of COVID-19 vaccine among older adults. Journal of Rural Community Nursing Practice, 1(2), 145-173. https://doi.org/10.58545/jrcnp.v1i2.115

35. AlGethami, H. J., Altamran, M. A., Khan, M. S., Zaman, K. M. N., & Alswaied, N. (2021). Awareness and Knowledge Towards Pediatric and Adult COVID-19 Vaccination: A Cross Sectional Community-based Study in Saudi Arabia. Materia socio-medica, 33(4), 262–268. https://doi.org/10.5455/msm.2021.33.262-268.
36. Hassan, Z. ., Ullah, A. R. ., Ali, I. ., Aqeel, S. ., Khan, J. Z. ., Ali Shah, S. Z. ., … Hussain, A. . (2020). Knowledge, Risk Perception and Information Sources Regarding COVID-19 Among Allied Healthcare Workers in Peshawar. Annals of King Edward Medical University, 26(Special Issue), 269–275. https://doi.org/10.21649/akemu.v26iSpecial
37. James, B. C., Ede, S. S., Aroh, C. M., Okoh, C. F., Kanokwan, C., Rasip, M. L., & Enbeyle, W. (2022). Attitudes and perceptions of Nigerians regarding receiving COVID-19 vaccines: an online cross-sectional study. The Pan African medical journal, 41, 247. https://doi.org/10.11604/pamj.2022.41.247.33286.
38. Malik, A. A., McFadden, S. M., Elharake, J., & Omer, S. B. (2020). Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine, 100495. https://doi:10.1016/j.eclinm.2020.100495
39. Supremo, A., Bacason, S., Rex, A., & Sañosa, R. (2022). Sociodemographic correlates of older adult acceptance of the COVID-19 vaccine. Jurnal Ners. Advance online publication. https://doi: 10.20473/jn.v16i1.29655
40. Tasnim, T. (2021). The Relationship Between Demographic Factors And Individual Perception About COVID-19 Vaccines. Indonesian Journal Of Health Sciences Research and Development, 3(1). https://doi.org/10.36566/ijhsrd/Vol3.Iss1/70b
41. Habibunisha, H., Rathinam, V. A., & Nivethitha, K. (2021). A study on perception on Covid-19 vaccination among general public. Asian Journal of Nursing Education and Research, 537-540. https://doi.org/10.52711/2349-2996.2021.00127
42. Sonmezer, M. C., Sahin, T. K., Erul, E., Ceylan, F. S., Hamurcu, M. Y., Morova, N., Rudvan Al, I., & Unal, S. (2022). Knowledge, Attitudes, and Perception towards COVID-19 Vaccination among the Adult Population: A Cross-Sectional Study in Turkey. Vaccines, 10(2), 278. https://doi.org/10.3390/vaccines10020278
43. Lazarus, J. V., Wyka, K., Rauh, L., Rabin, K., Ratzan, S. C., Gostin, L. O., ... & El-Mohandes, A. (2021). Hesitant or not? The association of age, gender, and education with potential acceptance of a COVID-19 vaccine: a country-level analysis. Journal of Health Communication, 26(7), 527-537. https://doi.org/10.1080/10810730.2021.1946218.
44. Babatope, T., Ilyenkova, V., & Marais, D. (2023). COVID-19 vaccine hesitancy: A systematic review of barriers to the uptake of COVID-19 vaccine among adults in Nigeria. Bulletin of the National Research Centre, 47, 45. https://doi.org/10.1186/s42269-023-01017-w.
45. Oyekale, A. S. (2021). Factors influencing willingness to take COVID-19 vaccine in Nigeria. Journal of Community Health, 46(5), 878-889. https://doi:10.1007/s10900-021-00986-2
46. Cooper, S., van Rooyen, H., & Wiysonge, C.S. (2021). COVID-19 vaccine hesitancy in South Africa: how can we maximize uptake of COVID-19 vaccines? Expert Review of Vaccines, 20, 921 - 933.
47. Karlsson, L. C., Soveri, A., Lewandowsky, S., Karlsson, H., Karlsson, E., Nolvi, S., ... & Antfolk, J. (2021). Fearing the disease or the vaccine: The case of COVID-19. Personality and Individual Differences, 172, 110590. https://doi:10.1016/j.paid.2020.110590.
48. Lin, C., Tu, P., Beitsch, L. M. (2021). Acceptance of COVID-19 Vaccination in the United States: A Rapid Systematic Review. Vaccines, 9(3), 210. doi:10.3390/vaccines9030210
49. Ekwebelem, O. C., Yunusa, I., Onyeaka, H., Ekwebelem, N. C., Nnorom-Dike, O. V., & Abuh, O. M. (2021). COVID-19 vaccine rollout: will it affect the rates of vaccine hesitancy in Nigeria? Public Health in Practice, 2, 100128. https://doi.org/10.1016/j.puhip.2021.100128
50. 51.Solís Arce, J. S., Warren, S. S., Meriggi, N. F., Scacco, A., McMurry, N., Voors, M., & Omer, S. B. (2021). COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. Nature Medicine, 27(8), 1385-1394. https://doi.org/10.1038/s41591-021-01454-y
51. [52]. Huka, A. E., Alemeyehu, L., Jara, D., Ayele, A., & Shifa, T. (2023). Predictors of willingness to accept COVID-19 vaccine among adults. Frontiers in Epidemiology, 3. https://doi.org/10.3389/fepid.2023.1240557
52. Genovese, C., Costantino, C., Odone, A., Trimarchi, G., La Fauci, V., Mazzitelli, F., D'Amato, S., Squeri, R., & The Covid-Risk Perception Group (2022). A Knowledge, Attitude, and Perception Study

on Flu and COVID-19 Vaccination during the COVID-19 Pandemic: Multicentric Italian Survey Insights. Vaccines, 10(2), 142. https://doi.org/10.3390/vaccines10020142.

53. Paul, E., Steptoe, A., & Fancourt, D. (2021). Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communications. Lancet Regional Health Europe, 1, 100012. https://doi.org/10.1016/j.lanepe.2020.100012.
54. Adeniyi, O. V., Stead, D., Singata-Madliki, M., Batting, J., Wright, M., Jelliman, E., ... & Abrahams, S. (2021). Acceptance of COVID-19 vaccine among the healthcare workers in South Africa. Vaccines, 9(6), 666. https://doi.org/10.3390/vaccines9060666
55. Uchechukwu, O. U., Ejeh, F. E., Akpabio, I. I., Okon, K. O., Ojeh, V. N., & Otu, A. (2021). COVID-19 vaccine hesitancy among African countries: A review of the literature. Pan African Medical Journal, 39, 216. https://doi.org/10.11604/pamj.2021.39.216.28271
56. Murphy, J., Vallières, F., Bentall, R. P., Shevlin, M., McBride, O., Hartman, T. K., ... & Hyland, P. (2021). Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. Nature Communications, 12(1), 29. https://doi.org/10.1038/s41467-020-20226-9
57. Fisher, K. A., Bloomstone, S. J., Walder, J., Crawford, S., Fouayzi, H., & Mazor, K. M. (2020). Attitudes toward a potential SARS-CoV-2 vaccine: A survey of U.S. adults. Annals of Internal Medicine, 173(12), 964-973. https://doi.org/10.7326/M20-3569.