Behavioral Implications of COVID-19 Prevention and Vaccination Status in Africa During 2023

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Article

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Abstract: COVID-19 remains a global health emergency, causing thousands of illnesses. This study investigated peoples' knowledge of COVID-19 in Africa. It highlighted factors impacting acceptance of preventive and vaccination measures. This cross-sectional survey was conducted in Nigeria, and South Africa, from September 2023 to December 2023. It included 1000 participants via convenience sampling. Participants completed the validated survey online or in person. Data was analyzed using t-test, analysis of variance, regression analysis, Pearson Chi-square test, and Fisher's exact test. Most participants (96%) identified COVID-19 as a virus and were aware of its transmission modes. About 60% reported using facemasks and hand hygiene as preventative measures. Education, employment status, and living arrangements significantly influenced knowledge of COVID-19. Despite 88% of participants being aware of vaccines, 21% had received the first vaccine dose, and 81.7% had negative attitudes towards vaccinations. False information was the leading hindrance, especially in younger and less-educated individuals, who believed that the vaccine caused death (26%) or caused COVID-19 itself (17%). Therefore, future interventions should address misconceptions about vaccines and widen access to preventative measures. Further research should examine behavioral interventions to improve compliance with infection control measures.

Keywords: Africa; behavior; COVID-19; infection prevention; medical sociology; vaccine

Introduction

COVID-19 is an infectious disease caused by the SARS-CoV-2 virus. Most infected people experience mild to moderate respiratory illness and recover without special treatment. However, some people become seriously ill or die [1]. COVID-19 was declared a pandemic by the World Health Organization (WHO) in March 2020 [2,3]. COVID-19 has overwhelmed the health systems of many countries, caused significant deaths, and caused enormous economic losses. To date, COVID-19 has infected millions of people and caused millions of deaths worldwide [3]. Efforts have been made to mitigate the devastating effects of this unprecedented global health crisis. The WHO recommends disease control measures such as personal protective equipment, hand hygiene, physical distancing, and vaccination [3–5]. The WHO recommends vaccination to prevent severe disease and reduce the

likelihood of new variants emerging [5,6]. However, compliance with vaccination recommendations poses significant challenges in controlling the spread of the disease.

COVID-19 vaccine acceptance rates differ globally, with the highest rates in Ecuador (97%), Malaysia (94%), and Indonesia (93%), and the lowest in Lebanon (21%) [6]. COVID-19 vaccine hesitancy is widespread and influenced by various factors such as perceived infection risk, vaccine safety, vaccine efficacy, doctors' recommendations, and inoculation history [7]. Predictors of COVID-19 vaccine hesitancy include lower perceived risk of infection, institutional mistrust, lack of influenza vaccination, lower perceived severity of COVID-19, beliefs that vaccination will cause side effects, or beliefs that vaccines are unsafe [8].

African studies have demonstrated variability in knowledge and attitudes towards COVID-19 transmission and control. Additionally, studies have shown gaps between knowledge and practice of preventive guidelines and vaccine acceptance [9,10]. Studies in sub-Saharan African countries showed vaccine hesitancy was significantly associated with participant's gender, educational level, occupational status, attitude towards COVID-19 preventive measures, and primary information source being social media [11,12].

COVID-19 remains a global health emergency, causing thousands of illnesses and deaths [13]. The current study aims to analyze public knowledge and beliefs about COVID-19 disease, compliance with control measures, and vaccination in Africa. A pilot study was completed in 2021 to validate the questionnaire for collecting data in the final survey conducted in 2023. The study's objective is to analyze the public's knowledge of COVID-19 disease, factors influencing the practice of preventive measures, and vaccine acceptance towards making recommendations for better policies. The study is part of regional efforts to improve public health in the countries where the studies were conducted.

Materials and Methods

Study Design

This is a cross-sectional survey of the general population in the selected African cities of Port Harcourt, Nigeria, and Port Elizabeth, South Africa. It included people from all walks of life, ages, literacy levels, and professions. Participants were selected by convenience sampling. Those who refused to participate were excluded from the study. The South African Eastern Cape Department of Health approved the survey. One thousand participants were recruited via convenience sampling.

Data Collection

The study was conducted from September to December 2023. The study was questionnaire-based. The questionnaire was validated in a pilot study in 2021. Adjustments were made based on the preliminary data to ascertain that the responses reflected the questions asked and that the questions reflected the study's objectives. The validated questionnaire was administered partly online and partly in person in 2023. Data collectors administered the questionnaire in person to people in public places. The online questionnaire was disseminated via the research collaborators' social media accounts, including WhatsApp Messenger, Facebook, and LinkedIn.

Questions included sociodemographic data, knowledge of COVID-19 transmission, control, and remedies. Questions were designed in a multiple-choice format where participants were instructed to choose one or more options. For questions with only one answer choice, the correct answer was allotted one point. Each correct answer is given one point for questions with possible multiple correct answers. No point was given for incorrect responses. The total score was 22 points. A score of less than 11 (50%) was graded as poor, and a score greater than 50% was graded as good.

Knowledge about the COVID-19 vaccine was assessed, including vaccine type, preference, vaccination status, safety, efficacy, benefits, adverse effects, and vaccine ingredients. Questions on vaccine safety, effects, ingredients, and adequacy of vaccine testing were formulated in a Yes, No, and Not Sure format, instructing participants to choose only one option. Questions were graded and given 1 point for each correct answer. A total score of < 50% was graded as poor, and a total score of >50% was graded as good.

Data Analysis

Data was analyzed using IBM® SPSS® Statistics 28 (IBM Corp, Armonk, NY) through Student's t-test, analysis of variance, regression analysis, Pearson Chi-square test, and Fisher's exact test. Continuous variables such as age, knowledge score, and attitude score were converted into appropriate categories and analyzed using proper methods. Multivariate analysis was conducted using logistic regression for knowledge about COVID-19 and attitudes toward vaccines to determine predictors. A P-value <0.05 was considered significant. Quantitative and qualitative data are presented in tables, including numbers, categories, and percentages. The data were compared, analyzed, and interpreted appropriately.

Ethical Consideration

The study aims were explained to the participants. No coercion was used in the recruitment process. Participants were informed about the rationale and purpose of the research and signed an informed consent form before participating in the study.

Results

Table 1 provides an overview of the demographics of the study population. The largest age group in the study (68%) was early adult (20-49 years). Females make up the majority of the study population (57%). Most of the study population have completed either secondary education (31%) or a college/university degree (50%). People living with their spouse or small family comprise 47% of the population, while 30% live alone. More than half of the population (52%) are unemployed; the remainder are employed full-time or part-time. Students comprise 31% of the population, and office work is the second most common occupation, constituting 19%.

Table 1. Characteristics of the study population.

Variables	Number	%
Age Group		
13-19, Youth	175	18
20-49, Early adult	678	68
50-64, Middle-aged adult	110	11
65-99, Older adult	37	3.7
Gender		
Female	568	57
Male	432	43
Education Status		
Primary school	92	9.2
Secondary school	312	31
College/University	505	50
Vocational/Technical	91	9.1
Living Status		
Congregation	224	22
Single/Alone	304	30
Spouse or Small family	472	47
Job Status		
Full-time work	316	32
Part-time work	168	17
Unemployed because or since COVID	180	18
Unemployed before COVID	336	34
Job Type		
Business owner or executive	106	11

Essential worker, not healthcare	78	7.8
Healthcare worker	116	12
Labour worker	121	12
Market or store worker	83	8.3

In Table 2, an overview of the knowledge of the study population regarding COVID-19 is provided. Most of the population (96%) correctly identified that a virus causes it, and 94% recognized cough as the primary transmission mode. Of those who suggested a treatment, 42% mentioned vaccination, while 35% stated no cure. Most people believed COVID-19 could affect any country (86%) and anyone (87%). The most commonly listed preventive measures were facemask use (72%) and practicing good hand hygiene (61%).

Table 2. Knowledge of the population about COVID-19 disease transmission and control.

Characteristics	Number	%
Cause of COVID-19		
Bacteria	39	3.9
Virus	961	96
Route of transmission		
Insects	32	3.2
Cough, sneeze	939	94
Household items	273	27
Close physical contact	499	50
Curse, bad luck	12	1.2
Treatment cure		
Herbalist or spiritual cure	42	4.2
Antibiotic	117	12
Vaccine cure	418	42
Home remedy or mixture	108	11
Dexamethasone	36	3.6
No Cure	352	35
COVID is a problem		
Covid is a problem	811	81
Covid is not a problem	119	19
Population affected		
Affect poor people	98	9.8
Affect rich people	89	8.9
Affect rural people	72	7.2
Affect city people	61	6.1
Affect anyone	869	87
Preventive measures		
Facemask	716	72
Hand hygiene	614	61
Physical distance	565	56
Vaccine	531	53
Medicine or Herb	68	6.8
No prevention	60	6.0
Responsibility for control		
Government control	678	68
Private sector	319	32

Religious group	325	32
WHO control	518	52
Other charities or donors	191	19

Table 3 presents the knowledge of the study population concerning COVID-19 vaccines. According to the data, AstraZeneca is the most recognized vaccine with a recognition rate of 75%, while Pfizer ranks second with a recognition rate of 20%. Approximately 12% of the study population is not aware of any vaccine. Additionally, 21% of respondents have received the first dose of the COVID-19 vaccine, while only 4.4% have received the second dose. According to the study, 45% of people who are aware of the available vaccines prefer AstraZeneca, with 96% citing efficacy as the primary reason. Most of the population (56%) believe the vaccine is safe, while 41% believe it has minor side effects. Additionally, 63% of respondents reported that older adults would benefit from the vaccine, and 59% thought it is suitable for hospital workers.

Table 3. Knowledge of the COVID-19 vaccine types.

Characteristics	Number	%
Awareness about the type of vaccines		
AstraZeneca	748	75
Pfizer-Biontech	200	20
Sinovac	107	11
Covishield	112	11
Sputnik-Gamaleya	143	14
Moderna	90	9.0
Sinopharm	46	4.6
Janssen-Johnson	250	25
No vaccine awareness	124	12
Vaccine doses received		
Vaccine 1st dose received	213	21
Vaccine 2nd dose received	44	4.4
Vaccine preferred		
AstraZeneca	450	45
Covishield	89	8.9
Janssen-Johnson	275	28
Moderna	115	12
Pfizer-Biontech	71	7.1
Reasons of preference		
Safety	404	40
Efficacy	956	96
Recommended by doctor	107	11
Readily available	195	19.5
No choice	226	23
Recommend by government or employer	241	24
Characteristics of vaccines		
Vaccine safe	557	56
Vaccine secret ingredient	148	15
Vaccine tested well	397	40
Vaccine cause Covid	166	17
Vaccine minor effect	408	41
Vaccine death	262	26
Vaccines beneficial for the population		
Vaccines good for old people	631	63

Good for young people	358	36
Good for healthcare worker	592	59
Good for chronic disease	440	44
Good for international travelers	425	42
Good for rich	266	27

Table 4 summarizes the association between the level of knowledge about COVID-19 and sociodemographic parameters. The study reveals a significant association between knowledge about COVID-19 and participants' education level, living status, job status, and job type. The majority of participants with secondary and college/university education demonstrated good knowledge, while the majority of participants with vocational/technical education were reported to have poor knowledge. About 63% of individuals living with a spouse or a small family had good knowledge. Full-time employment was associated with a higher level of knowledge about COVID-19. Among the participants, most business owners/executives, essential workers not in healthcare, and labor workers had good knowledge. In contrast, 61% of healthcare workers were found to have poor knowledge about the cause and disease control variables of COVID-19.

Table 4. Association between sociodemographic factors and knowledge level COVID-19 disease.

Characteristics	Poor knowledge		Good knowledge		p-value
	Number N = 430	%	Number N = 570	%	
Age group			0.3		
13-19, Youth	78	45	97	55	
20-49, Early adult	297	44	381	56	
50-64, Middle-aged	38	35	72	65	
65-99, Older adult	17	46	20	54	
Gender					0.7
Female	247	43	321	57	
Male	183	42	249	58	
Education Status					0.001
Primary school	41	45	51	55	
Secondary school	126	40	186	60	
College/University	206	41	299	59	
Vocational/Technical	57	63	34	37	
Living Status					0.001
Congregation	112	50	112	50	
Single/alone	143	47	161	53	
Spouse/small family	175	37	297	63	
Job Status					0.002
Full-time work	114	36	202	64	
Part-time work	69	41	99	59	
Unemployed because or since COVID	76	42	104	58	
Unemployed before COVID	171	51	165	49	
Job Type					<0.001
Business owner or executive	32	30	74	70	
Essential worker, not healthcare	28	36	50	64	
Healthcare worker	71	61	45	39	
Labour work	47	39	74	61	
Market or store worker	35	42.2	48	57.8	
Office worker	78	42	108	58	
Student	139	45	171	55	

Table 5 depicts the logistic regression analysis of factors associated with poor knowledge of COVID-19. Among the list of sociodemographic parameters, vocational/technical education, unemployment, and being a healthcare worker were significantly associated with inadequate knowledge.

Table 5. Logistic regression of factors associated with poor knowledge about COVID-19 disease.

Characteristic	OR[1]	95% CI[1]	p-value
Education Status			
Primary	—	—	
Secondary	0.80	0.49 - 1.32	0.4
College/University	0.65	0.39 - 1.08	0.093
Vocational/Technical	2.20	1.16 - 4.23	0.017
Living Status			
Congregation	—	—	
Single/alone	1.22	0.84 - 1.77	0.3
Spouse/small family	0.83	0.58 - 1.18	0.3
Job Status			
Full-time work	—	—	
Part-time work	1.57	0.99 - 2.49	0.057
Unemployed because or since COVID	2.03	1.30 - 3.19	0.002
Unemployed before COVID	3.37	2.17 - 5.29	<0.001
Job Type			
Business owner or Executive	—	—	
Essential worker, not healthcare	1.22	0.61 - 2.43	0.6
Healthcare worker	6.08	3.20 - 11.8	<0.001
Labour work	1.02	0.57 - 1.85	>0.9
Market or store worker	1.36	0.68 - 2.71	0.4
Office worker	1.56	0.91 - 2.71	0.11
Student	0.98	0.57 - 1.70	>0.9

[1] OR = Odds Ratio, CI = Confidence Interval.

Table 6 shows the association between sociodemographic characteristics and attitudes toward the COVID-19 vaccine. The study showed a significant association between attitudes toward the COVID-19 vaccine and participants' age, education level, living situation, and employment status. Gender and job type were not found to have a significant association. At least 90% of participants aged 13-19 years, participants with vocational/technical education, and those who live in a congregation were found to have poor attitudes towards the vaccine.

Table 6. Association between sociodemographic factors and attitude toward COVID-19 vaccine.

Characteristic	Poor Attitude		Good attitude		p-value
	N = 817	%	N = 183	%	
Age Group					<0.001
13-19, Youth	164	94	11	6.3	
20-49, Early adult	546	81	132	19	
50-64, Middle-aged	82	75	28	25	
65-99, Older adult	25	68	12	32	
Gender					0.3
Female	471	83	97	17	
Male	346	80	86	20	
Education Status					<0.001

Primary	83	100	9	9.9	
Secondary	259	83	53	17	
College/University	391	77	114	23	
Vocational/Technical	84	92	7	7.7	
Living Status					<0.001
Congregation	214	96	10	4.5	
Single/alone	253	83	51	17	
Spouse/small family	350	74	122	26	
Job Status					<0.001
Full-time work	224	71	92	29	
Part-time work	143	85	25	15	
Unemployed because or since COVID	159	88	21	12	
Unemployed before COVID	291	87	45	13	
Job Type					0.1
Business owner or executive	85	80	21	20	
Essential worker, not healthcare	69	88	9	12	
Healthcare worker	91	78	25	22	
Labour work	99	82	22	18	
Market or store worker	63	75.9	20	24	
Office worker	142	76	44	24	
Student	268	86	42	14	

Table 7 depicts the logistic regression analysis, including factors associated with attitude level. It presents adjusted OR and p-values for each modality of categorical variables. Unemployment since COVID and before COVID is significantly related to poor attitude (OR=2.89 and OR=2.04, respectively); meaning it is a risk factor for poor attitude. Age above 20 years was protective against poor attitude (OR < 1, p < 0.05). Additionally, living alone or in a small family was protective against poor attitude. Modalities without OR and p-values are reference modalities considered in the analysis.

Table 7. Logistic regression of factors associated with poor attitude toward COVID-19 disease.

Characteristic	OR[1]	95% CI[1]	p-value
Age Group			
13-19, Youth	—	—	
20-49, Early adult	0.26	0.12, 0.56	<0.001
50-64, Middle-aged	0.22	0.08, 0.56	0.002
65-99, Older adult	0.12	0.04, 0.37	<0.001
Education Status			
Primary school	12,303	0.00, NA	>0.9
Secondary school	0.56	0.23, 1.23	0.2
College/University	0.48	0.20, 1.06	0.083
Vocational/Technical	1.23	0.40, 3.94	0.7
Living Status			
Congregation	—	—	
Single/alone	0.36	0.17, 0.72	0.006
Spouse/small family	0.17	0.08, 0.33	<0.001
Job Status			
Full-time work	—	—	
Part-time work	1.68	0.96, 3.00	0.075
Unemployed because or since COVID	2.89	1.61, 5.33	<0.001
Unemployed before COVID	2.04	1.18, 3.55	0.011

Job Type			
Business owner or executive	—	—	
Essential worker, not healthcare	2.02	0.81, 5.37	0.14
Healthcare worker	0.92	0.41, 2.07	0.8
Labour worker	0.70	0.33, 1.48	0.4
Market or store worker	0.56	0.24, 1.30	0.2
Office worker	0.68	0.35, 1.31	0.3
Student	0.47	0.22, 0.99	0.049

[1] OR = Odds Ratio, CI = Confidence Interval.

Discussion

Based on our study, many participants showed a good understanding of the COVID-19 disease. A high percentage (96%) correctly identified the causative organism as a virus, and most also recognized physical contact and respiratory droplets as the primary modes of transmission. A significant portion of the population (42%) identified vaccines as the most effective form of management. The well-informed nature of our study population may be attributed to the online data collection which skewed towards individuals with more digital literacy and perhaps more aware of public health issues. The practical information campaigns conducted by the relevant authorities may also be a contributing factor. This finding aligns with studies conducted in other African countries, which also demonstrated a high level of COVID-19 knowledge among respondents [10,12].

Over 60% of the participants mentioned wearing a mask and practicing hand hygiene as preventive measures, while approximately 56% listed maintaining physical distance. Similar studies in other African countries also showed that awareness of preventive measures is high but compliance with these measures remains below optimal levels. Reasons for poor compliance include negative attitudes, lack of personal protective equipment, and limited access to potable water [10,14]. Many respondents expressed that COVID-19 is a significant public health issue in their country and can potentially affect anyone. Approximately 68% of the participants stated that their governments must improve COVID-19 control and management.

The current study revealed a strong link between COVID-19 knowledge and participants' education level, living arrangement, employment status, and job type. Specifically, vocational/technical education, unemployment, and being a healthcare worker were significantly associated with poor knowledge. People with secondary and college education generally displayed good knowledge about COVID-19, while those with vocational and technical education showed poor knowledge. Some studies in Tanzania, Ethiopia, and Uganda also found that higher education is associated with a better understanding of COVID-19 [11,15]. Additionally, a study in Nigeria found tertiary education is associated with a positive attitude [16].

The current study showed that most people living with a spouse or in a small family had good knowledge about COVID-19, a finding also supported by studies in Nigeria and Ethiopia where marital status was linked to good knowledge [16,17]. Our study also revealed that participants' job status and type were associated with their COVID-19 knowledge. Full-time employment was linked to higher levels of expertise, and 70% of business owners or executives exhibited good knowledge. In contrast, most healthcare workers (61%) were found to have poor knowledge. This is a unique and unexpected finding that contradicts studies conducted among healthcare workers in different African countries [11,15]. The discrepancy could be due to the undefined job description and education level of the healthcare workers in the study in contrast to participants in the comparative analyses.

Most of our study participants (88%) know about the COVID-19 vaccine. AstraZeneca is the most recognized and preferred vaccine among the participants. The increased availability of the AstraZeneca vaccine in Africa compared to other brands may be the reason. Most patients with a vaccine preference (96%) cited efficacy as the primary reason for their choice. Most participants believed the vaccine was suitable for older adults and healthcare workers. Approximately 56% of participants thought the vaccine was safe, and 40% felt it was tested well. Despite this finding, only 21% and 4.4% of the participants received the first and second doses of the COVID-19 vaccine,

respectively. These findings show a discrepancy between participants' knowledge about the vaccine and their decision to get vaccinated. This may be due to negative attitudes towards the vaccine or lack of vaccine availability.

Our study also showed that a majority (81.7%) of study participants, regardless of other socioeconomic characteristics, were found to have poor attitudes toward the vaccine. This finding demonstrates that participants' attitudes might significantly influence their decision to take the vaccine. Approximately 26% of participants reported that they believe that vaccines cause death, and 17% believed that vaccines cause COVID-19, which might have contributed to the negative attitude towards vaccines. This finding implies that there are more factors, in addition to concerns about vaccine safety and efficacy, that influenced participants' attitudes about the COVID-19 vaccine, since the majority of the study participants believed it was safe and 99.8% had a vaccine preference, citing efficacy as their reason for choice. This finding contrasts with other studies on vaccine acceptance in different African countries, which showed a lack of information about the vaccine and uncertainty about the efficacy and safety of the vaccine as the main reasons for vaccine hesitancy [17,19].

The current research revealed a strong association between people's attitudes toward the COVID-19 vaccine and their age, level of education, living situation, and employment status. A significant majority (96%) of individuals aged 13-19 years expressed negative attitudes toward the vaccine. Similar negative attitudes were observed among young participants in other studies examining COVID-19 vaccine perspectives and uptake [20,21].

A study conducted in Zambia stated that participants received information about the vaccine from social media [22]. Young participants believed they were not at risk of COVID-19, with misinformation from social media being identified as a possible factor [22]. Another study in Mozambique focusing on vaccine acceptance noted a strong correlation between institutional trust and vaccine acceptance [12]. The negative impact of social media on young people's attitude towards the vaccine and its adverse effects on recommendations put out by the government might play a significant role in vaccine acceptance among this age group.

The current study showed that people with primary, vocational, or technical education also reported negative attitudes towards the vaccine. This aligns with other studies that showed individuals with secondary education or higher were more likely to accept the COVID-19 vaccine [23]. Furthermore, 96% of participants living in congregational settings demonstrated negative attitudes toward the vaccine. At the same time, at least 85% of individuals working part-time or unemployed were reported to have poor attitudes. Before and after COVID-19, unemployment was significantly associated with increased negative attitudes, as seen in a study on COVID-19 vaccine acceptance among sub-Saharan Africans, which indicated that unemployment was linked to a higher risk of vaccine resistance [24]. This might result from institutional grievances and mistrust affecting participants' attitudes towards vaccine recommendations put out by their government.

Limitation

This study explored various sociodemographic factors, permitting a detailed analysis of knowledge and attitudes amongst a large and varied sample of ages, educational backgrounds, and occupational statuses. Online and in-person data collection maximized the inclusivity of the sample, enabling the gathering of diverse perspectives within the selected countries. However, convenience sampling may limit the representativeness of the data, with online data collection increasing the possibility of response bias, where individuals with greater digital competence are overrepresented, skewing results towards those who are more informed about public health campaigns.

Conclusions

Most of the population had a good understanding of COVID-19, with education, occupation, and living arrangements greatly influencing knowledge. Despite awareness of preventative measures, compliance was low due to negative attitudes and limited availability of preventative resources such as facemasks. Most of the population deemed the vaccine safe. However, a minority

had concerns regarding the vaccine, including misunderstandings that the vaccine could cause COVID-19 itself.

Efforts should be made to correct misconceptions by providing accessible information about vaccine safety, particularly in communities with poor knowledge. The media and health authorities in the respective countries should work to address the institutional mistrust of health care systems which negatively affects peoples' attitude towards public health measures recommended by the authorities. Another focus should be widening access to preventative resources. Further research should explore behavioral interventions that can increase compliance with these resources and explore other socioeconomic factors, such as job security, to create targeted policies.

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