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Assessment of the public knowledge, attitudes, and perceptions of Nigerians regarding preparedness for future pandemics

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Abstract

Introduction Pandemics are global health crises that have caused millions of deaths, enormous socio-economic disruptions, and considerable public and global health security consequences. This study assessed Nigerians' knowledge, attitudes, and perceptions regarding preparedness for the next pandemics.

Methods A cross-sectional questionnaire-based national survey was conducted among 1276 respondents in Nigeria to determine public knowledge, attitudes, and perceptions of preparedness for future pandemics. Descriptive and inferential statistics were used for analyses.

Results Of the 1276 respondents to this survey, > 50% had not heard of the Spanish flu and Zika disease. Approximately half (594) of the respondents did not consider antimicrobial resistance a possible cause of future pandemics. Over an average proportion of respondents reported unsatisfactory knowledge (655, 51.3%) and poor perceptions (695, 54.5%) about pandemic preparedness. The respondents' good knowledge and satisfactory attitudes toward pandemic preparedness decreased with age. The respondents' education, age, and state of residence were significantly associated with good knowledge, satisfactory attitudes, and positive perceptions of pandemic preparedness with respondents with tertiary education levels being at least two times more likely to have these positive outcomes.

Conclusion This study revealed serious gaps in Nigerians' knowledge, attitudes, and perceptions of their readiness for upcoming pandemics. To protect Nigerians' health, emphasis should be placed on these issues by all stakeholders, including the government.

Keywords Pandemic · Preparedness · Public perception · Knowledge · Infectious diseases · Nigeria

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1 Introduction

Pandemics are rapidly spreading infectious diseases that affect large numbers of people across countries or continents. The recent (re)emergence of infectious diseases, exemplified by outbreaks such as Ebola, Zika, Monkeypox, and COVID-19, highlights the urgent need for a whole-of-society effective pandemic preparedness and response strategies [1–4]. The disease burdens and consequences of pandemics are huge. For instance, in the ongoing COVID-19 pandemic, excess mortality has been estimated as 18·2 million (95% uncertainty interval 17·1–19·6) deaths worldwide between Jan 1, 2020, and Dec 31, 2021 [5], and the Spanish Flu of 1918, reportedly infected 500 million people and caused about 50 million deaths globally [6]. The overuse and misuse of antimicrobial drugs, and antimicrobial resistance (AMR) pose a global but inadvertent health crisis akin to a pandemic and are projected to cause economic losses of approximately $100 trillion, and about 10 million annual deaths by 2050 [7]. Nigeria raised at least $560.52 million for COVID-19 response and health financing [8]. Typically, pandemic occurrences are associated with widespread poverty, especially in low-and-middle-income countries (LMICs) like Nigeria [8–10].

To develop a comprehensive pandemic preparedness plan, public involvement is paramount. This fosters rapid reporting, and community resilience, enhances adherence to preventive measures, and facilitates multichannel information exchange, which ultimately impacts the mitigation of the spread of infectious diseases [11, 12]. Risk communication and community engagement (RCCE) are germane in infectious disease control, as well as public knowledge, attitudes, and perceptions (KAP), which significantly influence behavioural change and public health crises such as pandemics [13, 14]. KAP offers valuable insights into communities' readiness to adopt preventive measures and compliance with health directives, impacting decisions on vaccination, hygiene, and social distancing that can be used in controlling pandemics [15–19]. Attitudes and perceptions also shape individuals' willingness to accept public health interventions such as quarantine or contact tracing [20–22]. Addressing these factors will enable authorities to tailor communication strategies effectively, fostering greater public cooperation and resilience in pandemic responses.

Understanding the Nigerian public perspectives on pandemic preparedness, specifically at the individual level, is crucial for developing targeted and culturally sensitive interventions [23, 24]. Such understanding must be engendered before outbreaks occur for coordination and effective response. Nigeria's diverse cultural landscape requires nuanced communication and community engagement strategies to ensure widespread acceptance and compliance with preventive measures [25]. Identifying knowledge gaps, attitudes, and perceptions among Nigerians, can allow authorities to tailor interventions to address specific concerns, build trust, and optimize resource allocation as evidenced earlier [25]. This approach is essential for promoting community resilience and effectively mitigating the impact of the future occurrence of infectious diseases in a country.

Previous studies on pandemic preparedness in Nigeria have, for the most part, concentrated on the country's authorities' responses to specific interventions against infectious diseases such as the COVID-19 pandemic [26–29] rather than on the preparedness of the Nigerian public at the individual level. Addressing this gap is critical for evaluating Nigeria's readiness for pandemics, pinpointing areas needing enhancement and minimizing the severity of future epidemics. Therefore, this study assessed the public (Nigerians) KAP regarding preparedness for future pandemics.

2 Methods

2.1 Study area and study design

The study area for this research is Nigeria, a country located in West Africa. Nigeria is the most populous country in Africa with a population of 229,152,217 as of July 1, 2024, according to the United Nations estimates [30], comprising diverse population groups representing different socio-economic backgrounds, educational levels, and geographical regions. Nigeria has six geo-political zones with 36 states and the Federal Capital Territory. In this study, we randomly selected individuals from six different states: Abia, Borno, Enugu, Kwara, Ogun, and Sokoto (Fig. 1), which represent five of Nigeria's six geo-political zones.

This study employed a cross-sectional design. The data were collected using a structured questionnaire through a face-to-face interview survey and online via a Google form from April to September 2023. Both methods were used to capture an adequate number of respondents. Some respondents opted for an online completion of the questionnaire because
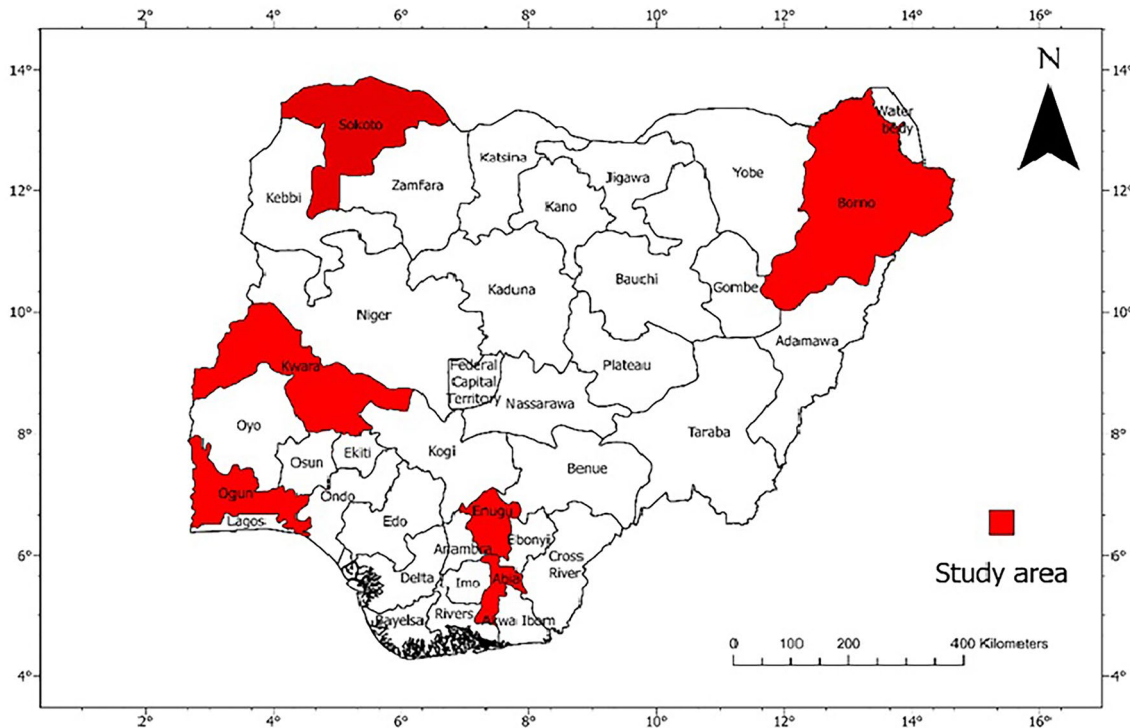
Fig. 1 Map of Nigeria showing the study area

it was considered easier. The study population included adults aged 18 years and older living in different communities across Nigeria. Individuals who could not communicate effectively or who were critically ill were excluded.

2.2 Sample size and sampling technique

The sample size was calculated using the Open-Source Epidemiologic Statistics for Public Health (OpenEpi), v.3.01 (updated June 4, 2013) tool based on the assumption of a confidence level of 95%, an expected proportion of 50% of the population having satisfactory knowledge of pandemic preparedness, and a precision of 3%. The sample size was calculated to be 1066. A 15% contingency was added to the calculated sample size to account for potential non-responses. At least 1226 participants were recruited for the study. To determine the sample size allocated to each state, the calculated sample size was divided by six to obtain a minimum of 204 samples. This ensured that at least 204 participants were recruited into the study within the study duration from each state.

First, six states were purposefully selected to recruit respondents from Nigeria's five geo-political zones to facilitate data collection: Abia, Borno, Enugu, Kwara, Ogun, and Sokoto. From each state, two local government areas (LGAs) were selected using a simple random sampling technique. Households from the following local governments were randomly selected across the selected states: Ilorin South, Moro, Odeda, Nsukka, Wammakko, Maiduguri, Biu, Udi Agwu, Yewa South, Kware, Umuahia South, and Umuahia North. However, for most LGAs sampled, we could not select households based on street names and house numbers because of deficient house numbering and poor planning or haphazard construction of buildings across the selected LGAs. Only one person was sampled from each household. In households with multiple qualified respondents, the most willing individual was sampled.

2.3 Questionnaire design

The questionnaire (Supplementary file 1) comprised four sections: socio-demographic characteristics, respondents' knowledge, attitudes, and perceptions of preparedness for future pandemics. The questionnaire was designed as closed-ended questions to prevent disparities in the responses received, to improve accuracy and to reduce the complexity of the data analysis. The first section on the demographic information of the respondents included variables such as gender, level of education, age range, and location (local government area). The second section focused on knowledge of

pandemics and included a total of 25 questions (sub-questions included). The questions on the attitudes of respondents toward future pandemic preparedness were included in the third section. The last section consisted of 12 questions on a 5-point Likert scale about respondents' perceptions of future pandemics in Nigeria. The questions included in the questionnaire were developed after reviewing relevant literature [31–38].

2.4 Questionnaire pre-test and administration

Two independent academic reviewers, who are experts in zoonoses and public health, validated the instrument after assessing its content and face validity, as well as its ease of administration [25]. We tested the questionnaire's reliability using Cronbach's alpha model and obtained a value of 0.734, indicating that the survey tool is reliable. The questionnaire was pre-tested among 20 individuals from Ilorin South LGA, Kwara State. The pre-test responses obtained were used to improve the quality of the questionnaire. Trained data enumerators (n = 12) translated the survey instrument into the local dialect, where needed, and surveyed the households across six selected states.

2.5 Ethical considerations

The study protocol was reviewed and approved (FVER/UG/2023-16/32TA029) by the Faculty of Veterinary Medicine Ethical Review Committee, University of Ilorin, Nigeria. The survey participants provided written informed consent before completing the questionnaire. The research objectives were explained to participants before they completed the survey tool. This study was carried out in compliance with the Helsinki Declaration.

2.6 Data management and analysis

The data were filtered and entered into a database using Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA, USA) and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0 (IBM Corporation, Armonk, NY, USA). Descriptive statistics such as frequencies, percentages, and means were used to summarize the data. We utilized a numeric scoring system [39] to evaluate the knowledge, attitudes, and perceptions of pandemic preparedness among participants, considering them as outcome variables. The outcome variables were calculated as previously described [40, 41]. A score of "1," was given for correct responses to both the knowledge and attitude questions, while a score of "0," was assigned for incorrect responses. The 5-point Likert scale responses for perception were rated on a scale from "4" for "strongly agree" to "0" for "strongly disagree." The total correct score for each outcome variable was determined as the cumulative score obtained from the questions answered correctly by the respondents. Respondents scoring greater or lower than the mean scores of all respondents for each outcome variable were considered good/satisfactory or poor/unsatisfactory, respectively [14, 41]. Significant demographic variables were analyzed as independent factors associated with good knowledge or satisfactory attitudes toward or perceptions of pandemic preparedness using a stepwise backward binary logistic regression model. The goodness of fit of the model was assessed using the Hosmer–Lemeshow test. All the statistical analyses were performed at a 95% confidence level, with $p < 0.05$ considered to indicate statistical significant.

3 Results

3.1 Demographic information for the study participants

A total of 1276 respondents, from various households in six states across the five sampled geo-political zones of Nigeria, completed the questionnaire. There were more male respondents (700, 54.9%) than female respondents (576, 45.1%) (Table 1). The majority of the respondents (695, 54.5%) had a tertiary level of education. The respondents were of a diverse age group, with the distribution of the participants being almost even across the surveyed states.

3.2 Knowledge of the respondents on pandemics and pandemic preparedness

Overall, slightly less than an average 621 (48.7%) of the respondents reported good knowledge of pandemics and pandemic preparedness. Although a substantial number, (1236, 96.5%), of the respondents were aware of what a pandemic was, the fraction of those acknowledging the Spanish flu (596/1276) and Zika viral disease (541/1276) as

Table 1 Demographic structure of the respondents (n = 1276)

Characteristic	Variables	Frequency (n)	Percentage (%)
Gender	Male	700	54.9
	Female	576	45.1
Level of education	None	225	17.6
	Primary	124	9.7
	Secondary	232	18.2
	Tertiary	695	54.5
Age (years)	18–30	499	39.1
	31–40	332	26.0
	41–50	314	24.6
	51–60	131	10.3
State of residence	Abia	221	17.3
	Borno	204	16.0
	Enugu	210	16.5
	Kwara	228	17.9
	Ogun	211	16.5
	Sokoto	202	15.8

causes of previous epidemics and pandemics and a possible future pandemic was low (Table 2). Notably, only 53.4% and 57.34% of the respondents were aware of AMR and highly pathogenic avian influenza as possible causes of future pandemics, respectively. Most participants demonstrated high awareness of preparedness strategies against future pandemics, such as social distancing (92.2%), personal hygiene practices (91.0%), controlled international travel and trade (82.8%), lockdown policies (80.6%), and vaccinations (86.7%). Only 533 (41.8%) of the respondents were aware of the Presidential Task Force put in place in Nigeria during the control of the last major pandemic.

3.3 Attitudes of respondents toward pandemics and pandemic preparedness

Table 3 presents the attitudes of respondents toward preparedness for future pandemics. While most respondents (63.6%) had a satisfactory attitude toward pandemic preparedness, a significant portion (40.5%: 515 out of 1276) had not engaged in related community initiatives. Moreover, approximately half of the respondents had not taken proactive steps to educate themselves about pandemic preparedness (55.2%: 704 out of 1276). Additionally, a substantial number of people did not trust the government's prioritization of pandemic preparedness and response (52.3%: 667 out of 1276), felt that they lacked sufficient knowledge to make informed decisions (57.2%: 730 out of 1276), and lacked confidence in the health authority's ability to swiftly recover from the economic impact of future pandemics (44.9%: 573 out of 1276).

3.4 Perception of the respondents concerning the control of future pandemics in Nigeria

Overall, fewer than half (581, 45.5%) of the respondents had positive perceptions about controlling future pandemics in Nigeria. In particular, 67.4% (860/1276) of the respondents expressed positive opinions regarding the personal responsibility for taking preventive measures during pandemics and 63.9% (816/1276) of the respondents expressed the personal responsibility for introducing pandemic control policies such as social distancing (Fig. 2). However, only a few of the respondents agreed that Nigeria is adequately prepared to handle future pandemics (25.2%: 321/1276).

3.5 Factors associated with good knowledge, satisfactory attitudes, and positive perceptions of pandemic preparedness among respondents

Age, educational level, and state of residence were significantly associated with good knowledge, satisfactory attitudes, and positive perceptions of pandemic preparedness (Table 4). Respondents with a tertiary education level were twice as likely to have good knowledge (OR: 2.21, 95% CI 1.62–3.01, $p < 0.001$), satisfactory attitudes (OR: 1.88, 95% CI 1.38–2.57, $p < 0.001$), or positive perceptions (OR: 1.54, 95% CI 1.14–2.09, $p = 0.006$) regarding the response to and control of future pandemics. Older respondents were less likely to have good knowledge, satisfactory attitudes, or a positive perception

Discover

Table 2 Knowledge of pandemic preparedness among respondents (n = 1276)

s/n	Question	n (%)
1	A pandemic is a disease outbreak that spreads within Nigeria, throughout Africa, and the rest of the world causing deaths among a high population of people	1236 (96.5)
2	Which of these are some of the pandemics that you have heard of in the past and could cause future pandemics?	
	Spanish flu	596 (46.7)
	HIV/AIDS	819 (64.2)
	Ebola viral disease	1055 (82.7)
	SARS including COVID-19	1083 (84.9)
	Monkeypox	933 (73.1)
	Lassa fever	1004 (78.7)
	Zika	541 (42.4)
	Highly pathogenic Avian influenza	732 (57.4)
	Antimicrobial resistance	682 (53.4)
	Tuberculosis	760 (59.6)
3	Are you aware of the basic preventive measures to reduce the spread of infectious diseases, such as hand hygiene and wearing masks?	1230 (96.4)
4	Which of these are some of the actions to be taken during pandemics?	
	Social distancing	1177 (92.2)
	Personal hygiene	1161 (91.0)
	Risk communication	756 (59.2)
	Controlled international travel and trade	1057 (82.8)
	Lockdown policy	1029 (80.6)
	Use of vaccines and antivirals	1106 (86.7)
5	Are you familiar with the signs and symptoms of common infectious diseases?	1187 (93.0)
6	The following are reliable organizations of information on infectious diseases and pandemics	
	Nigerian Centre for Disease Control and Prevention (NCDC)	1167 (91.5)
	Federal Ministry of Health	1083 (84.9)
	African CDC	801 (62.8)
	World Health Organization (WHO)	1101 (86.3)
	Centers for Disease Control and Prevention (CDC)	946 (74.1)
	Presidential Tasks Force Committee on Pandemic Control	533 (41.8)

Table 3 Attitudes of respondents on concerns regarding preparedness for future pandemics

| Question	n (%)
Are you personally concerned about the possibility of the occurrence of future pandemics?	1073 (84.1)
Have you taken any proactive steps to educate yourself about pandemic preparedness?	704 (55.2)
Do you believe that individuals have a responsibility to contribute to pandemic preparedness efforts?	1016 (79.6)
Have you participated in any community initiatives related to pandemic preparedness?	515 (40.5)
Do you trust that the government will prioritize pandemic preparedness and response?	667 (52.3)
Would you be willing to follow public health guidelines and recommendations during the occurrence of a future pandemic, even if they cause inconvenience?	881 (69.0)
Have you discussed pandemic preparedness with your friends or family members?	755 (59.2)
Do you feel that you have sufficient knowledge to make informed decisions about pandemic preparedness?	730 (57.2)
Are you confident in the ability of Nigeria to recover quickly from the economic impact of a future pandemic?	573 (44.9)
Would you be willing to volunteer your time or resources to support pandemic response efforts?	939 (73.6)
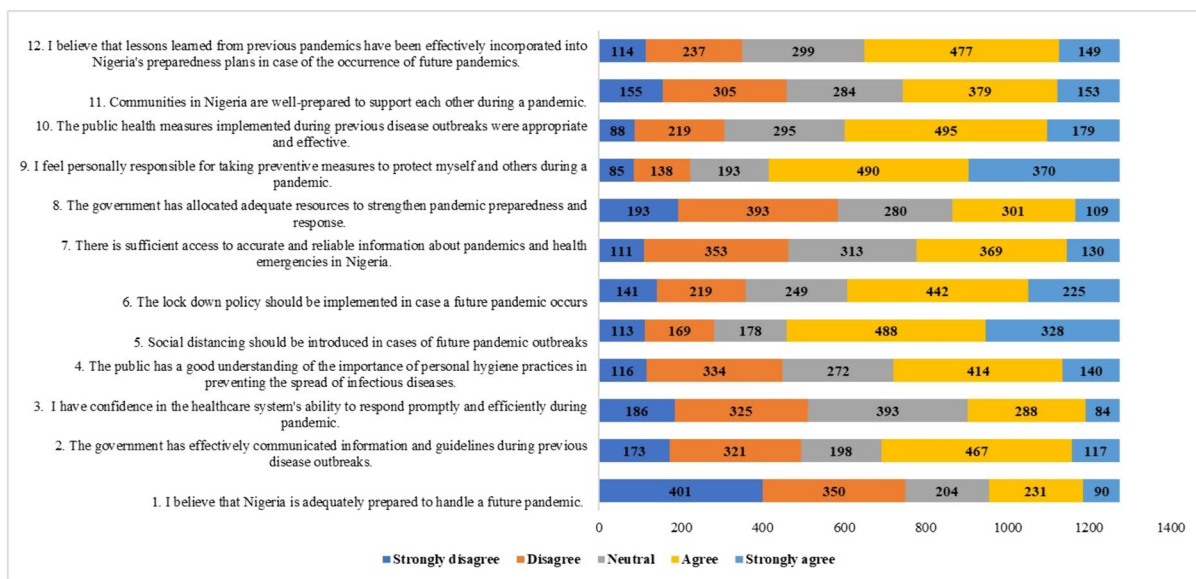
Fig. 2 Perception of respondents on the control of future pandemics in Nigeria

of pandemic preparedness. For instance, respondents within the age range of 51–60 years were three times less likely to report good knowledge (OR: 0.38, 95% CI 0.25, 0.56, p < 0.001) regarding future pandemic preparedness than younger individuals were. Respondents who were residents of Kwara State were more likely to have a positive perception (OR: 1.96, 95% CI 1.35–2.86, p = 0.001) of pandemic preparedness.

4 Discussion

We explored the KAP of Nigerians on pandemics and determined that the current state of pandemic preparedness among the general public requires urgent attention in terms of focused interventions and bolstering public health resilience. Although respondents demonstrated good knowledge of pandemic preparedness, cause-specific awareness about historical and potential causes of future pandemics, such as the Spanish flu, Zika disease, AMR, and highly pathogenic avian influenza, remains relatively low. While 63.6% of the respondents expressed satisfactory attitudes toward pandemic preparedness, a significant portion had not participated in community initiatives, half of them had not educated themselves about pandemic preparedness, and many lacked trust in the government's prioritization, felt insufficiently informed, and lacked confidence in the country's economic recovery from future pandemics. Less than half of the respondents had a positive perception of Nigeria's ability to control future pandemics, although they

Table 4 Binary logistic regression analysis of factors associated with good knowledge, satisfactory attitudes, and positive perception of pandemic preparedness among respondents

Factor	Poor	Good	P-value (χ^2) Knowledge	OR	95% CI	P-value
Gender						
Male	354 (50.6)	346 (49.4)	0.579	–	–	–
Female	301 (52.3)	275 (47.7)		–	–	–
Age						
18–30	209 (41.9)	290 (58.1)	0.000*	REF	–	–
31–40	174 (52.4)	158 (47.6)		0.65	0.49, 0.87	0.004*
41–50	186 (59.2)	128 (40.8)		0.49	0.37, 0.66	<0.001*
51–60	86 (65.6)	45 (34.4)		0.38	0.25, 0.56	<0.001*
Education						
None	141 (62.7)	84 (37.3)	0.000*	REF	–	–
Primary	74 (59.7)	50 (40.3)		1.13	0.72, 1.78	0.663
Secondary	140 (60.3)	92 (39.7)		1.10	0.76, 1.61	0.679
Tertiary	300 (43.2)	395 (56.6)		2.21	1.62, 3.01	<0.001*
State of residence						
Abia	86 (38.9)	135 (61.1)	0.000*	REF	–	–
Borno	114 (55.9)	90 (44.1)		0.50	0.34, 0.74	0.001*
Enugu	151 (71.9)	59 (28.1)		0.25	0.17, 0.37	<0.001*
Kwara	98 (43.0)	130 (57.0)		0.85	0.58, 1.23	0.435
Ogun	79 (37.4)	132 (62.6)		1.06	0.72, 1.57	0.829
Sokoto	127 (62.9)	75 (37.1)		0.38	0.25, 0.56	<0.001*
Attitudes						
Factor	Poor	Satisfactory	P-value (χ^2)	OR	95% CI	P-value
Gender						
Male	240 (34.3)	460 (65.7)	0.050	–	–	–
Female	224 (38.9)	352 (61.1)		–	–	–
Education						
None	94 (41.8)	131 (58.2)	0.000*	REF	–	–
Primary	62 (50.0)	62 (50.0)		0.72	0.46, 1.12	0.172
Secondary	116 (50.0)	116 (50.0)		0.72	0.49, 1.04	0.095
Tertiary	192 (27.6)	503 (72.4)		1.88	1.38, 2.57	<0.001*
Age						
18–30	133 (26.7)	366 (73.3)	0.000*	REF	–	–
31–40	141 (42.5)	191 (57.5)		0.49	0.37, 0.67	<0.001*
41–50	133 (42.4)	181 (57.6)		0.49	0.37, 0.67	<0.001*
51–60	57 (43.5)	74 (56.5)		0.47	0.32, 0.70	0.000*
State of residence						
Abia	68 (30.8)	153 (69.2)	0.000*	REF	–	–
Borno	72 (35.3)	132 (64.7)		0.81	0.54, 1.22	0.374
Enugu	95 (45.2)	115 (54.8)		0.54	0.36, 0.79	0.003*
Kwara	60 (26.3)	168 (73.7)		1.2	0.83, 1.88	0.347
Ogun	96 (45.5)	115 (54.5)		0.53	0.36, 0.79	0.002*
Sokoto	73 (36.1)	129 (63.9)		0.79	0.52, 1.18	0.286
Perceptions						
Factor	Low	High	P-value (χ^2)	OR	95% CI	P-value
Gender						
Male	395 (56.4)	305 (43.6)	0.127	–	–	–

Table 4 (continued)

Perceptions

Factor	Low	High	P-value (χ^2)	OR	95% CI	P-value
Female	300 (52.1)	276 (47.9)		–	–	–
Age						
18–30	221 (44.3)	278 (55.7)	0.000*	REF	–	–
31–40	194 (58.4)	138 (41.6)		0.57	0.43, 0.75	<0.001*
41–50	210 (66.9)	104 (33.1)		0.39	0.29, 0.53	<0.001*
51–60	70 (53.4)	61 (46.6)		0.69	0.47, 1.02	0.077
Education						
None	131 (58.2)	94 (41.8)	0.000*	REF	–	–
Primary	80 (64.5)	44 (35.5)		0.77	0.49, 1.21	0.299
Secondary	154 (66.4)	78 (33.6)		0.71	0.48, 1.03	0.088
Tertiary	330 (47.5)	365 (52.5)		1.54	1.14, 2.09	0.006*
State of residence						
Abia	122 (55.2)	99 (44.8)	0.000*	REF	–	–
Borno	112 (54.9)	92 (45.1)		1.05	0.71, 1.53	0.896
Enugu	154 (73.3)	56 (26.7)		0.45	0.29, 0.67	<0.001*
Kwara	88 (38.6)	140 (61.4)		1.96	1.35, 2.86	0.001*
Ogun	126 (59.7)	85 (40.3)		0.83	0.57, 1.22	0.395
Sokoto	93 (46.0)	109 (54.0)		1.44	0.98, 2.12	0.074

* values significant at $p < 0.05$

x^2 Chi-square test

expressed positive views on personal preventive measures and pandemic control policies, with few believing in Nigeria's preparedness for future pandemics. To the best of our knowledge, this study is the first to survey Nigerians' knowledge gaps, attitudes, and perceptions regarding preparedness for future pandemics.

A noteworthy finding from our study is the prevalence of inadequate knowledge regarding pandemics and preparedness measures among respondents. Despite the high awareness of pandemics in general, particularly in the recognition of recent outbreaks such as COVID-19, the understanding of emerging threats such as AMR remains low. Inadequate knowledge of cause-specific pathogens increases the difficulty of understanding of preventive measures among Nigerians even though awareness and knowledge exist. This deficiency in prospective knowledge underscores the need for targeted educational campaigns aimed at enhancing public awareness and understanding of pandemic dynamics. Although recent studies have indicated that citizens of various countries have good knowledge of recent pandemics such as the COVID-19 pandemic [14, 18, 42], emphasis should be placed on the need for Nigerian citizens to be more enlightened about these recent pandemics to create a sense of adequate preparation for future pandemics. A sufficient understanding of pandemics and general health information serves to dispel misconceptions surrounding pandemic situations, heighten awareness of susceptibility to infection risk, and bolster self-efficacy in self-protection measures [43–45]. In particular, awareness about AMR and highly pathogenic avian influenza pandemics is increasing as they present constant re-emergence threats to the world, including Nigeria.

We observed that most participants exhibited a strong awareness of preparedness strategies for future pandemics, including social distancing, personal hygiene, regulated international travel and trade, lockdown policies, and vaccination. This finding is similar to earlier reports in which citizens demonstrated the required level of awareness and preparedness for pandemics [46]. However, additional efforts should be made to educate Nigerian citizens on national bodies such as the Presidential Task Force entrusted with the duties to curtail pandemics.

Although most of the respondents (63.6%) in our survey displayed satisfactory attitudes toward pandemic preparedness, a significant portion did not engage in related community initiatives. Not participating in community initiatives causes society to leave the responsibility of pandemic control to health authorities alone, but the whole-of-society approach to disease management will better engender One Health disease intelligence better. Community initiatives are crucial for pandemic control, fostering collective responses to curb the spread of infectious diseases as they empower communities to promote public health guidelines, provide essential resources, organize vaccination drives,

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and support vulnerable populations. Strong community infrastructure is a necessary element that has been insufficiently addressed in effective pandemic prevention, preparedness, and response frameworks [47]. Poor community engagement initiatives led to disastrous events during the Ebola virus disease epidemic in West Africa from 2014 to 2016 [48]. However, during the COVID-19 pandemic, mothers' support groups through community empowerment initiatives were crucial for controlling COVID-19 outbreaks, which resulted in positive outcomes in Sri Lanka [49]. Through grassroots efforts, communities can disseminate accurate information, combat misinformation, and encourage adherence to preventive measures such as social distancing and hygiene practices. These initiatives promote solidarity, mutual aid, and resilience, ensuring that no one is left behind.

Moreover, our findings revealed a pervasive sense of skepticism and apprehension among respondents regarding the adequacy of preparedness efforts, with a substantial proportion (667/1276) expressing doubts about the government's commitment to prioritizing pandemic preparedness and response possibly due to poor management of previous public health epidemics. This finding is similar to that of an earlier report from South American countries [50]. This reflects broader concerns about institutional capacity and efficacy. There is a critical link between public trust, effective public health responses, and economic resilience. The lack of confidence in the country's ability to swiftly recover from the economic fallout of future pandemics underscores the interconnectedness of public health and socio-economic resilience. This is further complicated by the lack of confidence in the government's ability to contain disease outbreaks. This situation creates a trust gap, hence self-help and hiding information from the government about early outbreaks will become rampant. Addressing these perceptual challenges demands proactive engagement and advocacy with stakeholders to foster trust, transparency, and accountability in pandemic response strategies [51, 52].

Tertiary education has emerged as a key predictor of better knowledge, attitudes, and perceptions, emphasizing the pivotal role of education in shaping public health literacy and awareness. Similarly, younger respondents exhibit greater levels of knowledge and more positive perceptions than older respondents, suggesting the need for targeted interventions tailored to different demographic segments. Furthermore, variations in perceptions across different states highlight the importance of contextualizing interventions to address regional disparities and sociocultural nuances in Nigeria. Efforts to strengthen pandemic preparedness should prioritize comprehensive education initiatives targeting diverse demographic groups. However, tertiary education may not truly reflect the whole population structure of the country and, hence, may not provide an overall comprehensive outlook of how the whole of society may behave. A similar study in more rural areas may have different outcomes, as general health perceptions may vary by residence [53].

This study is subject to certain limitations, including its cross-sectional design and reliance on self-reported data, which may be subject to recall bias and social desirability effects. However, we ensured that our methodology was well-structured and included a validated instrument ensuring the reliability and depth of understanding Nigerians' knowledge, attitudes, and perceptions regarding pandemic preparedness. One limitation is that our study is based on the experience of controlling previous pandemics such as through social distancing, personal hygiene, regulated international travel and trade, lockdown policies, and vaccination. Care should be taken in generalizing these strategies as preventive measures for future epidemics will likely depend on the route of transmission of the causative agent. The main strength of the research lies in its comprehensive assessment, facilitated by a large and diverse sample of 1276 respondents across Nigeria. Additionally, adherence to ethical guidelines, contextual relevance, and the identification of significant knowledge gaps further enhance the study's robustness and its potential to inform targeted interventions and policy recommendations for enhancing public health resilience in Nigeria. Future research should adopt longitudinal approaches and incorporate qualitative methods to gain deeper insights into the socio-cultural factors shaping public perceptions of pandemic preparedness. Exploring the role of social media and traditional communication channels in influencing public attitudes can offer valuable insights into effective risk communication strategies.

5 Conclusion

Addressing the knowledge gaps and perception challenges identified in this study is imperative for strengthening Nigeria's resilience against future pandemics. By fostering a culture of proactive engagement, informed decision-making, and collaborative action, policymakers and public health practitioners can mitigate the impact of future infectious disease outbreaks and safeguard the well-being of the Nigerian population.

Declarations

Ethics approval and consent to participate The study protocol was reviewed and approved (FVER/UG/2023-16/32TA029) by the Faculty of Veterinary Medicine Ethical Review Committee, University of Ilorin, Nigeria. The survey participants provided written informed consent before completing the questionnaire. The research objectives were explained to participants before they completed the survey tool.

Competing interests The authors declare no competing interests.

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