



Knowledge, Attitudes and Practices Towards COVID-19: An Epidemiological Survey in North-Central Nigeria

Rine Christopher Reuben¹ · Margaret M. A. Danladi² · Dauda Akwai Saleh³ · Patricia Ene Ejembi⁴

Published online: 7 July 2020

© Springer Science+Business Media, LLC, part of Springer Nature 2020

Abstract

The COVID-19 pandemic has become a major public health challenge globally with countries of the world adopting unprecedented infection prevention and control (IPC) measures to urgently curtail the spread of the COVID-19 virus. The knowledge, attitudes and practices (KAP) of the people toward COVID-19 is critical to understanding the epidemiological dynamics of the disease and the effectiveness, compliance and success of IPC measures adopted in a country. This study sought to determine the levels of KAP toward COVID-19 among residents of north-central Nigeria. A cross-sectional online survey with a semi-structured questionnaire using a Snowball sampling technique was conducted during the national lockdown. Data collected were analyzed using descriptive statistics, analysis of variance (ANOVA), Pearson's correlation and regression tests. From a total of 589 responses received, 80.6, 59.6, 90.4 and 56.2% were from respondents between ages 18–39 years, males, had a college (Bachelor) degree or above and reside in urban areas respectively. Respondents had good knowledge (99.5%) of COVID-19, gained mainly through the internet/social media (55.7%) and Television (27.5%). The majority of the respondents (79.5%) had positive attitudes toward the adherence of government IPC measures with 92.7, 96.4 and 82.3% practicing social distancing/self-isolation, improved personal hygiene and using face mask respectively. However, 52.1% of the respondents perceived that the government is not doing enough to curtail COVID-19 in Nigeria. Pearson's correlation showed significant relationship between knowledge of COVID-19 and attitude towards preventive measures ($r = 0.177$, $p = 0.004$, $r = 0.137$, $p = 0.001$). Although 61.8% of the respondents have no confidence in the present intervention by Chinese doctors, only 29.0% would accept COVID-19 vaccines when available. This study recorded good knowledge and attitudes among participants, however, community-based health campaigns are necessary to hold optimistic attitudes and practice appropriate intervention measures devoid of misconceptions.

Keywords COVID-19 · Public health · Knowledge · Attitude · Practice · North-central Nigeria

Introduction

The novel coronavirus also referred to as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) causes a severe respiratory disease known as coronavirus disease

(COVID-19) [1, 2]. COVID-19 was first reported by the World Health Organization (WHO) on the 31st December 2019 and announced as a global pandemic on 11th March 2020 [3]. The contagious virus began its ravaging effect from Wuhan, Hubei Province, China and then around the world [1, 4–6] except Antarctica [7]. The surge of COVID-19 in Wuhan, China led to the closure of public places, halting of public transportation, isolation and management of infected persons, all in a bid to curb the spread of SARS-CoV-2 [5]. The clinical presentation of COVID-19 symptoms include fever, fatigue, dry cough, malaise and breathing difficulty [1]. So far, the disease is characterized by high morbidity and mortality rates [8] alongside other ailments. The shutting down of social activities throughout the world to mitigate the spread of the pandemic has

✉ Rine Christopher Reuben
reubenrine@yahoo.com

¹ Department of Science Laboratory Technology, Nasarawa State Polytechnic, Lafia, Nigeria

² Department of Microbiology, Plateau State University, Bokoos, Nigeria

³ Department of Psychology, Plateau State University, Bokoos, Nigeria

⁴ Department of Microbiology, University of Jos, Jos, Nigeria

led to a global lockdown, causing a downturn and global economic fall due to a break in the global supply chain [9].

Prior to the WHO pronouncement of COVID-19 as a global public health challenge and pandemic, many Nigerians regarded the disease as a distant white man's infirmity that could never spread to their abode. Without recourse to expert advice and recommendations, Nigerians and their government downplayed the emergence of COVID-19 in their territory thereby hesitating the adoption of initial preventive measures which would have saved costs while protecting the citizenry from undue exposure to the virus. With the confirmation of the index COVID-19 case in Lagos, Nigeria on February 20, 2020, other parts of the country including the north-central region continued their normal routines and social activities without observing the sketchy preventive measures initially outlined by Nigeria Centre for Disease Control (NCDC) [10]. The public opinion within central Nigeria was that COVID-19 is a "big man disease" (i.e. disease of the highly influential persons). With the low level of education within this region of Nigeria [11], their immediate conclusion and misinformation on those vulnerable to the disease were expected. As the number of COVID-19 cases gradually rises among the Nigerian population, mainly of metropolitan areas including Abuja, the Federal Capital Territory (FCT) situated in central Nigeria, unfound uncertainties, palpable fear amidst misinformation regarding COVID-19 characterized the state of the inhabitants of the region.

Furthermore, the prevailing presence of urban slums, dense population, inadequate access to potable water, fragile healthcare system, sharing of sanitation facilities with a high degree of social mixing among the inhabitants of central Nigeria will make the implementation of hygiene and other public health measures necessary for the curbing of the coronavirus impossible [12, 13]. Also, the spread of misinformation and tales regarding the COVID-19 and promotion of unscientific traditional treatment within the central Nigerian further jeopardized the implementation of preventive measures [14, 15]. Government inability to sustain the social distancing policy and ban on large gatherings including religious and cultural activities, funerals, weddings and sports may undoubtedly create accelerated COVID-19 super-spreading scenarios [16]. For effective control and mitigation of COVID-19 within this region, actional and timely epidemiological data generated from the populace will inform health authorities to design robust interventions and policies that are relevant and comprehensible to the inhabitant of this region.

The rapid gathering of information on the KAP of individuals in central Nigeria through online platforms amidst the lockdown will aid and speed up the planning, development and implementation of behavior change programs/

campaigns, provision of needed interventions and to some extend tracking of COVID-19.

Methods

Study Design and Population

This study was designed as a cross-sectional survey conducted within north-central Nigeria using a Snowball sampling technique. A semi-structured online questionnaire was designed using google forms which was appended with a respondent's consent form. Through emails, WhatsApp and other social media, the link of the questionnaire was sent to prospective respondents by the investigators. On sending the link, prospective respondents were encouraged to roll out the survey to their contacts and online platforms. Thus, the link was forwarded to people apart from the first point of contact and so on. The online survey was conducted during the second and third week of the strict lockdown imposed by the Nigerian government to implement the social distancing policy aimed at mitigating of the spread SARS-CoV-2. The online survey was selected for this study since a population-based survey was not feasible under the current critical condition.

The study population were individuals with access to the internet. Respondents who understood the English language and were 18 years old and above, and could give informed consent were recruited for the study. Respondents were pulled across all the states in north-central Nigeria including, Benue, Niger, Kogi, Kwara, Nasarawa, Plateau and the Federal Capital Territory (FCT). Been an online study using a Snowball sampling method, the survey also allowed respondents from other states in Nigeria to participate should they be willing. Participation in this survey was anonymous, consensual and voluntary with informed consent given by all prospective respondents.

Measures

The survey instrument used in this study was designed according to the guidelines recommended for the awareness and prevention of COVID-19 by the NCDC [10], and also from the KAP of previous outbreaks (Ebola and Lassa fever) in Nigeria [17, 18]. The online questionnaire used in this study was initially drafted and validated before hosting it online. Public health and epidemiology experts were asked to assess the instrument and give their expert view on the relevance and correctness of the KAP regarding COVID-19, and also the relativity and simplicity of the instrument having in mind the study population. In a pilot study, the questionnaire was pretested on 20 participants which were excluded afterward from the study. Expert opinions were

used in reshaping the questionnaire into an easier, simpler and shorter instrument which could be filled within 6 min. The data generated from the initial pilot study was excluded from the final analysis.

The online self-reported and a respondent-friendly questionnaire designed for this study contained questions assessing socio-demographics, source, Knowledge, attitude and practice (KAP) toward COVID-19 and perception toward national and community responses. The sociodemographic variables included age, gender, marital status, level of education, state of residence, residential location, residential layout, residential structure, and the number of family members living together.

The components of the knowledge section included the awareness of COVID-19 and the source of information, cause and modes of transmission, symptoms, individuals at risk and preventive measures. Attitude section comprised 13 items including attitudes towards COVID-19 preventive measures, adherence to government disease prevention orders, social distancing, use of face mask, feelings and adaptive measures towards the pandemic. The practice section included 12 items such as perception towards the COVID-19 pandemic, government response, compliance and satisfaction with NCDC guidelines, media coverage, acceptance of possible COVID-19 vaccine, community response and opinion about Chinese doctors' intervention in Nigeria.

Statistical Analysis

Data collected from this study were analyzed using SPSS V.21. Frequencies and percentages through descriptive analysis, analysis of variance (ANOVA), Pearson's correlation and regression tests were applied to find the relationship between respondents KAP. At less than 0.05 P-value, statistical significance was set in all tests.

Results

A total of 589 respondents participated in this online survey. Majority of the study population were male 59.6% (351), 80.6% (475) were between ages 18–39 years, 90.4% (522) had a college (Bachelor) degree or above and 56.2% (331) reside in urban areas respectively. Also, residents from Plateau 33.3% (196) and Nasarawa 25.5% (150) states constituted the majority of the respondents. The majority of the respondents 58.7% (346) and 56.5% (333) live in residences arranged in linear (straight) street patterns and houses with a maximum of 5 inhabitants (Table 1).

The current findings showed that almost all the respondents 99.5% (586) had knowledge of COVID-19 with the majority of the respondents 55.7% (328) and 27.5% (162)

stating the internet/social media and Television (TV) as their major source of knowledge. Although 91.9% (541) of the respondents agreed that COVID-19 is caused by a virus, only 55.3% (326) believed that it is similar to SARS. Knowledge regarding the transmission of COVID-19 showed 99.2% (584) and 92.2% (543) believed everyone is at risk of infection and COVID-19 virus have between 1 and 14 days incubation period while 93.0% (548) and 88.5% (521) of the respondents knew that COVID-19 virus can be transmitted through Air droplets (from patients' sneezing/coughing) and Close contact with infected persons. Also, majority of the respondents mentioned breathing difficulty 94.6% (557), dry cough 89.6% (528) and high fever 86.9% (512) as COVID-19 symptoms. However, 76.2% (449) of the respondents believed that it is possible to be infected without showing any symptom, and also 94.7% (558), 81.7% (481) and 58.6% (345) of the respondents opined that alcohol-based sanitizers, soap/detergents and cleaning of surfaces with diluted chlorine could kill COVID-19 virus (Table 2).

Results for the assessment of respondents' attitudes as shown in Fig. 1 revealed that 82.3% (485) believed that everyone (infected and noninfected) should wear face mask. Most reported protective measures against COVID-19 identified by most respondents included proper hygiene (96.4% (568)), self-isolation/social distance (93.4% (550)), face mask/gloves (92.0% (542)) and prayers (45.3% (267)). Although 94.7% (558) of the respondents know the FMOH and NCDC preventive guidelines against Covid-19, only 79.5% (468) follow those guidelines. Similarly, majority of the respondents (90.3% (532)) agreed that crowded places should be avoided during the COVID-19 pandemic, however, 4.2% (25) and 27.5% (162) affirmatively and somewhat confirmed to have visited crowded during the lockdown. Being bored, nervous, fearful, stressed, angry and happy were some of the feelings exhibited by 51.6% (304), 40.6% (239), 38.4% (226), 34.1% (201), 22.9% (135) and 1.2% (7) of the respondents regarding the current COVID-19 pandemic situation. To adapt with the current situation, majority of the respondents 80.3% (473), 70.3% (414), 64.2% (378) and 62.1% (366) reportedly followed social media (Facebook and WhatsApp), Watched TV/movies, read books/magazines and spent time with family.

With regards to national and community response to COVID-19, 52.1% (307) of the respondents believed that the government is not doing enough to curtail COVID-19 pandemic in Nigeria, as only 63.5% (374) of the respondents agreed with the obligatory lockdown enforced. Majority of the respondents 68.1% (401) and 45.5% (268) do not believe in Chinese doctors' intervention in the fight against COVID-19 in Nigeria, and would not accept COVID-19 vaccines when available. However, following/respecting health recommendations, social distancing/avoiding

Table 1 Socio-demographic characteristics of participants

Variable		Frequency (n = 589)	Percent (%)
Age (years)	18–29 years	261	44.3
	30–39 years	214	36.3
	40–49 years	93	15.8
	50–59 years	21	3.6
Gender	Female	238	40.4
	Male	351	59.6
Marital status	Married	230	39.0
	Single	354	60.1
	Divorced	3	0.5
	Widow/widower	2	0.3
Level of education	High school	26	4.4
	College/bachelor	348	59.1
	Master	153	26.0
	PhD	31	5.3
	Others	31	5.3
State of residence	Plateau	196	33.3
	Nasarawa	150	25.5
	FCT	67	11.4
	Benue	18	3.1
	Kwara	10	1.7
	Kogi	8	1.4
	Niger	4	0.7
	Others	136	23.1
Residential location	Urban	331	56.2
	Semi-urban	213	36.2
	Rural	45	7.6
Residential layout	Linear (strait) street arrangement	346	58.7
	Nucleated (round) street arrangement	75	12.7
	Scattered street arrangement	100	17.0
	No clear street arrangement	68	11.5
Residential structure	Flat	386	65.5
	Congregated compound	130	22.1
	Estate	73	12.4
Number of family member living together in one house	0–5 people	333	56.5
	15–20 people	7	1.2
	5–10 people	214	36.3
	10–15 people	26	4.4
	Much more	9	1.5

crowd, avoiding handshakes and face kissing were some of the practices to reduce community spread COVID-19 as reported by 90.2% (531), 78.8% (464) and 74.4% (438) of the respondents. Most of the respondents 45.3% (267), 70.5% (415) and 93.7% (552) were satisfied with the media reportage of the COVID-19 pandemic, optimistic that a recurrence of another pandemic can be prevented and willing to read and share to others the right information about COVID-19 (Table 3).

Hypotheses Testing

Hypothesis 1 Residents of north-central Nigeria with good knowledge of COVID-19 will have positive attitude towards COVID-19.

Residents of north-central Nigeria with good knowledge of COVID-19 had significantly positive attitude towards COVID-19, $F(1,585) = 11.116$, $p = 0.001$ ($p < 0.05$); with a mean score of 1.961 for positive attitudes towards

Table 2 Knowledge of residents of north-central Nigerian about COVID-19

S/N	Questions	Frequency (n = 589)	Percent (%)
1	Have you heard of COVID-19?		
	Yes	586	99.5
	No	3	.5
2	If yes in 1 above, from where did you hear of it?		
	Other sources	22	3.7
	Internet/social media	328	55.7
	Newspaper	7	1.2
	Friends/family	16	2.7
	TV	162	27.5
	Government enlightenment campaign	54	9.2
3	Is COVID-19 the same as Flu virus?		
	Yes	154	26.1
	No	352	59.8
	I don't know	83	14.1
4	What causes COVID-19?		
	Bacteria	11	1.9
	Fungi	3	.5
	Virus	541	91.9
	I don't know	34	5.8
5	Does eating or contacting wild animals' results in COVID-19 infection?		
	Yes	136	23.1
	No	316	53.7
	I don't know	137	23.3
6	Which of the following disease(s) is similar to COVID-19? You are free to choose more than one		
	Typhoid	55	9.3
	Malaria	119	20.2
	Ebola	199	33.8
	HIV/AIDS	50	8.5
	SARS	326	55.3
	All of the above	29	4.9
	None of the above	65	11.0
7	Is it possible for a COVID-19 positive person to show no symptoms?		
	Yes	449	76.2
	No	108	18.3
	I don't know	32	5.4
8	How long does it take from contracting the disease till showing symptoms (Incubation period)?		
	Less than 7 days	15	2.5
	1–14 days	543	92.2
	2–21 days	16	2.7
	1–3 months	2	.3
	I don't know	13	2.2
9	Who can get infected with COVID-19?		
	Old people only	3	.5
	Young adults only	1	.2
	Anyone can be infected	584	99.2
	Teenagers and children only	1	.2
10	Which is a symptom for COVID-19? (select all that applies)		
	High fever	512	86.9
	Runny nose	241	40.9

Table 2 (continued)

S/N	Questions	Frequency (n = 589)	Percent (%)
	Dry cough	528	89.6
	Breathing difficulty	557	94.6
	Muscle pain	181	30.7
	Fatigue	308	52.3
	Bleeding	53	9.0
11	How does the virus spread? (select all that applies)		
	Air droplets (from patient sneezing/coughing)	548	93.0
	Mosquitoes/flies	7	1.2
	Contact with contaminated surfaces	504	85.6
	Close contact with people who have the virus	521	88.5
	I don't know	5	0.8
12	What can kill the virus? (select all that applies)		
	Clean surfaces with diluted chlorine	345	58.6
	Alcohol-based sanitizers	558	94.7
	Soap/detergents	481	81.7
	Water alone	17	2.9
	I don't know	19	3.2
13	Is hand-wash important?		
	Yes	583	99.0
	No	2	0.3
	Maybe	4	0.7
14	If yes in 13 above, how long should you wash your hands to kill the virus?		
	Less than 20 s	57	9.7
	20 s to 1 min	485	82.3
	I don't know	47	8.0

COVID-19 and 1.886 for negative attitudes towards COVID-19 (Tables 4, 5), hence, hypothesis 1 was supported.

Hypothesis 2 Residents of north-central Nigeria with good knowledge of COVID-19 will have positive perception towards national response of COVID-19.

Residents of north-central Nigeria with good knowledge of COVID-19 had positive perception towards national response of COVID-19, $F(1,585) = 5.896$, $p = 0.015$ ($p < 0.05$); with a mean score of 1.951 and 1.896 for positive perception and negative perception towards national response of COVID-19 respectively (Tables 4, 5). The hypothesis that residents of North Central Nigeria with good knowledge of COVID-19 will have positive perception towards national response of COVID-19 was supported.

Hypothesis 3 There is a significant relationship between knowledge of COVID-19, attitude towards preventive measures and perception of national response among residents of north-central Nigeria.

The hypothesis tested with Pearson's correlation statistics showed that there was a significant relationship between knowledge of COVID-19, attitude towards preventive measures and perception of national response, $r = 0.177$, $p = 0.004$ ($p < 0.01$), $r = 0.137$, $p = 0.001$ ($p < 0.01$) respectively (Table 6), hence, the hypothesis tested was supported.

Hypothesis 4 Good knowledge of COVID-19 is inversely proportional to the spread of the COVID-19 virus in north-central Nigeria.

The results of the regression model 1 summary (Table 7) revealed that the coefficient of determination $R^2 = 0.041$, $F_{(1,587)} = 0.316$, $DW = 2.075$ (95% confidence interval). This showed that the model can be held for 4.1% change in the spread of the COVID-19 virus. The F- statistic (ANOVA) of the model had no closeness of fit which means that the model is not statistically significant at 95% CI ($p < 0.05$) level of significance. The Durbin–Watson value of 2.075 shows that autocorrelation between the variables under consideration are without multicollinearity.

Fig. 1 Attitudes of residents of north-central Nigeria towards COVID-19

The result of hypothesis 4 reveals that the regression coefficient of the spread of COVID-19 in the estimated regression line is 0.041 which indicates that 4.1% of the change in the spread of COVID-19 was accounted for by good knowledge. The value of the calculated statistics of spread of COVID-19 was not significant, $t = 1.003$, $p = 0.316$ ($p > 0.05$) (Tables 7, 8). The hypothesis is not supported.

Hypothesis 5 Community response to COVID-19 pandemic significantly decreases community transmission of COVID-19 virus in north-central Nigeria.

The result of the regression model 2 summary (Table 7) revealed that the coefficient of determination $R^2 = 0.19.7$, $F_{(1,587)} = 0.000$, $DW = 2.160$ (95% confidence interval). This showed that the model can be held for 19.7% change in the spread of community transmission. The F- statistic (ANOVA) of the model had closeness of fit which means that the model is statistically significant at 95% CI ($p < 0.05$) level of significance. The Durbin-Watson value of 2.160 shows that autocorrelation between the variables under consideration have multicollinearity.

The result of hypothesis 5 reveals that the regression coefficient of community transmission in the estimated regression

Fig. 1 (continued)

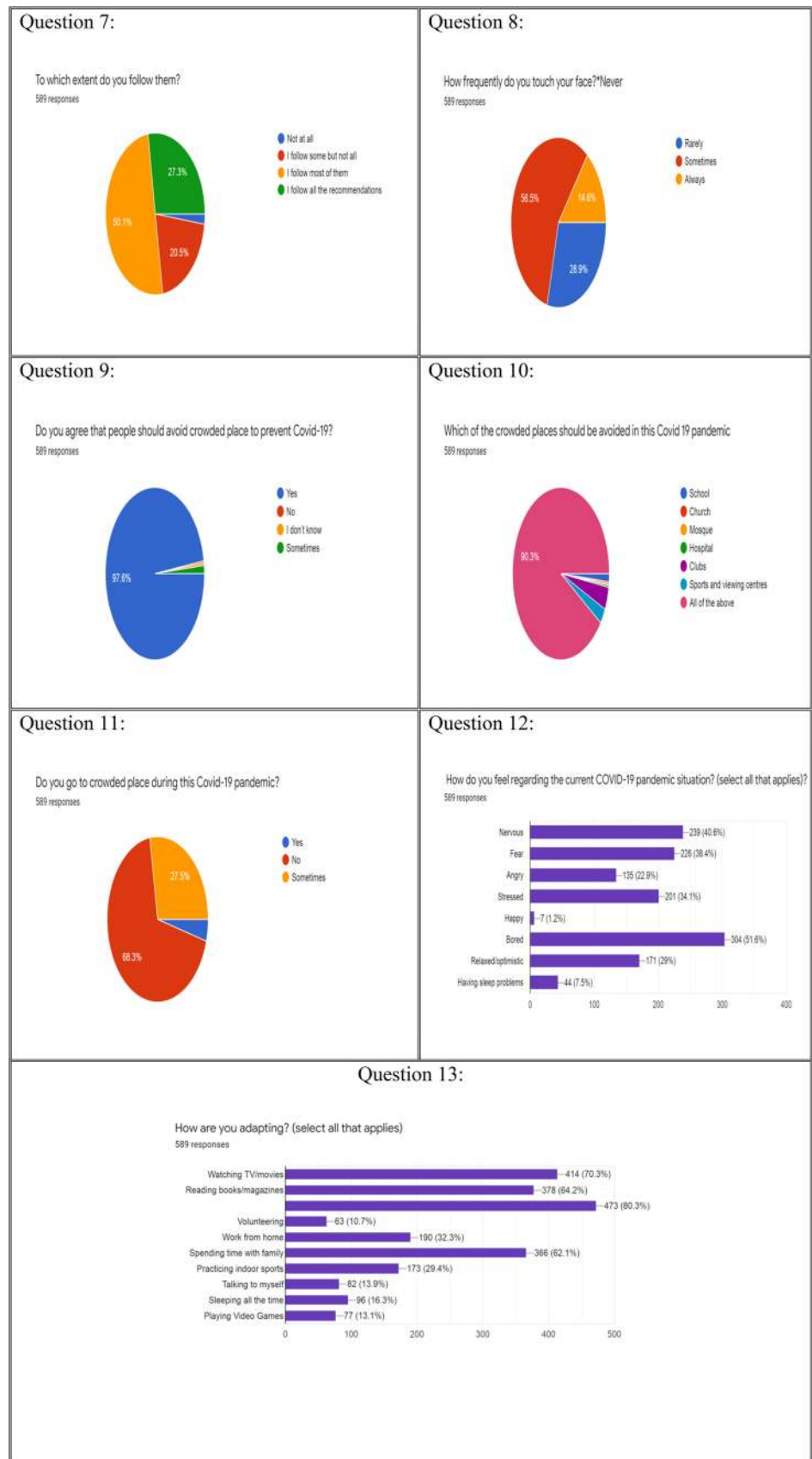


Table 3 Perception of Nigerians towards national/community response of COVID-19

S/N	Variable	Frequency (n = 598)	Percent (%)
1	Do you think that the government has/is doing enough to stop the global pandemic in Nigeria?		
	Yes	139	23.6
	No	307	52.1
	Maybe	143	24.3
2	Do you agree with the obligatory lockdown/measures Nigeria is taking?		
	Yes	374	63.5
	No	115	19.5
	Maybe	100	17.0
3	Do you agree with the government stay-at-home order?		
	Yes	428	72.7
	No	84	14.3
	Maybe	77	13.1
4	Are you complying with the government stay-at-home order?		
	Yes	460	78.1
	No	25	4.2
	Sometimes	104	17.7
5	Do you believe in Chinese doctors' intervention in Nigeria?		
	Yes	73	12.4
	No	401	68.1
	Maybe	115	19.5
6	Will you accept COVID-19 vaccine?		
	Yes	171	29.0
	No	268	45.5
	Maybe	150	25.5
7	On a scale of 1–5, how satisfied are you with your country's response against the COVID-19 pandemic?		
	Not satisfied	141	23.9
	Partly satisfied	155	26.3
	Satisfied	234	39.7
	More than satisfied	34	5.8
	Very satisfied	25	4.2
8	How satisfied are you with the media/social media coverage of the COVID-19 pandemic?		
	Very satisfied/keeps me updated	267	45.3
	Makes me worry more/stressful	55	9.3
	Not enough information	70	11.9
	There are more lies than truth	138	23.4
	I don't follow any media update	8	1.4
	No comment	51	8.7
9	What do you think we can do as a community to reduce the spread COVID-19 (select all that applies)?		
	Follow/respect the health recommendations of my country	531	90.2
	Eat healthy/practice sports	311	52.8
	Attending religious gatherings	28	4.8
	Social distancing/avoid crowd	464	78.8
	Volunteer to support whenever possible	268	45.5
	Avoid handshakes and face kissing	438	74.4
	I don't know	5	0.8
10	Do you think we can prevent such a global pandemic in the future?		
	Yes	415	70.5
	No	34	5.8
	Maybe	140	23.8

Table 3 (continued)

S/N	Variable	Frequency (n = 598)	Percent (%)
11	Which of these can prevent/help against the occurrence of such a global pandemic in the future? (select all that applies)		
	Reduced international travels	266	42.2
	Improve surveillance in the human and animal health sectors	394	66.9
	Establish early alerts and global warning systems for infectious diseases	486	82.5
	Collaboration between environmental, animal and human health workers	344	58.4
	Intensify research on preventive measures such as vaccines/diagnosis	460	78.1
	Raise public awareness of proper hygiene/healthy habits	452	76.7
	Prioritize human life/health welfare over animal or environmental ones	208	35.3
12	Are you willing to read and share with others the right information about COVID-19?		
	Yes	552	93.7
	No	8	1.4
	Maybe	29	4.9

Table 4 Mean score of COVID-19 knowledge in relation to attitude and perception towards preventive measures and national response

Attitudes towards preventive measures, perception towards national response	Mean score	Std. error	95% Confidence interval	
			Lower bound	Upper bound
Negative attitude	1.886	0.018	1.852	1.921
Positive attitude	1.961	0.014	1.934	1.988
Negative perception	1.896	0.014	1.868	1.925
Positive perception	1.951	0.017	1.917	1.984

Table 5 ANOVA source table for knowledge of COVID-19, attitude towards preventive measures and perception of national response

Source	Type III sum of squares	Df	Mean square	F	p-value
Corrected model	1.756 ^a	3	0.585	8.789	0.000
Intercept	1983.049	1	1983.049	29,778.429	0.000
Attitude towards preventive measures	0.740	1	0.740	11.116	0.001
Perception of national response	0.393	1	0.393	5.896	0.015
Attitude towards preventive measures*perception of national response	0.393	1	0.393	5.896	0.015
Error	38.957	585	0.067		
Total	2224.000	589			
Corrected total	40.713	588			

^aR Squared = 0.043 (Adjusted R Squared = 0.038)**Table 6** Pearson's correlation table for relationship between knowledge of COVID-19, attitude towards preventive measures and perception of national response

	Perception of national response	
	Pearson's correlation (r)	p-value
Knowledge of COVID-19	0.177	0.004
Attitude towards preventive measures	0.137	0.001

line is 0.19.7 which indicates that 19.7% of the change in community transmission was accounted for by community response. The value of the calculated statistics of community transmission was significant, $t = 4.863$, $p = 0.000$ ($p < 0.05$) (Tables 7, 8). The hypothesis is supported.

Table 7 Summary of regression models

	R ²	F Change	df1	df2	Sig F change	Durbin–Watson
Model 1	0.04.1	1.006	1	587	0.316	2.075
Model 2	0.19.7	23.648	1	587	0.000	2.160

Table 8 Coefficients of regression models

Model		Unstandardized coef- ficients		Standardized coefficients	T	p-value
		B	Std. error	Beta		
Model 1	(Constant)	1.511	0.121		12.441	0.000
	Spread of COVID-19	0.016	0.016	0.041	1.003	0.316
Model 2	(Constant)	5.750	0.148	0.197	38.901	0.000
	Community transmission	0.121	0.025	0.197	4.863	0.000

Discussion

The emergence of COVID-19 from the city of Wuhan, China in December 2019 and its rapid global spread across over 215 countries and territories has become one of the largest pandemics in recent times with several devastating and significant public health challenges [3]. Being the most populous African nation and the 7th most populated country in the world, Nigeria's population could undoubtedly be associated with a higher risk of increased morbidity and mortality due to COVID-19. With the infection prevention and control (IPC) strategies adopted by the NCDC and Nigerian government to curtail COVID-19, the adherence of the citizenry depends largely on their level of awareness and knowledge regarding the pandemic [5]. Unconcerned attitudes and adherence to false and superstitious beliefs by the public often arise due to inadequate awareness, which further affects the level of preparedness and the proper implementation of IPC measures at the national or subnational levels.

This study is the first epidemiological survey aimed at assessing the KAP of individuals within north-central Nigeria towards the COVID-19 pandemic as well as identifying key areas of concerns and needs for optimal subnational and community intervention. Collating such information is necessary for the promotion of major preventive behaviors including personal hygiene, social distancing as well as appraising the challenges emanating as a result of prolonged lockdown and restrictions. With the novelty of COVID-19 and its pathological and epidemiological uncertainties, the study of the population levels of KAP becomes critical for efficient health planning, implementation and management of the public.

This survey was dominated by male (59.6%) and single (60.1%) respondents who are mostly educated up to

college (Bachelor) degree or above (90.4%) with an overall 99.5% awareness of COVID-19 thus, depicting that the respondents are knowledgeable about COVID-19 pandemic. In agreement with our findings, previous studies conducted in different Asian countries [5, 19–21], Egypt, Kenya and Nigeria [1, 22, 23] indicated high COVID-19 knowledge among the population. The high level of COVID-19 knowledge recorded in this study could be attributed to the caliber of respondents who participated in the survey. In the study area, only the educated use social media and the internet since they understand the use of the English Language. Those with college (Bachelor) degree or higher educational qualifications, and less than 40 years old constituted the vast majority of the respondents in this study (Table 1). Although the high level of COVID-19 awareness among the respondents signifies a positive predictor in curtailing COVID-19 pandemic within north-central Nigeria, the result however excluded the underprivileged (uneducated and vulnerable) individuals. The use of social media (55.7%) and TV (27.5%) constitute the major sources of information about COVID-19. This is consistent with other findings that reported the use of social media as the major tool for COVID-19 information [1, 5, 21]. In Nigeria, the use of the social media especially WhatsApp, Facebook and the internet constitute the main sources of information with about 85.49 million users recorded within the first quarter of 2020 of which more than 70% are youth [24] (who constitute the majority of the respondents in this study). Right from the WHO declaration of COVID-19 as pandemic, several guidelines and information on COVID-19 have been uploaded online by WHO and NCDC which are easily accessible by internet users. Access to such reliable information could help dispel the pandemic of misinformation, misconception and citizenry ignorance about COVID-19.

Although 91.7% of the respondents believed that COVID-19 is caused by a virus, only 55.5% agreed that it is similar to SARS. The transmission routes, incubation period and symptoms of COVID-19 are well recognized by the respondents. Also, 99.2% of the respondents believed that everyone is at risk of getting infected with the COVID-19 virus. This further reflects the effectiveness of the social media and internet in the creation of awareness about COVID-19 pandemic within the Nigerian population however, some media platforms often exaggerate the risk associated with COVID-19 pandemic [1].

Our findings on respondents' knowledge on the transmission, incubation period and symptoms of COVID-19 aligns with the findings of Saqlain et al. [21] and Giao et al. [20] who reported good knowledge (93.2% and 89.51%) of participants regarding COVID-19 transmission and symptoms. Nevertheless, in another study conducted among the Iranian population, a lower proportion of the study population (56.5%) had sufficient knowledge of COVID-19 transmission and symptoms [25] when compared with the current study.

The majority of the respondents in this study reportedly took different precautionary measures including social distancing, improved personal hygiene and use of face mask during the lockdown period. This generally indicates the optimism and willingness of the Nigerian population in effecting attitudinal and behavioral changes relevant in the fight against the COVID-19 pandemic. The awareness and sensitization campaigns by the Federal Ministry of Health (FMOH) and the NCDC have significantly reflected in the attitude of the respondents as 94.7% are aware of the preventive guidelines laid down by the government and 79.5% reportedly follow those guidelines accordingly. Though 90.3% of the respondents agreed that all crowded places should be avoided during the COVID-19 pandemic, however, 27.5% sometimes visited crowded places during the period of the survey. The inability of the various states and local governments within the Nigerian north-central region to implement very strict IPC measures including total lockdown, banning of all public gatherings, social distancing and the compulsory use of face mask becomes noticeable risk behaviors among the study population. The higher risk of visiting crowded places as recorded in this study is attributed to the age brackets of the respondents, as most of them (80.1%) are below 40 years of age. More so, most of the young people within the study area still live on menial jobs for their daily survival even during the pandemic and lockdown as government palliatives were not provided during the time of the survey. Furthermore, due to fewer number of COVID-19 positive cases within north-central Nigeria during the study period [26], residents believed they are at lower risk of contracting COVID-19 virus as similarly reported in a study conducted among residents in non-Hubei districts of

China [5]. This study showed a significant ($p < 0.05$) relationship existing between good knowledge of COVID-19 amongst residents of north-central Nigeria and positive attitude towards COVID-19.

As part of the protective measures against COVID-19, 45.3% of the respondents believed prayer is also effectual in COVID-19 prevention. This agrees with the previous findings of a KAP survey on COVID-19 within a Nigerian population [23]. This finding is consistent with the strict religious adherence and beliefs among Nigerians which foster increasing carefree and lackadaisical attitudes of the populace, making the majority of the population to resort to only prayers and religious rituals during disease outbreaks without recourse to laid down IPC measures [27]. The direct involvement of religious leaders and clerics by the Nigerian government in the fight against COVID-19 would immeasurably aid in the dissemination of factual information about COVID-19 among their followers.

The major adaptive activities resorted to by the majority of the respondents during the implementation of strict lockdown policy were spending time on social media (Facebook and WhatsApp), watching TV/movies and reading books/magazines. However, although 50.6 and 40.6% of the respondents were bored and nervous, 38.7, 34.1 and 7.5% were fearful/paranoid, stressed and having insomnia while only 1.2% were happy regarding the COVID-19 pandemic situation. Our findings are similar to the report recently recorded from an Indian population in response to the COVID-19 pandemic [8]. Once a larger proportion of the population becomes anxious and paranoid during epidemics/pandemics, panic buying, stress, rumors and exhaustion of available resources become the resultant effects. The drastic change in dietary needs, food consumption, lifestyle, behaviors and daily routines are usually observed [8]. Also, various measures including social distancing policies, lockdown, travel ban, self-isolation and quarantine among others and the wild misconceptions in the media might have further contributed adversely to the mental health and psyche of the respondents [28]. This indicates that despite possessing significant knowledge about COVID-19 by the majority of the respondents as earlier reported, the respondents are still largely influenced by media misinformation and misconception, rumors, superstitious and religious beliefs. The media especially social media, TV and the internet negatively influence mental wellbeing with an attendant increase in anxiety level [8].

The perception of the study population regarding governments' efforts in mitigating the COVID-19 pandemic in Nigeria showed that only 25.3% of the respondents were satisfied with government efforts. Despite public outcry especially by the Trade Union Congress (TUC) of Nigeria and Nigerian Medical Association (NMA) opposing government plan to invite Chinese doctors to fight COVID-19 in

Nigeria, the government proceeded with their plan prior to this survey. However, majority of the respondents (68.1%) have no faith in Chinese doctors' intervention in Nigeria. The NMA vehemently argues that spike in COVID-19 cases and death in Italy coincided with the arrival of Chinese medical experts, moreover Chinese doctors are not licensure to practice in Nigeria [29]. Should COVID-19 vaccines be developed and made available, only 29.0% of the respondents would accept to be vaccinated. The increased rejection and indecisiveness of accepting COVID-19 vaccines when available may be attributed to the fear and misconceptions trending on the media about COVID-19 vaccines and associated health dangers.

Most of the respondents (90.2%) believed that community spread of COVID-19 within the study area could be reduced through adherence to all the FMOH and NCDC IPC guidelines. Additionally, 70.5% of the respondents were optimistic about the possible prevention of future pandemics as 82.5% opined that the establishment of early alerts and global warning are key in preventing the occurrence of a global pandemic in the future. The majority of the study population (93.7%) were willing to read and share with others the right information about COVID-19. Based on the data analyzed, community response to COVID-19 pandemic will significantly ($p < 0.05$) decrease community transmission of COVID-19 virus in north-central Nigeria.

Due to limited accesses to phones and internet, the underprivileged and vulnerable Nigerian population especially the older adults, unemployed, illiterates, farmers, rural and semi-urban dwellers (who constitute a significant number of the population with the study area) are more probably to have limited and/or poor knowledge about COVID-19. Undoubtedly, this would result in negative KAP towards COVID-19 hence, negating all efforts geared towards COVID-19 mitigation. Therefore, conducting KAP regarding COVID-19 among the underprivileged and vulnerable Nigerian population deserves immense and urgent attention especially with the daily increase in COVID-19 cases. Further studies could use open-ended questions, in-depth interviews or focus group discussion for adequate assessment of attitudes and practices of the population towards COVID-19. With the current government plans to initiate gradual easing of the lockdown, public health experts could visit households to assess adequate KAP regarding COVID-19 and associated public health, socio-economic and psychological burdens.

For the last few couple of months, COVID-19 has risen into a major global public health challenge with no known pharmaceutical treatment or vaccines, as such different treatment options are currently been explored. The identification of national, sub-national or community levels of KAP towards COVID-19 will enable the prompt identification and adequate design of cost-effective and viable public health campaigns. The present study reveals the

need for intensified and comprehensive health education programs focused on the dissemination of consistent and harmonized information to the public. The Nigerian government and NCDC should urgently take proactive measures in counteracting and dispelling different trending misconceptions, misinformation, tales and conflicting medical opinions about COVID-19. With the increasing usage of the media, internet and telecommunication amongst the Nigerian population [24], the government would undoubtedly benefit immensely in the utilization of both the telecommunication, social and traditional media in massive dissemination of adequate information.

Conclusion

This study provides a comprehensive assessment of the KAP of residents of north-central Nigeria towards COVID-19 during the second and third weeks of the strict lockdown enforced by the government. The findings suggest that Nigerians who participated in this study have good level of knowledge on COVID-19 with a positive attitude and compliance with the necessary IPC measures outlined by the government, which are necessary for mitigating the spread of COVID-19. Despite their demerits, social media and the internet contributed significantly to the acquisition of the needed knowledge. There was no remarkable satisfaction in the government efforts in curtailing COVID-19 especially the involvement of Chinese doctors. Efforts toward assessing the KAP of the underprivileged and vulnerable population and the dissemination of health education via indigenous languages among these groups should be intensified. Efforts targeting every group of the Nigerian population would constitute holistic and viable approach in curtailing COVID-19.

Acknowledgements All authors have interest on public health, emerging infectious diseases and disease control. They have over the years worked on Ebola, Lassa, rabies among other infections. They are trained public health microbiologists, clinical psychologists and faculty members.

Compliance with Ethical Standards

Conflict of interests The authors declare that they have no conflict of interest.

Ethical Approval The approval for this research was given by the Research and Ethics Committee (REC) of Plateau State University, Bokkos, Nigeria. Furthermore, data obtained from each respondent were anonymous and confidentially treated.

Informed Consent Participation in this survey was anonymous, consensual and voluntary with informed consent given by all prospective respondents.

References

- Abdelhafiz, A. S., Mohammed, Z., Ibrahim, M. E., Ziady, H. H., Alorab, M., Ayyad, M., et al. (2020). Knowledge, perceptions, and attitude of Egyptians towards the novel coronavirus disease (COVID-19). *Journal of Community Health*. <https://doi.org/10.1007/s10900-020-00827-7>.
- Shrikrushna, U., Bilal, Q. S., Shubham, T., Suraj, W., Shreya, B. R., Suraj, S., et al. (2020). A review on corona virus (COVID-19). *International Journal of Pharmaceutical and Life Sciences*, 6, 109–115.
- World Health Organization (WHO). (2020). Coronavirus disease (COVID-19) Situation Report—126. Retrieved May 25, 2020, from https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200525-covid-19-sitrep-126.pdf?sfvrsn=887dbd66_2.
- CDC. (2020). Novel coronavirus, Wuhan, China. Retrieved April 4, 2020, from <https://www.cdc.gov/coronavirus/2019-nCoV/summary.html>.
- Zhong, B. L., Luo, W., Li, H. M., Zhang, Q. Q., Liu, X. G., & Li, W. T. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: A quick online cross-sectional survey. *International Journal of Biological Science*, 16(10), 1745–1752. <https://doi.org/10.7150/ijbs.45221>.
- Wang, C., Horby, P. W., Hayden, F. G., & Gao, G. F. (2020). A novel coronavirus outbreak of global health concern. *The Lancet*, 395(10223), 470–473. [https://doi.org/10.1016/S0140-6736\(20\)30185-9](https://doi.org/10.1016/S0140-6736(20)30185-9).
- Rahman, S., & Bahar, T. (2020). COVID-19: The new threat. *International Journal of Infection*, 7(1), e102184. <https://doi.org/10.5812/iji.102184>.
- Roy, D., Tripathy, S., Kar, S. K., Sharma, N., Verma, S. K., & Kaushal, V. (2020). Study of knowledge, attitude, anxiety and perceived mental healthcare need in Indian population during COVID-19 pandemic. *Asian Journal of Psychology*, 51, 102083. <https://doi.org/10.1016/j.ajp.2020.102083>.
- Ephraim, S. H., Ahmed, Q. A., Gozzer, E., Schlagenhauf, P., & Memish, Z. A. (2020). Covid-19 and Community mitigation strategies in a pandemic. *BMJ*, 368, m1066. <https://doi.org/10.1136/bmj.m1066>.
- Nigerian Centre for disease control (NCDC). (2020). Frequently asked questions on Coronavirus—29/02/20. Retrieved May 8, 2020, from <https://covid19.ncdc.gov.ng/faq/>.
- Ige, A. M. (2014). Poverty of primary education in Nigeria: The way forward. *Education*, 42(6), 637–647. <https://doi.org/10.1080/03004279.2012.759603>.
- Winter, S., Dzombo, M. N., & Barchi, F. (2019). Exploring the complex relationship between women's sanitation practices and household diarrhea in the slums of Nairobi: A cross-sectional study. *BMC Infectious Diseases*, 2019, 242. <https://doi.org/10.1186/s12879-019-3875-9>.
- Makoni, M. (2020). Africa prepares for coronavirus. *The Lancet*, 395(10223), 483. [https://doi.org/10.1016/S0140-6736\(20\)30355-X](https://doi.org/10.1016/S0140-6736(20)30355-X).
- Ioannidis, J. P. A. (2020). Coronavirus disease 2019: The harms of exaggerated information and nonevidence-based measures. *European Journal of Clinical Investigation*, 50(4), e13223. <https://doi.org/10.1111/eci.13223>.
- Vigdor, N. (2020). Man fatally poisons himself while self-medicating for coronavirus, doctor says. *The New York Times*. Retrieved March 23, 24, from <https://www.nytimes.com/2020/03/24/us/chloroquine-poisoningcoronavirus.html>.
- Wong, G., Liu, W., Liu, Y., Zhou, B., Bi, Y., & Gao, G. F. (2015). MERS, SARS, and Ebola: The role of super-spreaders in infectious disease. *Cell Host & Microbes*, 18(4), 398–401. <https://doi.org/10.1016/j.chom.2015.09.013>.
- Reuben, C. R., & Gyar, S. D. (2016). Knowledge, attitudes and practices of Lassa fever in and around Lafia, Central Nigeria. *International Journal of Public Health and Epidemiology Research*, 2(1), 14–21.
- Etokidem, A. J., Ago, B. U., Mary, M., Affiong, E., Eno, U., & Anastasia, I. (2018). Ebola virus disease: Assessment of knowledge, attitude and practice of nursing students of a Nigerian University. *African Journal of Health Science*, 18(1), 55–65. <https://doi.org/10.4314/ahs.v18i1.9>.
- Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H., & Mohamad, E. (2020). Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. *PLoS ONE*, 15(5), e0233668. <https://doi.org/10.1371/journal.pone.0233668>.
- Giao, H., Nguyen, T. N. H., Tran, V. K., Vo, K. N., Vo, V. T., & Pham, L. A. (2020). Knowledge and attitude toward COVID-19 among healthcare workers at District 2 Hospital, Ho Chi Minh City. *Asian Pacific Journal of Tropical Medicine*. <https://doi.org/10.4103/1995-7645.280396>.
- Saqlain, M., Munir, M. M., Rehman, S., Gulzar, A., Naz, S., Ahmed, Z., et al. (2020). Knowledge, attitude, practice and perceived barriers among healthcare professionals regarding COVID-19: A Cross-sectional survey from Pakistan. *Journal of Hospital Infection*, 105, 419–423. <https://doi.org/10.1016/j.jhin.2020.05.007>.
- Austrian, K., Pinchoff, J., Tidwell, J. B., White, C., Abuya, T., & Kangwana, B. (2020). COVID-19 related knowledge, attitudes, practices and needs of households in informal settlements in Nairobi, Kenya. *Bulletin of World Health Organization*. <https://doi.org/10.2471/BLT.20.260281>.
- Olapegba, P. O., Ayandele, O., Kolawole, S. O., Oguntayo, R., Gandi, J. C., Dangiwa, A. L., et al. (2020). A preliminary assessment of novel coronavirus (COVID-19) knowledge and perceptions in Nigeria. *BMJ*. <https://doi.org/10.1101/2020.04.11.20061408>.
- Internet World Stat (IWS). (2020). Internet penetration in Africa 2020-Q1 March. Retrieved May 8, 2020, from <https://www.internetworldstats.com/stats1.htm>.
- Nemati, M., Ebrahimi, B., & Nemati, F. (2020). Assessment of Iranian nurses' knowledge and anxiety toward COVID-19 during the current outbreak in Iran. *Archives of Clinical and Infectious Diseases*. <https://doi.org/10.5812/archid.102848>.
- Nigerian Centre for disease control (NCDC). (2020). COVID-19 Situation report 54 data as reported and accurate by NCDC by Midnight 24 April 2020. Retrieved May 8, 2020, from <https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%2520update%2520of%2520COVID-19%2520outbreak%2520in%2520Nigeria>.
- Abati, R. (2020). Corona blues. Retrieved May 7, 2020, from <https://saharareporters.com/2020/04/07/corona-blues-reuben-abati>.
- Banerjee, D. (2020). The impact of Covid-19 pandemic on elderly mental health. *International Journal of Geriatric Psychology*. <https://doi.org/10.1002/gps.5320>.
- Anadolu Agency (AA). (2020). COVID-19: Nigerian doctors oppose Chinese team's visit. Retrieved May 8, 2020, from <https://www.aa.com.tr/en/africa/covid-19-nigerian-doctors-oppose-chinese-teams-visit/1794073>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.