





Article

Knowledge, Attitude and Perception towards COVID-19 Pandemic among Veterinary Professionals and Impacts: A Cross-Sectional Nationwide-Based Survey

Olubukola Adenubi ¹, Oluwawemimo Adebawale ^{2,*}, Hezekiah Adesokan ³, Abimbola Oloye ⁴, Noah Bankole ⁵, Oladotun Fadipe ⁶, Patience Ayo-Ajayi ⁷ and Adebayo Akinloye ⁸

- ¹ Department of Veterinary Pharmacology and Toxicology, College of Veterinary Medicine, Federal University of Agriculture, Alabata, Abeokuta PMB 2240, Ogun State, Nigeria; bukiadenubi@gmail.com
- ² Department of Veterinary Public Health and Preventive Medicine, College of Veterinary Medicine, Federal University of Agriculture, Alabata, Abeokuta PMB 2240, Ogun State, Nigeria
- ³ Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Ibadan PMB 5017, Oyo State, Nigeria; greaterglory2008@gmail.com
- ⁴ Department of Veterinary Surgery and Theriogenology, College of Veterinary Medicine, Federal University of Agriculture, Alabata, Abeokuta PMB 2240, Ogun State, Nigeria; drabimbola2002@yahoo.com
- ⁵ Department of Veterinary Microbiology, College of Veterinary Medicine, Federal University of Agriculture, Alabata, Abeokuta PMB 2240, Ogun State, Nigeria; noahbankole95@gmail.com
- ⁶ Veterinary Council of Nigeria, Abuja PMB 5555, Jigawa State, Nigeria; dotunfadipe@gmail.com
- ⁷ Department of Veterinary Services, Federal Ministry of Agriculture and Rural Development, Ita-Eko, Abeokuta PMB 2037, Ogun State, Nigeria; drtoyinayo@gmail.com
- ⁸ Department of Veterinary Anatomy, College of Veterinary Medicine, Federal University of Agriculture, Alabata, Abeokuta PMB 2240, Ogun State, Nigeria; bayoakinloye@gmail.com
- * Correspondence: oluwawemimo1@yahoo.com; Tel.: +234-(0)-90-8560-8043



Citation: Adenubi, O.; Adebawale, O.; Adesokan, H.; Oloye, A.; Bankole, N.; Fadipe, O.; Ayo-Ajayi, P.; Akinloye, A. Knowledge, Attitude and Perception towards COVID-19 Pandemic among Veterinary Professionals and Impacts: A Cross-Sectional Nationwide-Based Survey. *COVID* **2021**, *1*, 645–665.

<https://doi.org/10.3390/covid1030053>

Academic Editor: Guglielmo Campus

Received: 22 October 2021

Accepted: 16 November 2021

Published: 22 November 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Abstract: This study evaluated the knowledge, attitude and perception (KAP) towards COVID-19 pandemic control among veterinarians in Nigeria. A nation-wide web-based cross-sectional survey was conducted. Information on KAP towards the COVID-19 pandemic was gathered (April 23 and May 31, 2020) and multivariate logistic regression was performed to identify associated factors. A total of 368 veterinarians participated in the study. The majority of respondents were males (72.8%), between the ages of 30–39 years (39.7%). Generally, respondents displayed a good level of knowledge about COVID-19 (72.4% ± 9.9%, range 44.1–91.2%), while the general attitude level was poor (65.4% ± 10.8, range 35.3–94.1%). Various determinants for good attitude among respondents were: if they were above 60 years old (aOR = 4.49, 95% CI: 1.379–14.594, $p = 0.013$), possessed postgraduate qualification (aOR = 1.63, 95% CI: 1.045–2.553, $p = 0.031$), worked over 30 years post DVM (aOR = 5.63, 95% CI: 1.966–16.100, $p = 0.001$), had household members between five and 10 (aOR = 1.73, 95% CI: 1.130–2.641, $p = 0.012$), and if respondents' residence was on total lockdown (aOR = 1.66, 95% CI: 1.070–2.590, $p = 0.024$). The pandemic had moderate impacts on social, financial and physical status of the participants. Stricter policy measures and educational programs should be implemented to keep veterinarians and the populace informed about the best practices recommended for COVID-19 management.

Keywords: COVID-19; determinant factors; knowledge; attitude; perception; veterinarians; Nigeria

1. Introduction

After the Ebola outbreak (causative agent: Ebola virus) in 2014, avian influenza epidemic (causative agent: H5N1 virus) in 2015, the ongoing Lassa fever outbreak (causative agent: Lassa virus), a more devastating, emerging coronavirus disease (COVID-19) caused by SARS-CoV-2 is ravaging the world, including Nigeria [1]. As of 16 August 2021, over 206,958,371 confirmed cases and 4,357,179 deaths have been reported globally [2].

Based on the World Health Organisation (WHO) guidelines, many countries, including Nigeria, imposed nationwide lockdowns/curfews to help curb the virus spread and save health systems globally from complete collapse [3]. The lockdown involved restrictions on international, national and inter-state transport links, markets, office or business transactions, educational institutions (primary, secondary and tertiary), sports, religious and all other related social gatherings [1]. In Nigeria, a lockdown was imposed from March 30, 2020 and has been gradually eased in three phases from 4 May 2020 to 10 May 2021. The fourth tier of lockdown was imposed again on 11 May 2021 by the federal government.

COVID-19 infection has spread to all states of the country and the Federal Capital Territory (FCT). A total of 182,503 confirmed cases, 13,152 active cases, 2219 deaths, 167,132 recoveries and over one million vaccinations have been reported as of this 16 August 2021 [4]. With the persistent increase in community transmission and confirmed cases of the disease, knowledge concerning the virus and infection which can affect an individual's attitude and behaviour should be understood.

Veterinarians play vital roles in several organizations in Nigeria and contribute significantly to the country's economy [5]. Veterinarians are at the forefront for healthcare provision for animals including diagnosis and treatment, vaccine administration, drug distribution, health education and providing direct patient care. This means that close contact between animal owners and the community is unavoidable. Also, many veterinarians were unpreparedly seconded by the Nigeria Centre for Disease Control (NCDC) for contact tracing of suspected COVID-19 cases. The incubation period of COVID-19 (median incubation period estimated to be 5.1 days, 95% CI 4.5–5.8 or up to 14 days) before any symptoms could even be detected [6] makes it even more challenging and a great threat to veterinarians and other members of the medical team. As the virus is mainly spread by respiratory droplets produced when an infected person coughs or sneezes, which quickly settle on surfaces, the veterinary clinics are not immune to the possibility of transmitting and acquiring the infection between individuals. Veterinarians should, therefore, entertain a high level of knowledge and integrity to deal with the disease and be able to control and manage its spread. The scientific evidence gathered in this study would inform relevant training and policies at professional and national levels during the pandemic era. It will guide veterinarians in shaping their risk perceptions and communication practices, thereby avoiding occupational exposure. Also, this will help them contribute at a population level, in the prevention and control of the disease [7].

The aim of the study is to assess the level of knowledge, attitudes and perception (KAP) towards the COVID-19 pandemic and infection control among veterinarians in Nigeria.

2. Materials and Methods

2.1. The Study Area

This study was conducted in Nigeria, a West African country that is comprised of 36 states divided into six geopolitical zones: South West, South East, South South, North East, North West, North Central and the Federal Capital Territory (FCT), Figure 1. The study was performed among veterinarians from 23 April–31 May, three weeks after the start of the lockdown implementation in Nigeria. At the commencement of this study, on 23 April, the Nigerian Centre for Disease Control had announced an upsurge in the number of COVID 19 new cases in the country, with a total number of 27 states (26 States + FCT) reported with at least one confirmed case despite the strict lockdown policy imposed nationwide.

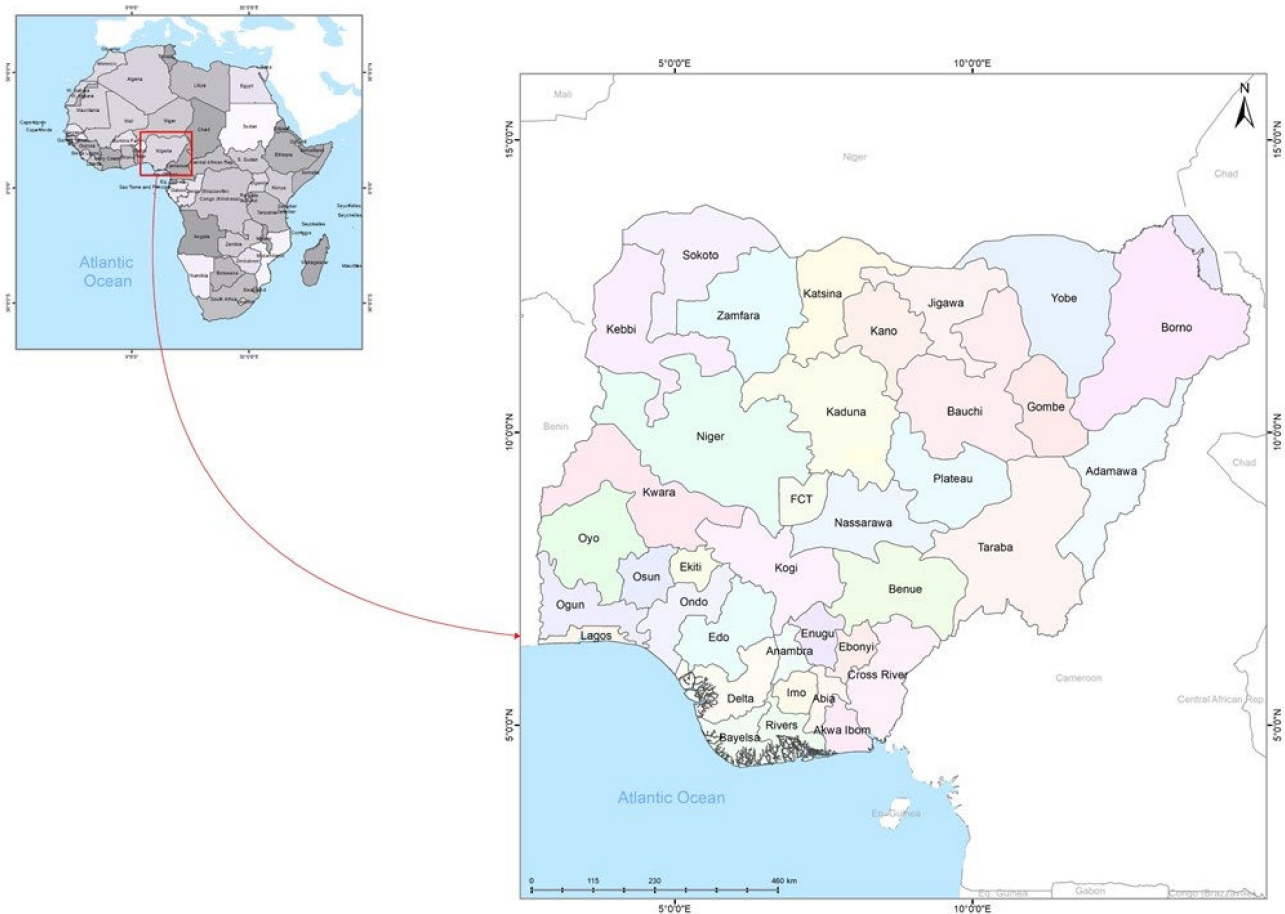


Figure 1. Spatial representation of Nigeria. A total of 368 veterinarians from 35 states and the Federal Capital Territory participated in the online KAP survey between 23 April and 31 May 2020.

2.1.1. Study Design and Participants

Cross-sectional study-based online surveys were performed. A web-survey was used due to the COVID-19 health crisis and the need to ensure contact distancing. The questionnaires were developed using the Google Forms Platform (Google Inc. Mountain View, CA, USA) to facilitate the completion and collection of data. All veterinarians registered with the Veterinary Council of Nigeria and working currently in the country were our target population for this study. The sample size for each survey was calculated based on the assumptions that levels of KAP towards the pandemic among respondents was 50%, an absolute precision of 95% confidence interval, and an acceptable error of 5%. Using Working in Epidemiology (WinEpi v.2.0, Ignacio de Blas, Facultad de Veterinaria, Universidad de Zaragoza, Spain), a total of 385 participants was estimated.

Invitations were sent to veterinarians nationwide to participate in the study using the WhatsApp platforms of the College of Veterinary Surgeons, Veterinary Schools, Veterinary Teaching Hospitals and the Nigerian Veterinary Medical Association. The questions for the online survey were in English and developed after reviewing pertinent literature. The link to the survey was included in the sent invitations and brief descriptions of the purpose of the survey were provided. Duplicate entries were avoided by preventing users with the same IP address access to the survey twice in the Google Form settings. The questionnaire was anonymous in order to maintain the privacy and confidentiality of all information collected in the study. The online survey was conducted from 23 April (second phase of lockdown) to 31 May (last week of the lockdown). Figure 2 provides details of the recruitment of veterinarians for this study.

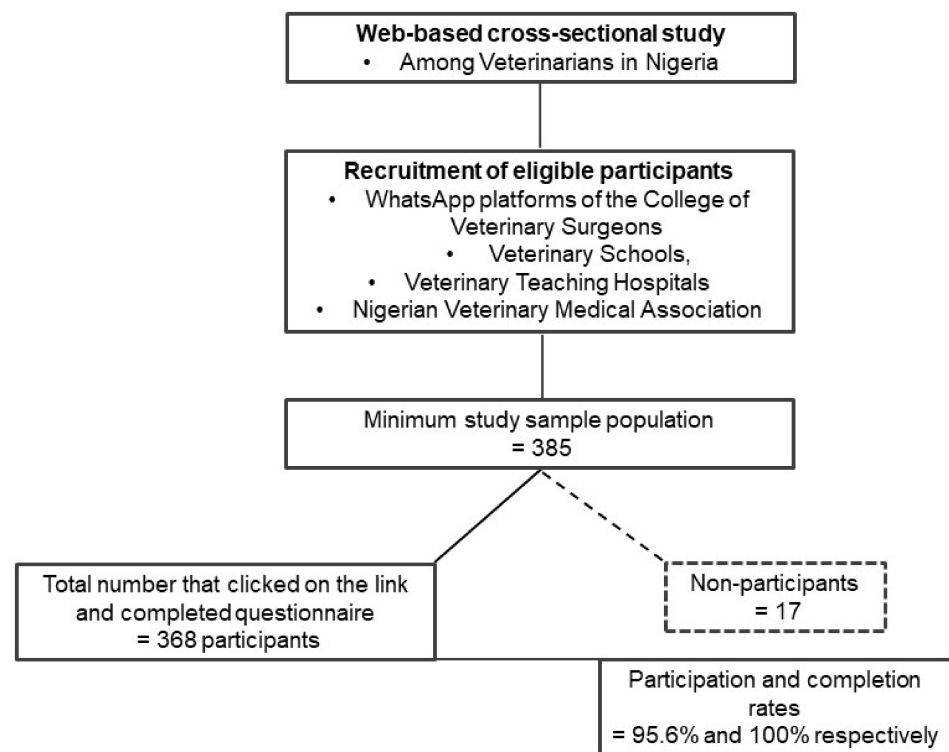


Figure 2. The flowchart on the recruitment of veterinarians for this study.

2.1.2. Questionnaire and Data Collection

The questionnaire comprised a total of 56 questions (four pages), of which 14 were on socio-demographic profiles and the other 42 questions were on KAP of veterinarians towards the COVID-19 pandemic and infection control. The questionnaire was pretested by collecting data from seven veterinarians not included in the study sample. Feedback on the time used for completion of the questionnaire and on the clarity and simplicity of the questions were received and adjusted accordingly. The average completion time of the questionnaire was estimated at 15 min. The final questionnaire had structured, closed-ended questions with responses based on multiple-choice and 5-point Likert scale formats.

The questionnaire was divided into four sections. The first section consisted of questions assessing socio-demographic and profession-related profiles; which were age, sex, educational qualification, number of years post DVM, work category, marital status, religion, number of persons in a household, states of residence during the lockdown, and type of lockdown instituted. The second section assessed general knowledge about COVID-19. It consisted of 14 questions regarding the source of infection, modes of transmission, role animals play in the spread of infection, symptoms, susceptible individuals and methods of prevention, control and treatment.

In section three of the questionnaire, the respondents' attitude was assessed by 15 questions. The questions were structured to evaluate their attitudes towards adherence to the non-pharmaceutical intervention and social distancing regulations implemented by the government, for example, if going out during the lockdown was acceptable, attitudes towards seeking updates on COVID-19, dispositions to certain activities during the lockdown and prophylactic drugs (orthodox or herbal) taken. The 5-point Likert scale (1-lowest negative effect, 5-highest negative effect) was used to measure the impact of the lockdown on the social, financial, physical, and mental well-being of the respondents. The effect of the lockdown on their sexual performance was also assessed.

The final section focused on the perception of the veterinarians. They were asked on a scale of 1 to 5 about their opinion on the impact of the pandemic on the delivery of veterinary services in the country. The section evaluated which of the impacts of the pandemic veterinarians were most concerned about e.g., the impact on business/economy,

veterinary care delivery, zoonosis, the spread, the actions or inactions of the Nigerian government and/or international bodies. The rate of satisfaction to current measures taken by the Nigerian government and the veterinarians' roles in the pandemic were also assessed.

The survey was available online for five weeks to ensure that as many veterinarians as possible participated. Detailed information on the questionnaire is presented as Supplementary File S1. The online survey was conducted based on the Checklist for Reporting Results of Internet E-Surveys (CHERRIES), and guidelines for good practice in the conduct and reporting of online research [8].

2.2. Data Analysis

Descriptive statistics were conducted for all variables and presented in forms of frequencies and proportions/percentages using Microsoft Excel (2013; Microsoft Corporation, Redmond, WA, USA). As for the descriptive statistical methods, the following were used: measures of central tendency (arithmetic mean and median), measures of variability (standard deviation), and as absolute numbers (n) and percentage representation [9]. A correct response to an item was assigned one point, while an incorrect or uncertain response was assigned 0 point. Respondents' knowledge and attitude levels towards COVID-19 was arrived at by assuming correct responses, generating maximum possible scores of 34 and 17, respectively. The knowledge and attitude scores were thereafter converted to percentages and cut-off points of $<70\%$ and $\geq 70\%$ were used to categorise respondents as having poor and good levels, respectively. These cut-off points were set since it is expected that veterinary medical professionals should demonstrate good knowledge, attitude and perceptions towards global health issues. Besides, such cut-off points had earlier been employed in other studies [9,10]. The levels of measured outcomes were expressed as mean and standard deviation (Mean \pm SD). Mean scores were compared across demographic categories using ANOVA and independent t -tests where appropriate. For post hoc comparison, Dunnett's test was performed. Associations between the demographics of respondents (sex, age, educational qualification, years of work experience post-DVM, work type i.e., whether private, public or both, marital status, religion, number of persons in the household, and type of lockdown) and KAP levels (Poor or Good) were determined using a univariate chi-square test. Variables significant at $p \leq 0.25$ from the univariate analysis were processed further by a stepwise forward likelihood multivariate analysis (multivariate logistic regression analysis-MLRA) using STATA version 14.2. The decision for a liberal p -value ($p \leq 0.25$) at this step was to ensure important potential predictor/risk variables were included in the model. A $p < 0.05$ was considered statistically significant and the adjusted odds ratios (AORs) were computed to determine the strength of associations between variables at 95% confidence intervals (CIs). All illustrations were performed with Microsoft Excel (2013).

3. Results

3.1. Respondents' Socio-Demographics

A total of 368 veterinarians (participation and completion rate of 95.5% and 100%, respectively) from 35 states and the federal capital territory (FCT), Abuja was covered, and 367 (99.7%) resided in states where positive COVID-19 cases had been identified within the study period. Most representation was from the South West (35.3%, 95% CI, 30.6–40.3), followed by the North Central (23.4%; 95% CI, 19.3–28.0), and the least from the South East (4.3%, 95% CI, 2.6–7.0). Of the respondents, 268 (72.8%) were males and 100 (27.2%) were females. The majority of respondents were within the age category of 30–39 years (39.7%); 273 (74.2%) were married; 265 (72.0%) identified as Christian, and 180 (48.9%) had less than five household members (Table 1). A total of 133 (36.2%) and 70 (19.0%) had completed their Master's and PhD degrees, respectively, in addition to the Doctor of Veterinary Medicine (DVM) degree. Respondents with years of work practice post DVM within 1–10 years (46.5%) was common, followed by those within 11–19 years (29.9%). About 53.5% were

employed into the public service, 35.3% private practice and 1.1% indicated they were unemployed (Table 1). A majority (235) indicated a partial lockdown (63.8%) in their states of residence, while others (122) experienced total lockdown (33.2%). Self-reported states with total lockdown included FCT, Lagos, Ogun, Adamawa, Plateau, Nassarawa, Kaduna, Katsina, Kwara, Niger, Benue, Delta, Kano, Enugu, Taraba, Rivers, Osun and Borno.

Table 1. Sociodemographic profiles of registered Veterinarians in Nigeria who participated in this study from April–May 2020.

S/N	Variables	Proportions (%)	95% CI
1	Age (<i>n</i> = 368)		
	20–29	54 (14.7)	11.4–18.7
	30–39	146 (39.7)	34.8–44.7
	40–49	103 (28.0)	23.6–32.8
	50–59	50 (13.6)	10.4–17.5
	60–69	15 (4.1)	2.4–6.7
2	Sex (<i>n</i> = 368)		
	Female	100 (27.2)	22.9–31.9
	Male	268 (72.8)	68.1–77.1
3	Marital status (<i>n</i> = 368)		
	Single	91 (24.7)	20.6–29.4
	Married	273 (74.2)	69.5–78.4
	Widowed	3 (0.8)	0.16–2.5
	Divorced	1 (0.3)	<0.01–1.7
4	Religion (<i>n</i> = 368)		
	Christianity	265 (72.0)	67.2–76.4
	Islam	100 (27.2)	22.9–31.9
	Others	3 (0.8)	0.16–2.5
5	Educational qualification (<i>n</i> = 368)		
	DVM only	165 (44.8)	39.3–49.4
	Master's	133 (36.2)	32.0–41.72
	PhD	70 (19.0)	15.3–23.4
6	Years of work experience post DVM (<i>n</i> = 368)		
	1–10		
	11–19	171 (46.5)	41.4–51.6
	20–29	110 (29.9)	25.4–34.8
	>30	66 (17.9)	14.3–22.2
		21 (5.7)	3.7– 0.9
7	Work background (<i>n</i> = 368)		
	Private	130 (35.3)	30.6–40.3
	Public	197 (53.5)	48.4–58.6
	Both	27 (7.3)	0.5–10.5
	Retired	3 (0.8)	0.2–2.5
	Others	11 (3.0)	1.6–5.3
8	Number of household members (<i>n</i> = 368)		
	Less than 5		
	5–10	180 (48.9)	43.8–54.0
	10 and above	174(47.3)	42.2–52.4
		14 (3.8)	2.2–6.3

Table 1. Cont.

S/N	Variables	Proportions (%)	95% CI
9	State of residence during the lockdown		
	(<i>n</i> = 368)		0.5–3.2
	Abia	5 (1.4)	5.7–11.4
	Abuja (FCT)	30 (8.2)	0.3–2.9
	Adamawa	4 (1.1)	0.5–3.2
	Akwa Ibom	5 (1.4)	<0.01–1.7
	Bauchi	1 (0.3)	<0.01–1.7
	Bayelsa	1 (0.3)	2.0–6.0
	Benue	13 (3.5)	0.8–4.0
	Borno	7 (1.9)	<0.01–1.7
	Cross River	1(0.3)	1.2–4.7
	Delta	9 (2.4)	<0.01–1.7
	Ebonyi	1 (0.3)	1.6–5.3
	Edo	11 (3.0)	0.02–2.1
	Ekiti	2 (0.5)	1.2–4.7
	Enugu	9 (2.4)	0.3–2.9
	Gombe	4 (1.1)	<0.01–1.7
	Imo	1 (0.3)	0.02–2.1
	Jigawa	2 (0.5)	4.6–9.9
	Kaduna	25 (6.8)	0.3–2.9
	Kano	4 (1.1)	1.6–5.3
	Katsina	11 (3.0)	0.2–2.5
	Kebbi	3 (0.8)	0.02–2.1
	Kogi	2 (0.5)	3.9–8.9
	Kwara	22 (6.0)	9.5–16.3
	Lagos	46 (12.5)	0.3–2.9
	Nasarawa	4 (1.1)	0.02–2.1
	Niger	2 (0.5)	8.8–15.4
	Ogun	43 (11.7)	0.3–2.9
	Ondo	4 (1.1)	0.2–2.5
	Osun	3 (0.8)	6.2–12.1
	Oyo	32 (8.7)	2.0–6.0
	Plateau	13 (3.5)	3.9–8.9
	Rivers	21 (5.7)	4.2–9.2
	Sokoto	23 (6.3)	<0.01–1.7
	Taraba	1 (0.3)	0.02–2.1
	Yobe	2 (0.5)	<0.01–1.7
	Zamfara	1 (0.3)	
10	Type of lockdown where resident		
	(<i>n</i> = 368)		
	Partial	235 (63.8)	58.8–68.6
	Total	122 (33.2)	28.5–38.1
	Not Sure	11(3.0)	1.6–5.3

FCT—Federal Capital Territory.

3.2. Knowledge of COVID-19 among Respondents

Channels of information or updates on COVID-19 reported by respondents were majorly from TV/Radio (81.5%) and social media (81.0%). Other sources used were the NCDC and WHO websites.

Of the 368 respondents, 95.7% correctly identified the acronym for COVID-19. Only 20.6% of the respondents reported that COVID-19 was similar to MERS-CoV and SARS-CoV. The majority (94.4%) indicated the incubation period for the pathogen was between 2–14 days and that currently there is no cure for the disease (91.0%). Sources of virus transmission identified were contact with an infected person when they cough or sneeze (97.8%) and touching eyes, nose and mouth after contact with contaminated surfaces (98.6%). The older adults (92.9%), people with underlying infections (91.3%), and frontline health workers (86.6%) were indicated as more likely to be susceptible to the virus than veterinarians (35.6%), children (34.8%), and pregnant women (29.9%). The use of facemasks in public to assist in curbing the spread of the virus was agreed on by 81.5% of the respondents (Table 2).

Table 2. Different sources of information and distribution of the knowledge responses towards COVID-19 pandemic and infection control by veterinarians in Nigeria (*n* = 368).

S/N	Variables	Proportion (%)
1	Source of information and updates on COVID 19. Tick as many that apply	
	Social media	291 (81.0)
	TV/Radio	300 (81.5)
	Friends	82 (22.3)
	Government Health Ministry	167 (45.4)
	World Health Organization	200 (54.3)
2	COVID-19 is acronym for Virus. Tick as many that apply	
	Corona virus debacle–19	2 (0.5)
	Corona virulent disease version 19	12 (3.3)
	Corona venom disease number 19	2 (0.5)
	Corona virus disease–19	352 (95.7)
3	COVID-19 is similar to Infectious disease. Tick as many that apply	
	Common flu	112 (30.4)
	MERS-CoV	144 (39.1)
	SARS-CoV	347 (94.3)
	Don't know	5 (1.4)
4	Scientific evidence to identify the source of COVID-19 transmission to humans	
	Yes	223 (60.6)
	No	81 (22.0)
	Don't know	64 (17.4)
5	Spread of COVID-19 is a result of human to human transmission	
	Yes	356 (96.7)
	No	11 (3.0)
	Don't know	1 (0.3)
6	A person can get infected with the virus while caring for his/her pet	
	Yes	189 (51.4)
	No	153 (41.6)
	Don't know	26 (7.0)
7	If yes, what precautionary measures should be taken for a companion or other animals? Tick as many that apply	
	Hand washing before being around or handling animals, their food, or supplies	244 (66.3)
	Avoid kissing, licking or sharing food	211 (57.3)
	Other members of their household can care for animals	202 (54.9)
	Maintaining good hygiene practices	246 (66.8)
	Wearing a face mask if possible	233 (63.3)
	Animals belonging to owners infected with COVID-19 should be kept indoors as much as possible	187 (50.8)
Contact with other pets/animals can still be allowed	21 (5.7)	
	Don't know	1 (0.3)

Table 2. Cont.

S/N	Variables	Proportion (%)
8	COVID-19 is spread by (Tick as many that apply)	
	Contact with an infected person when they cough or sneeze	360 (97.8)
	Touching eyes, nose and mouth after contact with contaminated surfaces	363 (98.6)
	Consumption of wildlife (bushmeat)	62 (16.8)
	Contact with pets	49 (13.3)
	From pregnant mother to baby	43 (11.7)
9	Who is more likely to develop COVID-19? Tick as many that apply	
	The elderly	342 (92.9)
	Children	128 (34.8)
	People with underlying infections	336 (91.3)
	Frontline health workers	326 (88.6)
	Veterinarians	131 (35.6)
	Pet owners	65 (17.7)
Pregnant women	110 (29.9)	
	Anyone	139 (37.8)
10	How long does it take to develop COVID-19 symptoms?	
	1–2 days	2 (0.5)
	3–7 days	6 (1.6)
	2–14 days	347 (94.4)
	14–28 days	13 (3.5)
	1–2 months	0
11	Wearing of facemasks in public curbs the virus spread?	
	Yes	300 (81.5)
	No	67 (18.2)
	I don't know	1 (0.3)
12	Personal protective equipment must be worn by	
	Frontline workers	228 (62.0)
	Caregivers	73 (19.8)
	Everyone	67 (18.2)
13	Is there a cure/vaccine for COVID-19?	
	Yes	14 (3.8)
	No	335 (91.0)
	I don't know	19 (5.2)

A majority of the participants (96.7%) agreed that the current status and spread of the pathogen in the country is a result of human to human transmission (community propagation), as people with no history of travelling to the affected countries now get sick with the virus. Of the 368 responses, 85.3% reported that animals could become infected through close contact with infected humans. Slightly more than half (51.4%) of the respondents reported that owners infected with the virus can still care and handle their animals. Hand washing before being around or handling animals, their food, or supplies (66.3%), avoiding kissing, licking or sharing food with pets (57.3%), allowing other members of the household care for animals (54.9%), maintaining good hygiene practices (66.8%), wearing a face mask if possible (63.3%), and keeping pets indoors by owners infected with COVID-19 (50.8%) were precautionary measures mentioned to prevent cross-infection (Table 2).

The overall knowledge mean score was 24.6 (SD \pm 3.4; score 0–34), suggesting an overall of 72.4% (SD \pm 9.9%, range 44.1–91.2%). The general knowledge about COVID-19 among veterinarians was good, and almost 64.0% of the respondents had \geq 70.0%. The knowledge level based on geopolitical zoning was 71.8 ± 10.5 , 75.9 ± 9.8 , 71.0 ± 9.5 , 69.5 ± 9.9 , 72.5 ± 10.8 , and 73.5 ± 9.2 for North Central, North East, North West, South East, South South and South West respectively. The knowledge scores on COVID-19 was similar across the geopolitical zones ($p = 0.20$; Table 3). Similarly, knowledge was similar across various categories of demographic profiles of respondents investigated ($p > 0.05$).

Table 3. Demographic characteristics of respondents' association with the knowledge and attitude scores.

S/N	Variables	Proportions (%)	Knowledge Level (%) (Mean ± SD)	p Value (ANOVA Independent T-Test)	Attitude Level (%) (Mean ± SD)	p Value (ANOVA Independent T-Test)
1	Age (n = 368)					
	20–29	54 (14.7)	73.8 ± 8.8	0.51	61.2 ± 11.5	<0.0001 *
	30–39	146 (39.7)	72.0 ± 10.6		65.9 ± 10.2	
	40–49	103 (28.0)	72.1 ± 9.7		67.0 ± 10.9	
	50–59	50 (13.6)	71.9 ± 9.4		69.4 ± 10.6	
	60–69	15 (4.1)	75.9 ± 10.4		73.2 ± 9.7	
2	Sex (n = 368)					
	Female	100 (27.2)	72.6 ± 9.1	0.88	65.7 ± 9.8	0.77
	Male	268 (72.8)	72.39 ± 10.2		65.3 ± 11.1	
3	Marital status (n = 368)					
	Single	91 (24.7)	72.6 ± 9.2	0.86	63.35 ± 11.5	0.20
	Married	273 (74.2)	72.4 ± 10.2		66.09 ± 10.5	
	Widowed	3 (0.8)	67.6 ± 10.2		62.73 ± 12.3	
	Divorced	1 (0.3)	73.5 ± 0.0		64.70 ± 0.0	
4	Religion (n = 368)					
	Christianity	265 (72.0)	72.6 ± 9.8	0.85	65.53 ± 10.6	0.55
	Islam	100 (27.2)	72.0 ± 10.1		65.18 ± 11.0	
	Others	3 (0.8)	71.6 ± 17.3		58.83 ± 15.6	
5	Educational qualification (n = 368)					
	DVM	165 (44.8)	72.1 ± 9.6	0.65	64.10 ± 10.9	0.10
	Master's	133 (36.2)	73.1 ± 9.8		66.08 ± 10.5	
	PhD	70 (19.0)	73.1 ± 9.8		67.06 ± 10.6	
6	Years of work experience post DVM (n = 368)					
	1–10	171 (46.5)	72.9 ± 9.9	0.68	64.2 ± 11.1	0.04 *
	11–19	110 (29.9)	71.6 ± 9.8		65.8 ± 10.4	
	20–29	66 (17.9)	72.2 ± 10.2		65.9 ± 10.6	
	>30	21 (5.7)	73.5 ± 9.5		71.2 ± 9.1	
7	Work background (n = 368)					
	Private	130 (35.3)	72.4 ± 10.4	0.67	66.3 ± 10.0	0.35
	Public	197 (53.5)	72.6 ± 9.0		64.2 ± 11.8	
	Both	27 (7.3)	71.6 ± 11.2		63.4 ± 10.6	
	Retired	3 (0.8)	80.4 ± 1.7		66.7 ± 9.0	
	Others	11 (3.0)	71.1 ± 9.7		67.9 ± 11.0	

Table 3. Cont.

S/N	Variables	Proportions (%)	Knowledge Level (%) (Mean ± SD)	p Value (ANOVA Independent T-Test)	Attitude Level (%) (Mean ± SD)	p Value (ANOVA Independent T-Test)
8	Number of household members (n = 368)					
	Less than 5	180 (48.9)	73.0 ± 9.4	0.40	64.6 ± 9.8	0.01 *
	5–10	174(47.3)	72.0 ± 10.4		66.7 ± 11.6	
	10 and above	14 (3.8)	69.9 ± 9.5		58.8 ± 9.8	
9	Region of residence during the lockdown (n = 368)					
	North Central	86 (23.4)	71.8 ± 10.5	0.20	66.5 ± 12.2	0.001 *
	North East	20 (5.4)	75.9 ± 9.8		74.6 ± 10.0	
	North West	69 (18.8)	71.0 ± 9.5		64.3 ± 10.0	
	South East	16 (4.3)	69.5 ± 9.9		60.3 ± 12.4	
	South South	48 (13.0)	72.5 ± 10.8		64.5 ± 11.7	
	South West	129(35.1)	73.5 ± 9.2		64.9 ± 9.1	
10	Type of lockdown where resident (n = 368)					
	Partial	235 (63.8)	72.5 ± 10.1	0.09	64.6 ± 11.0	0.04 *
	Total	122 (33.2)	72.9 ± 9.1		67.2 ± 10.3	
	Not Sure	11(3.0)	66.0 ± 11.7		61.0 ± 9.6	

* Level of significance at p value ≤ 0.05.

3.3. Attitude during the Lockdown

Regarding attitudes on preventive measures towards COVID-19, the respondents thought they should adhere to good handwashing hygiene, maintain social distancing and regular hand sanitisation using alcohol-based sanitisers. A majority of the respondents (77.2%) agreed that they should keep 1–3 m apart when in the presence of people, while others considered less than 1 m (6.5%) or more than 4 m (16.3%) as sufficient. For frequency of going out, up to 66.5% of the respondents reported leaving the house about two to five times a week or every day during the lockdown was no problem. A majority of the respondents did not view visiting human clinics (90.8%), religious places (89.4%), home visits/ambulatory (84.2%) and farms (72.3%) as places of risk exposure (Table 4).

Table 4. The attitude responses of veterinarians towards the COVID-19 pandemic and lockdown.

S/N	Variables	Proportion (%)
1.	I do not think I should adhere to any of these non-pharmaceutical interventions, except. Tick as many that apply	
	Good hand washing hygiene	359 (97.6)
	Rubbing hands regularly with alcohol-based sanitizer	332 (90.2)
	Social distancing	344 (93.4)
	Staying at home	284 (77.2)
	Wearing face masks when going out	323 (87.8)
2	I think I should keep a distance of—during social distancing	
	Less than 1 m	24 (6.5)
	3 m	284 (77.2)
	4–6 m	35 (9.7)
	More than 6 m	10 (2.7)
	I don't know	15 (4.1)

Table 4. Cont.

S/N	Variables	Proportion (%)
3	For me, going out is not a concern during the lockdown	
	Not at all	28 (7.8)
	Once a week	95 (25.8)
	2–5 times a week	147 (39.9)
4	Everday	98 (26.6)
	Going to these areas during the lockdown was not a concern for me. Tick as many that apply	
	Workplace	204 (55.4)
	Market	160 (43.5)
	Religious places	39 (10.6)
	Human clinic	34 (9.2)
	Vet clinic	150 (40.8)
	Farms	102 (27.7)
Home visits/ambulatory	58 (15.8)	
5	Others	16 (4.3)
	I think I should listen to updates on COVID-19	
	Yes	326 (88.6)
6	Sometimes	41 (11.1)
	Not at all	1 (0.3)
	I caught my fun doing the following. Tick as many as apply	
	Watching TV/Movies	239 (64.9)
	Reading books	220 (59.8)
	Exercising	174 (47.3)
	Following social media (WhatsApp, Instagram, Facebook, Twitter etc.)	223 (63.3)
	Visiting friends	10 (2.7)
Spending time with the family	181 (49.2)	
7	Working from home	171 (46.5)
	Playing with pets	8 (2.2)
	Others	14 (3.8)
	Taking such drugs to prevent COVID-19 is appropriate for me. Tick as many as apply	
	Antibiotics	5 (1.4)
	Herbs	16 (4.3)
	Antimalarial	2 (0.5)
Blood tonic	1 (0.3)	
8	Vitamins	121 (32.9)
	Others	12 (3.3)
	None	209 (56.8)
	I felt mentally ——— towards the lockdown?	
	Anxious/Afraid/Restless/Worried	246 (66.8)
	Angry	15 (4.1)
	Stressed	74 (20.1)
	Lonely	45 (12.2)
Bored	127 (34.5)	
9	Optimistic	206 (56.0)
	Pessimistic	10 (2.7)
	Depressed	25 (6.8)
	Reducing my contact with animals or taking preventive measures is very vital to prevent COVID-19?	
9	Yes	217 (59.0)
	No	135 (36.7)
	Not sure	16 (4.3)

Of the 386 respondents, 326 (88.6%) thought it was necessary to regularly listen to updates on the COVID-19 pandemic. Interestingly, a lesser number spent time with their pets (2.2%) and about 47.0% self-reported they worked from home. Respondents indicated that they passed their time mostly by watching TV/movies, being on social

media, and reading. The respondents also indicated that the pandemic made them feel more anxious/worried/restless/afraid (66.8%). A majority (56.0%) were optimistic, while 2.7% were pessimistic about the situation. Almost half (42.6%) were taking herbal mixtures, antibiotics, vitamins and immune boosters, aspirin and fruits as preventive measures against COVID-19 (Table 4).

The overall attitude mean score was 11.1 (SD ± 1.66; score: 0→17), suggesting an overall 65.4% (SD ± 10.8; range 35.3–94.1%), which was categorised as being poor towards the pandemic. Less than 50.0% of the respondents reported having a good/positive attitude, which is unsatisfactory. Participants’ attitude mean scores are presented in Table 3. These significantly differed across most of the sociodemographic variables such as age categories ($p < 0.0001$, age groups from 30 and above having higher positive attitude), years of work experience post DVM ($p = 0.04$, participants above 30 years of work experience having better attitude than those with 1–10 years’ ($p = 0.02$)), number of household members ($p = 0.01$), and geopolitical regions ($p = 0.001$, participants from the North Central having better attitude than those from the North East).

3.4. Demographic Factors Associated with Knowledge and Attitude Levels of Respondents

At the univariate analysis (Table 5), none of the demographic variables of respondents were associated with knowledge towards the COVID-19 pandemic and infection control. However, the attitude level was associated with age ($p = 0.019$), education ($p = 0.092$), years of work experience post-DVM ($p = 0.005$), work type ($p = 0.084$), number of persons per household ($p = 0.011$) and type of lockdown ($p = 0.070$).

Table 5. Univariate analysis of the levels of knowledge and attitude towards the COVID-19 pandemic and infection control among veterinarians in Nigeria in relation to their socio-demographic characteristics ($n = 368$).

Variable	Category	Knowledge			Attitude		
		Good n (%)	Poor n (%)	p Value	Good n (%)	Poor n (%)	p Value
Age	20–39	128 (64.0)	72 (36.0)	0.716	76 (38.0)	124 (62.0)	0.019 *
	40–59	96 (62.7)	57 (37.3)		69 (45.1)	84 (54.9)	
	≥60	11 (73.3)	4 (26.7)		11 (73.3)	4 (26.7)	
Sex	Male	171 (63.8)	97 (36.2)	0.973	116 (43.3)	152 (56.7)	0.571
	Female	64 (64.0)	36 (36.0)		40 (40.0)	60 (60.0)	
Education	DVM	106 (65.0)	57 (35.0)	0.616	59 (36.2)	104 (63.8)	0.092 *
	Postgraduate	102 (64.6)	56 (35.4)		76 (48.1)	82 (51.9)	
	Advanced Professional	27 (57.4)	20 (42.6)		21 (44.7)	26 (55.3)	
Work experience post-DVM	1–10	114 (66.7)	57 (33.3)	0.400	62 (36.3)	109 (63.7)	0.005 *
	11–19	63 (57.3)	47 (42.7)		49 (44.5)	61 (55.5)	
	20–29	44 (66.7)	22 (33.3)		29 (43.9)	37 (56.1)	
	≥30	14 (66.7)	7 (33.3)		16 (76.2)	5 (23.8)	
Marital status	Single	63 (67.7)	30 (32.3)	0.579	33 (35.5)	60 (64.5)	0.271
	Married	172 (62.5)	103 (37.5)		123 (44.7)	152 (55.3)	
Religion	Islam	67 (65.7)	35 (34.3)	0.651	43 (42.2)	59 (57.8)	0.955
	Christianity	168 (63.2)	98 (36.8)		113 (42.5)	153 (57.5)	
Work type	Private	98 (68.1)	46 (31.9)	0.396	57 (39.6)	87 (60.4)	0.084 *
	Public	121 (61.4)	76 (38.6)		92 (46.7)	105 (53.3)	
	Both	16 (59.3)	11 (40.7)		7 (25.9)	20 (74.1)	

Table 5. Cont.

Variable	Category	Knowledge			Attitude		
		Good n (%)	Poor n (%)	p Value	Good n (%)	Poor n (%)	p Value
Number of persons per household	<5	120 (66.7)	60 (33.3)	0.519	66 (36.7)	114 (63.3)	0.011 *
	5–10	107 (61.5)	67 (38.5)		87 (50.0)	87 (50.0)	
	>10	8 (57.1)	6 (42.9)		3 (21.4)	11 (78.6)	
Type of lockdown	Partial	149 (63.4)	86 (36.6)	0.745	90 (38.3)	145 (61.7)	0.070 *
	Total	80 (65.6)	42 (34.4)		62 (50.8)	60 (49.2)	
	Unsure	6 (54.5)	5 (45.5)		4 (36.4)	7 (63.6)	

*: Variables significant at $p \leq 0.25$.

Further analysis using multivariate logistic regression reveals that among those 60 and above, there were increased odds of demonstrating good COVID-19 attitudes compared to those below 60 years (aOR = 4.49, 95% CI: 1.379–14.594). Also, those who had received postgraduate training had higher odds of demonstrating good attitudes than those with a DVM degree (aOR = 1.63, 95 CI: 1.045–2.553). Similarly, among respondents with ≥ 30 years’ work experience post DVM, there was a greater likelihood of demonstrating a good attitude than respondents with less than 30 years’ work experience post DVM (aOR = 5.63, 95% CI: 1.966–16.100. In the same vein, the odds of demonstrating good attitudes was about 1.7 times higher among respondents’ resident in states where there was a total lockdown (aOR = 1.66, 95% CI: 1.070–2.590) than those in states with a partial lockdown. In contrast, the odds of developing good attitudes towards the COVID-19 pandemic and infection control was about twice as low among respondents with more than 10 persons per household (aOR = 0.47; 0.127–1.750) than those with less than five persons per household (Table 6).

Table 6. Multivariate logistic regression analysis of significant factors for level of attitude among veterinarians in Nigeria towards COVID-19 pandemic and infection control (Phase I study; $n = 368$).

Variable	Category	Attitude		aOR	95% CI	p Value
		Good n (%)	Poor n (%)			
Age	20–39	76 (38.0)	124 (62.0)	1.00 (Referent)	-	-
	40–59	69 (45.1)	84 (54.9)	1.34	0.873–2.056	0.18
	≥ 60	11 (73.3)	4 (26.7)	4.49	1.379–14.594	0.013 *
Education	DVM	59 (36.2)	104 (63.8)	1.00 (Referent)	-	-
	Postgraduate	76 (48.1)	82 (51.9)	1.63	1.045–2.553	0.031 *
	Advanced Professional	21 (44.7)	26 (55.3)	1.42	0.737–2.749	0.293
Work experience post DVM	1–10	62 (36.3)	109 (63.7)	1.00 (Referent)	-	-
	11–19	49 (44.5)	61 (55.5)	1.41	0.867–2.302	0.166
	20–29	29 (43.9)	37 (56.1)	1.38	0.773–2.458	0.277
	≥ 30	16 (76.2)	5 (23.8)	5.63	1.966–16.100	0.001 *
Work type	Private	57 (39.6)	87 (60.4)	1.00 (Referent)	-	-
	Public	92 (46.7)	105 (53.3)	1.34	0.865–2.068	0.191
	Both	7 (25.9)	20 (74.1)	0.53	0.212–1.345	0.183

Table 6. Cont.

Variable	Category	Attitude		aOR	95% CI	p Value
		Good n (%)	Poor n (%)			
No. of persons/household	<5	66 (36.7)	114 (63.3)	1.00 (Referent)	-	-
	5–10	87 (50.0)	87 (50.0)	1.73	1.130–2.641	0.012 *
	>10	3 (21.4)	11 (78.6)	0.47	0.127–1.750	0.261
Type of lockdown	Partial	90 (38.3)	145 (61.7)	1.00 (Referent)	-	-
	Total	62 (50.8)	60 (49.2)	1.66	1.070–2.590	0.024 *
	Unsure	4 (36.4)	7 (63.6)	0.92	0.262–3.234	0.897

*: Variables significant at $p \leq 0.05$.

3.5. Perception and Concerns about COVID-19

In the perception section, respondents were asked on a scale of 1 to 5 about their opinion on the impact of the pandemic on their lifestyles, the veterinary services and delivery in the country. Figure 3 demonstrates the impact of the pandemic lockdown on respondents' social, financial, physical and mental wellbeing. The lockdown had a moderate impact on the social (40.8%), financial (28.8%) and physical (30.4%) status of respondents. However, the lowest impact (35.6%) was recorded for the mental health of respondents. Sexual performance during this period was described by the respondents as the same as before the lockdown (52.4%), low (14.1%), high (12.2%) or not at all (21.2%).

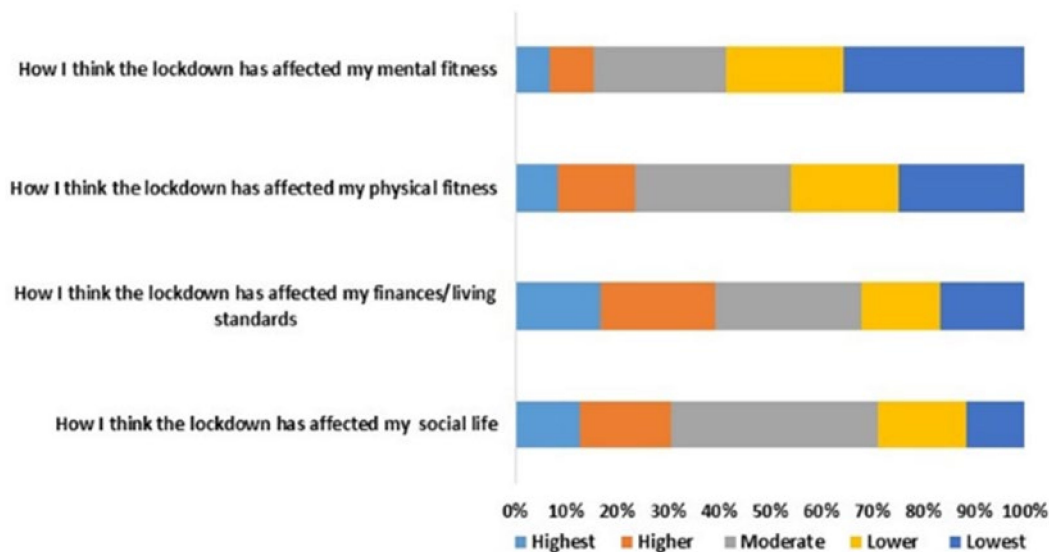


Figure 3. The impact of COVID-19 pandemic on the social, financial, physical and mental well-being of veterinarians in Nigeria.

About 28.0% (103 respondents) indicated that veterinary services and their delivery in the country would be moderately affected, while 41.1% and 31.0% believed the pandemic would have a high and less impact, respectively. Meanwhile, an average of the respondents (50%), believed that veterinary services in the country would not close down during and post-pandemic, while 34.3% viewed otherwise. The major concerns raised by the respondents about the pandemic and lockdown was the impact on the economy (96.2%). The misinformation going around social media about COVID 19 (58.4%), the impact on the education system (53.5%) and the mental wellbeing of Nigerians (53.0%) were also mentioned.

Other concerns raised were that the pandemic would increase unemployment and job insecurities, poverty and hunger, the crime rate, unwanted pregnancies, domestic

violence, stigmatization against COVID 19 patients and recoveries, corrupt practices at different governmental agencies, the burden on health care system and community spread of the disease. Asked if they were concerned about contracting the virus through zoonosis, 29.6% of the respondents were moderately worried, while 39.7% and 30.7% were less and more concerned, respectively. The lockdown in the country was agreed to be necessary by the majority of respondents (78.5%); however, 66.3% were dissatisfied with the federal government's implementation and measures to mitigate disease spread within the country. Participants suggested containment measures for the spread of COVID-19 in the country would improve if the government would liaise with national medical and veterinary laboratories (96.7%), national researchers (87.8%), international health agencies (83.7%) and non-governmental organisations (70.1%).

Moreover, many veterinarians (68.5%) agreed that the profession has not been effectively involved in government intervention plans and decisions in fighting the current pandemic. Several areas that many perceived to be veterinarians' roles in this pandemic were as follows: to initiate multi-stakeholders (one health) approach to tackling the community transmission, ensure coherent and appropriate risk management and communication, and support surveillance screening and testing of human samples. A total of 98.4% veterinarians showed that they were ready to willingly contribute their quota to combat the pandemic whenever the need arose or they were summoned to do so.

4. Discussion

This survey provides an insight into the KAP of veterinarians in Nigeria about the COVID-19 pandemic and infection control. For veterinarians and Nigerians to thrive during and in the post-COVID era, best knowledge, attitude and perception towards the disease is required. Such knowledge can help to contain the pandemic by adopting the right precautionary measures or interventions, which will invariably boost both the physical and mental health of veterinarians and the society enormously.

In our study, males were predominant, and this might be because veterinary medicine is still considered a male-dominated profession in many low–middle income countries [9,11]. The culture of the profession encourages masculine characteristics, especially in large animal handling and freedom from familial responsibilities. A recent study on knowledge, attitude, and practices of community pharmacists regarding COVID-19 in Pakistan reported more males than females in the profession [12]. However, in developed countries such as Canada, the United States of America and the United Kingdom, a significant increase in the number of females studying at veterinary colleges and practising in all fields of the profession has been reported [13,14]. In a study focused on the gendered burdens of the COVID-19 pandemic in Sri Lanka, Malaysia, Vietnam and Australia found that during disease outbreaks, females endure additional burdens in unpaid care work and community activities [15]. It may be worthwhile to gear public policy and health efforts towards addressing the issues concerned with the associations between gender and disease outbreaks.

Knowledge is a prerequisite for establishing good prevention beliefs, forming positive attitudes, promoting positive behaviour and individual cognition of their coping strategies to a certain extent [16]. The general knowledge about the cause, transmission, incubation period and those susceptible to COVID-19 among veterinarians was reported to be good in this study. This is similar to reports of knowledge of COVID-19 among health workers in China, Pakistan and Guinea [17–21], as well as dentists [22,23] and pharmacists in Jordan and Pakistan [7,12]. This may be due to the educational status of the respondents, and agrees with previous studies assessing the effect of level of education during epidemics/pandemics [24–26].

Our study also identified the mass media—TV/radio and social media as the major sources of information about COVID-19. This is consistent with other findings that showed the use of social media as a major tool for COVID-19 information dissemination in Nigeria [1,27]. About 85.49 million internet users were recorded within the first quarter of

2020, of which more than 70% are youth between 18–35 years of age [27]. This may also be the reason why highest representation of respondents in our study were between 30 and 39 years, many of who fell within one–10 years post DVM work practice. This age category is more agile, versatile, internet and social media network savvy (the medium used for the survey). Despite having adequate knowledge about the disease, this age group is largely influenced by media information. The importance of the media in providing vital information during outbreaks has been confirmed by several researchers [28–30]. Reliable guidelines and information on COVID-19 should be made available regularly by WHO and NCDC through this route. This could help dispel misinformation, misconception and ignorance in the citizenry about the COVID-19 pandemic [31]. Misinformation, underreporting and uncertainty give rise to mass hysteria and mistrust [32].

Almost half of the respondents took herbal mixtures, antibiotics, vitamins and immune boosters, aspirin and fruits as preventive measures against COVID-19. It is important to understand that no research supports the use of supplements, a particular diet, or any lifestyle modification other than observing the non-pharmaceutical measures and proper hygiene to protect against COVID-19. This study indicated that despite possessing significant knowledge about COVID-19, veterinarians are still largely influenced by media misinformation, myths and misconception, rumours, superstitions and religious beliefs. Furthermore, the self-isolation, social distancing and the wild misconceptions about the pandemic may have contributed adversely to the mental well-being and psyche of the respondents [33], as shown in this study. Several studies have shown that the mental health and well-being of populations globally appears to have been affected, especially in the initial phase of the COVID-19 pandemic, with moderate to high levels of depression, anxiety, suicidal thoughts, and an increase in prescriptions of mental health medications [34–36]. The increasing rates of suicidal thoughts, especially among young adults, are concerning [36,37]. In Nigeria, there is unfortunately widespread neglect and ignorance of mental health, with the myth that this is a foreign concept. The country only has 130 registered psychiatrists in a population of over 180 million people [38]. The recent COVID-19 crisis has had a huge impact on the mental health of Nigerians, and there is a need for detailed evaluation and quantification of this impact in order to inform necessary interventions. The government should make available, if not for all, psychological and public health services for the vulnerable population in Nigeria [33].

A majority of the respondents adhered to different precautionary measures, including good handwashing hygiene, the wearing of face masks, and maintaining social distancing. This is similar to the report recorded from an Indian population in response to the COVID-19 pandemic [38]. However, for this study, the overall attitude was categorised as being poor towards the pandemic. This finding is consistent with the strict religious beliefs, culture and tradition among Nigerians which fosters the increasingly carefree and lackadaisical attitudes of the populace [27]. The involvement of religious leaders in the fight against COVID-19 pandemic may aid in the dissemination of correct information about COVID-19 to their followers.

We further investigated the determinants for a good attitude towards the pandemic lockdown and infection control among veterinarians in Nigeria. We report that the odds of having good attitudes towards the pandemic increases among respondents aged ≥ 60 years than others. This is because they understand that the older people and those with underlying conditions are especially vulnerable to the virus. People in their 60s or 70s are, in general, at higher risk for severe illness, intensive care, the need to be put on a ventilator, and deaths than people in their 40s or 50s [39]. A meta-analysis of available data from national reports of China, Italy, Spain, the United Kingdom, and New York State on the effect of age on mortality in patients with COVID-19 showed an increase in mortality risk among patients aged 60 to 69 years compared with those aged 50 to 59 years [40]. Another study by the CDC in 2020 suggests that a person's chances of dying from the disease increase with age, and that of the 1023 deaths recorded, a majority have been ≥ 60 years of age and/or have had pre-existing, comorbid conditions such as

hypertension, cardiovascular disease, and diabetes [41]. Ageing comes with a myriad of psychological, social and environmental vulnerabilities. Frailty in older adults brings in the risk of opportunistic infections and decreased immunity. Furthermore, the older adults have multiple co-morbidities and increased hospitalizations, which increase the chance of contracting the infection during a pandemic [42,43]. Similarly, the type of lockdown influenced veterinarians' attitude to the health pandemic. The odds of demonstrating good attitudes were higher among respondents' that resided in states where there was a total lockdown. This is not surprising as there was a restriction in movement and people had to adhere to strict rules. Also, Veterinarians who had received postgraduate training were about 1.6 times more likely to demonstrate good attitudes than those who only had a DVM degree, which may be due to increased experience and exposure.

A household has been defined as spatial units, where members live in the same dwelling and share basic domestic and/or reproduction activities such as cooking and eating. Crowding is a state in which the restrictive and other physical aspects of limited space result in some psycho-physiological reactions [44]. The odds of developing good attitudes towards the COVID-19 pandemic and infection control was about twice as low among respondents with more than 10 persons per household than those with less than 5 persons, as reported in this study. This is quite worrisome, because such households with more members and poorer attitudes towards the pandemic increases household transmission as well as community spread. It's been reported that COVID-19 impacted Nigerians socioeconomically, and that smaller households will prevent crowding, ensure food security and promote good physical and mental well-being [45–47].

Many veterinarians opined that the profession has not been effectively involved in government intervention plans and decisions against the pandemic. Coronaviruses are thought to be zoonotic and have been reported as far back as 2007 as agents of emerging and re-emerging infections [48]. This brings to fore the importance of the animal, human and environment interface. Veterinarians and physicians have long dealt with many viral diseases in their daily routines, following parallel, but often non-convergent pathways. What can make a difference is an integrated control, particularly for those of zoonotic concern [49]. This should be geared towards effective management of COVID-19 by filling the gaps of communication between physicians and veterinarians to accelerate diagnosis, and to expedite treatment decisions and the implementation of preventive measures including vaccination at local, national and international levels.

Despite our findings, it is important to stress that this survey had some limitations. There was a relatively low response rate, which resulted in a smaller than expected sample size. This could have been caused by the short period of data collection. Also, only those who were active on social media had the opportunity to participate in the study. Furthermore, the lack of access to internet facilities eliminated the potential input of some veterinarians. The issue of response bias, which is prevalent in self-report surveys, could have also influenced the results. Additionally, the measurement of KAP may be imprecise due to the limited number of items. Notwithstanding these issues, this study is significant, as it is the first survey to provide baseline information on the KAP about the ravaging COVID-19 pandemic among veterinarians in Nigeria.

5. Conclusions

Veterinarians in Nigeria are aware of COVID-19 symptoms, the mode of transmission and the means of infection control. However, many had limited comprehension of the extra precautionary measures that protect their staff and other clients from COVID-19. Guidelines released by WHO and the NCDC should be highlighted by the Veterinary Council of Nigeria (VCN) and Nigerian Veterinary Medical Association (NVMA) to veterinarians during a crisis such as this. Also, the professional bodies should work towards increasing awareness among veterinarians, and ensuring they are better prepared to deal with the emergencies and challenges the pandemic and other future emerging diseases pose. This will ensure that veterinarians are well informed about the best practices recommended for

disease management and response approaches. It will also help when planning for effective risk communication. Similarly, there is the need for the profession to collectively develop and implement strategies to ensure that the veterinary practice survives the pandemic and post-pandemic eras. Generally, policy should be implemented to convey the importance of possible exposure to the virus and its prevention among the public.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/covid1030053/s1>, File S1: An online survey on the knowledge, attitude and perception of veterinarians in Nigeria towards COVID-19 pandemic.

Author Contributions: Conceptualization, O.A. (Olubukola Adenubi), A.A. and O.A. (Oluwawemimo Adebawale); methodology, O.A. (Olubukola Adenubi), O.A. (Oluwawemimo Adebawale), H.A., A.O., N.B., O.F. and P.A.-A.; software, O.A. (Oluwawemimo Adebawale) and H.A.; validation, A.A.; formal analysis, O.A. (Oluwawemimo Adebawale) and H.A.; investigation, O.A. (Olubukola Adenubi), O.A. (Oluwawemimo Adebawale), H.A., A.O., N.B., O.F. and P.A.-A.; data curation, O.A. (Oluwawemimo Adebawale) and O.A. (Olubukola Adenubi); writing—original draft preparation, O.A. (Olubukola Adenubi) and O.A. (Oluwawemimo Adebawale); writing—review and editing, A.A.; visualization, O.A. (Oluwawemimo Adebawale); supervision, A.A.; project administration, O.A. (Olubukola Adenubi), O.A. (Oluwawemimo Adebawale) and A.A.; All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was approved by the College of Veterinary Medicine, Federal University of Agriculture Research Ethics Committee (reference number: 21/132/2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. A statement at the beginning of the questionnaire introduced the purpose of our study, and that participation in the study was strictly voluntary and considered as consent. Precautions were taken to ensure confidentiality and tracing the identity of the subjects was not possible. No advertisement of this study was done or incentives provided for.

Data Availability Statement: The datasets generated and/or analysed during the current study are available in the Mendeley data repository. Reserved doi:10.17632/ssfxhn68jw.1. Link: <https://data.mendeley.com/drafts/ssfxhn68jw>.

Acknowledgments: The authors are grateful to the Veterinary Council of Nigeria, Deans of Veterinary Schools and Directors of Veterinary Teaching Hospitals. All our colleagues who assisted in data collection and the respondents are also acknowledged. This research work is dedicated to the memory of the president of the Nigerian Veterinary Medical Association (2018–2020), Bello Muhammed Agaie who died on 12 May 2020 due to COVID-19 complications.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Social Science Research Network (SSRN). A Preliminary Assessment of Novel Coronavirus (COVID-19) Knowledge and Perceptions in Nigeria. Available online: <https://doi.org/10.2139/ssrn.3584408> (accessed on 20 May 2021).
2. WHO. World Health Organization Coronavirus (COVID-19) Dashboard. Available online: <https://covid19.who.int/> (accessed on 16 August 2021).
3. Peter Lloyd. The Virus and Lockdown: The Devil and the Deep Blue Sea. Available online: <https://www.peter-lloyd.co.uk/papers-and-blogs/> (accessed on 11 May 2021).
4. Nigeria Centre for Disease Control (NCDC). Available online: <https://covid19.ncdc.gov.ng/report/> (accessed on 21 May 2021).
5. Achoja, O.F.; Ike, P.C.; Akporhwarcho, P.O. Economics of veterinary services delivery among commercial poultry farmers in a market-driven economy: Evidence from Delta State, Nigeria. *Int. J. Polut. Sci.* **2010**, *9*, 1140–1145. [[CrossRef](#)]
6. Lauer, S.A.; Grantz, K.H.; Bi, Q.; Jones, F.K.; Zheng, Q.; Meredith, H.R.; Asman, A.S.; Reich, N.J.; Lessler, J. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: Estimation and application. *Ann. Intern. Med.* **2020**, *172*, 577–582. [[CrossRef](#)] [[PubMed](#)]
7. Karasneh, R.; Al-Azzam, S.; Muflih, S.; Soudah, O.; Hawamdeh, S.; Khader, Y. Media's effect on shaping knowledge, awareness risk perceptions and communication practices of pandemic COVID-19 among pharmacists. *Res. Soc. Adm. Pharm.* **2020**, *17*, 1897–1902. [[CrossRef](#)] [[PubMed](#)]

8. Eysenbach, G. Improving the quality of Web surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *J. Med. Internet Res.* **2004**, *6*, e34. [[CrossRef](#)]
9. Adebowale, O.O.; Adenubi, O.T.; Adesokan, H.K.; Oloye, A.A.; Bankole, N.O.; Fadipe, O.E.; Ayo-Ajayi, P.O.; Akinloye, A.K. SARS-CoV-2 (COVID-19 pandemic) in Nigeria: Multi-institutional survey of knowledge, practices and perception amongst undergraduate veterinary medical students. *PLoS ONE* **2021**, *16*, e0248189. [[CrossRef](#)]
10. Kaliyaperumal, K.I. Guideline for conducting a knowledge, attitude and practice (KAP) study. *AECS Illumin.* **2004**, *4*, 7–9.
11. Adebowale, O.O.; Afolabi, M.O.; Adesokan, H.K.; Fasanmi, O.G.; Awoyomi, O.J.; Fasina, O.F. Determinants of work-related risks among veterinary clinical students in South West Nigeria. *Vet. Med. Int.* **2020**, *1*, 1–10. [[CrossRef](#)]
12. Muhammad, K.; Saqlain, M.; Muhammad, G.; Hamdard, A.; Naveed, M.; Butt, M.H.; Khan, S.; Ismael, N.S.; Khan, Z.; Karatas, Y. Knowledge, Attitude, and Practices (KAPs) of Community Pharmacists Regarding COVID-19: A Cross-Sectional Survey in 2 Provinces of Pakistan. *Disaster Med. Public Health Prep.* **2021**, *16*, 1–9. [[CrossRef](#)]
13. Lofstedt, J. Gender and veterinary medicine. *Can. Vet. J.* **2003**, *44*, 533–535.
14. Begeny, C.; Ryan, M. Gender discrimination in the veterinary profession. *Policy* **2018**, *20*, 6370.
15. McLarn, H.J.; Wong, K.R.; Nguyen, K.N.; Mahamadachchi, K.N.D. Covid-19 and women's triple burden: Vignettes from Sri Lanka, Malaysia, Vietnam and Australia. *Soc. Sci.* **2020**, *9*, 87. [[CrossRef](#)]
16. McEachan, R.; Taylor, N.; Harrison, R.; Lawton, R.; Gardner, P.; Conner, M. Meta-analysis of the reasoned action approach (RAA) to understanding health behaviours. *Ann. Behav. Med.* **2016**, *50*, 592–612. [[CrossRef](#)]
17. Zhou, M.; Tang, F.; Wang, Y.; Nie, H.; Zhang, L.; You, G.; Zhang, M. Knowledge, attitude and practice regarding COVID-19 among health care workers in Henan, China. *J. Hosp. Infect.* **2020**, *105*, 183–187. [[CrossRef](#)]
18. Gao, H.; Nguyen, T.N.H.; Tran, V.K.; Vo, K.N.; Vo, V.T.; Pham, L.A. Knowledge and attitude toward COVID-19 among healthcare workers at District 2 Hospital, Ho Chi Minh City. *Asian Pac. J. Trop. Med.* **2020**, *13*, 260–265. [[CrossRef](#)]
19. Saqlain, M.; Munir, M.M.; Rehman, S.; Gulzar, A.; Naz, S.; Ahmed, Z.; Tahir, A.H.; Mashhood, M. Knowledge, attitude, practice and perceived barriers among healthcare professionals regarding COVID-19: A Cross-sectional survey from Pakistan. *J. Hosp. Infect.* **2020**, *105*, 419–423. [[CrossRef](#)]
20. Shi, Y.; Wang, J.; Yang, Y.; Wang, Z.; Wang, G.; Hashimoto, K.; Zhang, K.; Liu, H. Knowledge and attitudes of medical staff in Chinese psychiatric hospitals regarding COVID-19. *Brain Behav. Immun.* **2020**, *4*, 100064. [[CrossRef](#)]
21. Camara, I.; Touré, A.; Camara, A.; Le Marcis, F.; Bangoura, S.T.; Kpamou, C.; Sow, M.S.; Keita, A.K. Preparing for the COVID-19 pandemic response in a country emerging from an Ebola epidemic: Assessment of health workers' knowledge, attitudes and practices on Coronavirus (COVID-19) in Guinea. *J. Public Health Epidemiol.* **2020**, *12*, 318–328. [[CrossRef](#)]
22. Khanal, N.; Singh, A.K. Knowledge, Attitude and Practice Regarding COVID-19 and its Impact on Dentistry: A Cross-sectional Survey among Nepalese Dentists. *Kathmandu Univ. Med. J.* **2020**, *18*, 3–9. [[CrossRef](#)]
23. Khader, Y.; Al Nsour, M.; Al-Batayneh, O.B.; Saadeh, R.; Bashier, H.; Alfaqih, M.; Al-Azzam, S. Dentists' awareness, perception, and attitude regarding COVID-19 and infection control: Cross-sectional study among Jordanian dentists. *JMIR Public Health Surveill.* **2020**, *6*, e18798. [[CrossRef](#)]
24. Brug, J.; Aro, A.R.; Oenema, A.; De Zwart, O.; Richardus, J.H.; Bishop, G.D. SARS risk perception, knowledge, precautions and information sources, the Netherlands. *Emerg. Infect. Dis.* **2004**, *10*, 1486–1489. [[CrossRef](#)]
25. Choi, J.S.; Yang, N.Y. Perceived knowledge, attitude, and compliance with preventive behavior on influenza A (H1N1) by university students. *J. Korean Acad. Adult Nurs.* **2010**, *22*, 250–259.
26. Hussain, Z.A.; Hussain, S.A.; Hussain, F.A. Medical students' knowledge, perceptions, and behavioral intentions towards the H1N1 influenza, swine flu in Pakistan: A brief report. *Am. J. Infect. Control* **2012**, *40*, e11–e13. [[CrossRef](#)]
27. Reuben, R.C.; Danladi, M.M.; Saleh, D.A.; Ejembi, P.E. Knowledge, attitudes and practices towards COVID-19: An epidemiological survey in North-Central Nigeria. *J. Community Health* **2021**, *46*, 457–470. [[CrossRef](#)]
28. Lau, J.T.F.; Yang, X.; Tsui, H.; Kim, J.H. Monitoring community responses to the SARS epidemic in Hong Kong: From day 10 to day 62. *J. Epidemiol. Community Health* **2003**, *57*, 864–870. [[CrossRef](#)]
29. Vartti, A.M.; Oenema, A.; Schreck, M.; Uutela, A.; de Zwart, O.; Brug, J.; Aro, A.R. SARS knowledge, perceptions, and behaviors: A comparison between Finns and the Dutch during the SARS outbreak in 2003. *Int. J. Behav. Med.* **2009**, *16*, 41–48. [[CrossRef](#)]
30. Voeten, H.; De Zwart, O.; Veldhuijzen, I.K.; Yuen, C.; Jiang, X.; Elam, G.; Abraham, T.; Brug, J. Sources of information and health beliefs related to SARS and Avian influenza among Chinese communities in the United Kingdom and The Netherlands, compared to the general population in these countries. *Int. J. Behav. Med.* **2009**, *16*, 49–57. [[CrossRef](#)]
31. Adenubi, O.T.; Adebowale, O.O.; Oloye, A.A.; Bankole, N.O.; Ayo-Ajayi, P.O.; Akinloye, A.K. University community-based survey on the knowledge, attitude and perception about COVID-19 pandemic: The Federal University of Agriculture, Abeokuta, Nigeria as a case study. *J. Prev. Med. Hyg.* **2021**, *62*, 575–585. [[CrossRef](#)]
32. Banerjee, D. The impact of Covid-19 pandemic on elderly mental health. *Int. J. Geriatr. Psychiatry* **2020**, *35*, 1466–1467. [[CrossRef](#)]
33. Olaseni, A.O.; Akinsola, O.S.; Agberotimi, S.F.; Oguntayo, R. Psychological distress experiences of Nigerians amid COVID-19 pandemic. *SSRN Open* **2020**, *2*, 1–7. [[CrossRef](#)]
34. O'Connor, R.C.; Wetherall, K.; Cleare, S.; McClelland, H.; Melson, A.J.; Niedzwiedz, C.L.; O'Carroll, R.E.; O'Connor, D.B.; Platt, S.; Scowcroft, S.; et al. Mental health and well-being during the COVID-19 pandemic: Longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study. *Br. J. Psychiatry* **2020**, *218*, 1–8. [[CrossRef](#)]

35. Gray, N.S.; O'Connor, C.; Knowles, J.; Pink, J.; Simkiss, N.J.; Williams, S.D.; Snowden, R.J. The influence of the COVID-19 pandemic on mental well-being and psychological distress: Impact upon a single country. *Front. Psychiatry* **2020**, *11*, 594115. [[CrossRef](#)] [[PubMed](#)]
36. McGinty, E.E.; Presskreischer, R.; Han, H.; Barry, C.L. Psychological distress and loneliness reported by US Adults in 2018 and April 2020. *JAMA* **2020**, *324*, 93–94. [[CrossRef](#)] [[PubMed](#)]
37. Shahil, F.A.; Akber, A.N.; Feroz, R.; Nazim, M.S.; Saleem, S. Impact of the COVID-19 pandemic on mental health and well-being of communities: An exploratory qualitative study protocol. *BMJ Open* **2020**, *10*, e041641. [[CrossRef](#)]
38. Medtrendorg. Available online: <https://medtrend.org/impact-of-mental-health-neglect-and-ignorance-in-nigeria> (accessed on 21 May 2021).
39. Roy, D.; Tripathy, S.; Kar, S.K.; Sharma, N.; Verma, S.K.; Kaushal, V. Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic. *Asian J. Psychiatry* **2020**, *51*, 102083. [[CrossRef](#)]
40. Bonanad, C.; García-Blas, S.; Tarazona-Santabalbina, F.; Sanchis, J.; Bertomeu-González, V.; Fácila, L.; Ariza, A.; Nuñez, J.; Cordero, A. The effect of age on mortality in patients with COVID-19: A meta-analysis with 611,583 subjects. *J. Am. Med. Dir. Assoc.* **2020**, *21*, 915–918. [[CrossRef](#)]
41. Word Journal of Clinical Cases. Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) in China. Available online: <https://doi.org/10.3760/cma.j.issn.0254-6450.2020.02.003> (accessed on 21 May 2021).
42. Sanyaolu, A.; Okorie, C.; Marinkovic, A.; Patidar, R.; Younis, K.; Desai, P.; Hosein, Z.; Padda, I.; Mangat, J.; Altaf, M. Comorbidity and its Impact on Patients with COVID-19. *SN Compr. Clin. Med.* **2020**, *2*, 1069–1076. [[CrossRef](#)]
43. Banerjee, D. 'Age and ageism in COVID-19': Elderly mental health-care vulnerabilities and needs. *Asian J. Psychiatry* **2020**, *51*, 102154. [[CrossRef](#)]
44. Asiyanbola, R.A. Psychological wellbeing, urban household crowding and gender in developing countries: Nigeria. *Dev. Ctry. Stud.* **2012**, *2*, 127–134.
45. Titus, B.; Adetokunbo, G. An analysis of food security situation among Nigerian urban households: Evidence from Lagos State, Nigeria. *J. Cent. Eur. Agric.* **2007**, *8*, 397–406.
46. Social Science Research Network (SSRN). COVID-19 Pandemic and Financial Well-Being: Insights from Nigerian Households. Available online: <https://doi.org/10.2139/ssrn.3620096> (accessed on 21 May 2021).
47. Williams, M.C.; Ezeoke, Q.A.; Adelodun, V. Nigerians perspectives on covid-19 pandemic and how it affects their lifestyle and financial status. *Eur. J. Biol. Med. Sci. Res.* **2020**, *8*, 8–19.
48. Kahn, L.H. Confronting zoonoses, linking human and veterinary medicine. *Emerg. Infect. Dis.* **2006**, *12*, 556–561. [[CrossRef](#)]
49. Wong, S.; Lau, S.; Woo, P.; Yuen, K.Y. Bats as a continuing source of emerging infections in humans. *Rev. Med. Virol.* **2007**, *17*, 67–91. [[CrossRef](#)]