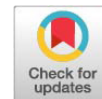


Research Article



A Retrospective Study of Coronavirus Infection (COVID-19) in Nigeria

Bridget Maria Jessica Adah^{1*}, James Agbo Ameh¹, Samuel Mailafia¹, Hamza Olatunde Kazeem Olabode¹, Monday M. Onakpa², Martha Echiada Ogbale¹, Casmir Ifeanyichukwu Cajetan Ifeanyi⁴, George Goodness Awopetu⁴ and Olamide Tawa Owolabi³.

¹Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Abuja, Nigeria; ²Department of Veterinary Pharmacology, Faculty of Veterinary Medicine, University of Abuja, Nigeria; ³Department of Animal Health and Production Technology, Rufus Giwa Polytechnic, Ondo State, Nigeria; ⁴Department of Medical Laboratory Science, Faculty of Allied Health Science, University of Abuja, Nigeria.

Abstract | This retrospective study evaluated the Laboratory/clinical and epidemiological reports of patients with confirmed *Coronavirus* disease (COVID-19) in Nigeria to determine the prevalence of the disease in Nigeria. For this retrospective study, data was collected from online weekly reports of the Nigerian Center for Disease Control (NCDC) on patients with suspected/confirmed COVID-19 infection between the periods of February 2020, to September 2021. This study observed a case fatality rate (CFR) of 1.32% for COVID-19 infection in Nigeria during the pandemic (February 2020–September 2021), with Lagos state having the highest number of confirmed / positive cases (77,193), highest number of cases admitted into the hospital (4,179), highest number of discharged patients from the hospital (72,350) and highest number of deaths recorded (664) during the pandemic than other states of the federation (Table 1). The lowest number of laboratories confirmed cases (based on the PCR-based SARS-COV-2 Virus test kits used), was observed in patients tested in Kogi State (5), the state also showed the lowest incidence of death (2) and had no admitted cases (0) (Table 1) with COVID-19 Infection. The CFR reported earlier was 2.8% by the NCDC but the CFR obtained in this study is 1.32%. In this retrospective study, prevalence rates were established for all the 36 states and the FCT as shown in (Table 2). The highest prevalence rates were observed in Lagos (77,193) and FCT (22,645) to be 0.70% and 0.63% respectively, while the lowest prevalence rates were observed in Kogi State (5) and Zamfara (276) with a prevalent rate of 0.0001% and 0.006%, respectively. This study has established the prevalence of COVID-19 infections in all the states of Nigeria and a more prospective study is required in other to evaluate treatment protocols to determine the best effective methods as early diagnosis is a crucial tool for controlling the spread of COVID-19 infections.

Received | January 20, 2025; **Accepted** | April 05, 2026; **Published** | June 29, 2026

***Correspondence** | Bridget Maria Jessica Adah, Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Abuja, Nigeria; **Email:** bridget.adah@uniabuja.edu.ng

Citation | Adah, B.M.J., J.A. Ameh, S. Mailafia, H.O.K. Olabode, M.M. Onakpa, M.E. Ogbale, C.I.C. Ifeanyi, G.G. Awopetu and O.T. Owolabi. 2026. A retrospective study of coronavirus infection (COVID-19) in Nigeria. *Hosts and Viruses*, 13: 87-94.

DOI | <https://dx.doi.org/10.17582/journal.hv/2026/13.87.94>

Keywords: COVID-19 Virus, CFR, Prevalence rate, Retrospective study, Nigeria, Pandemic



Copyright: 2026 by the authors. Licensee ResearchersLinks Ltd, England, UK.

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/>).

Introduction

The novel SARS-CoV-2 (Severe Acute Respiratory Syndrome *Corona Virus 2*) is a highly transmissible and pathogenic *coronavirus* that emerged in late 2019 and has caused a pandemic of acute respiratory disease, named “*Coronavirus disease 2019*” (COVID 19), which threatens human health and public safety. *Corona virus* first appeared in Wuhan, China, in December 2019, and by early 2020 the outbreak of *coronavirus disease 2019* (COVID-19) had progressed to a global pandemic (Ben *et al.*, 2021). On January 30, 2020, the World Health Organization (WHO) designated the epidemic as a public health emergency of international concern (PHEIC). On March 11, 2020, the WHO determined that the outbreak has progressed to the point of pandemic, with more than seven million cases documented worldwide as of June 7, 2020 (WHO, 2020).

The virus is a novel beta *coronavirus* which belongs to the family *Coronaviridae*, Genus Beta *coronavirus* and Subgenus *Sarbecovirus* (Decaro and Lorusso, 2020). It has been reported to cause disease in both human and animals with clinical signs like fever, fatigue, dry cough, sputum production, headache, haemoptysis, diarrhea, anorexia, sore throat, chest pain, chills, nausea, vomiting, olfactory and taste disorders, dyspnea and pneumonia which are seen after an incubation period of 1-14 days (Tsai *et al.*, 2021; Lau *et al.*, 2005). COVID-19 symptoms range from asymptomatic to deadly, but the most commonly reported symptoms worldwide are fever, sore throat, nocturnal cough, and fatigue (Assiri *et al.*, 2024).

The route of transmission is via inhalation of aerosol and direct contact with mucous membranes but transplacental transmission of SARS-CoV-2 from an infected mother to a neonate has been reported (Chen, 2020). Mutations have produced many strains (variants) with varying degrees of infectivity and virulence (Diard and Hardt, 2017).

The time between symptom onset and death ranges from 6 to 41 days, typically about 14 days. Mortality rates increase as a function of age. People at the greatest mortality risk are the elderly and those with underlying conditions. However, clinical manifestation differs with age and individuals greater than 60 years of age are more greatly affected and most likely requires hospitalization whereas younger

individuals and children shows only a mild disease or to a large extent, might be asymptomatic (Liu *et al.*, 2020).

Diagnosis is usually based on the use of serological and molecular assays, while treatment is currently based on symptomatic treatment in patients as no specific antiviral agents against SARS-CoV-2 has been developed yet though currently, COVID-19 vaccines are being administered all over the world as a preventive/control measure (Zhao *et al.*, 2020).

The initial cases of COVID-19 were described as pneumonia of unknown etiology. The first four patients were exposed in the Huanan (Southern China) Seafood Market. Initially, the pneumonia presented with symptoms of respiratory infection, but some patients experienced severe disease that ultimately progressed to acute respiratory distress syndrome (ARDS), or even death (Li *et al.*, 2020).

The Coronavirus disease of 2019 (COVID-19) pandemic shocked the world, overwhelming the health systems of even high-income countries. Predictably, the situation has elicited social and medical responses from the public and governments, respectively. Nigeria recorded an imported case from Italy on February 27, 2020. This paper employs analytical methods and collates data from various online sources.

The incidence of COVID-19 in Nigeria

On 27th February, a 44-year old Italian citizen was diagnosed of COVID-19 in Lagos State. The case is the first to be reported in Nigeria since the first confirmed case was reported from China in January 2020. The case arrived the Murtala Muhammed International Airport, Lagos at 10pm on 24th February 2020 aboard Turkish airline from Milan, Italy. He traveled on to his company site in Ogun state on 25th February. On 26th February, he presented at the staff clinic in Ogun and there was high index of suspicion by the managing physician. He was referred to IDH Lagos and COVID-19 was confirmed on 27th February (Odukoya *et al.*, 2021).

A multi-sectoral emergency operations centre (EOC) was activated on the 28th of February at Level 3 which is the highest level of response to public health emergencies. And there is an ongoing risk communications campaign across the country.

The incidence of COVID-19 grew steadily in Nigeria, moving from an imported case to community transmission. The case fatality stood at 2.8% (NCDC, 2021). The country recorded an upsurge (52% of total cases) in the transmission of COVID-19 during the short period the lockdown was relaxed (Chen, 2020).

Following this WHO declaration, the *Coronavirus* Preparedness Group was constituted on January 31 in Nigeria (a country with 36 states and a Federal Capital Territory [FCT]). WHO categorized Nigeria as one of the 13 high-risk African countries with respect to the spread of COVID-19. Nigeria is also among the vulnerable African nations, given the weak state of healthcare system (Wu *et al.*, 2020).

In Africa, there are still communities without healthcare facilities, apart from the scarcity of health workers. The projection is that Africa could bear the final burden of the COVID-19 pandemic if the countries do not institute effective measures to combat the pandemic (Ben *et al.*, 2021).

Sociologically, the pandemic has caused global social disruption by limiting global social relations. The idea of “social distancing” decreases regular social interaction, which is the bedrock of human society. A contagious disease of global health importance also disrupts the usual norms of close physical contacts since the disease transmits through contact with individuals who already contracted the disease. COVID-19 deglobalizes the world in terms of human migration with airports shut, and social events (sports, festivals and the like) postponed indefinitely. The stay-at-home campaign and proscription of (large) social gatherings mean that social interaction has been limited.

Globalization, which signifies compression of time and space, aids the transmission of diseases on a global scale, facilitating the spread of COVID-19. The world has been witnessing global trade, movement of people, and the globalization of health. The global transmission of diseases is one of the dysfunctions or latent functions of globalization, which offers both opportunities and catastrophes (Li *et al.*, 2020).

The first discharged case after treatment was reported on the 13th of March 2020 in Ogun state. The discharged case was a confirmed contact of the 1st index case reported on the 27th of February in Ogun

state, which was treated in the infectious disease hospital (IDH) Lagos state.

In the absence of suitable data collection and research funding, stopping the *coronavirus*'s global spread will be challenging, if not impossible. In the shortest amount of time, the Covid-19 virus's genome was sequenced, which made it possible to share information and diagnose the illness in other nations (Sharma *et al.*, 2021). Identification of persons at risk has also been aided by reporting of the clinical characteristics of infected individuals. Local research that can aid in comprehending the dynamics of the disease in Nigeria should be supported by the NCDC and the Nigerian government. In order to respond appropriately, the acquired data should also be shared with the pertinent authorities and parties (Olayinka and Yetunde, 2020).

Post pandemic situational reports on COVID 19

COVID-19 vaccines were developed rapidly and deployed to the general public beginning in December 2020, made available through government and international programmes such as COVAX (COVID-19 Vaccines Global Access), aiming to provide vaccine equity. Treatments include novel antiviral drugs and symptom control. Common mitigation measures during the public health emergency included travel restrictions, lockdowns, business restrictions and closures, workplace hazard controls, mask mandates, quarantines, testing systems, and contact tracing of the infected.

The pandemic caused severe social and economic disruption around the world, including the largest global recession since the Great Depression. Widespread supply shortages, including food shortages, were caused by supply chain disruptions and panic buying. Reduced human activity led to an unprecedented temporary decrease in pollution. Educational institutions and public areas were partially or fully closed in many jurisdictions, and many events were cancelled or postponed during 2020 and 2021. Telework became much more common for white-collar workers as the pandemic evolved. Misinformation circulated through social media and mass media, and political tensions intensified. The pandemic raised issues of racial and geographic discrimination, health equity, and the balance between public health imperatives and individual rights.

In May 2022, the WHO estimated the number of excess deaths by the end of 2021 to be 14.9 million compared to 5.4 million reported COVID-19 deaths, with the majority of the unreported 9.5 million deaths believed to be direct deaths due to the virus, rather than indirect deaths. Some deaths were because people with other conditions could not access medical services.

As of 10 March 2023, more than 6.88 million deaths had been attributed to COVID-19. The first confirmed death was in Wuhan on 9 January 2020. These numbers vary by region and over time, influenced by testing volume, healthcare system quality, treatment options, government response, time since the initial outbreak, and population characteristics, such as age, sex, and overall health.

The WHO ended the PHEIC for COVID-19 on 5 May 2023. The disease has continued to circulate. However, as of 2024, experts were uncertain as to whether it was still a pandemic. Pandemics and their ends are not well-defined, and whether or not one has ended differs according to the definition used. As of 9 March 2025, COVID-19 has caused 7,090,763 confirmed deaths, and 18.2 to 33.5 million estimated deaths. The COVID-19 pandemic ranks as the fifth-deadliest pandemic or epidemic in history.

Multiple measures are used to quantify mortality. Official death counts typically include people who died after testing positive. Such counts exclude deaths without a test. Conversely, deaths of people who died from underlying conditions following a positive test may be included. Countries such as Belgium include deaths from suspected cases, including those without a test, thereby increasing counts.

Materials and Methods

Study area

Nigeria is a country situated on the Western coast of Africa, which has a varied geography with various climatic conditions ranging from dry to humid tropics. The country is blessed with sufficient natural resources like petroleum deposits, natural gas, limestone and coal. The national capital is Abuja located in the F.C.T. Nigeria is surrounded by Niger to the North, Chad and Cameroon to the East, Gulf of Guinea in the Atlantic Ocean to the South, and Benin to the West. The country has three geographical regions namely; the South, the Central and the Northern

regions. Nigeria is one of the heavily populated countries in Africa covering a land area of 923,769 square kilometers (KM²), with a population density of over two hundred and eleven million. The largest city in Nigeria is Lagos, which is where the first incidence case of COVID 19 was reported (Juang, 2008; Kirk-greene *et al.*, 2022).

Study design

This study is a descriptive retrospective study, carried out to evaluate the incidence of COVID-19 from the Laboratory/clinical and epidemiological reports of patients with confirmed *Coronavirus* disease (COVID-19) in Nigeria from February 2020 to September 2021 using an online data collation method.

Source of data

The data used for this retrospective study was obtained and collated from the report of the Nigeria center for disease control (NCDC) official website using online data collation method. The data used was collated from online weekly reports of the NCDC on patients with suspected/confirmed COVID-19 infection between the periods of February 2020, to September 2021 (during the COVID -19 pandemic).

Statistical analysis

Statistical packages for social science (SPSS) software (version 23.0), was used in this study for all the statistical analysis required. The frequency and distribution of *Coronavirus* infection in all the states were presented using simple descriptive statistical measures like percentages, tables and charts. The CFR derived from this study, was calculated using the following fomula:

$$CFR = \frac{\text{Number of death}}{\text{Number of cases}} \times 100$$

$$\text{COVID - 19 Infection Case Fatality Rate (CFR)} = \frac{\text{Total Number of Deaths}}{\text{Total Number of Infected Patients}} \times 100$$

$$CFR = \frac{2,756}{208,153} \times 100$$

$$CFR = 1.32\%$$

Result and Discussion

This study observed a CFR of 1.32% for COVID -19 infection in Nigeria during the pandemic (February 2020-September 2021), with Lagos state having the highest number of confirmed/ positive cases (77,193), highest number of cases admitted into the hospital (4,179), highest number of discharged patients from

the hospital (72,350) and highest number of death recorded (664) during the pandemic than other states of the federation (Table 1).

Table 1: *The total number of confirmed cases in all the states in Nigeria.*

States affected	No. of cases (Lab confirmed)	No. of cases (on admission)	No. discharged	No. of deaths
Confirmed cases by state				
Lagos	77,193	4,179	72,350	664
FCT	22,645	1,618	20,822	205
Rivers	12,335	118	12,063	154
Kaduna	9,824	142	9,607	75
Plateau	9,508	108	9,335	65
Oyo	8,712	525	7,996	191
Edo	6,539	344	5,972	223
Ogun	5,370	5	5,285	80
Ondo	4,514	64	4,352	98
Akwa Ibom	4,342	358	3,940	44
Kano	4,249	62	4,073	114
Kwara	3,904	192	3,650	62
Delta	3,541	877	2,556	108
Osun	2,948	20	2,843	85
Enugu	2,682	64	2,589	29
Gombe	2,530	58	2,420	52
Nasarawa	2,472	88	2,345	39
Anambra	2,369	17	2,333	19
Katsina	2,226	6	2,185	35
Ebonyi	2,059	24	2,003	32
Imo	1,988	72	1,875	41
Abia	1,975	53	1,896	26
Ekiti	1,745	46	1,672	27
Benue	1,744	264	1,455	25
Bauchi	1,631	18	1,596	17
Borno	1,356	4	1,314	38
Bayelsa	1,227	11	1,188	28
Adamawa	1,157	27	1,098	32
Taraba	1,092	14	1,054	24
Niger	1,036	18	998	20
Sokoto	802	2	772	28
Cross River	605	15	565	25
Jigawa	592	15	561	16
Yobe	502	3	490	9
Kebbi	458	9	433	16
Zamfara	276	21	247	8
Kogi	5	0	3	2
Total	208,153	9,461	195,936	2,756

Source: NCDC, 2021.

The case fatality reported earlier was 2.8% by the NCDC but the CFR obtained in this study is 1.32%, which is lower than that reported earlier. This might imply that all the COVID-19 protocols put in place in the country are effective and hence led to a reduction of the case fatality rate from 2.8% to 1.3% recorded in this study.

This high incidence observed in Lagos (Figure 1) was attributed to the overcrowded and busy nature of Lagos State as an active centre of commerce with a very active international airport which allows for inflow of individuals out/into the state and country (point of entry) (NCDC, 2021), which can serve as a portal of entry or source of infection as the disease is highly infectious and spread via aerosol/droplets.

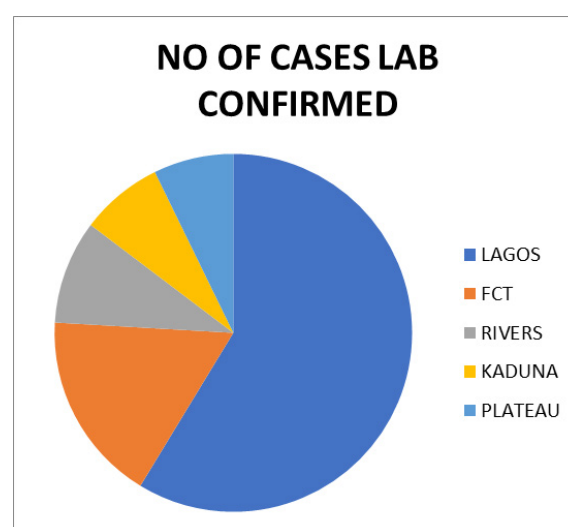


Figure 1: *The 5 states with the highest number of confirmed positive cases.*

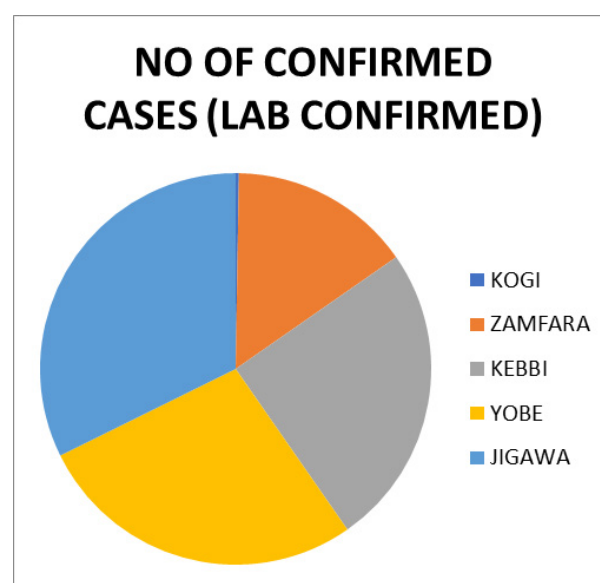


Figure 2: *The 5 states with the lowest number of confirmed positive cases.*

Table 2: *The prevalence rates of Covid-19 infections in all the states and FCT of Nigeria.*

S. No	State	Total positive cases of COV-ID-19	Population (2016)	Prevalence rate (%)
1	Lagos	77,193	11,000,598	0.70
2	Fct	22,645	3,564,126	0.63
3	Rivers	12,335	7,000,924	0.17
4	Kaduna	9,824	8,252,366	0.11
5	Plateau	9,508	4,200,442	0.22
6	Oyo	8,712	7,010,864	0.12
7	Edo	6,539	4,235,595	0.15
8	Ogun	5,370	5,217,716	0.10
9	Ondo	4,514	4,671,695	0.09
10	Akwa Ibom	4,342	5,482,177	0.07
11	Kano	4,249	16,076,892	0.02
12	Kwara	3,904	3,192,893	0.12
13	Delta	3,541	5,663,362	0.06
14	Osun	2,948	5,556,247	0.05
15	Enugu	2,682	4,411,119	0.06
16	Gombe	2,530	3,256,962	0.07
17	Nasarawa	2,472	2,523,395	0.09
18	Anambra	2,369	5,527,809	0.04
19	Katsina	2,226	7,831,319	0.02
20	Ebonyi	2,059	3,490,383	0.05
21	Imo	1,988	4,408,756	0.04
22	Abia	1,975	3,727,347	0.005
23	Ekiti	1,745	3,270,798	0.05
24	Benue	1,744	5,741,815	0.03
25	Bauchi	1,631	6,834,314	0.02
26	Borno	1,356	5,860,183	0.02
27	Bayelsa	1,227	2,277,961	0.05
28	Adamawa	1,157	4,248,436	0.02
29	Taraba	1,092	3,066,834	0.03
30	Niger	1,036	5,556,247	0.01
31	Sokoto	802	4,998,090	0.01
32	Cross River	605	3,866,269	0.01
33	Jigawa	592	6,000,163	0.009
34	Yobe	502	3,294,137	0.01
35	Kebbi	458	4,440,050	0.01
36	Zamfara	276	4,515,427	0.006
37	Kogi	5	4,473,490	0.0001
	Total	208,153	194,747,200	20.1001

The lowest number of laboratory confirmed cases (based on the PCR-based SARS-COV-2 Virus test kits used), was observed in patients tested in Kogi State (5), the state also showed the lowest incidence

of death (2) and had no admitted cases (0) (Table 1) with COVID-19 Infection, as shown in Figure 2. This was attributed to under reporting or lack of adequate testing materials required for laboratory confirmation of the disease in line with the report of the NCDC which states that inadequate testing for COVID -19 in Kogi State leading to an underestimation of the true extent of the spread of the disease in Kogi State (Figure 2) (NCDC, 2021: Odukoya, 2021).

In this retrospective study, prevalence rates were established for all the 36 states and the FCT (Table 2). The highest prevalence rates were observed in Lagos (77,193) and FCT (22,645) to be 0.70% and 0.63% respectively, while the lowest prevalence rates were observed in Kogi State (5) and Zamfara (276) with a prevalent rate of 0.0001% and 0.006% respectively and this was attributed to under reporting due to inadequate/lack of testing for COVID- 19 Virus infection due to inadequate availability of the PCR-based SARS-COV-2 Virus test kits.

At December 2022 WHO study estimated excess deaths from the pandemic during 2020 /2021 and reported that over 14.8 million excess early deaths occurred, reaffirming and detailing their prior calculations from May as well as updating them, addressing criticisms. These numbers do not include measures like years of potential life lost and this may make the pandemic 2021's leading cause of death worldwide.

Study limitations

In this study, it was difficult to analyze the association of differences between variables and severity because the load of infection and demographic data was not evaluated and evaluations of the pre- pandemic periods were not carried out.

Conclusion

This study has established the case fatality rate of covid-19 infections in all the states of Nigeria and a more prospective study is required in other to evaluate treatment protocols to determine the best effective methods as early diagnosis is crucial for controlling the spread of COVID-19 infections. The study is of value in providing baseline prevalence data that add to what is known of this emerging viral disease and will be of use in the ongoing effort to control this pandemic.

Official death counts have been claimed to underreport the actual death toll, because excess mortality (the number of deaths in a period compared to a long-term average) data show an increase in deaths that is not explained by COVID-19 deaths alone. Using such data, estimates of the true number of deaths from COVID-19 worldwide have included a range from 18.2 to 33.5 million (≈ 27.4 million) by 18 November 2023 by The Economist, as well as over 18.5 million by 1 April 2023 by the Institute for Health Metrics and Evaluation and ≈ 18.2 million (earlier) deaths between 1 January 2020, and 31 December 2021, by a comprehensive international study. Such deaths include deaths due to healthcare capacity constraints and priorities, as well as reluctance to seek care (to avoid possible infection). Further research may help distinguish the proportions directly caused by COVID-19 from those caused by indirect consequences of the pandemic.

Recommendation

1. There is need for carrying out a further retrospective study of pre pandemic periods and also a prospective study to give a greater insight on the study of COVID -19 Infections in Nigeria.
2. Further investigations of banked samples collected during the pandemic in Nigeria will give details of distribution of the diseases with regards to demographic data like age, sex etc
3. Samples collected can further be evaluated using other types of diagnostic tools apart from the one mentioned in this study.

Acknowledgments

We will like acknowledge the Nigeria Center for Disease Control for publishing (online) the weekly epidemiological updates on COVID –19 in Nigeria. Special thanks to all my co-authors for the value added to this manuscript.

Novelty Statement

This retrospective study reviewed the situation of COVID 19 in Nigeria and the Case Fatality Rate (CFR) found in this study is 1.32%, which is lower than the case fatality rate previously reported by the NCDC, which was 2.8%. This could suggest that all of the nation's COVID-19 guidelines and control measures implemented are effective, which is prob-

ably why the study's case fatality rate dropped from 2.8% to 1.32%. Hence, this report will serve as a baseline data for further research in the study area.

Author's Contribution

Bridget Maria Jessica Adah: Contributed to the conceptualization, overall design, collation of online data and literature review/ writing of the manuscript.
Olatunde Hamza Olabode, Samuel Mailafia and James Agbo Ameh: Contributed in the review of the manuscript.
Onakpa Monday: Helped with formal analysis and manuscript editing.
Martha Echiada-Ogbole and Owolabi Olamide Tawa: Contributed in the funding acquisition required.

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

References

- Assiri, B., McDonald, E. G., Afshar, A., Boyles, T., Hsu, J. M., Khuong, N., and Lee, T. C. (2024). Pneumocystis jirovecii pneumonia in people living with HIV: a review. Clinical microbiology reviews, 37(1), e00101-22.
- Ben, H., H. Guo, P. Zhou and Z.L. Shi. 2021. Characteristics of SARS-CoV-2 and COVID 19. Nat. Rev. Microbiol., 19: 141-154. <https://doi.org/10.1038/s41579-020-00459-7>
- Chen, Y., 2020. Emerging coronaviruses: Genome structure, replication and pathogenesis. J. Med. Virol., 92(4): 418-423. <https://doi.org/10.1002/jmv.25681>
- Decaro, N. and Lorusso, A., 2020. Novel human coronavirus (SARS-CoV-2): A lesson from animal coronaviruses. Vet. Microbiol., 244: 108693. <https://doi.org/10.1016/j.vetmic.2020.108693>
- Diard, M. and Hardt, W.D., 2017. Evolution of bacterial virulence. FEMS Microbiol. Rev., 41(5): 679-697. <https://doi.org/10.1093/femsre/fux023>
- Juang, R.M., 2008. Africa and the Americas: Culture,

- politics, and history: A Multidisciplinary Encyclopedia Volume 2. ABC-CLIO. pp. 597. <https://doi.org/10.5040/9798400607431>
- Kirk-Greene, Anthony, H.M., Falola, T.O., Udo, R.K. and Ajayi, J.F., 2022. Nigeria: Encyclopedia Britannica, <https://www.britannica.com/place/Nigeria>. Accessed 18th February 2022.
- Lau, S.K., Woo, P.C., Li, K.S., Huang, Y., Tsoi, H.W. and Wong, B.H., 2005. Severe acute respiratory syndrome coronavirus-like virus in Chinese horseshoe bats. *Proc. Natl. Acad. Sci. U.S.A.*, <https://doi.org/10.1073/pnas.0506735102>
- Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L. and Tong, Y., 2020. Early transmission dynamics in Wuhan, China, of novel Coronavirus-infected pneumonia. *N. Engl. J. Med.*, 382: 1199–207.
- Liu, K., Chen, Y., Lin, R. and Han, K., 2020. Clinical features of COVID-19 in elderly patients: A comparison with young and middle-aged patients. *J. Infect.*, 80(6): e14–e18. <https://doi.org/10.1016/j.jinf.2020.03.005>
- Nigeria Centre for Disease Control. (2021). First COVID-19 case in Nigeria: Situation report. NCDC. <https://ncdc.gov.ng>. An update of COVID-19 outbreak in Nigeria. Availableat: <https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria>
- Odukoya, O., Akin, O., Mobonlanle, B., Jide, I. and Yetunde, K., 2021. Outcomes of COVID-19 Patients with Comorbidities in Southwest Nigeria. *PLoS One*, 16(3). <https://doi.org/10.1371/journal.pone.0248281>
- Olayinka, R.I. and Yetunde, T.O., 2020. Coronavirus disease (Covid-19) in Nigeria: Mitigating the Global Pandemic. *J. Clin. Med. Kazakhstan*, 1(55): 36–38. <https://doi.org/10.23950/1812-2892-JCMK-00748>
- Sharma, A., Ahmad, F.I. and Lal, S.K., 2021. COVID-19: A review on the novel coronavirus disease evolution, transmission, detection, control and prevention. *Viruses*, 13(2): 202. <https://doi.org/10.3390/v13020202>
- WHO Coronavirus Disease, 2019. (COVID-19) Situation Report-72 (2020). Available online at: <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200401-sitrep-72-covid-19.pdf>
- Wu, J.T., Leung, K. and Leung, G.M., 2020. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: A modelling study. *Lancet*, 395: 689–697. [https://doi.org/10.1016/S0140-6736\(20\)30260-9](https://doi.org/10.1016/S0140-6736(20)30260-9)
- Zhao, S., Lin, Q., Ran, J., Musa, S.S., Yang, G. and Wang, W., 2020. Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. *Int. J. Infect. Dis.*, 92: 214–217. <https://doi.org/10.1016/j.ijid.2020.01.050>