

COVID-19 Pandemic: A Global Health Burden

Oluwatosin Wuraola Akande, Tanimola Makanjuola Akande

Department of Epidemiology and Community Health, University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria

Abstract

Coronavirus disease 2019 (COVID-19) pandemic began in China with a group of severe pneumonia cases, later identified to be caused by the severe acute respiratory syndrome coronavirus 2 in December 2019. Thailand reported the first COVID-19 case outside of China on 13th January 2020, Africa reported its first case in Egypt on 14th February 2020 and Nigeria reported its index case of COVID-19 on 27th February 2020. Virtually, all countries in the world are affected, with over 5 million cases reported globally. A literature search was conducted using publications from academic databases and websites of relevant organisations. The disease is associated with typical and atypical signs and symptoms, mimicking other common illnesses. Nigeria is now in the phase of widespread community transmission as almost all the states have reported confirmed cases. The pandemic has shown a wide range of case-fatality rate (CFR) globally; this is postulated to be related to the demographics, existing health systems and probably other unidentified factors. There has been a steady increase in the burden caused by the disease in Nigeria with a relatively stable CFR, which is lower than the global CFR. Health systems have responded with the guidelines for prevention, management, and surveillance of the disease, while effort is being put in place to find a vaccine and a specific therapy for the cure of the disease. The pandemic has had a severe effect on health systems globally, including an unintended disruption in the service delivery of other diseases. It has the potential to disrupt the weak health system in Nigeria significantly. As such, a combination of non-pharmaceutical preventive measures that are cost-effective needs to be scaled up to prevent it from further weakening the existing health system.

Keywords: Coronavirus disease 2019, health burden, Nigeria, pandemic

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the virus responsible for the coronavirus disease 2019 (COVID-19) previously called the '2019-novel coronavirus'. The SARS-CoV-2 is an enveloped positive-sense single-stranded RNA virus believed to have a zoonotic origin; it is 96% similar at the whole-genome level to a bat coronavirus.^[1,2] The pandemic started as a group of severe pneumonia cases of unidentified cause reported in Wuhan, Hubei province of China in December 2019. On 30th December 2019, the real-time polymerase chain reaction assays on broncho-alveolar lavage samples taken from a patient with pneumonia of unknown aetiology (meeting a surveillance definition following the SARS outbreak of 2002–2003) tested positive for pan-*Betacoronavirus* in Wuhan Jinyintan Hospital.^[3] These findings were officially reported to the Country Office of World Health Organization (WHO) in China on 31st December 2019.^[4]

As of 24th May 2020, the pandemic had affected over 5 million persons including more than 337,000 deaths in 213 countries/territories and two international conveyances, giving an estimated global case-fatality rate (CFR) of 6.5%.^[5] The burden of the disease in terms of the number of confirmed cases and deaths (including CFR) varies across different countries and regions [Figure 1]. Reflective of the varying capacities across health systems, demographics, differences in the number of people tested and probably other yet to be identified factors, the CFR globally ranges from 0.1% to 16.3%.^[6] The African region, as reported by the WHO, accounted for 1.49% of cases (77,295) and 0.61% of deaths (2,073). In Nigeria, there were 7,839 cases and 226 deaths across the 35 affected states including the Federal Capital Territory, with a CFR of 3% as of 24th May 2020, as reported by the Nigeria Centre for Disease Control (NCDC).^[7]

Address for correspondence: Dr. Oluwatosin Wuraola Akande, Department of Epidemiology and Community Health, University of Ilorin Teaching Hospital, P.M.B. 1459, Ilorin, Kwara State, Nigeria. E-mail: akande.wuraola@gmail.com

Received: 18-05-2020, Revised: 19-06-2020,
Accepted: 21-06-2020, Published: 17-07-2020

Access this article online

Quick Response Code:



Website:
www.npmj.org

DOI:
10.4103/npmj.npmj_157_20

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Akande OW, Akande TM. COVID-19 pandemic: A global health burden. Niger Postgrad Med J 2020;27:147-55.



Figure 1: Number of cases and case-fatality rates across the World Health Organization regions as of 24th May 2020

As a novel virus, more insight into the disease (learning, relearning and unlearning) is being regularly published. Globally, countries and international organisations are putting efforts into preventive measures, management protocols, research activities for definitive treatment and vaccines to halt the transmission of the disease. This article aims to highlight the global observational epidemiology and burden of COVID-19 with an emphasis on Nigeria.

DELAY IN CHINA AND SUBSEQUENT GLOBAL RECOGNITION OF THE DISEASE

There are various theories on the emergence of COVID-19. Many scientists believe in the theory of viral mutation with the possibility of further mutations.^[8,9] It is said that all COVID-19 strains are similar to other strains of the *Coronaviridae* family and that COVID-19 emerged from several mutations of coronaviruses related to the same infection.^[9]

However, social media and mainstream media outlets have also reported ‘conspiracy’ theories regarding its emergence. One of these theories implies that there was a (accidental) leak of the virus from the Wuhan Institute of Virology close to the South China Seafood market.^[10] Some sects have labelled the emergence of the pandemic as anti-Israeli and anti-Semitic, a deliberate population control scheme, a plan to attract funding for the manufacture of a vaccine, a spy operation or a biological weapon being used by some countries against others.^[11-13] Scientific evidence is being used to disprove theories, suggesting that the epidemic is artificial. A study by Dawood emphasises that ‘genomic analysis does not support the belief that COVID-19 is a laboratory construct, but it is impossible to disprove or prove the theories of its origin’.^[9]

Although anecdotal, grey literatures have claimed that the Chinese government delayed in admitting the outbreak to international authorities. There are reports of Chinese officials reprimanding medical doctors who were seen as whistle-blowers on account of ‘spreading rumours’ and ‘harming stability’ for hinting an on-going outbreak of a novel virus.^[14] Until 20th January 2020, Chinese officials claimed that there was no human-to-human transmission of the virus.^[14] This was corroborated by a tweet sent out by the

WHO on 14th January 2020 saying, ‘Preliminary investigations conducted by the Chinese authorities have found no clear evidence of human-to-human transmission of the novel #coronavirus (2019-nCoV) identified in #Wuhan, #China’.^[15] On 22nd January 2020, the WHO mission to China made a turnaround by issuing a statement confirming human-to-human transmission of the virus in Wuhan.^[16]

About a month after the novel disease was reported to the WHO Country Office in China, the WHO confirmed it a public health emergency of international concern (PHEIC) on 30th January 2020.^[4] As in the 2005 International Health Regulations (IHRs), a PHEIC is ‘an extraordinary event which is determined to constitute a public health risk to other states through the international spread of disease and to potentially require a coordinated international response’.^[17] This marks the sixth time the WHO has declared a public health risk a PHEIC since the 2005 IHR came into implementation.^[18] On 11th March 2020, the COVID-19 outbreak was declared a global pandemic because of the disturbing spread (and severity) of the disease and the levels of inaction across health systems.^[18,19]

Evidence has shown that a delay in recognising the disease which occurred in China and subsequently in other countries could be linked to an increased burden of the disease.^[20] Hellewell *et al.* have also associated a decrease in the control of the disease with a long delay from the onset to symptoms to management measures, such as isolation and contact tracing.^[21] Misinformation from media sources has the potential to undermine effective responses to this pandemic.^[22] This was seen during the Monkeypox and Ebola outbreaks where many media reports were negatively sensationalised; this increased anxiety in the general populace and also led to the circulation of false preventive measures which could increase disease burden.^[23-25]

MODE OF TRANSMISSION

While there is no evidence of documented cases of the bat-to-human transmission of the virus, it is being suggested that the virus might have been transmitted to humans via a yet to be identified intermediate host.^[26-28] It is also believed that the outbreak is likely to have started in a seafood market that traded live wild animals, which led to zoonotic transmission. A study conducted among confirmed cases between 1st January and 20th January 2020 showed that 49% of them had a positive history of exposure to the Huanan seafood market.^[29]

Human-to-human transmission is evident. The disease can be transmitted during close unprotected contact through droplets and fomites.^[3] Faecal shedding is apparent in a limited number of cases; nonetheless, the faeco-oral route is not a significant driver of transmission.^[3] Similarly, there is no evidence to prove that air-borne transmission is a significant driver of spread, though it can be foreseen if aerosol-generating procedures are conducted in healthcare facilities.^[3] There is evidence of asymptomatic transmission, pre-symptomatic transmission and symptomatic transmission; the median period

and longest duration of viral shedding among survivors are 20 and 37 days, respectively.^[30,31]

The average incubation period of the disease is between 5 and 6 days, though it can be up to 14 days or more.^[30] In a pooled analysis of confirmed SARS-CoV-2 cases, it was found that 1.01% of cases show symptoms after 14 days of quarantine or active monitoring.^[32]

The virus is highly contagious. A systematic review of 21 studies estimated the serial interval to be 4–8 days, similar to that of SARS which has been estimated to be about 7 days.^[33,34] Several studies have found the basic reproduction number (R_0) to range from 1.4 to 6.5.^[33,35,36] The R_0 is lower than that of measles which is between 12 and 18 but higher than that of SARS, which is between 3.1 and 4.2.^[37,38] The secondary attack rate among close contacts is 35% and doubling time about 7.4 days.^[35,39] Based on these findings, the virus is highly transmissible within a relatively short period. It is noteworthy that changes in the case definition of the disease should be considered when making inferences on the transmission dynamics of the virus.^[40]

DISEASE BURDEN

There is sparse scientific evidence to prove susceptibility regarding natural neutralising immunity as the current evidence suggests that everyone irrespective of socio-demographic factors who has had close contact with an infected individual is susceptible.^[33] While there is no evidence of vertical transmission, some studies have reported unfavourable health outcomes in infants born to mothers with the disease.^[41,42]

Studies have shown differences in the prevalence of the disease based on socio-demographic factors such as age and gender. According to a summary of a report of over 72,000 cases from the Chinese Centre for Disease Control and Prevention, majority of the cases (87%) were between 30 and 79 years, 8% were between 20 and 29 years, 3% were >80 years and 2% were <19 years.^[43] Similarly, data on persons ≤18 years by the WHO suggest a comparatively low attack rate, representing 2.4% of all reported cases.^[3] An analysis of over 2900 hospitalised cases in Iran found the rate at which males were affected to be almost double the rate at which females were affected, with a male-to-female ratio of 1.93:1.^[44] Wu *et al.* also found that 63% of the patients admitted for the disease in a hospital in Wuhan, China, at the beginning of the pandemic were males.^[45] The findings from Nigeria further support a higher prevalence of the disease among males who account for 68% of all reported cases.^[7] However, another study in China that investigated the role of gender in morbidity and mortality found an equal prevalence in both genders; however, the male gender had an increased risk of worse outcomes and mortality as the number of males was 2.4 times more than that of females.^[46]

The signs and symptoms can be constitutional and range from no symptoms to severe pneumonia and eventually

death.^[3] Based on the reports from China, four out of five infected persons were asymptomatic (about 80%) though asymptomatic persons could be carriers.^[47] The true proportion of symptomatic infections was uncertain as some cases reported as asymptomatic on the day of data collection may develop symptoms later.

Majority (80%) have mild or moderate disease (including non-pneumonia and pneumonia cases), less than a quarter (13.8%) have severe disease (dyspnoea, respiratory rate ≥30/min, blood oxygen saturation ≤93%, $\text{PaO}_2/\text{FiO}_2$ ratio 50% of the lung field within 24–48 h) and less than a tenth (6.1%) are critical (respiratory failure, septic shock, and multiple organ failure).^[3] According to the WHO, ‘typical signs and symptoms include fever (87.9%), dry cough (67.7%), fatigue (38.1%), sputum production (33.4%), shortness of breath (18.6%), sore throat (13.9%), headache (13.6%), myalgia or arthralgia (14.8%), chills (11.4%), nausea or vomiting (5.0%), nasal congestion (4.8%), diarrhoea (3.7%), haemoptysis (0.9%) and conjunctival congestion (0.8%)’.^[3] Associated atypical symptoms could be neurological (acute cerebrovascular disease), dermatological, ocular (conjunctivitis), anosmia/hyposmia and aguesia.^[47–50] Current evidence suggests the disease is less severe in paediatric cases but more severe among older patients and those with pre-existing comorbidities.^[33,43] Children usually have mild symptoms and relatively shorter hospital stay with good prognosis although some have found a Kawasaki-like complication in this age group.^[51–53]

A total number of 5,204,508 cases and 337,687 deaths had been recorded in 213 countries and territories and two international conveyances on 24th May 2020 [Figure 2].^[54,55] Less than a month after the pandemic started in China, Thailand reported the first COVID-19 case outside of China on 13th January 2020. The first case of COVID-19 in Africa was reported in Egypt on 14th February 2020, about 6 weeks after it started in China.^[56] The index case was reported in Lagos on 27th February 2020, a foreigner who returned from Italy on 25th February 2020. As of 24th May 2020, 45,683 samples tested had been tested and there were 7839 confirmed cases of the disease, with a test positivity rate of 17.2% and a CFR of 3%.^[7] Current evidence suggests that the country has entered the widespread community transmission phase as majority of those affected (56%) were found to have no epidemiological link to any known case and 23% were known contacts of confirmed cases.^[7] Almost all the states including the Federal Capital Territory (35 out of 37) have confirmed cases.

As of 24th May 2020, the CFR using the number of reported deaths per number of reported cases across 90 countries ranged from 16.3% (Belgium) to 0.1% (Qatar and Singapore), with a global CFR of 6.5%.^[6,51] The significant disparity in CFR across these countries may be linked to selection bias in those who get tested in each country (testing criteria), difference in patient demographics such as age, and difference in how deaths are attributable to the disease, i.e., dying with the disease (association) versus dying from the disease (causation).^[57] In



Figure 2: Map of the global spread of coronavirus disease 2019 cases

Italy, about 23% of the population are >65 years; Italy recorded a higher CFR (7.2%) compared to the global CFR (6.5%), the median age of the patients was 62 years, the median age among those who died was 78 years and the majority of those who died (52.3%) were >80 years.^[58] These findings are in keeping with evidence from other countries, showing that increasing age is linked to increasing mortality rate. A review of cases in China by Wu and McGoogan found the CFR to be 2.3%; this rate was however found to be higher among those between 70 and 79 years (8%), those >80 years (14.8%) and those in critical conditions (49%).^[43] This may not be unrelated to less rigorous immune response among older patients.^[45] Higher CFRs have also been linked to those with pre-existing comorbidities such as cardiovascular diseases (10.5%), diabetes (7.3%) or chronic respiratory diseases (6.3%) compared to those with no pre-existing conditions (0.9%).^[43] Zhou *et al.* found that among 54 out of 191 patients who died in a hospital-based study, 48% of them had a comorbidity: hypertension, diabetes and coronary health disease accounted for 30%, 19% and 8% of these comorbidities, respectively.^[31] Multiple regression further found older age, higher sequential organ failure assessment score and D-dimer greater than 1 µg/mL on admission to be associated with increased odds of in-hospital deaths.^[31] Similarly, the male gender, older age and presence of comorbidities were found to be significantly associated with a higher risk of mortality among patients in Iran.^[44]

A preliminary analysis of the first 32 patients managed in one of the isolation centres in Lagos state by Bowale *et al.* has been published.^[7] The mean age was 38.1 years (standard deviation [SD] - 15.5), and majority of the patients were males. Most patients (94%) had a history of recent travel or contact with a confirmed case, and most of them (75%) presented to the isolation centre in moderately severe conditions. While about a quarter (16%) of the patients were asymptomatic, the most frequent symptoms were fever, dry cough, anosmia and aguesia accounting for 59%, 44%, 19% and 19%, respectively. Most patients were admitted within 1 or 2 days after testing positive (mean time - 1.65 days, SD - 1.31). All

the patients were given medications: while 97% received lopinavir-ritonavir, 3% (one patient) received chloroquine phosphate. All the patients survived and were discharged home following a mean duration of 12 days of hospital stay (range of 6–24 days).

A study of progression of the pandemic in Nigeria in its first 12 weeks has shown a steady increase and subsequently a rise in the curve of the weekly number of confirmed cases and deaths [Figure 3].^[7] This is not unexpected as the testing capacity, and surveillance measures are being scaled up across the country.^[60] As of May 2020, 25 laboratories had joined the national COVID laboratory network, and effort is being out in place to scale up testing to every state in the country and also involve accredited private laboratories.^[60]

The burden of the disease has taken its toll on every health system affected, including those with seemingly strong health systems before the pandemic. Despite being ranked second out of 191 WHO member states based on overall efficiency, the pandemic caused a significant strain in the Italian health system.^[61] Lombardy, one of the 20 administrative regions in Italy, has a total of 724 intensive care unit (ICU) beds as its standard operational level for a population of about 10 million people; during the pandemic, there was shortage of medical equipment as the system tackled inadequate bed spaces, ICUs, respiratory ventilators, personal protective equipment and also healthcare workers.^[62,63] Healthcare workers were forced to 'prioritise' patients who would be managed with ventilators based on their likelihood to survive when ICU beds and equipment became insufficient.^[64] At the peak of the pandemic in China, general beds were converted to ICU beds and additional healthcare workers were quickly trained on critical care to meet the health system demands of the outbreak.^[65] Healthcare workers were not spared from the pandemic; in China, 3.8% of them were affected and 14.8% of them were in severe condition, further reducing the already insufficient workforce.^[43] Likewise, France, the United Kingdom and the United States reported a huge

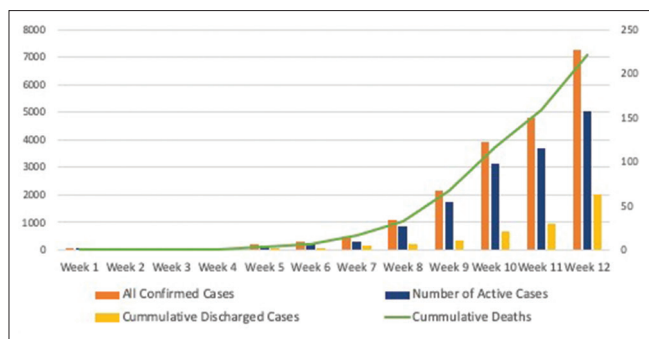


Figure 3: Weekly evolution of coronavirus disease 2019 cases in Nigeria as of 24th May 2020

overburden on their health systems in terms of medical supplies and human resources due to the pandemic.^[66-68]

In Africa, ICU beds and trained ICU specialists are very limited in supply before the pandemic; according to Houreld *et al.*, the continents (three giants based on population – Nigeria, Ethiopia and Egypt) have a total of 1920 ICU beds for more than 400 million people. Of these, Nigeria accounts for only 350 ICU beds despite being the most populated country in the continent, with about 200 million people. With a pre-pandemic state of 0.4 physicians per 1000 people, 1.2 nurses and midwives per 1000 people and 1.4 specialist surgical workforce per 100,000 population, the Nigerian health system suffers from an insufficient number of healthcare workers to adequately cater for its people.^[69] On the background of the Nigerian health system (and many other African countries) being chronically underfunded, the pandemic will significantly strain the already fragile health system if the progression in the number and severity of cases continues at the current rate.^[70]

The COVID-19 pandemic has significantly harmed a wide array of health services globally, particularly in low- and middle-income countries (LMICs).^[71-73] According to the Global Fund Survey, as many as 85%, 78% and 73% of HIV, TB and malaria programmes, respectively, have been disrupted across 106 countries, with Latin America, Caribbean and high-burden African countries reporting the highest level of disruption in health service delivery.^[73] Prevention and treatment services for non-communicable diseases have also been disrupted. Across 155 countries, health services for hypertension, diabetes and diabetes-related complication, cancer and cardiovascular emergencies have been disrupted in 53%, 49%, 42% and 31% of countries, respectively.^[71] Robertson *et al.* have estimated that the resultant decrease in maternal health services could account for 60% of additional maternal deaths; an increase in wasting prevalence could lead to an additional 18%–23% of child deaths, and a decrease in the treatment of pneumonia, neonatal sepsis and diarrhoea could result in an additional 41% of child deaths in LMICs.^[74]

PREVENTION OF CORONAVIRUS DISEASE 2019

Scientists across the world are racing to produce an efficacious

vaccine, many of which are undergoing clinical evaluation.^[75] Owing to the current lack of vaccine against the disease for now, non-pharmacological measures are being put in place to curtail the spread of the virus. These measures include physical distancing, hand hygiene and use of masks.

Physical distancing is one of the measures being out in place to curtail the transmission of the virus. This is the act of keeping space between oneself and other people outside one's household. It involves staying at least 6 feet away from other people, not gathering in groups and avoiding crowded places or mass gatherings.^[76,77] When 20% of transmission is driven by unidentified infected persons, high levels of physical distancing efforts is needed to contain the virus.^[78] Physical distancing is a non-pharmaceutical intervention that has a significant potential to reduce the magnitude COVID-19 epidemic peak.^[79] While some sources refer to the terms 'social distancing' and 'physical distancing' as synonymous, the WHO announced in a press briefing on 20th of March 2020 that it was moving away from the term 'social distancing'.^[76,80] The organisation through Maria Van Kerkhove, an infectious diseases epidemiologist said, 'We've been saying physical distancing because it's important to remain physically separate but socially connected'.

Contact transmission of COVID-19 can occur when contaminated hands touch the mucosa of the eyes, nose or mouth. It can also be transmitted between surfaces via contaminated hands. Hand hygiene is the most effective single practice that can be used to decrease the spread of infections through multimodal measures.^[81] Therefore, hand hygiene is paramount in preventing the spread of the COVID-19 and other viruses and bacteria. Furthermore, healthcare workers are encouraged to observe the five moments of hand hygiene.^[82] Universal access to public hand hygiene stations and making their use mandatory on entry or exist into private or public buildings and public transport facilities will improve hand hygiene. Hand sanitisers with at least 60% alcohol can be used when soap and water are not available, though hand sanitisers are not as effective as hand washing with soap and water.^[83]

The effectiveness of the use of masks as a preventive measure against the disease and the type of mask to be used among the general population and healthcare workers is being debated globally.^[84,85] Ecological evaluations suggest that countries that have implemented the general mandatory use of masks have better experienced outcomes.^[86] The N95 mask, surgical mask and cloth mask can provide 99%, 75% and 67% protection, respectively, against the virus; these masks can also reduce the transmission of the virus by 70%, 50% and 40%, respectively.^[84] The higher risk of people infecting themselves if masks are worn incorrectly, the need to frequently touch the face more to adjust the mask and the possibility of ignoring physical distancing when wearing a mask are some of the reasons being used against the mandatory use of masks by the public.^[85] There is a global deficiency of medical masks; to preserve the limited supplies, medical masks are being

rationed and reserved for healthcare settings and the vulnerable population.^[87] NCDC advises the use of cloth mask among the general population and the use of medical mask among healthcare workers and those caring for the ill, individuals experiencing respiratory symptoms, the elderly and those with chronic medical conditions.^[88]

Quarantine is the separation or limitation of activities of apparently healthy individuals who may have been exposed to a disease. It is included in the legal frameworks of the IHR 2005 and the Nigerian Quarantine Act.^[89,90] Contacts of those who test positive are advised to self-quarantine at home. Quarantine aims to monitor symptoms and ensure early detection of the disease. The timeliness and proportion of the population in quarantine are essential in the effectiveness of this measure. Xiong *et al.* have suggested that quarantine rate should be at least 63% for the epidemic to be averted, and this measure should be implemented throughout the epidemic.^[91] Once an epidemic is in the community transmission phase, the combination of isolating infected individuals and quarantining their contacts, workplace distancing and school closure has been found to significantly reduce the number of COVID-19 infections.^[92]

Different management protocols are being implemented globally, majorly tailored to the health system capacity. While some countries like the United Kingdom and Italy ask those who test positive but remain asymptomatic or show mild-to-moderate symptoms to remain at home, some other countries like Nigeria isolate all those who test positive to the virus as of May 2020.^[93,94] Nigeria has adopted the central management system of confirmed cases in designated state isolation centres where health facilities refer confirmed cases of the diseases to for management. In the early stages of the pandemic, all suspected cases in France were referred to hospitals; however, by week 12 of the pandemic, the national recommendations changed, as tele-consultations became the standard recommendation for those with mild-to-moderate cases. Those with severe symptoms (e.g. difficulty in breathing) were advised to call the paramedics and stay at home while emergency transportation to the hospital was handled by the paramedics.^[64]

The pre-existing structure of the health systems and other health-related factors may be responsible for the differences across regions. In countries where the majority of citizens have a good standard of living, access to quality healthcare (including effective tele-consultation services, emergency ambulance services and advanced medical care), good transportation and housing systems, isolation of positive cases in their homes is a feasible and efficient option for the nation. However, in countries where these services are not readily available, other management options must be sought. The centralised management of cases may not be unrelated to the fact that the majority of health facilities do not have the resources (equipment and workforce) to manage moderate-to-severe cases of the disease; therefore, pulling

resources in designated centres may be the more efficient option in these regions. However, as the prevalence of the disease continues to increase, this management protocol may change, as seen in France.

Pending the confirmation of an effective and definitive drug for the diseases, countries around the world have developed treatment guidelines based on symptomatic treatment and also the use of some drugs on clinical trial.^[95] The WHO gives guidance on the implementation of global surveillance for the disease to monitor trends, promptly detect new cases and provide robust epidemiological information. The organisation provides case definitions, classification of transmission scenarios, recommendations for laboratory testing and recommendations for reporting surveillance data (including templates for case reporting forms, line listing forms, weekly reporting of new cases) which are adopted or adapted by countries.^[96] The NCDC takes the lead role in Nigeria in providing guidelines in the active monitoring and surveillance of cases across the country. The agency continues to update its case definitions, as more knowledge is known about the virus, and also provides reporting tools for active surveillance.^[97] The NCDC has provided an interim guideline for the management of COVID-19 cases in Nigeria.^[94] The general principles of management include the use of supplemental oxygen, conservative use of fluids, empiric antibiotics treatment, including antivirals such as remdesivir, and close monitoring of vital signs.

CONCLUSION

The COVID-19 disease caused by a novel virus started in China and has now spread globally, causing a significant burden on humans' health. The African region has a relatively lower burden of the disease using the proportion of cases and CFR when compared to other regions. Likewise, the CFR seen in Nigeria is lower than the global rate. However, a 'late start' of the disease was recorded in this region, and with uncontrolled community transmission, the pandemic has the potential to take a different turn in terms of increased spread and mortality. With the knowledge of the disease increasing rapidly, signs and symptoms, case definitions and surveillance measures are also being updated. Potential vaccines and therapies for a definitive cure are still undergoing clinical trials. Management protocols vary across countries, tailored to the capacity of its health system. The health burden caused by the pandemic has the potential to disrupt and further weaken already fragile health systems including Nigeria. Considering the unintended effect of the pandemic in the disruption of health services for other diseases, these services must be considered in the preparedness and response plans for the pandemic to prevent eroding previous gains in other disease programs. Media partnerships with authorised organisations that regularly convey culturally appropriate, simple and concise messages on the situation of the pandemic and preventive measures will help reduce the spread of false information and boost the populace's confidence in the government's efforts

in curtailing the spread of the disease. The combination of non-pharmaceutical measures including physical distancing, hand hygiene, use of masks, quarantine and isolation of cases pending the availability of a vaccine and a specific drug for treatment should be implemented to decrease the burden and the consequent strain on the existing health system globally and particularly in Nigeria.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, *et al.* The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* 2020;5:536-44. Available from: <https://doi.org/10.1038/s41564-020-0695-z>. [Last accessed on 2020 May 04].
- Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, *et al.* pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature* 2020;579:270-3.
- World Health Organisation. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Geneva: World Health Organization; 2020. p. 40.
- World Health Organisation. Coronavirus Disease (COVID-19) Events as they Happen; 2020. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>. [Last accessed on 2020 May 02].
- World Health Organization. Coronavirus Disease (COVID-19) Situation Report – 125. World Health Organization; 2020. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200524-covid-19-sitrep-125.pdf?sfvrsn=80e7d7f0_2. [Last accessed on 2020 May 04].
- Johns Hopkins University and Medicine. Mortality Analyses. Johns Hopkins Coronavirus Resource Center; 2020. Available from: <https://coronavirus.jhu.edu/data/mortality>. [Last accessed on 2020 May 25].
- Nigeria Centre for Disease Control. COVID-19 Situation Report 86; 2020. Available from: <https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria>. [Last accessed on 2020 May 25].
- Calisher C, Carroll D, Colwell R, Corley RB, Daszak P, Drosten C, *et al.* Statement in support of the scientists, public health professionals, and medical professionals of China combatting COVID-19. *Lancet* 2020;395:e42-3.
- Dawood AA. Mutated COVID-19, May Foretells Mankind in a Great Risk in the Future [published online ahead of print, 2020 Apr 4]. *New Microbes New Infect.* 2020;35:100673. doi:10.1016/j.nmni.2020.100673. [Last accessed on 2020 May 04].
- BBC. Wuhan Pneumonia: “Wuhan Virus Research Institute” Involved in the Epidemic and Fake News Storm. BBC News; 2020. Available from: <https://www.bbc.com/zhongwen/simp/chinese-news-51388024>. [Last accessed on 2020 May 04].
- The Jerusalem Post. Arab Media Accuse US, Israel of Coronavirus Conspiracy Against China; 2020. Available from: <https://www.jpost.com/Middle-East/Arab-media-accuse-US-Israel-of-coronavirus-conspiracy-against-China-617021>. [Last accessed on 2020 May 04].
- The Jerusalem Post. Iran's Regime Pushes Antisemitic Conspiracies about Coronavirus; 2020. Available from: <https://www.jpost.com/Middle-East/Iran-News/Iran-regime-pushes-antisemitic-conspiracies-about-coronavirus-620212>. [Last accessed on 2020 May 04].
- BBC. China Coronavirus: Misinformation Spreads Online. BBC News; 30 January, 2020. Available from: <https://www.bbc.com/news/blogs-trending-51271037>. [Last accessed on 2020 May 04].
- Kuo L. Coronavirus: Wuhan Doctor Speaks out Against Authorities. The Guardian; 11 March, 2020. Available from: <https://www.theguardian.com/world/2020/mar/11/coronavirus-wuhan-doctor-ai-fen-speaks-out-against-authorities>. [Last accessed on 2020 May 03].
- World Health Organisation. World Health Organization on Twitter. Twitter; 2020. Available from: <https://twitter.com/who/status/1217043229427761152>. [Last accessed on 2020 May 03].
- World Health Organization. Mission Summary: WHO Field Visit to Wuhan, China; 20-21 January, 2020. Available from: <https://www.who.int/china/news/detail/22-01-2020-field-visit-wuhan-china-jan-2020>. [Last accessed on 2020 May 04].
- World Health Organization. IHR Procedures Concerning Public Health Emergencies of International Concern (PHEIC). World Health Organization; 2020. Available from: <http://www.who.int/ihr/procedures/pheic/en/>. [Last accessed on 2020 May 03].
- World Health Organization. WHO Timeline COVID-19; 2020. Available from: <https://www.who.int/news-room/detail/27-04-2020-who-timeline-covid-19>. [Last accessed on 2020 May 04].
- Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed* 2020;91:157-60.
- Khanna RC, Cicinelli MV, Gilbert SS, Honavar SG, Murthy GS. COVID-19 pandemic: Lessons learned and future directions. *Indian J Ophthalmol* 2020;68:703.
- Hellewell J, Abbott S, Gimma A, Bosse NI, Jarvis CI, Russell TW, *et al.* Feasibility of controlling COVID-19 outbreaks by isolation of cases and contacts. *Lancet Global Health* 2020;8:e488-96.
- Limaye RJ, Sauer M, Ali J, Bernstein J, Wahl B, Barnhill A, *et al.* Building trust while influencing online COVID-19 content in the social media world. *Lancet Digital Health* 2020;2:e277-8.
- Ihekweazu C. Ebola in prime time: A content analysis of sensationalism and efficacy information in U.S. Nightly news coverage of the ebola outbreaks. *Health Communication* 2017;32:741-8.
- Oyebanji O, Ofonagoro U, Akande O, Nsofor I, Ukenedo C, Mohammed TB, *et al.* Lay media reporting of monkeypox in Nigeria. *BMJ Global Health* 2019;4:e002019.
- Hopman J, Allegranzi B, Mehtar S. Managing COVID-19 in Low- and Middle-Income Countries [published online ahead of print, 2020 Mar 16]. *JAMA.* 2020;10.1001/jama.2020.4169. doi:10.1001/jama.2020.4169.
- Scripps Research Institute. COVID-19 Coronavirus Epidemic has a Natural Origin. Science Daily; 2020. Available from: <https://www.sciencedaily.com/releases/2020/03/200317175442.htm>. [Last accessed on 2020 May 03].
- World Organisation for Animal Health. Questions and Answers on the COVID-19; 2020. Available from: <https://www.oie.int/scientific-expertise/specific-information-and-recommendations/questions-and-answers-on-2019-novel-coronavirus/>. [Last accessed on 2020 May 03].
- World Health Organization. Coronavirus Disease 2019 (COVID-19) Situation Report – 32; 2020. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200221-sitrep-32-covid-19.pdf?sfvrsn=4802d089_2. [Last accessed on 2020 May 04].
- Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, *et al.* Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. *Lancet* 2020;395:507-13.
- World Health Organization. Coronavirus Disease 2019 (COVID-19) Situation Report – 73; 2020. Available from: <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf>. [Last accessed on 2020 May 04].
- Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, *et al.* Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. *Lancet* 2020;395:1054-62.
- Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith H, *et al.* The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application. *Ann Intern Med.* 2020;172:577-82. doi:10.7326/M20-0504. Available from: <https://pubmed.ncbi.nlm.nih.gov/32150748/>. [Last accessed on 2020 May 04].
- Park M, Cook AR, Lim JT, Sun Y, Dickens BL. Systematic review of COVID-19 epidemiology based on current evidence. *J Clin Med* 2020;9:967.
- Lipsitch M, Cohen T, Cooper B, Robins JM, Ma S, James L, *et al.*

- Transmission dynamics and control of severe acute respiratory syndrome. *Science* 2003;300:1966-70.
35. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, *et al.* Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *Engl J Med* 2020;382:1199-207.
 36. Riou J, Althaus CL. Pattern of early human-to-human transmission of Wuhan 2019 novel coronavirus (2019-nCoV), December 2019 to January 2020 [published correction appears in *Euro Surveill.* 2020 Feb;25(7):]. *Euro Surveill.* 2020;25:2000058. doi:10.2807/1560-7917.ES.2020.25.4.2000058. Available from: <https://pubmed.ncbi.nlm.nih.gov/32019669/>. [Last accessed on 2020 May 04].
 37. Guerra FM, Bolotin S, Lim G, Heffernan J, Deeks SL, Li Y, *et al.* The basic reproduction number (R0) of measles: A systematic review. *Lancet Infect Dis* 2017;17:e420-8.
 38. Wallinga J, Teunis P. Different epidemic curves for severe acute respiratory syndrome reveal similar impacts of control measures. *Am J Epidemiol* 2004;160:509-16.
 39. Liu Y, Eggo RM, Kucharski AJ. Secondary attack rate and superspreading events for SARS-CoV-2. *Lancet* 2020;395:e47.
 40. Tsang TK, Wu P, Lin Y, Lau EH, Leung GM, Cowling BJ. Effect of changing case definitions for COVID-19 on the epidemic curve and transmission parameters in mainland China: A modelling study. *Lancet Public Health* 2020;5:e289-96.
 41. Chen H, Guo J, Wang C, Luo F, Yu X, Zhang W, *et al.* Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: A retrospective review of medical records. *Lancet* 2020;395:809-15.
 42. Zhu H, Wang L, Fang C, Peng S, Zhang L, Chang G, *et al.* Clinical analysis of 10 neonates born to mothers with 2019-nCoV pneumonia. *Transl Pediatr* 2020;9:51-60.
 43. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72 314 cases from the Chinese center for disease control and prevention. *JAMA* 2020;323:1239-42.
 44. Nikpouraghdam M, Jalali Farahani A, Alishiri G, Heydari S, Ebrahimnia M, Samadinia H, *et al.* Epidemiological characteristics of coronavirus disease 2019 (COVID-19) patients in IRAN: A single center study. *J Clin Virol.* 2020;127:104378. doi:10.1016/j.jcv.2020.104378.
 45. Eastin C, Eastin T. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. *Emerg Med* 2020;58:713-4.
 46. Jin JM, Bai P, He W, Wu F, Liu XF, Han DM, *et al.* Gender differences in patients with COVID-19: Focus on severity and mortality. *Front Public Health* 2020;8.
 47. Day M. Covid-19: four fifths of cases are asymptomatic, China figures indicate. *BMJ.* 2020;369:m1375. doi:10.1136/bmj.m1375.
 48. Kimball A, Hatfield KM, Arons M, *et al.* Asymptomatic and Presymptomatic SARS-CoV-2 Infections in Residents of a Long-Term Care Skilled Nursing Facility — King County, Washington, March 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:377–381. DOI: <http://dx.doi.org/10.15585/mmwr.mm6913e1>.
 49. Marinucci A, Landis BN, Calmy A. Possible link between anosmia and COVID-19: sniffing out the truth. *Eur Arch Otorhinolaryngol.* 2020;277:2149-2150. doi:10.1007/s00405-020-05966-0.
 50. Casas CG, Català A, Hernández GC, Rodríguez-Jiménez P, Nieto DF, Lario AR-V, *et al.* Classification of the cutaneous manifestations of COVID-19: a rapid prospective nationwide consensus study in Spain with 375 cases. *Br J Dermatol.* 2020;183:71-7. doi:10.1111/bjd.19163.
 51. Liu W, Zhang Q, Chen J, Xiang R, Song H, Shu S, *et al.* Detection of Covid-19 in children in early January 2020 in Wuhan, China. *N Engl J Med* 2020;382:1370-1.
 52. Chen ZM, Fu JF, Shu Q, Chen YH, Hua CZ, Li FB, *et al.* Diagnosis and treatment recommendations for pediatric respiratory infection caused by the 2019 novel coronavirus. *World J Pediatr.* 2020;16:240-246. doi:10.1007/s12519-020-00345-5.
 53. Viner RM, Whittaker E. Kawasaki-like disease: emerging complication during the COVID-19 pandemic. *Lancet.* 2020;395:1741-3. doi:10.1016/S0140-6736(20)31129-6.
 54. World Health Organization. Coronavirus Disease (COVID-19) Situation Report – 117. World Health Organization; 2020. Available from: https://www.who.int/docs/default-source/coronavirus/situation-reports/20200516-covid-19-sitrep-117.pdf?sfvrsn=8f562cc_2. [Last accessed on 2020 May 16].
 55. World Health Organization Regional Office for Africa. COVID-19 Cases top 10 000 in Africa. WHO Regional Office for Africa; 2020. Available from: <https://www.afro.who.int/news/covid-19-cases-top-10-000-africa>. [Last accessed on 2020 May 04].
 56. Centers for Disease Control and Prevention. International Locations with Confirmed COVID-19 Cases. Centers for Disease Control and Prevention; 2020. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/global-covid-19/world-map.html>. [Last accessed on 2020 Jun 07].
 57. Centre for Evidence-Based Medicine. Global Covid-19 Case Fatality Rates. Centre for Evidence-Based Medicine; 2020. Available from: <https://www.cebm.net/covid-19/global-covid-19-case-fatality-rates/>. [Last accessed on 2020 May 04].
 58. Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *JAMA* 2020;323:1775-6.
 59. Bowale A, Abayomi A, Idris J, Omilabu S, Abdus-Salam I, Adebayo B, *et al.* Clinical presentation, case management and outcomes for the first 32 COVID-19 patients in Nigeria. *Pan African Medical Journal.* 2020;35:24. [doi: 10.11604/pamj.suppl.2020.35.2.23262].
 60. Nigeria Centre for Disease Control. National Strategy to Scale Up Access to Coronavirus Disease Testing in Nigeria. Nigeria Centre for Disease Control; 2020. Available from: https://covid19.ncdc.gov.ng/media/files/COVID19TestingStrategy_Lz3ZVsT.pdf. [Last accessed on 2020 May 16].
 61. Tandon A, Murray C, Lauer J, Evans D. Measuring Overall Health System Performance for 191 Countries. World Health Organization; 2020. Available from: <https://www.who.int/healthinfo/paper30.pdf>. [Last accessed on 2020 May 06].
 62. Armocida B, Formenti B, Ussai S, Palestra F, Missoni E. The Italian health system and the COVID-19 challenge. *Lancet Public Health* 2020;5:e253.
 63. Odone A, Delmonte D, Scognamiglio T, Signorelli C. COVID-19 deaths in Lombardy, Italy: Data in context. *Lancet Public Health* 2020;5:e310.
 64. WHO Regional Office for Europe, European Commission, European Observatory on Health Systems and Policies. COVID 19 Health System Response Monitor; 2020. Available from: <https://www.covid19healthsystem.org/searchandcompare.aspx>. [Last accessed on 2020 Jun 07].
 65. Xie J, Tong Z, Guan X, Du B, Qiu H, Slutsky AS. Critical care crisis and some recommendations during the COVID-19 epidemic in China. *Intensive Care Med* 2020;46:837-40.
 66. Moatti JP. The French response to COVID-19: Intrinsic difficulties at the interface of science, public health, and policy. *Lancet Public Health* 2020;5:e255.
 67. Hunter DJ. COVID-19 and the Stiff Upper Lip The pandemic response in the United Kingdom. *New England J Med* 2020;382:e31.
 68. Ranney ML, Griffith V, Jha AK. Critical supply shortages The need for ventilators and personal protective equipment during the Covid-19 pandemic. *N Engl J Med* 2020;382:e41.
 69. World Bank. World Development Indicators; 2017. Available from: <http://wdi.worldbank.org/table/2.12>. [Last accessed on 2020 May 25].
 70. World Health Organization. Global Health Expenditure Database; 2020. Available from: <https://apps.who.int/nha/database/ViewData/Indicators/en>. [Last accessed on 2020 Apr 22].
 71. World Health Organization. COVID-19 Significantly Impacts Health Services for Noncommunicable Diseases; 2020. Available from: <https://www.who.int/news-room/detail/01-06-2020-covid-19-significantly-impacts-health-services-for-noncommunicable-diseases>. [Last accessed on 2020 Jun 19].
 72. Riley T, Sully E, Ahmed Z, Biddlecom A. Estimates of the Potential Impact of the COVID-19 Pandemic on Sexual and Reproductive Health In Low- and Middle-Income Countries. *Int Perspect Sex Reprod Health.* 2020;46:73-76. doi:10.1363/46e9020.
 73. The Global Fund. Global Fund Survey: Majority of HIV, TB and Malaria Programs Face Disruptions as a Result of COVID-19; 2020. Available from: <https://www.theglobalfund.org/en/covid-19/news/2020-06-17-global-fund-survey-majority-of-hiv-tb-and-malaria-programs-face>

- disruptions-as-a-result-of-covid-19/. [Last accessed on 2020 Jun 19].
74. Robertson T, Carter ED, Chou VB, Stegmuller AR, Jackson BD, Tam Y, *et al*. Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: A modelling study. *Lancet Global Health* 2020;8:e901-8.
75. World Health Organization. Draft Landscape of COVID-19 Candidate Vaccines – 20 April 2020; 2020. Available from: <https://www.who.int/blueprint/priority-diseases/key-action/novel-coronavirus-landscape-ncov.pdf?ua=1>. [Last accessed on 2020 May 08].
76. Center for Disease Control and Prevention. Social Distancing. Centers for Disease Control and Prevention; 2020. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html>. [Last accessed on 2020 May 06].
77. Nigeria Centre for Disease Control. Guideline on Social Distancing. Nigeria Centre for Disease Control; 2020. Available from: https://covid19.ncdc.gov.ng/media/files/Social_Distancing_Guide_3.pdf. [Last accessed on 2020 May 07].
78. Sanche S, Lin YT, Xu C, Romero-Severson E, Hengartner N, Ke R. High Contagiousness and Rapid Spread of Severe Acute Respiratory Syndrome Coronavirus 2. *Emerg Infect Dis*. 2020;26:1470-77. doi:10.3201/eid2607.200282.
79. Prem K, Liu Y, Russell TW, Kucharski AJ, Eggo RM, Davies N, *et al*. The effect of control strategies to reduce social mixing on outcomes of the COVID-19 epidemic in Wuhan, China: A modelling study. *Lancet Public Health* 2020;5:e261-70.
80. World Health Organization. Covid-19 Press Briefing; 2020. Available from: https://www.who.int/docs/default-source/coronaviruse/transcripts/who-audio-emergencies-coronavirus-press-conference-full-20mar2020.pdf?sfvrsn=leafbff_0. [Last accessed on 2020 May 04].
81. World Health Organization. The Evidence for Clean Hands. World Health Organization; 2020. Available from: http://www.who.int/infection-prevention/publications/hh_evidence/en/. [Last accessed on 2020 May 07].
82. World Health Organization. About SAVE LIVES: Clean Your Hands. World Health Organization; 2020. Available from: <https://www.who.int/gpsc/5may/background/5moments/en/>. [Last accessed on 2020 May 07].
83. Center for Disease Control and Prevention. Show Me the Science – When & How to Use Hand Sanitizer in Community Settings Handwashing; 2020. Available from: <https://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html>. [Last accessed on 2020 May 07].
84. Salvi SS. In this pandemic and panic of COVID-19 what should doctors know about masks and respirators? *Assoc Phys India* 2020. Available from: <http://apiindia.org/wp-content/uploads/pdf/corona-virus/review-article-on-mask.pdf>. [Last accessed on 2020 May 04].
85. Nigeria Centre for Disease Control. Advisory on the Use of Masks by Members of the Public without Respiratory Symptoms. Nigeria Centre for Disease Control; 2020. Available from: https://covid19.ncdc.gov.ng/media/files/UseOfMasks_IBDgzHH.pdf. [Last accessed on 2020 May 07].
86. Kenyon C. Widespread use of face masks in public may slow the spread of SARS CoV-2: an ecological study. *medRxiv* 2020.03.31.20048652; doi: <https://doi.org/10.1101/2020.03.31.20048652>.
87. Feng S, Shen C, Xia N, Song W, Fan M, Cowling BJ. Rational use of face masks in the COVID-19 pandemic. *Lancet Res Med* 2020;8:434-6.
88. Nigeria Centre for Disease Control. Advisory on Use of Cloth Face Masks. Nigeria Centre for Disease Control; 2020. Available from: <https://covid19.ncdc.gov.ng/media/files/UseOfClothFaceMasks.pdf>. [Last accessed on 2020 May 07].
89. World Health Organization. International Health Regulations. 3rd ed.. Geneva, Switzerland: World Health Organization; 2016.
90. Nigeria Centre for Disease Control. IHR Implementation in Nigerian Law. Nigeria Centre for Disease Control; 2020. Available from: https://ncdc.gov.ng/themes/common/docs/protocols/116_1580654680.pdf. [Last accessed on 2020 May 04].
91. Xiong H, Yan H. Simulating the Infected Population and Spread Trend of 2019-nCov Under Different Policy by EIR Model (EIR 2019-nCov). Rochester, NY: Social Science Research Network; 2020. Available from: <https://papers.ssrn.com/abstract=3537083>. [Last accessed on 2020 May 04].
92. Koo JR, Cook AR, Park M, Sun Y, Sun H, Lim JT, *et al*. Interventions to mitigate early spread of SARS-CoV-2 in Singapore: A modelling study. *Lancet Infect Dis* 2020;20:678-88.
93. Public Health England. COVID-19: Investigation and Initial Clinical Management of Possible Cases; 2020. Available from: <https://www.gov.uk/government/publications/wuhan-novel-coronavirus-initial-investigation-of-possible-cases/investigation-and-initial-clinical-management-of-possible-cases-of-wuhan-novel-coronavirus-wn-cov-infection>. [Last accessed on 2020 May 25].
94. Nigeria Centre for Disease Control. National Interim Guidelines for Clinical Management of COVID-19: Version 1. Nigeria Centre for Disease Control; 2020. Available from: https://ncdc.gov.ng/themes/common/docs/protocols/177_1584210847.pdf. [Last accessed on 2020 May 07].
95. Food and Drug Administration. Emergency Use Authorization. Food and Drug Administration; 2020. Available from: <https://www.fda.gov/emergency-preparedness-and-response/mcm-legal-regulatory-and-policy-framework/emergency-use-authorization>. [Last accessed on 2020 May 08].
96. World Health Organization. Global Surveillance for COVID-19 Caused by Human Infection with COVID-19 Virus; 2020. Available from: [https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-\(2019-ncov\)](https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-(2019-ncov)). [Last accessed on 2020 May 09].
97. Nigeria Centre for Disease Control. Case Definitions for Coronavirus Disease. Nigeria Centre for Disease Control; 2020. Available from: https://covid19.ncdc.gov.ng/media/files/Case_Definition.pdf. [Last accessed on 2020 May 04].