



Combating the zoonotic trio of Ebola virus disease, Lassa fever, and COVID-19 in Nigeria: a retrospection of the challenges and lessons

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Abstract

Various infectious disease outbreaks linked to zoonotic sources have been recorded over the years, some of which have resulted in epidemics on a national, regional, or global scale. In Africa, a number of such outbreaks occur intermittently, especially in countries like Nigeria with a high-risk of epidemiological transmission. Three viral outbreaks with zoonotic links have hit the Nigerian healthcare system hardest, which are the Ebola virus disease, Lassa fever and Coronavirus disease 2019. Due to the fragile nature of the Nigerian health system, several challenges were encountered in the process of responding to these viral outbreaks, some of which included inadequate healthcare infrastructure, limited diagnostic capacity, unfledged nature of emergency response, unsatisfactory remuneration of health workers, misinformation trends, amongst others. By reminiscing on the challenges and lessons learnt from these viral disease outbreaks, the Nigerian government and policymakers will be able to adopt more effective approaches towards emergency preparedness for future outbreaks of infectious diseases.

Keywords: COVID-19, disease, ebola, lassa fever, Nigeria, outbreak

Introduction

Throughout history, infectious disease outbreaks have greatly affected local and global healthcare systems. In Nigeria, three viral diseases have had the most significant impact: Ebola virus disease (EVD), Lassa fever (LF) and Coronavirus disease 2019 (COVID-19)^[1]. EVD, a viral haemorrhagic fever, was first discovered in 1976 near the Ebola river in the Democratic Republic of Congo^[2]. Fruit bats are believed to be its zoonotic source, and

HIGHLIGHTS

- Outbreaks from Ebola virus disease, Lassa fever and Coronavirus disease 2019 stand out as the most prominent viral disease outbreaks in Nigeria.
- The Nigerian healthcare system was not fully prepared for an effective response to these disease outbreaks, hence, the myriad of challenges encountered.
- Capitalising on the lessons learnt from these outbreaks will enable Nigeria and other African countries to implement approaches for adequate emergency preparedness against future outbreaks.

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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Annals of Medicine & Surgery (2023) 85:3955–3959

Received 24 May 2023; Accepted 26 June 2023

Published online 3 July 2023

<http://dx.doi.org/10.1097/MS9.0000000000001038>

it is endemic in African countries such as Liberia, Sierra Leone, Guinea and the Democratic Republic of Congo^[3]. The largest Ebola outbreak occurred in 2014, spreading across West African countries, including Nigeria, and even reaching Spain and the United States^[3]. The disease causes internal and external bleeding, with an average case fatality rate of 50% and up to 90% in severe cases^[4]. In Nigeria, the disease transmission occurred in two states, Lagos and Rivers, resulting in 20 confirmed cases and 8 deaths^[4].

Another major viral haemorrhagic disease in Nigeria is LF, caused by the Lassa Virus, which originated from the *Mastomys natalensis* rat species discovered in Lassa town, Borno State, in 1969^[5]. The disease has experienced several outbreaks in Nigeria, affecting states such as Taraba, Nasarawa, Plateau, Ondo, Yobe, Edo, Imo, Rivers, Ebonyi and Anambra, as well as other West African countries like Sierra Leone, Ghana, Guinea and Liberia^[6]. LF has a case fatality rate of 1–2% and can rise above 15% in severe cases. Annually, West Africa witnesses

300 000–500 000 cases and over 5000 deaths^[7]. In 2022, Nigeria recorded over 797 LF cases, resulting in 158 deaths and a case fatality ratio of 19.8%^[8].

The most significant disease outbreak in history is COVID-19, causing a global pandemic that impacted all continents. The severe acute respiratory syndrome coronavirus 2 is responsible for this disease, infecting and inflaming the lower respiratory tract^[9]. Animal reservoirs, such as Horseshoe bats, Pangolins and Civet cats, have been linked to its transmission^[10,11]. COVID-19 was first identified in December 2019 in China's Wuhan Province and quickly spread worldwide, leading the WHO to declare it a global public health emergency on 11 March 2020^[12]. Nigeria reported its first case in Lagos on 27 February 2020, with subsequent spread to all states^[13]. Presently, Nigeria has recorded over 259 485 COVID-19 cases, resulting in 3146 deaths^[14]. The discovery of the COVID-19 vaccine brought relief to healthcare systems worldwide, aiding in reducing the disease's prevalence and transmission.

This paper aims to discuss these major viral disease outbreaks in Nigeria, focusing on the challenges and impeding factors encountered, and ways to enhance epidemic preparedness by highlighting lessons and recommendations to inform government decision-making and guide policymakers in improving the Nigerian healthcare system.

Efforts and challenges in the fight against ebola virus disease

Efforts against ebola in Nigeria

Nigeria's index case of EVD was linked to a Liberian diplomat on an official visit to Nigeria on 20 July 2014^[15]. Immediate measures were taken upon diagnosing the diplomat with EVD, including quarantine and the declaration of an EVD emergency by the Federal Ministry of Health and Nigeria Centre for Disease Control (NCDC)^[15]. Prior to the outbreak, the Lagos State Government had already raised awareness about EVD through various media channels, emphasising hand washing and environmental hygiene. Following the index case confirmation, an Emergency Operations Centre was established to coordinate the response, along with a national treatment centre. A rapid response team was deployed, consisting of units for epidemiology, surveillance, laboratory services, case management, infection control, points of entry, management and coordination and social mobilisation^[16]. Partnerships with international organisations like WHO, CDC, UNICEF, NGOs, and private businesses were harnessed to enhance financial and infrastructural capacity^[16].

Challenges encountered

Infrastructure deficit posed a major challenge, as there were no designated treatment or quarantine centres before the outbreak. These facilities were hastily established following the index case^[16]. Initially, Nigeria lacked the diagnostic capacity for Ebola virus detection, and samples were initially sent to the WHO reference laboratory in Senegal, causing delays in receiving results^[17]. This gap allowed for further transmission, including the infection of the treating medical doctor for the index case^[17]. Challenges with the payment of healthcare workers also arose, as the country's Medical Doctors were on strike during the outbreak

due to dissatisfaction with their remuneration^[18]. The absence of a national emergency response framework at the time was also an impediment, but was eventually resolved through a multisectoral approach^[16].

Efforts and challenges in the fight against lassa fever

When LF emerged in Nigeria during the late 1960s, the country's underdeveloped healthcare system, compounded by existing economic and political challenges, left it vulnerable to the impact of viral haemorrhagic fevers^[19,20]. Despite collaborative efforts between the government and the WHO, Nigeria recorded the highest number of cases during the 2018 outbreak^[21], and in 2020, amidst the heat of the COVID-19 pandemic, the NCDC reported 188 deaths from LF^[22].

Efforts against lassa fever in Nigeria

Nigeria has made significant progress in raising public awareness about LF through mass media campaigns, including national broadcasts, newspapers, radio, webinars and conferences^[23]. These initiatives have educated the population about the virus' mode of transmission, symptoms, case management and preventive measures. The emphasis on proper personal and food hygiene, waste management and avoiding rodent consumption as food has been widespread throughout the country. Control measures have also been implemented, such as constructing rodent traps, using rodent-proof roofs and walls, employing natural rodent predators, improving food storage facilities, and sealing homes^[24]. The NCDC has invested in training healthcare workers and established a network of diagnostic laboratories across the country^[25,26]. With support from the WHO, the Nigerian government has mobilised experts to enhance surveillance, risk analysis, early detection and effective case management^[27].

Challenges encountered

Prior to the establishment of the NCDC in 2011, most diagnostic tests for LF were conducted outside the country, while local diagnoses were performed at just two teaching Hospitals in Nigeria – Lagos University Teaching Hospital and Irrua Specialist Teaching Hospital^[26]. Following the establishment of the NCDC, there was a notable increase in reported LF cases, resulting in the WHO declaring it a public health emergency in 2019^[28]. This emphasised the fact that improved surveillance yielded an increase in the detection of LF cases, and a likelihood exists that Nigeria will witness higher rates of case detection as the country's surveillance and diagnostic capacity keeps improving. Currently, the NCDC is the only national public health institute equipped and dedicated to LF case detection and management in Nigeria. However, it is also laden with the responsibility of detection and surveillance of various other outbreaks such as Yellow fever, Monkey pox, Cholera, Tuberculosis and COVID-19^[28]. Thus, the multitude of responsibilities borne by the NCDC serves as a factor that dampens the allocation of sufficient resources and attention to LF in Nigeria.

Efforts and challenges in the fight against coronavirus disease 2019

Before the index case of COVID-19 in Nigeria, the WHO classified Nigeria as a high-risk zone, prompting the need for adequate surveillance and infection prevention and control measures against COVID-19^[13]. In the Bloomberg COVID-19 resilience rankings, Nigeria ranked 46th out of 53 countries, with a resilience score of 61.4%^[29]. Despite significant efforts, Nigeria faced various challenges in its pandemic response.

Efforts against COVID-19 in Nigeria

Nigeria's COVID-19 response began with national awareness campaigns following the disease's emergence in Wuhan, China, in December 2019. The NCDC had prepared measures beforehand to ensure a prompt response to the outbreak. Details of the measures by the NCDC before and after Nigeria's first COVID-19 index case are outlined in Table 1.

Challenges encountered

Despite the NCDC's efforts to limit COVID-19 transmission in Nigeria, various challenges were encountered. For instance, the NCDC employed improved publicity approaches to educate Nigerian citizens on safety control measures, but adherence was suboptimal, with just 36% compliance^[31]. This hampered the effectiveness of the Nigerian government's lockdown measures, which had an average severity score of 36% in the Bloomberg rankings, compared to countries like China with scores as high as 71%^[29]. Low confidence in the healthcare system contributed to the low adherence, as only about 30% of Nigerian citizens trusted the efficacy of the country's healthcare system^[32]. Additionally, some Nigerians doubted the existence of the virus or believed Africans were immune to it, further reducing adherence to precautionary measures^[33].

The lockdown measures also exacerbated household poverty rates, leading many citizens to defy restrictions in order to sustain their livelihoods^[34]. Movement restrictions and diversion of healthcare resources to the COVID-19 response resulted in limited delivery of healthcare services, including reduced antenatal care visits and increased maternal and child mortality^[35,36], decreased tuberculosis diagnostics with a corresponding rise in tuberculosis cases^[37], and a decline in vaccination campaigns, contributing to recent outbreaks of Yellow fever and Cholera in Nigeria during the pandemic^[38,39]. As a result, the country

experienced a gradual decline in progress across various health indices prior to the COVID-19 pandemic^[40]. Inadequate testing capacity initially hindered prompt diagnosis of COVID-19 cases, further impeding the response in Nigeria^[41].

Lessons and recommendations for tackling future viral disease outbreaks

One crucial lesson from the discussed viral outbreaks is the need for the Nigerian government to prioritise healthcare by allocating a higher percentage of the national budget to the healthcare system, which currently stands at only 3% of the country's GDP^[42]. With Nigeria being the most populated country in Africa and the seventh most populated globally, increased budgetary allocation would ensure better healthcare access for the large population. Additionally, attention should be given to health workers in terms of training, payments, incentives, and equipment to effectively respond to infectious disease outbreaks. Citizens should have access to adequate health insurance schemes and palliative measures to safeguard their health and well-being during emergencies. Another important lesson is the strengthening of Nigeria's emergency preparedness. This includes establishing outbreak-specific frameworks for risk assessment and emergency response, improving disease surveillance, laboratory diagnostics, case management, infection prevention and control measures, and utilising digital tools for coordinated outbreak response. Sustained healthcare delivery for other public health concerns, such as maternal and child health, mental health, sexual and reproductive health, and priority diseases like tuberculosis, malaria, HIV/AIDS, cholera, and yellow fever, is also crucial. Continued surveillance for infectious diseases and maintaining vaccination campaigns are essential for preventing future outbreaks. Investing in vaccine research and development can enhance coverage and reduce reliance on purchasing vaccines from developed countries.

Addressing the spread of misinformation, termed an 'infodemic surge' by the WHO^[43], is another challenge. Implementing measures to identify and counter misinformation during public health emergencies, such as myth busters, information filters, accurate infographics and multimodal communication channels, is vital. Improved health promotion strategies and community engagement activities are necessary to enhance public awareness of disease outbreaks and emergencies. In addition to these recommendations, employing a mixed health system model is

Table 1
NCDC measures prior to and after Nigeria's index case of COVID-19^[30].

Measures prior to COVID-19 index case	Measures after COVID-19 index case
Collation of data and information on the COVID-19 outbreak situation in other countries.	Publication of information, education and communication (IEC) materials containing COVID-19 guidelines.
Establishment of the National Coronavirus Preparedness Group (NCPG).	Setup of the national multisectoral COVID-19 emergency operations centre (EOC).
Assessment of the country's COVID-19 transmission risk.	Inauguration of the COVID-19 Presidential Task Force (PTF).
COVID-19 training for health workers (contact training and case management).	Deployment of rapid response teams (RRTs) and supply of COVID-19 response materials to all Nigerian states.
Creation of points of entry (PoE) surveillance systems.	Development of the national incident action plan.
Setup of COVID-19 isolation and case management centres.	Genomic sequencing of the viral strain isolated from the Nigerian index case.
Equipment of 3 preliminary molecular laboratories for COVID-19 diagnostics.	Establishment of the NCDC COVID-19 Microsite.
Improvement of supply and logistics capacity for COVID-19 response.	Implementation of lockdown and travel restrictions.
Preparation and training of rapid response teams (RRTs) for eventual outbreak.	Expansion of the number of COVID-19 testing labs nationwide (from 3 to 161).

suggested, involving decentralisation of health infrastructure and healthcare delivery, while centralising public health data and information channels. This approach allows for grassroots development of healthcare resources and epidemic preparedness, while ensuring streamlined health data and communication at all levels of the health sector to mitigate misinformation.

Overall, despite the fact that Nigeria's public health infrastructure was not well prepared to handle such massive disease outbreaks and most of the response efforts were reactive, not proactive, the country appeared to have demonstrated a commendable outbreak response considering its high transmission risk. One key lesson from Nigeria's response is the importance of swift and decisive action. The NCDC, in collaboration with international partners, acted promptly by establishing emergency operations centres, implementing contact tracing, isolation measures, and public awareness campaigns. The country invested in expanding its laboratory diagnostic capacity and training healthcare workers on early detection and management of cases, which is evident from the COVID-19 outbreak response efforts outlined earlier in Table 1. This approach improved the efficacy of case detection, timely intervention, and the prevention of further spread. The Nigerian response to these zoonotic disease outbreaks highlights the importance of adaptive strategies in resource-constrained settings, and such adaptive measures could provide valuable insight for other countries within the lower- and middle-income strata that are dealing with similar challenges.

Conclusion

Nigeria has experienced a variety of viral infectious disease outbreaks, of which the zoonotic trio of LF, Ebola, and COVID-19 appear to have hit the country hardest. Efforts made by the Nigerian health sector to curb these diseases proved effective to an extent, but this was not without major challenges. The lessons learnt from these outbreaks must be harnessed by the Nigerian government and policymakers to strengthen the country's infrastructure and preparedness for future outbreaks, and could also provide insight to other African countries battling similar epidemics.

Ethical approval

Not applicable.

Consent

Informed consent was not required for this review.

Sources of funding

We did not receive any financial support for this manuscript.

Author contribution

E.E.E., E.F.B.: conceptualisation, writing - original draft; A.M.O., F.P.K., O.F.A.: writing - original draft; O.C.A., S.G.Y.: writing - review and editing All authors read and approved the final version of the manuscript and take responsibility for it.

Conflicts of interest disclosure

The authors declare no conflicts of interest.

Research registration unique identifying number (UIN)

Not applicable to this study.

Guarantor

Emmanuel Ebuka Elebesunu.

Data availability statement

Not applicable.

Provenance and peer review

This paper was not commissioned or invited.

Acknowledgements

None.

References

- [1] Olumade TJ, Adesanya OA, Fred-Akintunwa IJ. Infectious disease outbreak preparedness and response in Nigeria: history, limitations and recommendations for global health policy and practice. *AIMS Public Health* 2020;7:736–57.
- [2] Feldmann H, Geisbert TW. Ebola haemorrhagic fever. *Lancet* 2011;377:849–62.
- [3] Gatherer D. The 2014 Ebola virus disease outbreak in West Africa. *J Gen Virol* 2014;95(Pt 8):1619–24.
- [4] Elemuwa C, Kutalek R, Ali M, *et al.* Vienna vaccine safety initiative. Global lessons from Nigeria's ebolavirus control strategy. *Expert Rev Vaccines* 2015;14:1397–400.
- [5] Ogbu O, Ajuluchukwu E, Uneke CJ. Lassa fever in West African sub-region: an overview. *J Vector Borne Dis* 2007;44:1–11.
- [6] Okoro OA, Bamgboye E, Dan-Nwafor C, *et al.* Descriptive epidemiology of Lassa fever in Nigeria, 2012–2017. *Pan Afr Med J* 2020;37:15.
- [7] Yaro CA, Kogi E, Opara KN, *et al.* Infection pattern, case fatality rate and spread of Lassa virus in Nigeria. *BMC Infect Dis* 2021;21:149.
- [8] Nigeria Centre for Disease Control (2022). NCDC Lassa fever Situation Report Epi Week 24: 13 - 19 June, 2022. Available from <https://reliefweb.int/report/nigeria/ncdc-lassa-fever-situation-report-epi-week-24-13-19-june-2022>
- [9] Oke GI, Fajobi TO, Elebesunu EE, *et al.* COVID-19 in the elderly and the immunocompromised. *J Health Rep Technol* 2020;7:e105955.
- [10] Lytras S, Xia W, Hughes J, *et al.* The animal origin of SARS-CoV-2. *Science* 2021;373:968–70.
- [11] Kunzmann K (2021). WHO, China Report Suggests COVID-19 Passed from Bats to Humans Through Another Animal. Available from: <https://www.contagionlive.com/view/who-china-report-covid-19-passed-bats-humans-animal>
- [12] World Health Organization. 2020 COVID-19 public health emergency of international concern (PHEIC) global research and innovation forum 2020 February 12. Available from [https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-\(pheic\)-global-research-and-innovation-forum](https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-(pheic)-global-research-and-innovation-forum)
- [13] Amzat J, Aminu K, Kolo VI, *et al.* Coronavirus outbreak in Nigeria: Burden and socio-medical response during the first 100 days. *Int J Infect Dis* 2020;98:218–24.
- [14] Nigeria Centre for Disease Control (2022). COVID-19 in Nigeria. Available from: <https://covid19.ncdc.gov.ng/>

- [15] Fasina FO, Shittu A, Lazarus D, *et al.* Transmission dynamics and control of Ebola virus disease outbreak in Nigeria, July to September 2014. *Euro Surveill* 2014;19:20920.
- [16] Otu A, Ameh S, Osifo-Dawodu E, *et al.* An account of the Ebola virus disease outbreak in Nigeria: implications and lessons learnt. *BMC Public Health* 2017;18:3.
- [17] Azuonwu O, Chukwu EC. Emergence and Re-emergence of 2014 Ebola outbreak in Sub- Sahara Africa: 'Challenges and lessons learned' from Nigerian epidemic outbreak. *Sch J App Med Sci* 2015;3 (8A):2802–14.
- [18] Ibeh N (2014). Ebola: Nigerian doctors still on strike – Official. Available from: <https://www.premiumtimesng.com/news/top-news/166225-ebola-nigerian-doctors-still-on-strike-official.html>
- [19] Alubo SO. Underdevelopment and the health care crisis in Nigeria. *Med Anthropol* 1985;9:319–35.
- [20] Bond N, Schieffelin JS, Moses LM, *et al.* A historical look at the first reported cases of Lassa fever: IgG antibodies 40 years after acute infection. *Am J Trop Med Hyg* 2013;88:241–4.
- [21] World Health Organization (2018). Nigeria battles its largest Lassa fever outbreak on record. Available from: <https://www.afro.who.int/news/nigeria-battles-its-largest-lassa-fever-outbreak-record>
- [22] Bagcchi S. Lassa fever outbreak continues across Nigeria. *Lancet Infect Dis* 2020;20:543.
- [23] Wogu JO, Chukwu CO, Nwafor KA, *et al.* Mass media reportage of Lassa fever in Nigeria: a viewpoint. *J Int Med Res* 2020;48:300060518821552.
- [24] Abdullahi IN, Anka AU, Ghamba PE, *et al.* Need for preventive and control measures for Lassa fever through the One Health strategic approach. *Proc Singapore Healthc* 2020;29:190–4.
- [25] Njidda AM, Oyebanji O, Obasanya J, *et al.* The Nigeria centre for disease control. *BMJ Glob Health* 2018;3:e000712.
- [26] Naidoo D, Ihekweazu C. Nigeria's efforts to strengthen laboratory diagnostics - Why access to reliable and affordable diagnostics is key to building resilient laboratory systems. *Afr J Lab Med* 2020; 9:1019.
- [27] World Health Organization (2019). WHO supports five countries to fight Lassa fever outbreaks. Available from: <https://www.afro.who.int/news/who-supports-five-countries-fight-lassa-fever-outbreaks>
- [28] Dan-Nwafor CC, Furuse Y, Ilori EA, *et al.* Measures to control protracted large Lassa fever outbreak in Nigeria, 1 January to 28 April 2019. *Euro Surveill* 2019;24:1900272.
- [29] Bloomberg (2022). The Best and Worst Places to Be as COVID Travel Curbs Fall Away. Available from: <https://www.bloomberg.com/graphics/covid-resilience-ranking/>
- [30] Dan-Nwafor C, Ochu CL, Elimian K, *et al.* Nigeria's public health response to the COVID-19 pandemic: January to May 2020. *J Glob Health* 2020;10:020399.
- [31] Hager E, Odetokun IA, Bolarinwa O, *et al.* Knowledge, attitude, and perceptions towards the 2019 Coronavirus Pandemic: A bi-national survey in Africa. *PLoS One* 2020;15:e0236918.
- [32] Roder-DeWan S, Gage A, Hirschhorn LR, *et al.* Level of confidence in and endorsement of the health system among internet users in 12 low-income and middle-income countries. *BMJ Glob Health* 2020;5:e002205.
- [33] Obi-Ani NA, Anikwenze C, Isiani MC. Social media and the COVID-19 pandemic: Observations from Nigeria. *Cogent Arts Humanit*, 2020;7:1.
- [34] Andam K, Edeh H, Oboh V, *et al.* Impacts of COVID-19 on food systems and poverty in Nigeria. *Adv Food Secur Sustain* 2020;5:145–73.
- [35] Elebesunu EE, Oke GI, Adebisi YA, *et al.* COVID-19 calls for health systems strengthening in Africa: A case of Nigeria. *Int J Health Plann Manage* 2021;36:2035–43.
- [36] Oke GI, Elebesunu EE, Ihekweazu V. Impact of the COVID-19 pandemic on maternal and child health. *Mod Care J* 2020;17:e110808.
- [37] Elebesunu EE, Ani EC, Anyabolo EE, *et al.* Strengthening tuberculosis diagnostics and healthcare amidst COVID-19: a call to action. *Global Biosecurity* 2022;4:1–5.
- [38] World Health Organization (2020). Responding to a yellow fever outbreak in Nigeria amidst a global pandemic. Available from: <https://www.afro.who.int/news/responding-yellow-fever-outbreak-nigeria-amidst-global-pandemic>
- [39] Musa SS, Gyeltsen D, Manirambona E, *et al.* Dual tension as Nigeria battles cholera during the COVID-19 pandemic. *Clin Epidemiol Glob Health* 2021;12:100913.
- [40] Abubakar I, Dalglish SL, Angell B, *et al.* The Lancet Nigeria Commission: investing in health and the future of the nation. *Lancet* 2022;399:1155–200.
- [41] Jacobs ED, Okeke MI. A critical evaluation of Nigeria's response to the first wave of COVID-19. *Bull Natl Res Cent* 2022;46:44.
- [42] World Bank Data (2022). Current health expenditure (% of GDP) – Nigeria. Available from: <https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS?locations=NG>
- [43] World Health Organization (2022). Let's flatten the infodemic curve. Available from: <https://www.who.int/news-room/spotlight/let-s-flatten-the-infodemic-curve>