

# Epidemiological trends of Lassa fever in Nigeria from 2015-2021: A review

John-Ugwuanya A. Grace, PhD , Ifunanya J. Egoh, MSc and Nnenna Udensi, MSc

*Ther Adv Infectious Dis*

2021, Vol. 8: 1–7

DOI: 10.1177/  
20499361211058252

© The Author(s), 2021.  
Article reuse guidelines:  
[sagepub.com/journals-  
permissions](https://sagepub.com/journals-permissions)

## Abstract

**Introduction:** Lassa fever is a viral haemorrhagic fever with non-specific symptoms that has shown an upward trend in Nigeria and other West African countries, which is depicted by high incidence and case fatality in recent years. There are different reports on the yearly case burden of Lassa fever from the Federal Ministry of Health in Nigeria, through the regulatory body – Nigeria Centre for Disease Control (NCDC). Being the epicentre of the disease, Lassa fever has been exported from Nigeria to both neighbouring and distant countries.

**Methods:** The aim of this review was to carry out a retrospective analysis from January 2015 to 26 September 2021 of the weekly and yearly outbreak of Lassa fever in Nigeria based on selected publications. The focus was on timely diagnosis, treatment option, public health interventions and progress of clinical trials for vaccine candidates, and to identify proactive measures that can be sustained to curb periodic outbreaks. The review was done using percentages, cross-tabulation and graphical charts.

**Results:** The predominant age group infected was 21 to 40 years with a male to female ratio of 1:0.8. A total of 3311 laboratory-confirmed Lassa fever cases out of 20,588 suspected cases were identified from 29 states. Edo, Ondo, Taraba, Ebonyi, Bauchi, Plateau and Nasarawa had yearly Lassa fever incidence over the time frame considered. Contact tracing was done on over 33,804 individuals with about 90% completing follow-up. Case fatality rate within the period ranged from 9.3% to 29.2%. There is a sharp decline in the epidemiological trend of Lassa fever in the yearly seasonal peaks from weeks 1 to 13 with about 75% reduction in incidence between 2020 and 2021.

**Conclusion:** The effective management of Lassa fever needs the implementation of preventive methods, prompt laboratory diagnosis, timely treatment, provision of personal protective equipment, cross-border surveillance, contact tracing, community awareness and vector control in order to minimise spread.

**Keywords:** case fatality rate, confirmed cases, Lassa fever, Nigeria, Nigeria Centre for Disease Control (NCDC), probable cases, suspected cases

Received: 2 July 2021; revised manuscript accepted: 20 October 2021.

## Introduction

Lassa fever (LF) has been identified as a yearly outbreak in West Africa with Nigeria having the highest yearly incidence. Seasonal peaks of this viral haemorrhagic fever occur during the dry season from November to April, and it is common in Sierra Leone, Ghana, Mali, Nigeria, Benin, Togo, Guinea and Liberia.<sup>1</sup> Delay in LF diagnosis often

occurs because of non-specific symptoms such as fever and the assumption that the febrile illness is caused by other factors, especially malaria that is endemic in sub-Saharan Africa.<sup>2</sup> Identifying the onset of the disease is often difficult due to the generalised symptoms and clinical presentation such as fever, vomiting, fatigue, abdominal pain, sore throat, chest pain and myalgia. It may

Correspondence to:  
**John-Ugwuanya A. Grace**  
Medbury Medical Services,  
Lagos, Nigeria  
[graceamy2k@yahoo.com](mailto:graceamy2k@yahoo.com)

**Ifunanya J. Egoh**  
Department of Virology,  
University of Ibadan,  
Ibadan, Nigeria

**Nnenna Udensi**  
Department of  
Haematology, Federal  
Medical Centre, Abia,  
Nigeria



progress to serious complications such as encephalitis, respiratory difficulty, haemorrhage, neurological problems and hearing loss.<sup>1,3</sup>

LF is a viral haemorrhagic fever of zoonotic origin from the urine and faeces of multimammate rat *Mastomys natalensis*. Person-to-person transmission occurs by contacting aerosol or fluid secretions such as sputum, sneezing, blood, seminal fluid and stool.<sup>1-3</sup> It was first discovered in 1969 when a nurse became ill at Lassa town of Borno, Nigeria. The first nosocomial spread was observed among the health workers where the nurse was admitted before becoming endemic in different parts of Nigeria and West Africa. The Lassa virus is an enveloped, single-stranded, bisegmented negative-strand RNA virus belonging to the family *Arenaviridae*.<sup>2,4-6</sup> LF cases are categorised based on suspected, confirmed and probable case. Suspected cases involve individuals who have symptoms and a history of contact with a probable or confirmed LF case within a 21-day period. There are public health concerns about its incidence, virulence and potential as a bioterrorism agent.<sup>7-11</sup>

LF has an incubation period of 1 to 3 weeks, and this long incubation period means infected person resident on endemic regions can travel both locally and internationally thereby causing an epidemic.<sup>4</sup> The interconnection between West African countries and the ease of human movement escalates the risk of international spread of disease. Disease surveillance systems and comprehensive outbreak response is needed as a public health procedure in cross-border migration.<sup>12</sup> According to a probabilistic model on exported cases by Tuite *et al.*,<sup>7</sup> a low probability of case exportation was quantified using the 2018 LF outbreak; however, countries with close proximity to Nigeria needed to be on the alert for LF importation and ensure prompt epidemic response.<sup>7</sup> Previous cases of LF outbreaks in Nigeria were exported to neighbouring countries and even more distant countries especially via international air travels.

The aim of this study is to carry out a retrospective analysis of the national outbreak of LF in Nigeria from January 2015 to 26 September 2021 with a focus on the weekly and yearly available report, importance of prompt and accurate diagnosis, treatment option, public health interventions and progress of clinical trials for vaccine

candidates, and to identify proactive measures that can be sustained to curb periodic outbreaks.

## Method

The systematic literature review was conducted using the search term 'Lassa fever and Nigeria' in online databases, including PubMed, Google Scholar Africa Journal Online, WHO Library Database, Research Gate, Nigeria Centre for Disease Control (NCDC) website and the Federal Ministry of Health of Nigeria. The NCDC is the public health institute for the nation, and it was carved out from different divisions in the Federal Ministry of Health to handle preparedness in public health emergencies with the detection and response to infectious disease outbreaks. Characteristics of data are period of inclusion, demographics, contact tracing, yearly trend of confirmed cases and the effect of national proactive measures in LF outbreaks. The raw data obtained were collated using Excel spreadsheets and analysed using basic statistics such as percentages, cross-tabulation and graphical chart.

## Quantitative analysis and state distribution of LF in Nigeria

The age group and gender infected by LF over the years vary. Considering the recent outbreak in 2021, the predominant age group affected were 21 to 30 years with a male to female ratio of 1:0.8 in the confirmed cases (Table 1). The details of those who had come in contact with infected persons during the yearly outbreak was obtained and intense follow-up done to identify those that were symptomatic and the laboratory-confirmed cases (Table 2). Report on the yearly LF outbreak from the Federal Ministry of Health in Nigeria and NCDC indicates different percentage of mortality (Table 3). The significantly high mortality rate from LF outbreaks is often associated with the poor sanitary conditions and daily environmental lifestyle common in high-risk areas.<sup>9</sup> Prior to 2018, the yearly confirmed cases ranged from 25 to 143. The first largest outbreak having 633 confirmed cases of LF occurred in 2018 (Table 3), followed by a persistent increase of confirmed cases of LF in subsequent years (NCDC, 2021). The high case count of laboratory-confirmed LF may be due to the availability of Lassa virus diagnostic centres within the states and heightened surveillance sensitivity.<sup>6</sup> It is encouraging to note that there is a steady decline in the fatality rate from 2018 to 2020.

**Table 1.** Demographics of Lassa fever.

Demographics	2015	2016	2017	2018	2019	2020	2021
Age range	-	-	-	-	1 ≤ 98 years	1 ≤ 99 years	1 ≤ 70 years
Predominant age group	-	-	-	21–40	21–40	21–30	21–30
Median age	-	-	-	32	34	30	29
Male to female ratio	-	-	-	1.6:1	1:1	1:0.9	1:0.8
(-): not available.							

**Table 2.** Lassa fever contact tracing from January 2015 to 26 September 2021.

Contact tracing	2015–2016	2017	2018	2019	2020	26 September 2021
Cumulative	2504	Nil	9643	9379	10,118	2160
Under follow-up	1942	-	421	405	3	141
Completed follow-up	562	-	9089	8894	10,014	2002
Symptomatic contacts	0	-	118	144	172	15
Positive contacts	0	-	38	68	57	10
Lost to follow-up	-	-	15	120	44	7
(-): not available.						

The 53-week epidemiological trend shows an active LF outbreak from weeks 1 to 13 of 2016 to 2021, which tapers down in the remaining weeks of the year. In the first 24 weeks of 2021, the trend of LF confirmed cases is lower compared with what was observed within the same time frame in 2020 (Figures 1 and 2). According to NCDC LF situation report from 2015 to 26 September 2021, the epicentre having the highest number of confirmed cases of LF is Edo, Ondo, Ebonyi and Taraba.<sup>16</sup> The coordinated sensitisation and response activities across different states have helped in curbing the seasonal peaks previously experienced.

### Community lifestyle

In different countries of West Africa, bacterial and viral infection seems to be re-occurring with fluctuating preparedness in handling such outbreaks. Community lifestyle that made LF endemic in some locations includes consumption of rats, forceful ingestion of bathing water from dead corpses as part of an age-long tradition and

overnight drying of agricultural products thereby exposing it to contamination from rat urine and faeces.<sup>4,9,18</sup> Preventive and surveillance measures include public enlightenment on mode of transmission, effect of personal and environmental hygiene, the need for timely medical intervention and contact tracing of people exposed to the infected person. Our aim was to review the epidemiological trend of LF in Nigeria, the national level of preparedness and the effect that proactive activities will have in curbing the recurrent outbreaks.

### Public health interventions for LF in Nigeria

The World Health Organization (WHO) posited that the capacity of Nigeria to fully implement disease surveillance to handle LF and initiate appropriate public health measures has contributed to the repeated LF outbreaks at the state and national level.<sup>3</sup> Negligence on the part of the Nigerian government to health care contributed significantly in the high mortality rate observed yearly.<sup>8</sup> In recent years, the provision and use of

**Table 3.** NCDC yearly summary of Lassa fever cases from 2015 to 26 September 2021.

Reporting period	Suspected cases	Confirmed cases (N1)	Probable cases (N2)	Case fatality in N1 + N2 (%)	States affected
January–December 2015	430	25	–	40 (9.3%) <sup>a</sup>	15
January–December 2016	921	109	–	119 (12.9%) <sup>a</sup>	29
January–December 2017	733	143	–	71 (9.7%) <sup>a</sup>	29 (70% from Edo, Ondo and Taraba)
January–December 2018	3498	633	20	191 (29.2%)	23 (80% from Edo – 44%, Ondo – 25% and Ebonyi – 11%)
January–December 2019	5057	833	19	174 (20.9%)	23 (87% from Edo – 37%, Ondo – 34%, Ebonyi and Bauchi – 7% each, Taraba – 5% and Plateau – 4%)
January–December 2020	6791	1189	14	244 (20.5%)	27 (83.2% from Ondo – 35%, Edo – 32%, Ebonyi – 6.8%, Taraba – 4.9% and Bauchi – 4.5%)
1 January–26 September 2021 (week 24)	3158	379	3	77 (20.2%)	14 (83% from Edo – 45%, Ondo – 33% and Taraba – 5%)

NCDC, Nigeria Centre for Disease Control.

FMOH, Federal Ministry of Health

<sup>a</sup>Based on FMOH and NCDC report, the case fatality rate for 2015 to 2017 was calculated using the number of suspected cases and not a cumulative of N1 + N2.<sup>11,13–15</sup>

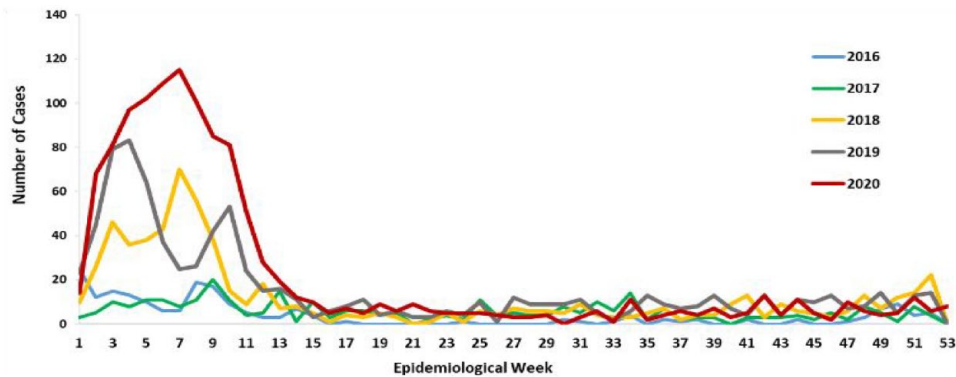
personal protective equipment (PPE) for health care workers has resulted in a significant decline of confirmed LF cases among the Nigerian health care workers and the spread within hospital settings coupled with the intense effort in contact tracing.<sup>19–21</sup>

The LF National Emergency Operations Centre (EOC) in Nigeria was activated on 22 January 2018 by the NCDC due to the high number of confirmed cases observed in 2018. The response pillars in which the EOC was set up include coordination, case management, surveillance and epidemiology, infection, prevention and control, safe burial, turnaround time of laboratory test, risk communication and logistic pillars, research and vector control, food safety and environmental sanitation.<sup>10,22</sup> The research pillar was introduced to facilitate and support LF research that would provide evidence-based knowledge and inform appropriate preventive and control measures. Adequate funding would be required to support research and address important knowledge gaps that could aid in the management of LF outbreaks. All the affected states had State Public

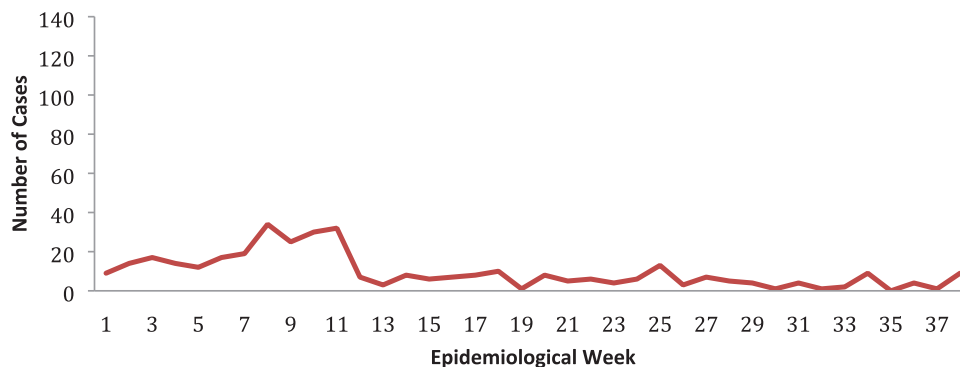
Health Emergency Operations Centre (PHEOC) activated as part of its epidemic preparedness.<sup>8,11</sup>

### Laboratory diagnosis of LF

Laboratory diagnosis of LF is often confirmed with a reverse-transcriptase polymerase chain reaction (RT-PCR), antibody enzyme-linked immunosorbent assay, virus isolation using cell culture and antigen detection tests.<sup>5</sup> The increase in laboratory detection and reporting of confirmed cases is attributed to the setting up of LF laboratories in endemic areas, initiating a workable sample transport system and strengthening laboratory capacity.<sup>23</sup> Correct diagnosis became possible based on clinical manifestations, confirmatory laboratory tests and the epidemiological findings.<sup>1</sup> Other laboratory investigations such as full blood count, urinalysis, liver function test, urine and blood culture, and microscopy for malaria parasites are also carried out to aid in diagnosis and treatment. Any suspected case with laboratory confirmation involving positive IgM antibody, molecular detection and virus isolation were referred to as confirmed case. The probable



**Figure 1.** Trend of Lassa fever confirmed cases in Nigeria from 2016 to 2020 by 53 epidemiological weeks [retrieved from NCDC Lassa Fever Situation Report, 2020]<sup>17</sup>.



**Figure 2.** Current 2021 epidemiological weekly trend for weeks 1 to 38.

cases were suspected cases that died or absconded without sample collection for laboratory testing.<sup>11</sup>

### Treatment

Ribavirin, a broad spectrum guanosine analogue, is the recommended treatment for LF and for post-exposure prophylaxis using both oral and intravenous administration. Initiating early treatment is vital to improve the rate of survival. Oral ribavirin is indicated in the dose of 500 to 600 mg every 6 h for 7 to 10 days while intravenous dosing begins with a loading dose of 2.4 g, followed by 1 g every 6 h for 10 days based on average weight adults.<sup>1,4,24,25</sup> According to Ilori *et al.*,<sup>6</sup> the case fatality for patients who did not receive ribavirin was 71.4% compared with 20.7% for patients who received ribavirin. Renal dialysis was also

reported to improve the prognosis of some patients with LF.<sup>22</sup>

### Vaccine development

Considering the significant mortality associated with Lassa haemorrhagic fever, the WHO listed the virus as a high priority organism requiring prophylaxis and treatment. Different vaccine candidates involving human monoclonal antibodies have undergone preclinical trials, with some showing efficacy in animal models. However, only one vaccine candidate has progressed to clinical trials.<sup>26</sup> A DNA vaccine candidate INO-4500 has been developed for LF by INOVIO Pharmaceuticals, Plymouth, and in February 2021, the first trial patient was dosed in Ghana, in its phase 1B human trial. About 220 adults aged 18 to 50 years will be enrolled for the clinical trial

by receiving a two-dose regimen injection on days 0 and 28 while being evaluated for immunogenicity and safety within an African population.<sup>27,28</sup> The DNA plasmid induces target antigen production, which triggers T cell and antibody-mediated cellular immunity. A major factor limiting the LF vaccine development has been associated with the high cost of bio-containment required.<sup>13</sup> Detailed understanding of the pathogenesis, course of the disease, signs and symptoms, and possible complications is needed in the development of the LF vaccine and other antiviral compounds.<sup>2</sup>

### Conclusion

From this overview, it is vital to note that LF is highly endemic in Nigeria with public health implications that require prompt action. Strategic preventive methods and awareness need to be put in place routinely to curb the spread. Setting up LF diagnostic laboratories in other locations can improve diagnosis and increase the number of confirmed cases in locations with seemingly low incidence, while ensuring timely treatment of LF. Provision of PPE for health care workers in endemic areas and other essential resources is necessary to strengthen the porous health care system in West African countries. Ribavirin, the choice drug for LF treatment, should be made readily available in public health centres and clinics within the endemic areas.

### Author contributions

J.-U.A.G. was involved in study conceptualisation and draft manuscript preparation. J.-U.A.G., I.J.E. and N.U. were involved in data collection, analysis and interpretation, and have contributed to resources. All the authors read and gave their consent for the submission of this manuscript.

### Conflict of interest statement

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### ORCID iD

John-Ugwuanya A. Grace  <https://orcid.org/0000-0002-1004-132X>

### References

1. Mofolorunsho KC. Outbreak of Lassa fever in Nigeria: measures for prevention and control. *Pan Afr Med J* 2016; 23: 210.
2. Ezeomah C, Adoga A, Ihekweazu C, *et al.* Sequelae of Lassa fever: postviral cerebellar ataxia. *Open Forum Infect Dis* 2019;6: ofz512.
3. Reuben RC, Danladi MMA and Pennap GR. Is the COVID-19 pandemic masking the deadlier Lassa fever epidemic in Nigeria? *J Clin Virol* 2020; 128: 104434.
4. Inegbenebor U, Okosun J and Inegbenebor J. Prevention of Lassa fever in Nigeria. *Trans R Soc Trop Med Hyg* 2009; 104: 51–54.
5. Akhiwu HO, Yiltok ES, Ebonyi AO, *et al.* Lassa fever outbreak in adolescents in North Central Nigeria: report of cases. *J Vir Eradic* 2018; 4: 225–227.
6. Ilori EA, Furuse Ipadeola YOA, *et al.* Epidemiologic and clinical features of Lassa fever outbreak in Nigeria, January 1 – May 6, 2018. *Emerg Infect Dis* 2019; 25: 1066–1074.
7. Tuite AR, Watts AG, Kraemer MUG, *et al.* Potential for seasonal Lassa fever case exportation from Nigeria. *Am Soc Trop Med Hyg* 2019; 100: 647–651.
8. Bagcchi S. Lassa fever outbreak continues across Nigeria. *Lancet Inf Dis* 2020; 20: 1.
9. Wogu JO, Chukwu CO, Nwafor KA, *et al.* Mass media reportage of Lassa fever in Nigeria: a viewpoint. *J Int Med Res* 2019; 48: 1–7.
10. Olayinka AT, Nwafor CD, Adejoke A, *et al.* Research as a pillar of Lassa fever emergency response: lessons from Nigeria. *Pan Afr Med J* 2020; 37: 179, <https://www.panafrican-med-journal.com/content/article/37/179/full> (accessed 22 March 2021).
11. Nigeria Centre for Disease Control. An update of Lassa fever outbreak in Nigeria, June 2021. <https://ncdc.gov.ng/diseases/sitreps/?cat=5&name=An%20update%20of%20Lassa%20fever%20outbreak%20in%20NigeriaU3> (accessed 17 June 2021).
12. Kakai CG, Okunromade OF, Dan-Nwafor CC, *et al.* Improving cross-border preparedness and response: lessons learned from 3 Lassa fever outbreaks across Benin, Nigeria, and Togo, 2017–2019. *Health Secur* 2020; 18: S105–S112.
13. World Health Organization. Disease Outbreak: Lassa fever – Nigeria. 2016, <https://www.afro.who.int/health-topics/lassa-fever/outbreak/27-may-2016-nigeria> (accessed 16 November 2021).

14. Federal Ministry of Health – Nigeria. Weekly Epidemiology Report, Vol. 6: 39, 2016, [https://ncdc.gov.ng/themes/common/docs/wers/10\\_1477398165.pdf](https://ncdc.gov.ng/themes/common/docs/wers/10_1477398165.pdf) (accessed 1 October 2021).
15. Nigeria Centre for Disease Control, 2016, <https://ncdc.gov.ng/reports/101/2017-december-week-52> (accessed 25 June 2021).
16. Yaro CA, Kogi E, Opara KN, *et al.* Infection pattern, case fatality rate and spread of Lassa virus in Nigeria. *BMC Inf Dis* 2021; 21: 149.
17. Nigeria Centre for Disease Control, Lassa fever Situation Report Epi Week 52, 2020, <https://reliefweb.int/report/nigeria/ncdc-lassa-fever-situation-report-epi-week-52-21-27-december-2020> (accessed 16 November, 2021).
18. Ejembi J, Emma-Ukaegbu U, Garba I, *et al.* Contact tracing in Lassa fever outbreak response: an effective strategy for control. *Online J Public Health Inform* 2019; 11: e378.
19. Koyuncu OO, Hogue IB and Enquist IW. Virus infections in the nervous system. *Cell Host Microbe* 2013; 13: 379–393.
20. Tambo E, Adetunde OT and Olalubi OA. Re-emerging Lassa fever outbreaks in Nigeria: re-enforcing ‘One Health’ community surveillance and emergency practice. *Infect Dis Poverty* 2018; 7: 37.
21. Ipadeola O, Furuse Y, de Gooyer T, *et al.* Determination of the emergency phase for response against endemic disease outbreak: a case of Lassa fever outbreak in Nigeria. *J Glob Health* 2020; 10: 020353.
22. 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. *Eur Surveill* 2019; 24: pii1900272.
23. Denué BA, Stephen M and Dauvoux I. The unending threat of Lassa fever in Nigeria, what can be done; what should be done. *Port Harcourt Med J* 2017; 11: 113–121.
24. Okogbenin EO, Obagaye MO, Aweh BE, *et al.* One-year retrospective review of psychiatric consultations in Lassa fever, Southern Nigeria. *Emerg Infect Dis* 2020; 26: 3091–3093.
25. Okokhere P, Colubri A, Azubike C, *et al.* Clinical and laboratory predictors of Lassa fever outcome in a dedicated treatment facility in Nigeria: an observational cohort study. *Lancet Infect Dis* 2018; 18: 684–695.
26. Balfour H. Patient dosed with first Lassa fever vaccine to reach human trials. *Eur Pharm Rev* 2021, <https://www.europharm7npharmaceuticalreview.com/news/144089/patient-dosed-with-first-lassa-fever-vaccine-to-reach-human-trials/> (accessed 25 June 2021).
27. INOVIO News Details. INOVIO announces first subject dosed in phase 1B clinical trial for its DNA vaccine against Lassa fever, INO-4500, in West Africa, 23 February 2021, <https://ir.inovio.com/news-releases/news-releases-details/2021/INOVIO-Announces-First-Subject-Dosed-in-Phase-1B-Clinical-Trial-for-its-DNA-Vaccine-Against-Lassa-Fever-INO-4500-in-West-Africa/default.aspx> (accessed 16 November 2021).
28. Purushotham J, Lambe T and Gilbert SC. Vaccine platforms for the prevention of Lassa fever. *Immunol Lett* 2019; 215: 1–11.

Visit SAGE journals online  
[journals.sagepub.com/  
home/tai](https://journals.sagepub.com/home/tai)

 SAGE journals