Asian Journal of Advances in Research

Volume 7, Issue 1, Page 321-328, 2024; Article no.AJOAIR.3472

A Retrospective Study and the Risk Factors of Lassa Fever Infection in Some Selected States in the North Central Zone of Nigeria

Ogunrinde David Oluseyi [a++*], Enem Simon Ikechukwu [b#], Mailafia Samuel [c#], Olanrewaju Samuel [d#] and Atiba Aanuoluwa Dorcas [a†]

[a] University of Abuja, Nigeria.
[b] Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Abuja, Nigeria.
[c] Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Abuja, Nigeria.
[d] Department of Statistics, Faculty of Science, University of Abuja, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author ODO designed the study, managed the literature searches, wrote the protocol, and wrote the first draft of the manuscript. Authors ESI and MS managed the analyses of the study. Author OS performed the statistical analysis. Author AAD also managed the literature review. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://prh.mbimph.com/review-history/3472

Original Research Article

Received: 23/04/2024
Accepted: 26/06/2024
Published: 28/06/2024

[++] Principal Investigator;
[#] Professor;
[†] Assistant Researcher;
**Corresponding author: Email: seyi.ogunrinde.so@gmail.com, oluseyi448@gmail.com;*

Cite as: *Oluseyi, Ogunrinde David, Enem Simon Ikechukwu, Mailafia Samuel, Olanrewaju Samuel, and Atiba Aanuoluwa Dorcas. 2024. "A Retrospective Study and the Risk Factors of Lassa Fever Infection in Some Selected States in the North Central Zone of Nigeria". Asian Journal of Advances in Research 7 (1):321-28. https://jasianresearch.com/index.php/AJOAIR/article/view/459.*

ABSTRACT

Lassa fever is an acute rodent borne viral hemorrhagic fever which is caused by contacts with the multi-mammate rat, *Mastomys natalensis* which is commonly found in human households, eaten as a delicacy in several African countries and lives in close contact with humans. The aim of the study was to carry out a retrospective study and risk factors of Lassa fever infection in some selected States in the North Central zone of Nigeria. Purposive sampling was used in selecting 3 States in North Central Nigeria. Based on rodent availability, Benue, Nasarawa and Plateau States were selected. Ethical report was obtained from the Federal Ministry of Health Headquarters, Abuja, Nigeria. Secondary data were obtained from Nigeria Centre for Disease Control (NCDC), Integrated Disease Surveillance and Response (IDSR) records from 2016-2019. Chi square tool was used to analyze the level of significance between the States and the years under the study. Values below $p<0.05$ were considered insignificant. The total prevalence in the three states in 2016 were 27.3%, 17.5% in 2017, 9.5% in 2018 followed by a spike in the number of recorded cases at 45.7% in 2019. A total of 68.06% of the patients survived while 15.25% of the patients died during this period. A total of 23.76% of the patients were within 31 – 40 years old. There was no significant difference ($P=0.01$) between the age group of patients and the outcome of cases during the period under study. In conclusion, the prevalence of Lassa fever infection in the North central region of Nigeria remains a burden and a more realistic and time bound approach need to be put in place by policy makers and other stakeholders in order to curb the spread of the virus. Personal and environmental hygiene remains the first and most effective line of defense against Lassa fever infection. Provision of food storage facilities and adequate safety measures in food and water consumption will aid in the reduction of outbreak of the viral infection.

Keywords: Lassa fever; retrospective study; risk factors; multi-mammate rat.

1. INTRODUCTION

Nigeria is one of the Lassa fever virus disease endemic countries in West Africa and reports indicate that it may account for up to 6% of febrile admissions in endemic areas in the country [1]. Its initial clinical manifestations are difficult to differentiate from those of other common febrile illnesses such as malaria [2]. Every year, approximately 100, 000 – 300, 000 people contract Lassa virus and 5,000 people die from the infection [3]. Due to its potential for zoonotic and human transmission as well as difficulties in treatment and prevention, Lassa fever virus is one of the high-priority pathogens identified on the WHO (R and D) Blueprint [4], [3].

Lassa fever is a viral hemorrhagic fever endemic to countries in West Africa which includes Nigeria, Benin, Ghana, Guinea, Liberia, Mali and Seirria Leone [5], placing 2 million persons per annum at risk of becoming infected, with 5,000–10,000 fatalities annually [6]. It is a zoonotic disease whose animal reservoir is the 'multi-mammate rat', a rodent of the genus *Mastomys*, which shed virus in their urine and faeces [7].

Lassa virus (LASV, *Arenaviridae*) is the causative agent of Lassa fever (LF), which is a systemic infectious disease that can lead to acute hemorrhage, as well as neurological disorders [8]. Due to international travel, LF poses a significant risk to both visitors to endemic countries and populations in non-endemic regions [8]. Lassa fever was brought to the consciousness of the medical community world-wide when a nurse became infected in 1969 while working in a small missionary hospital at Lassa town in North East Nigeria [6].

According to the World Health Organization, the outbreak of Lassa fever in Nigeria re-emerged on December 2016 and involved 17 States of Nigeria [7]. In June 2017, there were a total of 501 suspected cases including 104 deaths with a Case Fatality Rate (CFR) of 21% [3]. In August 2017, two cases of Lassa fever were also reported in Lagos State in adults, both of whom died [7]. The recent 2018 outbreak in Nigeria saw 423 confirmed cases with a CFR of 25% [7] and a higher CFR of up to 50%–70% have been reported [3].

Most infections with Lassa virus in Africa are asymptomatic, mild or subclinical, but case fatality in hospitalized patients can be as high as 15–25% [9], [10]. Clinical manifestations are variable and often nonspecific as many of those

are seen in other febrile infectious diseases in endemic areas. The incubation period of Lassa fever is between 3 -21 days [10].

About 80% of human infections are without symptoms while the remaining cases have severe multiple organ disease affecting several organs in the body such as the liver, spleen and kidneys. According to the WHO [11], the onset of the disease, when it is symptomatic is usually gradual, starting with fever, general weakness, muscle and joint pains, prostration, and malaise. After a few days, headache, sore throat from pharyngitis, muscle pain, retrosternal pain, nausea, vomiting, diarrhea, cough, and abdominal pain may follow. Hearing loss is common in adults (among those who survive, about a quarter have deafness which improves over time) [11].

Spontaneous abortion and birth defects have been documented [10]. When Lassa fever infects pregnant women late in their third trimester, induction of labor is necessary for the mother to have a good chance of survival [9]. This is because the virus has an affinity for the placenta and other highly vascular tissues. The fetus has only a one in ten chance of survival no matter what course of action is taken [9]. Following delivery, women should receive the same treatment as other Lassa fever patients [12]. In severe cases, facial edema, pulmonary edema, bleeding from the mouth, nose, vagina, or GI tract, and low blood pressure may develop. Shock, seizures, tremor, disorientation, and coma may be seen in the later stages. The virus is excreted in urine for 3–9 weeks and in semen for 3 months [12].

The aim of this study is to carry out a retrospective study and risk factors of Lassa fever infection in some selected States in the North Central zone of Nigeria.

2. METHODOLOGY

The study was carried out in the North Central zone of the country which consists of Nasarawa State, Benue State, Plateau State, Niger State, Kogi State, Kwara State and the Federal Capital Territory (FCT).

Nasarawa State lies between latitude 7^{o} 45' and 9^{o} 25' of the equator and longitude 7^{o} and 9^{o} 37' of the Greenwich meridian. It has a total land area of 27,137.8 sq.km and a population size of 1,869,377 [13]. Niger state lies between latitude 8^{o} and 11^{o}N and longitude 3^{o} and 7^{o}E of the prime-time meridian with a population size of 3,950,429 in 2006 [13]. Benue State lies between latitude 6^{o}30' and 8^{o}24' N, longitude 7^{o}40' and 10^{o}00'E with a land mass of 31,400sq.km and a population size of 4,253,641 by 2006 population census [14]. Kogi State lies between latitude 6^{o}30N and 8^{o}42N and longitude 5^{o}18E and 7^{o}54E with a land mass of approximately 28,312 Km^{2}. It has a population size of 3,314,043 [13]. Kwara State lies between latitude 7^{o}N and 12^{o}N and longitude 3^{o}E and 7^{o}E and with a population size of 2,365,353 in 2006 [13]. Plateau State is located between longitude 8^{o}40' and 9^{o}50'E and latitude 9^{o} and 10^{o}45'N. These six states surround the Federal Capital Territory (FCT), Abuja (Fig. 1).

This study was a retrospective study of the occurrence of Lassa fever in the North Central States of Nigeria. Purposive sampling was used in selecting the 3 states in North Central Nigeria. Based on rodents' availability, Benue, Nasarawa and Plateau States were the states selected during the course of this study.

The study was a secondary data obtained from the Lassa fever specific Integrated Disease Surveillance and Response (IDSR) records in Nigeria from 2016-2019. IDSR weekly epidemiological data line-list for the years under review was obtained from the Surveillance and Epidemiology Department, Nigeria Center for Disease Control (NCDC). The variables reported were; State of residence, and Lassa fever classification based on laboratory diagnosis (suspected, confirmed). The data was analyzed for prevalence and significant difference in the prevalence ($p < 0.05$; 95% CI).

3. RESULTS

The prevalence of LASV in Benue was 0.00%, 0.00%, 3.34% and 8.07% for the year 2016, 2017, 2018 and 2019 respectively. In Nasarawa State the prevalence of LASV was 45.88%, 52.3%, 35.60% and 9.47% for the year 2016, 2017, 2018 and 2019 respectively. While in Plateau State, the prevalence of LASV was 54.12%, 47.70%, 61.06% and 82.46% for 2016, 2017, 2018 and 2019 respectively, (Table 1).

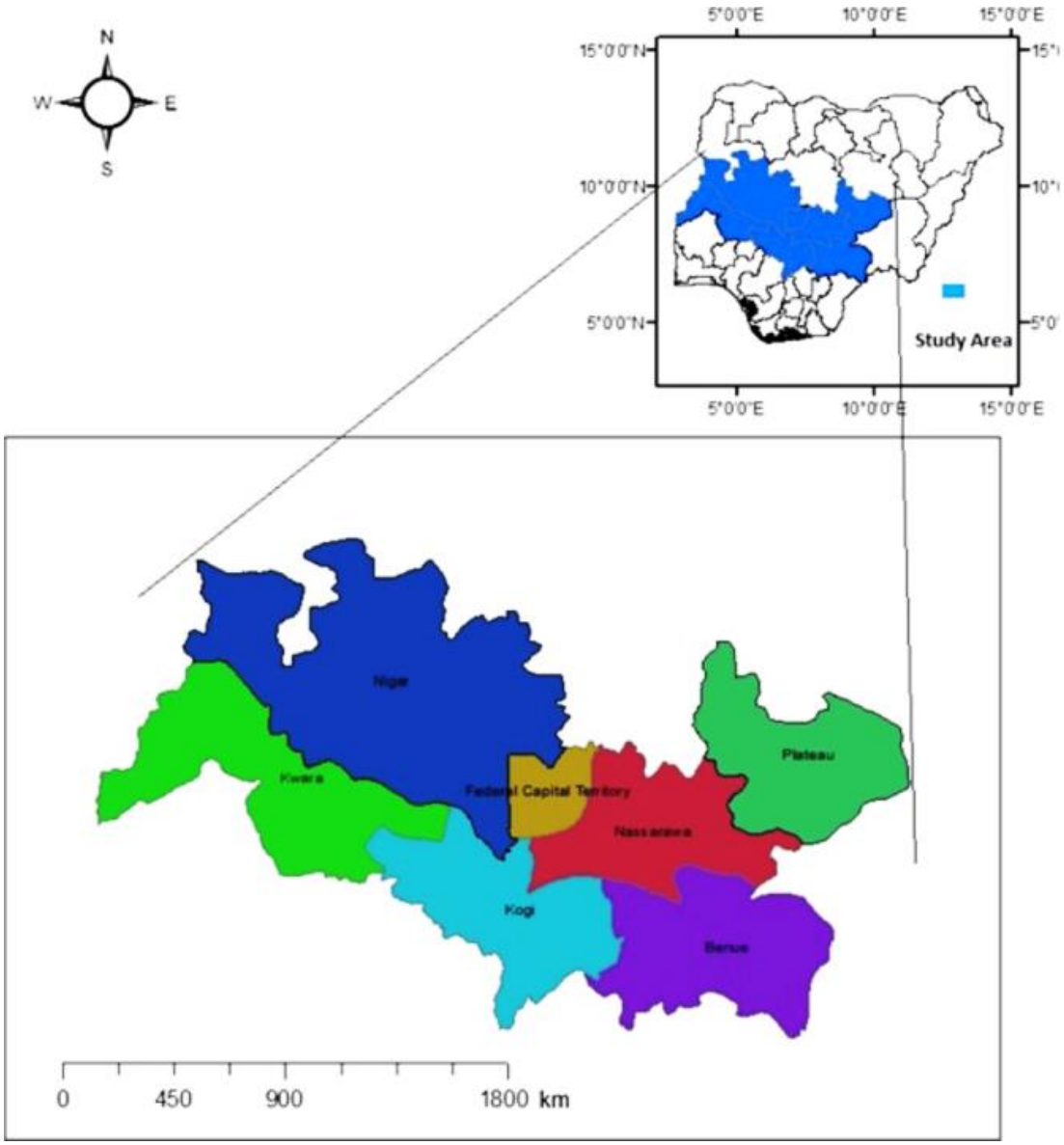

Fig. 1. Map of the Study Area [15]

Table 2 shows the recorded outcome of Lassa Fever Infection in Nasarawa, Benue and Plateau States during the period under study. The total number of patients who recovered in the three states during the period under study is 424. Benue state had 0.47%, Nasarawa State had 22.41% while Plateau State had 77.12%. The total number of patients who died during the period under study in the three States was 95. Benue State recorded 2.11%, Nasarawa State recorded 41.05% while Plateau State recorded 56.84%. However, from the data collected there were cases with no recorded outcomes. The total number of cases with no outcomes is 104. Benue State had 20.20%, Nasarawa State had 46.15% while Plateau State had 33.65%.

Table 3 shows the comparison of the recorded prevalence in the three States under the study between years 2016-2019. In 2016, 2018 and 2019, Plateau State recorded the highest prevalence while in 2017 Nasarawa State recorded the highest prevalence.

Table 4 shows the age distribution of patients in the three states during the period under study. The ranges used for the age distribution include 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90. The highest recorded number of cases fell within 31-40 years age range with a total number of 148 recorded cases while the age groups with the lowest number of patients

were 71-80 and 80-90 which had one (1) case each recorded during the years under this study. Chi square value showed that there was no significant relationship between Lassa fever infection and age of patients during the period under study where $p < 0.05$.

Table 1. Prevalence of Lassa fever in North Central Geopolitical Zone

State	2016		2017		2018		2019	
	Cases(n)	%	Cases(n)	%	Cases(n)	%	Cases(n)	%
Benue	0	0.00	0	0.00	2	3.34	23	8.07
Nasarawa	78	45.88	57	52.3	21	35.6	27	9.47
Plateau	92	54.12	52	47.7	36	61.6	235	82.46
Total	170	100	109	100	59	100	285	100

Table 2. Outcome of cases by State within 2016-2019

		Outcome					
State	Total No of cases	Recovered		Death		No outcome	
		No	%	No	%	No	%
Benue	25	2	0.47	2	2.11	21	20.20
Nasarawa	182	95	22.41	39	41.05	48	46.15
Plateau	416	327	77.12	54	56.84	35	33.65
Total	623	424	100	95	100	104	100

Table 3. Table showing the comparism of the prevalence of LASV in Benue, Nasarawa and Plateau states between 2016-2019

	Year							
States	2016		2017		2018		2019	
	Cases (n)	%	Cases (n)	%	Cases (n)	%	Cases (n)	%
Benue	0	0.00	0	0.00	2	3.33	23	8.07
Nasarawa	79	46.20	55	51.40	21	35.00	27	9.47
Plateau	92	53.80	52	48.60	37	61.67	235	82.46
Total	171	100	107	100	60	100	285	100

Table 4. The table shows the age distribution of the infected patients

Age Range	Number of patients	Percentage %	P-value
1 – 10	114	18.30	0.01
11 – 20	126	20.22	
21 – 30	144	23.11	
31 – 40	148	23.76	
41 – 50	53	8.51	
51 - 60	24	3.85	
61 – 70	12	1.93	
71 – 80	1	0.16	
81 – 90	1	0.16	
Total	623	100	

$P < 0.05$.

Table 5. Showing the Sex Distribution of LASV Patients in the three states under study

Sex	Total no. of patient in the 3 states under the study. (n)	Percentage (%)	P-value
Male	313	58.18	0.132
Female	225	41.82	
Total	538	100	

$P > 0.05$

Table 5 shows the sex of LASV patients in Benue, Nasarawa and Plateau States during the period under study. The data obtained from NCDC showed that a total of 225 patients were females while 313 were males. There was a significant difference between sex of patients and Lassa fever infection, P > 0.05.

4. DISCUSSION

Lassa fever is an animal-borne, or zoonotic, acute viral illness spread by the common African rat. It is endemic in parts of West Africa including Sierra Leone, Liberia, Guinea and Nigeria. Neighboring countries are also at risk because the animal vector lives throughout the region [16].

In the current study, the prevalence of Lassa fever virus from 2016 – 2019 was higher in Plateau and Nasarawa States compared to Benue State. The high prevalence of LASV in Plateau and Nasarawa States may be attributed to weak surveillance report, cultural and religious beliefs particularly in these States. Studies in literature have also attributed the heightened prevalence of Lassa fever in this region to internally displaced persons fleeing Boko Haram insurgence [17].

The findings also showed the outcome of cases during the period under study. The percentage of patients who survived is 68.06%, the percentage of those who died is 15.25% while the percentage of those with “no recorded outcome yet” as at the point of data collection is 16.69%. This shows that the presence of both Government and Private medical facilities within the states under study aided in the successful recovery of majority of the patients during the period under study. According to WHO, the overall case-fatality rate is 1%. Among patients who are hospitalized with severe clinical presentation of Lassa fever, case-fatality is estimated at around 15% [7]. Early supportive care with rehydration and symptomatic treatment improves survival, [18]. This validates the findings in this research which showed that there was a case fatality of 15.25% from year 2016-2019.

The result showed the prevalence of Lassa Fever infection in three North Central States of Nigeria; Benue, Nasarawa and Plateau States which was recorded over a period of four years, from 2016 to 2019. The total prevalence in the three States in 2016 was 27.3.%, however, there was a decrease in the number of recorded cases in 2017 which was 17.5% and a further decrease in the number of recorded cases of 9.5% was seen in 2018 followed by a spike in the number of recorded cases to 45.7% which was seen in 2019. The reduction in the prevalence in 2018 may be due to continuous awareness and government policies which could have led to the relaxation in compliance to strict personal hygiene in the States under study which later accounted for highest number of recorded cases which was in 2019. A prior study by Solomonaudu *et al*., [19] studying the prevalence of Lassa fever in Nasarawa State from November 2018 to January 2019 reported a prevalence of 16.7% in suspected cases. These finding further shows that there is indeed the burden of LFI in the study area.

The result showed a clear breakdown of cases among age group between the ages 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80 and 81-90 with the percentage of 18.30%, 20.22%, 23.11%, 23.76%, 8.51%, 3.85%, 1.93%, 0.16% and 0.16% respectively. From the study, most patient of LASV in the three states were between the age of 31-40 with 23.76% while the age group with the lowest number of cases during the period under study are 71-80, 81-90 with the percentage 0.16 and 0.16% respectively. John *et al.*, [20], studying the epidemiological trends of Lassa fever in Nigeria from 2015-2021 also noted that the predominant age group which was infected was between ages 21-40 years. This similarity further suggests that the young adults (21-40) are the most active people in the population which engage in various activities including; farming, mining, hunting, artisans etc.

A test for significance difference between age groups and outcome of cases of LASV during the period under study was carried out; chi square (0.010) where $p<0.05$, showed that there was no significant difference between the age group of patients and the outcome of cases during the period under study.

The result also showed the sex of infected patients in the three states within period under study, 36.1% of the patients were female, 50.2% of the patients were male while the sex of 13.6% of the patients were unknown. The sex of the patient’s unknown could be attributed to poorly collected data and monitoring. Solomonaudu *et al.,* [19], found that more Lassa fever cases occurred in males (52%) than females (47%). This is in contrast with a study carried out by [21] which showed that the infection affects females 1.2 times more than males.

The findings showed the test for significant difference between the sex of patients and the outcome of cases of LASV during the period under study. The chi square value of (0.132) where $p<0.05$ shows that there is a significant difference between the sex of patients and the outcome of cases during the period under study.

5. CONCLUSION

Lassa Fever Infection remains an endemic disease in the North Central region of Nigeria especially in the states under this study. The Prevalence of Lassa fever in the North Central Region of Nigeria remains a burden and more realistic and time bound policies need to be put in place to curb the spread of the virus. From the study, the high prevalence of LASV in Plateau and Nasarawa States may be attributed to weak surveillance, reporting, cultural and religious beliefs particularly in these States. It is important for policy makers and healthcare facilities to put in place more effective policy measures to strengthen already existing policies in other to tackle the spread of the disease.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

APPENDIX

Appendix is available in the following link: https://www.mbimph.com/index.php/AJOAIR/libraryFiles/downloadPublic/23

ETHICAL APPROVAL

Ethical report was obtained from the Federal Ministry of Health Headquarters, Abuja, Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Omilabu SA, Badaru SO, Okokhere P, Asogun D, Drosten C, Emmerich P. Lassa fever, Nigeria, 2003 and 2004 [letter]. Emerg Infect Dis [serial on the Internet]; 2005 Oct [*date cited*]. Available:http://dx.doi.org/10.3201/eid1110.041343
2. Okokhere PO, Akpede GO. Central nervous system manifestations of Lassa fever in Nigeria and the effect on mortality. Journal of Neurological Science. 2013;333;e604
3. World Health Organization WHO. Lassa fever; 2017. Available:http://www.who.int/csr/disease/lassafever/en/ [accessed 26 Oct 2018].
4. Centers for Disease Control. Lassa fever; 2017. Available:https://www.cdc.gov/vhf/lassa/index.html.
5. Centers for Disease Control and Prevention. Fact sheet: Lassa fever; 2018. Available: www.cdc.gov/
6. Frame JD, Baldwin JMJ, Gocke DJ, Troup JM. Lassa fever, a new virus disease of man from West Africa. Am J Trop Med Hyg. 1970;19:670–676.
7. World Health Organization WHO. Lassa fever outbreak news; 2018. Available:http://www.who.int/csr/don/archive/disease/lassa_fever/en/ [accessed 26 Oct 2018].
8. McCormick JB. Lassa fever. In: Saluzzo JF, Dodet B, editors. Emergence and control of rodent-borne viral diseases. Elsevier. 1999;177–195.
9. Isa SE, Shehu NY, Juryit RN, Simji SG, Shuaibu JA, Egah DZ, Banwat EB, Chikaike O. Epidemiological and clinical description of Lassa fever in Jos, Nigeria. Highland Medical Research Journal. 2013;13(1).
10. Shehu NY, Gomerep SS, Isah SE, Iraoyah KO, Mafuka J, Bitrus N, Dachom MC, Ogwuche JE, Onukak AE, Onyedibe KI, Ogbaini-Emovon E, Egah DZ, Mateer EJ, Paesler S. Lassa Fever 2016 Outbreak in Plateau State, Nigeria—The Changing Epidemiology and Clinical Presentation. Secondary Infectious Diseases: Epidemiology and Prevention. 2018; 6(2018). Available:https://doi.org/10.3389/fpubh.2018.00232
11. World Health Organization (WHO). Lassa fever—Nigeria. Geneva: WHO; 2016. Available: http://www.who.int/csr/don/27-january-2016-lassa-fever-nigeria/en/#
12. Ogbu O, Ajuluchukwu E, Uneke CJ. Lassa fever in West African sub-region: an overview. Journal of Vector Borne Disease. 2007;44:1–11.

13. National Population Commission (NPC). Abuja, Nigeria; 2006.
14. Hilhorst T, Liere MJ, Ode AV. Impact of AIDS on rural livelihoods in Benue State, Nigeria. Journal of Social Aspects of HIV/AIDS. 2006;3:382–393.
15. Alhaji N.B., and Yatswako, S. (2017). https://www.researchgate.net/figure/Map-of-North-central-zone-of-Nigeria-study-area_fig1_318183914
16. Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of High-Consequence Pathogens and Pathology (DHCPP), Viral Special Pathogens Branch (VSPB); 2022.
17. Denue BA, Stephen M, Dauvoux I. The unending threat of Lassa fever in Nigeria, what can be done; what should be done. Port Harcourt Medical Journal. 2017; 11:113-121.
18. World Health Organization. Who.int/health-topics/lassa-fever; 2012. Retrieved June 2023.
19. Solomonaudu E, Adiukwu C, Surajudeen B, Ashuku YA, Alhassan IA, Usman LM. Lassa fever burden among suspected cases presenting in health facilities in Nasarawa State, North Central Nigeria. International Journal of Dental and Medical Science. 2019;18(2):25-29.
20. John-Ugwuanya AG, Ifunanya JE, Nnenna U. Epidemiological trends of Lassa fever in Nigeria from 2015-2021: A review. Therapeutic Advances in Infectious Disease. 2021;2021: 204993612110 58252.
Published online 2021 Nov 29. DOI: 10.1177/20499361211058252
21. Owoseye, Ayodamola (11 March 2020). "Lassa Fever: Nigeria's death toll reaches 144". Retrieved 13 March 2020.

Peer-review history:
The peer review history for this paper can be accessed here:
https://prh.mbimph.com/review-history/3472