Original

Pattern And Outcome of Lassa Fever Cases Seen at the Virology Unit of Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria

[1]Chiemeka Nwankwor, Okoro, [1,2]Oyekanmi Femi Awelegbe

[1]*Department of Industrial Mathematics and Applied Statistics, Ebonyi State University, Abakaliki.*
[2]*Department of Research and Statistics, Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State.*
Corresponding author: ***Chiemeka Nwankwor Okoro,*** Department of Industrial Mathematics and Applied Statistics, Ebonyi State University, Abakaliki. okoro.nwankwor@ebsu.edu.ng: +2348037745408

Article history: Received 04 February 2026, Reviewed 07 March 2026, Accepted for publication 22 March 2026

ABSTRACT

Background: Lassa fever (LF) remains a major public health challenge in Nigeria, particularly in endemic areas like Ebonyi State. Despite the establishment of specialized treatment centres, mortality rates remain worrisome. This study determines the socio-demographic patterns, clinical characteristics, and treatment outcomes of laboratory-confirmed LF cases at Virology Unit of Alex Ekwueme Federal University Teaching Hospital, Abakaliki, (AEFUTHA) Ebonyi State.
Methods: A retrospective review was conducted on the clinical records of 67 laboratory-confirmed LF cases managed at the AE-FUTHA Virology Unit between January and December 2024. Data were analyzed using IBM SPSS version 26.
Results: The mean age of the participants was 32.9±14.8years, with the 30–49 age group most affected (50.7%). Females comprised 56.7% of cases. Notably, students and traders (23.9% each) shared the highest occupational burden, shifting the narrative away from a purely agrarian disease. Seasonality was evident, with 74.6% of cases occurring between January and March. While fever was universal (100%), hemorrhage (31.3%) and sore throat (29.9%) were significant clinical features. The overall Case Fatality Rate (CFR) was 43.3%, with disproportionately high mortality among pediatric and adolescent populations (63.6%) and those with lower educational attainment.
Conclusion: LF in Ebonyi State presents a high CFR and significant hemorrhagic manifestations, heavily impacting both the workforce and vulnerable children. The prevalence among non-farming groups suggests active peri-urban transmission. Urgent interventions are required to promote early presentation and provide subsidized critical care, especially dialysis, to mitigate mortality in the post-partner support era.

Keywords: Lassa fever, Pattern, Outcome, Virology Unit, AEFUTHA.

How to cite this article

Okoro CN. Awelegbe OF. Pattern And Outcome of Lassa Fever Cases Seen at the Virology Unit of Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State – Nigeria. The Nigerian Health Journal 2026; 26(1): 355 – 366. https://doi.org/10.71637/tnhj.v26i1.1315

INTRODUCTION

Lassa fever (LF) is an acute viral hemorrhagic illness caused by the Lassa virus (LASV), a bisegmented single-stranded RNA virus belonging to the family *Arenaviridae*.[1,2] Since its identification in 1969, LF has become a significant public health challenge in West Africa, where it is endemic in countries such as Nigeria, Sierra Leone, Liberia, and Guinea.[3,4] Estimates suggest that the virus causes between 100,000 and 300,000 infections annually, resulting in approximately 5,000 deaths, although these figures are widely considered underestimates due to limited surveillance and the non-specific clinical presentation of the disease.[5-8,15]

Nigeria bears the highest burden of the disease globally.[9,10] While historically restricted to specific "belts," the geographical footprint of the virus has expanded significantly in recent years.[11] By the end of 2024 and entering 2025, the disease had established active transmission in 28 states, with confirmed cases recorded in over 120 Local Government Areas (LGAs).[10] As of epidemiological week 51 in 2025, Nigeria recorded 1,119 confirmed cases and 206 deaths, translating to a national Case Fatality Rate (CFR) of 18.4%.[12] This persistent high mortality, despite improved awareness, underscores the challenges in early diagnosis and case management.[13,14]

Ebonyi State, located in Southeastern Nigeria, consistently ranks among the top contributors to the national Lassa fever burden, alongside Edo and Ondo States.[15] The epidemiology of LF in Ebonyi is distinct due to specific virological and ecological factors.[15,16] Phylogenetic studies have identified that the LASV strains circulating in Ebonyi (Lineage II-Eastern) are genetically distinct from those in the western axis (Edo/Ondo).[17] This genetic divergence is estimated to have occurred over 200 years ago, and clinical observations suggest it may correlate with differences in disease phenotype, including a higher propensity for early-onset neurological manifestations and renal complications.[18,19]

The state experienced a catastrophic outbreak in early 2018, which served as a pivotal moment for public health response in the region.[20,21] The 2018 episode was characterized by a high rate of nosocomial transmission, resulting in the deaths of 16 healthcare workers at the Federal Teaching Hospital, Abakaliki (now AE-FUTHA).[21] This event highlighted critical gaps in Infection Prevention and Control (IPC) and necessitated an immediate restructuring of clinical management protocols.[21]

Research at AE-FUTHA and similar Nigerian centers reveals that Lassa fever often presents with non-specific "malaria-like" symptoms, which frequently lead to misdiagnosis and delayed treatment.[18] Fever is a universal feature (100% of cases), often accompanied by fatigue, abdominal pain, and vomiting.[18,23] Unusual outbreaks in Ebonyi State have shown an early onset of neurological features, which is a departure from the "traditional" clinical pattern where such symptoms typically appear in terminal stages.[18,27] Studies in the region indicate a slight male predominance, with the most affected age group being young adults between 30–39 years.[18] Transmission is highly seasonal, peaking during the dry months (November to March) when food scarcity drives *Mastomys natalensis* rodents into human settlements.[15]

The outcomes of LF cases at AE-FUTHA are heavily influenced by the speed of diagnosis and the presence of specific complications. Hospital-based studies at AE-FUTHA have reported a CFR of approximately 26.2%.[18,23] However, certain "unusual" outbreaks in the region have seen mortality rates spike as high as 85.7%, potentially due to more virulent viral strains or late presentation.[18,27] Bleeding, convulsions, and unconsciousness are significantly associated with fatal outcomes. For example, patients with bleeding are 40 times more likely to die than those without.[18,23] Acute Kidney Injury (AKI) is a frequent and severe complication, appearing in about 19% of severe cases across West African cohorts. Among survivors, sensorineural hearing loss (SNHL) is the most common permanent complication, affecting roughly one-third of patients.[18,27]

Management of cases at AE-FUTHA adheres to the NCDC National Guidelines, which emphasize early administration of Ribavirin, aggressive rehydration, and supportive care for complications such as Acute Kidney Injury (AKI).[22,23] AKI is a frequent and fatal complication, affecting approximately 19% of hospitalized cases in Nigeria. The availability of free dialysis services at AE-FUTHA during the intervention period has been cited as a key factor in reducing the CFR in Abakaliki to approximately 6% in specific cohorts, significantly lower than the pooled national average.[24]In December 2024, MSF officially handed over the management of the Lassa fever project to the Ebonyi State Ministry of Health and AE-FUTHA management, marking the beginning of a new operational phase.[24]

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Despite Ebonyi State being a recognized "hotspot" for Lassa fever (LF), the Virology Unit at AE-FUTHA continues to record significant mortality rates. The core problem lies in the diagnostic ambiguity of the disease; early symptoms are indistinguishable from common tropical illnesses like malaria and typhoid. This leads to late hospital presentation, usually when multi-organ failure or hemorrhagic signs have already commenced. Furthermore, there is a lack of recent, localized data that correlates specific clinical "patterns" (such as neurological or renal symptoms) with final patient "outcomes," making it difficult for clinicians to predict which patients are at the highest risk of death upon admission.

Despite the significant volume of cases managed at AE-FUTHA, there is a need to comprehensively document the patterns and clinical outcomes of patients treated during the period of enhanced capacity (2018–2025). Most existing literature on LF outcomes in Nigeria is derived from the Irrua Specialist Teaching Hospital (ISTH) in Edo State. Data specific to the "Ebonyi clade" of the virus and the unique operational context of AE-FUTHA is essential for several reasons:

1. Benchmarking Quality of Care: Establishing a baseline of outcomes (CFR, complication rates) achieved during the subsidized care period is vital for monitoring performance in the post-handover era.
2. Clinical Characterization: Detailed analysis is required to validate observed clinical nuances of the Ebonyi strain, particularly regarding neurological sequelae and renal failure.
3. Vaccine Trial Preparedness: As AE-FUTHA is a designated site for upcoming Phase 2b Lassa fever vaccine trials, a robust understanding of the background epidemiology and "natural history" of the disease in the local population is a prerequisite for trial design.

This study therefore aims to review the pattern, socio-demographic distribution, and clinical outcomes of laboratory-confirmed Lassa fever cases managed at the Virology Unit of AE-FUTHA, providing evidence to guide future clinical practice and policy.

METHODOLOGY

Study Design: This was a retrospective, hospital-based observational study reviewing the clinical records of all laboratory-confirmed Lassa fever patients managed at the Alex Ekwueme Federal University Teaching Hospital, Abakaliki (AE-FUTHA) over one-year period (January to December 2024). This timeframe was selected to capture the period of enhanced clinical capacity supported by the partnership between the hospital and Médecins Sans Frontières (MSF), which concluded in late 2024.

***Study Setting*:** The study was conducted at the Virology Centre of AE-FUTHA. AE-FUTHA is a 720-bed tertiary health institution located in Abakaliki, the capital of Ebonyi State, South-East Nigeria. It serves as the primary referral centre for viral hemorrhagic fevers for Ebonyi State and parts of the neighbouring Benue, Cross River, and Enugu States.The Virology Centre, established following the 2018 outbreak, is a purpose-built isolation and treatment facility. It comprises Triage and Observation Baysfor the screening and holding of suspected cases pending laboratory confirmation; Confirmed Ward i.e. a 27-bed isolation unit dedicated to the management of PCR-positive patients; High Dependency Unit (HDU) equipped for the management of severe cases, including onsite hemodialysis facilities dedicated solely to infectious patients to manage acute kidney injury (AKI) without risking contamination of the general hospital dialysis unit; and Molecular Laboratory i.e. a Biosafety Level 2 (BSL-2) laboratory with BSL-3 practices, capable of performing Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) for Lassa virus diagnosis. During the study period (January to December 2024), clinical management was supported by MSF, which ensured the provision of free medication (including Ribavirin), laboratory investigations, and hemodialysis services, removing financial barriers to care.

***Study Population*:** The study population included 67 patients (paediatric and adult) admitted to the Virology Centre who tested positive for Lassa virus RNA by RT-PCR between January and December, 2024.

- *Inclusion Criteria*: All patients with a laboratory-confirmed diagnosis of Lassa fever.
- *Exclusion Criteria*: Suspected cases that tested negative for Lassa virus, probable cases (deaths without sample collection), and patients with incomplete clinical records (missing >20% of core variables).

Instrument for Data Collection: Data were extracted from patient case notes and the electronic medical database maintained by the Virology Unit using a structured proforma. The following variables were collected: Socio-demographics i.e. age, sex, occupation,

Print ISSN: 0189-9287 Online ISSN: 2992-345X

level of education, and Local Government Area (LGA) of residence. Also collected is clinical presentation i.e. signs and symptoms prior to presentation such as fever, weakness/ malaise, headache, respiratory disease, vomiting, chest pain, sore throat, diarrhoea, abdominal pain, and cough. Also included are outcome measures such as duration of hospital stay, complications (haemorrhage, facial swelling and hearing loss), and final outcome (discharged or dead).

Method of Data Analysis: Data were cleaned and analysed using IBM SPSS Statistics for Windows, Version 26.0 (Armonk, NY: IBM Corp). Categorical variables (sex, age, level of education, occupation, signs and symptoms) were summarized as frequencies and percentages. Binary logistic regression was used to test for associations between categorical variables and outcome of treatment. Statistical significance was set at $p < 0.05$.

RESULTS

In Table 1, the study population of 67 confirmed Lassa fever patients had a mean age of 32.9 ± 14.8 years, indicating that the disease primarily affected the active workforce. The highest prevalence was recorded in the 30–49 age group (50.7%), followed by young adults aged 20–29 years (22.4%). There was a slight female preponderance (56.7%) compared to males (43.3%). Occupational distribution revealed a shift from the traditional agrarian pattern; while farmers accounted for 20.9% of cases, the combined burden among Students/Children (23.9%) and Traders/Business owners (23.9%) was significantly higher, suggesting active transmission in peri-urban and commercial settings in Abakaliki. Geographically, the majority of patients (58.2%) resided in the Ebonyi North senatorial zone. In Table 2, the clinical presentation was characterized by universal fever (100%), with non-specific symptoms such as weakness (92.5%) and headache (91.0%) being nearly ubiquitous. Gastrointestinal symptoms were also frequent, with vomiting reported in 37.3% and abdominal pain in 29.9% of patients. Notably, specific features often associated with severe Lassa fever were prevalent; 29.9% of patients presented with a sore throat, and a remarkably high proportion (31.3%) exhibited hemorrhage (bleeding) at the time of admission. Late-stage complications such as hearing loss (3.0%) and facial swelling (1.5%) were rare at presentation, likely developing later in the disease course or during convalescence. In Table 3, the temporal distribution of cases demonstrated a strong seasonal pattern consistent with the epidemiology of Lassa fever in Nigeria. The vast majority of admissions (74.6%) occurred in the first quarter of the year (January–March), coinciding with the dry "Harmattan" season which facilitates rodent-to-human transmission. A smaller cluster of cases (20.9%) was observed in the fourth quarter (October–December), while transmission dropped to zero (0.0%) during the second quarter (April–June) and remained minimal (4.5%) in the third quarter (July–September), reinforcing the link between climatic conditions and disease incidence in this region. The treatment outcomes revealed a critically high mortality rate despite the specialized care provided at the Virology Unit. Out of the 67 confirmed cases managed, 38 patients (56.7%) were successfully treated and discharged, while 29 patients died, resulting in a Case Fatality Rate (CFR) of 43.3%. This mortality figure is significantly higher than the national average typically reported (approx. 20%), highlighting the severity of the disease phenotype in Ebonyi State and the challenges of late presentation among the study cohort. The multivariate analysis of socio-demographic variables in relation to treatment outcomes reveals that factors such as age, sex, occupation, and educational level are not significant predictors of mortality for Lassa fever cases at the AE-FUTHA Virology Unit. All recorded variables yielded p-values greater than 0.05, and the notably wide 95% Confidence Intervals suggest that the sample size (n=67) may lack the statistical power to establish a demographic-based risk profile for death. Specifically, while the adjusted odds ratio for females (aOR = 0.43) suggests a potentially lower risk of mortality compared to males, the lack of statistical significance ($p = 0.182$) indicates that this could be due to chance. Consequently, these findings shift the clinical focus away from patient background, suggesting instead that the high mortality rate (43.3%) is likely driven by clinical severity, biological virulence, or delays in hospital presentation rather than the socio-demographic identity of the participants.

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Table 1: Socio-demographic characteristics of the participants

Socio-demographic Variables	Frequency (n=67)	Percentage (%)
Age (years)		
0-19	11	16.4
20-29	15	22.4
30-49	34	50.7
≥50	7	10.4
Mean ±SD	32.9±14.8	
Sex		
Male	29	43.3
Female	38	56.7
Occupation		
Students/ Children	16	23.9
Traders/ Business	16	23.9
Farmers	14	20.9
Civil Servants/ Professionals	13	19.4
Artisans/ Others	8	11.9
Level of Education		
Preschool	2	3.0
Primary	10	14.9
Secondary	6	9.0
Tertiary	16	23.9
Unknown	33	49.3
State/ Zone		
Ebonyi North	39	58.2
Ebonyi Central	12	17.9
Other states	16	23.9

Table 2: Signs and Symptoms

Signs and Symptoms**	Frequency (n=67)	Percentage (%)
Fever	67	100.0
Weakness/ Malaise	62	92.5
Headache	61	91.0
Respiratory disease	11	16.4
Vomiting	25	37.3
Chest pain	1	1.5
Sore throat	20	29.9
Diarrhoea	15	22.4
Abdominal pain	20	29.9
Cough	10	14.9
Haemorrhage	21	31.3
Facial swelling	1	1.5
Hearing loss	2	3.0

**Multiple signs and symptoms allowed

Table 3: Pattern of occurrence and outcome of treatment

Pattern of Occurrence and Outcome of Treatment	Frequency (n=67)	Percentage (%)
Seasonal Distribution		
January – March	50	74.6
April – June	0	0.0
July – September	3	4.5
October – December	14	20.9

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Outcome of Treatment		
Discharged	38	56.7
Died	29	43.3

Table 4: Relationship between socio-demographic variables and outcome of treatment

Variables	cOR	95% C.I. for cOR	P-value	aOR	95% C.I. for aOR	P-value
Age (years)						
0-19 (*ref.*)	1			1		
20-29	0.21	0.04-1.11	0.067	0.24	0.01-6.28	0.392
30-49	0.45	0.11-1.83	0.266	0.58	0.01-24.00	0.774
≥50	0.43	0.6-2.97	0.391	0.54	0.01-33.25	0.770
Sex						
Male (*ref.*)	1			1		
Female	0.70	0.26-1.86	0.472	0.43	0.12-1.49	0.182
Occupation						
Students/ Children (*ref.*)	1			1		
Traders/ Business	0.60	0.15-2.46	0.477	0.58	0.02-19.45	0.759
Farmers	1.00	0.24-4.20	1.000	1.24	0.03-54.17	0.911
Civil Servants/ Professionals	0.44	0.10-2.06	0.300	0.51	0.03-10.16	0.659
Artisans/ Others	1.00	0.18-5.46	1.000	0.93	0.02-47.12	0.973
Level of Education						
Preschool (*ref.*)	1			1		
Primary	0.67	0.09-5.13	0.697	1.87	0.11-31.08	0.661
Secondary	0.22	0.04-1.21	0.082	0.38	0.03-5.70	0.483
Tertiary	0.56	0.13-2.34	0.423	0.85	0.08-8.52	0.889
Unknown	0.67	0.03-14.03	0.794	0.30	0.01-8.52	0.477
State/ Zone						
Ebonyi North (*ref.*)	1			1		
Ebonyi Central	1.29	0.35-4.73	0.697	0.96	0.19-4.81	0.956
Other states	0.78	0.24-2.56	0.678	0.57	0.10-3.15	0.517
Quarterly Pattern						
January – March (*ref.*)	1			1		
July – September	2.35	0.20-27.59	0.497	0.26	0.16-43.52	0.504
October – December	0.47	0.13-1.70	0.249	0.37	0.07-1.99	0.245

Print ISSN: 0189-9287 Online ISSN: 2992-345X

DISCUSSION

The socio-demographic profile of the study participants (Table 1) reflects the established epidemiological pattern of Lassa fever in Nigeria, identifying the economically active population as the most vulnerable group. The mean age of 32.9 ± 14.8 years, with a predominant cluster in the 30–49 year and 20–29 year age brackets, aligns with national surveillance reports from the Nigeria Centre for Disease Control (NCDC), which consistently identify young adults as the demographic with the highest burden of infection.[12] This concentration of morbidity within the workforce underscores the profound economic impact of the disease on families and the state economy. Notably, this study observed a female preponderance, which contrasts with recent national Situation Reports (2024–2025) that typically document a male-to-female ratio of approximately 1:0.8 to 1:1. While male dominance in other regions is often attributed to occupational exposure in farming, the higher female proportion in this Ebonyi cohort may reflect local socio-cultural practices. Women in this region are heavily involved in the post-harvest processing of crops (such as drying rice and cassava on roadsides) and domestic caregiving, activities that significantly increase the risk of contact with *Mastomys* rodents and their excreta. Occupational analysis challenges the perception of Lassa fever as an exclusively rural, agrarian disease. While Farmers remain a high-risk group, the combined prevalence among students/children and Traders/Business owners suggests active transmission in peri-urban environments. This supports findings by *Usman et al.* and others indicating that poor environmental sanitation in student hostels and crowded markets in Abakaliki facilitates rodent-human interaction beyond the farm setting.[25]

Clinically, the presentation of patients in this study (Table 2) confirms the diagnostic challenge posed by Lassa fever's "viral chameleon" nature. The universal presence of Fever (100%), accompanied by Weakness (92.5%) and Headache (91.0%), mimics common tropical febrile illnesses like malaria and typhoid, contributing to the delays in appropriate suspicion and treatment often cited in literature. However, specific distinguishing features were prominent. The prevalence of Sore throat (29.9%) in our cohort is clinically significant. While *Ilori et al.* reported sore throat in only about 5% of confirmed cases during the 2018 national outbreak, our finding aligns more closely with earlier descriptions of the disease and recent knowledge, attitude, and practice (KAP) surveys where sore throat is recognized as a key symptom.[26] This variability suggests that exudative pharyngitis may be a more common feature of the Lassa virus strains circulating in Ebonyi State compared to other regions. Of greatest concern is the high prevalence of Hemorrhage (31.3%) observed in this study. This is markedly higher than the pooled prevalence of 17–19% reported in systematic reviews of Lassa fever cases across West Africa. The elevated rate of bleeding diathesis at AE-FUTHA likely indicates a pattern of late presentation, where patients only seek tertiary care after the onset of severe complications. It may also point to distinct virulence factors of the local viral lineage. Conversely, signs like Facial swelling (1.5%) and Hearing loss (3.0%) were rare at presentation, consistent with literature suggesting these are often late-stage or convalescent features.

The temporal distribution of cases in this study (Table 3) demonstrates a profound seasonal variation that is characteristic of Lassa fever epidemiology in Nigeria. The overwhelming concentration of cases (74.6%) in the first quarter (January–March), coupled with a resurgence in the fourth quarter (October–December, 20.9%), indicates that 95.5% of the disease burden in this cohort occurred during the dry season. This aligns perfectly with the well-documented "Lassa fever season" described in national surveillance data and specific studies in Ebonyi State, which consistently record peak transmission between November and March.[15,27,28]This seasonal spike is ecologically driven by the Harmattan period. During the dry season, widespread bush burning for agricultural land preparation and hunting destroys the natural habitat of the reservoir host, *Mastomys natalensis*, driving these rodents from the wild into human residential areas in search of food and shelter.[29] Furthermore, this period coincides with the post-harvest storage of crops (yam, rice, cassava) within households, which attracts rodents and intensifies human-rodent interaction. The dry, dusty environmental conditions also facilitate the aerosolization of the virus from dried rodent excreta, increasing the risk of airborne transmission.[30]The complete absence of cases in the second quarter (0.0% in April–June) and minimal occurrence in the third quarter (4.5% in July–September) is a notable finding. While recent national reports suggest an evolution toward "year-round" transmission with active cases even during the rainy season,[31] this study suggests that in the specific catchment area of AE-FUTHA, transmission remains heavily punctuated by seasonality. This distinct lull during the wet season supports the hypothesis that wet conditions may reduce

Print ISSN: 0189-9287 Online ISSN: 2992-345X

the viability of the virus in the environment and that the abundance of food in the wild during the rains reduces the need for rodents to encroach on human dwellings.[32] The treatment outcomes observed in this study reveal a Case Fatality Rate (CFR) of 43.3%, a figure that is critically high compared to the national average. While the pooled case fatality rate for hospitalized Lassa fever patients in Nigeria typically ranges between 19% and 24%,[31,32] the mortality recorded in this AE-FUTHA cohort is significantly elevated. This finding, however, is consistent with recent specific epidemiological analyses of Lassa fever in Ebonyi State between 2020 and 2025, which also documented a CFR of approximately 43%, suggesting that the disease phenotype in this region may be particularly severe.[33]Several factors likely contribute to this high mortality. Firstly, the clinical profile of the patients (Table 2) showed a high prevalence of hemorrhage (31.3%) at presentation. Bleeding diathesis is a known marker of late-stage disease and a strong independent predictor of death; its high frequency implies that a significant proportion of patients arrived at the facility in a critical state, possibly having exhausted other treatment options at patent medicine stores or private clinics before referral.[34,35] Late presentation diminishes the efficacy of Ribavirin, which is most beneficial when administered within the first six days of symptom onset.[36]Secondly, the specific viral lineage circulating in Ebonyi State (Lineage II-Eastern) has been associated with higher virulence, characterized by severe renal and neurological complications compared to strains in Edo or Ondo States.[37,38] Even with the availability of dialysis support at AE-FUTHA, the presence of Acute Kidney Injury (AKI) in Lassa fever patients drastically reduces survival chances, often driving mortality rates in renal-compromised cohorts above 60%.[39-41] The disparity between our finding and the lower mortality rates often reported from centers like Irrua Specialist Teaching Hospital (ISTH) may reflect differences in patient volume, early detection networks, and the cumulative clinical experience of the centers.

The multivariate analysis in this study demonstrates that socio-demographic variables including age, sex, occupation, and educational status do not significantly influence the clinical outcome of Lassa fever patients at AE-FUTHA ($p > 0.05$). While some regional studies, such as those by Ilori et al.[26], have suggested that older age groups (≥ 50 years) may face higher mortality due to age-related comorbidities, these findings align with more recent data from Akpede et al.[41], which posits that the biological virulence of the Lassa virus often outweighs demographic protective factors once the disease reaches a systemic stage. The lack of gender-based significance ($p = 0.182$) further supports the empirical view that while women may have higher domestic exposure, the pathological progression of the virus does not discriminate by sex.[42] Furthermore, the wide confidence intervals observed in this study suggest that the high mortality rate (43.3%) is an "equal opportunity" outcome at this facility, likely dictated by the "Three Delays" model i.e. delay in seeking care, delay in reaching the facility, and delay in receiving specialized intervention rather than the patient's socio-economic profile.[43] Consequently, these results reinforce the clinical consensus that early administration of Ribavirin, regardless of the patient's demographic background, remains the only significant determinant of survival.[44]

Strengths and Limitations of the Study

Strengths of the Study

(1) *Clinical Relevance and Setting:* A primary strength of this study is its location at the Virology Unit of AE-FUTHA, which is a designated national center of excellence for Lassa fever management. This ensures that the data represents confirmed cases managed by specialists, providing a high level of clinical validity.

(2) *Comprehensive Data Capture:* Despite the challenges of an outbreak setting, the study captured a broad range of variables, from seasonal temporal patterns (Table 3) to detailed clinical symptomatology (Table 2). This allows for a holistic view of the disease "pattern" in Ebonyi State.

(3) *Multivariate Analysis:* The use of Adjusted Odds Ratios (aOR) through logistic regression (Table 4) is a methodological strength. By controlling for confounding variables, the study was able to demonstrate that socio-demographic factors do not independently predict mortality, thereby shifting the focus to clinical and biological determinants.

(4) *Direct Local Impact:* As the study focuses on a specific "hotspot" (Ebonyi North), the findings are immediately actionable for local health authorities and State Ministry of Health to tailor dry-season intervention strategies.

Limitations of the Study

(1) *Sample Size and Statistical Power:* With a total of 67 participants, the study may have been "underpowered" to detect small but significant

Print ISSN: 0189-9287 Online ISSN: 2992-345X

differences in mortality predictors. This is reflected in the wide 95% Confidence Intervals and non-significant p-values in the multivariate analysis (Table 4).

(2) *Missing Data (Information Bias):* A significant limitation is the high proportion of "Unknown" data points, particularly regarding educational level (49.3%). In a retrospective study during an epidemic, severe illness often prevents patients from providing a full history, which may lead to an underestimation of the impact of socio-economic factors on outcomes.

(3) *Retrospective Design:* As the study relied on existing hospital records, it was subject to the quality of initial documentation. Certain long-term outcomes, such as late-onset sensorineural hearing loss or psychological sequelae, may not have been fully captured if they occurred after discharge.

(4) *Referral Bias:* Because AE-FUTHA is a tertiary referral center, the cohort likely represents the most severe cases (as evidenced by the 43.3% mortality rate). Therefore, the findings may not be fully generalizable to mild or subclinical Lassa fever cases that are managed at the community level.

Implications of the findings of the study

(1) Clinicians cannot afford to wait for "classic" signs like bleeding to initiate Ribavirin. There is an urgent need for a standardized, local Early-Warning Score at AE-FUTHA that triggers aggressive supportive care (such as early dialysis for suspected renal failure) based on the non-specific patterns identified in Table 2.

(2) The "wait-and-see" approach to epidemic preparedness must be replaced by Predictive Stockpiling. Logistics for Ribavirin, Personal Protective Equipment (PPE), and dialysis consumables should be finalized by November each year. Furthermore, since Ebonyi North contributed 58.2% of cases, the State Ministry of Health should concentrate rodent-control and food-hygiene campaigns in these specific local government areas just before the Q1 peak.

(3) Risk communication should not be limited to "poor farmers." Since students, traders, and civil servants are all represented and face similar mortality risks, public health messaging must be inclusive and urban-reaching. Lassa fever must be framed as a universal threat to the productive workforce of Ebonyi State (mean age 32.9 years).

(4) There is a policy need to decentralize Rapid Diagnostic Testing (RDT) or improve the "referral speed" from rural primary health centers to the Abakaliki Virology Unit. Reducing the time from symptom onset to the first dose of Ribavirin is the only way to significantly lower the 43.3% death rate.

(5) Future research should involve prospective cohorts where a dedicated research assistant collects data during the stabilization phase, ensuring that the impact of health literacy on survival can be more accurately measured.

CONCLUSION

The study confirms that Lassa fever remains a highly lethal endemic threat at the Alex Ekwueme Federal University Teaching Hospital, Abakaliki, characterized by a staggering case fatality rate of 43.3% and a distinct bimodal seasonal peak between January and March (74.6%). While the clinical pattern consistently begins with universal symptoms like fever and malaise, the significant presence of late-stage markers such as hemorrhage (31.3%) suggests that many patients reach the Virology Unit only after the window for optimal therapeutic intervention has narrowed. Crucially, the lack of statistically significant socio-demographic predictors for mortality ($p > 0.05$) implies that the disease outcome is governed more by clinical severity and biological factors than by the patient's background. These findings necessitate a strategic shift toward intensified dry-season community surveillance, standardized early-warning triage protocols, and a strengthened referral system to ensure that the productive young adult population of Ebonyi State receives life-saving Ribavirin therapy before the onset of irreversible multi-organ complications.

Declarations

Conflict of interest: No competing interest
Acknowledgement: Thanks to the management of Alex Ekwueme Federal University Teaching Hospital Abakaliki especially the staff working in Virology Unit for releasing the data for this study
Funding: Self-funded

REFERENCES

1. WHO (2024). Lassa fever. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/lassa-fever
2. Uppala PK, Karanam SK, Kandra NV, Edhi S. Lassa fever: A comprehensive review of virology, clinical management, and global health implications. World J Virol. 2025 Sep 25;14(3):108405. doi:

Print ISSN: 0189-9287 Online ISSN: 2992-345X

10.5501/wjv.v14.i3.108405. PMID: 41025087; PMCID: PMC12476800.
3. Ogundele GO, Jolayemi KO, Bello S. Lassa fever in West Africa: a systematic review and meta-analysis of attack rates, case fatality rates and risk factors. BMC Public Health. 2025 Aug 27;25(1):2948. doi: 10.1186/s12889-025-24377-6. PMID: 40866826; PMCID: PMC12382145.
4. Christian O. Aleke, Emeka U. Mong, Edith N. Obande-Ogbuinya, Lois N. Omaka-Amari, Patricia C. Ngwakwe, Abdulqadir J. Nashwan. Re-emergence of Lassa fever outbreaks in Africa with ongoing threat from COVID-19, Journal of Medicine, Surgery, and Public Health, Volume 1, 2023, 100005, ISSN 2949-916X, https://doi.org/10.1016/j.glmedi.2023.100005.
5. Reyna RA, Littlefield KE, Shehu N, Makishima T, Maruyama J, Paessler S. The Importance of Lassa Fever and Its Disease Management in West Africa. Viruses. 2024 Feb 7;16(2):266. doi: 10.3390/v16020266. PMID: 38400041; PMCID: PMC10892767.
6. Taboe, H.B., Pilyugin, S.S. & Ngonghala, C.N. Revealing hidden drivers of Lassa fever through a model-informed approach for reproducing and predicting disease dynamics and guiding control strategies. Sci Rep 15, 33786 (2025). https://doi.org/10.1038/s41598-025-01176-y
7. Moore SM, Rapheal E, Mendoza Guerrero S, Dean NE, Stoddard ST. Estimation of Lassa fever incidence rates in West Africa: development of a modeling framework to inform vaccine trial design. PLOS Neglected Tropical Diseases. 2025 Jul 29;19(7):e0012751.
8. Madueme PG, Chirove F. A systematic review of mathematical models of Lassa fever. Mathematical Biosciences. 2024 Aug 1;374:109227.
9. Wada YH, Ogunyinka IA, Yusuff KB, Ochu CL, Yahaya M, Khalid GM, et al. (2022) Knowledge of Lassa fever, its prevention and control practices and their predictors among healthcare workers during an outbreak in Northern Nigeria: A multi-centre cross-sectional assessment. PLoS Negl Trop Dis 16(3): e0010259. https://doi.org/10.1371/journal.pntd.0010259.
10. Eneh SC, Obi CG, Ephraim Ikpongifono U, Dauda Z, Udoewah SA, Anokwuru CC, Onukansi FO, Ikhuoria OV, Ojo TO, Madukaku CU, Orabueze IN, Chizoba AF. The resurgence of Lassa fever in Nigeria: economic impact, challenges, and strategic public health interventions. Front Public Health. 2025 Jul 16;13:1574459. doi: 10.3389/fpubh.2025.1574459. PMID: 40740381; PMCID: PMC12307277.
11. Simons D. Urbanisation as an Ecological Filter: Decoupling Lassa Virus Hazard from Spillover Risk in West Africa. medRxiv. 2025 Dec 17:2025-12.
12. Nigeria Centre for Disease Control (NCDC). Lassa Fever Situation Report: Epidemiological Week 52, 2024. Abuja, Nigeria: NCDC; 2024.
13. Kamara AS, Fatoma P, Moseray A. The Perspectives of Healthcare Professionals on the Strategies, Challenges, and Community Responses to Health System Response and Interventions Towards Lassa Fever Infections and Mortality in Sierra Leone. Risk Manag Healthc Policy. 2024 May 7;17:1127-1149. doi: 10.2147/RMHP.S455254. PMID: 38737418; PMCID: PMC11088388.
14. Awoniyi AM, Bangura U. The enduring story of Lassa fever: Advancing the case for sustainable management strategies. Asian Pacific Journal of Tropical Medicine. 2026 Jan 1;19(1):1-3.
15. Ezenwa-Ahanene A, Salawu AT, Adebowale AS. Descriptive epidemiology of Lassa fever, its trend, seasonality, and mortality predictors in Ebonyi State, South-East, Nigeria, 2018—2022. BMC Public Health. 2024 Dec 18;24(1):3470.
16. Igbodo G., Chika-Igwenyi N., Oluwole, T., Umahi, C., Ajayi, N., Nwambeke, O., Ehiakhamen, O., Olugbade, T., Adedire, E. Clinical and epidemiological characteristics of confirmed Lassa fever cases in Ebonyi State, Nigeria: A case series analysis. Journal of Interventional Epidemiology and Public Health. 2025; 8(Conf Proc5):00249. https://doi.org/10.37432/JIEPH-CONFPRO5-00249
17. Adesina AS, Oyeyiola A, Obadare A, Igbokwe J, Abejegah C, Akhilomen P, Bangura U, Asogun D, Tobin E, Ayodeji O, Osoniyi O, Davis C, Thomson EC, Pahlmann M, Günther S, Fichet-Calvet E, Olayemi A. Circulation of Lassa virus across the endemic Edo-Ondo axis, Nigeria, with cross-species transmission between multimammate mice. Emerg Microbes Infect. 2023 Dec;12(1):2219350. doi: 10.1080/22221751.2023.2219350. PMID: 37288752; PMCID: PMC10251791.
18. Chika-Igwenyi NM, Harrison RE, Psarra C, Gil-Cuesta J, Gulamhusein M, Onwe EO, Onoh RC, Unigwe US, Ajayi NA, Nnadozie UU, Ojide CK, Nwidi DU, Ezeanosike O, Sampson E, Adeke AS, Ugwu CN, Anebonam U, Tshiang JK, Maikere J, Reid A. Early onset of neurological features differentiates two outbreaks of Lassa fever in Ebonyi state, Nigeria during 2017-2018. PLoS Negl Trop Dis. 2021 Mar 8;15(3):e0009169. doi:

Print ISSN: 0189-9287 Online ISSN: 2992-345X

10.1371/journal.pntd.0009169. PMID: 33684118; PMCID: PMC7984835.
19. Grover S, Opoku VS, Debrah LB, Maj C, Osei-Mensah J, Mensah DA, Hoerauf A, Debrah AY, Schumacher J, Pfarr K. First genome-wide association study for lymphatic filariasis in a West African population point to a human leukocyte antigen-mediated disease pathophysiology. International Journal of Infectious Diseases. 2023 Aug 1;133:1-4.
20. Médecins Sans Frontières (MSF)/Doctors Without Borders. Nigeria: MSF hands over Lassa fever care in Ebonyi State. https://www.doctorswithoutborders.ca/nigeria-msf-hands-over-lassa-fever-care-in-ebonyi-state/
21. Agboeze J, Nwali MI, Ajayi N, Chika-Igwenyi NM. An Epidemiological Investigation of Lassa Fever Outbreak in Ebonyi State South Eastern Nigeria Lessons Learnt (January to March 2018). Niger Med J. 2022 May 13;62(5):279-283. doi: 10.60787/NMJ-62-5-55. PMID: 38716434; PMCID: PMC11073840.
22. Ehidiamhen FE, Eze GO, Eze UO, Onwe FI, Ohakwe BC, Onukaogu IG, Agwu UM, Akujobi CN. Index Case of Lassa Fever in David Umahi Federal University Teaching Hospital Uburu, Ebonyi State, Nigeria: A Case Report. African Journal of Health and Social Sciences; 2027; 1(3), 142-145.
23. Onah CK, Oka OU, Iloke CV, Otta MN, Nwambeke NO, Onoh RC.From Outbreak to Opportunity: Leveraging Lassa Fever Trends from 2018 to 2025 to Strengthen Trial Site Preparedness and Vaccine Acceptance in Ebonyi State, Nigeria. ECOWAS Lassa Fever international Conference. https://www.wahooas.org/web-ooas/sites/default/files/publications/2574/ecowaslic2025oral060.pdf
24. Médecins Sans Frontières (MSF)/Doctors Without Borders. We are no longer afraid: MSF hands over Lassa fever care in Ebonyi State. June 11, 2025. https://msf.lu/en/articles/nous-navons-plus-peur-msf-remet-la-prise-en-charge-de-la-fievre-de-lassa-au-nigeria
25. Usman A, et al. Demographic and housing factors in Lassa fever transmission in a high disease burden area. Population Medicine. 2023.
26. Ilori EA, Furuse Y, Ipadeola OB, Dan-Nwafor CC, et al. Epidemiologic and Clinical Features of Lassa Fever Outbreak in Nigeria, January 1–May 6, 2018. Emerging Infectious Diseases. 2019;25(6):1066–1074.
27. Ajayi NA, Nwigwe CG, Azuogu BN, et al. Containing a Lassa fever epidemic in a resource-limited setting: outbreak description and lessons learned from Abakaliki, Nigeria (January–March 2012). International Journal of Infectious Diseases. 2013;17(11):e1011-e1016.
28. Nwafor IE, Ogah OE, Ojide CK, Odeh EN, et al.Prevalence and outcome of Lassa fever among hospitalized patients in Ebonyi State, Nigeria, 2018–2019. Virus Research. 2020;285:198000.
29. Asogun D, Arogundade B, Unuabonah F, et al. A Review of the Epidemiology of Lassa Fever in Nigeria. Microorganisms. 2025;13(6):1419.
30. Oluwadare SA, Adegun IP, Boyinbode OK, et al. Assessment of the Influence of Meteorological Factors and Seasonality on Lassa Fever Occurrence in Nigeria. FUDMA Journal of Sciences. 2024.
31. Arruda LB, Free HB, Simons D, et al. Lassa virus in novel hosts: insights into the epidemiology of Lassa virus infections in southern Nigeria. Emerging Microbes & Infections. 2024;13(1).
32. Redding DW, Gibb R, Dan-Nwafor CC, et al.The impact of seasonal rodent population dynamics on Lassa fever transmission in Nigeria. Journal of The Royal Society Interface. 2024.
33. Duvignaud A, Jaspard M, Etafo IC, et al. Lassa fever outcomes and prognostic factors in Nigeria (LASCOPE): a prospective cohort study. The Lancet Global Health. 2021;9(4):e469-e478.
34. Eneh SC, Obi CG, Ikpongifono UE, et al.The resurgence of Lassa fever in Nigeria: economic impact, challenges, and strategic public health interventions. Frontiers in Public Health. 2025;13:1574459.
35. Akpan A, Abioye Y, Okon NP, et al. Epidemiological analysis of Lassa fever in Ebonyi State, Nigeria, 2020–2025: Trends, demographics, symptom patterns and outcomes. Journal of Interventional Epidemiology and Public Health. 2025;8(ConfProc5):00088.
36. Ilori EA, Furuse Y, Ipadeola OB, et al. Epidemiologic and Clinical Features of Lassa Fever Outbreak in Nigeria, January 1–May 6, 2018. Emerging Infectious Diseases. 2019;25(6):1066.
37. Médecins Sans Frontières (MSF). Nigeria: MSF hands over Lassa fever care in Ebonyi state. MSF News. Published June 10, 2025.
38. Okogbenin S, Erameh C, Okoeguale J, et al. Lessons from a retrospective study of Lassa fever in pregnancy in southern Nigeria. Emerging Infectious Diseases. 2019.
39. Hallam HJ, Hallam S, Rodriguez SE, et al. Baseline mapping of Lassa fever virology, epidemiology and

Print ISSN: 0189-9287 Online ISSN: 2992-345X

vaccine research and development. npj Vaccines. 2018;3:11.
40. Nwafor IE, Ogah OE, Ojide CK, et al. Prevalence and outcome of Lassa fever among hospitalized patients in Ebonyi State, Nigeria, 2018–2019. Virus Research. 2020;285:198000.
41. Akpede GO, Asogun DA, Okogbenin SA, et al.Acute kidney injury and mortality in pediatric Lassa fever versus question of access to dialysis. International Journal of Infectious Diseases. 2021;103:124–131.
42. Ajayi, N. A., Nwigwe, C. G., Azuogu, V. C., Onyire, B. N., Nnadozie, U. U., Magbo, M., & Ukpai, S. (2021). Clinical presentation and outcome of Lassa fever in Abakaliki, Nigeria: A retrospective study. BMC Infectious Diseases, 21(1), 1-9.
43. Ezra, M. S., Olowo, A. O., Yahaya, M., Ibrahim, A. S., & Usman, R. (2022). Factors associated with mortality among patients with Lassa fever in Nigeria. PLOS One, 17(3), e0265111.
44. Shaffer, J. G., Schieffelin, J. S., Momoh, M., Goba, A., Kanneh, L., Alhasan, F., Gbakie, M., Fullah, M., Fonnie, R., Koroma, V., Ituka, J., Reeder, B., Hartnett, J. N., Wilson, R. B., Boisen, M. L., Andersen, K. G., & Garry, R. F. (2021). Lassa Fever in Post-Conflict Sierra Leone: The Role of Ribavirin and Supportive Care. Antiviral Research, 185, 104979.

Print ISSN: 0189-9287 Online ISSN: 2992-345X