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A Retrospective Longitudinal Analysis of Lassa fever outbreaks in Nigeria between 2020 to 2025

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Abstract

Background

Lassa fever (LF) is an acute viral haemorrhagic illness caused by the Lassa mammarenavirus and remains a major public health concern in Nigeria. Between 2020 and 2025, Nigeria experienced repeated LF outbreaks amid broader health system disruptions associated with the COVID-19 pandemic. Evidence suggests that the diversion of molecular diagnostic capacity during the pandemic may have initially affected LF surveillance and reporting. This study analysed national trends in Lassa fever outbreaks in Nigeria between 2020 and 2025, focusing on temporal patterns, geographic distribution, and key epidemiological indicators.

Methods

A retrospective longitudinal study was conducted using secondary surveillance data from January 2020 to December 2025. Data were obtained from weekly and annual Lassa fever situation reports published by the Nigeria Centre for Disease Control (NCDC). The study covered all 36 states and the Federal Capital Territory. Time-series analysis, seasonal decomposition, descriptive statistics, and spatial analysis were performed using the Python programming language to examine annual trends, seasonal patterns, geographic distribution, and case fatality rates.

Results

Between January 2020 and December 2025, Nigeria reported 47,814 suspected Lassa fever cases, of which 6,456 were laboratory-confirmed, and 1,008 deaths were recorded, yielding an overall case fatality rate of 15.6%. Confirmed cases declined in 2021 but increased steadily from 2022 to 2024, peaking in 2024 before slightly declining in 2025. Strong seasonality was observed, with 83% of confirmed cases occurring during the dry season and nearly two-thirds of cases occurring in the first quarter of each year. Time-series decomposition confirmed recurrent annual peaks between January and March and troughs between July and September. Geographic analysis showed a marked concentration of cases in five states (Ondo, Edo, Bauchi, Taraba, and Ebonyi). The national case fatality rate increased from 13.36% in 2020 to 18.66% in 2025, with notable regional variability.

Conclusions

Lassa fever in Nigeria remains persistently endemic, characterized by pronounced seasonal transmission, geographic clustering in high-burden states, and a rising case fatality rate. Strengthening seasonal preparedness, expanding diagnostic and treatment capacity in hotspot regions, and improving clinical management are critical to reducing mortality and controlling future outbreaks

BACKGROUND

Between 2020 and 2025, Lassa fever (LF) repeatedly surged across Nigeria, inflicting a heavy burden of disease and mortality and highlighting persistent challenges in epidemic preparedness in a healthcare system already recalibrated by the COVID-19 pandemic. In the first six weeks of 2020 alone, Nigeria reported 472 laboratory-confirmed cases of Lassa fever and 70 deaths (case fatality ratio [CFR] = 14.8%) across 26 states and the Federal Capital Territory, underscoring the endemic nature of the disease and foreshadowing the sustained outbreaks that would follow in subsequent years (World Health Organization, 2020).

By 2023, the magnitude and severity of LF outbreaks had intensified markedly. That year recorded 1170 confirmed cases and 200 deaths, corresponding to a CFR of over 17%, reflecting both expanding transmission and persistently high mortality (Nigeria Centre for Disease Control and Prevention (NCDC), 2023). This trajectory continued through 2025, when Nigeria documented 1148 confirmed cases and 215 deaths from 9389 suspected infections, yielding a cumulative CFR of 18.7% across 21 states and 107 local government areas (NCDC, 2025). Notably, Ondo, Bauchi, Edo and Taraba states accounted for 88% of confirmed cases, highlighting pronounced geographic clustering of transmission (Vanguard, 2026). Collectively, these patterns suggest a shift from a largely predictable, seasonal outbreak profile to a more persistent epidemic characterised by sustained transmission in established hotspots, alongside expansion into additional states, which necessitates a critical re-evaluation of national monitoring and control strategies.

Lassa fever is an acute viral haemorrhagic illness caused by the Lassa mammarenavirus. Since its first clinical description in 1969 in Lassa, Borno State, the disease has become deeply endemic in Nigeria, which reports one the highest national burdens in West Africa, a region recognised as the global epicentre of Lassa fever, (Agbonlahor et al., 2021, Asogun et al., 2025). Transmission occurs primarily through contact with food or household items contaminated with urine or faeces of infected multimammate rats (*Mastomys natalensis*), with limited but consequential human-to-human transmission documented, particularly in healthcare settings (Madueme et al., 2022). The World Health Organization (WHO) estimates that LF causes 100,000–300,000 infections annually across West Africa (Asogun et al., 2025), with substantial under-ascertainment due to non-specific early symptoms and diagnostic constraints, while clinical presentation ranges from mild febrile illness to severe haemorrhage, multi-organ failure, and death in the absence of timely supportive care (Madueme et al., 2022). In light of its epidemic potential, high CFR, and absence of a licensed vaccine, LF remains prioritised under the WHO Research and Development (R&D) Blueprint (Mehand et al., 2018).

The epidemiological landscape of LF in Nigeria has evolved considerably over the past five years. Historically, transmission was largely confined to a “fever belt” encompassing Edo, Ondo, and Ebonyi states, with peak incidence during the dry season (November-May) (McCormick et al., 1987, Adewumi et al., 2025). However, surveillance data from 2020 to 2025 indicate expansion into more than 28 states, including urban and peri-urban areas previously considered low risk. This geographic spread is likely

driven by a combination of ecological and socio-environmental factors, including climate-related shifts in rodent habitats, deforestation, and increased human-rodent contact (Eneh et al., 2025).

The public health relevance of the 2020–2025 period is further heightened by concurrent health system disruptions. Evidence from 2020–2022 indicates that the diversion of molecular diagnostic capacity toward COVID-19 response activities may have initially obscured LF incidence, contributing to under-reporting (Musa et al., 2022). Although diagnostic capacity was subsequently restored and expanded by the NCDC, CFRs have remained persistently high, frequently exceeding 15%, which suggests that gains in detection have not been matched by improvements in early presentation, clinical management, or access to timely antiviral therapy such as ribavirin (Eneh et al., 2025).

Despite Nigeria consistently bearing the highest LF burden in the region, and advances in viral genomics and outbreak detection, a critical knowledge gap remains regarding multi-year national trends in Lassa fever during the post-COVID-19 period. Annual outbreak reports and single-season analyses dominate the evidence base, with only few studies integrating surveillance data across multiple years to assess how temporal patterns, geographic spread, and mortality dynamics have evolved within the context of changing ecological conditions and health system performance. Without such synthesis, public health responses risk remaining reactive rather than anticipatory, perpetuating cycles of high mortality and recurrent outbreaks.

Understanding longitudinal trends in Lassa fever is therefore essential to inform evidence-based preparedness and response. Trend analyses can identify emerging hotspots, quantify shifts in disease burden, and guide targeted surveillance, clinical preparedness and resource allocation in persistently affected states. These insights are particularly critical given the sustained high CFRs and concentration of cases in a limited number of states, which continue to challenge outbreak containment and clinical care.

Therefore, this study aims to analyse the trends of Lassa fever outbreaks in Nigeria from 2020 to 2025. The specific objectives are to describe annual and seasonal patterns of confirmed cases and deaths, assess changes in geographic distribution over time, and examine trends in key epidemiological indicators across this five-year period.

LITERATURE REVIEW

Overview of Lassa fever in Nigeria

Lassa fever is an endemic viral hemorrhagic disease that remains a significant public health challenge in Nigeria. Since its first identification in 1969, Nigeria has continued to bear the highest burden of Lassa fever globally, experiencing recurrent outbreaks with considerable morbidity and mortality (Asogun et al., 2025). The persistence of the disease, along with high case fatality rates among severe infections, underscores its ongoing threat to population health and the national healthcare system (Asogun et al., 2025). The disease is caused by the Lassa virus, which belongs to the *Arenaviridae* family. Transmission

primarily occurs through exposure to the urine or feces of infected *Mastomys natalensis* rodents, which are widespread in Nigerian households, particularly in rural and peri-urban areas characterized by poor housing and inadequate sanitation. In addition to zoonotic transmission, human-to-human spread can occur through direct contact with infected bodily fluids, especially in healthcare settings where infection prevention and control measures are insufficient. Consequently, healthcare workers are frequently at elevated risk during outbreaks (Oli et al., 2025).

Clinically, Lassa fever presents a diagnostic challenge due to its broad and nonspecific symptom profile, as early symptoms such as fever, headache, weakness, and sore throat often mimic common endemic illnesses like malaria and typhoid fever; consequently, these similarities frequently result in misdiagnosis and delayed treatment, increasing the likelihood of progression to severe disease which, if untreated, may advance to hemorrhage, neurological complications, and organ failure, contributing significantly to the high mortality observed among hospitalized patients (Grace et al., 2021).

Epidemiology and distribution in Nigeria.

Lassa fever in Nigeria exhibits pronounced seasonality. The majority of cases occur during the dry season, typically between December and April, when human-rodent contact increases due to food storage practices and agricultural activities(Adewumi et al., 2025). Certain states, including Edo, Ondo, Ebonyi, and Bauchi, have consistently recorded higher case numbers, although recent trends indicate a gradual spread into previously less-affected regions (Asogun et al., 2025). The number of reported Lassa fever cases has increased over time; however, this trend reflects not only enhanced surveillance capacity but also ongoing transmission driven by ecological and socio-economic factors. Rapid urbanization, population growth, and persistent poverty have altered human-rodent interactions, thereby sustaining transmission cycles; accordingly, these dynamics underscore that factors Lassa fever is intrinsically linked to environmental and social determinants, rather than representing solely a biomedical condition (Besson et al., 2024).

Public Health and Lassa Fever in Nigeria.

Public awareness and risk perception are critical to disease prevention. While general awareness of Lassa fever has improved, many individuals lack a comprehensive understanding of transmission routes and preventive measures. This gap often leads to poor adherence to practices such as environmental sanitation, safe food storage, and early health-seeking behavior, thereby facilitating continued community transmission (Al-Mustapha et al., 2024). Health system challenges further exacerbate the disease burden. Limited access to diagnostic services, shortages of trained personnel, inadequate isolation facilities, and inconsistent availability of antiviral treatment weaken outbreak response, particularly in rural areas (Besson et al., 2024). Despite these challenges, improvements in surveillance, case management, and research have strengthened Nigeria's response; however the persistence of outbreaks and high mortality rates highlights the need for sustained, coordinated, and multisectoral interventions (Asogun et al., 2025).

Trends before 2020.

In the early decades following its discovery, Lassa fever cases in Nigeria were reported sporadically, largely due to limited surveillance capacity and diagnostic infrastructure; however, from the 1990s onward, improved clinical awareness and gradual expansion of laboratory confirmation revealed that the disease was more widespread than previously assumed(Dalhart et al., 2022; Agbonlahor et al., 2021). By the early 2010s, Nigeria began to experience increasingly frequent and larger outbreaks, signaling a shift toward sustained endemic transmission (Grace et al., 2021). Temporal trend analyses indicate a steady rise in reported Lassa fever cases in the years leading up to 2020. This increase was particularly pronounced from 2015 onward, coinciding with the strengthening of the Integrated Disease Surveillance and Response (IDSR) system and the establishment of molecular diagnostic laboratories across the country (Grace et al., 2021). Nonetheless, modeling studies suggest that improved detection alone does not fully explain the upward trend, as ecological changes, population growth, and increased human-rodent contact have also contributed to sustained transmission (Ojo et al., 2021).

The 2018 and 2019 outbreaks marked a turning point in Nigeria's Lassa fever epidemiology. These outbreaks were among the largest recorded before 2020, with widespread geographic involvement and high case numbers. Epidemiological investigations from this period highlighted both increased transmission intensity and improved reporting accuracy (Ipadeola et al., 2020). One of the defining epidemiological characteristics of Lassa fever in Nigeria prior to 2020 was its strong seasonal pattern. Most cases consistently occurred during the dry season, typically between December and April. This seasonal peak has been linked to increased human exposure to infected *Mastomys natalensis* rodents during periods of food scarcity and changes in agricultural and food storage practices (Grace et al., 2021).

During the dry season, rodents are more likely to enter human dwellings in search of food, thereby increasing the risk of contamination of household items with infected urine and feces. Mathematical modeling studies further support the role of seasonality in shaping outbreak dynamics, showing predictable annual peaks followed by declines during the rainy season (Ojo et al., 2021). These seasonal trends were consistently observed across multiple years before 2020, reinforcing their importance in outbreak forecasting and preparedness. Geographically, Lassa fever before 2020 exhibited a heterogeneous distribution across Nigeria. Certain states emerged as persistent hotspots, reporting cases year after year. Edo, Ondo, Ebonyi, Bauchi, and Taraba states were consistently identified as high-burden areas, likely due to a combination of ecological suitability for rodent reservoirs, socio-economic conditions, and population density (Asogun et al., 2025). While southern and central states initially accounted for most confirmed cases, later years saw a gradual geographic expansion into northern and north-central regions. This spread reflected both genuine transmission and improved surveillance coverage (Ipadeola et al., 2020). Importantly, the geographic expansion underscored that Lassa fever was no longer confined to historically endemic zones but had become a nationwide public health concern. The historical and epidemiological profile of Lassa fever in Nigeria prior to 2020 was characterized by increasing temporal trends, predictable seasonal peaks, expanding geographic

distribution, and consistently high case fatality rates. Although improved surveillance enhanced outbreak detection, underlying ecological and socio-economic drivers continued to sustain transmission. These pre-2020 patterns provided critical context for understanding subsequent trends and underscored the need for sustained surveillance, targeted interventions in endemic hotspots, and strengthened healthcare systems.

The years 2018–2021 were characterized by fluctuating Lassa fever case numbers. Dalhat et al. (2022), analyzing national surveillance data from 2018 to 2021, reported sustained annual outbreaks with variations in magnitude. Although a reduction in reported cases was observed in 2021, the authors cautioned that this decline may reflect underreporting due to COVID-19-related disruptions rather than a true reduction in transmission.

Trends between 2020 and 2025.

Between 2020 and 2025, Nigeria continued to face recurring outbreaks of Lassa fever, reflecting the persistent challenge posed by this viral hemorrhagic disease. Case numbers during this period fluctuated, influenced not only by the natural dynamics of the virus but also by external factors, including the COVID-19 pandemic. These findings illustrate the complex interplay between infectious disease epidemiology and broader public health challenges.

Following the initial decline, Lassa fever cases resurged, highlighting the virus's resilience despite ongoing public health interventions. Confirmed cases and associated deaths increased in the post-pandemic period, demonstrating that transmission remained robust and that gaps in control efforts could quickly allow the virus to reemerge (Asogun et al., 2025). By 2023, multiple states reported significant outbreaks, reflecting both continued endemicity in traditional areas and the emergence of cases in regions previously considered low-risk. Data from the Nigeria Centre for Disease Control (NCDC) reinforced the observation that Lassa fever has now become a persistent threat to population health across the country (NCDC, 2025). The persistent seasonality underscores the importance of targeting prevention strategies during high-risk months, particularly in areas with dense rodent populations.

Geographical distribution patterns also remained noteworthy. Endemic states such as Edo, Ondo, Ebonyi, Bauchi, and Taraba consistently recorded the highest numbers of cases. However, recent evidence indicates a gradual geographic expansion, with previously low-incidence states beginning to report confirmed infections (Asogun et al., 2025). This expansion highlights the necessity for a nationwide approach to surveillance and preparedness, as focusing solely on traditional hotspots may leave populations in newly affected regions vulnerable. Despite improvements in diagnostics and surveillance, case fatality rates (CFRs) continued to reflect substantial challenges in clinical management. High mortality is often associated with delays in diagnosis, limited access to specialized care, and inconsistent availability of antiviral treatments (Asogun et al., 2025). These ongoing challenges underscore that while surveillance and public health interventions are critical, timely clinical management remains equally essential in reducing fatalities.

Overall, between 2020 to 2025 Lassa fever in Nigeria demonstrated persistence resilience, marked by geographic expansion beyond traditional endemic states and consistently high case fatality rates. These trends highlight the ongoing public health challenges posed by the disease and indicating the imperative for strengthened surveillance, enhanced clinical management, and targeted preventive measures to effectively reduce the burden of Lassa fever in Nigeria (NCDC., 2025).

Factors influencing Lassa fever in Nigeria.

Environmental determinants of Lassa fever remain critical drivers of transmission. Climatic variability, including fluctuations in rainfall, temperature, and humidity, significantly influences rodent populations, the primary reservoirs of Lassa virus. Studies indicate that prolonged dry seasons and erratic rainfall patterns result in increased human-rodent contact, as rodents seek food and shelter within human dwellings (Arotolu, Olayinka-Olagunju, & Dosumu, 2025). The *Mastomys natalensis* species, widely distributed across Nigeria, thrives in environments with abundant food sources and shelter, making poor housing conditions particularly susceptible to infestation. Seasonal variations also contribute to the epidemiology of Lassa fever, with peak incidences occurring during the dry months, typically from December to April. During this period, human behaviors, including food storage practices and agricultural activities, intersect with ecological factors to increase the risk of exposure to infected rodents (Agbonlahor et al., 2021). Consequently, environmental conditions do not act in isolation but in combination with human activities, amplifying the transmission potential of the virus.

Socio-economic factors further compound the risk and severity of Lassa fever outbreaks. Poor housing quality, overcrowding, and inadequate sanitation create conditions conducive to rodent infestation and human exposure to the Lassa virus. Unsafe food storage practices, such as storing grains and other consumables in open containers or near rodent habitats, remain widespread in rural and peri-urban communities, facilitating zoonotic transmission (Izah, Ovuru, & Ogwu, 2022). Behavioral determinants, including delayed healthcare seeking, limited knowledge of preventive measures, and reliance on traditional healing practices, exacerbate the burden of disease by increasing the probability of severe outcomes. Evidence also suggests that socio-demographic factors such as age, gender, and occupation influence exposure and disease outcomes. Studies showed that individuals engaged in farming or activities that bring them into frequent contact with rodents are at heightened risk, while children and the elderly often experience more severe disease due to immunological vulnerabilities (Olayinka et al., 2022). Conversely, adult males are often more exposed to rodent vectors due to occupational, outdoor, and agricultural activities, increasing their risk of infection(Ochu et al., 2023)

Hospitals in endemic regions frequently face challenges in isolating infectious patients and implementing protective measures for healthcare workers, leading to nosocomial transmission and compounding the overall outbreak burden.Community awareness and risk perception are crucial determinants of outbreak control. While public health campaigns have improved general knowledge of Lassa fever in endemic states, gaps in understanding remain significant. Many individuals remain unaware of the specific transmission routes of the virus or the importance of preventive measures such

as proper food storage, rodent-proofing homes, and prompt healthcare seeking (Oyinloye & Abiodun, 2022).

Clinical and epidemiological factors also influence trends in Lassa fever. The disease manifests with a wide spectrum of clinical severity, from mild febrile illness to severe hemorrhagic disease with multi-organ involvement. Patient outcomes are strongly influenced by timely diagnosis, access to care, and supportive treatment availability. Olayinka et al. (2022) demonstrate that delayed hospital presentation, older age, and the presence of comorbid conditions are associated with higher mortality. Strampe et al. (2021) further identify that progression to death is often linked to late initiation of antiviral therapy, limited monitoring capacity, and inadequate supportive care infrastructure. These findings highlight that mortality trends are not merely reflections of viral virulence but are also shaped by healthcare access and quality, emphasizing the importance of strengthening health systems in endemic areas.

Human mobility and population dynamics contribute to the geographical expansion of Lassa fever. While historically concentrated in states such as Edo, Ondo, Ebonyi, and Bauchi, recent evidence indicates increasing reports from previously low-incidence regions, suggesting gradual expansion beyond traditional endemic zones (Asogun et al., 2025).

Prevention and Control Measures of Lassa Fever.

Prevention and control of Lassa fever require a multi-pronged approach addressing environmental, behavioral, and healthcare-related factors. Central to primary prevention is reducing human contact with the *Mastomys natalensis* rodent reservoir. Effective rodent control, proper disposal of waste, and maintenance of clean household environments can significantly reduce exposure risk. Additionally, storing food in rodent-proof containers and improving general sanitation are critical preventive measures, especially in rural and peri-urban communities where poor housing and environmental conditions facilitate rodent infestation (Olayiwola & Bakarey, 2017).

Community-level public health education plays a crucial role in minimizing transmission. Increasing awareness about the routes of Lassa virus infection, recognizing early symptoms, and seeking prompt medical care can help prevent both community and healthcare-associated transmission. Despite ongoing educational efforts, adherence to recommended preventive practices remains inconsistent. Cultural norms, limited access to accurate information, and socio-economic constraints often affect the adoption of behaviors such as safe food storage and proper hygiene (Aromolaran, Samson, & Falodun, 2023).

Healthcare-based interventions are equally important in controlling outbreaks. Strengthening infection prevention and control (IPC) measures in health facilities helps reduce nosocomial transmission. Training healthcare workers in the safe handling of bodily fluids, use of personal protective equipment, and isolation of suspected cases significantly decreases the risk of hospital-acquired infections (Olayiwola & Bakarey, 2017). The disruptions caused by the COVID-19 pandemic highlighted the need for

resilient healthcare systems capable of maintaining essential services, including Lassa fever diagnosis and containment, during public health crises (Uwishema, 2021).

Economic and logistical limitations further affect the effectiveness of prevention strategies. Limited funding, insufficient healthcare infrastructure, and competing public health priorities can compromise the sustainability of control programs. Addressing these challenges requires continuous surveillance, community engagement, and investment in public health systems to ensure preventive measures are both implemented and maintained over time (Eneh et al., 2025). Overall, Lassa fever prevention and control demand coordinated efforts that combine environmental management, community participation, and robust healthcare interventions to reduce disease burden in Nigeria.

METHODOLOGY

Aim of the Study

This study aimed to analyse the trends of Lassa fever outbreaks in Nigeria between January 2020 and December 2025. Specifically, the study sought to:

1. Describe annual and seasonal patterns of confirmed cases and deaths.
2. Assess changes in geographic distribution over time.
3. Examine trends in key epidemiological indicators, particularly case fatality rate.

Study Design and Setting

A retrospective longitudinal study design was employed using routinely collected national surveillance data. The study was conducted across Nigeria, encompassing all 36 states and the Federal Capital Territory (FCT). Nigeria is endemic for Lassa fever, with recurrent outbreaks reported across diverse ecological zones, making it an appropriate setting for national-level temporal and spatial analysis.

Study Population and Data Sources

The study population comprised all reported Lassa fever cases in Nigeria from January 2020 to December 2025. Secondary data were obtained from publicly available weekly and annual Lassa fever situation reports published by the Nigeria Centre for Disease Control and Prevention (NCDC).

The dataset included the following variables: Number of suspected cases, Number of confirmed cases, Number of probable cases, Number of deaths, Case fatality rate (CFR), State-level distribution, Epidemiological week and month of reporting

The unit of analysis included:

- Temporal units: year, quarter, month, and epidemiological week

- Spatial units: state and geopolitical zone
- Epidemiological indicators: confirmed cases, deaths, and CFR

Data Processing and Analysis

Data analysis was conducted using the python programming language (time-series analysis, trend modelling, spatial analysis, descriptive and inferential statistics), ArcGIS/QGIS (geospatial mapping and spatial trend analysis), and Microsoft Excel (data management and preliminary analysis).

The first objective, to determine the annual and seasonal pattern, was performed with the following analysis: descriptive statistics (frequencies, percentages, rates), time-series plots of confirmed cases and deaths, seasonal decomposition analysis, and monthly and quarterly trend analysis. The second objective, to determine the geographic distribution, involved state-level trend mapping, spatial distribution analysis, hotspot identification using choropleth mapping, and trend comparison across geopolitical zones. Lastly, the third objective comprised epidemiological Indicators, trend analysis of CFR over time

Statistical Analysis

Descriptive and inferential statistical analyses were conducted using Python. Time-series decomposition techniques were applied to separate trend, seasonal, and residual components of Lassa fever incidence. Comparative analyses were performed across time periods, seasons, and geographic regions. Results were presented using tables, charts, and geospatial maps. Given that this study utilised complete national surveillance data rather than a sample, power calculation was not applicable.

Ethical Considerations

This study utilised secondary, anonymised, and publicly available surveillance data and did not involve direct human participants. Therefore, formal ethical approval was not required. However, principles of data integrity, responsible reporting, and appropriate citation of data sources were strictly maintained.

RESULTS

This chapter presents the findings of the analysis of Lassa fever surveillance data in Nigeria from 2020 to 2025. The results are organized in line with the study objectives and focus on temporal patterns, seasonal variation, geographic distribution, and key epidemiological indicators. Descriptive statistics, time-series analysis, seasonal decomposition, and spatial assessments are used to summarize observed trends in confirmed cases, deaths, and case fatality rates. The findings are presented using tables and figures, with emphasis on objectively describing patterns observed in the data.

ANNUAL AND SEASONAL PATTERNS OF CONFIRMED CASES AND DEATHS

Descriptive Summary of Lassa Fever Surveillance Indicators

Table 1 summarises the distribution of key Lassa fever surveillance indicators in Nigeria between 2020 and 2025. Over the study period, a total of 47,814 suspected cases were reported. Of these, 6,456 cases were laboratory confirmed, representing a confirmation rate of 13.5%. In addition, 53 probable cases were recorded, accounting for **0.1%** of reported suspected cases.

A total of 1,008 deaths were documented among confirmed cases, corresponding to an overall case fatality rate of 15.6%. The observed differences between suspected, confirmed, and probable cases reflect the surveillance and case classification process over the study period. Confirmed cases and associated deaths were recorded throughout the study years, indicating sustained transmission of Lassa fever in Nigeria from 2020 to 2025.

Table 1
Descriptive Statistics showing frequencies and rates of Lassa Fever Indicators.

Indicator	Frequencies	Rates
suspected_cases	47814	-
confirmed_cases	6456	13.5%
probable_cases	53	0.1%
deaths	1008	15.6%

Time-Series Trends of Confirmed Cases and Deaths

Figure 1 shows the annual trends in confirmed Lassa fever cases and associated deaths in Nigeria from 2020 to 2025. Confirmed cases exhibited marked inter-annual variation, with a pronounced decline observed in 2021, followed by a steady increase from 2022, peaking in 2024, and a subsequent decline in 2025.

Deaths followed a broadly similar temporal pattern to confirmed cases, with the lowest number recorded in 2021 and higher values observed in subsequent years. Peaks in mortality coincided with periods of increased confirmed cases, particularly in 2023, 2024, and 2025. Despite year-to-year fluctuations in magnitude, the temporal alignment between confirmed cases and deaths remained consistent throughout the study period.

Seasonal Distribution of Confirmed Cases and Deaths

In the review of seasonal distribution of confirmed Lassa fever cases and associated deaths for the same time period, a substantially higher number of confirmed cases were recorded during the dry season (5,362 cases) with 849 deaths recorded giving a 15.83% case fatality rate compared with the rainy season (1,094 cases) with 159 deaths and 14.53% case fatality rate.

Overall, both confirmed cases and deaths were concentrated predominantly in the dry season, while the rainy season accounted for a smaller proportion of the total disease burden over the study period.

Monthly Trends in Confirmed Cases and Deaths

Monthly trends in confirmed Lassa fever cases and deaths show a clear seasonal pattern (Fig. 4.3). Case counts were highest in the early months of the year, peaking in February, with similarly high levels observed in January and March. From April, a marked decline in cases was observed, with consistently lower numbers recorded between May and September. A gradual increase occurred from October, with a secondary rise toward November and December.

Deaths followed a pattern comparable to confirmed cases, with the highest mortality occurring during peak incidence months, particularly February. This alignment indicates that mortality trends closely mirror fluctuations in case incidence. The findings demonstrate strong intra-annual seasonality, with Lassa fever burden concentrated in the first quarter of the year and a resurgence toward year-end supporting the observed high incidence rate in the dry season.

Quarterly Trends in Confirmed Cases and Deaths

Quarterly analysis further illustrates pronounced seasonal variation (Fig. 3). The first quarter (Q1) recorded the highest burden, accounting for 65% of confirmed cases and 66% of deaths, representing the peak transmission and mortality period. This was followed by a substantial decline in Q2, accounting for 11% of confirmed cases and deaths, and a further reduction in Q3, which recorded the lowest number of confirmed cases (530) and deaths (71).

A resurgence was observed in Q4, with confirmed cases increasing to 1,038 and deaths to 169, indicating a renewed rise in transmission toward the end of the year. The confirmed cases and deaths were heavily concentrated in the first quarter, with reduced activity during the middle of the year and a secondary increase in the final quarter. These findings reinforce the strong seasonal pattern of Lassa fever transmission and underscore the importance of intensified surveillance and preparedness ahead of the first quarter each year.

Seasonal Decomposition Analysis

Seasonal decomposition of weekly confirmed Lassa fever cases revealed a pronounced and consistent seasonal pattern across the study period (Fig. 4). The trend component demonstrated recurrent annual waves, with increases during peak transmission periods followed by declines during the off-season, indicating cyclical inter-annual variability rather than a sustained long-term trend. The seasonal

component showed stable and repetitive weekly fluctuations, confirming strong seasonality in disease transmission. Residual variations were larger during peak periods and minimal during low-incidence weeks, suggesting episodic outbreaks or reporting variability not captured by trend or seasonality. The decomposition provides robust evidence that Lassa fever transmission in Nigeria is strongly seasonal, reinforcing findings from the monthly and quarterly analyses and concluding the assessment of temporal patterns.

ASSESSMENT OF THE CHANGES IN GEOGRAPHIC DISTRIBUTION OVER TIME

State-Level Distribution of Lassa Fever Cases

Analysis of state-level distribution revealed a marked geographic concentration of Lassa fever cases in a limited number of states across Nigeria. Five states-Ondo, Edo, Bauchi, Taraba, and Ebonyi-accounted for approximately 86% of all confirmed cases and 81% of reported deaths over the study period, indicating substantial spatial clustering of disease burden.

Ondo State recorded the highest number of confirmed cases and deaths, followed closely by Edo State. Collectively, these two states contributed nearly 60% of confirmed cases and 43% of deaths, underscoring their role as persistent epicentres of Lassa fever transmission in Nigeria. Additional high-burden states were observed in the North East and North Central geopolitical zones, notably Bauchi, Taraba, Kogi, and Benue, as well as Ebonyi State in the South-East.

The spatial distribution map further highlights pronounced clustering of Lassa fever burden in the south-west and selected northern states, with large disparities observed between high- and low-burden regions. This geographic concentration underscores the need for targeted surveillance, early case detection, and strengthened clinical management in high-burden states to reduce transmission and mortality.

Table 2
State-level distribution of confirmed Lassa fever cases and deaths in Nigeria (2020–2025)

Top Burden States	Suspected Cases	Confirmed Cases	Deaths	Percentage of Confirmed Cases	Percentage of Deaths
Ondo	12428	2177	315	33.5%	26.4%
Edo	18588	1691	195	26.0%	16.4%
Bauchi	4985	986	187	15.2%	15.7%
Taraba	1324	467	144	7.2%	12.1%
Ebonyi	1853	283	125	4.4%	10.5%
Benue	1957	182	38	2.8%	3.2%
Kogi	582	157	27	2.4%	2.3%

Geopolitical Zone Distribution of Lassa Fever Cases and Deaths

Aggregation of confirmed Lassa fever cases and deaths by geopolitical zone revealed marked regional disparities in disease burden across Nigeria (Fig. 6). The South West geopolitical zone recorded the highest number of confirmed cases (2,222) and deaths (324), followed closely by the South South zone with 1,764 confirmed cases and 220 deaths.

The North East zone also demonstrated substantial burden, accounting for 1,530 confirmed cases and 356 deaths, while the North Central and South East zones recorded moderate levels of transmission. In contrast, the North West zone reported comparatively low numbers of confirmed cases (88) and deaths (36) over the study period.

The zonal distribution highlights a pronounced concentration of Lassa fever burden in the southern regions—particularly the South West and South South—as well as in the North East. These findings reinforce evidence of spatial clustering and the need for regionally targeted surveillance, prevention, and clinical response strategies in high-burden geopolitical zones.

A zonal choropleth map with proportional symbols was used to visualise regional differences in Lassa fever burden. States were coloured according to geopolitical zone, while proportional circles scaled by cumulative confirmed cases highlighted intra-zonal variation.

Temporal Changes in Geographic Distribution of Lassa Fever (Geopolitical Zones)

Temporal analysis of confirmed Lassa fever cases and associated deaths across Nigeria’s geopolitical zones between 2020 and 2025 revealed persistent regional disparities in disease burden, with mortality

patterns closely mirroring case distribution. The South West zone consistently recorded high numbers of confirmed cases and deaths throughout the study period, reflecting sustained transmission and ongoing clinical burden. Similarly, the South South and North East zones maintained substantial disease burden over time, with the North East demonstrating a steady increase in both confirmed cases and deaths in the later years of the study.

In contrast, the North Central and South East zones experienced moderate and fluctuating case counts and mortality, while the North West zone consistently recorded the lowest numbers of confirmed cases and deaths across all years. The observed temporal variations largely reflected changes in outbreak intensity within established endemic zones, rather than shifts in geographic spread. These findings indicate that Lassa fever transmission and mortality in Nigeria during the study period were driven by persistent endemic foci, showcasing the need for sustained, geographically targeted surveillance and clinical interventions in high-burden zones.

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Figure 7–8: Trend Line Plots showing the Temporal Changes of Confirmed Lassa fever cases and Deaths by Geopolitical Zones (2020–2025)

Temporal Trends in High-Burden States (Confirmed Cases and Deaths)

Analysis of confirmed Lassa fever cases and associated deaths in selected high-burden states between 2020 and 2025 demonstrated persistent but variable state-level transmission patterns. Ondo and Edo States consistently recorded the highest disease burden, reflecting sustained endemic transmission despite periodic fluctuations in outbreak intensity. In contrast, Bauchi and Taraba States showed progressive increases in confirmed cases and deaths over time, indicating strengthening transmission in these states. Ebonyi State maintained comparatively lower and variable case counts without evidence of sustained increase.

These observed changes in disease burden were driven mainly by variations in transmission intensity within established endemic states, rather than by the emergence of new high-burden locations. These findings highlight the need for continued targeted control efforts in long-standing hotspots alongside enhanced surveillance and response in states with rising trends.

TRENDS IN KEY EPIDEMIOLOGICAL INDICATORS ACROSS THIS FIVE-YEAR PERIOD

This section examines key epidemiological indicators of Lassa fever in Nigeria between 2020 and 2025, with particular focus on case fatality rate (CFR) as a measure of disease severity and clinical outcome. Analyses were conducted to assess temporal, seasonal, and geographic variations in CFR, alongside

national trends in confirmed cases and deaths. Understanding these patterns provides insight into changes in disease severity over time and highlights areas where improvements in early diagnosis, case management, and health system response may be required.

Temporal Trend in Case Fatality Rate (2020–2025)

The annual trend in case fatality rate (CFR) between the time period demonstrates notable year-to-year variability with an overall upward trajectory. The CFR increased from 13.36% in 2020 to 15.07% in 2021, before declining to 13.82% in 2022. A sharp rise was observed in 2023 (16.52%), followed by a slight reduction in 2024 (15.79%), and a subsequent increase to the highest level recorded during the study period in 2025 (18.66%).

Although fluctuations were observed across the years, the general pattern indicates a progressive increase in mortality among confirmed cases over time. The peak CFR in 2025 suggests either increased disease severity, delays in case detection and treatment, or health system constraints affecting clinical outcomes. The persistent elevation of CFR above 15% in the later years of the study underscores the continued need for strengthened case management, earlier diagnosis, and improved access to effective treatment in high-burden areas.

Seasonal Variation in Case Fatality Rate (CFR)

Seasonal analysis of the case fatality rate (CFR) revealed consistently higher mortality during the dry season compared to the rainy season across most years of the study period. Overall, the dry season recorded 5,362 confirmed cases and 849 deaths, corresponding to a CFR of 15.83%, whereas the rainy season recorded 1,094 confirmed cases and 159 deaths, with a slightly lower CFR of 14.53%.

Year-to-year comparison shows that although CFR fluctuated in both seasons, the dry season maintained a generally upward trajectory from 2020 (12.77%) to 2025 (18.79%). In contrast, the rainy season exhibited greater variability, including a marked decline in 2024 (8.59%) before rising sharply again in 2025 (16.95%).

These findings indicate that, beyond increased transmission during the dry season, mortality risk is also elevated during this period. The seasonal disparity in CFR suggests that intensified case management capacity and early detection efforts during peak transmission months may be critical in reducing fatal outcomes.

Table 3
Summary Table showing the Seasonal Epidemiological Indicators Values

Seasons	Confirmed Cases	Deaths	CFR
Dry	5362	849	15.83
Rainy	1094	159	14.53

Case Fatality Rate (CFR) by Geopolitical Zone

The CFR varied considerably across geopolitical zones between 2020 and 2025. The Northwest and Southeast recorded the highest and most volatile CFR values, with notable peaks in 2022 and 2023–2024, indicating periods of elevated mortality relative to confirmed cases. The Northeast showed initially high CFR values that gradually declined over time, suggesting possible improvements in response capacity. In contrast, the South, South, and Southwest maintained comparatively lower and more stable CFR levels throughout the study period. Overall, the findings demonstrate significant regional disparities in mortality risk, highlighting zones where strengthened clinical management and surveillance are required.

Case Fatality Rate (CFR) in High-Burden States

Among the high-burden states, substantial variation in CFR was observed between 2020 and 2025. Ebonyi and Taraba recorded consistently high and volatile CFR values, with peaks above 50% in multiple years, indicating disproportionately high mortality relative to confirmed cases. Bauchi also showed elevated CFR in earlier years, though values declined in later periods.

In contrast, Edo and Ondo maintained comparatively lower and more stable CFR levels across the study period, suggesting relatively better clinical outcomes despite high transmission. Overall, the findings indicate that while some high-burden states experience sustained transmission with controlled mortality, others demonstrate persistently high fatality rates, underscoring the need for strengthened case management and early detection strategies in the latter group.

DISCUSSION

This study analyzed the trends of Lassa fever outbreaks in Nigeria from January 2020 to December 2025, drawing on national surveillance data from the Nigeria Centre for Disease Control (NCDC). The findings reveal a complex and evolving epidemiological landscape that is majorly characterized by seasonality, geographical concentration, inter-annual variation, and an upward trajectory in case fatality rates. Across the study period, a total of 47,814 suspected cases were reported, of which 6,456 were laboratory-confirmed and 1,008 deaths were recorded, corresponding to an overall case fatality rate (CFR) of 15.6%. These patterns affirm that Lassa fever remains endemic in Nigeria, underscore its persistent threat to public health, and suggest vulnerabilities in the national response framework.

Studies on Lassa Fever in Nigeria have consistently suggested significant underreporting (Denue et al., 2017; Okwor et al., 2018; Simons, 2022; Ahmad et al., 2025). Simons et al. (2022), for example, noted that even though Nigeria's surveillance is comparatively stronger than other endemic countries', about 42% of cases go unrecorded. This suggests that the true burden of Lassa fever is significantly higher than the 6,456 reported in this study. Okoro et al., (2020) had reported a 12.7% overall case positivity rate from 2012 to 2017, Ochu et al., (2023) reported 15.8% from 2018 to 2021, while Grace et al., (2021) reported 16.1% between 2015 and 2021. All these reports closely mirror and lend credibility to the 13.5% observed in this study. The number of deaths documented within the observed period (i.e. 1,008) should be of significant public health concern, considering that it is likely substantially higher. The figure only represents confirmed mortality among laboratory-diagnosed cases, and it is widely acknowledged that community deaths from unconfirmed Lassa fever are not captured in surveillance data (Ahmad et al., 2025). Lassa fever reporting in the endemic belt of West Africa is usually compounded by the non-specific clinical presentation of the disease, which frequently results in deaths being attributed to other causes (Naeem et al., 2023). Therefore, even as the findings of this study suggest the continued endemicity of Lassa fever and the concerning burden of disease and death rate, the true scale of the epidemic is most likely far worse.

The inter-annual pattern of confirmed Lassa fever cases between 2020 and 2025 shows a distinctive pattern of decline followed by progressive resurgence. It revealed that a decline was observed in 2021, followed by a continuous increase through 2022, 2023, and 2024, and moderation in 2025. This is perfectly consistent with the observations of Dalhat et al. (2022), who described the 2018–2021 national surveillance data and similarly noted a decline in reported cases in 2021. The cyclical variation observed in this study also confirms that Nigerian Lassa fever outbreak remains defined by periodic surges rather than continuous exponential increase in cases, and this aligns with the surveillance data analysis from Ibrahim and Dénes (2021) whose mathematical modeling of periodic systems confirmed that these waves of infection naturally recur every year. The apparent reduction in confirmed cases observed in 2021 may not be straightforwardly interpreted as a genuine decline in transmission. Multiple evidences (Grace et al., 2021; Reuben et al., 2020; Reuben et al., 2021) suggest that this decrease was in fact artefactual, driven by the disruption of health services due to the COVID-19 pandemic. Musa et al. (2021) also demonstrated, through analysis of NCDC surveillance data, that a decrease of approximately 727 confirmed Lassa fever cases was observed from 2020 to 2021 during the epidemiological peak period (a decline far larger than any observed in previous years) and attributed this to the syndemic effects of COVID-19 on healthcare-seeking behaviour. During the COVID-19 pandemic, patients with febrile illness were frequently reluctant to attend health facilities for fear of infection or stigma, and healthcare staff were redeployed toward pandemic response activities, resulting in reduced testing, case detection, and reporting for other priority infectious diseases like Lassa fever. Hence, this COVID-19 effect on Lassa fever surveillance echoes patterns documented for malaria, HIV, and tuberculosis across sub-Saharan Africa during the same period (Chanda-Kapata et al., 2022).

The post-2021 resurgence extends over three consecutive years with a peak in 2024, and such sustainability may not be explained by surveillance recovery and restoration of public health functions

alone. Asogun et al. (2025) suggested that it could rather reflect robust ongoing transmission and gaps in control strategy. The 2024 peak is also consistent with the forecasting work of Musa et al. (2024), which projected an upward trajectory in Lassa fever cases between 2024 and 2029, based on NCDC weekly data from 2017 to 2023. The 2025 data, however, showed a slight decline from the 2024 peak. While this may reflect the beginning of a genuine downturn, it may also reflect incomplete reporting or surveillance fatigue in the final data capture period. This is because early NCDC data for 2025 indicate continued high transmission, with 290 confirmed cases and 53 deaths reported in the first four weeks of January alone, corresponding to a CFR of 18.3% (NCDC, 2025, cited in Eneh et al., 2025). More so, all the socio-economic and structural healthcare factors that Lassa fever transmission has been linked to have not significantly changed between 2024 and 2025 (Asogun et al., 2025; Eneh et al., 2025).

One of the most established characteristics of Lassa fever epidemiology in Nigeria is its seasonal pattern, and this study confirms it. The dry season accounted for 5,362 confirmed cases and 849 deaths, representing approximately 83% and 84% of the total confirmed case and death burden, respectively (as compared to 1,094 confirmed cases and 159 deaths during the rainy season). This near fivefold seasonal differential in confirmed cases aligns with the findings of multiple prior studies (Eneh et al., 2025; Akafa et al., 2025; Iziomo et al., 2025). Dalhat et al. (2022) similarly found that more than half of all Lassa fever cases over the 2018–2021 period were reported within the first quarter of the year. Musa et al. (2024) as well confirmed through seasonal decomposition of weekly NCDC data that November to March were consistently the peak transmission period. These patterns reaffirm the established dry-season peak of Lassa fever transmission in Nigeria, likely driven by ecological and behavioural factors that increase human–rodent contact when agricultural activity and food storage intensify and rodents invade homes seeking food in drier conditions (Grace et al., 2021; Ojo et al., 2021). Monthly analysis in this study reveals that the Q1 period accounted for fully 65% of all confirmed cases and 66% of all deaths over the study period, with a secondary resurgence observed toward Q4. This finding has direct implications for the country's outbreak resource planning and preparedness. Q3, however, represented the nadir of transmission, and this is equally consistent with the understanding that sustained rainfall during the West African wet season reduces human-rodent proximity, as food sources in the environment become more plentiful and rodents are less likely to seek sustenance within human homes and food stores (Ojo et al., 2021). The consistency of this seasonal pattern across all the study years demonstrates that the ecological and behavioral drivers of Lassa fever seasonality have not been meaningfully challenged by existing public health interventions.

The geographic analysis reveals a pattern of spatial concentration of Lassa fever burden, with five states (Ondo, Edo, Bauchi, Taraba, and Ebonyi) accounting for over 80% of all confirmed cases and deaths over the study period. These findings mirror historical hotspot patterns observed before 2020 when Edo and Ondo consistently reported the majority of cases (Ilori et al., 2019; Grace et al., 2021). It shows that despite sustained national public health efforts, the concentration of burden in these states has not materially changed, suggesting that the drivers of endemic transmission in these areas remain largely unaddressed. Ondo State emerged as the single highest-burden state, contributing 33.5% of all confirmed cases and 26.4% of all deaths, while Edo State closely followed. Collectively, Ondo and Edo

contributed nearly 60% of confirmed cases, a finding consistent with their designation as Nigeria's persistent Lassa fever epicentres across multiple independent analyses spanning 2015 to 2024 (Dalhat et al., 2022; WHO, 2023). Worthy of note also is that Ondo and Edo together host the Federal Medical Centre Owo and the Irrua Specialist Teaching Hospital respectively, which are among Nigeria's primary Lassa fever treatment centres, so the concentration of cases in these states may therefore partly reflect case referral from surrounding areas rather than solely reflecting community-level incidence within the state (Ilori et al., 2019).

While traditional endemic zones persisted as the dominant foci throughout the study period, some geographic shifts were also observed. Bauchi and Taraba states showed progressive increases in confirmed cases over time, indicating increasing transmission rate in these states beyond what might be attributed to improved surveillance alone. WHO (2023) also noted that confirmed Lassa fever cases had begun appearing in states bordering Cameroon, including Adamawa, Benue, Cross River, and Taraba, suggesting a possible northeastward geographic expansion. This trajectory is particularly alarming given that this region already bears a disproportionate burden of conflict-related displacement, food insecurity, and compromised healthcare infrastructure, all of which amplify Lassa fever risk and delay access to diagnosis and treatment (Asogun et al., 2025).

The geopolitical zone analysis also reveals that the Southwest zone recorded the highest absolute burden of confirmed cases (2,222) and deaths (324) across the study period, followed by the South South zone (1,764 confirmed cases; 220 deaths). In contrast, the North West zone reported comparatively low numbers of confirmed cases (88) and deaths (36) over the study period, a development that may be due to the fact that the Sahel ecology of much of the North West is less hospitable to Mastomys natalensis than the forest-savanna transition zones of the South West (Demby et al., 2001) or indicate significant under-detection due to weaker surveillance infrastructure, fewer diagnostic laboratories, and limited transport infrastructure for sample submission in the region (Fonkeng et al., 2025). These findings highlight the importance of strengthening surveillance and diagnostic capabilities uniformly across all geopolitical zones rather than concentrating solely on historic hotspots.

The most concerning finding of this study is the steady rise in the national case fatality rate over the study period. The CFR increased from 13.36% in 2020 to a peak of 18.66% in 2025. This trend is particularly troubling because it has occurred within a national health system that has, on paper, strengthened its Lassa fever response capacity through expanded diagnostic laboratory networks, implementation of the Surveillance Outbreak Response and Management System (SORMAS), and continued healthcare worker training (Dalhat et al., 2022; Asogun et al., 2025). The persistence and escalation of mortality despite these improvements point to underlying gaps in outbreak management that current interventions have not fully addressed. However, the rising CFR may not be attributable solely to worsening clinical outcomes. Geographic expansion of confirmed cases into states with comparatively weaker Lassa fever management infrastructure and delays in healthcare-seeking behaviors among patients may partly explain the observed increase. The former may be relevant in the

case of Ebonyi State, as suggested by Onah et al. (2025), while the latter has been observed in Bauchi, where Abdulkarim et al. (2020) highlighted patterns of delayed presentation. Delayed presentation could also reflect broader structural barriers, including limited access to healthcare services and negative patient experiences arising from inadequate infrastructure, which have gradually positioned formal healthcare as a last resort rather than a first point of care. Other possible drivers include symptom non-specificity leading to initial attribution to malaria or typhoid, reliance on patent medicine vendors and traditional healers, cost and distance barriers to healthcare access, and lack of awareness of Lassa fever transmission routes (Al-Mustapha et al., 2024; Oyinloye and Abiodun, 2022).

The LASCOPE prospective cohort study, conducted at the Federal Medical Centre Owo between 2018 and 2020, reported an overall CFR of 12% under controlled conditions with ribavirin and dialysis access and intensive nursing care (Strampe et al., 2021). On the other hand, Grace et al. (2021) reported an average annual CFR of 23% within the same timeframe, and Yaro et al. (2021) reported 20%. The fact that the national surveillance-based CFR consistently exceeds that observed in the well-resourced cohort by such high percentage points proves the stark reality that most Lassa fever patients in Nigeria do not receive the level of care available at specialist centres and that this gap in care quality translates directly into preventable deaths.

The finding of consistently higher CFR during the dry season (15.83%) compared to the rainy season (14.53%) adds an important dimension to this discussion by revealing that the peak transmission season is doubly burdensome (i.e., more people become infected, and of those who are infected, a greater proportion die). This may be because of overwhelmed clinical services and consequent resource scarcity (including ribavirin stock-outs and the saturation of isolation ward capacity) (Ipadeola et al., 2020; Asogun et al., 2025). Year-to-year comparison further shows that the dry season largely maintained an upward trajectory from 12.77% in 2020 to 18.79% in 2025, while the rainy season exhibited more interannual variability, likely due to the smaller case denominators' effect, wherein a few severe cases in a low-incidence period disproportionately elevate the calculated value. At the geopolitical zone level, the Northwest and Southeast zones recorded the highest and most volatile CFR values over the study period. These findings stand in contrast to the low case burden in these zones, thus becoming epidemiologically significant. High CFR in low case counts is a classic hallmark of inadequate surveillance and clinical capacity. When Lassa fever cases occur in zones without robust diagnostic infrastructure, they are more likely to be detected only when they have progressed to severe disease, by which time mortality risk is significantly increased.

Strengths and Limitations

This study represents the most recent and relevant analyses of Lassa fever surveillance data in Nigeria to date, spanning the last six calendar years (2020–2025) and encompassing the disruptions of the COVID-19 pandemic, post-pandemic resurgence, and the most recent outbreak cycles. The limitations of this study are, however, primarily rooted in the characteristics of the surveillance data on which it relies. First, the absence of individual-level data (such as age, sex, occupation, time from symptom onset to

treatment, comorbidities, and ribavirin receipt) prevents the analysis of clinical predictors of mortality, which would have permitted evaluation of the specific factors driving CFR changes over time. Also, the geographic analysis is constrained by the state-level unit of analysis, which masks considerable within-state information. Sub-state geographic analysis would provide more actionable intelligence for targeted community-level interventions. Moreso, the study does not account for changes in population size across states over the study period, meaning that trends in absolute case numbers may partly reflect population growth rather than changes in incidence rates.

Recommendations

1. 1. Seasonal Preparedness: The concentration of 65% of annual confirmed cases in Q1 (January–March) provides a clear window for targeted intensification of surveillance, clinical preparedness, and community engagement. NCDC and state health authorities should make adequate preparation (e.g., prestock and allocate adequate resources, expand isolation capacity, and deploy rapid response teams) in the period preceding the transmission. Enhanced surveillance and community-based rodent control interventions (implemented from the beginning of the dry season) should also be implemented.
2. 2. Targeted Geographic Interventions: Persistent hotspots such as Ondo and Edo, along with emerging high-risk states such as Bauchi and Taraba, should receive priority for strengthened laboratory networks, community engagement, and clinical capacity building. The rising burden of transmission in the Northeast and CFRs in the Northwest and Southeast zones argue for a broader national strategy beyond the traditional focus on the five historically high-burden states.
3. **3.** Clinical Management Strengthening: Community-level interventions to promote early health-seeking at the onset of febrile illness during the dry season may be implemented through community health workers, radio campaigns, and engagement of community and religious leaders. This has the potential to shift the distribution of presentation timing toward earlier stages of disease when treatment is more effective.

CONCLUSION

The epidemiology of Lassa fever in Nigeria from 2020 to 2025 reveals enduring endemicity, seasonal cycles, geographic hotspots, and a concerning trend toward higher case fatality. These patterns collectively affirm that Nigerian Lassa fever remains in a persistent endemic equilibrium; thus, there is a need for urgent, sustained, and evidence-driven action towards seasonal preparedness, geographically targeted clinical and diagnostic infrastructure investment, and clinical management strengthening. Only through such integrated efforts can Nigeria meaningfully reduce the burden of Lassa fever and improve outcomes for the persons and communities affected by this preventable disease.

Abbreviations

• CFR

Case Fatality Rate
• COVID-19
Coronavirus Disease 2019
• FCT
Federal Capital Territory
• IDSR
Integrated Disease Surveillance and Response
• LF
Lassa Fever
• NCDC
Nigeria Centre for Disease Control and Prevention
• Q1
First Quarter
• Q2
Second Quarter
• Q3
Third Quarter
• Q4
Fourth Quarter
• SORMAS
Surveillance Outbreak Response Management and Analysis System
• WHO
World Health Organization

Declarations

Ethics approval and consent to participate

This study utilised secondary, publicly available, and anonymised surveillance data obtained from the Nigeria Centre for Disease Control and Prevention (NCDC). As no human participants were directly involved and no identifiable personal data were used, ethical approval was not required in accordance with national and institutional guidelines.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

AAS contributed to literature review and critical revision of the manuscript.AVI contributed to data acquisition, geospatial analysis, and manuscript editing.FPE conceptualised the methodology study and contributed to manuscript development.ORA contributed to interpretation, discussion and conclusion.OE contributed to topic refinement and introductionAll authors read and approved the final manuscript.

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Data Availability

The datasets analysed during the current study are publicly available from the Nigeria Centre for Disease Control and Prevention (NCDC) through its official website: https://ncdc.gov.ng/diseases/sitreps/?cat=5. Additional processed datasets generated and/or analysed during the study are available from the corresponding author on reasonable request.

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Figures

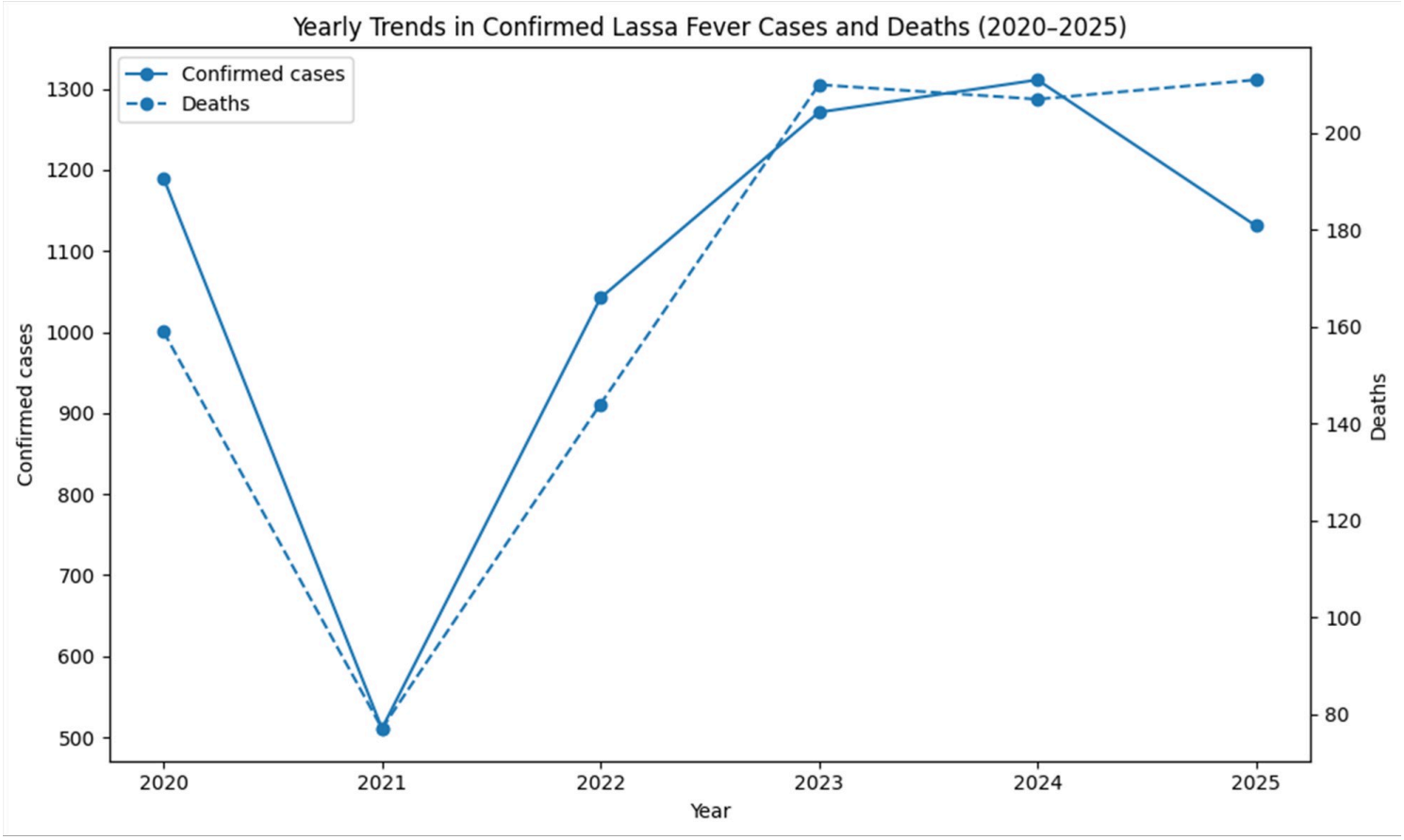


Figure 1

Figure 1: Time-Series Trends of Confirmed Cases and Deaths

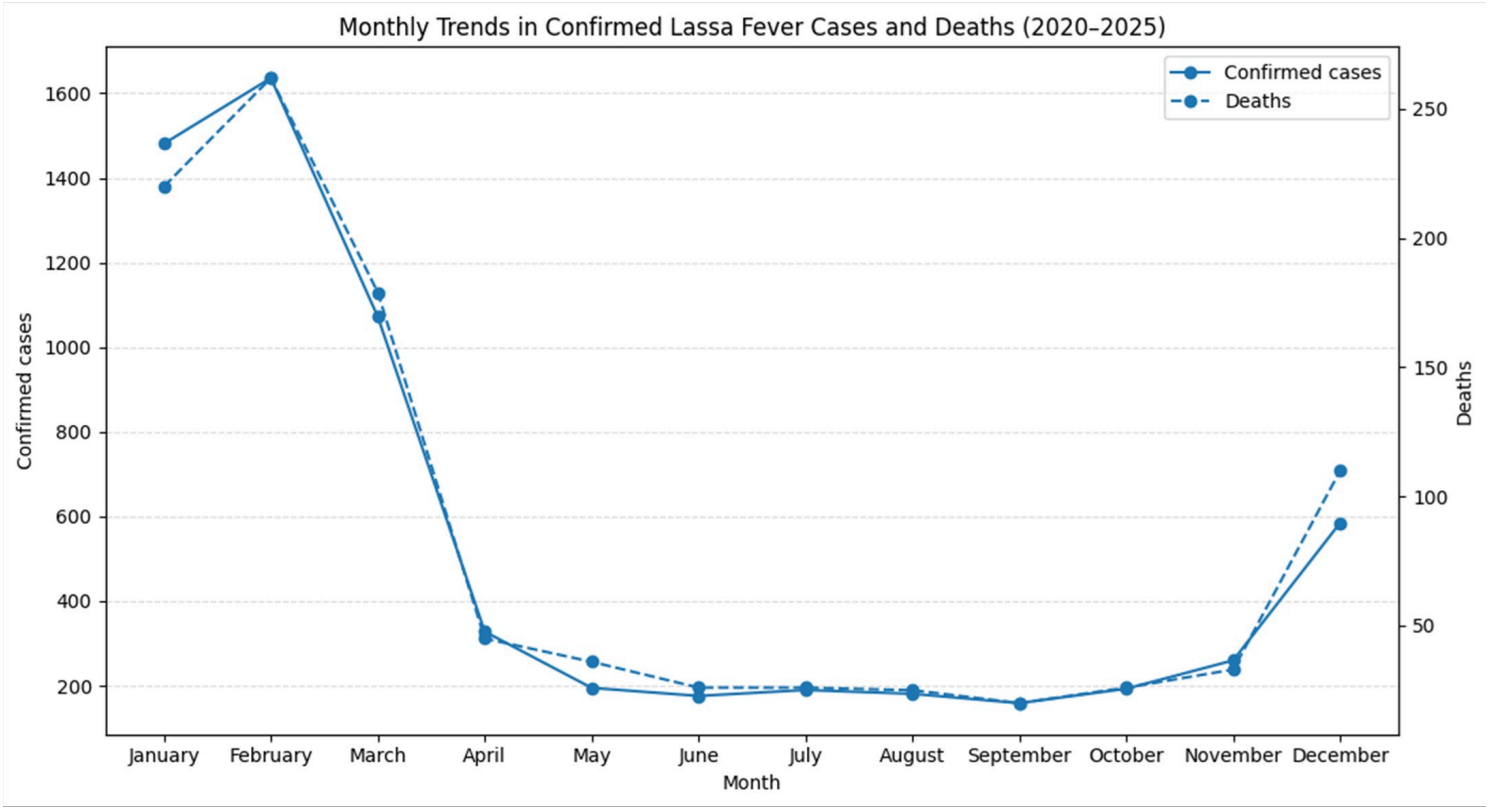


Figure 2

Figure 2: Monthly Trends in Confirmed Cases and Deaths

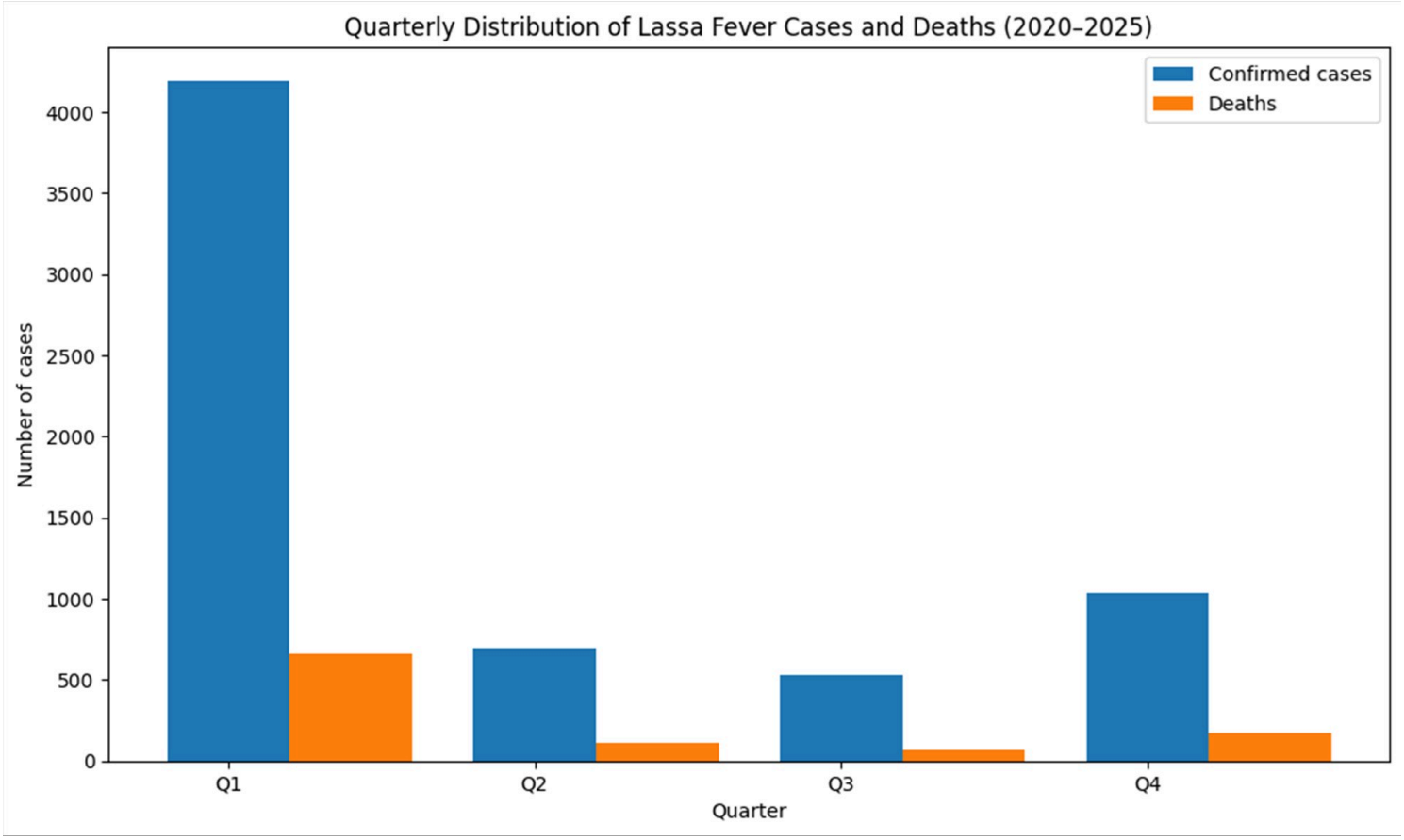


Figure 3

Figure 3: Quarterly Trends in Confirmed Cases and Deaths

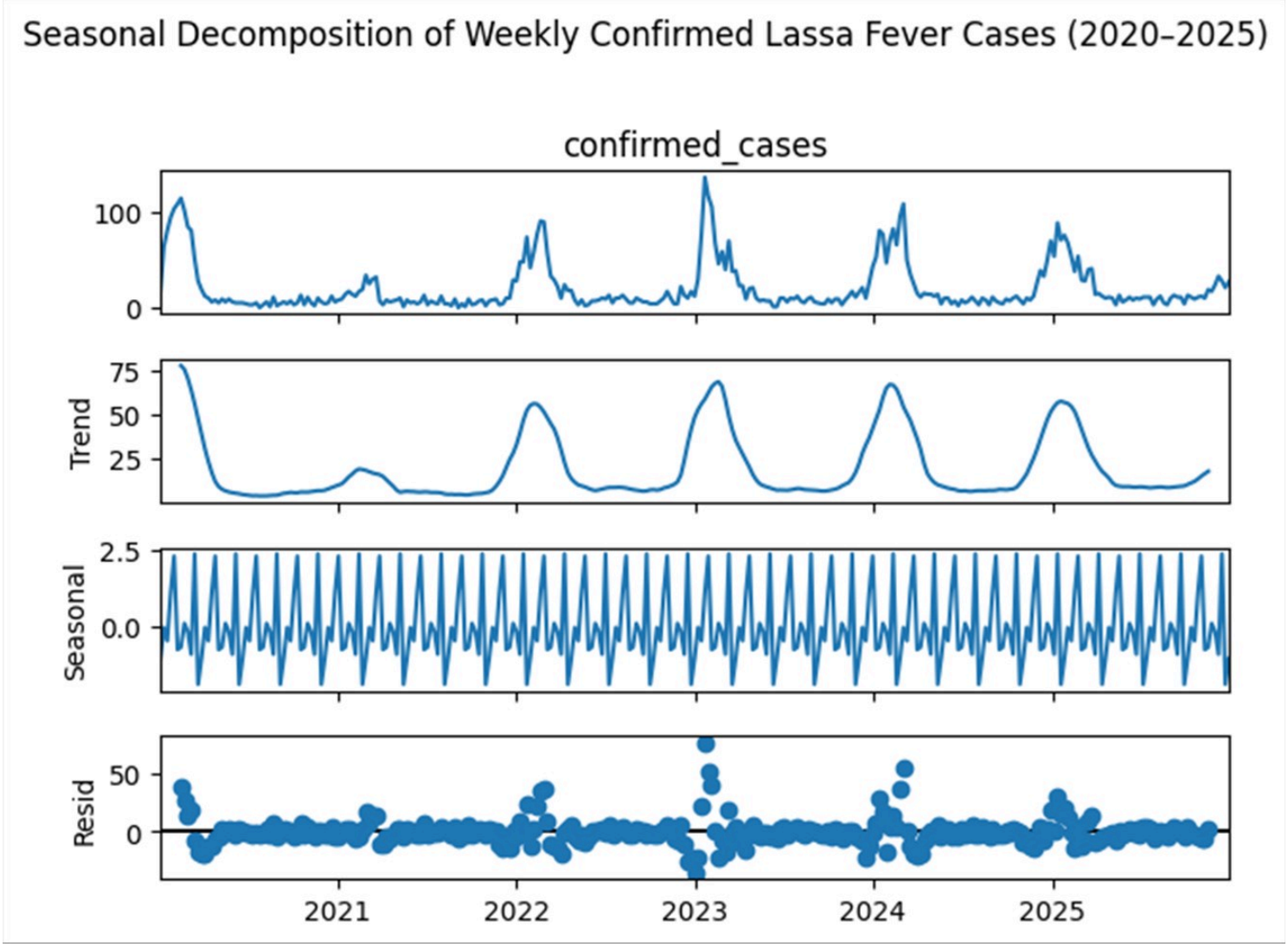


Figure 4

Figure 4 Seasonal Decomposition of Weekly Confirmed Lassa Fever Cases (2020-2025)

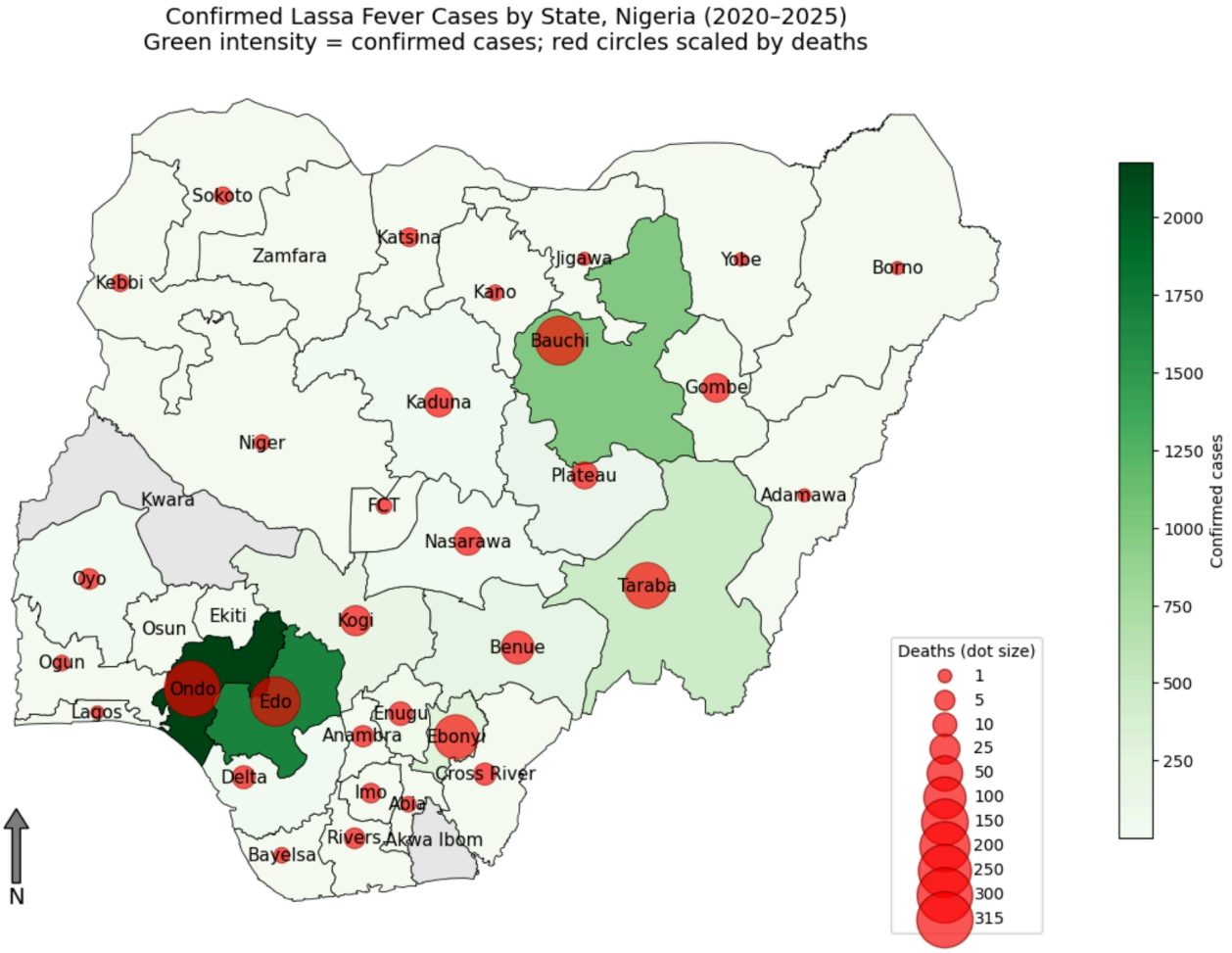


Figure 5

Figure 5: Nigeria Map Showing the Cumulative State-Level Distribution of Lassa Fever Cases and deaths (2020-2025)

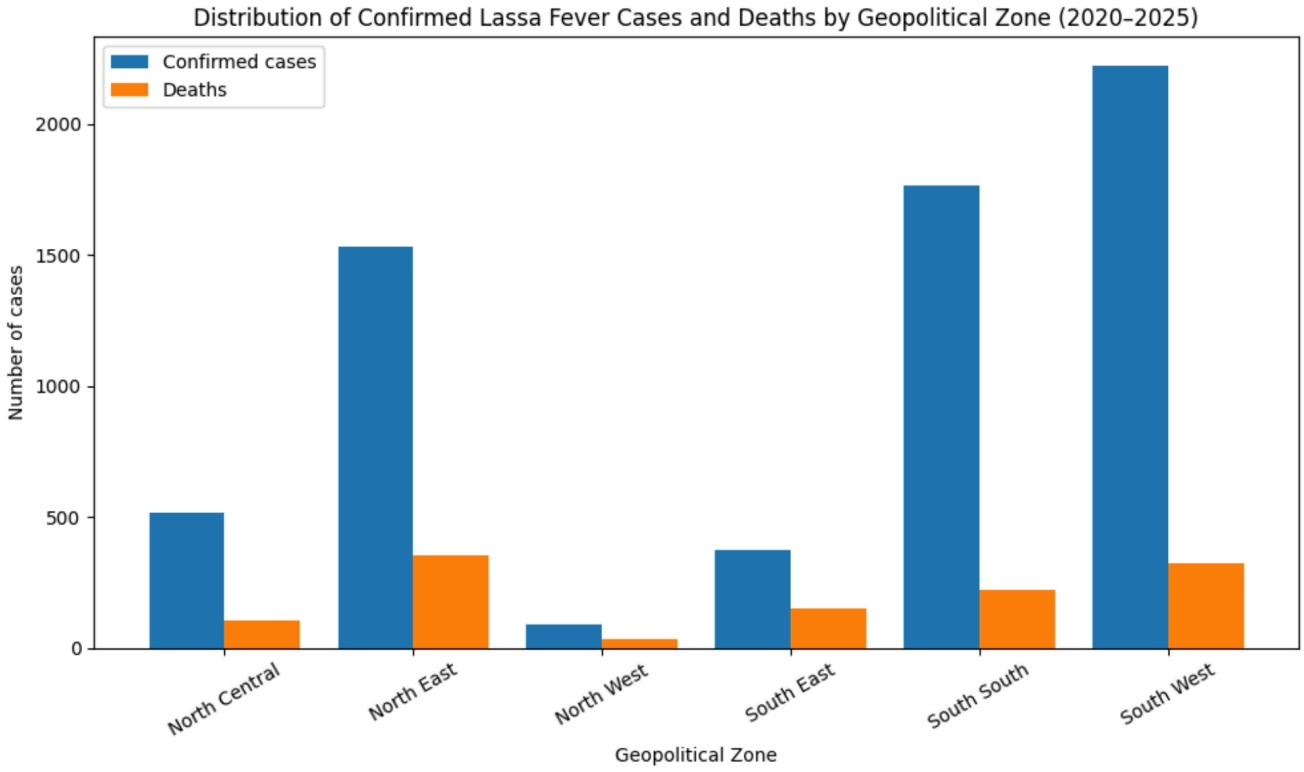


Figure 6

Figure 5: Clustered Bar Chart Showing the Distribution of Confirmed Lassa Fever Cases and Deaths by Geopolitical Zone (2020-2025)

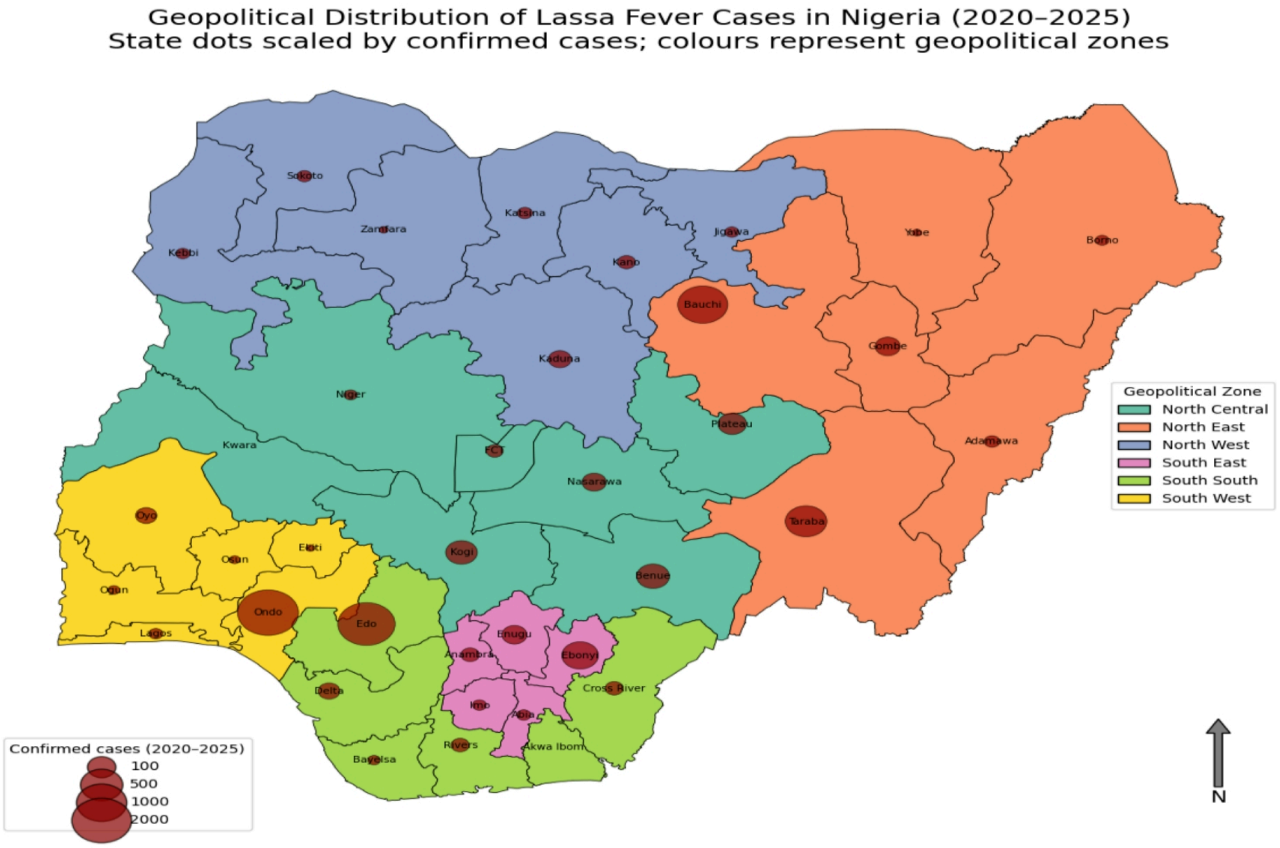


Figure 7

Figure 6: Nigerian Map showing the Geopolitical Distribution of Lassa Fever Confirmed Cases (2020-2025)

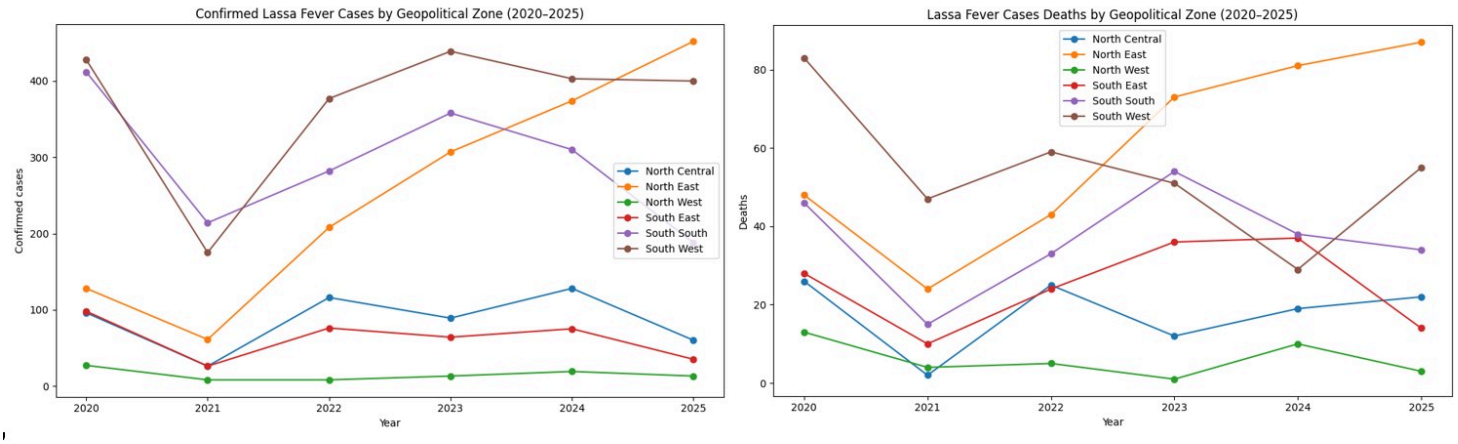


Figure 8

Figure 7-8: Trend Line Plots showing the Temporal Changes of Confirmed Lassa fever cases and Deaths by Geopolitical Zones (2020-2025)

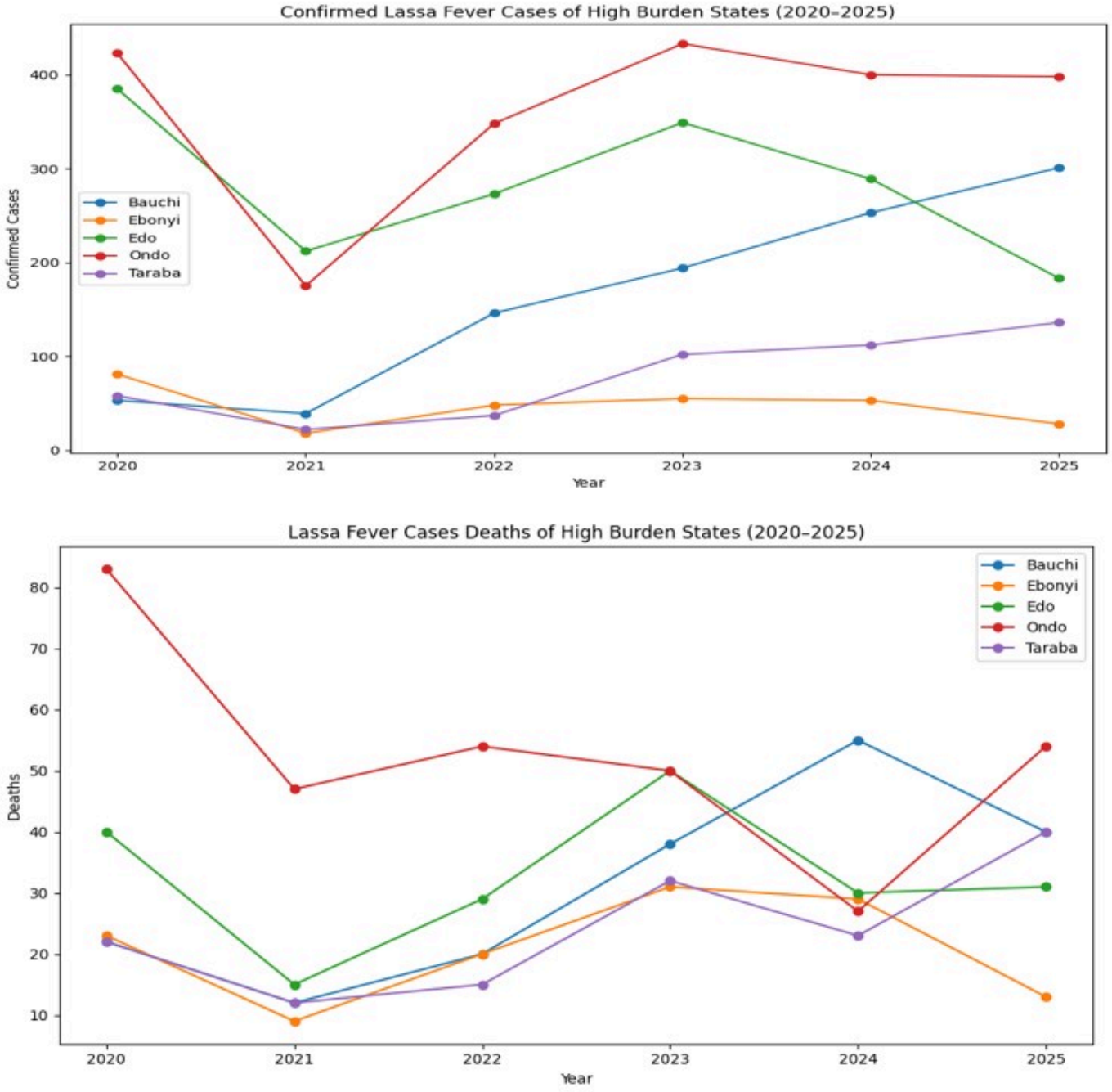


Figure 9

Figure 9-10: Trend Line Plots showing the Temporal Changes of Confirmed Lassa fever cases and Deaths by High Burden States (2020-2025)

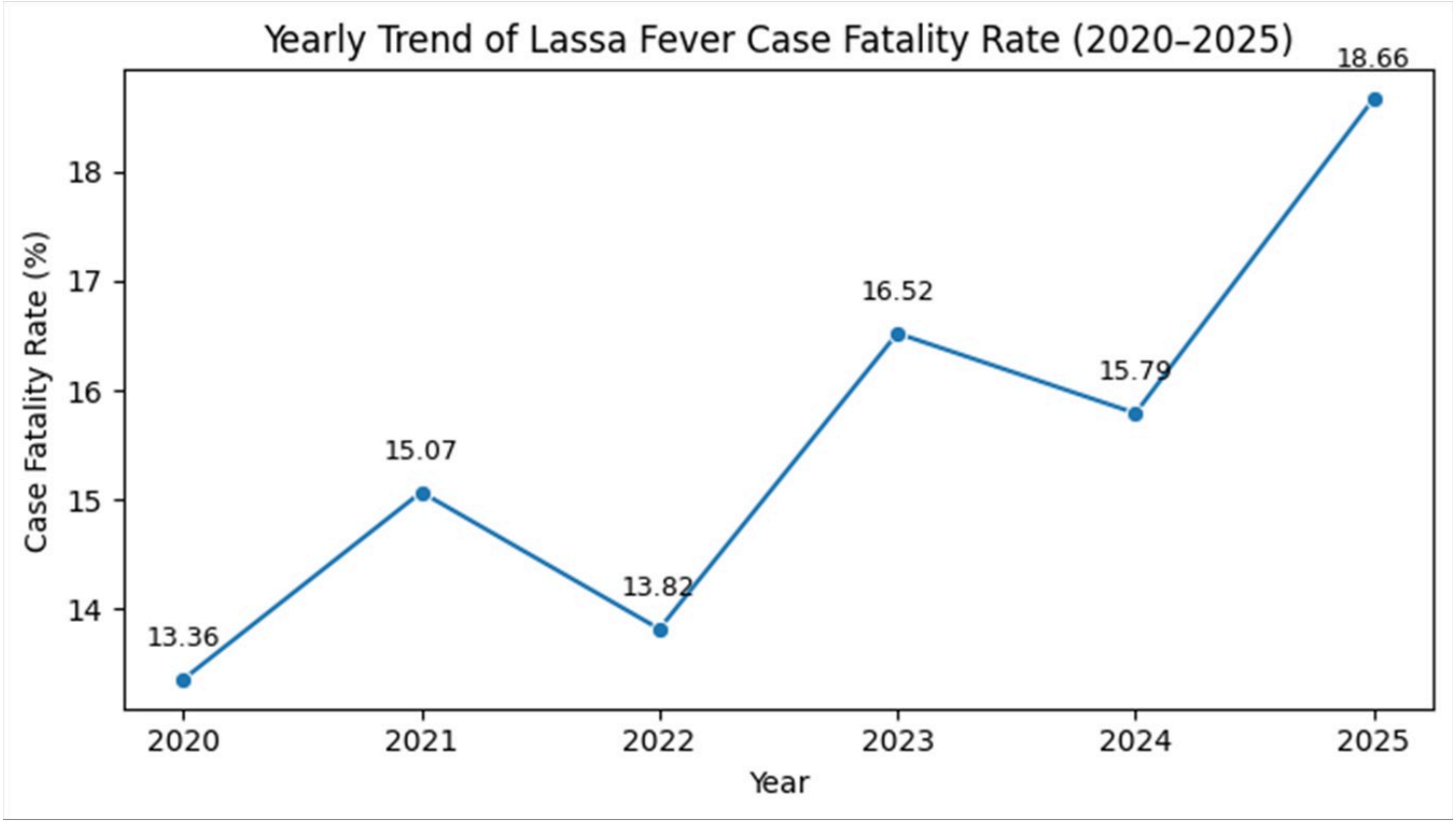


Figure 10

Figure 11: Trend Line Plots showing the Temporal Changes of Case Fatality Rate in Nigeria (2020-2025)

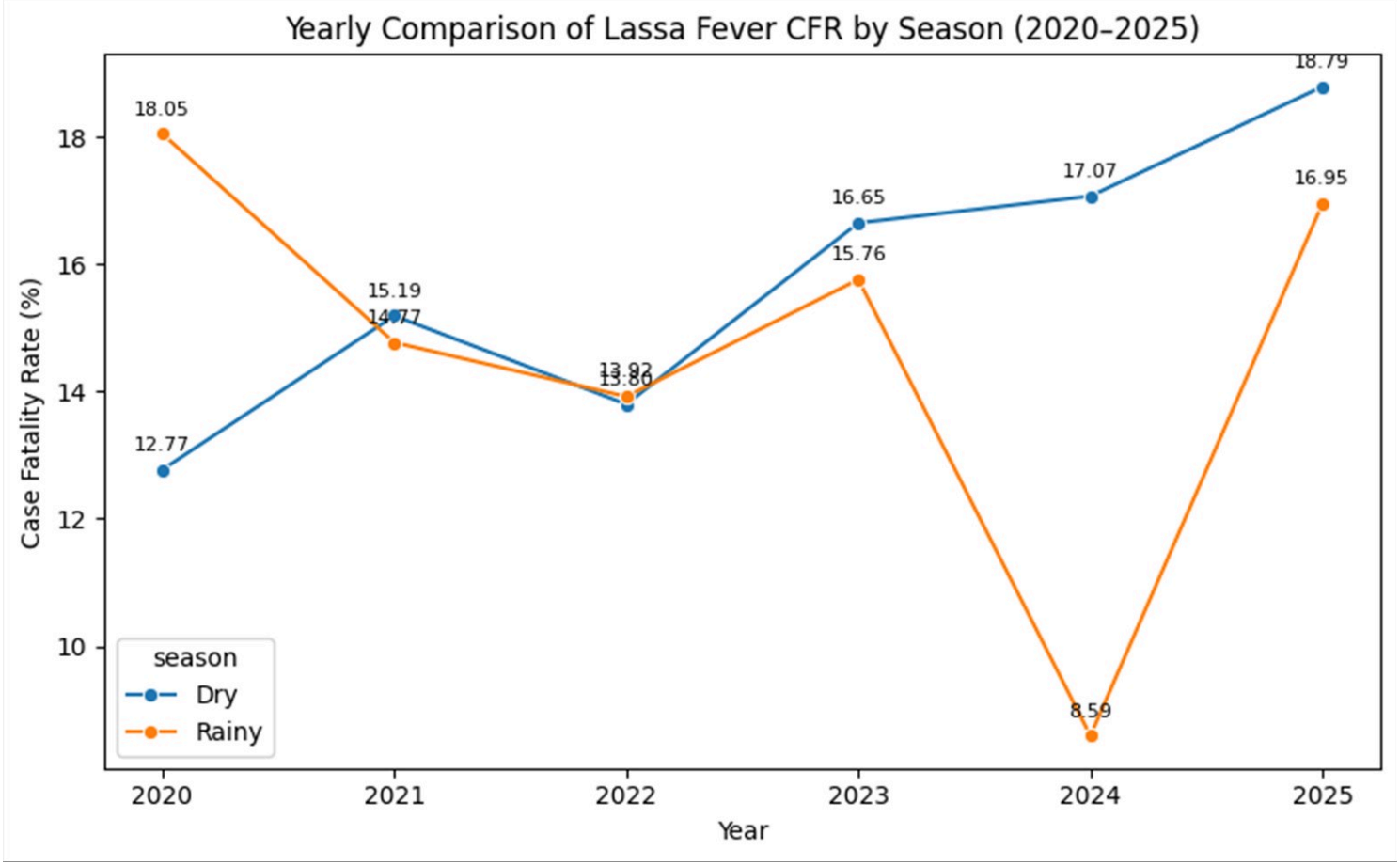


Figure 11

Figure 12: Trendline Showing Yearly Comparison of Lassa Fever CFR by Season (2020-2025)

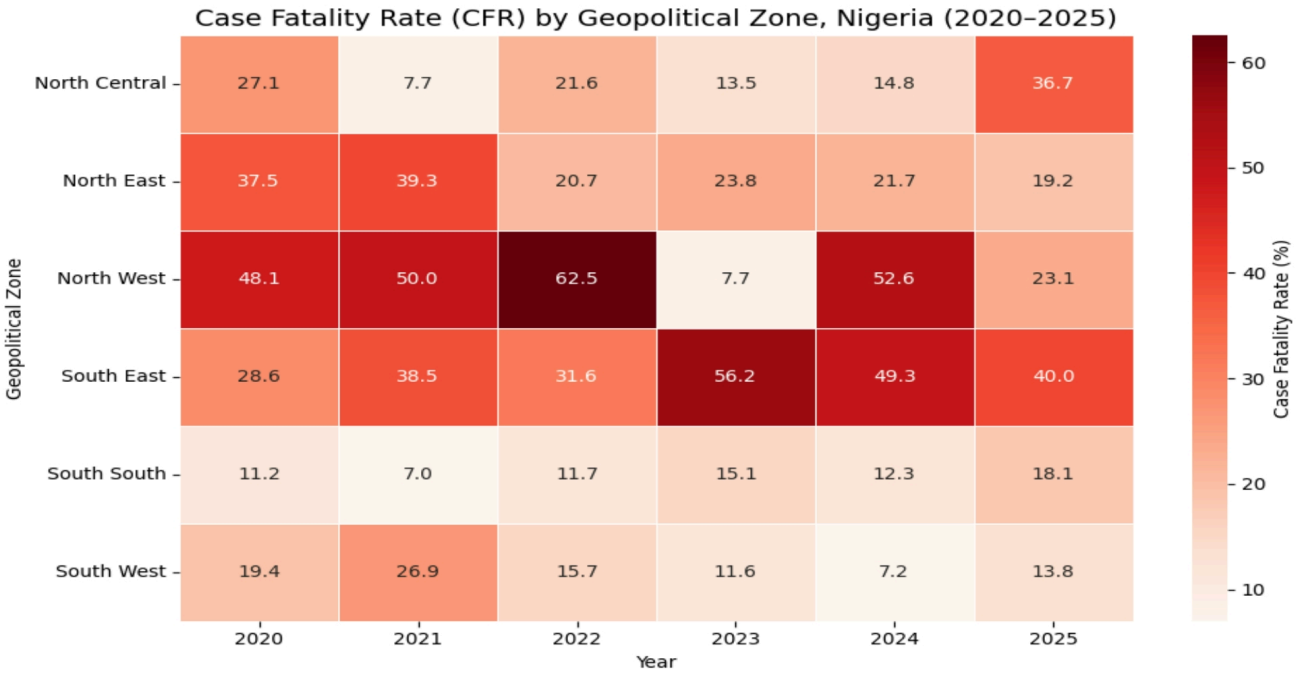


Figure 12

Figure 13: Heatmap showing the CFR for Geopolitical Zones in Nigeria (2020-2025)

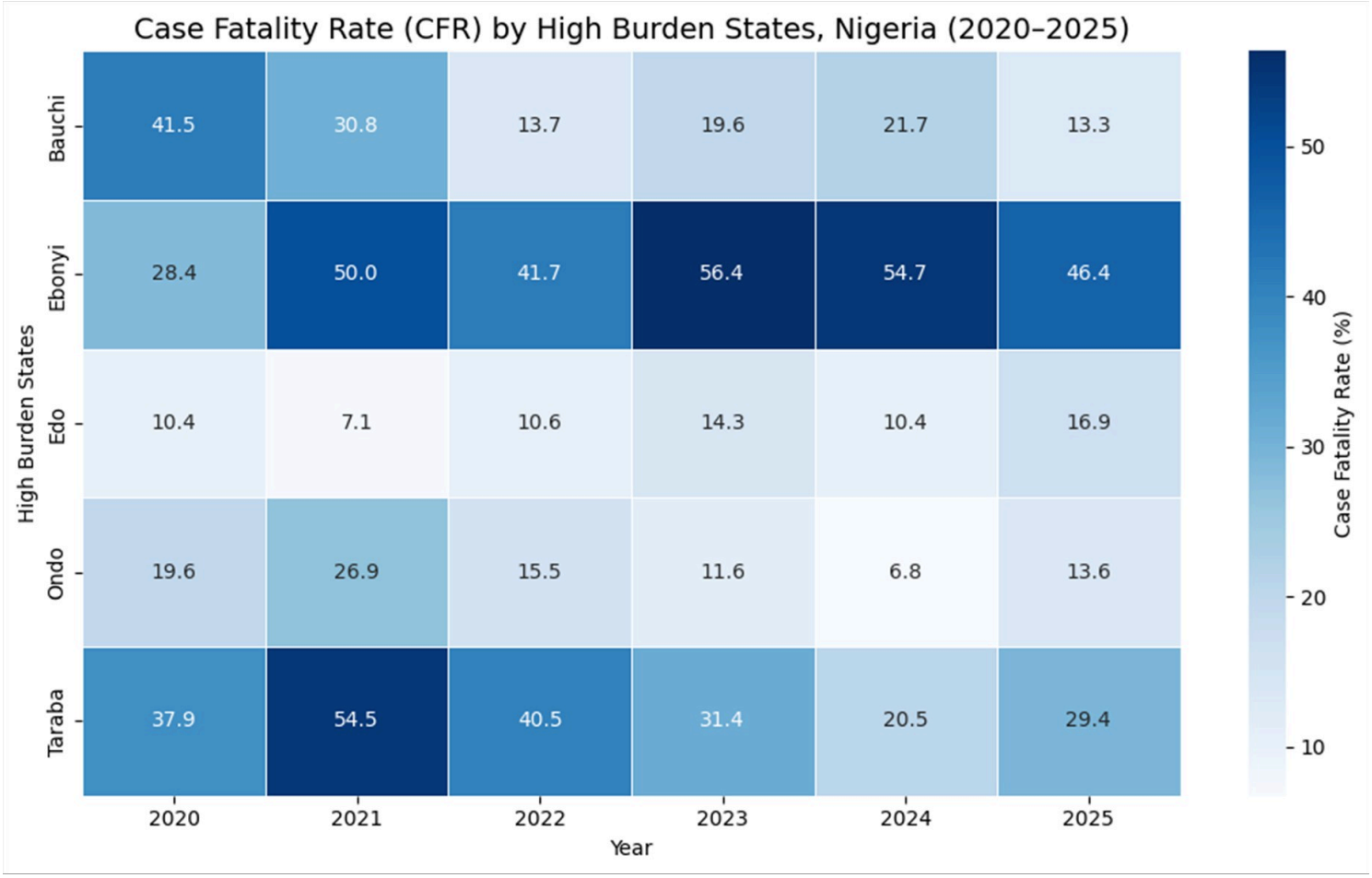


Figure 13

Figure 14: Heatmap showing the CFR for High Burden States in Nigeria (2020-2025)