

LASSA FEVER IN LOWER BAMBARA CHIEFDOM, KENEMA DISTRICT, SIERRA LEONE (2016-2020): MAGNITUDE, SEASONALITY, AND ASSOCIATED RISK FACTORS

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ABSTRACT

Lassa fever (LF) is an acute viral hemorrhagic infection that poses a growing concern in Lower Bambara chiefdom, Kenema District Eastern Sierra Leone. This study aimed to assess the magnitude of Lassa fever infection and mortality in the study area from 2016 to 2020.

A retrospective desk review was conducted on Kenema district surveillance records to extract Lower Bambara chiefdom Lassa fever-related infections and deaths. Descriptive statistics and charts were employed to evaluate the magnitude and trends of Lassa fever morbidity and deaths. Chi-square was used to determine associations.

A case fatality rate (CFR) of 53.57% (15/28) and a survival rate (SR) of 46.40% (13/28) were found among the 28 Lassa fever cases between 2016 and 2020. More female cases 71.40% (20/28) were recorded than males 28.60% (8/28) but case fatality was higher in males 62.50% (5/8) compared to their female counterparts 37.50% (3/8) as males were 1.67 times more likely to die of LF infection than females at a 95% confidence interval (0.31 and 8.93). Patients between the ages of 20-38 and 13-19 had more cases (13/28, 46.00%) and (7/28, 25.00%) respectively. LF had a case fatality rate (CFR) of 53.60% (15/28) and a survival rate (SR) of 46.40% (13/28). 2016 and 2017 have the highest LF death (5/15) each whilst 2019 and 2020 recorded the least LF death (1/15) each. More LF cases and deaths occurred in the dry season 61.90% (13/21) than the rainy season 38.10% (8/21).

The study found that the magnitude of LF cases and deaths is high in Lower Bambara chiefdom, Kenema district Eastern Sierra Leone, and outbreaks were identified across the studied years. The results suggested the need for robust and coordinated preventive measures at LF endemic

areas and improve on surveillance, and health education for Lassa fever nationwide as the Lassa belt keeps expanding.

Keywords: Lassa Fever, Mortality, Cases, Trends, Lower Bambara, Sierra Leone.

INTRODUCTION

LF is a viral hemorrhagic disease that is endemic in West Africa and still contributes to an alarming increase in cases and fatalities. Numerous studies have shown that this illness is prevalent in this region, with periodic outbreaks putting a strain on already overburdened healthcare systems (Babalola et al., 2019; Shaffer et al., 2019.). Although cases have been well documented from 10 of Sierra Leone's 16 districts, the Eastern Province, particularly the Kenema district, is a Lassa-endemic zone (Akpede et al., 2019).

Common signs and symptoms include drowsiness, vomiting, bleeding, nausea, chest pain malaise, cough, abdominal problems, muscle pain, diarrhea, ear impairment, and some cases mental abnormalities (Ilesanmi et al., 2022). It is mainly transmitted through eating food contaminated with the feces and or urine of infected *Mastomys* rodents. Secondary infection occurs through contact with the body fluids of infected humans (F. March et al., 2022).

Annually, LF contributes approximately between 100,000 - 300,000 cases and 5000 deaths in West Africa (Izah & Ogwu, 2022). The spread of the virus is mostly at its peak between December to March which correlates with the dry season (McKendrick et al., 2023).

Generally, LF virus has a case fatality rate of approximately 1%, however, a 15%-20% case fatality has been reported among patients admitted to hospitals (Mustapha et al., 2020). The virus can affect anybody regardless of age, class, sex, etc. For instance, in an Ademola et al. (2022) study involving 1,991 suspected laboratory LF cases between January 2018 to June 2019 across all age categories and sex, 815 were PCR positive and 100 died. Most LF cases and death were between 25-44 years (cases: 43.4%(340/815); death: 45.8%(42/100) and males (case: 58.6%, 477/815; death: 61.0%, 61/100) were more affected (Olayinka ID et al., 2022) and is consistent with other similar studies (Dalhat et al., 2022). However, another study conducted in Liberia reported 26.9% (103/382) confirmed cases of which the most prevalent ages included children less than 18 years (40.8%; 42/103) and females were the most affected (52.4%, 54/103)(Jetoh et al., 2022). Additionally, Between April 2011 and February 2012, all children and women having obstetric crises at a rural district hospital in Sierra Leone with either suspected or confirmed Lassa fever were included in a retrospective analysis. There were 84 suspected cases, with 73 youngsters and 10 pregnant women among them. The most prevalent were healthcare providers. There were 36 confirmed cases in all, and 22 (61%) of them died. The high case fatality rate was explained in part by the hospital's status as a referral institution for children and pregnant women, where patients with severe disease were likely to present (Dahmane et al., 2014).

Sierra Leone, with its unique environmental and socio-economic landscape, has been one of the nation's grappling with the repercussions of this infectious disease, particularly in regions like the Kenema District (Smither AR, 2020). However, there are gaps in determining the burden of LF morbidity and mortality especially due to COVID-19 pandemic which resulted into hesitancy of clinic visitations contributing to underreported LF cases in Sierra Leone and Africa as a whole (Uwishema et al., 2021). Consequently, late detection and diagnosis of the virus is also another factor for the under-reported LF cases (Kamorudeen et al., 2016.). However, between 2012-2018, out of 2,879 suspected cases of LF, 14.2%(408/2,879) were positive, case fatality was 38.8%(157/408) and Kenema district was the most prevalent district (K. Kamara et al., 2023). Moreover, a seven (7) years (2012-2018) retrospective survey on the prevalent of LF among children younger 18 years admitted at the Kenema government hospital reported 292 confirmed cases of LF

with a mortality and case fatality rate of 21% and 63% ($P < 0.01$) respectively (Samuels et al., 2021). Nevertheless, granular studies concentrating on the Lower Bambara in the Kenema District are scarce, resulting in a knowledge deficit in comprehending the unique factors and patterns in these localized places. The study was designed to review the Kenema government LF surveillance system to determine the proportion of LF infection and case fatalities across sections in the Lower Bambara Chiefdom from 2016 to 2020.

METHODS

Study Location

The study was carried out in Kenema Government Hospital (KGH). KGH is the main referral hospital in Kenema district that houses a Lassa fever treatment center, the only specialized Lassa diagnosis and treatment hospital in Sierra Leone, and the Mano River Union with a biosafety level 3 laboratory for diagnosis of viral hemorrhagic fevers (VHFs) (Oldstone & Rose Oldstone, 2017; Sesay et al., 2022).

Study Design and Subjects

A desk study quantitative design was employed to conduct a retrospective review of all patients who have been treated and registered for LF infection and death from 2016 to 2020.

Sampling Technique

A Retrospective chart review was conducted in KGH. This involved going through the medical records of patients who were admitted to the hospital during the period under review and extracting relevant information. The information extracted includes demographic data, laboratory results, and treatment outcomes (discharge or death). All patients diagnosed with Lassa fever were identified by reviewing the laboratory and medical records. Also, we manually went through each patient's charts and recorded the information of interest in a standardized data form (excel spreadsheet). All LF records of LF patients from Lower Bambara chiefdom treated at the KGH Lassa treatment center were recruited into the study. 28 LF records were found in the period under investigation.

Data Analyses

Data were extracted from the Kenema government hospital surveillance report into MS Excel 2016 for cleaning and analysis. Descriptive statistics was used to compute means and simple proportions which are presented as charts or tables to assess trends within and between sections in the Lower Bambara Chiefdom. The chi-square test was used to determine associations between the independent variable, sections, and the dependent variables demographic characteristics, age, and sex.

Ethical Approval

Ethical approval for the conduct of this study was obtained from the Njala University Institutional Review Board (IRB) and facility entry protocols and approval was obtained from the Kenema District Health Medical Officer (DMO). A letter of approval was sent to the DMO a week before data collection.

RESULT

Tables 1 and 2 present the demographic characteristics of LF cases, survival, and mortality of the study group. Out of the twenty-eight (28) LF-related cases captured within the periods 2016-2020, fifteen (15) of those cases were fatal accounting for 53.60% case fatality and a survival rate of 13/28, 46.40%. More females' cases (20/28; 71.40%) were recorded than males (8/28; 28.60%). However, more males (5/8; 62.50%) died compared to (3/8; 37.50%) that survived contrasting an equal number of deaths (10/20; 50.00%) and survival (10/20; 50.00%) for female counterparts. The odds of dying and surviving LF infection were 1.25 (CI=0.63; 2.50) and 0.75 (CI=0.28; 2.03) respectively. At a 95% CI (0.31 and 8.93), males were 1.67 times more likely to die of LF infection than females (Table 1).

Furthermore, following the age distribution of LF cases and mortality, the majority of the LF cases (13/28, 46.00%) were in the age 20-38 years accounting for a case fatality of 53.80% (7/13) and a survival rate of 46.20% (6/13). This was followed by 13-19 years that recorded 7/28 (25.00%) LF cases and reported a case fatality of 42.90% (3/7) and a survival rate of 47.10% (4/7). 5/28 (17.90%) were reported for age bracket 6-12 years: 60.00% (3/5) died whilst 40.00% (2/5) survived. The lowest number of cases (3/28; 10.70%) was reported for the age 0-5 years with a fatality of 66.70% (2/3) and a survival of 33.30% (1/3) (Table 2).

Figure 1. illustrates the periodic distribution of LF cases and mortalities by age and sex dispersal. 2018 (9 cases; case fatality of 33.30%, 3/9; survival rate of 66.70%, 6/9) registered the most LF cases in Lower Bambara Chiefdom compared to 2019 and 2020 that recorded the least LF cases (1/28 case each). However, 2016 and 2017 have the highest LF deaths (5/15) each whilst 2019 and 2020 recorded the least LF deaths (1/15) each. Lassa fever deaths trend showed a decrease from 2017 to 2020. Cases dropped to three in 2018 (3/15), then to 1/15 each in 2019 and 2020 respectively. LF cases in 2016 were evenly distributed within age groups. No cases were reported for ages 0-5 years and 6-12 years whilst three and four cases were reported for ages 13-19 and 20-38 respectively in 2017. In 2018, the highest number of cases recorded was between the ages of 20-38, followed by two cases each for age groups 6-12 and 13-19 and one case for age group 0-5 years (Figure 1).

Figure 2 depicts the seasonality of LF infection and mortality for the period under review. Fourteen cases with seven deaths (50.00% fatality) occurred between January and March in the dry season. LF Cases dropped to 7 (50.00%) whilst LF fatality declined from 7 deaths to 4 (57.10%) between April and June in the early rains. Cases continued to drop to four but fatality increased to 100.00% (4 cases/4 deaths) at the peak of the rainy season between August to October. Cases dropped to three and fatalities to zero in November, the start of the dry season.

DISCUSSION

LF infection which is caused by Lassa Virus is an endemic zoonotic hemorrhagic illness that is considered a major public health challenge spread across some West African nations including Sierra Leone and Nigeria predominantly (Yun et al., 2016). There is still a frightening increase in LF cases in West Africa (Wiley et al., 2019) reporting approximately 100,000 to 500,000 LF cases and 10,000 deaths occurring annually in endemic West Africa (Happi et al., 2019) regardless of its asymptomatic nature which can affect the case

count. However, rural areas where rats are prevalent happened to be the most affected (Baumann et al., 2019) corresponding to the setting of the present study (Lower Bambara chiefdom, Kenema district); a hotspot for LF in Sierra Leone. This research is a desk-review investigation of LF prevalence of cases and mortalities in Sierra Leone reporting 28 LF cases from 2016 to 2020. Females (20/28, 71.4%) were the most affected in terms of cases compared to males.

According to the European Surveillance System report, from January 1–May 6, 2018. A total of 1,893 cases were reported in Nigeria alone; 423 were laboratory-confirmed cases, among which 106 deaths were recorded) (EA Ilori et al, 2019) which is consistent with the current study despite its huge case variation which is due to the small sample size studied compared to the Nigeria nationwide report. Nonetheless, the case fatality and survival rates were 25.1% and 74.9% respectively with males dying more of LF infection than females.

Our study report contends with a Béhanzin et al., (2018) paper which revealed a 15% case fatality rate annually (Béhanzin et al., 2018.) regardless of the case fatality rate of the current survey calculated over five years. Additionally, a seroprevalence study among endemic nations in West Africa for Lassa-specific antibodies showcased a high prevalence in Guinea (55%) and Sierra Leone (52%) with Nigeria reporting the least (21.3%) (Abdullahi et al., 2020). Studies from Smither (2021) and Shaffer, Schieffelin et al. (2019) also reported a case fatality rate of 66.6% (Shaffer et al., 2021; Smither, 2021) which is similar to the current result and is further consistent with an overall annual LF mortality (Nwafor et al., 2021) globally. The present study sampled six sections (Bonya, Fallay, Gboro, Korjei Ngieya, Nyawa, and Sei) in Lower Bambara chiefdom Kenema district. Within these sections, Bonya (46.3%) and Nyawa (25.0%) contributed more cases with the other sections reporting equal proportions of cases 7.1% (2/28) each respectively.

These results, compared to various reviews conducted in Nigeria from 2017 to 2018, highlighted Ebonyi, Edo, and Ondo states as having the highest prevalence of LF, with a prevalence rate of 74.6% (Amoo et al., 2021). Furthermore, within the Bonya sections, there were more cases of infection among females 69.2% (9/13) compared to males 30.8% (4/13), with infections among males resulting in a 100% (4/4) case fatality rate (CFR).

According to the Nigerian serosurveillance report between 2018 to 2021, LF has highlighted predominance among males and adults above 18 years as well as males reporting a worse case fatality burden (Dalhat et al., 2022). When compared to the present study which was done among six sections in endemic Lower Bambara chiefdom, all the sections recorded at least one case of infection among females; however, no cases were reported for males in Fallay and Gboro. The incidence of infections was equal for both males and females, resulting in a 1:1 ratio contending the aforementioned study where males suffered more incidence. The age group most significantly affected was those between 21 and 40 years old which is common with a Nigerian study that reported a predominance of LF cases among individuals above 18 years (Dalhat et al., 2022).

Moreover, the occurrence of LF cases is influenced by seasonal fluctuations (Akhmetzhanov et al., 2019; Osho et al., 2020). This is demonstrated by the elevated virus incidence and increased rodent reproduction during the rainy season, as opposed to the dry season (Tewogbola & Aung, 2020), and the occurrence of LF cases is

influenced by seasonal fluctuations. High rat reproduction along with high Lassa virus was observed during the rainy season, as opposed to the dry season (Balogun et al., 2021). Also, areas with moderate rainfall (about 1500-3000 mm) contribute more LF incidence compared to areas with more or lesser rainfall (Redding et al., 2021). This report is not consistent with the present study where more (50%) of the LF incidence and mortalities occurred between January and March which is in the dry season and dropped as it tends towards the rainy season though mortality increases at the peak of the raining season between August to October which does not related with other studies where higher LF incidence occur in the rainy season (Okoro et al., 2020; Dalhat et al., 2022).

Periodically, 2016 recorded the highest LF incidence burden (8/28; 28.6%). The majority of cases were females though reporting an inferior case fatality rate compared to their male counterparts (Dalhat et al., 2022). Due to the robustness of health surveillance and community engagement (Buba et al., 2018), the burden of LF case incidence dropped. Regardless of the coordinated effort against LF incidence, there was a boost in LF case incidence in 2018. Nevertheless, a drastic reduction of only two and one LF case incidence occurred in 2019 and 2020 respectively and females also bear the most infection burden.

CONCLUSION

The findings from the study unraveled that LF cases were more common among females and individuals aged 20-38 years in Lower Bambara Chiefdom. However, more male cases died from LF infection than females. Periodic variations in the incidence of LF cases and deaths were observed. The study revealed a decreasing trend in the number of LF deaths from 2017 to 2020, with 2018 recording the highest number of cases. The LF infection and mortality were seasonal, with the highest number of cases and deaths occurring in the dry season (January-March). Based on these findings, we recommend that global health policymakers prioritize LF control and prevention measures, particularly in regions where the disease is endemic. Strategies such as community sensitization, health education, and improved surveillance and case management should be implemented. Also, efforts should be made to develop a vaccine to combat the disease, as the current treatment options are limited. Additionally, more research is needed to understand the variations in LF incidence and mortality across different age and gender groups and to determine the factors contributing to these differences. Overall, a multi-sectoral approach involving healthcare providers, policymakers, community leaders, and researchers is needed to effectively control and prevent the spread of LF.

Strengths

The study was able to unravel the endemicity of LF in Lower Bambara chiefdom hence confirming LF outbreak across the studied years. Additionally, the findings from this study

can serve as baseline to other research opportunities in relating to Lassa fever in Sierra Leone and other countries where the disease is endemic.

Limitation

Amidst the challenges associated with desk study, the review was characterized by two limitations. Firstly, data completeness: data were uncompleted for some years, areas and even cases which may affect the study findings. Secondly, as a result of the secondary data used, could fairly limit the study findings. However, all these limitations do not query the credibility of the study result hence suggesting that future research may need to determine the magnitude of LF mortality nationwide.

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Conflict of Interest Declaration

None of the authors had any conflict of interest.

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