An Epidemiological Analysis of Lassa Fever Outbreak in Nigeria from 2019 to 2023

Abstract:

Lassa fever (LF) is an acute viral haemorrhagic zoonotic disease, is endemic in some parts of Nigeria. The disease alert and outbreak threshold are known; however, there has been a shift from the previous seasonal transmission pattern to an all year-round transmission. The aim of this study was to carry out the analysis on LF and highlight the magnitude of the disease over a five-year period. We described data on Lassa fever and highlighted the magnitude of the disease over a six-year period. We conducted a secondary data analysis of LF with specific surveillance data from the NCDC website for five years period (2019 to 2023). A total of 29347 suspected cases were reported within the study period; of these, 4469 were confirmed cases, 861 were dead cases by NCDC. However, highest percentage for the case fatality rate/ratio was recorded in the year 2019 with 20.9% and lowest was recorded in the year 2023 with 17.3%. The highest percentage case positive rate was recorded in the year 2023 with 18.7% and lowest was recorded in the year 2021 with 11.0%.

Keywords: Lassa fever, NCDC, Yearly-round Transmission, Epidemiological Trends, Suspected Cases, Case Fatality Rate

1 Introduction

Lassa fever (LF) has been identified as a yearly outbreak in West Africa with Nigeria having the highest yearly incidence. Seasonal peaks of this viral hemorrhagic fever occur during the dry season from November to April, and it is common in Sierra Leone, Ghana, Mali, Nigeria, Benin, Togo, Guinea and Liberia etc. Delay in LF diagnosis often occurs because of non-specific symptoms such as fever and the assumption that the febrile illness is caused by other factors, especially malaria that is endemic in sub-Saharan Africa. Identifying the onset of the disease is often difficult due to the generalized symptoms and clinical presentation such as fever, vomiting, fatigue, abdominal pain, sore throat, chest pain and myalgia [1].

Lassa fever is endemic in Nigeria and the annual peak of Lassa fever cases are typically observed during the dry season (December-April). Thus, the number of infections is expected to rise further until the end of the dry season. While endemic in Nigeria, cases are much higher than the previous epidemic seasons. This could be attributed to reduced response capacity in surveillance

and laboratory testing. It is necessary to continue to monitor the annual peaks of Lassa fever in order to contextualize incidence and inform the effective management of Lassa fever [2].

Lassa fever (LF) is a viral hemorrhagic disease transmitted from infected rodents to humans or through human-to-human contacts [1]. Generally, animal-to-human transmission occurs following exposure to rodent excreta and secretions (urine and saliva) while human-to-human transmission occurs via contact with body fluids of an infected person and is related to poor infection control practices [1]. Historical data indicate that LF is endemic in West African countries of Nigeria, Sierra Leone, Liberia, Benin and Guinea, with sporadic cases occurring elsewhere in the region [2]. In West Africa, the disease is widespread, affecting an estimated two million persons and deaths of 5,000-10,000 persons annually [2]. Nigeria has reported the greatest number of confirmed LF cases in the region, accounting for 66% & 67% of all reported LF cases in 2018 & 2019 respectively [3]. Overall, there were 1,463 reported LF confirmed cases and 344 (23.5%) deaths in Nigeria during the 2018 and 2019 outbreaks, with 23 of the 36 states reporting confirmed cases [4].

The increase in number and geographical spread of reported LF cases across Nigeria has been attributed to improvement in the surveillance and laboratory system, which has enhanced the detection of cases compared to what obtained previously [5]. Nevertheless, there is paucity of evidence on factors associated with LF disease and deaths, for context-specific public health planning and interventions. From literature review, we found that available studies are mainly on description of epidemiologic and clinical features, on trends of LF and on nosocomial transmission of LF in health facilities [5-8]. Previous epidemiological studies which assessed factors associated with LF in Nigeria have usually been limited to specific localities and these haven't provided comprehensive evidence of the national situation [8-9]. This study aimed to analyze the epidemiological trend of LF in the country [10-11].

1.1 Definition of some key variables

Definition 1 (Outcome variables): The two outcome variables for this study were: (1) LF disease, defined as a suspected case that is subsequently laboratory confirmed (RT-PCR) either positive or negative for LASV, and (2) clinical outcome of a confirmed case as (alive or dead). Both variables were treated as binary [7].

Definition 2 (Independent variables/covariates): Variables presumed to be potentially associated with both outcome variables were identified based on evidence in the literature and

biological plausibility. Age in years, was based on self-report by patients/relatives. Occupation/Job categories were grouped as follows: Unemployed/uncategorized, artisan/unskilled job, business/trading, agricultural workers/farmer, community leader, wage earning job and health-related job [1].

Definition 3 (Suspected Case): Any individual presenting with one or more of the following: malaise, fever, headache, sore throat, cough, nausea, vomiting, diarrhea, myalgia, chest pain, hearing loss and either; (a) history of contact with excreta or urine of rodents and (b) history of contact with a probable or confirmed Lassa fever case within a period of 21 days of onset of symptoms or Any person with inexplicable bleeding/hemorrhagic [1].

Definition 4 (Confirmed Case): Any suspected case with laboratory confirmation (positive antibody, PCR or virus isolation).

Definition 5 (Probable Case): Any suspected case (see definition above) who died or absconded without collection of specimen for laboratory testing.

Definition 6 (Contact): Anyone who has been exposed to an infected person, or to an infected person's secretions, excretions, or tissues within three weeks of last contact with a confirmed or probable case of Lassa fever.

Definition 7 (Epidemic): A wide spread of of an infectious disease a region at a certain period.

Definition 8 (Case Fatality Rate): The number of deaths divided by the number of confirmed cases multiplied by 100.

Definition 9 (Case Positive Rate): The number of confirmed cases divided by the number of suspected cases tested multiplied by 100.

2 Method

2.1 Study Design and Data Source

The analysis of studying LF observed data from all the 36 states in Nigeria, including the Federal Capital Territory (FCT), between January 2019 to June 2023 which covers the high transmission season for LF in Nigeria [12].

The systematic literature review was conducted using the search term 'Lassa fever and Nigeria' in online databases, including PubMed, Google Scholar Africa Journal Online, WHO Library Database, Research Gate, Nigeria Centre for Disease Control (NCDC) website and the Federal Ministry of Health of Nigeria. The NCDC is the public health institute for the nation, and it was carved out from different divisions in the Federal Ministry of Health to handle

preparedness in public health emergencies with the detection and response to infectious disease outbreaks [13-14].

2.2 Statistical Analyses and Results

The analyses were carried out in Maple version 18 (the language of technical computing). The Nigeria Center for Disease Control and Prevention (NCDCP) yearly Lassa fever situation report cases from January 2019 to June 2023 is been considered in this study. The following table 1 and figure 1 evidently shows epidemiological situation of Lassa fever in Nigeria.

The analysis plan for the study started with request for permission from the Director General of NCDC for access to data on Lassa fever for years Jan. 2019 to June. 2023. The data which excluded identifiers was exported from NCDC to Maple 18 software package for analysis. The lists of all epidemiologic variables on the platform were generated and data were checked for completeness and to identify proportion of missing data across all variables. Outcome and independent variables had been defined. Information for this disease was case-based data retrieved from the NCDC portal [13-14].

Table 1: Current situation of Lassa fever in Nigeria from Jan. 2019 to June. 2023

Period/year	Suspected cases (μ)	Conformed cases (κ)	No. of Deaths (σ)	Case Fatality Rate/Ratio (Ω)	Case Positive Rate (Ψ)
Jan-Dec 2019	5057	833	174	20.9%	16.5%
Jan-Dec 2020	6732	1181	244	20.7%	17.5%
Jan-Dec 2021	4654	511	102	20.0%	11.0%
Jan-Dec 2022	8202	1067	189	17.7%	13.0%
Jan-Jun 2023	4702	877	152	17.3%	18.7%
Total (Σ)	29347	4469	861	96.6	76.7%

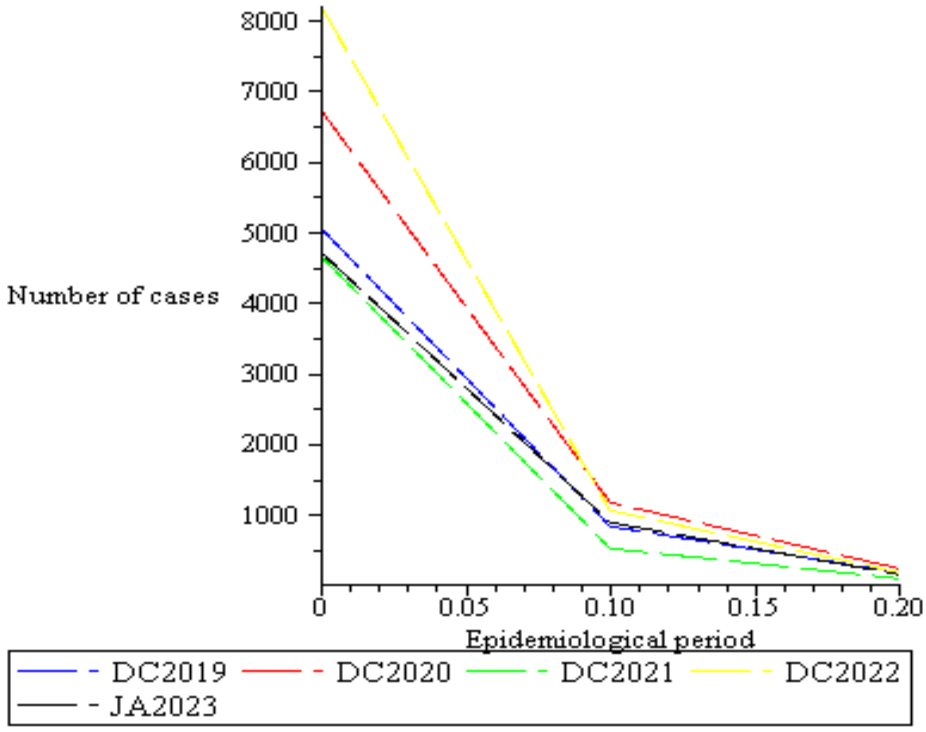

Figure 1: Current situation of Lassa fever in Nigeria from January 2019 to June 2023

3 Discussion of Result

3.1 Quantitative Analysis and Yearly Distribution of Lassa fever in Nigeria

We described the five-year situation of LF in from January 2019 to June 2023. The report was situated in Table 1 and Figure 1, from the improved surveillance and laboratory diagnosis of LF from (NCDC). Our data shows general instability of yearly distribution of LF across the country from 2019 through 2023. This has been reported by some earlier works describing the possible charging epidemiological periods of LF in Nigeria [9, 17].

The report on the yearly LF from Federal Ministry of Health in Nigeria and NCDC indicates different percentage of case fatality rate/ratio (table 1). Significantly, larger numbers of suspected cases (μ), which shows that in the year 2022 (January to December) has highest number with 8202 recorded suspected cases (μ), and in the year 2021 (January to December) has least number of suspected with 4654 cases. However, in the year, 2023 (January to June) which has only 6 months report suspected case was recorded 4702 number suspected cases (μ), slightely more than the year 2021 Jan. to Dec.

Based on the reports of the yearly suspected cases, these results follow consistently with confirmed cases (κ), which r 2021 (January to December) recorded in the the highest number of

confirmed cases 1181and the least was recorded in the year 2021 (Jan. to Dec.) with 511 number of conformed cases (κ). Based on the report from table 1, significantly the high number of death (σ) that the mortality rate recorded yearly and case fatality rate/ratio (Ω)as indicated by [17], state that a LF outbreaks is often associated with the poor sanitary conditions and daily environmental life style common in high-risk areas.

Furthermore, the highest percentage case positive rate (Ψ) was recorded in 2023, despite that it was 6 months reports, unlike the other 4 years that are full 12 months and the least percentage case, positive rate (Ψ) was recorded in 2021 (January to December). It is obvious from Figure 1 that, 2019 comes third from the above through all the indicating variables.

The year 2019, it shows that suspected cases (μ)were more in two years (2020 and 2022) compared to 2019. Therefore, the report from January to June 2023 although six months only has spear headed to become at the middle of number of cases and epidemiological periods. Therefore, the output in figure 1 and table 1, the personal reports the five years, consider the suspected cases $(\mu)$and confirmed cases (κ), this may resulted from the persistent count of laboratory, confirmed LF cases may be due to availability of Lassa virus diagnostics centers within state and heightened surveillance sensitivity [13-16]

The variation in case positivity rates (Ψ) in Table 1, was in relation to outbreaks implies more proficiency at beginning of outbreak when clinician were more alert, most especially in areas that commonly diagnose and manage case of the disease. The subsequent instability in case positivity might be due to the low threshold to screen cases of fever that results from increased active or passive sensitization of fever that health workers [9].

The observed relationship among the suspected (μ) cases, confirmed cases (κ), number of deaths (σ), percentage case fatality rate/ratio (Ω) and percentage case positivity rate (Ψ) may be due, the result of the development of more resources during large outbreaks (human and financial resources, political will, activation of EOC/IMS) or the disparity of health workers, proficiency between high-density states and areas with low density in the country. As assumed, those in endemic areas will be more proficiency and will have a lower threshold for suspecting and requesting test whereby reducing delayed diagnosis and commencement of treatment. This fact remains that, there is a dedicated centers, the Institution of Lassa Fever Research and Control (ISTFR&C), irrua Specialist Teaching Hospital (ISTA) within or closed proximity to the high-burden states in Nigeria might further explains the differences in fatality [9].

Our study is limited to the fact that, the observation made were based on the number of reports include the analysis of data specific to number of cases and epidemiological periods. Therefore, our report reports were obtained directly from (NCDC) portal, without factory in specific surveillance and response efforts that might explain variation in number of suspected cases,

number of confirmed cases, number of death, percentage case fatality rate/ratio and number of case positivity rate and even clinical outcome [9].

3.2 Summary and Conclusion

We conclude the study by saying that LF is endemic in Nigeria with some clear cases that the disease spreading with in states of the country, owing to the spread, at least in part, to improve surveillance and reporting as well as laboratory diagnosis. To identify more specific clinical symptoms and signs that could be served as indicators for LF, there will be need for more detail from both those whose test positive and negative. However, the identified variables as predictors of LF disease are related to sociodemographic, health system related, environmental and clinical factors. Moreover, there is need for putting emphasizes in addressing of a one health challenging the LF, also by providing context specific evidence for improved LF outbreak preparedness and response as well as pointes to its health sector in Nigeria.

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