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Predictors of Lassa Fever Mortality And Control Efforts In Plateau State, Nigeria

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Abstract

Background

Various public health response measures that have been put in place across Nigeria in recent years to control Lassa fever. However, many more cases are being reported with variations in mortality in different parts of the country including Plateau State. This study aimed to describe the predictors of Lassa fever mortality within the period of 2015-2019 and control efforts in Plateau State, Nigeria.

Materials and Methods

The study was a cross-sectional study employing the use of quantitative (records of Lassa fever cases in the state) and qualitative (key informant interviews of selected stakeholders) data. Analysis was carried out using IBM SPSS version 23. Logistic regression was used to determine the predictors of mortality and content analysis for qualitative data was done to describe the control efforts in the State.

Results

Lassa fever mortality rate for the period of study was 18.3% among all suspected and confirmed cases and was 43.4% among confirmed cases only. Age group, senatorial zone of residence and employment status were associated with mortality but only age group was a significant predictor of mortality (AOR=7.4; 95%CI 4.3–21.7 for young adult and AOR=16.4; 95%CI 2.3–33.2 for middle aged when compared to children aged below 18 years). Control efforts are hinged on establishment of treatment centres and Emergency Operation Centre, surveillance, commodity supplies and mass education which come with challenges.

Conclusion

Lassa fever mortality remains high in Plateau state with the risk of dying associated with increasing age. Even with improvements in control efforts, there is need to further improve early case detection and management and also institute other preventive measures that will reduce mortality.

***Key words**: Lassa fever, mortality, predictors, control, Plateau State*

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I. Introduction

Lassa fever is an acute hemorrhagic fever caused by the arena virus, *Lassa virus*, and transmitted to humans through contact with the peridomestic rodent, the multimmamate rat which is widely found in the sub-saharan African region.[1] Human to human transmission also occur when there is contact with secretions from infected individuals. Among infected person, 80% are either asymptomatic or show mild symptoms while 20% of cases have severe multisystem disease. The incubation period is 6-21 days. Its symptoms and signs are similar to those of other illnesses such as malaria, typhoid fever, other viral haemorrhagic fevers like Ebola and yellow fever. This makes it difficult to be diagnosed clinically.[2, 3]

The incidence of the disease has been found to range from 1.8% in developed countries to 55% in developing endemic countries.[4] Although an average 300,000 to 500,000 cases and 5000 deaths occur yearly across the West African sub-region, during epidemics, annual incidence of the disease could be as high as 3 million.[3] The Case Fatality Rate (CFR) of Lassa fever may be up to 50% at the onset of epidemics.[3] Since the first case of Lassa was reported in 1969, Nigeria has shown variations in the number of reported cases as well as in mortality.[6]In recent years, the number of reported cases has risen from 733 in 2017 to 3498 in 2018 and then to 6791 in 2020.[6, 7] There has also been a corresponding rise in mortality rate from 6.5% in 2012 to over 20% from 2018 till date.[7, 8] Some states within Nigeria continue to report Lassa fever cases and deaths year in, year

out. The mortality rates reported from endemic States such as Plateau state remain higher than national averages.

Many factors in developing countries contribute to the mortality observed in Lassa fever outbreaks. The poor socioeconomic conditions and poor health seeking behavior of individuals in developing countries influence their access to healthcare. Lassa fever patients may not report to the health facility early in the course of their illness. This makes it difficult to treat and resulting in poor outcomes including mortality.[4, 9] Early presentation will lead to early identification and early treatment with ribavirin which has also been proven to reduce mortality among cases. Studies have shown that patients who received ribavirin were less likely to die than those who did not, especially when administered early in the course of the disease.[9, 10, 11] Mortality from Lassa fever has also been shown to be associated with age, [11, 12] occupation as a health care worker,[13, 14] and the practice of infection prevention and control.[15]

Lassa fever is one of the epidemic prone diseases for immediate notification under the integrated Disease Surveillance and Response (IDSR) system and a priority disease to be controlled especially in endemic countries. Countries where Lassa fever is endemic establish regional and national epidemic preparedness teams, working with international partners in order to coordinate preparedness, detection and timely response to public health emergencies.[16]

Following the outbreak of Ebola viral disease in September 2014, efforts have been scaled up by the Federal Government of Nigeria in partnership with other organizations, State and Local Governments, to prevent, detect and respond to threats of infectious diseases including Lassa fever in various states across the country. Some of the actions taken include establishment of Nigerian Center for Disease Control (NCDC) and National Lassa fever Emergency Operations Centre (EOC) to provide technical support in outbreak investigations and rapid response to affected states in the country.[17, 18]Generally, the outbreak response of the Nigerian Government consists mainly of effective coordination, laboratory testing, active surveillance, community mobilization, contact tracing, suspected case evaluation and case management.[9, 16]Despite all the control measures instituted within these past five years, Plateau State, along with other endemic states, continue to report deaths from this disease. Response to outbreaks is definitely not enough to control the disease.

Since Plateau state is one of the states contributing significantly to the burden of Lassa fever in Nigeria, it is important to understand the factors that affect mortality and what has been done to manage the situation over these past few years. Gaps may be identified which may enable stakeholders institute state-specific control measures. Hence this study aims to identify the predictors of Lassa fever mortality and describe the control efforts for Lassa fever in Plateau state, Nigeria.

II. Materials and Methods

Study Area

Plateau State is located in North Central, Nigeria. It has a total of 3 senatorial zones and 17 Local Government Areas (LGAs). It shares boundaries with Kaduna State (North West), Bauchi State (North East), Nassarawa State (South West) and Taraba State (South East).[19]

Study design and study population

This was a cross sectional study using a mixed method of data collection. Retrospective analysis of secondary data was employed for the quantitative assessment. Data included records of Lassa fever cases in Plateau State Epidemiological Unit from January 2015 to June 2019. The qualitative component of the study was done through key informant interviews (KIIs) conducted among selected stakeholders in Lassa fever control in Plateau State.

Sample size and sampling technique

A total sampling was done whereby all records of Lassa fever cases (a total 343 cases) in the Epidemiological unit were selected and included in the study. Purposive sampling was used to select major stakeholders in Lassa fever control in the State from the Epidemiological Unit and the two main Lassa fever treatment facilities - Jos University Teaching Hospital (JUTH) and Bingham University Teaching Hospital (BUTH).

Study instruments

These include line lists for Lassa fever in the State Epidemiological Unit for quantitative data (used to extract information on number of cases; socio-demographic characteristics such as age, sex, place of residence; duration of illness before presentation in the health facility; duration between disease onset and treatment; and outcome of illness), KII guides and a digital voice recorder, pen and note pad to obtain information during KIIs from the study participants.

Data Collection Technique

Two research assistants were selected and trained on data extraction from records, conduction of key informant interviews and transcription. Records of Lassa fever for the study period were retrieved after obtaining permission from the State Ministry of Health.

KIIs were conducted for the State Epidemiologist, the State Disease Surveillance and Notification Officer (DSNO) and the Consultants in Charge of Infectious Disease Unit of JUTH and BUTH. The interviews which lasted about 45 – 60 minutes were conducted in quiet and comfortable offices. During the interview, the research team asked preformed questions while making observations and taking notes of the responses. A digital voice recorder was used to record the interviews. Informed consent and permission were obtained from interviewees before the interviews were recorded.

Data Analysis

The quantitative data which was retrieved from an excel spreadsheet was analyzed using IBM Statistical Package for Social Sciences (SPSS) version 23 and Microsoft Excel 2016. Quantitative variables which include age and time of presentation in the hospital were summarized using mean and standard deviation while qualitative variables such as gender, place of residence (LGA and geopolitical zone) and outcome of illness were summarized and displayed in tables and charts.

The Mortality Rate of LF for the study period was calculated as:

$$\text{Mortality rate} = \frac{\text{No. of deaths from LF during study period}}{\text{No. of LF cases during study period}} \times 100$$

Predictors of Lassa fever mortality such as age, gender, employment, place of residence, case positivity and late presentation to health facility were determined using logistic regression, after a bivariate (chi-square) analysis had been used to pick out the factors that significantly affect mortality. At a 95% confidence level, a p-value of ≤ 0.05 was considered significant.

Information on Lassa fever control efforts obtained from KIIs were transcribed, recurrent themes identified and content analysis was carried out. Results were presented in summarized statements and pros.

III. Results

Three hundred and forty-three Lassa fever cases were reported in Plateau State within the study period of January 2015 – June 2019. Records on outcome of illness (dead or alive) were available for 338 cases (98.5% of cases) and 132 cases (38.9%) had records for time seen in the health facility. Data become more complete as the years advanced.

The mean time of presentation to health facility from date of onset of illness was (7.8 ± 2.7) days ranging from 1 to 24 days, and mean age of cases was 25 ± 10 years.

Mortality rate of Lassa fever cases

The mortality rate observed among all cases (suspected and confirmed) for the study period was found to be 18.3% (Figure 1). Mortality rate among only laboratory confirmed cases was 43.4% (Figure 2).

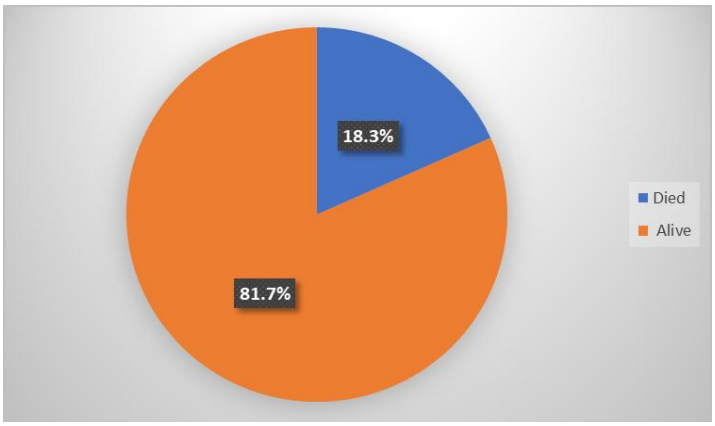

Figure 1: Mortality among all cases of LF from Jan 2015 - Jun 2019

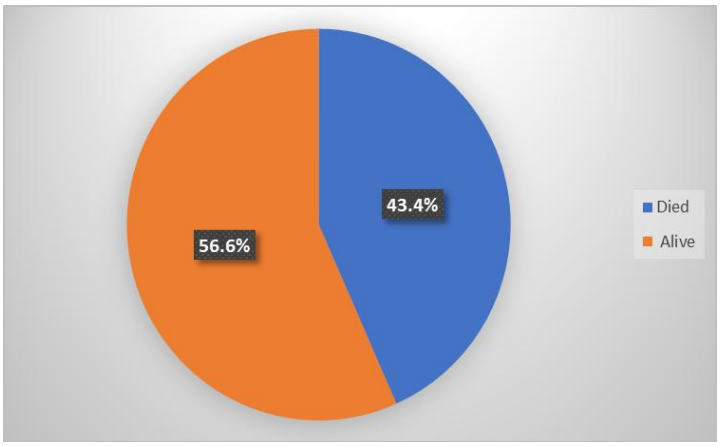

Figure 2: Mortality among confirmed cases of LF from Jan 2015 - Jun 2019

Predictors of mortality among Lassa fever cases

Bivariate analysis showed that age group, employment status and residential location of the cases were factors found to be significantly associated with mortality ($p \leq 0.05$). Although not statistically significant, more deaths were observed among those who reported late in the course of their illness (Table 2).

Table 1: Factors associated with Lassa Fever mortality

Factors	**Alive (n =277) Freq (%)**	**Dead (n =62) Freq (%)**	χ^2	**df**	**p-value**
Age Group (years)					
Children (0-17)	119 (90.2)	13 (9.8)			
Young Adults (18-39)	106 (82.2)	23 (17.8)			
Middle aged (40-59)	48 (67.6)	23 (32.4)	18.59	1	<0.001*
Elderly (≥ 60)	4 (57.1)	3 (42.9)			
Gender					
Male	169 (82.8)	35 (17.2)			
Female	108 (80.0)	26 (20.0)	0.44	1	0.566
Location					
Southern zone	42 (68.9)	19 (31.1)			
Northern zone	198 (86.1)	32 (13.9)			
Central zone	29 (80.6)	7 (19.4)	10.29	1	0.016*
Outside Plateau	12 (75.0)	4 (25.0)			
*Employment Status***					
Employed	21 (72.4)	8 (27.6)			
Unemployed	67 (88.2)	9 (11.8)	3.83	1	0.050*
*Time seen in Health facility***					
Within 72 hours	38 (86.4)	6 (13.6)			
After 72 hours	77 (87.5)	11 (12.5)	0.03	1	0.854
*Time seen in Health facility***					
Within 24 hours	5 (100.0)	0 (0.0)			
After 24 hours	110 (86.6)	17 (13.4)	0.78	1	0.381

*Significant

**Computed for available data

When subjected to multivariate analysis as shown in table 3, it was found that the significant predictor of mortality was age group. Young adult and middle age groups of 18-39 years and 40-59 years respectively, were more likely to die of the infection compared to children (OR = 7.4; 95% CI 4.3 – 21.7 and OR 16.4; 95% CI 2.3 – 33.2 respectively). Employment status when compared to non-employment as well as being resident in the northern and central senatorial zones when compared the southern zone had higher odds of mortality, although not statistically significant.

Table 2: Predictors of Lassa Fever mortality

Factors	Adjusted Odds Ratio	95% Confidence Interval	P-value
Age Group (years)			
Children (0-17)	1		
Young Adults (18-39)	7.4	4.3 – 21.7	0.023*
Middle aged (40-59)	16.4	2.3 – 33.2	0.005*
Elderly (≥ 60)	30.0	0.9 – 71.1	0.980
Location			
Southern zone	1		
Northern zone	1.3	0.2 – 8.9	0.778
Central zone	2.6	0.1 – 15.2	0.516
Outside Plateau	1.9	0.2 – 14.8	0.540
Employment Status			
Unemployed	1		
Employed	1.2	0.3 – 4.8	0.764

*Significant

Lassa fever control efforts in plateau state

Results are presented based on themes generated from the KIIs.

A. Control efforts within the health facility

The two main treatment centers for LF in the State, JUTH and BUTH, each have a team formed for management of LF cases which is headed by the consultant in charge of the Infectious Disease Unit.

The facility representatives mentioned resources available for Lassa fever control to include: human resources (consultants, resident doctors, pharmacists, nurses, supportive laboratory personnel, attendants, security personnel); isolation centers with isolation rooms; commodities supplied by the State Epidemiological unit such as ribavirin tabs and injections; PPEs like gowns, boots, goggles, safety gloves, regular surgical gloves, aprons. The facilities also have IEC materials on display for both patients and health workers.

Cases are suspected using case definitions. Patients usually come as referrals from outside the facilities, from other teams/units within the facilities or suspected primarily by the managing teams. Suspicion is usually made late in the course of the disease.

In most cases, patients come in very late presenting with high grade, unrelenting fever even after treating for common causes of fever in this environment, such as thyphoid and malaria. Some may even present unconscious, with renal impairment, bleeding from orifices or even hearing impairment. When they come as referrals, it is easier for us to manage because the health care workers can fully kit themselves up even before touching them. (A health facility representative)

Clinical features and laboratory test results obtained from the general labs are used to identify a suspected case.

Right now, we are using the general lab for preliminary testing like Full Blood Count (FBC), Liver Function Test (LFT), urinalysis, etc. We are hoping that when the isolation centre is completed, we will have a special lab for only LF cases. (A health facility representative)

- *Hospital management protocol*

Once a case is suspected, he/she is moved to an isolation ward/center (presently being developed in both facilities) and the LGA DSNO is quickly notified through telephone call. A line list (form 001) is filled by the facility focal person or the LGA DSNO in line with immediate notification of IDSR. Both facilities follow a Standard Operating Protocol (SOP) on patient admission and management. Treatment with ribavirin and other supportive treatments are commenced using the SOP. Blood samples are taken from the patient and sent to the State epidemiologist for onward transportation to the reference lab in Abuja through a dedicated courier service. The result of the test is sent back through email to the heads of unit in the facilities and this takes about 24 - 48 hours.

The earliest we have had is 12 hours which was so impressive. The latest we had was after 12 days when the patient had died. But generally, we get results within 48 hours. Sometimes the samples may lyse or spill and we may never get such results, but this is quite rare. (A health facility representative)

Treatment is usually with IV ribavirin after which the patients are discharged and followed up if he/she survives. Contact tracing is also done for each confirmed case by the hospital Lassa fever management team in collaboration with the State and LGA DSNO. Those who have had significant exposure with the confirmed case and classified as high risk contacts, including health workers and relatives are given Post Exposure Prophylaxis (PEP) using tabs ribavirin.

- *Infection control in the facility*

The facility representatives mentioned universal precaution as the minimum standard to be adhered to by all the health care workers in the facilities. Some health workers who may not have high index of suspicion when initially managing a patient may be significantly exposed and become high risk contacts. For such persons, PEP is administered while being excused from work.

A few health workers have contracted the infection due to poor adherence to infection control practices like universal precaution. Two were managed in this facility this year. (A health facility representative)

All hospital staff are required to regularly wash hands and wear gloves. For all suspected cases, the SOP for infection prevention and control is adhered to. Use of PPEs is also emphasized. Restriction of movement is emphasized in the isolation wards. Regular decontamination or destruction of patients' materials and decontamination of rooms for 48-72 hours are done. Safe burial practices are carried out.

B. Control efforts at the state level

- *Health education and community mobilization*

Interviewees unanimously stated that sensitization and education of the general public take place from time to time. This includes radio and television jingles especially during the dry seasons when the outbreak is more pronounce. The State also leveraged on polio immunization activities in the past to educate the general public on Lassa fever prevention. Health education materials like posters and flyers have been produced and distributed to health facilities. In collaboration with other ministries such as ministry of environment, environmental sanitation exercises are ongoing but not properly emphasized.

Despite the level of sensitization that is ongoing, all stakeholders mentioned that most cases of Lassa fever delay in reporting to the health facilities. They do so usually when complications may have set in. i.e. about 8-10 days (second week) after onset of symptoms. Stakeholders believe that there is need to create better awareness among members of communities about Lassa fever especially about timely reporting to the health facility.

People are very used to self-medication whenever they have fever and this contributes greatly to mortality. If they feel no improvement after self-treatment, they contact their health worker friends or go to the chemist after which they may visit the nearest clinic. They fail to realize that Lassa virus doesn't wait that long. By the time fever fails to subside after 2-3 days of malaria treatment, the patient should visit the clinic. So the State needs to put in more efforts to sensitize the general public and discourage self-medications. (A state representative)

Even after presentation to the hospital, there will still be some delay before any suspicion is made.

Some health care workers still have low index of suspicion. They treat using one antimalarial after the other and then change from one antibiotic to another, until the patient develops complications before they refer. (a health facility representative)

- *Disease surveillance, notification and response*

When any case is suspected, the LGA DSNO receives information about the case from the health facility and fills the Line list on paper with appropriate Epidemiological number which is sent to the State. The State DSNO fills the State line list on Excel spreadsheet and shares the information electronically with the National body and other partners. During an outbreak, reports are sent daily but can be sent monthly when outbreak is over and cases are occurring sporadically.

A Public Health Emergency Operation Centre (EOC) has been created to manage all epidemics including LF. Whenever there is an outbreak of LF or if one case is confirmed, the EOC will be activated. A rapid response team then will be deployed to the area to investigate and control the outbreak. Contact tracing is also carried for high risk contacts of confirmed cases.

- *Resource allocation*

All stakeholders noted that there has been an improvement in allocation of resources including manpower development within the past few years.

I think both Federal and State Government are trying very hard in controlling Lassa fever in the State but efforts can still be improved. There is an improved supply of drugs and consumable such as PPEs to JUTH and BUTH. Since 2018 we have not experienced out-of-stock for ribavirin. (A state representative)

Development partners are also contributing to the control of Lassa fever through sponsoring contact tracing through the surveillance focal persons, LGA DSNO and their assistants. (A state representative)

The establishment of dedicated isolation centers within the last few years, improvement in regular supply of drugs and PPEs shows some level of commitment in Lassa fever control and this has improved case management and reduced mortality to an extent. This commitment has been shown by the management of the facilities, the government and development partners.

Unlike before when we used to rely on expired drugs and reuse PPEs, we now have regular drug supplies and PPEs are always available for use. (A health facility representative)

In my opinion, mortality rate is gradually decreasing. We had more mortality last year than this year and I think it is because of better sensitization. Cases are beginning to be referred earlier to the clinics. (A state representative)

Other observations

All stakeholders observed that despite the increasing trend in LF incidence in the past few years, increased sensitization of the general public and health workers have improved case identification and reporting to an extent, especially those working in secondary and tertiary facilities. Even with the increasing incidence, the State has tried to ensure that mortality among LF patients is reduced to the barest minimum.

More cases are being seen over the years since I took over LF management team in this facility over 5 years ago and I think it is because more people are aware. It used to be more of a dry season outbreak, but now cases are been seen throughout the year even during the rainy season, making it endemic in the State. (Health facility representative)

Before now, only about 1 confirmed case could be found out of 20 suspected cases But now, you can get 1 out of 5 suspected cases as a confirmed case. This shows that case identification is better. (A state representative)

C. *Challenges of control efforts*

Challenges faced in LF control in the State mostly mentioned by stakeholders include lack of skilled manpower that can better identify and manage the disease, poor attitudes towards universal precautions in the hospitals, poor enforcement of environmental sanitation which favours proliferation of the rodent, lack of a designated dialysis machine for LF patients, stigmatization of health workers that manage LF cases and poor funding.

Before the creation of EOC, there was no dedicated budget or funding for emergency response. Now with the EOC in place there is a budget but the cash backing is poor. So funding to carry out many activities remains a challenge. (A state representative)

Even though Government pays for the supply of commodities for LF management such as drugs, patients still struggle to pay out of pocket for preliminary tests, admission, feeding and other requirements making patient management difficult. (health facility representative)

Those of us that mange the patients are generally stigmatized especially in the hospital environment. People refrain from shaking hands with us because of the fear of contracting the disease from us. (A health facility representative)

IV. Discussion

Just like other endemic states in the country, Plateau state has a higher CFR compared to national average.[9, 12] The Lassa fever mortality rate for the period of this study was found to be 18.3% which is higher than the national average of 12.7% in 2016[17] or 14.4% for the period between 2015 and 2018.[14, 17, 20]Other countries like Sierra Leone and Liberia have also recorded high mortality rates of 61% and 29% respectively, even though these were among hospitalized patients and during active outbreaks.[10] Case Fatality Rates (CFR) can be up to 15–20% among hospitalized patients in West Africa.[2] The CFR among confirmed cases and hospital acquired cases have been found to be as high as 36% to 65%.[3] Similarly in this study, mortality among confirmed cases was as high as 43.4% which is almost 1 in 2.

Lassa fever was found to have affected all ages and both sexes throughout the period of study and it was demonstrated that the odds of mortality increased with increasing age. When compared with children, young adults and middle-aged individuals had higher probability of dying from the disease. This finding was similar to that found in Irrua Specialist Teaching Hospital, Edo State in Nigeria where there was a 1.4 increase in mortality for every 10-year increase in age.[12] However, in a county-wide outbreak in 2016, mortality was highest among the youngest (less than 5 years) and the oldest (more than 55 years) patients. Fever is more common in children than adults and it is the most common reason why they are taken to hospitals. A child is more likely to be seen in a hospital in the early phase of fever onset than an adult determined by various factors.[21, 22] This may probably be a reason for this finding since prognosis of the disease is tied to early presentation and treatment in the hospital.

Employment status had an effect on mortality but was not a significant predictor. This may be connected to increasing age which was a significant predictor of mortality since the adults, especially those in the youthful and middle age ranges, are usually found more in employment compared to children or even the elderly. Those in employment may tend to have more contact with people than the unemployed who may either be in school or largely at home, thus explaining the finding. Health workers are particularly more vulnerable. The state records did not specifically capture health workers but results from the interviews show that few health workers have contracted the disease from patients they had managed. National figures also show that health workers are particularly at risk as 18 out of 615 confirmed cases (3%) were health workers in the first half of 2019.[23] The probability of dying from Lassa fever was higher among cases from both Central and Northern zones compared to southern zone, although not significant. This may be because the Northern zone had more cases compared to the other parts of the state. The northern zone also houses the main treatment centers, hence will attract more cases.

Late presentation to the hospital can affect survival. The mean time of presentation which was (7.8 $\pm$ 2.7) days shows that many cases present late to the health facility. Some even presented after 3 weeks of disease

onset. The health facility representatives also had the same concerns as they mentioned that majority of cases present in the second week of illness making treatment and survival difficult. Although it was not significant, this study showed that more cases that presented after 72 hours died compared to those that presented within 72 hours. Studies have shown that many LF patients present late to the health facility, both in developed and developing countries, and this significantly affect their survival.[4, 9, 24]The non-specificity of symptoms shown by most patients in the early phase of the disease that mimics those of other common illnesses and their poor health seeking behavior may have contributed to these findings.

The control of Lassa fever in the Plateau State spans across the community, facility and government levels. The protocol for Lassa fever outbreak investigation and management as stipulated by the Federal government is applicable in the State. These include having functional epidemic management committees and rapid-response team (RRT) through the aid of an EOC activated by the NCDC in collaboration with WHO and other partners .[1, 17, 25]

Lassa fever being one of the priority epidemic prone diseases is reported immediately using the immediate case base reporting (IDSR001A) form in the IDRS notification system and uploaded to a national database. Prompt reporting from the health facilities to the LGAs and then to the State is in line with the requirements by the Federal Ministry of Health.[17, 26] Immediate reporting of cases which to an extent, is ongoing in the State, encourages rapid response and control of the outbreak. However, the delay in reporting of cases to the facilities remain a challenge. This delay that usually results from late presentation due to prior self-medication or empirical treatment for presumed malaria or bacterial infections, increases the potential risk of transmission to family members and health care workers. It also leads to delayed diagnosis and delayed initiation of ribavirin therapy. Ultimately, there is decreased beneficial effect of treatment which leads to mortality or other poor outcomes.[27]

As noted by Lassa fever stakeholders, presumptive diagnosis and treatment for other diseases in a patient with LF is a common occurrence among health workers. Unfortunately, many Lassa fever cases go unrecognized in the early phase of the disease when treatment is effective. This is the observations made in other parts of West Africa where the disease is endemic and index of suspicion should be high.[28, 29] Correct identification of the cause of an acute febrile illness within the shortest possible time frame requires high level of clinical suspicion and having appropriate diagnostic facilities that should be cited within the region where such an illness frequently occurs. For Lassa fever, the Bio-Safety Level 4 (BSL-4) is required for setting up the laboratory.[51, 54] Since this remains a challenge for resource-limited regions, the WHO has called for the use of rapid diagnostic test kits for Lassa fever especially at the primary and secondary levels of care so that early screening and prompt referral of suspected cases can be done. Although doubts have been expressed about the validity of these Kits.[30]

The stakeholders in Lassa fever control in the State have opined that there is a need to establish a reference laboratory in the State which is obviously not the first time such a call was made. Other reports have shown that there is an urgent need to establish a diagnostic and treatment centers in the State.[8, 31] Efforts have been made to establish treatment centers which need to be upgraded, but a diagnostic center is desired for better case management. Nevertheless, the Federal Government has reiterated its efforts to establish functional molecular laboratories for Lassa fever testing in each of the six geopolitical zones in the country.[32]

The index of suspicion still remains low especially among lower level health workers and this probably explains why cases are referred late in the course of the disease. This same reason may also explain why health workers do not take universal precautions seriously and easily contract the disease even while being are aware that the disease can easily be contracted while working in an endemic area.[36] This observation may also contribute to why workers in the Lassa fever managing teams are usually stigmatized due to fear of contracting the disease from them.

Poor funding is a general problem in the health sector. Prompt response to outbreaks requires appropriate planning which cannot be implemented without sufficient funds especially for commodities, logistics and manpower development. All stakeholders mentioned this as a major challenge that affects rapid response to the outbreak. The supply of drugs and PPEs is not enough as other needs still have to be met. For example, patients who cannot afford preliminary tests may be missed because the tests aid in case identification. Furthermore, reliance on donor sources for provision of free drugs and PPEs has been a major concern for public health experts who feel that sustainability will be an issue when these donors withdraw their support.[33] Insufficient funding have been mentioned in other reports as a challenge to control of Lassa fever.[15, 25] Poverty contributes to poor health seeking behavior. Most Nigerians including Plateau State residents are not health insured. This prevents them from seeking medical care in hospitals which is capable of pushing them further into poverty due to out-of-pockets payments for services.

There is need for improvement in general awareness about the disease among the public, improvement in infection prevention control practice and case identification among health workers, and improvement in

environmental sanitation as stated by stakeholders in Plateau State. These are also the concerns of National Lassa fever control stakeholders.[33]

V. Conclusion And Recommendations

A mortality rate of 18.3% was observed for the study period and mortality was significantly higher among the older age groups. Efforts to control Lassa fever in the State by health workers and the State government has shown some improvement over the years. This is shown by increased sensitization of the general public about of the disease, improved case identification by health workers, improved commitment to ensure regular supplies of commodities and improved rapid response to outbreaks. There are however, challenges that need to be addressed such as late presentation, poor funding, poor environmental sanitation practices, inadequate skilled health workforce and poor attitude to infection control.

The State government should endeavor to establish a diagnostic centre that is specific for Lassa fever within the State, which can be done by upgrading one of the highly equipped laboratories in the State. This will further improve timing of testing and management of cases.

Poverty contributes to poor health seeking behavior. In order to encourage good health-seeking behavior and discourage self-medication, the government should improve coverage of health insurance especially to the poor, or make treatment of all fever cases free for all age groups including adults. This will encourage early presentation to the health facilities and probably improve outcome of the disease.

Limitation of the study

Incomplete data especially for the earlier years of study.

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Competing Interests

The authors declare no conflict of interests.

Authors' Contributions

This research was carried out as a collaboration among all authors. The principal investigator Author EOO, was involved in study conception, design, data collection, analysis and manuscript writing. Authors SG, HAA and IAZ participated in study conception, design, technical editing and critical review while authors GNO and MOA participated in data collection, analysis and writing of manuscript.

Ethical Consideration

Ethical clearance with the protocol number PSSH/ADM/ETH.CO/2019/005, was obtained from Plateau State Specialist Hospital Ethical Committee. Permission for the study was obtained from the Plateau State Commissioner for Health, State Director Public Health and Medical Directors of the teaching hospitals. Verbal and written informed consent were also obtained from participants of KIIs before capturing on audio tape. All records were kept confidential and used only for the purpose of this study.

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