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Outbreak Investigation of Lassa Fever in Ebonyi State

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Abstract

Background: *Lassa fever is a viral haemorrhagic disease caused by an RNA virus of the family Arenaviridae. The seroprevalence in Nigeria is about 21%. Since 1969, several outbreaks reported in various states in Nigeria. The objective of this study was to investigate and control the Lassa fever outbreak in Ebonyi State, Nigeria.*

Methodology: *A cross-sectional study was done with laboratory confirmation. Sociodemographic data were collected and recorded on a line list and used for descriptive epidemiology. Blood samples were collected for confirmation by reverse transcriptase-polymerase chain reaction.*

Findings: *From January 22nd to March 1st, 2019 a total of 92 suspected cases were identified; with most being between 15-44 years, (59.1%), female (62.5%) and from Abakaliki LGA (47.6%). There were 30 laboratory-confirmed cases and 12 deaths with a case fatality rate (CFR) of 40%. Following confirmation, the incidence was highest in those aged 15-44 years (66.7%), and the CFR was highest in the same age group (58.3%). Disaggregated CFR showed a CFR of 25% in males and 50% in females. The Number of days from onset of symptoms to the presentation at the health facility was statistically significant with an odds ratio of 1.3 (1.009-1.700). (P-value $\leq$ 0.05).*

Conclusion: *Poor health-seeking behaviour increases the chance of death from Lassa fever infection. It is essential to continue to institute preventive measure like health promotion. it will increase awareness on signs and symptoms as well as service availability of health for Lassa fever management.*

Keywords: *Lassa fever, Arenaviridae, Incidence, Disease Outbreak.*

Introduction

Background

Lassa fever (LF) is a viral haemorrhagic disease caused by an RNA virus of the family Arenaviridae that was described in the 1950s but first identified in 1969 in a town called Lassa in the Northern part of Nigeria.[1] It is a zoonotic disease that is transmitted by direct contact with multimammate rat, *Mastomys natalensis* and has its peak occurrence between January and June of each year and no record of age, sex or racial predilection has been noted.[2–4]

It is endemic in West Africa resulting in 300,000–500,000 cases annually, causing about 5000–10,000 deaths. Outbreaks of the disease have been reported in Guinea, Sierra Leone, Liberia, Nigeria and the Central African Republic. The seroprevalence of LF in Nigeria is about 21%.5 Since 1969, several outbreaks reported in various states in Nigeria including Plateau, Nasarawa, Taraba, Yobe, Ondo, Edo, Rivers, Imo, Anambra and Ebonyi.[5]

Contiguous states are affected, and a good topographical knowledge of the affected states reveals that they have rocky/hilly areas. Also, food processing with sun drying along the roads and on the rocks in some of the rural areas have been recorded, and these rats shed the virus in their excreta or urine, thereby infecting humans.[6,7]. The natural history of the disease is variable with over 80% of people who become infected remaining asymptomatic and 20% developing the disease.[8] The incubation period ranges from 6-21days. Some of the symptoms seen include; high-grade fever, sore throat, diarrhoea, vomiting and with advanced disease bleeding from various orifices, spontaneous abortion in pregnant mothers, hearing loss, seizures and multisystem organ failure[8,9]. During Lassa fever outbreaks, the case-

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fatality rate can reach as high as 50%. Lassa fever has an overall fatality rate of 1-2%; much lower than the fatality rate of 9.3% to 18% seen among all hospital admissions.[8]

Person to person transmission is an established mode of transmission as humans get infected by having contact with body fluids of the infected and poor infection prevention and control practices in the hospital environment. Lassa fever presents diagnostic challenges because it mimics other diseases like malaria and enteric fever which are endemic in West Africa. Consequently, a significant group of cases present with a history of being treated unsuccessfully for either malaria or typhoid fever and this should improve clinical suspicion of Lassa fever. The definitive diagnosis of Lassa fever has carried out using reverse transcriptase polymerase chain reaction (RT-PCR) in the virology laboratory located in Federal Teaching Hospital Abakaliki (FETHA) since 2018. Ribavirin, an antiviral, can be used to treat Lassa fever, which is effective when given early in the course of the disease and this should be combined with fluid therapy, oxygenation and other supportive treatment. Availability of the drug has improved compared to previous years and outbreaks despite the relatively high cost.

General objective

To investigate and control the Lassa fever outbreak in the state

Specific objectives

1. Assessing the overall Lassa fever outbreak situation in the state
2. Assessing infection control and prevention strategies in place and make recommendations to address identified gaps
3. Assessing the utilization of essential commodities and medicines in the state
4. Building the state capacity on surveillance and data management
5. Strengthening case management.

Materials and methods

Descriptive study

A cross-sectional study was done with laboratory confirmation. Sociodemographic data were collected and recorded on a line list and used for descriptive epidemiology. Blood samples were collected for confirmation by reverse transcriptase-polymerase chain reaction.

Case definitions

Cases were appropriately designated into suspect, confirmed and probable cases using the NCDC revised case definition for LF.

Suspected case

An illness of gradual onset with one or more of the following: malaise, fever, headache, sore throat, cough, nausea, vomiting, diarrhoea, myalgia (muscle pain), central chest pain or retrosternal pain, hearing loss and either history of contact with excreta or urine of rodents OR 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/hemorrhaging occurring in Ebonyi state between 5th January 2019 to 16th February 2019.

Probable case

Any suspected case as defined above but who died between 5th January 2019 to 16th February 2019 without collection of specimens for laboratory testing.

Confirmed case

Any suspected case with laboratory confirmation (positive IgM antibody, PCR or virus isolation) between 5th January, 2019 to 16th February, 2019.

Case finding, contact tracing and active case search

Active case search in community and health facilities and tracing of contacts of confirmed cases was used to identify cases. When a patient was admitted through the various entry points of the health facility on suspicion of LF, they were then sent to the observation/quarantine bay (which was recently established and donated to the teaching hospital by MSF) where they are held and given supportive treatment until results of the RT-PCR for which samples would have been taken during their stay is available. If the sample becomes positive, they are then moved to the virology center (Isolation ward) for definitive treatment and care. Until suspicion of LF, the patient remains in the ward where they were admitted. Most of the cases reported to FETHA on their own or were referred to the FETHA from peripheral health centers following failure to improve whilst on treatment. Active case search in the community was carried out by the DSNOs and by NFELTP residents in the health facility as designated by the team lead of the rapid response team. Five cases were identified during active case search; one confirmed, one negative and three probable cases.

Data analysis

This was conducted using STATA Version 12.0 (IC). Continuous variables were summarized using mean and standard deviation and categorical variables were summarized using proportions. Comparisons were made using Fischer's Exact test for categorical variables and Student T-test for difference in means of continuous variables. Bivariate analysis was done to check what variables were associated with outcome of PCR results and clinical outcome.

Laboratory investigations

Laboratory confirmation of LF was done using reverse transcriptase polymerase chain reaction (RT-PCR) in the laboratory located within the Virology center of FETHA. A total of 88 blood samples were collected and transported to the laboratory in triple packaging which was supplied by MSF.

Ethical considerations

Information obtained regarding cases was not shared with persons outside of the state and rapid response team and was safely stored in passworded files on laptops and in google drives.

Results

Ninety-two (92) suspected cases of Lassa fever were identified from eleven Local Government Areas (LGAs) in Ebonyi State since the onset of the outbreak till the 3rd of March 2019 with seven LGAs having the confirmed cases (Abakaliki, Ikwo, Ezza North, Ezza South, Afikpo North, Ebonyi, Izzi). However, Abakaliki LGA has recorded most of the cases. As at 3rd of March 2019, 30 cases confirmed from 7 LGAs and 16 wards, with 12 deaths recorded with a case fatality rate (CFR) of 40%. Out of the confirmed cases, 12 were males (40%), and 18 were females (60%) with a mean age of 31.2 ± 17.2 years. The incidence of the disease was highest in those aged 15-44 years (66.7%), and death is highest in the same age group (58.3%). Disaggregated CFR showed a CFR of 25% in males and 50% in females. There was a mean difference of 3.4 days in time from onset of symptoms to presentation at FETHA of cases that died and those that lived.

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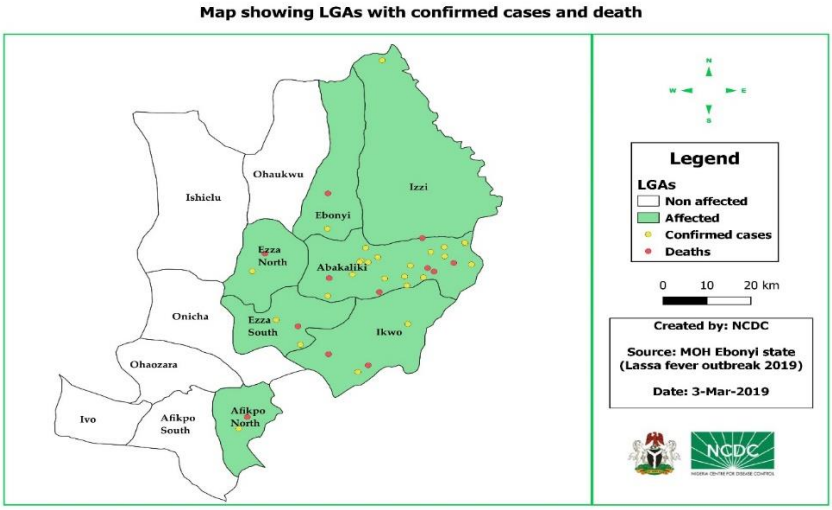

Figure 1. Map showing distribution of confirmed cases and deaths in Ebonyi state

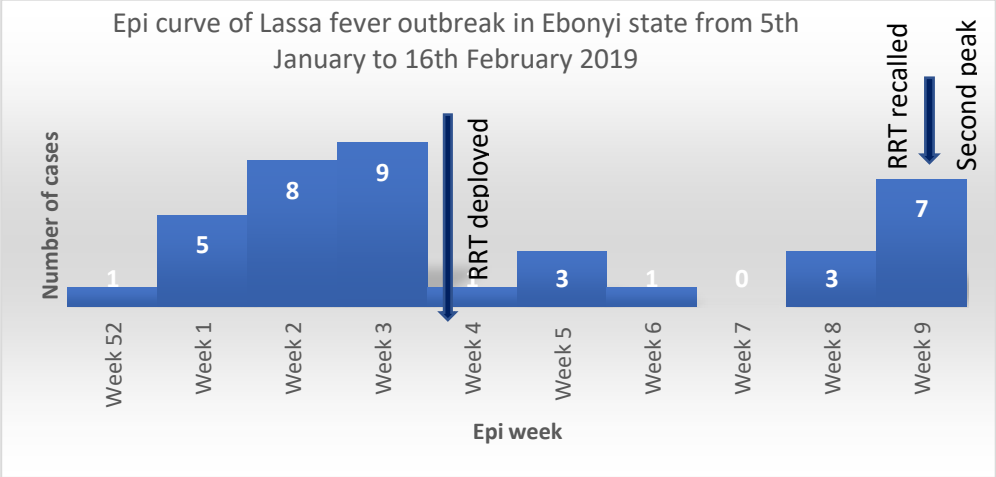

Figure 2. Epidemic curve of the outbreak of the 2019 lassa fever from epi week 1-9

*Information on cases from Epi week 9 was not used for analysis other than in this epi curve to show the second peak. Complete information on the new cases was not released to residents as RRT had been recalled.

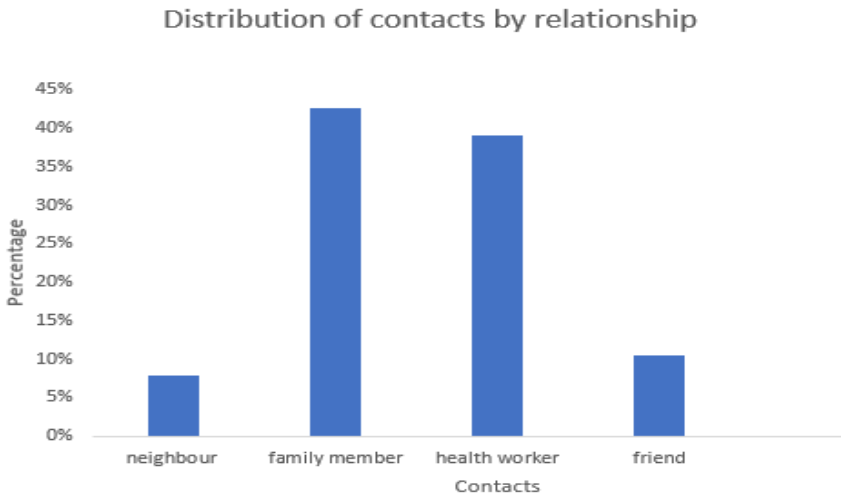

Figure 3. Relationship of contacts to confirmed case

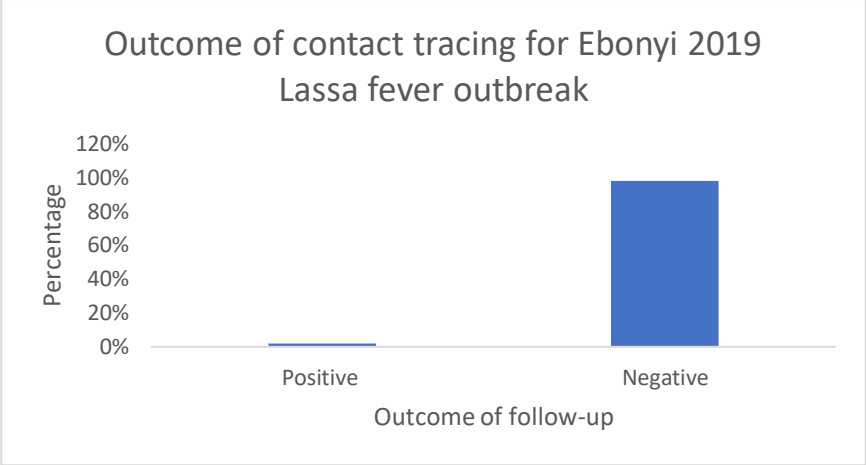

Figure 4. Outcome of follow-up of contacts of confirmed cases

Table 1. Demographic characteristics of suspected cases of Lassa fever from December 2018 to march 2019

Variable	n (%)
Age group (Years)	
0-4	4 (4.6)
5-14	10 (11.4)
15-44	52 (59.1)
≥45	22 (25)
Total	88
Age (Mean ± SD) *	32 ± 17.5
Sex	
Male	33 (37.5)
Female	55 (62.5)
Total	88
LGA of residence	
Abakaliki	39 (47.6)
Ebonyi	10 (12.2)
Izzi	9 (11)
Ikwo	5 (6.1)
Afikpo South	5 (6.1)
Afikpo North	4 (4.9)
Ezza South	4 (4.9)
Others	6 (7.3)
Total	82
Educational status	
Primary	5 (20)
Secondary	6 (24)
Tertiary	11 (44)
Not applicable*	3 (12)
Total	25
Occupation	
Healthcare worker	5 (13.5)
Trader	5 (13.5)
Farmer	4 (10.8)
Student	10 (27)
Others	13 (35)
Total	37

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Table 2. Characteristics of suspected Lassa fever cases by PCR result in Ebonyi State, Dec 2018 to mar 2019

Variable	Outcome of PCR results		P-value
	Positive n (%) N = 30 (34.1)	Negative n (%) N = 58 (65.9)	
Age Group (Years)			
0-4 (Ref)	1 (3.3)	3 (5.2)	—
5-14	4 (13.3)	6 (10.3)	0.600*
15-44	20 (66.7)	32 (55.2)	0.597*
≥45	5 (16.7)	17 (29.3)	0.921*
Age (mean ±SD)	31.2 ± 17.2	32.5 ± 17.9	—
Sex			
Male	12 (40)	21 (36.2)	0.728**
Female	18 (60)	37 (63.8)	
LGA of residence			
Abakaliki	20 (66.7)	19 (36.5)	0.25***
Ebonyi	2 (6.7)	8 (15.4)	
Izzi	2 (6.7)	7 (13.5)	
Ikwo	2 (6.7)	3 (5.8)	
Ezza South	2 (6.7)	2 (3.9)	
Ezza North	1 (3.3)	1 (1.9)	
Afikpo North	1 (3.3)	3 (5.8)	
Ohaukwu and Ishielu	0	4 (7.8)	
Afikpo South	0	5 (9.6)	
Outcome*			
Alive	18 (60)	46 (93.9)	0.001***
Dead	12 (40)	3 (6.1)	

*= p-value for bivariate logistics regression
**= p-value for Chi square test
***= p-value for Fisher's exact test

Table 3. Clinical outcome of confirmed cases by background characteristics

Variable	Outcome		P-value
	Alive n (%) N = 18 (60)	Dead n (%) N = 12 (40)	
Age Group (Years)			
0-14 (Ref.)	3 (16.7)	2 (16.7)	
15-44	13 (72.2)	7 (58.3)	0.835*
≥45	2 (11.1)	3 (25.0)	0.530*
Age (mean ±SD)	27.4 ± 15.2	36.8 ± 19.1	—
Sex			
Male	9 (50)	3 (25)	0.260**
Female	9 (50)	9 (75)	
Number of days between onset of symptoms and presentation at health facility: **mean±SD**	6.6 ± 3.5	9.8 ± 3.3	0.030*
Number of days between presentation at health facility and presentation at virology centre: **median (range)**	1.5 (0-7)	2 (0-5)	0.929*
Number of days between onset of symptoms and presentation at Virology center: **mean±SD**	8.9 ± 3.6	9.8 ± 4.7	0.563*

*= p-value for bivariate logistic regression
**= p-value for Fisher's exact test

Table 4. Predictors of mortality among confirmed cases

Variables	Odds Ratio (95% CI)	P-value*
Number of days from onset of symptoms to presentation at health facility	1.3 (1.009-1.700)	0.042**
Number of days from presentation at facility to presentation at virology centre	1.1 (0.64-1.85)	0.754
Sex		
Male (Ref)	-	-
Female	1.5 (0.23-9.44)	0.690
Age group (in years)		
0-14 (Ref)	0.7 (0.06-6.39)	0.722
15-44>=45	2.4 (0.12-46.17)	0.564

*= p-value for multivariate logistic regression
**= significant value

Discussion

Our investigation has shown a sensitive surveillance system with a third of suspected cases being positive. Two-third of the incidence of the disease was in those aged 15-44 years, an age range of people who are likely to be very active physically and move from place to place. This characteristic may aid the spread of the disease. However, a previous study in Ebonyi State reported more cases among males, although with higher incidence within a similar age range.10

The high CFR (40%) could be due to late presentation of cases to the health facility as there were statistical significance and association in the number of days between the onset of symptoms and presentation at health facility between survivors and those that died. A similar study in the same state also identified a high CFR and noted a mean delay to presentation for patients who died and those who survived.10 As at 3rd March 2019, Nigeria Centre for Disease Control reported a national CFR of 22.1% which is much lower than that of Ebonyi State.11 This may point to a possible gap in the healthcare-seeking behaviour of the populace and a need for widespread sensitization of the state and healthcare workers to improve the index of suspicion of the disease at all levels of healthcare.

Furthermore, due to the recently set up diagnostic capacity with the use of RT-PCR in FETHA, most suspected cases were tested with a result turnaround time of less than 48hours compared to previous outbreaks were samples were transported to Irrua Specialist Teaching Hospital in Edo State. Majority of the samples tested were from Ebonyi while others were from Enugu, Cross-River and Anambra States. This therefore shows the importance of diagnostics for LF in the south-eastern part of Nigeria as it has reduced the time to diagnosis of cases compared to same period in the previous years. Among LGAs with positive cases of LF, Abakaliki LGA, an urban setting, had recorded most cases (66.7%). This was consistent with a finding in a study were about 75% of cases were from urban areas. However, the detection of most of the cases from urban centres need to be scrutinized further as those in urban areas have better access to healthcare and particularly are closer to the treatment centre in FETHA. People resident in rural areas often resort to PMVs and PHCs and may die before reaching the teaching hospital where the definitive diagnosis is made. This is evident from the map in Fig 1 where although most of the deaths that occurred were from Abakaliki LGA because most cases were from there, the CFR of Abakaliki was less than 50%, while some LGAs had CFRs as high as 50%.

Generally, from the epidemic curve, there has been a decline in the number of cases of LF. It is due to the effective coordination of outbreak response through EOC that has served as a platform to organize response activities of different partners properly. However, as at the time of this report, there was a second wave of cases that were being reported with 9 cases reported in epidemiological week 9. This demands an intensification of efforts in understanding the actual exposures of each patient, epidemiological linkage of each case, rigorous active case search in facilities and the communities, sensitization of communities and intensified environmental sanitation activities. The actual exposures to the Lassa fever and how these occurred was still largely unknown for a majority of cases. This was a significant limitation of this outbreak response.

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Public health actions

Coordination pillar

1. Activation of the Emergency Operations Center and coordination of pillars
2. Development of an Incident Action Plan for the state

Surveillance and epidemiology

1. Training of 45 LGA DSNOs on contact tracing, proper line listing and active case search
2. Training of three data clerks on data management
3. A harmonized contact line list was developed for the state
4. Active case search in the community and health facilities with detection of one confirmed, one negative and three probable cases
5. 524 contacts of confirmed cases traced and monitored daily using the daily monitoring for temperature and other symptoms with detection of 13 symptomatic contacts, 8 of which became positive

IPC, Case Management and Burial Pillar

1. IPC sensitization of clinical departments of FETHA and several PHC workers in the state on the importance of handwashing, use of hand sanitizers, maintaining IPC, having a high index of suspicion and proper waste management
2. Provision of PPEs and hand sanitizers to healthcare workers in clinical departments in FETHA
3. Constitution of two state burial teams to handle safe burial of corpses

Risk communication pillar

1. Sensitization of PMVs, youth corp members, communities on Lassa fever, missionary hospitals in the state, NMA Ebonyi State Chapter.
2. Risk communication through media jingles in three languages
3. Advocacy visits to traditional rulers in the state, to Ministry of Agric and Environment, CMD of FETHA
4. House to house sensitization carried out in the most affected areas

Data management

1. One-week capacity building exercise on data management and use of QGIS for state staff

Animal and Environmental surveillance

1. 50 ADP extension workers and 30 community workers under the agricultural programs in two senatorial zones with the capacity to reach over 100,000 farmers were trained on prevention of LF.
2. Animal sampling for LF in hotspots within the state
3. Lassa Fever committee was constituted in the State Ministry of Agriculture and Natural Resources.

Logistics

1. Stock assessment of the state store
2. Development of a stock/tally sheet to keep track of the movement of items in and out of the store
3. Creation of a three-month projection of requirements for the state

Conclusion

Poor health-seeking behavior increases the chance of death from Lassa fever infection. It is essential to continue to institute preventive measure like health promotion. it will increase awareness on signs and symptoms as well as service availability of health for Lassa fever management

Recommendations

Federal

1. A thorough investigation of each case to determine their actual exposure through well-conducted analytic studies
2. Improved mobilization following notification of an outbreak (the first case was diagnosed on the 5th of January and NCDC deployed an RRT on the 22nd of January)

State

1. Earmarking of funds by the state beginning in September of each year as most outbreaks begin in December
2. Intensified environmental sanitation and expedient waste disposal in the state
3. Statewide sensitization and risk communication by use of radio jingles as part of epidemic preparedness activities, during the outbreak and for a while after the outbreak
4. Continuous engagement of PMVs and private healthcare facilities with lowering of tax for early reporting of cases

Health facility

1. Provision of running water in the health facility
2. Provision of chlorine water in other entry points other than the Virology centre
3. Monthly sensitization of healthcare workers to improve the index of suspicion beginning before each outbreak period, e.g. November

Individuals

1. Rat proofing of homes
2. Proper storage of food
3. Environmental cleanliness
4. Avoidance of eating of rodents and barehanded handling of rodents
5. Early reporting following unresolved fever of 3days

References

[1]. Shaffer JG, Grant DS, Schieffelin JS, Boisen ML, Goba A, Hartnett JN, et al. Lassa Fever in Post-Conflict Sierra Leone. PLoS Negl Trop Dis. 2014;8(3).
[2]. Faso B, Leone S, Diseases ZI. Lassa Fever. 2011.
[3]. Richmond JK, Baglole DJ. Clinical review social consequences. 2002;1271–5.
[4]. Shehu NY, Gomerep SS, Isa SE, Iraoyah KO, Mafuka J, Bitrus N, et al. Lassa Fever 2016 Outbreak in Plateau State, Nigeria—The Changing Epidemiology and Clinical Presentation. Front Public Heal. 2018;6(August):1–5.
[5]. Iroezindu MO, Unigwe US, Okwara CC, Ozoh GA, Ndu AC, Ohanu ME, et al. Lessons learnt from the management of a case of Lassa fever and follow-up of nosocomial primary contacts in Nigeria during Ebola virus disease outbreak in West Africa. Trop Med Int Heal. 2015;20(11):1424–30.
[6]. Du Toit A. Lassa fever outbreak in Nigeria. Nat Rev Microbiol. 2018;16(5):260.
[7]. Stephen Ilesanmi O, Omotoso B, Osaretin Alele F, Adewuyi P. Awareness of Lassa Fever in a Rural Community in South West Nigeria. J Community Heal Res. 2015;4(1):1–10.
[8]. Adebayo D, Amaechi Nwobi E. Response Preparedness to Viral Hemorrhagic Fever in Nigeria: Risk Perception, Attitude towards Lassa Fever. Epidemiol Open Access. 2015;05(03).
[9]. Richmond JK, Baglole DJ. Lassa fever: epidemiology, clinical features, and social consequences. BMJ Br Med J. 2003;327(7426):1271–5.
[10]. Ajayi NA, Nwigwe CG, Azuogu BN, Onyire BN, Nwonwu EU, Ogbonnaya LU, et al. Containing a Lassa fever epidemic in a resource-limited setting: outbreak description and lessons learned from Abakaliki , Nigeria. Int J Infect Dis. 2013;17: e1011–e1016.
[11]. NCDC. 2019 Lassa Fever Outbreak Situation Report. 2019.