REVIEW ARTICLE

Epidemic preparedness and management: A guide on Lassa fever outbreak preparedness plan

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ABSTRACT

Epidemic prone diseases threaten public health security. These include diseases such as cholera, meningitis, and hemorrhagic fevers, especially Lassa fever for which Nigeria reports considerable morbidity and mortality annually. Interestingly, where emergency epidemic preparedness plans are in place, timely detection of outbreaks is followed by a prompt and appropriate response. Furthermore, due to the nature of spread of Lassa fever in an outbreak setting, there is the need for health-care workers to be familiar with the emerging epidemic management framework that has worked in other settings for effective preparedness and response. This paper, therefore, discussed the principles of epidemic management using an emergency operating center model, review the epidemiology of Lassa fever in Nigeria, and provide guidance on what is expected to be done in preparing for epidemic of the disease at the health facilities, local and state government levels in line with the Integrated Disease Surveillance and Response strategy.

Key words: Epidemic management, epidemic preparedness, Nigeria, outbreak response

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INTRODUCTION

Epidemics of emerging and re-emerging infectious diseases are on the increase, with devastating health, social and economic consequences, especially in the developing countries.[1] One of the lessons learnt with the Ebola virus disease outbreak in Nigeria is that political and public health resources deployed rapidly must be managed effectively to contain the disease outbreak in a timely fashion.[2] Lassa fever, a hemorrhagic viral disease, was first described in Nigeria in 1969 and has been occurring in epidemic proportions yearly in different parts of the country since then.[3-8] The need for health-care workers to be familiar with the emerging epidemic management framework that has worked in other settings for effective preparedness and response to epidemics in general and Lassa fever outbreaks, in particular, motivated the writing of this paper. Here, we discussed the principles of epidemic management using an emergency operating center (EOC) model, review the epidemiology of Lassa fever in Nigeria, and provide guidance on what is expected to be done in preparing for epidemic of the disease at the health facilities, local and state government levels using the Integrated Disease Surveillance and Response (IDSR) strategy.

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METHODS

This paper is a narrative review of the literature. We defined and clarified the terms; epidemic management and preparedness, and provided the EOC framework for management of an on-going outbreak. We compared the Nigeria National data epidemiologic week 1–33 on Lassa fever in 2014 with that of 2015 same period. We also reviewed cases reported to the Ondo State Epidemiological Unit from 2009 to 2015.

PRINCIPLES OF EPIDEMIC MANAGEMENT

Epidemic management has been described as the process of anticipating, preventing, preparing for, detecting,

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responding, and controlling epidemics in order that the health and economic impacts are minimized.[9] It is an all-embracing term that described all that needs to be done before, during, and after epidemics. It involves anticipating or predicting the occurrence of an outbreak such that it could be prevented. However, if the outbreak could not be totally prevented, it involves preparedness so that there is a readiness to respond. Early detection through a sensitive surveillance system is required to know when and where the outbreak occurs to limit its spread.[10,11] Most importantly, a coordinated and rapid investigation is required to describe the outbreak and identify interventions. Following which an effective response will be required to implement appropriate control measures.[10] An epidemic management would not be complete without an evaluation to identify what went right and wrong before and during the outbreak.[9]

From the foregoing, preparedness is a subset of epidemic management. Epidemic preparedness constitutes all the activities that have to be undertaken from the national to the health facility levels to be ready to respond effectively to disease outbreaks.[10-13] Moreover when all the activities are put together in a plan, and then we have an epidemic preparedness and response plan (EPR). The elements of an epidemic preparedness will include to ensure that routine surveillance system can detect outbreaks as soon as it occurs, and to ensure that staff are organized to confirm, investigate, and respond to outbreaks.[10,12,13] It is also during the epidemic preparedness period which occurred at inter-epidemic periods that buffer stocks of drugs, essential equipment; materials and supplies are provided and maintained.[9] Furthermore, financial supports for preparation and response are ensured during epidemic preparedness.[12]

Although epidemic management requires adequate knowledge of medical and/or public health, effective management requires proper coordination of all the specialty areas involved in response activities.[5] Information could be obtained rapidly from reference books and/or disease specialists. Figure 1 illustrates the EOC conceptual model for coordinating responses to an epidemic.[12,14] For an effective epidemic response, expertizes in epidemiology, clinical medicine, health education, and laboratory medicine are required.[12] The technical groups must be supported by the political and public health authorities as well as administrative and logistics experts. The epidemiologists are involved in outbreak investigation, surveillance, including contact tracing and follow-ups as well as in prediction of epidemics. The clinicians will be involved in managing the exposed, the sick and the dead.

Although laboratory testing may not be required in all epidemics, the laboratory experts are involved in specimen transportation, transfers, and diagnosis. The needs to educate the general population and special groups such as the health workers are usually necessary during epidemics. The coordinating team is made up of representatives of the technical subgroups, the logistics and administrative personnel and headed by the representative of the Commissioner for Health.[9,12] The team provides the strategic directions for the responses which are implemented by the technical subgroups and also liaises with the media and the political authority.[9] The authority makes the decisions on infrastructure, regulations, vaccinations, etc., based on the advice from the coordinating group. The subgroups are expected to interact with each other.

The IDSR guidelines on outbreak response in Nigeria has a section on how to prepare to respond to an outbreak.[9] This includes the establishment of a functional state/local government area (SGA/LGA) epidemic management committees (EPR committee/rapid-response team [RRT], health management team), the need to prepare an epidemic and response plan, set-up contingency stocks of drugs, vaccines, reagents and supplies and training health-care workers both clinicians and laboratorians.[9] On the guide to responding to outbreaks, it specifies enhancing surveillance, updating health workers' skills and strengthening case management among others. The composition of the epidemic management committee, for example, as specified at the LGA level include; the Chairman LGA, supervisory councilor for health, the Director Primary Health Care (DPHC), the disease surveillance and notification officer (DSNO), the health educator, a community physician, representatives of nongovernmental organizations, red cross, communities, clinical, or nursing officer from private hospitals and pharmacist/chemists. The RRT should be made up of the DPHC, an epidemiologist, a laboratory technologist, a clinician, an environmental health officer, immunization officers, the DSNO, a veterinary officer, and others based on staff availability and specificity of outbreaks.[9]

The roles and responsibilities of committees are as follows: The management committees are to review and approve the plan on epidemics, mobilize resources, coordinate and monitor activities, monitor resource utilization, and coordinate postepidemic evaluation, while the RRTs are specifically involved in investigation of rumors or outbreaks, proposing and carrying out appropriate strategies and measures for rapid containment of the epidemics, preparing detailed investigation report and contributing to the postepidemic evaluation. During the nonepidemic period, the management committee should hold quarterly meetings to assess trends of epidemics and monitor implementation of plans (including training of health workers) and review level of preparedness and identify treatment centers. However, during the epidemic period, the management committee should meet as soon as the epidemic is recognized and holds daily meeting

thereafter, to assess and request for support if situation is beyond the LGAs capacity.[9]

EPIDEMIOLOGY AND CONTROL OF LASSA FEVER IN NIGERIA

Lassa fever is a viral hemorrhagic fever caused by the *Arenavirus* and transmitted primarily from rodents to humans.[3,15-19] It was discovered in Nigeria, in 1969 and is endemic in portions of West Africa, including Nigeria, Liberia, Sierra Leone, and Guinea.[17-23] It has a seasonal clustering: Occurring during late rainy and early dry season and affects all age groups and both sexes.[3,18] An estimated 300,000–500,000 infections/year with 5000 deaths have been reported.[24] Figure 2 shows the distribution of Lassa fever cases in the first 33 weeks of years 2014

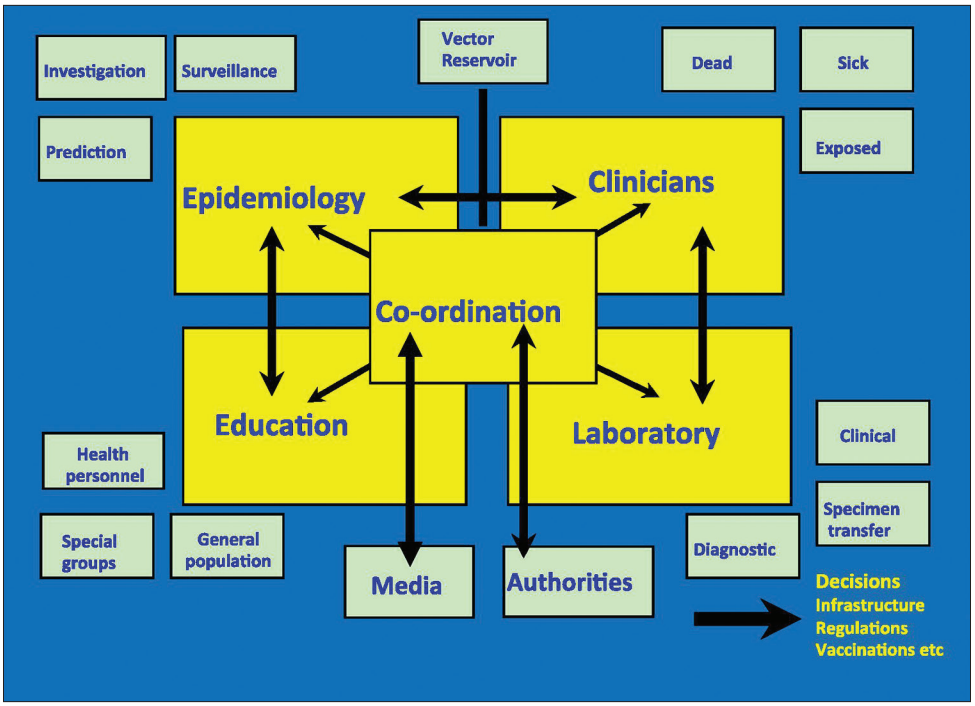

Figure 1: Epidemic management using an emergency operating center model

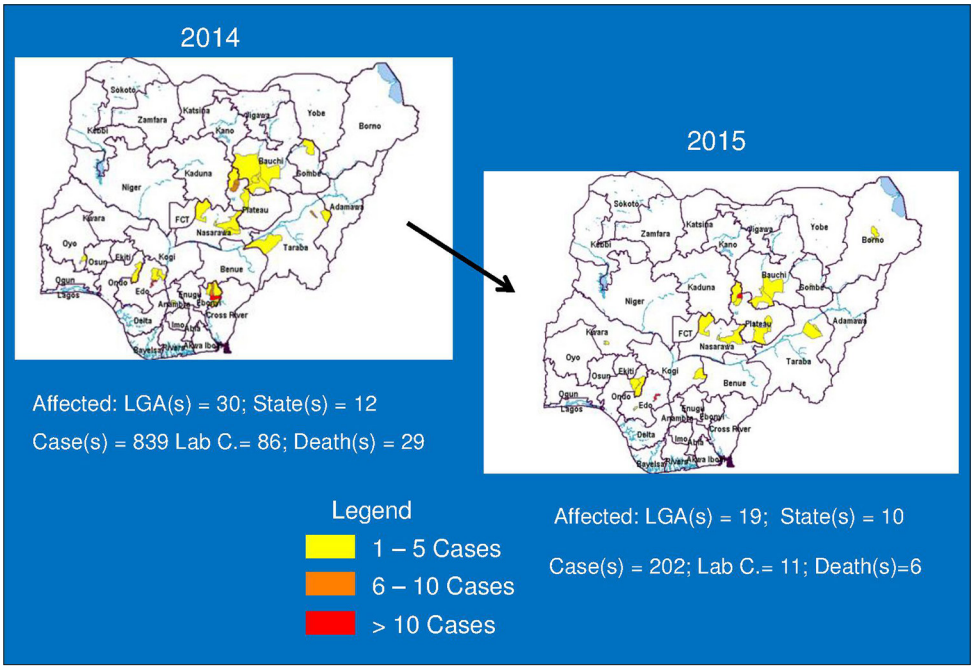

Figure 2: Maps of Nigeria showing areas affected by Lassa fever week 1–33, 2014 versus 2015

and 2015 in Nigeria. A total of 839 suspected cases of whom 86 were confirmed by the laboratory were reported from 30 LGAs in 12 States in 2014. Whereas caseload decreases to 202 suspected cases, with 11 confirmed from 19 LGAs in 10 States in 2015. The number of deaths also decreases from 29 in 2014 to 6 in the same period of 2015. The case-load and fatal trends of confirmed cases reported in Ondo State, one of the affected states in from 2009 to 2015 is shown in Figure 3. The case was localized to one LGA bordering another endemic State, Edo State. Rodent-to-human transmission is achieved through the "multimammate rat," *Mastomys* species-complex.[3,15,18] The taxonomy is still unclear; however, *Mastomys huberti*, which is more common in peridomestic habitat and *Mastomys erytholeucus* which is more common in brush habitat have been implicated. This transmission is usually via inhalation of aerosolized virus or ingestion of food or materials contaminated by infected rodent excreta or by catching and preparing *Mastomys* as a food source.[18] The secondary human-to-human transmission with the potential for nosocomial outbreaks with high case-fatality is common.[16,18] This form of transmission is usually by direct contact with blood, tissues, secretions or excretions of infected humans or through needle stick or cut or inhalation of aerosolized virus.

The incubation period is 5–21 days in a susceptible host.[9] There is a gradual onset of fever, headache, malaise, and other nonspecific signs and symptoms. Pharyngitis, myalgias, retrosternal pain, cough, and gastrointestinal symptoms are typically seen.[16,18] A minority present with classic symptoms of bleeding, neck/facial swelling, and shock. The case fatality of hospitalized cases ranged between 15% and 20%.[18] The disease is, particularly, severe in pregnant women and their offsprings. Deafness is a common sequela in most cases.[18-19] Lassa fever could be confused with malaria, typhoid fever, streptococcal pharyngitis, leptospirosis, bacterial sepsis, bacterial meningitis, arboviral infection, anicteric hepatitis, enterovirus infection, and bacterial or viral conjunctivitis; hence, clinical diagnosis is often

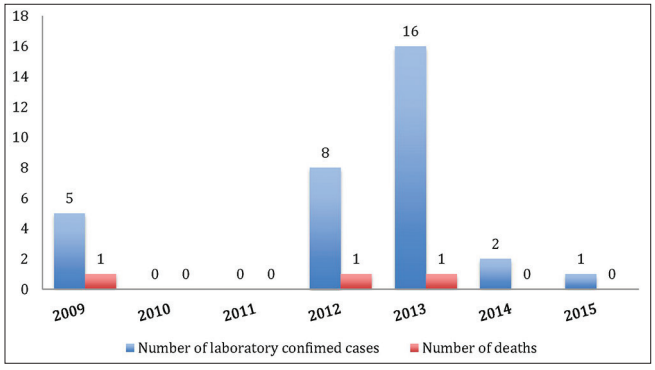

Figure 3: Number of laboratory confirmed cases and deaths of Lassa fever in Ondo State from 2009 to 2015

difficult. Enzyme-linked immunosorbent assays for antigen, IgM, and IgG antibodies are the common means of diagnosis.[18,21,23] However, as research tools; virus isolation, immunohistochemistry (for postmortem diagnosis), and reverse transcription-polymerase chain reaction are often performed.[16,21,23] Treatment is essentially supportive.[9,18] Antiviral, ribavirin is most effective when started within the first 6 days of illness.[9,16,18] However, major toxicities include mild hemolysis and suppression of erythropoiesis; although, both are reversible. Ribavirin is, presently, contraindicated in pregnancy, although may be warranted if mother's life is at risk.[18] The drug does not appear to reduce incidence or severity of deafness. High viremia, serum aspartate aminotransferase level >150 IU/L, bleeding, encephalitis, edema, and third trimester of pregnancy are associated with poor prognosis in Lassa fever.[9]

The prevention and control of Lassa fever will include village-based programs for rodent control and avoidance, hospital training programs to prevent the nosocomial spread, including barrier nursing, diagnostic technology transfer, and specific antiviral chemotherapy (ribavirin).[18] Rodent control would focus on proper storage of food in rodent-proof containers, cleaning around homes, trapping, and killing rodents with appropriate and safe disposal of carcasses and avoiding rodents as a food source.[18,25] Specific treatment with ribavirin could be achieved through two regimen. First, an intravenous (IV) ribavirin 33 mg/kg stat dose, then 16 mg/kg 6 hourly for 4 days, and then 8 mg/kg 8 hourly for 6 days. The constraints with this regimen are too frequent doses and longer duration of therapy (10 days). The second regimen is IV ribavirin 100 mg/kg stat, then 25 mg/kg daily for 4 days, and then 12.5 mg/kg daily for 3 days.[9]

LASSA FEVER EPIDEMIC PREPAREDNESS AND MANAGEMENT

Lassa fever outbreaks are capable of spreading fast causing large-scale outbreaks and panic, hence the need for preparedness. In addition, there is considerable public health, social and economic consequences of an outbreak, especially if not prepared for. Apart from the fact that epidemic preparedness is a statutorily mandated service, a delayed response can also lead to loss of lives.[18] Resources are likely to be judiciously use when an outbreak is well prepared for with a detail preparedness plan. A list of what should be done or required before, during, and after an outbreak of Lassa fever should be made. For instance, sensitization of health authorities and partners across the country, at the beginning of the epidemic season, dissemination to health facilities of technical guidelines and data collection and reporting tools (IDSR) and preposition drugs and personal protective equipment at State and LGA levels are important and should be included on the list. Surveillance, to detect timely any unusual situation or

Table 1: Worksheet for epidemic preparedness and response plan

Thematic area	Specific objective	Activities	Target	Indicators	Time line	Responsible	Budget
Surveillance							
Laboratory							
Case management							
Vaccination							
Coordination							
Social mobilization							
Capacity building							
Monitoring and evaluation							

event should be enhanced through the collection of relevant information for action.[9,18]

Thus, obtaining well-timed data needed for decision making to respond efficiently to Lassa fever epidemics becomes important through distribution of case definition or posters and brochures. There would be the need to conduct refresher training, monitor trends in disease reporting and distribute data collection and management tools. The laboratory should be identified and or strengthened to confirm the epidemic for any suspected cases.[9] Tools required for collection of the blood specimens and storage has to be listed in addition to transport requirement. Case management requirements, including ribavirin injections and tablets for prophylaxis should also be on the list.[16,18] The EPR committee meetings to coordinate interventions and mobilize resources in line with the IDSR guidelines are important to plan for. The committee will also be responsible for international cooperation, especially trans-border activities. These are expected to optimize the use of resources for an effective response.[9,12]

Finally, another important area to plan for during epidemic is communication and social mobilization.[9,12] The community needs to be informed appropriately. There will be the need to produce IEC materials for prevention and protection, have meetings with community groups and take them as partners. The media involvement and engagement are, therefore, very paramount. Other actions will include supervision, technical support on the field, training and orientation of staff, research, evaluation, feedback, and reports. When these have been listed, they could be categorized to thematic areas as shown in the worksheet template in Table 1, which will be developed to produce the epidemic preparedness plan. By definition, an epidemic preparedness plan is a written document giving decision-makers and other key players orientation on a list of activities to be implemented in order to respond to epidemics.[9] It includes the list of planned strategies and activities to face in an emergency situation during a given period. The steps for an epidemic preparedness plan include, defining the goal to be prepared to respond better to Lassa fever epidemics, defining the general and specific objectives of the plan and determining and listing activities to be implemented to reach the objectives. We also need to define the process, tools, and financial implications by quantifying and costing all activities.[9]

CONCLUSION

Preparing to respond to epidemic and other public health events such as Lassa fever is an important part of health-care delivery services. However, to be able to implement a coordinated disease outbreak response that will be timely and effective to prevent unnecessary deaths and disabilities, especially in resource-limited settings during disease outbreaks, an EOC model can be adopted by public health expert as it has proven to be an efficient preparedness framework for the control of disease outbreaks such as Ebola Virus Disease and other public health events in Nigeria and several African countries.

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Conflicts of interest
There are no conflicts of interest.

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