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Multisectoral One Health Based Joint Risk Assessment of Lassa Fever Virus in Sierra Leone

[1,2,3]Alhaji U. N'jai, [4]Umu-Kultumie Tejan-Jalloh, [5]Donald Grant, [6]Lily Kainwo, [7]Raymonda Johnson, [8]Mo-Bashir Idriss, [9]Angella M. George, [6]Joseph Bunting-Graden, [7]Mohamed S. Bah, [5]Mukeh Fahnbulleh, [5]James Squire, [5]Sulaiman Lakoh, [10]Fatmata Bockarie [11]Claudette Amuzu, [12]Jacqueline Lichoti, [12]Noelina Nantima,

[1]Department of Microbiology, College of Medicine and Allied Health Sciences and Department of Biological Sciences, Fourah Bay College, University of Sierra Leone, [2]Koinadugu College and Project1808, Kabala, Sierra Leone, [3]California University of Science and Medicine, [4]Department of Epidemiology and Biostatistics, University of Massachusetts, Amherst, USA, [5]Ministry of Health and Sanitation, Sierra Leone [6]One Health Secretariat, Ministry of Health and Sanitation, Sierra Leone, [7]Ministry of Agriculture, Sierra Leone, [8]Environmental Protection Agency, Sierra Leone, [9]Department of Community Health Sciences, Njala University, Sierra Leone, [10]Breakthrough Action, Sierra Leone, [11]World Health Organization, Sierra Leone, and [12]Food and Agriculture Organization, Sierra Leone

Abstract

Lassa fever (LF) is a viral hemorrhagic disease found in sub-Saharan Africa responsible for up to 300,000 cases and 5,000 deaths annually. LF is highly endemic in Sierra Leone, particularly in its Eastern Province. Acute LF cases most frequently presented during the dry season and case fatality rates (CFRs) among acute cases also peaked during the dry season. However, joint risk assessments (JRA) to determine likelihood of LF exposure and impacts on various communities has never been done. To fully understand the possible risks associated with LF virus disease in various communities, a multisectoral transdisciplinary One Health base Joint Risk Assessment (JRA) supported by FAO, OIE and WHO was conducted. The objective was to provide a basis for management or communications decisions regarding LF. JRA was done by trained experts drawn from the ministry of health and sanitation, ministry of agriculture, ministry of environment, and universities. The underlying assumptions for the JRA was the gap in knowledge on the introduction of LFV into Sierra Leone, animal reservoirs, and modes of transmission. Risk framing of the LF hazard was based on it endemicity in the country and increase in Lassa Fever incidence in non-endemic areas, coupled with limitations in clinical care and inadequate health worker safety. Following hazard and exposure characterization, a risk matrix was utilized to qualitatively determine the likelihood (negligible, low, moderate, high) of exposure and impact (negligible, minor, moderate, and severe) of the exposure on individuals and community. The JRA risk matrix assessment showed for instance that the likelihood of a health worker in a health facility being exposed to the LF Virus (LFV) infection is high, while impact is severe (CFRs of LF in humans will be high, with high disability and may cause epidemics), and level of Uncertainty is low (reliable data is available, although not specific to health care worker). Likewise, the likelihood of rodents infecting at least one person in Sierra Leone with Lassa Virus is high, while the Impact is moderate; due to availability of routine surveillance capacity, case management structures, and laboratory capacity, and level of Uncertainty is very low. This is consistent with the goal of the JRA and OH approach that suggest different exposure sources are associated with varying risks to humans and communities. Overall, the multi-sectoral OH JRA will inform policy makers and help

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formulate integrated action for detection, prevention, preparedness, and response to LF virus disease in Sierra Leone.

Introduction

Lassa fever (LF) is a viral hemorrhagic disease found in sub-Saharan Africa responsible for up to 300,000 cases and 5,000 deaths annually. LF is highly endemic in Sierra Leone (McCormick et al., 1987), particularly in its Eastern Province (Kamara et al., 2024; Samuels et al., 2020; Sesay et al.,2022). LF occurs in all age groups and both sexes. Acute LF cases most frequently presented during the dry season and CFRs among acute cases also peaked during the dry season. Subjects with recent (but not acute) exposure were significantly more likely to present during the rainy season.

Currently, there are no vaccines or proven therapeutics to prevent or control LF infection in humans. Due to the risks associated with LF infection in humans and the zoonotic nature of its transmission from animals (rodents) to humans (Njuguna et al., 2022; Webb et al., 1986; Shaffer et al., 2019; Kamara et al., 2024), a multi-sectoral (human, animal and environmental sectors) and multidisciplinary joint risk assessment (JRA) was conducted to understand the exposure scenarios for LF and impacts on various communities in Sierra Leone. The objective of the JRA was to support mitigation of the risks associated with Lassa Fever Virus and provide a basis for management or communications decisions regarding Lassa Fever (LF).

The JRA technical team assessed Lassa Fever Virus in terms of the likelihood and impact of a health worker in a health facility being exposed to the Lassa Fever Virus (LFV) infection within the next twelve months in Sierra Leone. In addition, the likelihood and impact of rodents infecting at least one person in Sierra Leone with Lassa Virus within the next six months. The overall goal of the JRA is to help understand the exposure scenarios associated with LF from animal to human and risk assess the likelihood of infection and impact of infection on the population. The results of the JRA will enhance risk communication and policy development to support mitigation and control of infections.

Approach or Methodology

Risk Framing

Hazard: Lassa Fever Virus

Lassa Fever is endemic in the country. Some districts particularly in the east experience frequent outbreaks with sporadic cases in neighboring districts. Increase in Lassa Fever incidence in non-endemic areas, coupled with limitations in clinical care and inadequate health worker safety.

Scope:

The scope of the JRA is health risks at the human-animal-environment interface posed by the above hazard within Sierra Leone.

Key assumptions underlying JRA

There is a lot of gap in knowledge in LFV. Information on the introduction of the LFV into Sierra Leone is not clear, but it has been genetically linked to its occurrence in Nigeria as far back as in 1969. It could have been introduced through an infected person from Nigeria or infected Rodent. It might also have

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been existing in Sierra Leone but not identified (the undiagnosed Yengema fever could have been due to LFV). LFV might be living within breed of other rodent or wild animal and can be transmitted through aerosol

Results

The likelihood a health worker in a health facility being exposed to the LFV infection within the next twelve months was determined to be high (Figure 1). The Rationale for likelihood estimate was there have been cases of LF in the country among healthcare workers within the last two years. It is assumed that the outbreak of LF will re-occur among healthcare workers in the country. The uncertainty level for likelihood estimate is low due to availability of reliable data, although not specific to health care workers. The impact of exposure was estimated to be severe. The rationale for impact estimate was that the CFR of LF in humans is high (65.5%), high disability in humans, and the potential to cause epidemic. The uncertainty level for the impact estimate was very Low (figure 1). The rationale for the low uncertainty level associated with impact estimate was the availability of reliable data and information are available on Lassa Fever in sufficient quantity.

The likelihood of rodents infecting at least one person in Sierra Leone with Lassa Virus within the next six months was estimated to be high (Figure 2). The rationale for the likelihood estimate was LF is endemic in Sierra Leone and has occurred in the country in the last six months, rodents are present in all districts around the country and is assumed that some of the rodents are host for Lassa virus. The uncertainty level for likelihood estimate is low (Figure 2). The rationale for uncertainty level associated with likelihood estimate is that reliable data and information is available on Lassa Fever cases but the information on rodents is limited to some part of the country, results based on expert consensus. The impact is estimated to be moderate. The rationale for impact estimate is based on the availability of routine surveillance capacity, case management structures, and laboratory capacity. It is assumed that these available structures will enhance early detection and response. The uncertainty level for impact estimate is determined to be very low. Rationale for uncertainty level associated with impact estimate is based on the availability of reliable data and information available in sufficient quantity.

Discussion

The assessment of the likelihood and impact of a health worker in a health facility being exposed to the LFV infection within the next twelve months in Sierra Leone, shows that the Likelihood is High (there have been cases of LF in the country within the last two years), the Impact is Severe (CFR of LF in humans will be high, with high disability and may cause epidemics) and level of Uncertainty is Low (reliable data is available although not specific to health care worker). Therefore, the risk is critical with regards the implementation of mitigating measures. These findings are consistent with previous studies on LF in Sierra Leone (Balogun et al., 2021; Shaffer et al., 2021; Shaffer et al., 2014; Gary, 2023; Njuguna et al, 2019; Samuels et al., 2020; Kamara et al., 2024; Ama et al, 2024) The management and communication include, 1) Infection Prevention Control (IPC), 2) vector control, and 3) early detection (Surveillance). In the short term, simulation exercises to assess response options for IPC should include, refresher training, provision of IPC materials, and enforcement of adherence to IPC

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measures. For Vector control in the HF, Environmental sanitation and use of rodenticides/ rap traps, whereas surveillance should include, active surveillance, establish standard case definition, and refresher training of HW on LFV, consistent with other studies on environmental and behavioral determinants of LF infections (Kumoji et al., 2022). For Long Term management for surveillance should include sustainability of active surveillance, whereas for long term management with vector control should include, improved sanitation, improved HF infrastructures, and use of Rat traps/Rodenticides. Long term management for laboratory involves establishing point of care diagnostic test kits at PHU's. IPC long term strategy includes establishing isolation units in all HF, maintaining adequate IPC supplies, and establishing treatment facilities in all district's hospitals. The communication options include, 1) developing key messages on LFV, 2) awareness raising among HW on signs and symptoms and mode of transmission of LFV, and printing and distribution of standard key definitions across HF

The assessment of the likelihood and impact of rodents infecting at least one person in with Lassa Virus within the next six months in Sierra Leone indicated that the Likelihood is High (Lassa Fever is endemic in Sierra Leone and has occurred in the country in the last six months and rodents are present in all districts around the country), the Impact is Moderate (availability of routine surveillance capacity, case management structures, and laboratory capacity) and level of Uncertainty is very Low (reliable data and information available in sufficient quantity). Therefore, the risk is critical in respect of implementation of mitigation measures. This is also consistent with the One Health approach to LF infection and management discussed in previous studies (Nwafor et al., 2021; Arruda et al, 2021). The management options in the short term for vector control with in WAU district were rat traps/rodenticides, improve sanitation of houses, and regular sanitary inspection of houses in WAU. For Surveillance, strengthening community-based surveillance systems was central for short term management. In the long term, vector control options suggested including improve maintain sanitation, improve housing condition, continue regular sanitary inspection of dwelling houses, and effective implementation of Public Health Ordinance/Acts. The communication options suggested, 1) development of community messages on LF transmission prevention and control, 2) Printing and distribution of IEC materials across all communities with in the WAU districts, and 3) Nutrition education and alternatives source of protein. The short to long-term management options are consistent with studies that have shown gaps in knowledge, attitude and risk perception for LF in communities (Kamara et al., 2024; Al-Mustapha et al., 2024; Kamara Kassim et al, 2024)

The JRA on LF identified gaps and data needs that includes, 1) specific data on health workers in terms of Lassa Fever infection, 2) information on rodents in other districts, 3) data for asymptomatic and mild cases around the country, and 4) further case investigation for suspected cases in non-endemic districts. Establishing data collection platform for rodents across all district was strongly recommended.

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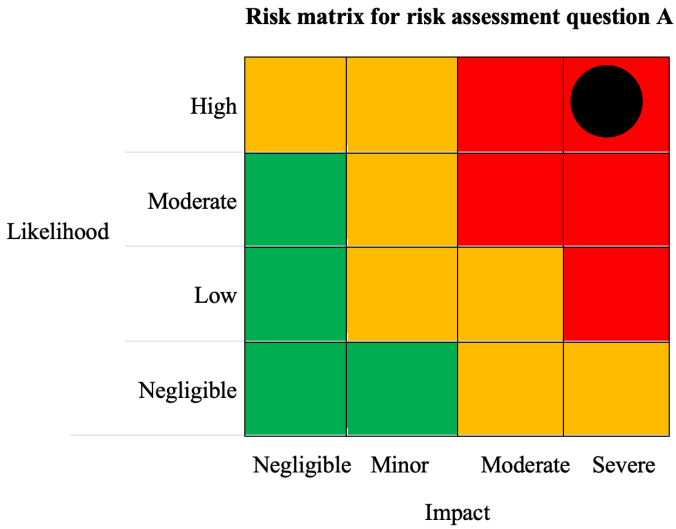

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Figure 1: The likelihood and impact of a health worker in a health facility being exposed to the Lassa Fever Virus infection

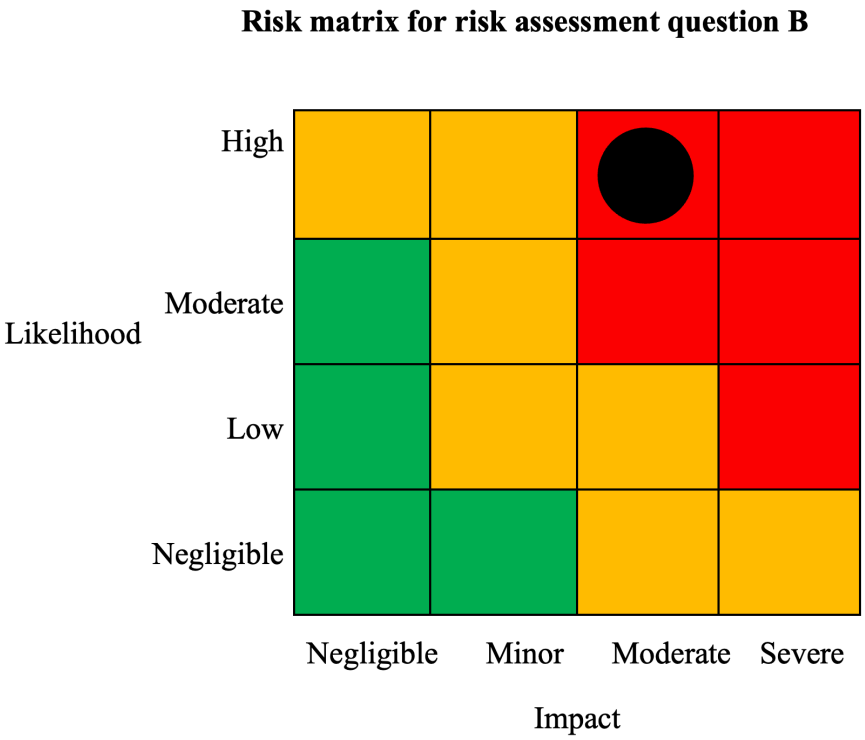

Figure 2: The likelihood of rodents infecting at least one person in Sierra Leone with Lassa Fever Virus