

# The Perspectives of Healthcare Professionals on the Strategies, Challenges, and Community Responses to Health System Response and Interventions Towards Lassa Fever Infections and Mortality in Sierra Leone

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**Background:** Lassa fever is a critical public health issue in Sierra Leone that demands appropriate health system responses and interventions to mitigate infections and reduce mortality.

**Methods:** A qualitative study was conducted to delve into healthcare workers' experiences with Lassa fever management and interventions across diverse healthcare settings in Sierra Leone, including the Eastern Province and Freetown's Directorate of Health Security and Emergency (DHSE). Engaging ten key informants through purposive sampling, the study employed NVivo version 10 for a detailed thematic analysis using Query and Coding to systematically identify, classify, and organize key themes regarding knowledge, diagnostics, management roles, and community impact.

**Results:** The findings indicate a well-informed healthcare workforce but highlight gaps in early detection, diagnostic accuracy, and procedural standardization. Concerns were raised about the potential overestimation of disease incidence due to improved diagnostics, suggesting a historical under-detection of Lassa fever. The analysis underscores the need for a multifaceted management approach, emphasizing international collaboration and culturally sensitive community engagement to effectively tackle the disease. A significant concern identified is the high mortality rate resulting from delayed referrals and communication challenges within the health system, leading to actionable recommendations for enhancing Lassa fever response strategies. The study's thematic analysis provides a nuanced understanding of the challenges and areas for improvement, emphasizing the critical role of healthcare professionals in combating Lassa fever.

**Conclusion:** Combating Lassa fever in Sierra Leone demands an integrative strategy that extends beyond medical interventions to encompass educational and infrastructural enhancements. This research pays homage to the commitment of healthcare professionals, underscoring the importance of sustained support and recognition of their essential contributions to advancing Lassa fever management and interventions.

**Keywords:** Lassa fever, Sierra Leone, healthcare professionals, health system response, community engagement, diagnostic challenges, mortality, communication strategies

## Introduction

Viral Hemorrhagic Fever (VHF) represents a group of illnesses that are not only a medical concern but also a profound socio-economic and political challenge. These diseases, which include Lassa Fever, Ebola, and Marburg, among others, have historically posed significant threats to global health, especially in regions like Africa. West Africa, particularly with its intricate tapestry of cultures and communities, has been a recurrent epicenter for some of these outbreaks.<sup>1-3</sup> The primary mode of transmission of Lassa Fever to humans is through rodents, though it also holds potential for human-to-human

transmission.<sup>4–6</sup> The disparity in mortality rates, which can fluctuate between 1% to 50%, underscores the crucial role of accessible and high-quality medical care.<sup>7–9</sup>

As Over the years, the global health community has redoubled its efforts to understand and contain the spread of these diseases, especially in the regions that bear the greatest burden.<sup>10</sup> While the 2014–2016 Ebola outbreak in West Africa is well remembered, Lassa Fever has consistently challenged the region since its discovery in Nigeria in the late 1960s.<sup>11</sup> Sierra Leone's health system has been a pioneer, in developing treatments and initiatives to monitor and mitigate the spread of Lassa Fever across the Mano River Union nations and West Africa.<sup>12</sup>

In November 2019, Sierra Leonean health officials, with support from WHO and other partners, responded to an outbreak of Lassa Fever that affected Tonkolili and Bombali districts.<sup>13</sup> As of November 28, 2019, there were 23 confirmed cases and 10 deaths. The outbreak was triggered by a probable case who died after surgery at a rural hospital IN Tonkolili District.<sup>14</sup> Two healthcare workers who participated in the surgery also got infected, and one of them died in the Netherlands after being medically evacuated.<sup>15</sup> Efforts to control the outbreak have been focused on strengthening surveillance, contact tracing, laboratory testing, infection prevention and control, case management, and community engagement. WHO and partners are providing technical and logistical support to national authorities. The risk of further spread of the outbreak is considered high due to the high population density, weak health system, and frequent movement of people in the affected areas.<sup>13</sup>

Healthcare professionals, critical in this response, offer valuable insights into the strategies in play, the challenges confronted, and the community feedback to these measures. Their narratives elucidate the real-world impact of policy choices, infrastructural issues, and socio-cultural factors that shape disease management.<sup>15</sup> Yet, the distinctions of these treatments, especially as perceived by healthcare workers, often remain underrepresented.<sup>2,16</sup> The firsthand experiences, backed by studies such as the 2019 WHO's report on hemorrhagic fevers in West Africa, provide a comprehensive understanding of disease management strategies.<sup>17</sup>

Research on a global scale has painted a comprehensive portrait of health system responses to Lassa fever.<sup>18–20</sup> These studies act as fundamental roadmaps, spotlighting best practices, preventive measures, therapeutic solutions, and guiding lights for countries wrestling with the disease. Yet, to truly grasp the multifaceted challenges and subtleties, it is paramount to narrow our focus to regional and national narratives.

The prevalence of LF in Africa reinforces the need for comprehensive public health interventions and disease control measures to limit its spread. Many of these diseases are continually threatening health systems in low-resource countries, including Sierra Leone, and have the potential to trigger new pandemics<sup>21</sup> and its risks influence travel, trade, and tourism.<sup>22</sup>

This research explores the experiences of healthcare personnel engaged in Lassa fever initiatives in Sierra Leone. The primary objective of this study is to elucidate the complexities involved in managing the Lassa virus by examining the perspectives of healthcare professionals. Through the synthesis of empirical research and professional testimonies, this investigation seeks to deliver a comprehensive analysis of Sierra Leone's methodologies in addressing Lassa Fever. This scholarly endeavor not only enriches the academic discourse on the subject but also contributes to the formulation of more efficacious interventions, thereby equipping Sierra Leone and analogous nations with the knowledge to navigate health challenges with greater efficacy.

## Methods and Strategies

### Study Design, Location, and Population

We adopted an approach that focused on the quality of the experience, and we used qualitative methods to gather and analyze data. The goal of this strategy was to gain a better understanding of the experiences of healthcare personnel working in Lassa fever interventions and programs. The study covered Panguma Government Hospital, Nixon Memorial Hospital Segbwema, Kenema Government Hospital, and the Directorate of Health Security and Emergency (DHSE). These institutions were chosen because they are the major players in the fight against Lassa fever. Healthcare professionals from Sierra Leone who have participated in Lassa fever interventions and activities are among the targeted groups. Among them were physicians, nurses, laboratory technicians, public health officials, and community health workers.

## Sampling Procedures

The selection of participants through purposive sampling for our study on interventions for LF was meticulously planned to encompass individuals with firsthand knowledge and experience in managing LF outbreaks. By incorporating a diverse range of healthcare professionals, our approach ensures a robust and comprehensive understanding of the challenges and strategies pertinent to combating Lassa fever in endemic regions.

The study rigorously included ten healthcare professionals, chosen based on stringent criteria to encapsulate a wide spectrum of expertise directly relevant to Lassa fever and other viral hemorrhagic fevers. This selection involved individuals at the forefront of Lassa fever management and response efforts within Sierra Leone, particularly those with significant experience in patient care, outbreak management, and operational roles within critical healthcare infrastructure. Specifically, our participants included case management team leads from the Directorate of Health Security and Emergency in Freetown, district medical officers, medical superintendents from key hospitals, and leading nursing and laboratory personnel involved in direct patient care and diagnostic services for Lassa fever.

This purposive approach to participant selection is a key strength of our study, as it enables us to draw upon the rich, in-depth insights and experiences of those intimately involved in the fight against Lassa fever. Their contributions are invaluable in shaping a nuanced understanding of effective interventions and challenges faced in the field, thereby offering a solid foundation for recommendations aimed at enhancing Lassa fever management and prevention strategies.

However, it is important to acknowledge the limitations inherent in this sampling method, including potential biases and the scope of generalizability. The insights derived from our study, while profound, represent the experiences and perspectives of a select group of professionals. Thus, our recommendations are best viewed as highly informed guidance rather than universal solutions. They offer a critical starting point for further research, dialogue, and action toward refining and implementing effective interventions for Lassa fever, with the potential for adaptation and expansion to broader contexts within endemic regions.

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## Data Collection, Tool and Analyses

We used a semi-structured interview technique in which a Key informant interview was employed to harness data on healthcare workers' experiences with LF implementation. The strategic deployment of three enumerators to conduct interviews with ten key informants across four geographically dispersed locales namely: Nixson Hospital in Segbwema, Panguma Catholic Hospital in Panguma town, Kenema Government Hospital in Kenema town, and the Directorate Office in Freetown was underpinned by a series of critical considerations. These considerations were aimed at optimizing the quality, efficiency, and depth of data collection for the study of LF program implementation. This deployment facilitated

the utilization of a semi-structured interview technique, leveraging KIIs to elicit detailed insights and sophisticated understandings from the vanguard of LF program implementation.

The logistical approach, necessitated by the geographic distribution of the interviewees, balanced thorough coverage with the practical constraints of time, budget, and human resources. This was effectively managed by assigning three trained enumerators, thereby ensuring that each site received comprehensive attention and that data collection was executed within the temporal confines of the project. The meticulous training of these enumerators was paramount, establishing a standardized method of capturing interviews via android smartphones, which minimized variability in data recording and ensured a focus on the qualitative depth of the interviewees' responses.

The questionnaire was developed by the authors with consultations with post-literature and deliberations.<sup>23–25</sup> The development of a rigorously designed questionnaire conceived through extensive consultations and validated via pretesting and feedback mechanisms underscored the necessity for a carefully calibrated number of enumerators. Pre-testing was done among healthcare professionals at the Bo government hospital sharing a similar nature of the actual study subjects. The questionnaire's open-ended interview guides necessitated enumerators proficient in navigating its depth and breadth to effectively probe for personal perspectives, challenges faced, and recommendations for improvement. The presence of three adept enumerators guaranteed that each interview was conducted with the requisite sensitivity and adaptability, thus capturing rich, qualitative data.

Further enriching the academic discourse, the integration of advanced functionalities of Query and Coding within NVivo version 10 played a seminal role in the systematic identification, classification, and organization of key themes. These themes pertained to critical areas such as knowledge dissemination, diagnostic practices, management roles, and the community impact of LF program interventions. The employment of Query functionality facilitated the efficient sifting through the extensive data generated by the interviews, enabling the research team to isolate and examine relevant data segments related to predefined thematic areas.

The subsequent application of the Coding feature allowed for the meticulous classification of these instances into structured themes and subthemes, thereby transforming raw interview data into a systematically organized form. This process illuminated the intricate interplay between key themes, providing a sophisticated exploration of the data collected.

This methodological rigor, embodied in the systematic application of Query and Coding functions, not only streamlined the analytical process but also ensured a high level of consistency in thematic analysis. By systematically identifying, classifying, and organizing key themes regarding knowledge, diagnostics, management roles, and community impact, the study furnished a comprehensive understanding of LF program implementation. This sophisticated approach facilitated the derivation of insights deeply rooted in empirical data, laying a robust foundation for the development of evidence-based recommendations aimed at enhancing LF management and intervention strategies.

## Ethical Considerations in Study Conduct

To prioritize the confidentiality and privacy of all study participants, we took great care in preparing detailed informed consent forms for each individual to sign before their participation. These forms clearly outlined the purpose and nature of the study, as well as the participant's right to withdraw at any time without consequence. Additionally, the consent forms provided extensive assurances regarding the protection of participants' personal information, stating that such data would only be used for research purposes and kept confidential. It is worth noting that the consent forms explicitly addressed the possibility of anonymized responses being published in research findings, ensuring that participants were fully informed. This study adhered to the highest ethical standards and was overseen and approved by the Njala University Institutional Review Board, which upholds ethical compliance in research activities.

## Findings

This study examined the country's context of health system reaction, programs, and interventions in Lower Bambara Chiefdom, Eastern Sierra Leone, regarding LF infections and mortality. The qualitative data were presented under specific theme categories that were guided by the interview guide. Nine themes were generated from the transcripts. In

the analysis, direct quotations from research participants were utilized to represent participants' viewpoints on certain subject concerns.

## Respondent Sociodemographic Characteristics

Table 1 outlines the socio-demographic and professional details of ten healthcare sector workers, featuring a mix of three females and seven males, with ages spanning from 29 to 75 years. These individuals hold varied positions, including nurses, medical doctors, laboratory technicians, surveillance officers, monitoring and evaluation officers, and a director, reflecting a broad spectrum of expertise within healthcare. Their experience ranges significantly from 7 to 45 years, suggesting a deep reservoir of knowledge and expertise across the group.

Participants are affiliated with different regions and places of employment, predominantly within Kenema and its vicinity, along with Freetown, indicating the geographic focus of the study. Specific workplaces mentioned include wards and hospitals such as the Kenema Government Hospital, Nixson Hospital Segbwema, and Panguma Government Hospital, as well as roles within the District of Health Response Emergency. This collection of data showcases the diverse backgrounds, roles, and environments these healthcare professionals operate in, offering a comprehensive view of the range of expertise and settings within the healthcare sector in these regions.

## Theme 1: Knowledge of LF Programs and Interventions

This foundational theme is crucial as it serves as the basis for all other themes. It highlights the necessity of healthcare professionals' understanding of Lassa Fever, including its transmission and treatments. The majority of healthcare stakeholders in Sierra Leone possess extensive knowledge about LF programs and interventions. This topic is divided into two subthemes: concern about spread and diagnostics, and role and responsibilities in LF management (See Table 2). The subthemes indicate that although there has been some progress in knowledge and skills concerning LF programs and interventions, gaps still need to be addressed. The study participants emphasized the importance of capacity-building interventions, particularly in enhancing the ability of healthcare workers to quickly identify suspected cases of viral hemorrhagic fevers and to utilize standard operating procedures for LF prevention, control, and management.

**Table 1** Socio-Demographic Characteristics of Study Participants

Participant	Age	Gender	Professional Background	Years of Experience	Region of Expertise	Place of Work
1	45	Female	Nurse	15	Kenema	Lassa Ward – Kenema Government hospital
2	55	Female	Nurse	21	Kenema	Matron – Kenema Government
3	48	Male	Medical Doctor	12	Kenema	District Medical Officer
4	75	Male	Medical Doctor	45	Segbwema - Kailahun	Medical Superintendent _ Nixson Hospital Segbwema
5	33	Male	Laboratory Technician	8	Kenema	Laboratory – Kenema Government hospital
6	29	Male	Laboratory Technician	7	Panguma – Kenema	Panguma Government Hospital
7	65	Male	Medical Doctor	35	Panguma – Kenema	Medical Superintendent – Panguma Government Hospital
8	45	Male	Surveillance Officer	10	Freetown	District of Health Response Emergency
9	55	Male	Monitoring and Evaluation officer	28	Freetown	District of Health Response Emergency
10	52	Male	Director	25	Freetown	District of Health Response Emergency

Table 2 Summary of Themes and Subthemes

Theme	Sub-Theme	Illustrative Quote
<b>Knowledge of LF Programs and Interventions</b>	Concern about Spread & Diagnostics	“Well, the first thing to consider is the concern among people about the spread of LF to other areas. It is important to critically examine whether it is a genuine spread or if it is due to improvements in diagnostics”.
	Roles & Responsibilities in LF Management	“We are responsible for covering the health component of LF, including diagnosis through MoHS surveillance activities, as well as its management. Given that LF is categorized as a Grade A security issue, managing cases is crucial to ensuring health security. ”
<b>Role of the Health System and Partnership Collaboration in LF Programs</b>	Institutional Collaboration & Structured Coordination	“We have a range of partners, including WHO, CDC, Tulane University, Harvard University, MSF, among others... each activity is in line with the MoH's objectives”.
	Global Context and Imperative for Research	“Absolutely! When it comes to development, LF is not limited to Sierra Leone alone. There is still much work to be done in terms of development through research”.
	Evolution of Health Systems through Partnership	“Tulane University has played a significant role in the transformation of the health system in Sierra Leone. With the DHSE now in place, the partners are more actively involved in decision-making processes”.
<b>Impact of Community Participation/ Cultural Practices on LF Programs</b>	Community Resistance and Strategies	“When you go to some communities, as I mentioned, there are pockets of resistance because we have some that would believe that if you have researchers or people that are entering into communities, they would introduce samples and the virus”.
	Traditional Beliefs and Behavioral Change	“Well, one thing I will say is that, to agree with a fool you listen to him/her first. Traditional people have their own beliefs and practices... when the ambulance comes, they are nowhere to be found”.
<b>Exploring LF Mortality and Death Certification</b>	Issues with Mortality Surveillance and Death Certification	“Yes, there is a possibility that people could be dying of LF without being reported to any medical facility or hospital because first of all those people do not report the deaths of their loved ones”.
	High Case Fatality Rates due to Late Referrals	“Case fatality is high because we do get cases now that would come of late but if they have cases that are referred early which is the primary thing when you talk about hemorrhagic fever, it will help a lot”.
<b>Channel of Communication on LF Programs and Interventions</b>	Communication Delays and Safety Concerns	“The difficulty at hand presents a significant risk to the successful execution of interventions for LF. RDTs can serve as a solution to overcome such challenges”.
	Training, Knowledge Gaps, and Consistent Updates	“What I am going to say is, one of the things we normally fail to get right is communication. Most of the time, I do engage the staff on key areas in the laboratory operations to update their skills”.
	Established Communication Protocols and Hierarchy	“So, as I mentioned, is part of the ministry of health... there are channels or lines of communications established by the ministry of health that have been followed”.
	Feedback Mechanisms and Referral Communication	“The only problem we have had with our referral hospital KGH is that they normally do not give us feedback... sometimes they get to send us feedback as well as a patient survive or died or whether they suffered further complications”.

<b>Challenges in LF Program Implementation</b>	Assessing Risk of Infections among Healthcare Workers	"According to the PGH key informant interview, a clinical staff member contracted LF from a patient in the hospital. The staff member had grown fond of a young child who was being treated for the virus".
	Mobility and Risk Perception	"Mobility is currently one of the main challenges that we face in our unit... reluctance of most motorbike riders in Panguma town to transport suspected laboratory samples".
	Comprehensive Challenges	"Currently, we face several challenges in our work... urgent need for improvement in these areas to enhance our ability to tackle this disease".
	Effective Intervention Strategies and Resource Management	"To date, we have not implemented any specific interventions for LF, aside from the projects led by the Tulane University team based in Kenema. However, we did initiate a Lassa fever survivors' project, but it was impacted by the COVID-19 outbreak".
<b>Sustainability in LF Management, Control, and Prevention</b>	Government Responsibility and Prior Donor Dependence	"I believe government always has it at the back of its mind that the work we are doing is for our own people, not for the donors. As a hospital, we do not have funds or any mechanisms at the moment to continue with the Lassa intervention in case donors and partners stop providing financial and logistical support".
	Sustainability through Local Leadership	"When we talk of sustainable approach, I think one of the ways we can to be sustainable as it is now is been led by the MOHS... it means it would be easy and more sustainable".
	Government's Inherent Responsibility	"That is their responsibility, the responsibility of the MoHS is taking care of the citizens of Sierra Leone... they support of the ministry is providing the human resource, infrastructure for diagnostics and all of these".
<b>Lessons Learnt and Ways to Improve LF Program Delivery</b>	Financing and Resource Provision	"The best way of improving the effectiveness of all LF services in Sierra Leone is just through finance. Finance, human resources, and laboratory interventions most especially if reagents and the rapid diagnostic test could be supplied to us would serve as a very good strategy in moving to the positive path".
	Emphasis on Research and Practical Solutions	"For me I will not just sit and say we need to develop this model. As for me I do not believe in getting policies all the time. All you do with the policies; you write them down. If we get to straight things right, disparities, diagnostics and vaccines will go forward".
	Transparency, Accountability, and Communication	"In order for us involved in the fight against LF in Sierra Leone to work effectively, there is need for transparency, accountability and communication across the board. If transparency and accountability are improved on and maintained, I believe Lassa interventions will be more robust and effective".
<b>Recommendations for LF Interventions</b>	Laboratory Equipment and Reagents	"Okay like in the first place we need to equip the laboratory, we need to be having most of the reagents, (because at times reagents can be outdated also lose their powers or potency) ".
	Decentralization of Testing Facilities	"...then we also need to increase the testing power of Lassa to other regional districts not only in Kenema. Because for example if you have Lassa in Tonkolili, there's no need to take the samples from there to Kenema so we also need to have it in regional districts to reduce the cost of petrol and risk of transporting samples; that is..."
	Staff Training and Manpower	"And number (3) we train more staff to have more manpower".

## Subtheme (i): Concern About Spread & Diagnostics

Participants discussed the spread of Lassa fever (LF) and questioned if improved diagnostics may have led to an overestimation of disease incidence. This raises the possibility of previous under-detection of LF due to limited surveillance efforts.

Well, the first thing to consider is the concern among people about the spread of LF to other areas. It's important to critically examine whether it is a genuine spread or if it is due to improvements in diagnostics. In the past, testing may have been limited to Kenema, which could have resulted in cases being missed in other districts. However, with increased surveillance activities across the country, we have learned from the Ebola outbreak that if you don't actively search for something in public health, you won't find it. Therefore, it's important to determine if the reported increase in cases is a true increase or if it's due to better identification of existing cases. Studies have shown that the vectors responsible for spreading Lassa fever, such as the *Mastomys*, are present throughout the country. (KII-KGH)

Fundamentally linked to knowledge and awareness, the enhancement of diagnostic methodologies is crucial for the prompt detection and management of Lassa Fever. This improvement directly influences both the outcomes of treatments and the understanding of the disease's propagation dynamics.

## Subtheme (ii): Roles & Responsibilities in LF Management

Respondents emphasize the multifaceted roles of LF management including diagnosis, community engagement, and its significance for national security.

We are responsible for covering the health component of LF, including diagnosis through MoHS surveillance activities, as well as its management. Additionally, we engage with the community to raise awareness about the disease. However, effective community engagement requires a collaborative approach that involves all line ministries to ensure a comprehensive health response. Given that LF is categorized as a Grade A security issue, managing cases is crucial to ensuring health security. This is why the ONS secretariat plays a key role in managing the disease. (KII-KGH)

## Theme 2: Role of the Health System and Partnership Collaboration in LF Programmes

This theme underscores the integral role of the healthcare system in formulating and executing strategic responses to Lassa Fever. It is significantly influenced by the prevailing knowledge base and diagnostic capabilities, impacting the efficacy of community engagement and collaborative partnerships.

This study provides insight into the health system of Sierra Leone, which is constantly evolving and incorporating global perspectives. It highlights the nation's dedication to organized collaboration, the urgent need for research and development in the LF field, and the transformative effects of international partnerships on health infrastructure and policies. The main theme is further divided into three sub-themes: institutional collaboration and structured coordination; the global context and the importance of research; and the evolution of the health system through partnerships (See [Table 2](#)).

## Subtheme (i): Institutional Collaboration & Structured Coordination

Working with a diverse range of partners, including global health organizations and renowned universities, demonstrates a broad spectrum of expertise. The existence of structured guidelines and service-level agreements indicates an organized and systematic approach to collaboration.

We have a range of partners, including WHO, CDC, Tulane University, Harvard University, MSF, among others. Their activities align with those of the MoHS, and they provide support and complement our efforts under a set of guidelines... each activity is in line with the MoH's objectives. (KII-KGH)

## Subtheme (ii): Global Context and Imperative for Research

The discourse provided by study participants eloquently explains the extensive ramifications of LF as an issue of international concern, surpassing the confines of Sierra Leone and asserting its prominence as a pivotal global health

challenge. The accentuation on the perpetual requirement for research elucidates the extant lacunae in our comprehension and delineates the pivotal domains necessitating immediate intervention for the formulation of efficacious counter-measures. Such recognition acts as a clarion call to the global consortium, underscoring the assertion that strides in mitigating LF are inextricably linked to the progression of research endeavors. This encompasses not merely the empirical elucidation of the virus and its modes of transmission but extends to the innovation of vaccines, diagnostic methodologies, and therapeutic modalities. The proclamation accentuates the critical need for persistent investigative endeavors and posits that the attainment of noteworthy benchmarks in the management and curtailment of LF is dependent upon a cohesive framework of international cooperation, substantial funding, and the seamless amalgamation of research outcomes into public health directives. It suggests a methodical approach to public health interventions, one that is perpetually informed by research and development initiatives, advocating for an international collaborative effort to catalyze innovation and disseminate knowledge, thereby amplifying the collective response to Lassa Fever.

Absolutely! When it comes to development, LF is not limited to Sierra Leone alone. There is still much work to be done in terms of development through research and we have not yet reached saturation in our understanding of Lassa fever. (KII- KGH)

### **Subtheme (iii): Evolution of Health Systems Through Partnership**

The involvement of Tulane University showcases how international collaborations can bring about transformative changes. The transition from the Directorate of Disease Prevention and Control (DPC) to the Directorate of Health Security and Emergency (DHSE) in Sierra Leone's healthcare system underscores its evolution, emphasizing a more collaborative and inclusive approach. The decision-making process involves active participation from partners, indicating a shift towards a more participatory model, which integrates external expertise with local insights to form a comprehensive healthcare strategy.

Tulane University has played a significant role in the transformation of the health system in Sierra Leone. With the DHSE now in place, the partners are more actively involved in decision-making processes. (KII-DHSE)

## **Theme 3: The Impact of Community Participation/Cultural Practices, Beliefs and Traditions on LF Programmes Interventions**

The efficacy of Lassa Fever intervention strategies is contingent upon robust community participation, which, in turn, is influenced by healthcare professionals' capacity for effective communication, comprehension of local cultural beliefs, and engagement with the community in a manner that is sensitive to cultural intricacies.

The narratives show how cultural beliefs and community dynamics influence Lassa Fever interventions. Community-centered, culturally sensitive approaches that provide evidence-based health education, foster trust, and encourage community ownership are critical for success. Two subthemes emerged (See [Table 2](#)).

### **Subtheme (i): Community Resistance and Strategies**

The text highlights the distrust some communities have towards external health workers and researchers after the Ebola outbreak. Conspiracy theories and cultural practices pose significant barriers to LF interventions. A community engagement strategy is crucial to gaining community trust, requiring grassroots-level sensitization and tailored communication strategies.

When you go to some communities, as I mentioned, there are pockets of resistance because we have some that would believe that if you have researchers or people that are entering into communities, they would introduce samples and the virus. So, these are the challenges across. (KII-KGH)

### **Subtheme (ii): Traditional Beliefs and Behavioral Change**

The research sheds light on the deep-seated cultural beliefs and practices, such as rat consumption, that pose obstacles to LF interventions. The statement emphasizes the traditional and generational reluctance to accept external health advice. The use

of historical examples of Lassa cases from the community or neighboring areas as cautionary tales highlights the importance of implementing context-specific behavioral change strategies. The mention of denial and evasion by some community members, when diagnosed, further emphasizes the challenges faced in ensuring compliance with medical recommendations.

Well, one thing I will say is that, to agree with a fool you listen to him/her first. Traditional people have their own beliefs and practices... when the ambulance comes, they are nowhere to be found. (KII-PGH)

## Theme 4: Exploring LF Mortality and Death Certification

The study looked at mortality and death certification in the context of LF response programs and interventions. According to the findings of the study, death certificates should be produced for each death that happens at a health facility, indicating the reason of death by medical autopsy. Some participants, however, stated that the job has now been duplicated due to the presence of the National Civil Registration Authority (NACRA).

Participants in the study reported that there is no specific death certificate issued for LF. All deaths, including LF, are certificated, but 70 to 80% of deaths occur outside healthcare facilities where no death certificates are issued, and thus the cause of death remains unknown. This highlights the importance of strengthening mortality surveillance and death certification in the context of LF, which is critical for understanding the disease burden and treatment options.

The study also highlighted that the case fatality rates of LF are relatively high due to late referral of suspected patients, which poses a challenge in LF case management and other response programs. This emphasizes the need for early diagnosis and treatment of LF, as well as strengthening community awareness and education on the disease to ensure prompt referral of suspected cases (See [Table 2](#)).

Case fatality is high because we do get cases now that would come of late but if they have cases that are referred early which is the primary thing when you talk about hemorrhagic fever, it will help a lot. But if you identify them late that is a little bit challenging because, hemorrhagic complications will set in and they sometimes come in convulsing or they are already bleeding, it is a rare stage, and is very likely that the patient will die. (KII Lassa Ward, KGH)

The result of the study suggests that LF deaths may be occurring at the community level without being captured by the conventional Ministry of Health (MoH) mortality surveillance system. This finding is significant because it highlights potential gaps in the surveillance system, which could have implications for disease control efforts.

Yes, there is a possibility that people could be dying of LF without being reported to any medical facility or hospital because first of all those people do not report the deaths of their loved ones most of the time, so it is possible that people can just die of certain diseases which they think could be associated with certain conditions that are traditional. So, at the end of the day, they won't be able to report such a death, they will bury the individual and simply forget. (KII-NMH Segbwema)

I believe some of the reasons can be one, because of lack of knowledge of LF, two, because of negligence, cost of transportation to come to the hospital for care, and maybe because of their beliefs. People in this part of the country believe that if someone has the signs and symptoms and cannot attribute those signs and symptoms to a particular disease e.g., LF, they will tend to associate it with witchcraft for which there could eventually be no viable treatment leading to the unreported death of the individual. (KII-PGH)

Yes, it is possible because the knowledge about it is that 80% of the cases are hosted with rats as you have cited here you knew you must have contracted the disease without knowing. So there has to be a report that 80% of people would contract the disease and would not get sick. So, if you do a quick survey here, you would get people, who just test for exposure you would be surprised. So, it does not that because you are infected, you will get sick. Only 20% would come down with severe symptoms that will require hospitality. (KII-KGH)

## Theme 5: Channel of Communication on LF Programmes and Interventions

The cornerstone of managing outbreaks and facilitating the dissemination of knowledge lies in effective communication strategies within the healthcare system and broader community. Such strategies are essential for fostering community participation in response efforts.

Narratives from participants in the study have offered valuable insights into the intricacies and difficulties associated with communication during LF interventions. The findings underscored the significance of prompt communication, ongoing training, well-defined communication protocols, and efficient feedback mechanisms, which were classified into four subthemes. Overcoming these communication hurdles is essential for the effective implementation and enhancement of LF initiatives and interventions (See [Table 2](#)).

### **Subtheme (i): Communication Delays and Safety Concerns**

The result highlighted the risky nature of communication delays in LF interventions. The need to chase results indicates inefficiencies in the communication process, and these delays pose safety risks. The proposed solution of Rapid Diagnostic Tests (RDTs) suggests a shift toward real-time, onsite diagnostics to mitigate communication bottlenecks and enhance safety.

The difficulty at hand presents a significant risk to the successful execution of interventions for LF. RDT scan serve as a solution to overcome such challenges. (KII-PGH)

### **Subtheme (ii): Training, Knowledge Gaps, and Consistent Updates**

The findings underscored the importance of continuous training and effective communication in the health sector. The mention of a knowledge gap, especially among laboratory technicians, highlights the need for regular training sessions and updates. The focus on consistent engagement and skill updates for staff members emphasizes the importance of internal communication and capacity building.

What I am going to say is, one of the things we normally fail to get right is communication. Most of the time, I do engage the staff on key areas in the laboratory operations to update their skills. (KII KGH, Lab)

### **Subtheme (iii): Established Communication Protocols and Hierarchy**

So, as I mentioned, is part of the ministry of health... there are channels or lines of communications established by the ministry of health that have been followed. (KII-PGH)

The verbatim above underlines the structured and hierarchical nature of communication within the health system. The process from diagnosis to community notification is systematic, involving multiple stakeholders. The emphasis on not causing panic indicates the importance of controlled communication in public health. The structured approach aims to ensure accurate, timely, and appropriate dissemination of information.

### **Subtheme (iv): Feedback Mechanisms and Referral Communication**

The only problem we have had with our referral hospital KGH is that they normally do not give us feedback... sometimes they get to send us feedback as well as a patient survive or died or whether they suffered further complications (KII-PGH)

This narrative showed a crucial gap in the communication chain: feedback from referral hospitals. The lack of feedback can impede continuous care and follow-up for patients. The recent engagement to improve feedback mechanisms indicates an acknowledgment of this gap and efforts to address it.

## **Theme 6: Challenges and Bottle-Necks in the Context of LF Programme Implementation**

These refer to the tangible challenges encountered during the implementation of response programs, including issues related to mobility, resource constraints, and perception of risk. These challenges have the potential to affect every facet of the Lassa Fever response, ranging from diagnostic processes to community engagement.

This theme provides a window into the practical challenges faced in the context of LF Programme Implementation. They reveal the complexities of mobility, the perceived risks among staff, the need for proper compensation, and

challenges related to human resources and equipment. These insights emphasize the need for comprehensive solutions that address both logistical and human resource challenges to ensure effective LF interventions. It also highlighted the innovative strategies employed, like the integrated one-health approach, to maximize the impact of limited resources. They also draw attention to the significant challenges faced in diagnostics, emphasizing the need for rapid on-site testing to enhance patient safety and streamline the treatment process. The insights from this verbatim underscore the multifaceted challenges in LF Programme Implementation and the adaptive strategies being employed to address them. Four subthemes have been attached to it (See Table 2).

### Subtheme (i): Assessing the Risk of Infections Among Healthcare Workers in LF Interventions

The study findings shed light on the multifaceted challenges healthcare workers face in LF interventions. While the medical risks are apparent, the emotional dimensions of patient care can further complicate the situation. Ensuring the safety of healthcare workers requires a balance of technical training, emotional support, and strict adherence to safety protocols.

The respondent responses underscore the significant risk that healthcare workers face when treating patients with infectious diseases like LF. The scenario depicts a dual challenge: the inherent risk of exposure to the virus and the emotional attachments that can sometimes cloud judgment or lead to relaxed precautions. The fondness that the staff member developed for the young child led to more intimate interactions, which subsequently resulted in the transmission of the disease.

According to the PGH key informant interview, a clinical staff member contracted LF from a patient in the hospital. The staff member had grown fond of a young child who was being treated for the virus, and after spending time with the child, the child's blood sample was found to be positive for LF. Three days later, the staff member fell ill and tested positive for Lassa fever. Both the staff member and the infected child were treated at KGH and eventually recovered. (KII-PGH)

While it is crucial to note that both individuals received treatment and recovered, the incident serves as an emotional reminder of the weakness healthcare workers face in their line of duty. Their dedication and emotional investment in patient care can sometimes expose them to heightened risks. This emphasizes the importance of continuous training and reinforcement of safety protocols, even in emotionally charged situations.

### Subtheme (ii): Mobility and Risk Perception

Transporting Lassa samples in a timely and efficient manner is challenging due to mobility issues. The reluctance of motorbike riders highlights the community's perception of risk associated with transporting Lassa samples, which points towards deeper challenges beyond just the availability of transportation means.

Mobility is currently one of the main challenges that we face in our unit... reluctance of most motorbike riders in Panguma town to transport suspected laboratory samples. (KII-PGH)

It is crucial to acknowledge the concerns raised by frontline workers regarding the perceived risks of working in a Lassa laboratory. The fact that they are requesting risk allowances demonstrates the need to ensure worker safety and morale in high-risk settings. Compensating them for the additional risks they take on, on top of their regular salaries, is essential to show that their safety and well-being are a top priority.

### Subtheme (iii): Comprehensive Challenges

The respondents have given a detailed account of the difficulties they face, which range from problems with mobility to issues with human resources. Some staff members are not recognized under the government's system, adding to their challenges. The lack of essential equipment, particularly diagnostic tools, also highlights the resource limitations that hinder effective Lassa interventions. These challenges are interconnected, highlighting the complex obstacles in implementing LF programs. It emphasizes the need for comprehensive solutions that address all aspects of the problem.

Currently, we face several challenges in our work... urgent need for improvement in these areas to enhance our ability to tackle this disease. (KII-PGH)

The study highlights a major concern regarding the delay in diagnosing patients. Currently, the lack of rapid diagnostic test requires samples to be transported to specific locations like KGH for analysis, which poses two potential risks. Firstly, there is the danger of transporting infectious samples, and secondly, there could be delays that negatively impact the patient's health. The study suggests that having on-site rapid diagnostic tests would significantly improve diagnostic efficiency, prioritize patient safety, and enable timely interventions.

In my opinion, one of the major challenges is the lack of availability of rapid diagnostic tests... if we have our own rapid diagnostic test, we can perform the test on-site and send the results and the patient directly for treatment. (KII- PGH)

## Subtheme (iv): Effective Intervention Strategies and Resource Management

Healthcare workers shared insights on interventions, challenges due to COVID-19 disease, and the significance of continued efforts for LF survivors.

To date, we have not implemented any specific interventions for LF, aside from the projects led by the Tulane University team based in Kenema. Unfortunately, we do not have any Lassa fever projects of our own. However, we did initiate a Lassa fever survivors' project, but it was impacted by the COVID-19 DISEASE outbreak. We were only able to hold one meeting before the pandemic hit Sierra Leone and all activities were put on hold. The goal of the project was to identify all LF survivors and provide them with medical care and support, as only Ebola survivors were receiving such care at the time. As the project coordinator, my role was to work alongside my boss at the KGH Lassa unit to register all Lassa survivors and address any issues they faced, such as deafness and stigmatization. It is crucial to continue such projects to raise awareness in the community and prevent the predisposing factors of LF. However, such initiatives require proper sponsorship and support. (KII-PGH)

During the discussion, the participants came up with some potential solutions to the challenges mentioned earlier. One of the solutions was to acquire motorbikes, which would address the mobility issue directly. The fact that some lab staff have driving licenses shows that they are ready and capable of adapting to this solution. This proactive approach demonstrates that the participants have a hands-on understanding of the challenges at the ground level, and are willing to find practical solutions.

To overcome these challenges, I have recommended to our partners that we need more support for mobility... would reduce the transportation constraints that we currently face. (KII-PGH)

The narrative stresses the importance of maintaining continuous engagement with partners and maximizing available resources. The use of an "integrated one health approach" is highlighted as a holistic strategy that addresses not only LF, but also other viral hemorrhagic fevers. This approach has numerous benefits, including broader surveillance and more comprehensive case definitions. By adopting such a proactive and comprehensive strategy, potential health threats can be managed efficiently, ensuring a more effective use of limited resources.

We continuously engage our partners, and the MoHS also keeps engaging partners, and we make use of whatever resources we have, no matter how limited. One of the most effective approaches we've been using is the integrated one health approach... the integrated approach has been very helpful for us. (KII DHSE)

## Theme 7: Exploring Sustainability on LF Management, Control and Prevention Programmes

The enduring success of Lassa Fever control initiatives is dependent on the sustainability of these interventions. This necessitates government backing, ongoing educational efforts, and the strategic adaptation of response measures in light of acquired insights.

The comments collected under the theme of sustainability highlight the crucial role of local governments and institutions in ensuring that the interventions for eliminating Lassa fever (LF) are effective in the long run. While

external assistance can be helpful, the real sustainability of these interventions depends on local commitment, leadership, and ownership. These statements reflect a strong belief in the government's responsibility and capability to support and maintain LF programs, even if the donors decide to withdraw. Three subthemes have emerged from these comments (See Table 2).

### Subtheme (i): Government Responsibility and Prior Donor Dependence

The statement below underscores the belief in the government's commitment to its people, suggesting that even if external donors withdraw, the government will find a way to support LF interventions. The reference to the hospital's previous reliance on Catholic support and the subsequent takeover by the government when the support ceased highlights the government's adaptability. However, the acknowledgment of current reliance on external support underscores the vulnerability of the current system.

I believe government always has it at the back of its mind that the work we are doing is for our own people, not for the donors. As a hospital, we do not have funds or any mechanisms at the moment to continue with the Lassa intervention in case donors and partners stop providing financial and logistical support. (KII-PGH)

### Subtheme (ii): Sustainability Through Local Leadership

"When we talk of sustainable approach, I think one of the ways we can to be sustainable as it is now is been led by the MOHS... it means it would be easy and more sustainable". (KII-DHSE)

The report above emphasized the importance of local ownership and leadership in sustainability. By having the MoH at the forefront of LF interventions, the program's longevity is more assured. While external partners bring in short-term research grants, true sustainability comes from local leadership and commitment.

### Subtheme (iii): Government's Inherent Responsibility

That is their responsibility, the responsibility of the MoHS is taking care of the citizens of Sierra Leone... they support of the ministry is providing the human resource, infrastructure for diagnostics and all of these. (KII-DHSE)

The statement above solidifies the idea that the government has an inherent duty to care for its citizens' health. The MoH's role in providing human resources, infrastructure, and diagnostics for LF and other diseases emphasizes the government's ongoing commitment, irrespective of external support.

## Theme 8: Lessons Learnt and Ways to Improve on LF Programme Delivery Models

This theme provides insights into the lessons learned and potential strategies to enhance LF program delivery models. The key takeaways focus on the need for adequate financing, the importance of actionable research over mere policy formulation, and the critical role of transparency, accountability, and effective communication in ensuring successful LF interventions (See Table 2).

### Subtheme (i): Financing and Resource Provision

The centrality of adequate financing to improve LF interventions is stressed here. The informant highlights the importance of not only funding but also equipping the laboratories with necessary reagents and diagnostic tests. This indicates that to achieve significant improvements in LF interventions, resources both financial and logistical are paramount.

The best way of improving the effectiveness of all LF services in Sierra Leone is just through finance. Finance, human resources, and laboratory interventions most especially if reagents and the rapid diagnostic test could be supplied to us would serve as a very good strategy in moving to the positive path. (KII-DHSE)

## Subtheme (ii): Emphasis on Research and Practical Solutions

The verbatim below underlines the importance of actionable research over policy documentation. The focus is on gaining more knowledge, improving diagnostics, and developing affordable vaccines. The sentiment expressed is that instead of continually drafting policies, there should be a shift towards actionable solutions that can directly benefit the population.

For me I will not just sit and say we need to develop this model. As for me I don't believe in getting policies all the time. All you do with the policies; you write them down. If we get to straight things right, disparities, diagnostics and vaccines will go forward. (KII-KGH)

## Subtheme (iii): Transparency, Accountability, and Communication

In order for us involved in the fight against LF in Sierra Leone to work effectively, there is need for transparency, accountability and communication across the board. If transparency and accountability are improved on and maintained, I believe Lassa interventions will be more robust and effective. (KII-KGH)

The statement above stresses the importance of open communication and transparency in improving LF interventions. The informant suggests that all units should be kept in the loop regarding programs or incentives related to LF, ensuring that everyone is informed about resources, costs, and strategies. By fostering a culture of transparency and accountability, the chances of achieving a more effective and robust LF intervention strategy are heightened.

## Theme 9: Recommendations

Deriving from a critical examination of existing strategies and identified challenges, the recommendations for augmenting the Lassa Fever response underscore the imperative for advanced diagnostic technologies, approaches centered around community engagement, and the provision of comprehensive training for healthcare practitioners.

Participants provided actionable insights to enhance the effectiveness of LF interventions. These recommendations emphasize the importance of proper laboratory equipment, decentralization of testing facilities for improved accessibility and logistics, and the critical role of training and manpower in combating the disease. Implementing such recommendations can pave the way for a more robust and effective LF intervention strategy. This theme was further segmented into three subthemes (See [Table 2](#)).

## Subtheme (i): Laboratory Equipment and Reagents

The study subjects' recommendation underscores the critical importance of a well-equipped laboratory for effective LF interventions. The mention of outdated reagents highlights the challenges faced due to suboptimal resources. Having up-to-date and potent reagents is vital for accurate diagnostics, which is foundational for appropriate treatment and management.

Okay like in the first place we need to equip the laboratory, we need to be having most of the reagents, (because at times reagents can be outdated also lose their powers or potency). (DHSE)

## Subtheme (iii): Decentralization of Testing Facilities

Then we also need to increase the testing power of Lassa to other regional districts not only in Kenema. Because for example if you have Lassa in Tonkolili, there's no need to take the samples from there to Kenema so we also need to have it in regional districts to reduce the cost of petrol and risk of transporting samples; that is.... (DHSE)

Respondents advocated for a decentralized approach to LF testing, suggesting that facilities be set up in various regional districts. The rationale behind this is to reduce risks and the logistical challenges and costs associated with transporting samples over long distances. Having testing facilities closer to potential outbreak areas can also speed up diagnostics, leading to quicker interventions.

## Subtheme (iv): Staff Training and Manpower

The study results emphasized the need for capacity building. Training more staff not only ensures that there's adequate manpower to handle the challenges posed by LF but also ensures that the staff is equipped with the latest knowledge and techniques to effectively manage and treat the disease.

And number (3) we train more staff to have more manpower.... (DHSE)

## Discussion

The investigation into Lassa Fever (LF) programs and interventions reveals significant progress, particularly in the knowledge and implementation of these programs, but gaps still exist. Participants emphasized the criticality of interventions in enhancing healthcare professionals' capacity for early detection, standardized treatment, and control of viral hemorrhagic fevers (VHFs). A notable decline in Lassa infections and deaths over the past five years is attributed to robust program interventions, although further testing and monitoring are required due to the disease's expansion into non-endemic regions. Capacity building and surveillance remain key for controlling VHF.<sup>25,26</sup>

LF endemicity varies across West African countries, including Sierra Leone, Nigeria, Guinea, and Liberia. The Mano River region is among the affected areas. Recent research indicates that the Lassa virus (LASV) is spreading more extensively in the Tropical Wooded Savanna ecozone of West Africa, which may indicate that the endemicity zone in the area is expanding.<sup>27–36</sup> Each year, cases of LF are reported in Nigeria, Guinea, Sierra Leone, and Liberia, which form the Mano River region. Based on the genetic epidemiology of LASV, it is believed that the virus originated in Nigeria over a thousand years ago and gradually spread to neighboring West African countries over several centuries. The region is home to multiple LASV lineages, with varying levels of prevalence. One such lineage, lineage IV, is present in Sierra Leone, Guinea, and Liberia.<sup>29</sup>

Lassa fever has a major impact on West Africa; however, case fatality rates differ by nation. Patients in Nigeria usually have a case fatality rate (CFR) of 20–30%, but an increase in 2015–2016 was linked to a 60% CFR. In contrast, patients in Sierra Leone have a higher CFR of 69%. Fever, sore throat, vomiting, and coughing are some of the symptoms that the disease manifests as, and over 40% of patients also have bleeding. LF usually kills 10 to 14 days after symptoms appear, and multi-organ system failure is the cause of death.<sup>29</sup> Essentially, while LF is widespread in Sierra Leone and other West African nations such as Nigeria, Guinea, and Liberia, it is important to recognize that there may be distinct epidemiological characteristics and unique lineages specific to each country. Understanding these differences is crucial for effectively monitoring, preventing, and managing the impact of Lassa fever on public health in the region.<sup>27,29,34</sup>

In Sierra Leone, the study highlights the essential role of partnership collaboration in LF program implementation, given the country's dependence on donor support, a consequence of historical conflicts, mismanagement, and low human capital. Consequently, there is a pronounced need for more collaborative efforts among key partners to enhance LF program delivery in the region.

Since the peak of the outbreak in March 2019, there has been a decline in confirmed cases of LF in Sierra Leone.<sup>37</sup> This decrease is credited to the effective implementation of the LF Response Plan, which involved strengthening surveillance, contact tracing, laboratory testing, infection prevention, case management, and community engagement. The World Health Organization (WHO) and partners like CDC, Tulane University, Harvard University, and MSF have been essential in this effort.<sup>13,38</sup> Their contributions are acknowledged by study participants and supported by recent literature emphasizing the importance of partnership collaboration in disease control.<sup>39,40</sup>

The Sierra Leone MoH leads the health system response, with partners bolstering government efforts. This effective partnership collaboration avoids duplication and enhances LF program delivery. The current study emphasizes the need for more collaboration between the private and public sectors to strengthen LF management, prevention, and control, advocating a multi-sectorial approach in Sierra Leone.<sup>41</sup> Other emphases mentioned were research, capacity building, community engagement, vaccine development, and involvement of key LF program partners which can help to mobilize resources, coordinate efforts, and accelerate progress towards disease control and elimination.<sup>42,43</sup>

WHO has prioritized LF<sup>44</sup> with notable contributions from Tulane University,<sup>45</sup> which has significantly contributed to LF programs in West Africa and has been actively involved in supporting LF control and prevention efforts, developing

diagnostic tools, and technical assistance, and promoting research and innovation in West Africa. The study identified Tulane University as one of the primary partners in the LF response in Sierra Leone, providing essential support in areas such as laboratory diagnosis, epidemiological surveillance, research, technical assistance, and training to healthcare workers which was essential in improving the knowledge and skills of healthcare workers in LF control and prevention. Another study done on the perception of LF control and prevention programs among healthcare workers in Nigeria also emphasized the critical role of Tulane University in the partnership collaboration.<sup>46</sup>

Challenges in LF response program implementation include transportation and logistical issues, human resource gaps, community resistance, and healthcare workers' perceptions of risk. The challenges presented by the study participants are consistent with the challenges faced by other countries in the implementation of LF response programs.<sup>47–49</sup> A study done in Sierra Leone has also highlighted some of these challenges stating that the implementation of LF response programs in rural healthcare facilities faced more significant challenges than those in urban settings.<sup>48</sup>

Strategies to address these concerns involve improving transportation and road infrastructure, enhancing coordination and communication, and recruiting and retaining qualified health workers.

Community engagement and cultural sensitivity are vital in LF interventions, considering the socio-cultural context, including beliefs, behaviors, knowledge, and practices related to the disease's transmission and treatment.<sup>47,50</sup> Addressing these cultural aspects is crucial for effective control and prevention.<sup>51,52</sup> Furthermore, the study participants identified low community participation, cultural practices, beliefs, and traditions as barriers that posed a significant threat to the implementation of LF programs. Based on the experience drawn from EVD and COVID-19 disease, cultural and traditional practices have adversely affected the response to these diseases. Participants reported situations where they experienced low community participation, especially where people were suspected of contracting the infection and refused to cooperate with the surveillance and response team. Although LF infection had been present in these communities<sup>53,54</sup> before the emergence of EVD and COVID-19 disease, participants held the view that the conspiracy theories built around these emerging infections were significant barriers to response interventions aimed at slowing the progression of these infections. Also, community members in LF endemic communities held the belief that sample collectors, researchers, and other healthcare workers were mostly the ones who introduced the virus into their communities.

The traditional healers' role in communities also presents barriers to LF program implementation as traditional healing practices are still dominant in such communities. Residents in LF endemic communities still prefer traditional healers for medical consultations despite the efforts of the surveillance team to engage with the community and mobilize them socially.<sup>55,56</sup> Late referrals of suspected LF patients due to traditional healer consultations are potential contributors to high infection and fatality rates. The present findings align with results from a study carried out in Sierra Leone on the health-seeking behaviors of rural dwellers.<sup>57</sup> Similarly, a study conducted in Tanzania found that cultural beliefs and practices, including the use of traditional healers, delayed the diagnosis and treatment of infectious diseases.<sup>58</sup> This reinforced the importance of addressing cultural beliefs and practices in controlling and preventing infectious diseases like LF emphasizing the need for culturally sensitive interventions that consider the beliefs and practices of the communities affected by LF. These interventions should include community engagement and social mobilization efforts aimed at changing community attitudes toward LF and increasing community participation in LF programs.

Communication challenges, particularly in the referral and diagnostic process, have been identified, with delays in receiving test results impacting LF interventions as mentioned in the study. The risk of transporting blood specimens of suspected Lassa patients to KGH for analysis and delays in receiving test results of suspected LF patients were also revealed as challenges limiting LF interventions and programs as reported in other studies done in a Lassa endemic zone.<sup>50,57</sup> This can pose a significant risk of Healthcare-Associated Infections (HAIs) among staff working at the Lassa unit of PGH. The findings of this study are consistent with studies conducted in Liberia<sup>59</sup> and Sierra Leone<sup>60,61</sup> which confirm the threat posed due to delays of test results. Another study done in Nigeria also mentioned delays in obtaining laboratory test results for LF patients, which was a major challenge in managing the disease.<sup>62</sup> Participants suggested that Rapid Diagnostic Tests (RDTs) facilities should be available in their facility to address these concerns hence providing a speedy and accurate diagnosis of LF, which can help reduce the time between symptom onset and the start of appropriate treatment. A study conducted in Nigeria found that the use of RDTs in diagnosing LF resulted in a significant reduction in the time between symptom onset and the start of treatment<sup>63</sup> which is in agreement with the study results.

During the study, participants expressed their concerns about communication channels while responding to disease emergencies and outbreaks, especially in areas where LF is prevalent in Sierra Leone. The Kenema Government Hospital (KGH) is the primary referral, diagnostic, and treatment facility for LF interventions and response in Sierra Leone and the Mano River Union nations.<sup>57,60</sup>

In addition, the study highlighted communication issues between the upper and lower levels of management when it comes to Lassa fever intervention strategies. The participants have reported that the senior management has failed to effectively communicate new strategies, resulting in knowledge gaps in Lassa fever interventions. Lack of communication has harmed strategic operations, especially among laboratory technicians who struggled with implementing Lassa fever infection prevention, control, and case management approaches.<sup>60</sup> To address these gaps and enhance the effectiveness of LF programs and interventions, the participants have recommended continuous communication and training, and further suggested feedback will be crucial for effective Lassa fever program interventions.<sup>60</sup> Based on the latest findings, healthcare workers have established effective communication channels to keep the community informed about LF activities professionally and ethically, thereby preventing panic. In the event of any suspected or confirmed cases of LF, it is important to take quick and appropriate measures to prevent the spread of the disease. This is where the laboratory unit plays a critical role. Once the tests have been conducted, the laboratory unit informs the DHMT surveillance unit of the results. The surveillance unit is responsible for communicating the test results to the affected community. This approach is taken to prevent any alarm or panic that may arise due to the fear of the disease spreading.<sup>64</sup> It is vital to note that this is a standard operating procedure followed by LF laboratories and helps to ensure that the community is informed of the situation in a timely and efficient manner. It also provides the community with the necessary information and steps to take to prevent the spread of the disease.

Furthermore, following standard operating procedures is crucial in infectious disease prevention.<sup>65</sup> Despite the training, healthcare workers' low compliance with Standard Operating Procedures (SOPs) for Infection Prevention and Control (IPC) remains a challenge, highlighting the need for continuous education, adequate staffing, and regular supervision. These attitudes and practices pose a significant challenge in preventing, controlling, and managing infectious diseases, leading to a high risk of Healthcare-Associated Infections (HAIs).<sup>66</sup> The current reports are consistent with a survey conducted in Nigeria among healthcare unraveling workload impact on standard precautions adherence<sup>67</sup> and adequate staffing levels, continuous education and training, as well as regular supervision, are crucial in ensuring compliance with standard precautions in infectious disease management.<sup>68</sup> Additionally, a Nigeria study in 2018 revealed that healthcare workers lacked knowledge and adherence to IPC measures in LF management, with some not using personal protective equipment (PPEs) and not following hand hygiene protocols.<sup>69</sup> This highlights the need for continuous education and training on standard precautions and the proper use of PPEs. Sierra Leonean studies further stressed regular training and supportive supervision for healthcare workers to improve compliance with IPC measures and reduce the risk of infections.<sup>70,71</sup>

Furthermore, the study also sheds light on gaps in mortality surveillance and death certification processes, emphasizing the need for improved systems to better understand the disease burden. It was revealed that for any death that occurs at a health facility, a death certificate should be issued indicating the cause of death. Some participants have mentioned that the National Civil Registration Authority (NACRA) is also involved in the process of recording death. However, there is no specific death certificate issued for LF, and as a result, even though all deaths are certified, including those caused by LF, 70 to 80% of deaths occur outside healthcare facilities where no death certificates are issued. This makes it difficult to determine the cause of death highlighting the need for improving mortality surveillance and death certification processes to understand the disease burden better and develop appropriate response interventions. Additionally, the survey underscores the importance of early diagnoses and treatments of LF, as well as increasing community awareness and education on the disease to ensure that suspected cases are promptly referred for treatment.<sup>60</sup> The research also suggests that deaths caused by LF may be happening at the community level and not being captured by the conventional MoH mortality surveillance system.

The recent finding is quite significant as it sheds light on the gaps in the surveillance system, which can have serious implications for disease control efforts. Similar studies conducted in various countries and regions have also revealed that deaths caused by LF often go unreported due to inadequate knowledge about the disease among healthcare providers and

the community, as well as poor surveillance systems.<sup>72,73</sup> Such studies emphasize the need for improved surveillance systems and heightened awareness about LF among healthcare providers and community members.

The results also indicate that there are some elements of exit strategies that can be used to retain, maintain, and sustain the gains made by LF programs and interventions, with or without partner support. It is clear from the current study that the MoH is willing to continue supporting LF programs and maintaining existing structures. Participants unanimously agreed that it is the responsibility of the Government of Sierra Leone (GoSL) through MoH to provide all forms of support to LF programs and interventions, even in the absence of partner support, and has become part of the government's budgetary support to MoH Sierra Leone. The government, as reported by participants, is committed to integrating partner support programs into their work in the future which is crucial for ensuring long-term sustainability once funding of partner-supported programs comes to an end.

Discussions with DHSE and KGH staff also showed a growing understanding of the need to integrate partner programs into their broader program of work. However, to sustain this effort, results from the study indicated that it is crucial to continue encouraging and creating continuity in the training of the LF program and response staff. The sustainability of LF programs and interventions, as revealed by the results, is dependent on trust building, prudent financial management, and strong human resource capacities and commitments<sup>74</sup> which is the goal of the government policy direction.

Nevertheless, more than half of the participants expressed concern about the financial and logistical challenges of independently sustaining the gains achieved through some of the partner-supported programs in case of program phasing out. This underscores the significant role that finance plays in ensuring sustainability.

In addition to the previously mentioned findings, the study revealed a vital aspect to improve the implementation of program delivery models in the future. Many participants believed that there is a high probability of future LF outbreaks in Sierra Leone, as the disease has been detected in non-endemic regions of the country. However, the results indicate that the MoH is well-prepared to handle future emergencies and outbreaks based on the lessons learned from the EVD and COVID-19 disease interventions and responses. Therefore, the participants proposed that comprehensive scientific research and innovations should be conducted to gain more knowledge about LF interventions and services in Sierra Leone. In summary, the research highlights the significance of partnership collaboration, capacity building, cultural sensitivity, effective communication, and sustainable financial and logistical support for LF program delivery in Sierra Leone.

The study on the perspectives of healthcare professionals regarding strategies, challenges, and community responses to health system interventions towards Lassa Fever infections and mortality in Sierra Leone incorporates a qualitative methodology, offering a detailed understanding of the management of the disease within diverse healthcare settings.<sup>75</sup> Employing purposive sampling, the research ensured data were collected from individuals directly involved in Lassa Fever management, enriching the findings with frontline experiences. The use of NVivo for thematic analysis facilitated a systematic examination of the data,<sup>76</sup> underlining the necessity for a multi-faceted management approach that emphasizes international collaboration and culturally sensitive community engagement. The study's actionable recommendations are based on real-world challenges and experiences identified by participants, making them highly relevant for policy and practice improvement. Despite these strengths, the study faces limitations concerning the sample size and generalizability of its findings. The selection of a small, specific group of healthcare professionals might limit the broader applicability of the insights gained. This method, while beneficial for obtaining depth of insight, could introduce biases as the perspectives of the participants might not fully represent the wider healthcare workforce's experiences in managing LF. The reliance on self-reported data introduces potential biases related to memory recall and the desire to present oneself in a favorable light. Moreover, the lack of quantitative data in the study creates a limitation in developing a comprehensive understanding of the prevalence and impact of distinct challenges and strategies in LF management. The healthcare landscape is continuously evolving and with infectious diseases such as LF, new challenges and strategies frequently arise, rendering the findings potentially outdated. In conclusion, while the study provides valuable insights into the experiences of healthcare professionals with Lassa Fever in Sierra Leone, its limitations necessitate cautious interpretation and application of its findings. Future research should aim to include larger and more diverse samples and incorporate quantitative data to complement and broaden the understanding of Lassa Fever management strategies and challenges.

## Conclusion

The study on LF in Sierra Leone underscores the need for an integrated approach to tackle the disease, emphasizing the enhancement of diagnostic tools, community engagement, and institutional collaborations. It highlights the importance of culturally sensitive strategies and effective communication for improving health delivery systems. Key findings advocate for advanced diagnostic capabilities, decentralized testing, and comprehensive healthcare worker training to boost responsiveness and effectiveness. Despite the progress made through partnership collaborations and international support, challenges like logistical constraints and human resource limitations remain. It concludes that a collaborative, multi-sectoral effort is essential for advancing LF management and public health outcomes in Sierra Leone.

## Recommendations

Based on the findings of this study, it is recommended that healthcare professionals in Sierra Leone prioritize knowledge sharing, collaboration, community engagement, communication, and resource allocation in their efforts to prevent and respond to LF outbreaks. The study also calls for increased governmental responsibility, sustainable financing, and continued international cooperation to address these challenges. Addressing these factors is crucial for effective health system responses and interventions to prevent LF infections and fatalities.

## Ethical Approval

All authors read the final paper drafted, decided, and approved on the journal for publication. Additionally, research participants gave their agreement after being fully told about the findings and anonymized publication of their responses.

## Acknowledgments

The contributions of healthcare professionals and stakeholders in Sierra Leone are acknowledged for their valuable insights and participation in this study.

## Author Contributions

All authors made significant contributions to the submitted manuscript whether it is in the conceptualization, research design, execution, data gathering, analysis, drafting, revising and interpretation, or in all these areas. Furthermore, all authors have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

## Funding

There is no funding to report.

## Disclosure

The authors generally declare no conflict of interest.

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