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Short Communication

Lassa Fever Infection among Healthcare Workers during the 2018 Outbreak in Nigeria

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ABSTRACT

Introduction: Healthcare workers (HCWs) are potentially exposed to infection during viral hemorrhagic fever outbreaks. In the wake of 2018, Nigeria experienced an unprecedented surge in cases of Lassa fever (LF), which affected HCWs. To guide infection prevention and control (IPC) strategies in similar settings, we characterize HCWs' infection and describe the gaps in IPC standards and practices during the outbreak.

Methods: Data was collected using a structured questionnaire, interview, and review of case notes of 21 HCWs with laboratory-confirmed Lassa fever who were treated at the Irrua Specialist Teaching Hospital (ISTH) Irrua and the Alex-Ekwemen Federal Teaching Hospital, Abakaliki (AEFETHA), between 1st January and 27th May 2018. Information collected was the patients' socio-demographic characteristics, date of potential exposure and onset of illness, nature and type of exposure, clinical features, outcome, use of personal protective equipment (PPE), and personnel IPC training. The obtained data were analyzed using descriptive statistics with Microsoft Excel.

Results: The study included 21 HCWs, and 12 (57.14%) were doctors. The case fatality rate was 23%. Nearly two-thirds (62%) of the HCWs could describe a likely procedure leading to their exposure and infection. Among 13 HCWs, 85% had multiple blood and body fluids exposure, while 15% had needle stick injury or scalpel cut. About one-fifth of the participants had received some IPC training.

Conclusion: Limited IPC adherence and inappropriate risk assessment were identified as factors leading to Lassa fever exposure and infection among HCWs. There is an urgent need to provide IPC training for all HCWs and to ensure an adequate supply of IPC materials to all healthcare facilities as part of emergency preparedness, especially in LF endemic areas.

Keywords: Healthcare workers, Lassa fever infection, Nigeria, Preventable calamity, 2018 outbreak

Introduction

Lassa fever (LF), an acute viral hemorrhagic disease caused by the Lassa virus, remains a public health challenge in West Africa, with an estimated 100,000–3,000,000 new infections and approximately 5000 deaths per year.[1] Since 1969, when the disease was first reported in the Lassa community in North Eastern Nigeria, among two missionary nurses who became ill and died, several outbreaks and sporadic cases have been reported with the increasing incidence among healthcare workers.[1–4]

The reservoir for the Lassa virus is the multimammate rat of the genus *Mastomys natalensis. This peri-domestic r*at is ubiquitous in many households in the endemic area of sub-Sahara Africa.[5] Two modes of transmission have been recognized, namely primary and secondary transmission. Primary transmission is via consuming contaminated food, inhaling aerosolized droplets from the rat, direct contact with rat excreta with broken skin or mucous membrane, and hunting and consuming rats as food in endemic areas.[6,7]

Secondary transmission from human–to–human may occur through direct contact with blood and body fluids or inhalation of droplets from infected patients at the community level or in healthcare settings. Nosocomial outbreaks involving transmission between patients and healthcare workers are associated with high mortality and are driven by poor understanding and compliance with standard precautions and other infection prevention and control measures.[4,8,9]

In Lassa fever endemic areas, it is difficult to distinguish between cases of primary and secondary infections acquired through occupational exposure. Also, direct estimation of the Lassa fever infection rate and risk factors among healthcare workers is cumbersome because about 80% of infections are asymptomatic, and some symptomatic infections occurring in healthcare workers may be self-limiting and mimic other febrile illnesses in endemic areas and, therefore, may not be recognized or reported.[1,5] A mathematical modeling research suggests that while outbreaks are primarily fuelled by independent zoonotic transmission events from infected rodent hosts, approximately 20% of cases may result from the secondary human-to-human transmission, typically in hospital settings.[3] Most available literature on Lassa fever in HCWs is based on serologic surveys conducted during outbreaks, and therefore the causal relationship between exposure and infection was challenging to establish.

This study described cases of Lassa fever infection among HCWs during the 2018 outbreak in Nigeria, with specific reference to laboratory-confirmed cases that were treated at the Irrua Specialist Teaching Hospital (ISTH) and the Alex Ekwemen Federal Teaching Hospital Abakaliki (AEFETHA) - two major Lassa fever treatment centers in Nigeria.

Methods

We conducted a review of all cases of infected healthcare workers in Nigeria during the 2018 Lassa fever outbreak between 1st January and 27th May 2018. A total of 21 HCWs who had laboratory-confirmed cases, treated either at Irrua Specialist Teaching Hospital (ISTH), Irrua, or Alex Ekwemen Federal Teaching Hospital, Abakiliki (AEFETHA) were interviewed using a structured questionnaire, and their case notes were reviewed. The data collected included socio-demographics, date of likely exposure and onset of illness, nature, and type of exposure, clinical features and outcome, infection prevention and control (IPC) practices at the point of care, and personnel IPC training. Data collected were analyzed using descriptive statistics with Microsoft Excel to identify exposure risk and gaps in infection prevention and control (IPC) measures during patient care in their various healthcare facilities.

Results

A total of 21 HCWs were treated in the two treatment centers, and about three-fifths (57.14%) of them were doctors, while one-fifth (19.0%) were nurses, and the other two were one laboratory technologist and one dental technologist. Male to female ratio was 1.6: 1, and the mean age of respondents was 37.76 ± 9.45 years. Fourteen cases

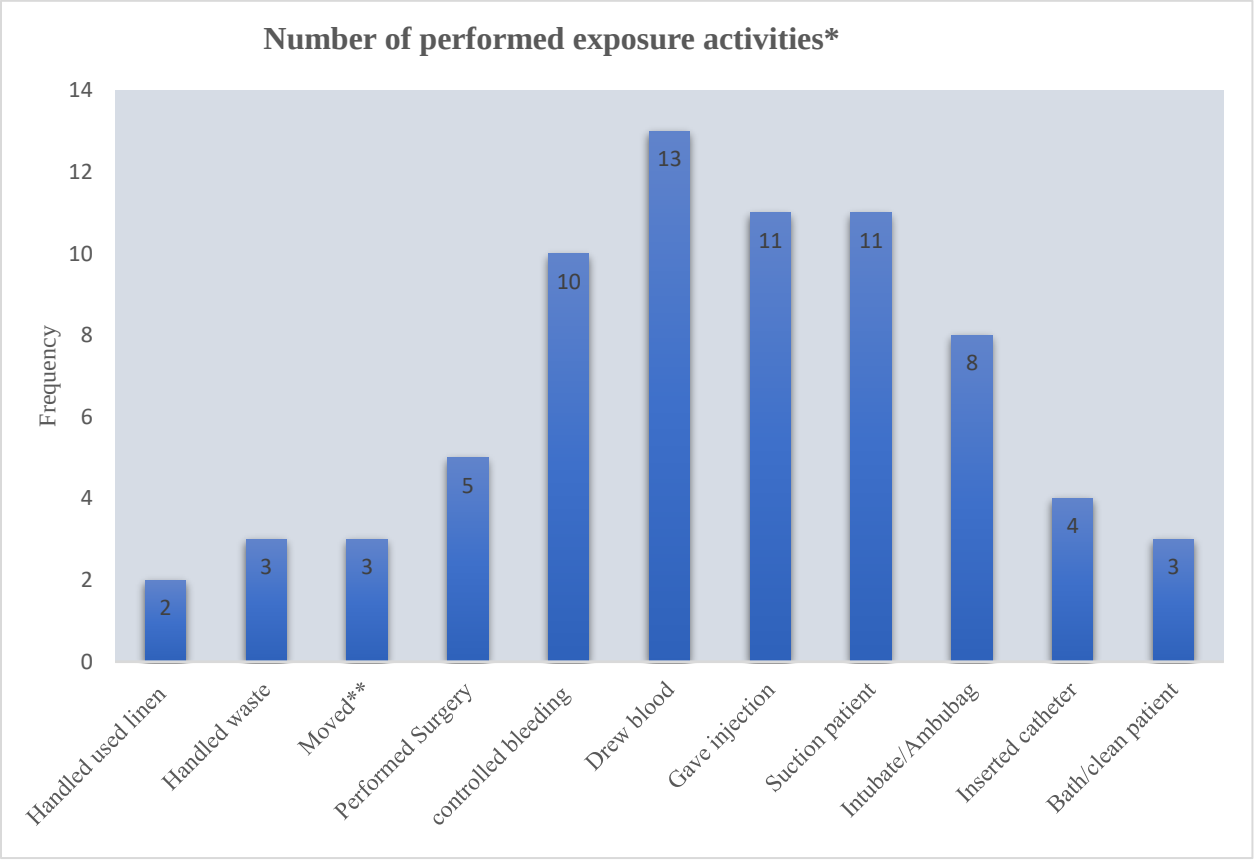
were treated at AEFETHA (eight doctors, five nurses, and one Laboratory technologist), while seven received treatments at ISTHI (four doctors, two nurses, and one dental technologist).

All the respondents were staff of tertiary healthcare facilities located in the Lassa fever endemic States of Edo, Ebonyi, Ondo, Nasarawa, and Kogi (Table 1). More than two-thirds (71.43%) were from FETHA/AEFETHA (Alex Ekwemen Federal Teaching Hospital, Abakaliki), three (14.29%) from ISTH (Irrua Specialist Teaching Hospital), Irrua, while other health facilities recorded one case each.

Table 1: The distribution of Lassa fever-infected HCWs by their health facility and state in Nigeria.

Institution	Frequency	Percentage
AEFETHA, Ebonyi State	15	71.43
ISTHI, Edo State	3	14.29
FMCK, Nasarawa State	1	4.76
FMCL, Kogi State	1	4.76
FMCO, Ondo State	1	4.76
Total	**21**	**100**

Key: AEFETHA (Alex Ekwemen Federal Teaching Hospital, Abakaliki), ISTHI (Irrua Specialist Teaching Hospital, Irrua), FMCK (Federal Medical Centre, Keffi), FMCL (Federal Medical Centre, Lokoja) and FMCO (Federal Medical Centre Owo).



Key: *Multiple responses reported, **patient/dead body.

Figure 1: The various exposure-prone activities performed by respondents

Nearly two-thirds (61.90%) of the HCWs were able to describe a likely procedure leading to exposure and infection. Exposure to blood through the drawing of blood from the patient(s)

they managed was recorded in all those whose possible source of exposure could be identified. Also, there were multiple sources of exposure in these respondents. Another exposure to blood and body fluids was experienced by 11 (84.62%) of the HCWs who were able to describe the likely exposure-related procedure, while two (15.38%) reported exposure through needle stick injury or scalpel cut.

In terms of infection prevention and control capacity, about one-fifth of the respondents had received IPC training, which did not include practical demonstrations. Amongst them, one respondent received one-day training while others got a maximum of three days. More than two-thirds (71.4%) of the respondents reported regular use of PPE when attending patients.

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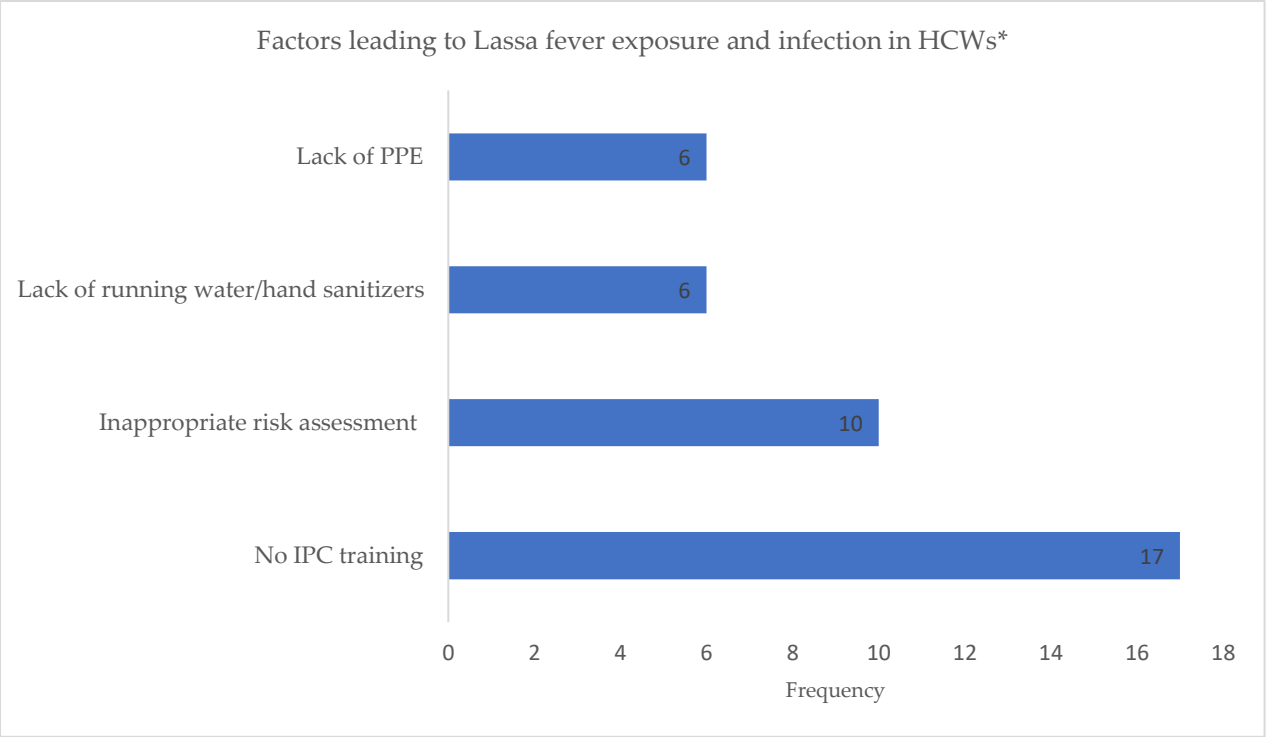
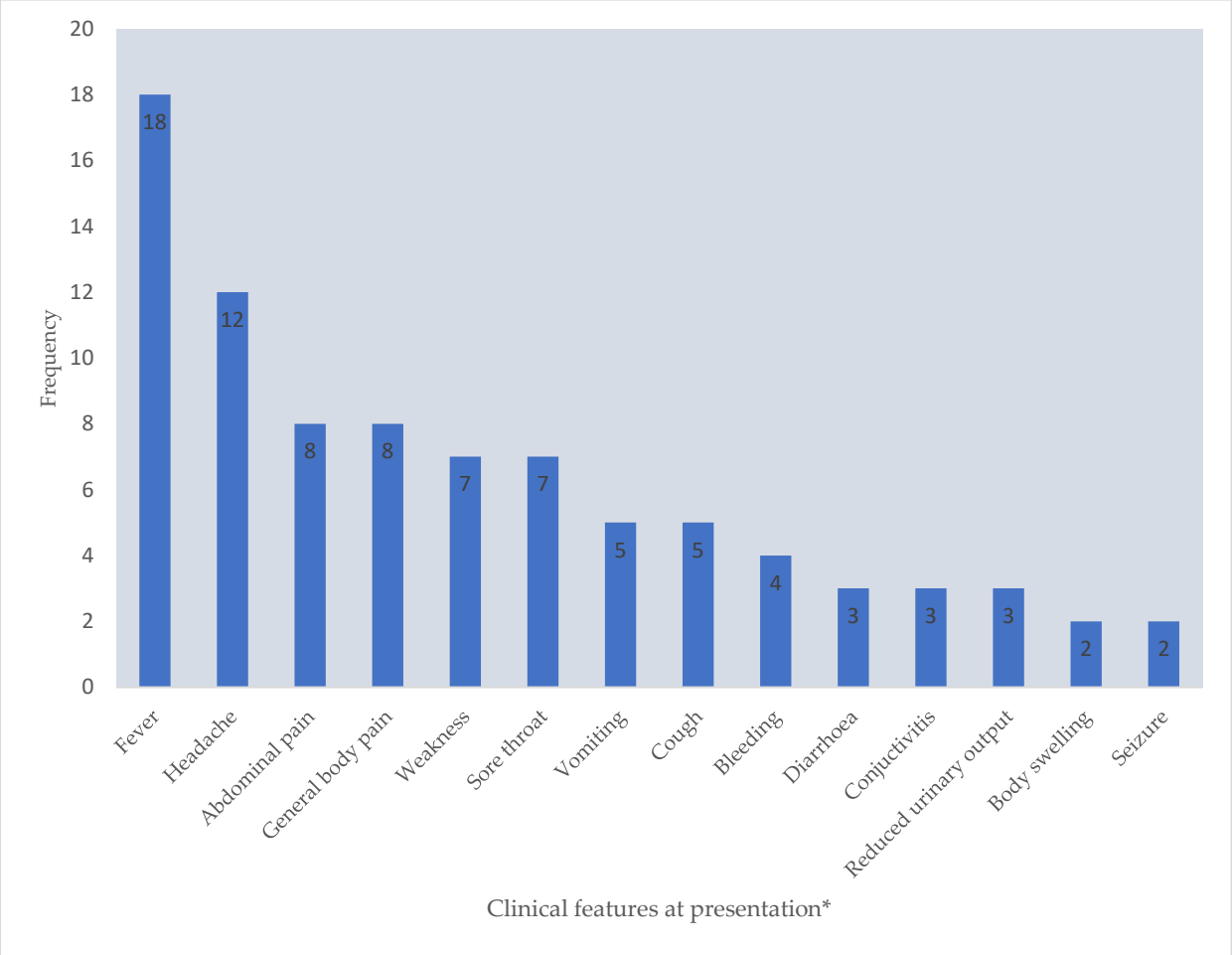


Key: **Multiple responses reported.*

Figure 2: Factors leading to Lassa fever exposure and infection in HCWs.

Overall, the challenges and gaps identified by respondents as contributory factors to exposure and infection at the place of work were lack of IPC training, inappropriate risk assessment when attending to patients, lack of PPE, and lack of running water/hand sanitizer.

The commonest clinical feature at the time of presentation by the respondents was fever (85.71%). Others were headache (57.14%), abdominal pain and general body pain (38.1%), weakness and sore throat (33.33%), vomiting and cough (23.81%). The least common clinical features were body swelling and seizure (9.52%). The mean incubation period estimated as the period between the time of likely exposure to the time of onset of illness was ten days, while the median number of days between the onset of symptoms and testing for Lassa fever was 12 days. The case fatality rate was 23.8%.



Key: *Multiple responses applicable.

Figure 3: Clinical features of respondents at the time of presentation.

Discussion

This study, to our knowledge, is the first, in recent times, to interrogate and characterize HCWs infected with Lassa fever during an outbreak situation and analyze the gap to guide infection prevention and control strategies in this population. The number of Lassa fever-infected HCWs described in this study represents about half [21(47.0%)] of the 45 HCWs infected nationwide in 2018, as reported by the Nigeria Centre for Disease Control (NCDC).[3] The infected HCWs represented 7(2.4%) of the 291 and 14(23.3%) of the 60 confirmed Lassa fever cases treated at ISTH and AEFETHA, respectively, during the year. The proportion of infected HCWs among the confirmed cases treated at AEFETHA was higher than that of ISTH because, in January 2018, there was a nosocomial outbreak of LF at AEFETHA with the death of 3 HCWs (2 doctors and a nurse). A similar situation of a nosocomial outbreak of LF was reported in South-Eastern Nigeria in 1989.[2] The proportion of infected HCWs among confirmed cases in this report is also similar to what was reported during the 2013-2016 Ebola virus disease (EVD) outbreak in West Africa.[10,11] Both Lassa and Ebola viruses are transmissible from human to human in healthcare settings where HCWs are under-protected.

The most affected healthcare professionals in this study are the medical doctors, followed by the nurses and laboratory technologists. The higher rate of infections among these professionals probably reflects their greater involvement in invasive procedures compared with other HCWs. For instance, the majority of the respondents reported drawing blood as one of the performed activities. Venepuncture is a procedure mainly performed by medical doctors, nurses, and laboratory technologists in many Nigerian hospitals, and 85% of those who recalled a likely exposure incidence leading to infection stated having direct contact with blood or body

fluids.[12,13]

The clinical profile of the infected HCWs in this study is expected and in keeping with the non-specific nature of the disease. Likely, Lassa fever was not suspected early, which may account for the delay in requesting laboratory tests, as observed in this study. In practice, most febrile illnesses are presumptively treated with anti-malaria and antibiotics as the first line of treatment, and LF is considered only after treatment failure.[14] It is, however, worrisome that physicians would not request LF testing early enough, especially in outbreak settings when a high index of suspicion is expected of them. The case fatality rate would probably have been lower if diagnosis and treatment with ribavirin were initiated early, as the clinical outcome of LF is known to depend on the stage of the disease at presentation.[15,16]

Nevertheless, this study's case fatality rate among infected HCWs is lower than in previous experiences.[4] In the past, there was no laboratory diagnostic capacity in Nigeria, and samples were transported outside the country with a delay in the return of laboratory results. Recent improvements in LF diagnostics in Nigeria, through the establishment of molecular diagnostic laboratories, development of testing algorithms, and guidelines for case management, through the collaborative efforts of the NCDC and ISTH, might have contributed to a reduction in mortality.

This study also identified risk situations and factors contributing to HCW exposure to LF infection. The most frequently cited deficiency was the lack of or inadequate training on IPC. Previous studies in Nigeria and other countries have recorded similar perceptions among health workers.[17–20] Education and training is one of the core components of the WHO National Guidelines for Implementation of IPC programme.[21] Pre-service and in-service training of healthcare workers in multidisciplinary sessions that would encourage collaboration across health professionals have been recommended. Whenever possible such training should be integrated to leverage existing programmes such as orientation programmes for new staff and regular hospital seminars and workshops. Several studies have demonstrated that compliance with standard precautions was improved significantly after training programs.[22,23]

Risk assessment is important in determining whether a febrile patient may have LF infection and deciding on the need for isolation and the level of personal protective equipment to be worn. Inappropriate risk assessment of potential LF patients was the second most cited contributory factor to HCWs exposure in this study. A high index of suspicion is required to quickly identify, triage, and isolate suspected LF cases, pending definitive diagnosis. This is especially important because the initial manifestations of LF may be non-specific. During outbreaks, exposure to unrecognized patients has been reduced by the use of standard precautions and is thus recommended.[24–27]

Effective implementation of infection control is at the core of breaking a chain of transmission during outbreaks of viral hemorrhagic fevers and cannot be performed without the required IPC supplies and equipment. This study revealed that lack of running water, hand hygiene products, and PPE contributed equally to HCWs' exposure, and in most situations, both were lacking or inadequate at the point of patient care. Overall, these findings are consistent with previous studies and still pose a challenge to VHF outbreak response in Africa.[17,28,29]

Strong health systems rely on a well-equipped, protected, and capable workforce to respond to outbreaks and emergencies. In previous outbreaks of VHFs in Africa, including the 2013-2016 Ebola outbreak in West Africa, many healthcare workers paid the supreme price while providing care for patients under grossly inadequate work conditions of weak infrastructure, lack of training, and deficient supply of PPE. There is a critical need to recognize that health worker protection and support is key to the capability of health systems to respond to outbreaks, and emergencies, and to meet the routine health need of the population. Capacity building of the health workforce, strengthening health infrastructure, the supply of IPC commodities, and the

institutionalization of IPC practices and standards across all levels of healthcare should be considered as an essential component of emergency preparedness, particularly in Lassa endemic areas. Thankfully, since 2017, the ISTH, in collaboration with the NCDC, has embarked on yearly training programmes on IPC and case management of LF for all categories of HCWs in Nigeria. The NCDC recently issued national Guidelines for Lassa Fever Case Management and Infection Prevention and Control.[30] Put together, these are laudable initiatives to guide the management and control of Lassa fever at the healthcare facility level and to reduce nosocomial transmission, including health workers' infections. Beyond the direct occupational risks described in this study, other factors such as psycho-social stress, fatigue due to long hours of work or excessive workload, workplace disharmony, and poor remunerations are all potential indirect determinants of exposure to harm in the workplace which should be addressed.

This study has some limitations. First, it assumed that HCWs infections occurred in the workplace without excluding the possibility of non-occupational exposure, particularly rodent-to-human transmission at the community level. Second, there was difficulty in obtaining good-quality data on exposure history and IPC practices from patients who were seriously ill or had died. In such cases, some information was obtained from co-workers and proxies in addition to what was documented on the patient case notes. Third, data on IPC practices were based on patient interviews and might have been affected by recall bias. Studies involving direct observation of the practice of standard precautions among healthcare workers in their workplaces, including an on-site survey of the infection prevention and control materials available to workers, are warranted to provide a more precise assessment. Despite these limitations, this study uniquely draws a direct connection between exposure and infection in healthcare settings where IPC infrastructure and supplies are deficient and HCWs training is neglected.

Preventing occupational LF infection places responsibilities on both HCW and the employer. HCWs at all levels in the health system (hospitals, clinics, laboratories, etc.) should mandatorily be taught the basics of LF and other highly infectious diseases, including practical training on IPC - hand hygiene, use of PPE, prevention of needle sticks and sharp injury, safe blood collection, environmental cleaning and decontamination of surfaces and equipment, safe management of linens and medical waste.

They should report any risky exposure forthwith in the workplace to their immediate supervisor or employer for appropriate post-exposure prophylaxis. All HCWs who develop febrile illness in Lassa fever endemic areas or living in an area of Lassa fever outbreak should seek immediate medical attention. IPC programmes and governance structures, such as IPC teams and committees, should be constituted at all healthcare system levels to provide leadership for IPC implementation and ensure compliance with recommended standards. Employers are responsible for ensuring employees are well-trained and equipped with the required preventive measures. Administrative controls (such as guidelines, standard operating procedures, and policies) and engineering controls (such as the provision of running water, isolation areas, and waste management facilities), and provisions of PPEs must be in place to minimize occupational risk.

It is gladdening that healthcare worker protection and security is beginning to receive global attention following the recent EVD outbreak in West Africa, which prompted WHO and ILO to recommend that HCWs with EVD resulting from workplace activities should have the right to compensation, as well as free rehabilitation and access to curative services.[31] Implementing similar strategies for LF and cementing them into the national policy for IPC and emergency preparedness will go a long way to strengthen and increase the health workforce's confidence and immortalize all those who lost their lives for the patients under their care.

Conclusion

This study reported limited IPC adherence

practices and inappropriate risk assessments among HCWs who cared for LF patients during the outbreak. These were some of the factors that led to their LF exposure and subsequent high infections. It is, therefore, of urgent importance to provide IPC training for all HCWs. The relevant IPC materials should be made available to all healthcare facilities, especially in LF endemic areas, as part of emergency preparedness in Nigeria.

Availability of data and material

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgments

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