CPQ Medicine (2023) 14:1
Research Article

Assessing the Extent of Knowledge of Lassa Fever Infection and Its Prevention and Control Practices among Healthcare Workers in Anambra State, Nigeria

Anetoh Maureen, U.[1], Ubeh Chizoba, N.[2], Adenola Ugochi, A.[1], Ajagu Nnenna[3], Ofomata Janefrances, C.[4], Akunne Maureen[5], Ogbonna Brian, O.[1,6*], Nduka Sunday, O.[1]

[1]*Department of Clinical Pharmacy and Pharmacy Management, Faculty of Pharmaceutical Sciences Nnamdi Azikiwe University Awka Nigeria*

[2]*Pharmacy Department, General Hospital Ikot Ekpene, Akwa Ibom State, Nigeria*

[3]*Department of Clinical Pharmacy and Biopharmaceutics, Enugu State University of Science and Technology Enugu State Nigeria*

[4]*Department of Public Health, University of Leeds, United Kingdom*

[5]*Department of Clinical Pharmacy and Pharmacy Management, University of Nigeria Nsukka, Nigeria*

[6]*Department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmacy, King David University of Medical Sciences, Uburu, Nigeria*

[*]**Correspondence to:** Dr. Ogbonna Brian, O., Department of Clinical Pharmacy and Pharmacy Management, Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University, Awka, & Department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmacy, King David University of Medical Sciences, Uburu, Nigeria.

Copyright

Received: 16 December 2022

Published: 05 January 2023

Keywords: *Lassa Fever (LF); Knowledge; Infection Prevention and Control; Healthcare Workers; Nigeria*

Abstract

Background: The menace caused by Lassa fever infection, especially in West Africa, keeps increasing, and hospitals are the key areas to escalate the spread of the virus. There is an urgent need to have knowledgeable healthcare teams with the right attitude and competencies to prevent, diagnose, refer and treat patients with Lassa fever and manage an outbreak effectively. This study thus assessed the knowledge of Lassa fever infection and its prevention and control practices among the healthcare workers in Anambra State, Nigeria.

Methods: A hospital-based cross-sectional study was carried out by 200 healthcare workers in Anambra State. The healthcare workers comprised the doctors, nurses, pharmacists and medical laboratory scientists in three selected hospitals in Anambra State, which represented the three tiers of the healthcare system in Nigeria, using a well-validated self-administered questionnaire. The data collected were analyzed using SPSS version 20.

Results: Descriptive statistics were presented as frequencies and percentages, while associations between the variables were analyzed using the Chi-square test and one-Way ANOVA at $p<0.05$. Almost all the respondents had very good knowledge and were aware of Lassa fever disease, 196 (98.0%) though with some identified gaps. Their attitude and practice level on the infection prevention and control measures of Lassa fever disease, which ought to be close to 100 percent, need to be improved.

Conclusion: The healthcare professional's knowledge and practice level were neither dependent on the hospital of practice nor years of practice but varies significantly among the various healthcare professionals and their gender. The hospitals were not fully ready to combat an outbreak of Lassa fever infection.

Abbreviations

LF- Lasser Fever, NCDC- National center for Disease Control, WHO- World Health Organization, IPC- infection control and prevention, PPE- personal protective equipment, HCWs- healthcare workers, NAUTH- Nnamdi Azikiwe University Teaching Hospital, COOUTH- Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, CEPI- Coalition for Epidemic Preparedness Innovations

Introduction

Lassa fever remains a zoonotic disease of global health and economic challenge because of the associated mortality, endemicity and recurrent seasonal epidemics, especially in West African countries [1]. The World Health Organization (WHO) 2015 listed Lassa fever among priority diseases requiring urgent research and development attention [1]. It was considered for vaccine development funding by the multi-agency Coalition for Epidemic Preparedness Innovations (CEPI), alongside several other emerging viruses (Gibb *et al*., 2017). Currently, no vaccine is available for Lassa fever infection prevention [2]. The multimammate

rat, a rodent of the genus Mastomy, which is the host of the Lassa virus and is indigenous to most Sub-Saharan African countries [3] spreads the virus through the ingestion and inhalation of their excreta (urine and faeces) [4]. The virus can also be spread from person to person, either within households, during care for sick relatives or in healthcare settings through direct contact with the blood, secretions, organs or other body fluids of infected persons [5].

There are 100,000-300,000 cases of Lassa fever each year worldwide, causing an estimated 5,000 deaths and about (10-15) % of admissions to hospitals in the Sub-Saharan region [6]. Studies have shown that the seroprevalence of Lassa fever virus in human populations ranges from (8 -22) % in Sierra Leone, (4-5) % in Guinea and (7-22) % in Nigeria [7]. Outbreaks of Lassa fever in Nigeria have peak cases during the dry season (December - April). They are common in rural communities and hospital settings, hiked by socio-cultural practices, poor environmental and personal hygiene and poor practices of infection prevention and control measures [8]. The 2012 Lassa fever outbreak in Nigeria recorded 623 cases involving 70 deaths and included seven healthcare professionals (three doctors and four nurses) reported from 19 out of the 36 states in the country. The estimates as the years progressed recorded increases in death tolls with an increasing number of healthcare workers (HCWs) and hospital-acquired infections [9]. The epidemiological link between cases has been uncertain, with more states in different geopolitical zones in Nigeria experiencing outbreaks, making it almost impossible to predict where a possible outbreak could occur.

Earlier research on this subject has been population-based and shown varying degrees of knowledge [10]. The morbidity and mortality associated with the disease can reduce by careful management of infected persons, proper and timely control measures and the administration of prophylactic therapy to relatives and healthcare workers after exposure [6]. Emphasis has shifted from the routine prevention of cases to the rapid identification of infection symptoms and the timely initiation of transmission-based precautions to eliminate unnecessary exposure for healthcare staff, hospital visitors, and other patients [11]. Hospital infection control is a vital element in controlling potential outbreaks of Lassa fever [12] as most outbreaks have been significantly associated with hospital transmission even though the index cases have usually come from the community. In most cases, the virus transmission had occurred before Lassa fever was suspected. The healthcare workers who are working in Lassa fever case management centers are trained in standard infection control and prevention (IPC) as well as in the use of personal protective equipment (PPE) [13]. What about the healthcare workers in the hospitals who are the first point of call by patients? They need to be adequately knowledgeable on the disease, its control, prevention and treatment.

Lassa fever virus disease could manifest as an asymptomatic infection, which occurs in over 80% of the cases [2], as an acute or severe disease. The onset of acute Lassa fever is gradual and nonspecific, often beginning with intermittent fever and malaise followed by myalgia, sore throat, facial oedema and severe headache. Recovery begins eight to ten days after onset, while fatal/ severe cases progress to shock, multiple organ failure and death, sometimes within 14 days of the onset of a fatal case [1,2]. The symptoms and signs at the early stage are indistinguishable from those of other viral, bacterial or parasitic infections common in the tropics like malaria, typhoid and other viral haemorrhagic fevers. The incubation period of Lassa fever ranges from 6 to 21 days. The disease is especially severe in late pregnancy, causing maternal death and/or fetal loss in more than 80% of cases [2,13].

Definitive diagnosis requires testing available only in reference laboratories which are few in the country. A suspect must be rapidly excluded or verified to facilitate appropriate case management, including treatment, the implementation of isolation measures, or tracking of contact persons. The drug ribavirin is effective if administered early, following infection, and cannot prevent a fatal occurrence on late administration [13]. Early diagnosis plus treatment also reduces the likelihood of secondary transmission, including nosocomial transmission. It is, therefore, imperative that all healthcare workers, especially those in endemic communities, are educated on the disease, its clinical features, diagnosis, prevention and treatment.

The transmission of Lassa fever in healthcare facilities represents a significant burden on the healthcare system and a potential for sporadic outbreaks in different parts of the country [14]. According to the Lassa fever situation report (Epi week 17 (25 April - 1 May 2022) by the Nigeria Centre for Disease Control, all the states in the country had suspected cases of Lassa fever, while 23 states had confirmed cases. Anambra State had 21 suspected cases and three confirmed cases [15]. This finding also necessitates that healthcare providers with the highest risk for infection have comprehensive information on Lassa fever infection [16]. Nosocomial transmission and outbreaks among healthcare workers in Nigeria have become a cause for concern for the healthcare system. Many studies on the knowledge, attitude and practices of Lassa fever conducted in Nigeria among community dwellers and healthcare workers showed varying results [8,17-19]. A review of the challenges limiting the establishment of comprehensive infection control systems in resource-limited settings found that hospitals with improved infection control practices have minimal Lassa virus transmission [8]. There is a scarcity of such studies conducted among healthcare workers in Anambra state. This study, therefore, assessed the level of knowledge of Lassa fever infection among the healthcare workers in Anambra State and their level of preparedness to control an outbreak of the infection.

Lassa fever presents with symptoms and signs similar to most febrile illnesses such as malaria, typhoid fever and other viral haemorrhagic fevers like Ebola, thus making its diagnosis difficult. Definite diagnoses are only possible in the reference laboratories. Previous studies conducted in Nigeria showed that the knowledge of Lassa fever disease and attitude toward the practice of IPC was lacking among many and inadequate amongst a large proportion of healthcare workers. This poor knowledge and practice may make it difficult to avert the occurrence of an outbreak. It is more worrisome when it involves the healthcare workers resulting in a wrong diagnosis and endangering the life of the patients, healthcare workers, caregivers and other patients. This study assessed the knowledge of Lassa fever infection among the healthcare workers in Anambra State and their level of preparedness to fight an outbreak.

Methods

Study Design

A descriptive cross-sectional study was carried out among healthcare workers (HCWs) in selected healthcare facilities in Anambra State. An adapted and well-validated self-administered questionnaire instrument was the study instrument used. The study lasted for four months; from August to December 2019.

Study Area

The study took place in Anambra State, Southeastern Nigeria. The healthcare facilities used were Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, St. Joseph Hospital Adazi-Nnukwu and the primary healthcare center at Amawbia. The hospitals represented the tertiary, secondary and primary healthcare systems respectively.

Study Population

The study population included HCWs in the selected hospitals in Anambra state. The healthcare workers involved in the study were doctors, pharmacists, nurses (trained and auxiliary) and medical laboratory scientists. They are the healthcare professionals directly involved in clinical patient care or specimen collection.

Sample Size and Sampling Technique

A sample size of 210 HCWs, was arrived at using a simplified formula developed by Taro Yamane (1967:886) at a 95% confidence level after adding 5% extra to cover for wrongly filled questionnaires. The sample size was distributed among the various hospitals in the ratio of 5:2:1 (131, 53 and 26) for tertiary, secondary and primary healthcare facilities respectively. This ratio was based on the approximate number of healthcare workers at the different levels of care. For the HCW's sample size distribution, the ratio; of 5:4:2:2 (81:65:32:32) for doctors, nurses, pharmacists and medical laboratory scientists' respectively, were used. The study sites were conveniently selected, while the healthcare professionals were selected randomly.

Instrument Development and Validation

The questionnaire used for the study was adapted from previous studies [7,19]. The developed questionnaire contained three sections. They include; the basic demographics of respondents, knowledge of the respondents about Lassa fever and attitude and practice towards prevention and control of Lassa fever. The questionnaire was face validated by three public healthcare professionals knowledgeable in the subject matter and pre-tested among twenty HCWs working at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital COOUTH, Awka, also in Anambra State. The corrections by the healthcare professionals and the outcome of the pre-test helped to further improve the clarity of the questionnaire.

Eligibility Criteria

Medical doctors, pharmacists, nurses and medical laboratory scientists working in the study hospitals were eligible to participate in the study. Other healthcare professionals working in the study hospitals, or those healthcare professionals earlier listed who did not consent to the study were excluded from the study.

Ethical Consideration

Oral informed consent was obtained from all the respondents before data collection. All the information obtained were kept confidential. Ethical clearance for the study was obtained from the Research Ethics

Committee of Nnamdi Azikiwe University Teaching Hospital Nnewi with reference number NAUTH/CS/66/VOL.12/069/2019/030, and oral informed consent was obtained from the respondents.

Data Analysis

The respondents' data, collated in a Microsoft Excel spreadsheet, were imputed into SPSS (Statistical Package for Social Sciences, version. 20.0 for Windows, Inc., Chicago, IL, USA) for analysis. Demographic variables were analyzed descriptively and presented as frequencies and percentages. Chi-square test ascertained the association between categorical variables and participant responses in the three hospitals. The scores of various categories of respondents were presented as mean ± standard deviation. Scores of the respondents were compared to demographic variables using an independent student's t-test (for two variables) and one-way analysis of variance (for more than two variables). Statistical significance was at a p-value of below 0.05 ($p < 0.05$).

Results

Social Demographic Characteristics

A total of 210 questionnaires, were shared to the respondents in the study hospitals and 200 (95.2%) retrieved. All the questionnaires from the nurses were completely retrieved., Most of the respondents were below the age of 30 years, 120 (60) %, while the majority of the healthcare workers in all the study hospitals 133 (66.5) % were less than five years in the practice of their profession as shown in Table 1.

Table 1: *Social demographic characteristics of the respondents*

	Category	Tertiary Hospital N (%)	Secondary Hospital N (%)	Primary Hospital N (%)	Total N (%)
Age Group in Years	<30	77 (61.6)	26 (52.0)	17 (68.0)	120 (60.0)
	31-40	32 (25.6)	18 (36.0)	6 (24.0)	56 (28.0)
	41-50	15 (12.0)	4 (8.0)	2 (8.0)	21 (10.5)
	51-60	1(0.8)	2 (4.0)	0 (0)	3 (1.5)
	Above 60	0 (0)	0 (0)	0 (0)	0 (0)
	Total	125 (62.5)	50 (25)	25 (12.5)	200 (100)
Gender	Male	59 (47.2)	26 (52.0)	12 (48.0)	97 (48.5)
	Female	66 (52.8)	24 (48.0)	13 (52.0)	103 (51.5)
Profession	Doctor	55 (44.0)	21 (42.0)	3 (12.0)	79 (39.5)
	Nurse	32 (25.6)	14 (28.0)	18 (72.0)	64 (32.0)
	Pharmacist	20 (16.0)	8 (16.0)	2 (8.0)	30 (15.0)
	Medical Laboratory Scientist	18 (14.4)	7 (14.0)	2 (8.0)	27 (13.5)

Years of practice	≤ 5	82 (65.6)	32 (64.0)	19 (76.0)	133 (66.5)
	6-10	28 (22.4)	10 (20.0)	4 (16.0)	42 (21.0)
	11-15	11 (8.8)	6 (12.0)	2 (8.0)	19 (9.5)
	16 – 20	1(0.8)	1 (2.0)	0 (0)	2 (1.0)
	>20	3 (3.4)	1 (2.0)	0 (0)	4 (2.0)

Values are expressed as N (%).

Knowledge of Respondents about Lassa Fever

Almost all the respondents had very good knowledge of Lassa fever disease, 196 (98.0) % and also were aware that the disease is infectious 198 (99.0) %, while half of the respondents knew that persons can be infected without manifesting the symptoms 100 (50.3) %. This knowledge base was independent of the type of hospital. More than 95% of the respondents got the answers to the questions in the knowledge section correctly. The respondents' major sources of information about Lassa fever were the internet 56 (28.3) % and the knowledge gained in schools 60 (30.3) % while the campaign programs and print media had the least impact. These and other findings are shown in Table 2.

Table 2: *Knowledge of Respondents about Lassa fever*

	Category	**Tertiary**	**Secondary**	**Primary**	**Total**	**$\chi 2$ (p-value)**
Have you heard about Lassa fever before?	Yes	125 (100.0)	48 (96.0)	23 (95.8)	196 (99.0)	4.19 (0.123)
	No	-	1 (2.0)	1 (4.2)	2 (1.0)	
Source of awareness	Radio	14 (11.2)	10 (20.8)	7 (28.0)	31 (15.7)	18.467 (0.102)
	Television	20 (16.0)	7 (14.6)	3 (12.0)	30 (15.2)	
	Print media	6 (4.8)	-	2 (8.0)	8 (4.0)	
	Internet	40 (32.0)	12 (25.0)	4 (16.0)	56 (28.3)	
	School	39 (31.2)	14 (29.2)	7 (28.0)	60 (30.3)	
	Campaign programme	5 (4.0)	4 (8.3)	0 (0)	9 (4.5)	
	Others	1 (0.8)	1 (2.1)	2 (8.0)	4 (2.0)	
Do you know that Lassa fever is infectious?	***Yes***	125(100.0)	50 (100.0)	23 (92.0)	198 (99.0)	**14.141 (0.001)**
	No	0 (0)	0 (0)	2 (8.0)	2 (1.0)	
Do you know it is a communicable disease?	***Yes***	120(96.0)	49 (98.0)	23 (92.0)	192 (96.0)	2.263 (0.688)
	No	5 (4.0)	1(2.0)	2 (8.0)	8 (4.0)	
Can Lassa fever infection result in serious consequences like death?	***Yes***	121 (96.8)	48 (96.0)	24 (96.0)	193 (96.5)	7.723 (0.102)
	No	4 (3.2)	2(4.0)	1 (4.0)	7 (3.5)	

What type of microorganism is responsible for Lassa fever?	***Virus***	122 (97.6)	48 (96.0)	23 (92.0)	193 (96.5)	8.269 (0.408)
	Fungi	-	1 (2.0)	1 (4.0)	2 (1.0)	
	Bacteria	1 (0.8)	1 (2.0)	0 (0)	2 (1.0)	
	Protozoa	1 (0.8)	0 (0)	0 (0)	1 (0.5)	
	I don't know	1 (0.8)	0 (0)	1 (4.0)	2 (1.0)	
what is the vector responsible for Lassa fever transmission?	***Rodents***	121 (96.8)	49 (98.0)	24 (96.0)	194 (97.0)	0.890 (0.926)
	Mosquito	3 (2.4)	1 (2.0)	1 (4.0)	5 (2.5)	
	Flies	0 (0)	0 (0)	0 (0)	0 (0)	
	Dogs	0 (0)	0 (0)	0 (0)	0 (0)	
	I don't know	1 (0.8)	0 (0)	0 (0)	1 (0.5)	
Can a person be infected with Lassa fever and still not show any symptoms?	***Yes***	68 (54.8)	22 (44.0)	10 (40.0)	100 (50.3)	**13.808 (0.008)**
	No	56 (45.2)	28 (56.0)	15 (60.0)	99.0(49.8)	

Values are expressed as n (%). Categories in bold and italicized font indicate correct answers P<0.05: Significantly associated among the three hospitals

More than half of the respondents had good knowledge of the signs and symptoms of Lassa fever disease. Surprisingly, more of the respondents in the primary healthcare center were aware that Lassa fever has malaise as one of the symptoms. However, more respondents from the tertiary hospital were knowledgeable about most of the signs and symptoms of Lassa fever, as shown in figure 1.

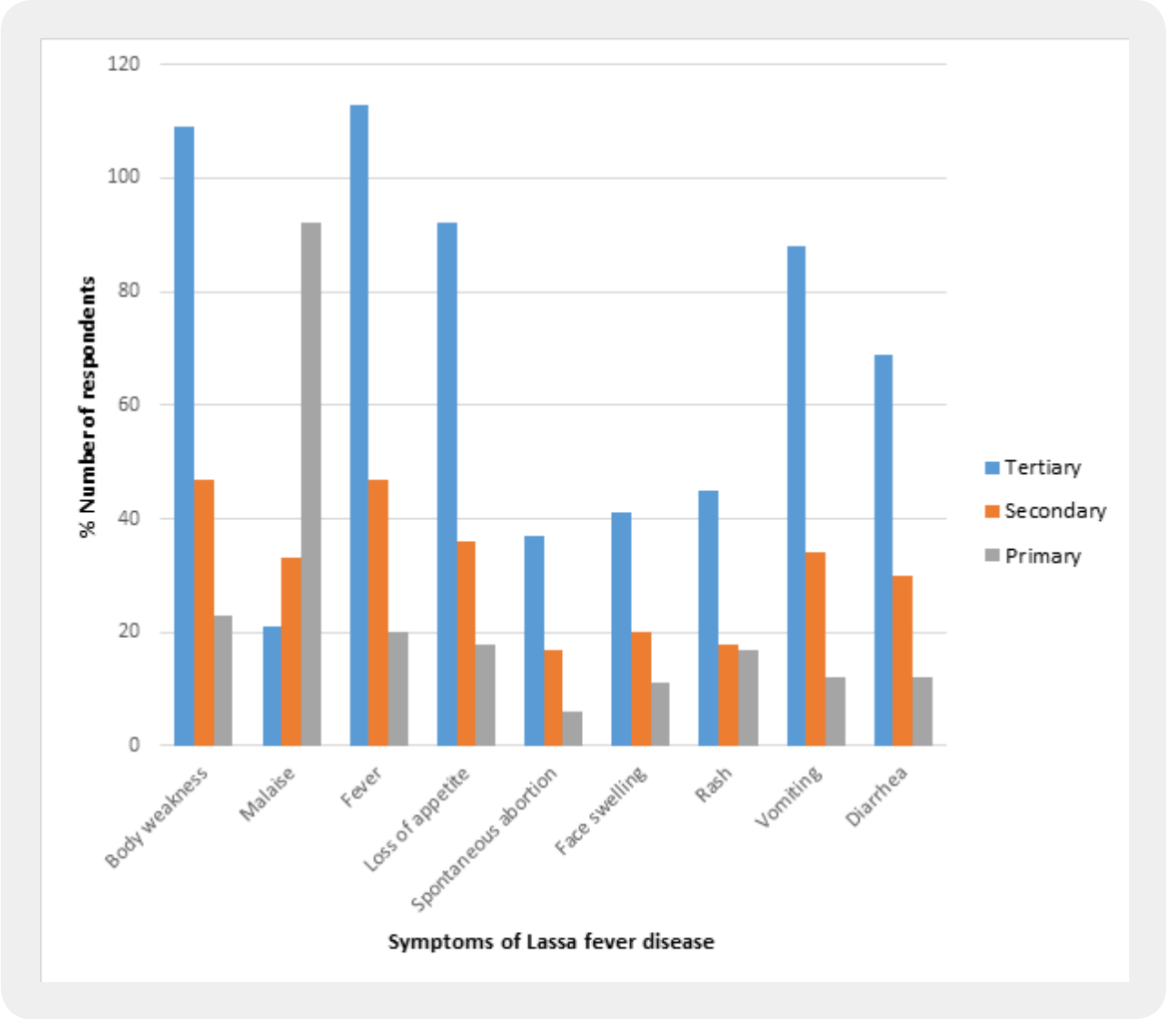

Figure 1: *Signs and Symptoms of Lassa fever*

Most of the respondents had a good knowledge of the preventive measures for Lassa fever infection. They include; avoiding contact with body fluids, good personal hygiene, use of personal protective equipment (PPE), avoiding rodents as a source of meat, community health education, clearing bushes around the house, early detection, environmental sanitation, and avoiding contact with infected persons. The respondents' responses on preventive measures of Lassa fever infection did not vary significantly in the three tiers of hospitals, except for the use of personal protective equipment, and early detection with p-values of (0.020) and (0.011) respectively. Here, the respondents from tertiary hospitals had more knowledge, as shown in Table 3. More than 50% of the respondents have the correct answer that "Lassa fever infection can be treated". The hospitals exhibited a significant ($\chi 2 = 7.516$, $p = 0.023$) knowledge of the treatment of Lassa fever, with respondents in the tertiary hospital 105 (84.7) % having more knowledge. Over three-quarters of the respondents, 150 (86.2) %, knew that Ribavirin is the drug of choice for the treatment of Lassa fever infection, as shown in Table 4.

Table 3: *Knowledge of the Preventive measures of Lassa fever infection*

	Category	Tertiary Hospital	Secondary Hospital	Primary Hospital	Total	$\chi 2$ (p-value)
What are the preventive measures for Lassa fever infection?	Avoid contact with body fluids	110	45	17	172	5.785 (0.055)
	Good personal hygiene	114	42	21	177	2.388 (0.303)
	Personal protective equipment	102	39	14	155	**7.839 (0.020)**
	Avoid rodents as a source of meat	102	42	17	161	2.975 (0.226)
	By vaccination	39	16	12	67	2.707 (0.258)
	Clearing bushes around the house	97	41	18	156	1.002 (0.606)
	Community health education	103	40	19	162	0.598 (0.742)
	Early detection	98	32	13	143	**8.966 (0.011)**
	Environmental sanitation	95	38	19	152	0.000 (1.000)
	Barrier nursing	54	22	10	86	0.114 (0.944)
	Isolation of infected person	88	40	20	148	2.245 (0.325)
	Proper Food storage	83	37	15	135	1.673 (0.433)
	Proper waste disposal	75	34	15	124	1.019 (0.601)
	Proper treatment of infected persons	72	28	15	115	0.110 (0.946)
	Fumigation	62	25	11	98	0.288 (0.866)

Values are expressed as n (%). Only persons with correct answers are enlisted. P<0.05: Significantly associated among the three hospitals.

Table 4: *Treatment of Lassa fever infection*

	Category	Tertiary Hospital	Secondary Hospital	Primary Hospital	Total	$\chi 2$ (p-value)
Can Lassa fever infection be treated?	***Yes***	105 (84.7)	41 (83.7)	14 (60.9)	160 (81.6)	7.516 **(0.023)**
	No	19 (15.3)	8 (16.3)	9 (39.1)	36 (18.4)	
	Do not know	0 (0)	0 (0)	0 (0)	0 (0)	
If yes, how can Lassa fever be treated?	***Use of Ribavirin***	101 (85.6)	34 (87.2)	15 (88.2)	150 (86.2)	5.523 (0.479)
	Use of antibiotics	3 (2.5)	0 (0)	1 (5.9)	4 (2.3)	
	By surgery	2 (1.7)	2 (5.1)	1 (5.9)	5 (2.9)	
	Do not know	12 (10.2)	3 (7.7)	0 (0)	15 (8.6)	
	Others	0 (0)	0 (0)	0 (0)	0 (0)	

Values are expressed as n (%). Categories in bold and italicized font indicate the correct answer. P<0.05: Significantly associated among the three hospitals.

The majority of respondents 128 (65.3) %, have never seen a suspected case of Lassa fever. When asked how to handle the cases if seen, about 35% of the respondents had no idea how to handle the cases. Among those who gave ideas on how to handle the cases, about 17 persons showed a wrong attitude of avoiding the patients and discharging them. Respondent's responses on the available preventive measures being practiced in their hospitals were good but not optimal and did not vary among the three hospitals. Only prevention of contact with body fluids was significantly (p=0.004) different and being practiced more by the respondents in the teaching hospital. Other findings are shown in Table 5. On the frequency of practice of the preventive measures, more than 50% of the respondents mentioned that they or their facilities always practiced the preventive measures, except for barrier nursing and fumigation of the environment which were sparingly practiced in all the hospitals. There was no statistical difference observed in the three hospitals.

Table 5: *Attitude and Practice towards Prevention of Lassa fever*

	Category	Tertiary	Secondary	Primary	Total	$\chi 2$ (p-value)
Have you seen a suspected Lassa fever case before?	Yes	47 (38.5)	13 (26.5)	8 (32.0)	68 (34.7)	2.311 (0.315)
	No	75 (61.5)	36 (73.5)	17 (68.0)	128 (65.3)	
If yes, how did you handle the case?	***Referral***	28	12	7	47	0.373 (0.830)
	Isolated the patient	23	12	4	39	0.936 (0.626)
	Discharged the patient	3	2	3	8	5.323 (0.070)
	Avoided the patient	6	1	2	9	1.466 (0.480)

	Reported the case to appropriate authorities	18	6	4	28	0.266 (0.876)
What preventive measures do you practice in your facility?	Avoid contact with body fluids	118	43	17	178	**15.444 (0.004)**
	Good personal hygiene	111	40	21	172	2.392 (0.302)
	Use of Personal protective equipment	96	39	20	155	0.132 (0.936)
	Clearing bushes around the facility	86	35	22	143	3.842 (0.146)
	Avoid contact with infected persons	94	36	22	152	2.456 (0.293)
	Isolation of suspected infected person	102	38	18	158	1.519 (0.468)
	Tracking of the immediate family members of the suspect	74	27	13	114	0.685 (0.710)
	Proper waste disposal	80	38	17	135	2.348 (0.309)
	Proper treatment of infected persons	81	32	16	129	0.013 (0.993)
	Adequate handwashing	82	36	14	132	1.925 (0.382)
	Barrier nursing	57	23	9	89	0.838 (0.658)
	Fumigation of the facility from time to time	62	22	14	98	1.008 (0.604)
	Others	14	7	5	26	1.444 (0.487)

Values are expressed as n (%). Categories in bold and italicized font indicate the correct answer. P<0.05: Significantly associated among the three hospitals.

Proper handwashing, use of personal protective equipment, Isolation of suspected infected persons and proper waste disposal were preventive measures frequently practiced by healthcare workers in the study hospitals as shown in Table 6. There was no significant difference in the frequency of practice of the preventive measures among the studied hospitals.

Table 6: *Frequency of practice of preventive measures*

Preventive Measures	Frequency	Tertiary Hospital	Secondary ---	Primary ---	Total	$\chi 2$ (p-value)
Proper hand-washing	Always	87 (69.6)	38 (77.6)	16 (64.0)	141 (70.9)	6.212 (0.399)
	Most of the time	25 (20.0)	9 (18.4)	8 (32.0)	42 (21.1)	
	Sometimes	12 (9.6)	1 (2.0)	1 (4.0)	14 (7.0)	
	Rarely	1 (0.8)	1 (2.0)	-	2 (1.0)	
	Never	-	-	-	-	
Fumigation of the facility	Always	29 (23.2)	10 (24.0)	6 (24.0)	45 (22.6)	6.520 (0.589)
	Most of the time	30 (24.0)	14 (28.6)	9 (36.0)	53 (26.6)	
	Sometimes	46 (36.8)	15 (30.6)	7 (28.0)	68 (34.2)	
	Rarely	19 (15.2)	10 (20.4)	2 (8.0)	31 (15.6)	
	Never	1 (0.8)	0 (0)	1 (4.0)	2 (1.0)	
Clearing bushes around the facility	Always	43 (34.7)	16 (32.0)	9 (36.0)	68 (34.2)	2.331 (0.887)
	Most of the time	42(33.9)	7 (14.0)	7 (28.0)	63 (31.7)	
	Sometimes	29 (23.4)	15 (30.0)	8 (32.0)	52 (26.1)	
	Rarely	10 (8.1)	5 (10.0)	1 (4.0)	16 (8.0)	
	Never	0 (0)	0 (0)	0 (0)	0 (0)	
Use of personal protective equipment	Always	67 (53.6)	29 (58.0)	12 (48.0)	108 (54.0)	4.755 (0.783)
	Most of the time	25 (20.0)	7 (14.0)	8 (32.0)	40 (20.0)	
	Sometimes	22 (17.6)	11 (22.0)	4 (16.0)	37 (18.5)	
	Rarely	9 (7.2)	2 (4.0)	1 (4.0)	12 (6.0)	
	Never	2 (1.6)	1 (2.0)	0 (0)	3 (1.5)	
Isolation of suspected infected person	Always	80 (64.0)	31 (63.3)	16 (64.0)	127 (63.8)	11.641 (0.168)
	Most of the time	26 (20.8)	10 (20.4)	7 (28.0)	43 (21.6)	
	Sometimes	17 (13.6)	5 (10.2)	2 (8.0)	24 (12.1)	
	Rarely	2 (1.6)	0 (0)	0 (0)	2 (1.0)	
	Never	0 (0)	3 (6.1)	0 (0)	3 (1.5)	

Proper waste disposal	Always	83 (66.4)	38 (76.0)	17 (68.0)	138 (69.0)	3.694 (0.718)
	Most of the time	29 (23.2)	10 (20.0)	7 (28.0)	46 (23.0)	
	Sometimes	11 (8.8)	2 (4.0)	1 (4.0)	14 (7.0)	
	Rarely	2 (1.2)	0 (0)	0 (0)	2 (1.0)	
	Never	0 (0)	0 (0)	0 (0)	0 (0)	

Values are expressed as N (%).

Overall Average Knowledge and Practice Scores of Respondents in Three Hospitals

For knowledge, a total of 39 scores was assigned to knowledge which is one point for each correct answer. Correct answers scored out of 39 points were used to assess respondents' knowledge of Lassa fever. Likert-scale format (always to never) was used to assess respondents' responses to the practice of Lassa fever. A total of 30 points was established as the highest score for those that answered "always". This implied that a score of 5-1 was assigned to each respondent who answered always, most of the time, sometimes, rarely and never respectively. One-way ANOVA did not reveal a significant difference in knowledge score (p = 0.548) as well as practice score (p = 0.793) of the respondents in the three hospitals. As shown in Table 7.

Comparing the knowledge and practice scores of the respondents on Lassa fever infection with the demographic variables, there were statistically significant differences in the knowledge and practice level of the respondents when compared with their gender (p-value 0.0005, 0.003), and profession (p-value 0.0005, 0.0005) respectively. There was no difference in the knowledge and practice of preventive measures for Lassa fever by the healthcare professional based on the years of practice in the three hospitals assessed. The knowledge score had a significant variation among the healthcare workers based on age groups (p-value=0.002) with the healthcare workers in the age range of 51-60 years, having the least knowledge of Lassa fever disease (14.33 ± 7.57) as shown in Table 7.

Table 7: *Comparison of knowledge, attitude and practice scores of respondents in three hospitals*

Variables	Category	Knowledge	Practice
Health Facilities	Tertiary	25.10 ± 6.64	25.23 ± 3.49
	Secondary	24.84 ± 7.80	25.12 ± 3.73
	Primary	23.44 ± 6.06	25.68 ± 2.41
	***p*-value**	0.548	0.793
Age Group in Years	<30	23.91 ± 6.68	25.47 ± 3.31
	31- 40	26.46 ± 6.43	24.63 ± 3.72
	41-50	27.19 ± 7.00	25.67 ± 3.26
	51-60	14.33 ± 7.57	26.00 ± 3.46
	Above 60	-	-

	***p*-value**	**0.002**	0.426
Gender	Male	26.65 ± 6.53	24.53 ± 3.60
	Female	23.11 ± 6.76	25.95 ± 3.11
	***p*-value**	**0.0005**	**0.003**
Profession	Doctor	28.49 ± 6.24	24.51 ±3.63
	Nurse	22.38 ± 6.24	26.59 ± 2.74
	Pharmacist	23.67 ± 5.33	23.87 ± 3.49
	Medical Laboratory Scientist	21.19 ± 6.87	25.85 ± 3.12
	p-value	**0.0005**	**0.0005**
Years of practice	≤5	24.14 ± 6.87	25.50 ± 3.26
	6-10	25.83 ± 5.91	24.40 ± 3.96
	11-15	27.53 ± 8.71	25.63 ± 3.04
	16 – 20	29.50 ± 3.54	25.50 ± 2.12
	>20	21.75 ± 3.20	24.50 ± 4.93
	p-value	0.141	0.454

Values are presented as mean ± standard deviation of sample size. p<0.05: a statistically significant difference. Values with different superscript symbols are significantly different from each other.

Discussion

The findings on the knowledge of Lassa fever infection and its infection prevention and control practices among the healthcare workers in the three tiers of the healthcare system in Anambra State revealed that the healthcare workers had somewhat adequate knowledge, however, attitude and practice of the preventive and control measures need to be improved on. There were statistically significant differences in the knowledge and practice level of the respondents when compared with their gender (p-value = 0.0005, 0.003), and profession (p-value = 0.0005, 0.0005) respectively. The males were more knowledgeable but less practical. The doctors had the highest knowledge score while the nurses had the best practice score. Studies in Kaduna [20] and Plateau State [21] recorded low knowledge of Lasser fever among doctors and nurses. High knowledge was atttributable to previous trainings obtained by the healthcare workers during the previous outbreak [17].

Generally, the level of knowledge in our study was similar to results in studies carried out in Enugu, Ondo, and Abakaliki [17,22,23]. There was no difference in the knowledge and practice of preventive and control measures of Lassa fever by the healthcare professionals, based on the years of practice in the three hospitals assessed. The knowledge score had a significant variation among the healthcare workers based on age groups (p-value=0.002). The healthcare workers that were within the age range of 51-60 years had the least score on knowledge of Lassa fever disease (14.33 ± 7.57).

The high knowledge scores by the healthcare workers in our study was encouraging. Our findings were similar to a study conducted in Edo State, Nigeria by Faith *et al* [15], but in contrast to another study carried out in northern Nigeria by Wada *et al* which found that half of the healthcare workers had poor knowledge of Lassa fever infection. Among those that were knowledgeable, the healthcare workers in the teaching hospital had significantly more knowledge of Lassa fever infection prevention and control practices than their counterparts in the secondary hospital or primary healthcare center [19]. The healthcare workers in the tertiary hospital in our study had slightly higher knowledge scores when compared to other hospitals though it was not statistically different. This disparity seen in various study settings may be due to variations in the geographical location of the study sites and the importance attached to Lassa fever IPC by the authorities concerned.

The importance of the knowledge of a clinical practitioner about an infection such as Lassa fever, especially during an outbreak, cannot be overemphasized as only on that can proper diagnosis, management, treatment, control, referral and reporting of such cases to the appropriate authorities be made. Our study showed a poor knowledge in some of some of the questions asked. A few of the healthcare workers did not know the microorganism that causes Lassa fever and how it is transmitted. This calls for continuous on-the-job education of the healthcare workers on this and possible inclusion of the subject matter in the various undergraduate curriculum of the healthcare professions. The doctors in this study had a higher average score on the knowledge of Lassa fever infection, prevention and control measures while the nurses were more grounded on the practice. The pharmacists had the least average score on the practice of IPC measures (23.87±3.49). This is contrary to the findings in a similar study conducted in western Nigeria, where the pharmacists had good attitude and nine times the odds of good Lassa fever IPC practices (OR=8.755, 95%CI=1.028-74.531) [17].

It is expected that good Lassa fever IPC measures should always be practiced by the healthcare workers as recommended in the National guideline for Lassa fever case management [15], to prevent and curtail the spread of the infection. Our findings did not reveal optimum practice of these IPC measures by the healthcare workers and thus imply that the hospitals in Anambra State were not fully ready and capable of controlling an outbreak. Step down lectures and workshops for all the healthcare workers are required to improve their knowledge and bring about behavioural and attitudinal changes among them to effectively prevent and control the outbreak and spread of Lassa fever in the communities.

Limitations

First, being a hospital-based study, only those HCWs met on their duty posts were enlisted and randomly chosen for the study. Secondly, some respondents were allowed to complete the questionnaire and return later. This may have introduced some bias, as they may have used reference materials to augment their knowledge scores. Despite these limitations, this study x-rayed the study objectives using the different tiers of the hospital system, healthcare professionals and locations.

Conclusion

The study revealed a high level of knowledge about Lassa fever among the healthcare workers in Anambra State though with some gaps in knowledge. Their attitude and practice level of the preventive measures of Lassa fever disease need to be improved. The hospitals in Anambra State are not fully ready to combat an outbreak of Lassa fever infection. There is an urgent need to increase the knowledge level among healthcare personnel regarding Lassa fever through education campaigns consisting of continuing professional education, seminars, pamphlets and workshops that would pay more attention to the identified gaps in knowledge. The healthcare professionals should always practice the preventive measures to ensure maximum prevention of the infection. Attitudinal change among the healthcare workers and the management of the healthcare institutions are needed to ensure adequate practice, provision of the necessary equipment and monitoring of the implementation of the IPC.

Recommendation

Improved level of education of the healthcare workers on Lassa fever infection and control measures. Institution of adequate monitoring teams and establishment of more reference laboratories to ensure fast delivery of results and treatment if necessary.

Conflicts of Interest

The authors have no conflict to declare

Funding

No fund or grant was received for this study

Bibliography

1. Gibb, R., Moses, L. M., Redding, D. W. & Jones, K. E. (2017). Understanding the cryptic nature of Lassa fever in West Africa. *Pathogens and Global Health, 111*(6), 276-288.

2. World Health Organization (2021). Lassa fever fact sheet.

3. Martynov, A., Aleksey, A. & Leonid, A. (2022). Multimammate mice of the genus; M, L (Rodentia: Muridae) in Ethiopia - diversity and distribution assessed by genetic approaches and environmental niche modelling Multimammate mice of the genus Mastomys (Rodentia: Muridae) in Ethiopia - diversity. May 2022.

4. Sf, U., Su, I., It, A., Od, A., Ea, O. & Faboya, T. (2018). Impact of Lassa Fever on the Practice and Consumption of Stored Food by the University of Benin Community, in Benin City. *Nigeria Community Medicine and Primary Health Care, 30*(1), 66-76.

5. State, E., Akunne, M. O., Isah, A., Anene-okeke, C. G. & Oguejiofor, F. A. (2018). Among the Undergraduate Students of University of, *1*(6), 6-9.

6. Nb, E., Rs, A., Im, S. & Pou, A. (2019). Knowledge, Attitude and Preventive Measures Regarding Lassa Fever among Residents of the University of Abuja Staff Quarters Giri, Gwagwalada Abuja. *American Journal of Medicine and Medical Sciences, 9*(3), 90-95.

7. Ighedosa, S. U., Odigie, A. E., Usifoh, S. F. & Asemota, O. (2017). Knowledge, attitude and practice of Lassa fever prevention by students of the University of Benin. October.

8. SI, A. & AE, E. (2017). Lassa Fever and Infection Control: Knowledge, Attitudes and Practice in a University Teaching Hospital in Uyo, Nigeria. *Ibom Medical Journal, 10*(1), 40-47.

9. WHO. (2022). WHO Updates on Lassa fever. Lassa Fever - Nigeria.

10. Ea, T., Da, A., Ec, I., Og, U. & Ebhodaghe, P. (2013). Assessment of knowledge and attitude towards Lassa fever among Primary care providers in an endemic suburban community of Edo State: implications for control. 4(August), 311-318.

11. Adebimpe, W. O. & Ibirongbe, D. O. (2019). Exploring the Knowledge and Preventive Practices on Isolation Precaution and Quarantine Among Health Care Workers in Ondo State. *Nigeria, 85*(1), 1-7.

12. Ijarotimi, I. T., Ilesanmi, O. S., Aderinwale, A., Abiodun-Adewusi, O. & Okon, I. M. (2018). Knowledge of Lassa fever and use of infection prevention and control facilities among health care workers during Lassa fever outbreak in Ondo State, Nigeria. *Pan African Medical Journal, 30,* 1-13.

13. NCDC. (2020). Lassa fever situation report. *Nigeria Centre for Disease Control, 1*(1), 1-6.

14. Faith, I., Harrison, E., O, A. A., Ekundare, F. O., A, R. E., O, O. C., Ifeanyi, O. & B, O. A. (2019). Knowledge, Attitude and Infection Prevention and Control Practices Regarding Lassa Fever among Healthcare Workers in Edo State, Nigeria. *International Journal of Prevention and Treatment, 8*(1), 21-27.

15. llllllll. (2018). National guideline for the management of Lassa fever.

16. Adebayo, D., Nwobi, E. A., Vincent, T. & Gonzalez, J. (2015). Response Preparedness to Viral Hemorrhagic Fever in Nigeria: Risk Perception, Attitude towards Lassa fever. Epidemiology. *Open Access, 5*(3).

17. Ukwenya, V. O., Fuwape, T. A., Fadahunsi, T. I. & Ilesanmi, O. S. (2021). Disparities in knowledge, attitude, and practices of infection prevention and control of Lassa fever among health care workers at the federal medical center, Owo, Ondo State, Nigeria. *Pan African Medical Journal, 38,* 357.

18. Usuwa, I. S., Akpa, C. O., Umeokonkwo, C. D., Umoke, M., Oguanuo, C. S., Olorukooba, A. A., Bamgboye, E. & Balogun, M. S. (2020). Knowledge and risk perception towards Lassa fever infection among residents of affected communities in Ebonyi State, Nigeria: Implications for risk communication. *BMC Public Health, 20*(217), 1-10.

19. Wada, Y. H., Ogunyinka, I. A., Yusuff, K. B., Ochu, C. L., Yahaya, M., Khalid, G. M., Mutalub, Y. B. & Adeniye, S. B. (2022). Knowledge of Lassa fever, its prevention and control practices and their predictors among healthcare workers during an outbreak in Northern Nigeria: A multi-centre cross-sectional assessment. *PLOS Neglected Tropical Diseases, 16*(3), e0010259.

20. Asuke, S., Agubamah, E., Ibrahim, M. S. & Ovosi, J. O. (2020). Knowledge, attitude, and practice toward Lassa fever prevention and control among health care providers in Sabon Gari Local Government Area, Kaduna State, Nigeria. *J Med Trop., 22,* 1-7.

21. Oladejo, J., Nwokoro, U., Ijarotimi, T., Jum, S., Bajoga, A., Shaflu, D., *et al*. (2018). Lassa fever prevention practices health workers during an outbreak in Plateau state. *International Journal of Medicine and Biomedical Research, 7*(1), 11-20.

22. Ndu, A. C., Kassy, W. C., Ochie, C. N., Arinze-Onyia, S. U., Okeke, T. A., Aguwa, E. N., *et al*. (2019). Knowledge, Misperceptions, Preparedness, and Barriers towards Lassa Fever Control among Health Care Workers in a Tertiary Institution in Enugu, Nigeria. *Journal of Health Care for the Poor and Underserved, 30*(3), 1151-1164.

23. Odegbemi, O. B., Umeokonkwo, C. D., Nwachukwu, W., Nwaekpe, C. N., Oladejo, J., Azuogu, B., *et al.* (2019). Infection prevention and control in a treatment centre during a Lassa fever outbreak in southeastern Nigeria - January, 2018. *Global Biosecurity, 1*(3).