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Knowledge and Risk Factors of Lassa Fever among Household Members in a Rural Community in Edo State, Southern Nigeria

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Abstract

Background: Lassa fever (LF) affects about two million people and causes 5000-10,000 deaths annually in West Africa. The study aimed to assess the knowledge and risk factors of LF among householders in Akhulowa community in Edo State.
Methods: This cross-sectional analytical study was carried out among all consenting eligible participants. Data collection was by structured interviewer-administered questionnaire and an observational checklist used to assess the housing conditions. Data was analyzed using IBM SPSS version 22.0. Univariate and bivariate analysis were done and p-value < 0.05 was considered statistically significant.
Results: There were 220 respondents with a mean age of 37.9±13.2 years and more females 127 (57.7%). One hundred and four (47.3%) of the respondents had secondary education. One hundred and ninety-one (86.8%) of them were aware of LF, out of which 112 (58.6%) had good knowledge. Higher education level (p=0.045), being employed (p=0.001) and lower household income (p=0.010) were significantly associated with good knowledge of LF. One hundred and fifty-eight participants (71.8%) had low risk assessment score for LF. Being employed (p=0.001); having stayed < 20 years in the community (p=0.001) and lower household income (p=0.004) were significantly associated with high risk of LF. One hundred and twenty-nine (58.6%) and 74 (33.6%) of the households had open refuse dumps and overgrown vegetation around their houses, respectively.
Conclusion: The study revealed a knowledge gap with majority of the respondents having low risk of LF. Repeated risk communication messages concerning LF should be delivered by the state and local government to households in the community.

Keywords: Knowledge; Risk factors; Lassa fever, Edo State, Nigeria.

Introduction

Lassa fever (LF) is an acute viral haemorraghic disease caused by the Lassa virus, a member of the family of Arenaviridae.[1] It was first reported in Nigeria in 1969 and since then, there have been repeated outbreaks in Nigeria and other countries in West Africa. The disease has also been reported in parts of Central, East Africa and parts of Europe and North America.[2] The countries affected in the West Africa sub-region include Nigeria, Sierra Leone, Guinea, Liberia, Democratic Republic of Congo, Mali, Senegal and Ghana.[3,4] It is estimated to affect two million people and cause 5000-10,000 deaths annually in West Africa.[5-7]

Recent data from Nigeria reveal that there were 833 confirmed cases and 174 deaths between January - December 2019. This was reported from 23 states across Nigeria.[8] The disease has a mean case fatality rate (CFR) of between 1-16%; although during

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epidemics and pregnancy, the CFRs could be up to 50% and 80%, respectively.[8-10] Lassa fever is transmitted by the ubiquitous multimamate rodent (Mastomys natalensis), which is widespread throughout West Africa. Although, other species of Mastomys and non-Mastomys small mammals (such as Rattus rattus) have also been implicated[11] The mastomys rodent, which lives near field crops and stored food around homes is often chronically infected with the virus, which it sheds in urine and faeces; resulting in human infection of varying severity. The mastomys rodent also lives in dirty and unkempt surroundings, especially where there is open waste dump where they derive their food.

The primary mode of transmission is "rodent- to-human", by ingestion of food contaminated by rodent urine and excrement as well as inhalation of aerosolized virus particles.[12,13] Secondary person to person transmission occurs in health care settings where basic infection control procedures are not maintained, and in the home, during contact with body fluids or soiled linen while rendering care to sick relatives.[14,15] Risk factors for LF include hunting, cooking and eating rats, poor environmental sanitation, poor housing structure, bush burning, deforestation, urbanization and having one's house infested with rodents.[15,16]

Lassa fever is an epidemic prone disease; hence it is classified under immediate notification by the Integrated Disease Surveillance and Response (IDSR) in Nigeria. It has an alert threshold of a single suspected case and an epidemic threshold of a single confirmed case.[16,17] There is currently no vaccines for the disease,so the preventive strategies towards the primary transmission of the disease are through surveillance and vector control. This is best heralded by extensive risk communication and community awareness programme.[13] Outbreaks of lassa fever have been reported in sub-Saharan Africa in recent times, especially in the last one decade. These outbreaks have been particularly worse in some states in Nigeria since January 2014. These states include Edo, Ondo, Gombe, Taraba, Bauchi, Ebonyi, Anambra, Yobe, Rivers and Plateau State.[18] In Edo State, Etsako West LGA has one of the highest burdens of the disease during this period. About 871 confirmed cases and 12 deaths were recorded between January and August 2019 in Etsako West LGA from LF.[18,19] The aim of this study was to assess the knowledge of LF, the risk profile and risk factors including predisposing environmental and housing conditions of householders within Akhulowa community in Etsako West LGA, Edo State, Nigeria.

Materials and methods

The study utilized a descriptive cross-sectional study design and was carried out in Akhulowa community in Etsako-west LGA in the northern part of Edo State. The survey was carried out between August and October 2019. Akhulowa is a rural, predominantly agrarian community with an estimated population of 12,540.[19] The predominant ethnic group and religion are Etsako and Islam, respectively. It has one Primary Health Care centre, one market, two primary and one secondary school.

The study population comprised heads of households or their representatives (≥ 18 years) who were permanent residents. A sample size of 220 was determined using the formula for estimation of sample size for a single independent proportion ($n= Z\alpha^2pq/d^2$)[20], and a prevalence of knowledge in an earlier study of 17.2%[21], Z_α of 1.96 at 95% confidence level and a precision of 5%, a minimum sample size of 210 was calculated but after correcting for 5% non-response, a sample size of 220 was obtained.

All consenting eligible participants in the community were included in the study.

Data was collected with the aid of a structured interviewer-administered questionnaire. The data collection was carried out over a period of 10 days by 25 trained research assistants who were final year medical students. Most of the respondents were interviewed in their homes in the mornings and afternoons while repeat visits were carried out in the evenings and weekends for those who were absent. The questionnaire consisted of four sections which sought information on the respondents' sociodemographic characteristics, knowledge of Lassa fever, respondents' risk profile, household risk factors and preventive practices for Lassa fever. An observation checklist was also designed to assess the housing conditions. This assessment was based on the type of the building materials; the intactness of windows; ceilings and roof of the house, the external hygiene of the house (presence or absence of vegetation, debris/rubbish, wood, etc.)

and the interior hygiene (presence or absence of refuse, arrangement of kitchen utensils, location/type of kitchen, and type of cooking fuel).

Data was screened for completeness, coded and entered into the IBM SPSS version 22.0 Univariate analysis was done to assess distribution of the variables. Bivariate analysis was done to determine the association between respondents' socio-demographic characteristics with their overall knowledge and overall risk assessment of Lassa fever using chi square test and Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

Respondents' knowledge of Lassa fever was assessed using eight (8) questions with some having multiple responses. A correct response was awarded a score of one (1) while an incorrect response a score of zero (0) with a maximum obtainable score of 18. The total score for each respondent was converted to percentage and classified as: Poor knowledge (less than 50%); Fair knowledge (50-69.9%) and Good knowledge (70% and above).

Respondents' risk of Lassa fever was assessed using 13 questions. A "Yes" response to any of the listed factors which increases the risk of Lassa fever such as contact with person diagnosed or who died of Lassa fever, having eaten rats/bush meat, handled rodents with bare hands, or participated in burial practices that included washing/hugging the corpse was given a score of one (1) while a "No" response was given a score of zero (0) with a maximum obtainable score of 13. The total score for each respondent was converted to percentage and classified as: Low risk (less than 50%); Moderate risk (50-69.9%) and High risk (70% and above).

Ethical approval (Protocol number: ADM/E.22/A/VOL. VII/14830946) was obtained from the University of Benin Teaching Hospital, Health Research Ethics Committee. Permission to carry out the study was also obtained from the Local Government authority and the *Daudu* of Akhulowa community before commencement of the study. Verbal Informed consent was obtained from the respondents before data was collected. All data was kept secured and available only to members of the research team.

Results

Two hundred and twenty respondents (140 heads of households and 80 representatives) with mean age (SD) 37.9 ± 13.2 years participated in the study. One hundred and thirty-seven (62.3%) of them were < 40 years and 127 (57.7%) were females. One hundred and four (47.3%) had secondary education, 128 (58.2%) were employed and 118 (53.6%) of them had been living in the community for more than 20 years.

Sixty-five (29.5%) and 155 (70.5%) of the respondents were in households with > 6 and ≤ 6 persons, respectively. Twenty (11.4%) and 195 (88.6%) were in households with > 3 and ≤ 3 sleeping rooms, respectively. (**Table 1**)

One hundred and ninety-one (86.8%) of the respondents were aware of Lassa fever and their main sources of information included radio/television 118 (61.8%), health workers 109 (57.1%) and family/friends 93 (48.7%).

One hundred and nine (57.1%) of the respondents knew that a virus caused Lassa fever, 171 (89.5%) knew that rats were involved in the transmission of Lassa fever while 109 (57.1%) correctly mentioned at least three symptoms of Lassa fever. (**Table 2a**)

One hundred and sixty-eight (88.0%), 159 (83.2%), and 157 (82.2%) knew that eating contaminated food/fruits/vegetables, eating with contaminated utensils and contact with infected persons can transmit Lassa fever, respectively. One hundred and seventy-eight (93.2%) and 170 (89.0%) of them knew that storage of food in closed containers and maintaining a clean environment can prevent Lassa fever, respectively. Ninety-nine (51.8%) and 169 (88.5%) knew that the disease is curable and preventable, respectively. (**Table 2b**)

One hundred and twelve (58.6%) of the respondents had good knowledge while 56 (29.3%) and 23 (12.0%) had fair and poor knowledge, respectively. Seventy-eight (62.4%) of those < 40 years had good knowledge of Lassa fever compared with 34 (51.5%) of those ≥ 40 years but this was not statistically significant, p=0.168. Fifty (65.8%) of the male respondents had good knowledge of Lassa fever compared with 62 (53.9%) of the female respondents but this was not statistically significant, p=0.052. Those who had higher level of education 85 (63.9%) had significantly higher proportion of good knowledge of Lassa fever compared with those with lower level of education 27 (46.6%), p=0.045. Those who are employed 70 (60.9%) had a

Table 1: Socio-Demographic Characteristics of Respondents

Variable	Frequency (n=220)	Percent
Age group (years)		
< 40	137	62.3
= 40	83	37.7
Sex		
Male	93	42.3
Female	127	57.7
Religion		
Christianity	130	59.1
Islam	89	40.5
ATR	1	0.4
Marital status		
Married	173	78.6
Not married	47	21.4
Level of Education		
No formal education	28	12.7
Primary	49	22.3
Secondary	104	47.3
Tertiary	39	17.7
Ethnicity		
Etsako	185	84.1
Others	35	15.9
Employment status		
Employed	128	58.2
Not employed	92	41.8
Household income (?)		
< 30,000	102	46.4
=30,000)	118	53.6
Length of stay (years)		
< 10	60	27.3
10-19	42	19.1
= 20	118	53.6

Table 3: Association between Socio-demographic Characteristics and Overall Knowledge Score of Respondents

Variable	Overall Knowledge Score			Test statistics	p-value
	Poor (n=23) n (%)	Fair (n=56) n (%)	Good (n=112) n (%)		
Age group (years)					
< 40	16 (12.8)	31 (24.8)	78 (62.4)		
= 40	7 (10.6)	25 (37.9)	34 (51.5)	χ^2= 3.565	0.168
Sex					
Male	4 (5.3)	22 (28.9)	50 (65.8)		
Female	19 (16.5)	34 (29.6)	62 (53.9)	χ^2= 5.923	0.052
Religion					
Christianity	12 (10.3)	30 (25.9)	74 (63.8)		
Islam	11 (14.7)	26 (34.7)	38 (50.7)	χ^2= 3.249	0.197
Level of Education					
NFE/Primary	7 (12.1)	24 (41.4)	27 (46.6)		
Secondary/Tertiary	16 (12.0)	32 (24.1)	85 (63.9)	χ^2= 6.207	**0.045***
Employment status					
Employed	9 (7.8)	36 (31.3)	70 (60.9)		
Not employed	14 (18.4)	20 (26.3)	42 (55.3)	χ^2= 5.588	**0.001***
Household income (?)					
< 30, 000	8 (8.1)	30 (30.3)	61 (61.6)		
=30,000)	15 (16.3)	26 (28.3)	51 (55.4)	χ^2= 6.119	**0.010***
Length of stay (years)					
< 10	7 (13.0)	12 (22.2)	35 (64.8)		
10-19	3 (7.7)	9 (23.1)	27 (69.2)		
= 20	13 (13.3)	35 (35.7)	50 (51.0)	χ^2= 5.653	0.227

*Statistically significant

Table 2a: Knowledge of Lassa fever among Respondents

Variables	Frequency	Percent
Heard of Lassa fever (n=220)		
Yes	191	86.8
No	29	13.2
Source of information* (n=191)		
Radio/Television	118	61.8
Health worker	109	57.1
Family/Friends	93	48.7
Posters	46	24.1
Newspapers	44	23.0
Church	2	1.0
Cause of Lassa fever (n=191)		
Correct (Virus)	109	57.1
Incorrect (Mosquito, bacteria, flies, worms)	82	42.9
Vector of Lassa fever (n=191)		
Correct (Rats)	171	89.5
Incorrect (Dogs, Cats)	20	10.5
Symptoms of Lassa fever (n=191)		
Correct (fever, sore throat, headache, bleeding from mouth, nose, etc.)	109	57.1
Incorrect (constipation, shivering, convulsion)	82	42.9

***Multiple responses**

Table 2b: Knowledge of Lassa fever among Respondents

Variable	Knowledge of Lassa fever	
	Yes n (%)	No n (%)
Spread of Lassa fever		
Contaminated food, fruits, vegetables	168 (88.0)	23 (12.0)
Eating with contaminated utensils	159 (83.2)	32 (16.8)
Contact with infected persons	157 (82.2)	34 (17.8)
Spreading uncovered food on the ground	133 (69.6)	58 (30.4)
Unsafe burial practices	94 (49.2)	97 (50.8)
Bush burning	67 (35.1)	124 (64.9)
Prevention of Lassa fever		
Storage of food in closed containers	178 (93.2)	713 (6.8)
Sleeping under mosquito nets	116 (60.7)	75 (39.3)
Maintaining a clean environment	170 (89.0)	21 (11.0)
Avoid eating infected animals	162 (84.8)	29 (15.2)
Blocking holes in roof and floor	162 (84.8)	29 (15.2)
Avoidance of bush burning	120 (62.8)	71 (37.2)
Lassa fever is curable	99 (51.8)	92 (48.2)
Lassa fever is preventable	169 (88.5)	22 (11.5)

(n=191)

Table 6: Household Risk Factors and Preventive Practices of Lassa fever

Variables	Yes n (%)	No n (%)
Risk Factors		
Rats seen in the house in the last 3 months	49 (22.3)	171 (77.7)
Signs of rats (urine or faeces) in the house in last 3 months	38 (17.3)	182 (82.7)
Signs of rat consumption of food in the house	7 (3.2)	213 (96.8)
Farm within vicinity of the house	59 (26.8)	161 (73.2)
Burnt bushes around the house in the last 3 months	91 (41.4)	129 (58.6)
Preventive practices		
Store raw food in covered containers	155 (70.5)	65 (29.5)
Wash eating utensils before use	147 (66.8)	73 (33.2)
Cover eating utensils when not in use	133 (60.5)	87 (39.5)
Store cooked food in covered containers	127 (57.7)	93 (42.3)
Cover cooking utensils when not in use	92 (41.8)	128 (58.2)
Leave unscreened doors ajar until late in the night	46 (20.9)	174 (79.1)
Use sanitary method of refuse disposal	43 (19.5)	177 (80.5)
Spread raw food on the ground outside to dry	19 (8.6)	201 (91.4)

significantly higher proportion of good knowledge of Lassa fever compared with those who are not employed, 42 (55.3%), p=0.001. Sixty-one (61.6%) of those with household income of < ₦30,000 had good knowledge of Lassa fever compared to 51 (55.4%) of those with household income of ≥ ₦30,000, and this was statistically significant, p=0.010. (**Table 3**)

Nine (4.1%) of the respondents had had contact with members of their families diagnosed with Lassa fever, 4 (1.8%) had had contact with persons outside their families with Lassa fever and 5 (2.3%) had had contact with person(s) having fever and bleeding. One hundred and forty-two (64.5%) regularly ate garri (cassava flour) soaked in water, 60 (27.3%) eat cooked rat meal or bush meat and 55 (25.0%) had received injection from a source other than a registered health facility. One hundred and fifty-eight (71.8%) of the respondents had low risk assessment score while 42 (19.1%) and 20 (9.1%) had moderate and high-risk assessment scores for Lassa fever, respectively. (**Table 4**)

High risk assessment score was higher among the female respondents 15 (11.8%) compared with the male respondents 5 (5.4%) but this was not statistically significant, p=0. 226. High risk assessment score was significantly higher among those who were employed 16 (12.5%) compared with those who were not employed 4 (4.3%), p=0.001. High risk assessment score was significantly higher among those with household income of <₦30,000 17 (16.70%), compared with those with household income of ≥ ₦30,000 3 (2.5%), p=0.004. High risk assessment score was higher among respondents who had stayed in the community for < 10 years 10 (16.7%) and 10-19 years 7 (16.7%) compared with those who had stayed in the community for ≥ 20 years 3 (2.5%), and this was statistically significant, p=0.001. (**Table 5**)

Table 4: Lassa fever Risk Factor Assessment of Respondents

Variable	Yes n (%)	No n (%)
Exposure to suspected case or case		
Contact with member of family diagnosed to have Lassa fever	9 (4.1)	211 (95.9)
Contact with persons outside your family with Lassa fever	4 (1.8)	216 (98.2)
Contact with person(s) having fever and bleeding	5 (2.3)	215 (97.7)
Contact with person(s) who died from an undiagnosed disease	7 (3.2)	213 (96.8)
Behavioural risk factor		
Regularly eaten garri soaked in water	142(64.5)	78 (35.5)
Eaten cooked rat meal or bush meat	60(27.3)	160 (72.7)
Received injection from a source other than a registered health facility	55(25.0)	165 (75.0)
Had contact with live or dead animals other than pets	37(16.8)	183 (83.2)
Participated in burial practices that included washing, hugging the corpse	36(16.4)	184 (83.6)
Handled dead rodents with bare hands	26(11.8)	194 (88.2)
Had any traditional incision/scarification	13(5.9)	207 (94.1)
Had any surgical procedure from a source other than a registered health facility	11(5.0)	209 (95.0)
Been bitten or scratched by a rat	5(2.3)	215 (97.7)
Overall risk assessment score		
Low risk	158(71.8)	
Moderate risk	42(19.1)	
High risk	20(9.1)	

Table 5: Association between Socio-demographic Characteristics and Overall Risk Assessment Score of Respondents

Variable	Overall risk assessment score Low (n=158) n (%)	Moderate (n=42) n (%)	High (n=20) n (%)	Test statistics	p-value
Age group (years)					
< 40	96 (70.1)	25 (18.2)	16 (1.7)		
= 40	62 (74.7)	17 (20.5)	4 (4.8)	χ^2= 2.964	0.227
Sex					
Male	68 (73.1)	20 (21.5)	5 (5.4)		
Female	90 (70.9)	22 (17.3)	15 (11.8)	χ^2= 2.975	0.226
Religion					
Christianity	101 (77.7)	18 (13.8)	11 (8.5)		
Islam	56 (62.9)	24 (27.0)	9 (10.1)		
ATR	1 (100.0)	0 (0.0)	0 (0.0)	χ^2=6.921	0.140
Level of Education					
NFE/Primary	52 (67.5)	19 (24.7)	6 (7.8)		
Secondary/Tertiary	106 (74.1)	23 (16.1)	14 (9.8)	χ^2=2.458	0.293
Employment status					
Employed	90 (70.3)	22 (17.2)	16 (12.5)		
Not employed	68 (73.9)	20 (21.7)	4 (4.3)	χ^2=7.888	**0.001***
Household income (?)					
< 30,000	60 (58.8)	25 (24.5)	17 (16.7)		
=30,000	98 (83.1)	17 (14.4)	3 (2.5)	χ^2=19.402	**< 0.001**
Length of stay (years)					
< 10	42 (70.0)	8 (13.3)	10 (16.7)		
10-19	31 (73.8)	4 (9.5)	7 (16.7)		
= 20	85 (72.0)	30 (25.4)	3 (2.5)	χ^2=17.592	**0.001***

*Statistically significant

Table 7: Housing conditions (Observation)

Variable	Yes n (%)	No n (%)
EXTERNAL HYGIENE		
Presence of open refuse dump around house	129 (58.6)	91 (41.4)
Overgrown vegetation around house	74 (33.6)	146 (66.4)
Presence of drying food stuff outdoors	34 (15.5)	186 (84.5)
Storage of wood close to the house	60 (27.3)	160 (72.7)
BUILDING		
Composition of walls		
Blocks	184 (83.6)	--
Mud	20 (9.1)	--
Wood	16 (7.3)	--
Cracks/holes in the walls	80 (36.4)	140 (63.6)
Presence of gaps/holes beneath entrance doors when shut	77 (35.0)	143 (65.0)
Presence of nets on windows	168 (76.4)	52 (23.6)
Screens on doors	94 (42.7)	126 (57.3)
ROOF/CEILING		
Composition of roof		
Long span	88 (40.0)	--
Wood	15 (6.8)	--
Palm fronts	3 (1.4)	--
Corrugated iron	114 (51.8)	--
Intactness of roof	106 (48.2)	114 (51.8)
Ceiling in the kitchen	168 (76.4)	52 (23.6)
Intactness of the ceiling	62 (28.2)	158 (71.8)
INTERIOR HYGIENE		
Kitchen floor free of refuse	156 (70.9)	64 (29.1)
Kitchen is crowded with household items	37 (16.8)	183 (83.2)
Obvious rat burrows on floor and walls	53 (24.1)	167 (75.9)
Leftover food seen uncovered	57 (25.9)	163 (74.1)
Food items spread on the floor	61 (27.7)	159 (72.3)
Uncovered plates/pots seen	78 (35.5)	142 (64.5)
Type of kitchen		
In-built kitchen inside the house	107 (48.6)	--
Outdoor open-air kitchen	59 (26.8)	--
Inside the house but not in kitchen/**a room**	36 (16.4)	--
Built kitchen outside the house	18 (8.2)	--
Fuel used for cooking		
Firewood	94 (42.7)	
Kerosene	86 (39.1)	--
Charcoal	25 (11.4)	--
Gas	15 (6.8)	--
Presence of mould and dampness in living/sleeping rooms	40 (18.2)	180 (81.8)
Evidence of smoke pollution in kitchen	208 (94.5)	12 (5.5)

n=220

Ninety-one (41.4%) of the households burnt bushes around their houses and 59 (26.8%) had farms within vicinity of their houses. Rats were seen in 49 (22.3%) of the households.

One hundred and fifty-five (70.5%) of the households store raw food in covered containers, 147 (66.8%) wash eating utensils before use, 133 (60.5%) cover eating utensils when not in use while 19 (8.6%) spread raw food on the ground outside to dry. One hundred and fifty-five (70.5%) of the households disposed of their refuse by open dumping, 81 (36.8%) by burning, 22 (10.0%) by waste managers and 21 ((9.5%) burying. (**Table 6**) One hundred and twenty-nine (58.6%) of the households had open refuse dumps and 74 (33.6%) had overgrown vegetation around their houses. Thirty-four (15.5%) of them were drying foodstuffs around houses. Eighty (36.4%) of the houses had cracks/holes in the walls, 52 (23.6%) had no window nets while 126 (57.3%) had no door screens. Fifty-three (24.1%) had obvious rat burrows on the floors and walls, 57 (25.9%) had uncovered leftover food and 78 (35.5%) had uncovered plates/pots. (**Table 7**)

Discussion

Almost two-thirds of the participants of this study had at least secondary education which is higher than the national average of 56%. This high literacy level in the community could mean that members will be more willing to adopt and assimilate new ideas.[22] More than four-fifth of the respondents were aware of LF and this may have resulted from repeated risk communication messages about the disease directed at the community and the entire LGA, based on the LF outbreak recorded in recent times.[23] It could also be adduced to the relatively high educational status of the respondents in this study. Education has been reported to promote awareness and positive health seeking behaviour of people in every society.[7,21] The level of awareness is in keeping with previous reports from some studies carried out in different parts of Nigeria between 2011 and 2019,[7,24-26] but was at variance with a report from Southwest Nigeria in 2014.[21] Nevertheless, only about half of the respondents who were aware of LF had a good knowledge of the disease. This observation reflects a knowledge gap for the disease amongst the respondents.

The apparent knowledge gap could be corrected by providing information to households using all channels of communication. The overall knowledge demonstrated in this study was based on the respondents' understanding of the causative agent, mode of transmission, symptoms and preventive measures against LF. As regards the causative agent and the vector that transmits the disease, slightly more than half of the households correctly identified the causative organism for LF and up to 89.5% were able to identify the vector involved in the transmission of the disease. This was indeed a fairly impressive observation and may not be unconnected with the repeated risk communication messages instituted by the State and Local Government to contain the repeated outbreak of the disease in recent times. It may also have been enhanced by the re-organization of various health committees by the Primary Health Care Department in the LGA; in an effort to engender community participation for improved health of the people.[19,27] These efforts should be further consolidated, as a mark of improving the control measures for Lassa fever. Furthermore, about half of the respondents correctly stated the symptoms of LF and four-fifth of them correctly stated that LF could be contracted through consumption of contaminated food, fruits and vegetables. Again, these findings are very invaluable in the prevention and control of the disease. Although, most of the symptoms have been reported to mimic common causes of fever (malaria, upper respiratory tract infection) in the environment, being familiar with them makes referral and early management of the disease easier.[13] In addition, the respondents' knowledge of disease transmission through consumption of contaminated fruits and vegetables is particularly important to consolidate on, because of the agrarian nature of the study area and the need to discourage practices of consuming unwashed fruits and vegetables.[19] This study also revealed that 35.1% of the participants were aware that bush burning could contribute to the transmission of the disease. The finding on bush burning is slightly lower than what was reported by Tobin et al among health workers in South-south Nigeria.[25] Moreover, the overall knowledge of LF demonstrated in this study is consistent with reports from a previous study carried out by Usuwa et al in South East Nigeria,[7]

which showed that about 50.3% of the respondents had good knowledge of LF disease. Similar observations have been reported by other researchers in Nigeria,[28,29] but a contrasting observation was reported from South West Nigeria,[21] where only about 20% of the respondents were aware of LF in the first place; and a much lower proportion had a good knowledge of LF.

The major source of information concerning LF was from television/radio, closely followed by health workers and posters. The predominance of radio and television as the source of information may be related to the location of the study area; being within an area with reception for numerous television and radio stations. These stations include Independent Radio and Television (ITV); African Independent Television (AIT) and the Nigeria Television Authority (NTA). The NTA has a transmission station within 500 meters of the study area. These television and radio stations which are purely non-subscription stations have been reported to present specific programmes dedicated to infectious diseases on a weekly bases.[19] These programmes are broadcasted in English language and the local dialect of the people. Similar findings have been reported elsewhere in Nigeria.[16,23,24] Overall, only about a quarter of the respondents received information on LF from newspaper and posters. This trend may have resulted from the fact that some level of education is required to appreciate information from these channels of communication. This observation is in keeping with a previous report from Nigeria (31%). [16]

Factors significantly associated with respondent's knowledge of Lassa fever in this study included educational status, employment status and household income level. Age and sex were not significantly associated with knowledge. This is at variance with a previous report from South East Nigeria[24], where age of the respondents was significantly associated with knowledge. However, a similar finding concerning the statistically significant effect of education on knowledge was reported by Ilesanmi et al[21] Those with at least a secondary education had a better knowledge of LF compared to others with less educational qualification. This corroborates previous reports on the importance of education in awareness and understanding of key health messages.[21] This may be related to the fact that respondents with secondary education were more likely to benefit from most channels of health education and risk communication messages; especially information sent through the print media than those with lower education. Furthermore, respondents who were employed had significantly better knowledge of LF than the unemployed. This could be related to the socioeconomic advantage of the employed and resultant opportunities to access health information through all available channels. This was in keeping with a previous observation by Ossai et al, from South East Nigeria,[16] but was at variance with other studies carried out in Nigeria.[21,24] However, households with monthly income less than ₦30,000 had significantly better knowledge of Lassa fever than those with higher income. This surprising observation could possibly be related to the fact that those of the lower socio-economic groups could get correct health information since they may participate more in community-based health programmes and other community groups formed to tackle health issues. Those of a relatively higher socioeconomic level may participate less in such health-related groups which may deliver risk communication messages in the community. But this was incongruous with most previous studies carried out in Nigeria.[16,21,30]

As regards the LF risk assessment of the respondents, more than two-thirds of them had an overall low risk assessment score. The overall risk of contracting LF was significantly higher among those who were employed, those with lower household income and those who had stayed in the community for less than 20 years. The risk of infection with LF was more likely to be higher among those whose jobs brought them closer to the mastomys rodents. This is particularly important because the community is predominantly an agrarian one. Also, respondents with lower household incomes are more likely to reside in houses with lower quality and they were less likely to seek medical care promptly, hence their greater risk to the disease. Households who had stayed in the community for less than 20 years had greater risk probably because of their failure to imbibe some good old cultural practices which include environmental hygiene; disposal of refuse and garbage away from homes and the rearing/keeping

of cats; which contributes significantly in reducing the population of rodents within the vicinity. Surprisingly, these results were at variance with reports from a previous study by Ilesanmi et al in South West Nigeria, in which the significantly associated factors for LF included respondents' lower level of education and ethnicity.[31] It was also incongruent with other studies carried out in Nigeria[7] and Sierra Leone.[13]

The risk assessment score comprised respondents' exposure to suspected case and behaviours that may predispose them to LF. In terms of exposure to suspected case, less than a tenth of the respondents had had contact with someone diagnosed with LF and died from LF, respectively. This is cause for concern because just one confirmed case is a criterion for an epidemic of LF.[17]There is therefore an urgent need to step up preventive efforts. In terms of behavioural risks, almost two-third of them had the habit of regular consumption of garri, soaked in water. This constitutes one of the major feeding habits of households in this community, and had been reported to contribute significantly to LF transmission.[7] However, modification of the production and storage of garri such as drying by firewood rather than spreading under the sun on the ground which reduces exposure to the rodents to the barest minimum has been documented to reduce the risk of infection to the barest minimum.[32,33] Notwithstanding, about 2.3% and 16.8% of the respondents reported that they had recently been bitten by a rat and had contact with a corpse, respectively. This remains worrisome, especially when living in a LF endemic environment. In addition, almost half and about a quarter of the respondents revealed that they had burnt bushes and seen a rat at home within the last three months, respectively. These are indeed telltale signs of Lassa fever prevalence within the community. This trend mirrors a previous observation from Sierra Leone.[13]

The poor housing condition revealed by observation of the houses is worrisome and may render ineffective all other efforts towards containing the repeated outbreaks of the disease. This study observed that slightly over half of the households had open dumps and one-third had overgrown vegetation around their houses. This is at variance with a report by Aigbirmolen et al concerning the students' hostel environment, where 16.7% and 50% of the respondents lived in places with open dumps and bushy environments, respectively. The predominance of open dumps in the environment may be a reflection of the insanitary condition of the community and this creates a good breeding ground for rodents which transmit LF. This may have resulted from poor refuse management by the environmental health department of the LGA. This department was carved out of the Primary Health Care department and needs to be strengthened for effective refuse management.[34] Moreover, about a sixth of the participants dried foodstuff around their houses. This finding is bothersome and gives a picture of the persistence of the old cultural practices in the community. It is also important to note that about a quarter of the respondents had obvious rat burrows on the floor and walls of their homes. This was lower than the value (50%) reported by Bonner et al among occupants from a refugee camp.[13]

In conclusion, the high level of awareness and moderate knowledge of LF among the householders in this study indicate that there is some knowledge gap. The knowledge of LF was influenced by the employment status and average monthly income of the respondents. Also, most of the respondents had a relatively low overall risk assessment to LF and this means that most of them had not been exposed to persons and conditions that could predispose them to the disease within the past three months. The study also demonstrated that the overall risk of contracting LF was influenced by the employment status, the duration of stay in the community and the average monthly income of the respondents. Close to half of the respondents lived in an environment with bushes and open dumps and this brings to the fore the current ineffective environmental sanitation activities in the community by the households and the authorities of the environment department of the local government.

It is therefore recommended that repeated risk communication messages concerning LF should be designed and presented to households in the community by the state and local government. These key messages should include community mobilization and those that must engage the recipients on a two-way communication. Also, the environmental and housing conditions of households in the community should be stepped up

by the local government health authorities and the state government. Health workers should initiate home visitation to households to ensure that LF preventive measures are adequately adhered to.

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