



Research article

Risk communication sources and knowledge of Lassa fever in Nigeria: An impact analysis

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ARTICLE INFO

Keywords:

Knowledge
Information sources
Lassa fever
Risk communication
Nigeria

ABSTRACT

This study examined the predominant risk communication sources for Lassa fever, and explored the correlation between risk communication sources and knowledge of Lassa fever in the most endemic states (Ebonyi, Edo and Ondo) of the disease outbreak in Nigeria, through a mixed-methods approach. Using the multi-stage sampling technique, 72 Focus Group Discussants and 653 survey respondents were selected for the study. Statistical analysis was conducted on the acquired quantitative data, whereas thematic analysis was employed for qualitative analysis. The results suggest that radio, posters and healthcare workers are predominant sources of information about Lassa fever in the endemic states. The majority of the respondents possess adequate knowledge of the Lassa fever vector, transmission routes, risk factors, and preventive measures, but knowledge of asymptomatic patients was generally poor across the selected states. The regression analysis indicates that radio and healthcare workers are the strongest predictor of the knowledge of Lassa fever at ($\beta = .191, p < .05, \text{Significant} .000$) respectively, followed by television and family members/relatives at ($\beta = .124, p < .05, \text{Significant} .002$) ($\beta = .110, p < .05, \text{Significant} .007$) respectively. The study recommends among others that; more efforts in risk communication should be geared towards the dissemination of the health risk information through radio, healthcare workers, television, and informal communication within the family network to further promote the knowledge of Lassa fever and other epidemics in Nigeria at large.

1. Introduction

The significant contributions of risk communication sources in disseminating health risk messages can never be over-emphasised. Person-to-person informal interactions in the family, workplace, community associations, religious gatherings, etc. enhance the rapid spread of health risk information among various groups, particularly during the outbreak of epidemics. The spread of awareness about a contagious disease through interpersonal networks not only lowers the incidence of the disease, it further reduces the possibility of the disease escalating into an epidemic, as behavioural changes are promoted through word of mouth from person to person (Zhou, Xiao & Heffernan, 2019). Interpersonal communication networks heighten risk perceptions, especially at the personal level, and may significantly influence preventive behaviours in pandemic-related circumstances (Lin et al., 2018; Sim, Hung, Su & Cui, 2018). However, some scholars submit that interpersonal networks only

act as reinforcement to risk issues made salient by the mass media, thereby increasing risk perception (Wu & Li, 2017). More so, as information permeates the society from person to person, its quality plummets. Put succinctly, first-hand information regarding an infectious disease may possibly allure stronger reactions than information that has been filtered by numerous individuals.

The mass media are active partners with health officials in health information delivery to a considerable number of persons, thereby shaping public discourse and the formation of public opinion on health matters (Adesina et al., 2021). Mass media partnerships with health officials across the globe have been a strong weapon for mobilising the public in the fight against epidemics and pandemics. Again, the internet and social media present new opportunities for communicating health risk messages albeit the enormous unsubstantiated information dissemination by nonprofessionals (Kumar, 2018; Lee, 2019; Wang et al., 2019).

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Risk communication sources influence the processing and interpretation of risk messages (Manno III, Lively, Manno, Cheng & Lau, 2018), and shape attitudes and behaviours towards health threats (Kott and Limaye, 2016). More so, repeated audience exposure to health risk information exerts positive influence on message comprehension (Wakefield, Loken & Hornik, 2010). Hence, maximum exposure to information regarding health risk such as the Lassa virus determine how the information is perceived.

Lassa haemorrhagic fever has remained a recurring decimal in Nigeria in the recent decade. Since its vaccine trial has not been concluded, the impact of Lassa fever epidemics on healthcare providers and local communities has been overwhelming with a high rate of confirmed cases and fatality rate in many instances. The burden of the Lassa fever epidemic is worsened by the complexity of Nigeria's low-income status and ill-equipped healthcare infrastructure (Ben-Enukora et al., 2019b). Consequently, risk communication interventions are carried out through various communication channels including electronic media, interpersonal communication channels, and print media to promote awareness and improve knowledge of the disease precisely in endemic areas and Nigeria at large.

The risk communication messages focus on the disease causation, transmission routes, risk factors, risk reduction or preventive measures as well as the treatment options for Lassa fever patients. However, there have been persistent cases of Lassa fever outbreaks with the preponderance of the infection in Ebonyi, Edo and Ondo state, regardless of the divergent efforts on risk communication for the disease prevention in Nigeria (Nigeria Centre for Disease Control and Prevention, (NCDC) 2017; 2018; 2019; 2020; 2021). Therefore, the effectiveness of the risk communication sources in promoting the knowledge of Lassa fever in the epicentres is worth investigating. This study underscores the need for improved knowledge of Lassa fever in all ramifications (host, risk factor, symptom and risk reduction measures). Based on the foregoing, the study examined the predominant source/s of risk information about Lassa fever and the knowledge of the disease in the most endemic states in Nigeria. Regression analysis was conducted to test whether the risk communication sources have no significant influence on the knowledge of Lassa fever in the study areas.

2. Methodology

This study focused on three identified Lassa fever endemic states in Nigeria namely; Ebonyi, Edo and Ondo state (from South-East, South-South and South-West regions respectively). Although the states are not exclusively affected by Lassa fever, they have remained the epicentres with the highest number of confirmed cases for five consecutive years (NCDC, 2017, 2018, 2019, 2020, 2021).

2.1. Design and participants

This cross-sectional research adopted a mixed-methods approach, using the survey method and Focus Group Discussion (FGD) based on a Sequential Exploratory Design which allows qualitative data collection and analysis prior to a quantitative research.

The sample size for the quantitative study was determined with the aid of the statistical table for a finite population by Krejcie and Morgan (1970), and Research Advisor (2006), which stipulate that a sample size of 663 is acceptable for over 1,000,000 people at 99% confidence level and 5% margin of error. Since the population of the study areas is within this margin (5, 131, 553 according to NPC, 2006), 663 respondents were selected for the survey but 72 purposively selected discussants (24 per state) participated in the qualitative study. Three FGD sessions (consisting of 4 males and 4 females) were conducted in this study. All the FGD sessions were conducted in native languages safe for Edo state conducted in English and Nigerian-Pidgin.

2.2. Instruments and measurement

The survey data were generated via a pretested self-designed structured questionnaire whereas the FGD sessions were facilitated with the aid of a self-designed open-ended interview guide.

The dependent variable (Knowledge promotion) was measured with specific items regarding Lassa fever vector, transmission routes, symptoms and risk reduction measures using five points Likert scale ranging from 1 (Strongly Agree) to 5 (Disagree).

2.3. Sampling techniques

The study adopted the multi-stage sampling technique involving seven stages. A simple random technique was employed in the selection of Senatorial Districts, Local Government Areas (LGAs), communities, clusters/districts within the communities, streets and households from which respondents were selected for the study. In the first stage, two senatorial districts were selected from each state using a simple random method. Then, two LGAs were randomly selected from each selected senatorial district in the second stage. In the third stage, one community each was randomly selected from the rural and urban strata in the selected Local Government Areas, making a total of 24 communities. Two clusters/districts were randomly selected from the selected communities in the fourth stage, whereas systematic sampling was employed in the selection of streets within the selected clusters in the fifth stage. Then, systematic sampling and sample intervals were employed in the selection of households that participated in the study in the sixth stage. One respondent from the eligible members of each systematically selected household was chosen to participate in the study with the aid of the method and matrix for selecting survey respondents as developed by Wimmer and Dominick (2014).

For the qualitative study, invitations were sent through the community heads to solicit for eligible participants in each selected community and random sampling was employed in selecting the study participants from the list of volunteers. The eligibility criteria include age and prior awareness of Lassa fever.

2.4. Reliability of the survey instrument

The questionnaire and interview guide for this study were pre-tested on a sample of 50 and 10 respondents respectively. Confirmatory Factor Analysis and Cronbach Alpha were used to determine the validity and reliability of the survey instrument. As noted by Biggs, Brough, and Barbour (2014), before an instrument can be regarded as reliable, the construct composite reliability outcome must be above 0.80 which is the minimum benchmark. Also, the Average Variance Extracted Estimate (AVE) value should be above 0.50 while Cronbach Alpha is expected to exceed 0.70. The construct average variance extracted estimate (AVE), error variance, composite reliability and Cronbach Alpha values were within the benchmark set. Specifically, the output of CFA analysis indicates that the factor loadings for the specific measures of the construct ranged between 0.791 and 0.896. Therefore, the instrument was deemed reliable and valid for the study. The questionnaire was proportionately distributed according to the population of the states through the face-to-face method. Hence, 155, 248 and 260 copies of the questionnaire were distributed in Ebonyi, Edo and Ondo state respectively but 653 copies (representing 98.5% response rate) were retrieved and used for analysis.

2.5. Data analysis

The survey data was organized with the aid of SPSS version 23 and presented in frequency tables whereas the tape-recorded FGD conversations were transcribed by the language experts, sorted according to emerging themes and analysed using the descriptive method. Inferences

were drawn from the hypothesis results based on the regression coefficients and the decision was reached at a significance value of $p < 0.05$. Regression was considered appropriate for this study because the mean in each comparison group (sources of risk communication and knowledge of Lassa fever) showed symmetric normal distribution and homogeneity in variability.

2.6. Ethical compliance

Ethical approval for this study was obtained from the Covenant University Research and Ethics Committee (Ref. number CHREC/107/2019) and the respondents voluntarily participated in the study after they were informed of their rights and consent was granted by filling and signing the informed consent form. In addition, personal identifiers were removed by assigning numbers to each participant to guarantee the confidentiality of the information obtained.

3. Respondents' demographic characteristics

The FGD respondents consisted of an equal number of males and females (36 each) whereas the average age of the respondents is 32 years. The demographic profile of the survey respondents is illustrated in Table 1.

Table 1 shows that the survey sample consisted of 55.3% males and 44.7% females. The majority of the respondents are young adults between 20–40 years. Furthermore, most (58.5%) of the sampled respondents are married persons. Also, most (48.5%) respondents had tertiary education and the majority of them are employed.

4. Results

4.1. Objective 1: predominant source/s of risk information about Lassa fever

To find out the predominant source/s of risk communication messages for Lassa fever, risk communication sources were categorised into three; electronic media, print media and interpersonal communication channels, and respondents were asked to rank a list of options in each category based on the quantity of information accessed from them. The qualitative results are presented before the quantitative data.

4.2. Qualitative results on the predominant electronic media source of risk communication messages on Lassa fever

All discussants across the FGD sessions reported hearing about Lassa fever through a variety of sources. Electronic media (radio, television, and social media) were widely mentioned as some of the communication sources of Lassa fever awareness across diverse sessions. However, radio is mentioned as the channel that provided the highest information. Some of the respondents said,

I can tell you that most of the things I know about Lassa fever are from radio news, public announcement and those jingles on the radio. The highest information I have gotten on Lassa fever is from radio (Male; 33; Ondo state).

Although I used to see information on Lassa fever on social media platforms sometimes, the majority of what I know about Lassa fever is from the radio (Female; 38; Ondo state).

The first time I heard about Lassa fever, I got the information from the radio. I have also listened to some Lassa fever jingles on the radio. I always hear about it on the radio (Female; 37; Ebonyi state).

Radio is my major source of information, because, in this area, we hardly watch television because NEPA (National Electric Power Authority now Power Holding Company of Nigeria PHCN) does not give us light, and we cannot afford to buy fuel on a daily basis. The same thing with social media. Data is not always available. So, we depend on the radio for vital information almost all of the time (Male; 42; Ebonyi State).

My highest source of information on Lassa fever is radio. Sometimes NEPA will not bring light for one week. So, we depend on the radio for information, most time (Male; 28; Edo state).

Alternatively, many discussants from the urban areas indicated that television contributed more to their awareness and knowledge of Lassa fever than radio and social media. Excerpts from participants' responses;

I got to know about Lassa fever from television, especially on NTA (Nigerian Television Authority) and Channels Television (Male; 40; Ondo state).

Most of the information I have on Lassa fever is a result of my exposure to television in my office. During office hours, I listen to information on Lassa fever on television, and I watch television news at night (Female; 36; Edo state).

For me, I received the highest amount of information from television. I also have access to Lassa fever information on social media, but it cannot be compared to television (Male; 33; Edo state).

4.3. Quantitative results on the predominant electronic media source of risk communication on Lassa fever

The survey respondents' ranking of electronic media sources of risk communication on Lassa fever according to information accessed from radio, television and social media are presented in Tables 2, 3, and 4.

The data in Table 2 depict that most respondents identified radio as the medium that provided the highest information regarding Lassa fever, followed by television. The data imply that the respondents may have had more access to radio than television and social media.

Table 1. Summary of the survey respondents' socio-demographic data.

Variables	%	%	%	%	%	Total
State of origin	Ebonyi (23.4)	Edo (37.7)	Ondo (38.9)			100
Age-groups	Below 20 years (14.7)	20–30 years (38.6)	31–40 years (23.3)	41–50 years (16.2)	51 years and above (7.2)	100
Gender	Male (55.3)	Female (44.7)				100
Marital status	Single (39.4)	Married (58.5)	Divorced/separated (2.1)			100
Main occupation	Civil/Public Servant (38.3)	Self-employed (38.6)	Unemployed (23.1)			100
Highest educational qualification	Primary/Basic Education (12.3)	Secondary school education (39.2)	Tertiary education (48.5)			100

Table 2. Distribution of respondents' major sources of information on Lassa fever via electronic media according to each selected state.

Respondents' ranking of the electronic media channels based on the amount of information accessed from	States			Overall number/%
	Ebonyi	Edo	Ondo	
Radio	58.8	54.5	57.5	(370) 56.7
Television	21.6	30.5	19.7	(158) 24.2
Social media	6.5	4.1	12.2	(51) 7.8
No information accessed from any of them	7.8	6.9	6.3	(45) 6.9
Undecided	5.2	4.1	4.3	(29) 4.4
Total	100	100	100	(653) 100

Table 3. Percentage distribution of respondents' major sources of information on Lassa fever via the print media according to each selected state.

Major source of awareness on Lassa fever via the print media	States			Overall number/%
	Ebonyi	Edo	Ondo	
Newspaper	2	5.3	5.5	(30) 4.6
Posters/flyers	17.6	17.5	18.1	(116) 17.8
No information accessed from any of them	78.4	75.6	75.2	(497) 76.1
Undecided	2	1.6	1.2	(10) 1.5
Total	100	100	100	653

Table 4. Distribution of respondents' major source of information on Lassa fever via interpersonal communication channels according to each selected state.

Major source of awareness on Lassa fever via interpersonal communication channels	States			Overall number/%
	Ebonyi	Edo	Ondo	
Healthcare workers	35.3	39	42.1	(257) 39.4
Community leaders	2.6	0	2	(9) 1.4
Family members/relatives	28.1	32.5	35.8	(214) 32.8
Friends	7.8	12.6	7.5	(62) 9.5
Neighbours	11.8	4.1	3.9	(38) 5.8
Colleagues	9.2	8.1	5.1	(47) 7.2
No information at all	3.9	1.2	2.4	(15) 2.3
Undecided	1.3	2.4	1.2	(11) 1.7
Total	100	100	100	(653) 100

4.4. Qualitative results on the amount of information accessed from print media sources of risk communication messages on Lassa fever

The results indicate that the print media source of information on Lassa fever was ranked very low in all focus group sessions as most discussants indicate that they have not read newspapers in a while, and only a few have accessed information from posters. Some of the discussants said;

How many people still read newspapers these days? I can't remember when last I read the newspaper. But for posters, I have seen a few on Lassa fever (Male; 40; Ondo state).

I have been exposed to Lassa fever posters on a few occasions when I visited the hospital. Since then, I have not seen any poster on Lassa fever. So, it provided the lowest information to me (Male; 43; Ebonyi state).

The focus group results show that most people do not have access to risk information about Lassa fever in newspapers, while a few discussants who are exposed to the Lassa fever risk information via posters ranked the medium very low in promoting access to Lassa fever risk communication.

4.5. Quantitative results on the predominant print media source of risk communication messages on Lassa fever

The survey respondents' ranking of newspapers and posters/flyers (print media sources of risk communication on Lassa fever) is presented in Table 3.

The results in Table 3 imply that slightly above three-quarters of the respondents have not had access to Lassa fever risk communication messages via the print media. Therefore, using print media for risk communication would not yield the desired result in terms of access.

4.6. Qualitative results on the predominant interpersonal source of risk communication messages on Lassa fever

The results of the focus group discussions show that family members and healthcare workers are the major interpersonal communication channel of information on Lassa fever, whereas community leaders are barely mentioned as sources of information on Lassa fever.

A few of the excerpts are;

I got most of the information on Lassa fever from my family member. My sister is a nurse and she has taken the time to explain this issue of Lassa fever to everybody in the family during our family gathering (Female; 32; Ondo state).

Health workers at the Irrua Specialist Teaching Hospital organise public enlightenment campaigns, seminars and workshops on Lassa fever to educate people on how the disease can be prevented and a lot of things I know about Lassa fever were learnt from them (Male; 35; Edo state).

The health workers have been trying in giving us teachings on how we can protect ourselves from Lassa fever. Most times when we go for immunisation, they tell us that we should keep our environment clean, and cover our foods very well so that rats will not contaminate them and give us Lassa fever (Female; 32; Edo state).

The highest information I received on Lassa fever is from my family member who works in the general hospital. Whenever there is a Lassa fever outbreak, he informs us about it and also tells us what we can do so that we don't catch the disease (Female; 33; Ebonyi state)

4.7. Quantitative results on the predominant interpersonal source of risk communication messages on Lassa fever

The survey respondents' ranking of interpersonal sources of risk communication (healthcare workers, community leaders, family members/relatives, friends, colleagues and neighbours) is presented in Table 4.

The results in Table 4 imply that healthcare workers have provided ample information about Lassa fever in the study areas. More so, people do share risk information about the disease within their social networks (family, friends, colleagues, neighbours) but community leaders are the least mentioned as sources of risk information in all selected communities.

4.8. Objective 2: knowledge of Lassa fever

The respondents' knowledge of Lassa fever was measured with specific statements regarding the Lassa fever vector and the transmission routes, as well as Lassa fever symptoms and the preventive measures.

4.9. Qualitative results on knowledge of Lassa fever vector/transmission routes

The discussants' opinion on the knowledge of Lassa fever in various FGD sessions varied. The description of Lassa fever ranges from a simple

Table 5. Percentage distribution of respondents' knowledge of Lassa fever vector and transmission routes according to each selected state.

	States			Overall number/%
	Ebonyi	Edo	Ondo	
Lassa fever is transmitted by rats				
Strongly agree	45.8	49.2	65.7	(358) 54.8
Agree	48.4	43.9	34.3	(269) 41.2
Undecided	5.9	6.1	0	(24) 3.7
Strongly disagree	0	0.8	0	(0) 0
Disagree	0	0	0	(2) 0.3
Total	100%	100%	100%	(653) 100%
I could contract Lassa fever by eating foods eaten by rats/polluted by rats' urine/faeces				
Strongly agree	34	40.2	59.1	(301) 45.9
Agree	37.9	43.9	31.1	(245) 37.3
Undecided	15.7	7.7	6.7	(60) 9.1
Strongly disagree	5.9	4.1	0.8	(21) 3.2
Disagree	6.5	4.1	2.4	(26) 4
Total	100%	100%	100%	(653) 100%
Person-to-person transmission of Lassa fever can occur through contact with body fluids of an infected person				
Strongly agree	17	36.6	37	(210) 32
Agree	39.2	37.2	46.9	(271) 41.3
Undecided	30.1	20.3	12.6	(128) 19.5
Strongly disagree	9.2	1.2	2.4	(18) 2.7
Disagree	4.6	3.3	1.2	(26) 4
Total	100%	100%	100%	(653) 100%
Sun-drying of farm produce and processed foods in open spaces outside the house is a risk factor for the Lassa virus				
Strongly agree	28.8	41.5	42.9	255 (38.9)
Agree	37.9	44.7	46.1	285 (43.6)
Undecided	9.8	8.1	3.5	44 (6.7)
Strongly disagree	11.1	2.4	3.9	36 (5.5)
Disagree	12.4	3.3	3.5	33 (5.1)
Total	100%	100%	100%	100%

explanation to a more scientific narrative specifically linking the disease to the rodent reservoir, transmission routes, symptoms and prevention, how dreadful the disease could be, its highly contagious nature, and how fast it could lead to death.

Some of the simple descriptions of Lassa fever include;

I know that Lassa fever is a dangerous disease that can kill easily just like the Ebola virus (Female; 52; Edo state).

An infection that is gotten from rats (Male; 33; Ondo state).

Lassa fever is an epidemic and a deadly disease that can wipe an entire household (Male; 26; Edo state).

Lassa fever is a deadly disease (Female; 18; Ebonyi state)

I heard that Lassa fever is the 'twin-sister' of Ebola virus (Male; 32; Ebonyi state).

Lassa fever is a killer disease (Male; 27; Edo state).

I know that Lassa fever is caused by rats. I also know that it's a viral disease (Female; 27; Ondo state)

The majority of the discussants described Lassa fever in relation to the disease vector, identifying rats/rodents as the reservoir of the Lassa virus. Some of the responses include;

Lassa fever is a disease which may be contracted from taking contaminated food substances. The bacteria [sic] that cause Lassa fever is usually from rodents such as rats (Male; 28; Edo state).

Lassa fever is a disease that can be contracted through eating food contaminated by rodents' urine and faeces (Female; 40; Ondo state).

It is a viral disease transmitted by a species of rat which can affect humans through contact with uncovered food or direct contact with blood, urine, saliva or faeces of rats (Male; 23; Ondo state).

I can describe Lassa fever as a disease caused by a particular rat. Human beings can get the virus when they (rats) have contact with uncovered food items or direct contact with someone's body or through their urine or stool (Male; 43; Edo state).

I heard that Lassa fever is a viral disease caused by rat that has plenty breasts. When it urinates on food and someone eats the food, the person will be infected by the Lassa virus (Female; 34; Edo state).

My understanding about Lassa fever is that it is a virus that is gotten as a result of contact with contaminated food through the urine or faeces of a particular rat (Female; 29; Ebonyi state).

Remarkably, male discussants gave a more detailed and scientific description of Lassa fever, although the majority of them failed to describe it as a preventable disease. Some respondents recounted that;

Lassa is a viral disease carried by a type of rat that is common in our environment. It is a haemorrhagic virus, which means it can cause bleeding. Some people who are infected with the virus do not manifest any of the symptoms. If the infection stays too long before treatment it can cause liver or kidney damage (Male; 42; Ondo state).

The Lassa virus is transmitted by rats through the contamination of food or household items with urine or faeces. Human beings can also transmit the disease from one person to another, especially in hospitals where they do not observe precautions (Male; 38; Edo state).

Lassa fever is a fatal viral disease that causes fever; sore throat and bleeding. It usually occurs in Nigeria and other African countries. The infection is acquired from infected rats and it can be life-threatening (Male; 43; Ebonyi state).

Although most of the female discussants gave simple explanations of their knowledge of Lassa fever, a female respondent's comment was exclusive. She said;

Lassa fever can be described as an animal-borne illness that is transmitted to human beings and it is prevalent in our society these days especially when such animals like rats are able to eat food that we keep in our stores if such foods are exposed. Or they probably pass urine or faeces on food or foodstuffs. If human being eats the food they will be infected (Female 47; Ondo state).

One of the male discussants from Edo state gave an amusing comment. He commented thus;

Lassa fever is a deadly disease. It is a new disease that is caused by rat. That's what we heard from the news. It is a new disease. It just came to Nigeria. It was not in Nigeria before. But our government is doing something about it (Male; 25; Edo state).

In summary, the FGD discussants recognized that Lassa fever is life-threatening. Rats were identified as the reservoir of the Lassa virus and the transmission routes were mentioned as well as the disease symptoms and preventive measures. This suggests that most discussants have adequate knowledge of the disease vector as well as the implication of

rat-infested households and consumption of food items contaminated by rats' excreta.

4.10. Quantitative results on knowledge of Lassa fever vector/transmission routes

The data in Table 5 show that over 90% of the respondents possess adequate knowledge of the primary host of Lassa fever and over 80% have adequate knowledge of the primary transmission of Lassa fever through eating foods contaminated by rats' excreta. Also, over 70% of the respondents have adequate knowledge about human-to-human transmissions of the Lassa virus and sun-drying of food items as a risk factor for food contamination by rodents respectively.

4.11. Qualitative results on knowledge of Lassa fever symptoms

The focus group results on knowledge of Lassa fever symptoms in the selected states are presented below.

Lassa fever is an infectious disease that is transmitted by rats through their faeces and urine. And this fever is contagious and endemic in nature. It has been killing people through high fever, red eye is one of the symptoms and it is very dangerous. From the information we gathered, it started in Bornu state a long time ago but it has now spread to other states. It has affected different local governments like Owo, Ose and Akoko, and recently, there was a case of it in Akure south (Male; 47; Ondo state).

Lassa fever is caused by rats with many breasts commonly found in our region. Any person that comes in contact with such rats' faeces, urine, and blood or eats any food eaten by the rats will get infected with the virus. So, we are encouraged to always visit the hospital when we notice symptoms like swollen face, difficulty in breathing, rashes, cough, bleeding from the nose, eyes or other openings in the body and others. And it is life-threatening (Male; 38; Ebonyi state).

Symptoms are bleeding from the mouth, eyes, ears, vomiting and high fever. When is noticed- the person should report the case to the nearest health centre. And they said the treatment is free (Male; 27; Ebonyi state).

I do not know exactly what a Lassa fever patient looks like. I have not seen anybody suffering from the disease. All I know is that they said it can kill faster than HIV (Female; 31; Ondo state)

Table 6. Percentage distribution of respondents' knowledge of Lassa fever symptoms according to each selected state.

	States			Overall number/%
	Ebonyi	Edo	Ondo	
Bleeding (internal or external) and difficulty in breathing are the symptoms that show that someone is infected with the Lassa virus				
Strongly agree	33.3	35.4	43.3	(248) 38
Agree	37.9	38.6	41.7	(259) 39.7
Undecided	22.2	19.1	11.4	(110) 16.8
Strongly disagree	2.6	2.8	1.2	(14) 2.1
Disagree	3.9	4.1	2.4	(22) 3.4
Total	100%	100%	100%	(653) 100%
It is possible for someone to have Lassa fever and not show its symptoms				
Strongly agree	5.9	15.4	9.4	(71) 10.9
Agree	17	15.4	24.8	(127) 19.4
Undecided	28.6	22.4	36.6	(192) 29.4
Strongly disagree	24.8	22.4	18.1	(139) 21.3
Disagree	23.5	24.4	11	(124) 19
Total	100%	100%	100%	(653) 100%

Table 7. Percentage distribution of respondents' knowledge of Lassa fever preventive measures according to each selected state.

	States			Overall number/%
	Ebonyi	Edo	Ondo	
Lassa fever can be prevented from spreading in the community by maintaining a clean environment with no rats				
Strongly agree	29.4	29.7	52.8	(257) 38.6
Agree	48.4	48.4	42.5	(301) 46.1
Undecided	17	15.4	3.1	(72) 11
Strongly disagree	2.6	3.7	1.2	(16) 2.5
Disagree	2.6	2.8	0.4	(12) 1.8
Total	100%	100%	100%	(653) 100%
Lassa fever can be prevented when people stop eating foods eaten by rats or polluted by rats' blood/stool/urine/saliva				
Strongly agree	39.2	36.2	59.1	(299) 45.8
Agree	42.5	53.7	35.8	(288) 44.1
Undecided	8.5	7.7	1.2	(35) 5.4
Strongly disagree	5.2	2	0.4	(14) 2.1
Disagree	4.6	0.4	3.5	(17) 2.6
Total	100%	100%	100%	(653) 100%
Disposal of refuse far away from my house/office/shop is a good practice for Lassa fever prevention				
Strongly agree	30.7	34.6	42.5	(240) 36.8
Agree	45.8	49.6	50.4	(320) 49
Undecided	17	13.4	5.9	(74) 11.3
Strongly disagree	4.6	1.2	0.8	(12) 1.8
Disagree	2	1.2	0.4	(7) 1.1
Total	100%	100%	100%	(653) 100%

The FGD results show that many discussants across the selected states are aware of the major symptoms of Lassa fever. However, male participants seem to possess adequate knowledge of the symptoms compared to their female counterparts.

4.12. Quantitative results on knowledge of Lassa fever symptoms

Table 6 demonstrates that over 70% of the respondents have sufficient knowledge of the symptoms of Lassa fever. However, the result signifies poor knowledge about the possibility of asymptomatic Lassa fever patients among the study population.

4.13. Knowledge of risk reduction measures for Lassa fever

Some excerpts from the focus group responses on knowledge of the recommended practices for Lassa fever prevention include the following;

The preventive measures include keeping the surroundings clean and free from rats, putting our foods in containers that have cover, and also avoiding contact with an infected person (Female 26; Edo state).

We should cover our foodstuff in tight containers, kill rats, and wash our hands with soap especially before cooking food (Female; 37; Ondo state).

To prevent Lassa fever, we should block rat holes at home, stop eating rats, throw away any food that rat has eaten and keep the environment clean (Male; 41; Ebonyi state).

We have been told not to dry our garri on the roadside again and keep our foods in closed containers (Female; 27; Edo state).

The FGD results show that most discussants shared more than two correct recommended preventive practices for Lassa fever prevention.

The result implies that most participants have adequate knowledge of the preventive practices for Lassa fever.

4.14. Quantitative results on knowledge of preventive measures for Lassa fever

The survey respondents' knowledge of Lassa fever preventive measures is presented in Table 7.

The data in Table 7 illustrate that over 80% of the respondents have ample knowledge of the maintenance of a clean environment with no rats as a preventive measure against Lassa fever. Almost 90% understand the implication of consuming foods contaminated by rats, and over 80% have adequate knowledge of disposal of refuse far away from homes/offices/shops as a good practice for averting rodents' infestation.

4.15. Hypothesis result

Table 8a shows that the risk communication sources (Radio, Television, Social Media, Newspapers, Health Workers, Community Leaders, Posters/Flyers, Family, Friends, Neighbours and Colleagues) have a positive relationship with the knowledge of Lassa fever. This means that knowledge of Lassa fever in the selected states is positively associated with access to risk communication via the under-listed risk communication sources, although the association was weak.

The ANOVA Table depicts that risk communication sources have a significant influence on residents' knowledge of Lassa fever in Ebonyi, Edo and Ondo states.

5. Discussion of findings

This study established that radio and posters/flyers are the predominant risk communication sources of Lassa fever in the electronic and print categories respectively, for the focus group discussants and survey respondents. However, the predominant source of interpersonal communication channels varied among the two groups. Family members/relatives are ranked as the highest information source by the focus group discussants except in Edo state, whereas healthcare workers are ranked as the highest source of interpersonal risk information among the survey respondents.

The choice of radio as a predominant information source of Lassa fever awareness in the electronic platform implies that radio has been widely utilised in providing risk communication messages for Lassa fever, and most residents are exposed to radio more than television and social media in all the selected states. This result is expected as radio breaks the barriers of power supply, mobility, and language. The finding of this study corroborates the result of Adesoji et al. (2016) who state that radio was the highest source of information about Lassa fever. It also substantiates the findings of Ben-Enukora et al. (2019) that radio was a major source of information on a health-related risk. It is not surprising that radio is rated as the medium that provided the highest information on Lassa fever since a study on contemporary media use among Nigerians has earlier found that about 83.4% of households in Nigeria have a working radio, 78.4% of Nigerians listen to radio every week, 64.7% report using a conventional radio, and almost four in 10 reports listening to radio weekly via a mobile phone and 12% report listening on a car

Table 8a. Regression model summary illustrating the interaction between risk communication sources and knowledge of Lassa fever.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.300 ^a	.090	.075	.48360

a. Predictors: (Constant), Radio, Television, Social Media, Newspapers, Health Workers, Community Leaders, Posters/Flyers, Family, Friends, Neighbours and Colleagues.

b. Dependent Variable: Knowledge Promotion

Table 8b. ANOVA Model illustrating the interaction between risk communication sources and knowledge of Lassa fever.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	14.856	11	1.351	5.775	.000 ^b
	Residual	149.913	641	.234		
	Total	164.769	652			

a. Dependent Variable: Knowledge Promotion

b. Predictors: (Constant), Radio, Television, Social Media, Newspapers, Health Workers, Community Leaders, Posters/Flyers, Family, Friends, Neighbours and Colleagues.

Table 8c. Coefficients Model illustrating the interaction between risk communication sources and knowledge of Lassa fever.

Model		Unstandardised Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.469	.203		17.107	.000
	Radio	.026	.005	.193	4.808	.000
	Television	.017	.006	.124	3.065	.002
	Social media	.010	.004	.096	2.392	.017
	Newspaper	.010	.005	.087	2.071	.039
	Health workers	.016	.005	.147	3.511	.000
	Community leaders	-.006	.006	-.045	-1.153	.249
	Posters/flyers	.006	.005	.047	1.117	.264
	Family members	.015	.006	.110	2.687	.007
	Friends	0.172	.006	.000	.005	.996
	Neighbours	.003	.006	.022	.532	.595
	Colleagues	.011	.008	.058	1.431	.153

a. Dependent Variable: Knowledge Promotion

stereo (Broadcasting Board of Governors, 2014). It is, therefore, evident that Nigerians are great radio listeners, using various devices ranging from personal radio sets, mobile phones and car stereos to access information that appeals to them. Due to radio's ability to break the language barriers in multilingual societies such as Nigeria, catering for the needs of the literate, semi-literate and uneducated audiences, and its ability to reach people in the hinterlands at a relatively low cost, health communication interventionists utilize the medium as a veritable tool for health promotion. Remarkably, television was ranked second in the electronic media category regardless of the erratic power supply that has been a major challenge to television viewership in Nigeria. Television as an audio-visual medium is significant for its demonstration ability and the opportunity for group viewership (James and Akintunde, 2018). Although the internet with social media platforms provides new opportunities for communicating health messages, smartphones, data subscriptions, and Internet network deficiencies in some locations limit access to social media platforms, which may have resulted in its low ranking in this study. More so, the spread of unsubstantiated rumours about health risks through the social media tend to reduce its potential for risk communication (Kumar, 2018; Lee, 2019; Wang et al., 2019).

In the print media category, the majority of the study participants are not exposed to risk communication messages via print media channels (see Table 3). This result is justified by the decline in newspaper circulation and readership in Nigeria. Various authors have noted that print media is gradually fading away with the circulation figure of the presently existing Nigeria newspapers far less than the circulation figures of the Nigeria Daily Times as far back as 1980 (when Nigeria's population was almost half of the present figure) (Woweffer, 2018; Ohia, 2019).

Even though posters/flyers were ranked as the most accessed print medium, access to Lassa fever risk information via this channel was limited. This result could be attributed to the placement of posters in designated areas such as primary and secondary healthcare facilities. Again, illiterate audiences hardly interpret the meaning of the illustrations on posters (James and Akitunde, 2018).

Even though the interpersonal communication approaches of risk communication take a longer time, and reach a limited number of persons compared to the mass media, the results of this study show that person-to-person information sources are the highest accessed channel among the three categories. Among them, family members/relatives and healthcare workers were ranked the predominant for FGD discussants and survey respondents. These results imply that family health communication and health workers have contributed to creating awareness about Lassa fever in the endemic states. However, Alberti et al. (2018) note that adequate health literacy might impact the efficacy of family health communication. Thus, inadequate health literacy could lead to information distortion through this channel. Besides, family communication and other forms of informal sources of interpersonal communication (friends, neighbours and colleagues) found in this study imply that people who are exposed to information on Lassa fever tend to pass the information to other members in their informal social networks. This finding corroborates Adegoke, Ajibola and Ogundairo's (2017) claim that social interaction and relationships also served as a medium for spreading awareness about Lassa fever. Also, the finding confirms Efe's (2020) report that people who have access to information on other infectious diseases such as COVID-19 tend to educate their family members/friends about the disease. However, improvement in the promotion of knowledge about Lassa fever by community leaders is desirable, since it is ranked as the least interpersonal source of Lassa fever risk information across the selected states (see Table 4).

Regarding the knowledge of Lassa fever, the results show that the majority of the study participants have adequate knowledge of the Lassa virus vector. This finding supports Akinwumi et al. (2016) claim that students' knowledge of the Lassa fever vector, causative agent, diagnostic method, and person-to-person transmission of the disease was above average, even though it could be argued that those in an academic environment should possess high-level knowledge about the outbreak of infectious diseases. The finding also corroborates Awosanya's (2018) and Akinwumi et al., (2018) report of a high level of knowledge about the reservoir of Lassa fever in a combined area of the academic environment and rural communities in Ibadan. It also supports Saka, Gubio, Kerecvel, Saka and Oyemakinde's (2017) submission that many Nigerians are now aware that "rat-infected foodstuff" is a source of Lassa fever infection. However, the result contradicts an earlier report by Adefisan (2014) that the level of awareness that rat is a vector of Lassa fever in some rural communities of Ijebu-North Local Government Area in Ogun state was poor.

A greater number of the respondents in this study had adequate knowledge of the primary and secondary transmission routes. The finding marks a departure from Adebimpe's (2015) and Olanlekan's (2015) submissions that the knowledge of Lassa fever transmission among the urban slumps population in Southwest, Nigeria was low.

Also, respondents' knowledge of Lassa fever risk factors and preventive measures in this study was sufficient. This observation confirms Mbuk's (2018) claim that the shop owners in Community Markets in a Military Barrack in Kaduna state showed adequate knowledge of Lassa fever. These results may be attributed to recurring events of Lassa fever outbreaks in the study areas with the aggressive risk communication interventions that followed it since 2018.

The respondents show adequate knowledge of the Lassa fever symptoms, but the knowledge of asymptomatic patients was generally poor in all selected states as shown in Table 6. This finding supports Adesoji et al. (2016) report that almost two-thirds (58.3%) of the respondents do not

know that Lassa fever could be contracted from a healthy-looking person. A possible explanation for this finding is that risk communication messages focus more on symptoms without mentioning that some patients may not experience any symptoms. This finding implies that people are likely to identify that they have been infected with Lassa fever only when the symptoms are fully blown, thereby leading to late presentation of cases.

The overall high level of knowledge found in this study is consistent with Ben-Enukora et al. (2020) and Erubami (2022) reports that increased exposure to risk messages about Lassa fever positively influences the knowledge of Lassa fever vector, modes of transmission and symptoms of the disease in Southern Nigeria. However, at the state level, poor knowledge of person-to-person transmission and symptoms of Lassa fever was poor among the respondents from Ebonyi state. The finding supports Nwonwu et al. (2018) report that more than two-thirds of the respondents had poor knowledge of the mode of transmission of Lassa fever in Ebonyi state. This result also corroborates Wogu's (2018) report that most respondents from Ebonyi lacked adequate knowledge of Lassa fever symptoms.

The Anova Model in Table 8b denotes that risk communication sources have a significant influence on respondent's knowledge of Lassa fever in all the selected states. However, the regression coefficient in Table 8c shows that radio and healthcare workers have a more significant effect on the knowledge of Lassa fever with the highest beta values of .191, $p < .05$ and .147, $p < .05$ respectively, followed by television and family members/relatives with $beta = .124$, $p < .05$ and $beta = .110$, $p < .05$ in that order. The results imply that radio, healthcare workers, television, and family members/relatives positively influence the knowledge of Lassa fever. Thus, a unit increase in the information accessed through these channels would result in a more significant increase in the level of knowledge among the respondents. It then means that other risk communication sources (social media, newspapers, posters/flyers, community leaders, friends, neighbours and colleagues) do not have a significant relationship with the knowledge of Lassa fever. Therefore, the null hypothesis which stated that risk communication sources have no significant influence on knowledge of Lassa fever was rejected for radio, television, healthcare workers and family members/relatives but not rejected for social media, newspapers, posters/flyers, community leaders, friends, neighbours and colleagues.

6. Conclusion and policy recommendations

This study concludes that residents in the epicentres of Lassa fever outbreaks (Ebonyi, Edo and Ondo state) in Nigeria have access to multiple sources of risk communication regarding the disease. Thus, access to risk communication through a combination of channels significantly influenced the knowledge of Lassa fever in the selected states. Among the risk communication sources investigated in the study, messages accessed from radio, healthcare workers, television and family members/relatives have a significant influence on knowledge of Lassa fever compared to other sources of risk communication such as social media, newspapers, posters, friends, neighbours, colleagues and community leaders. Therefore, the study recommends that;

1. More efforts in risk communication should be geared towards the dissemination of health risk information through radio, healthcare workers, television and informal communication within the family network to further promote knowledge of Lassa fever and other epidemics in Nigeria.
2. Risk communication messages should endeavour to encourage the residents to engage in the propagation of Lassa fever risk information within the family and other social networks via word of mouth and social media engagements.
3. The opportunities presented by the social media platforms should be harnessed to promote the knowledge of Lassa fever.

4. Community leaders should be better engaged to promote the knowledge of Lassa fever in their various domains.
5. More emphasis should be placed on modes of transmission and symptoms of Lassa fever in future risk communication efforts in Ebonyi state to improve knowledge in this regard.
6. Risk communication messages should also highlight that some patients may not experience any symptoms of Lassa fever for people to take precautionary measures and reduce the chances of person-to-person transmission of the Lassa virus.

6.1. Limitation of the study

Participants in this study consisted of residents between the ages of 15–64 years who had been exposed to risk communication interventions in all the selected states. Therefore, the high level of knowledge shown in this study may vary from other studies involving the general population. Another limitation to this study is the absence of cheater questions to effectively test the survey respondents' claims on knowledge of Lassa fever. Also, the use of the Likert scale limited the respondents to choosing only one option for the responses. Moreover, we did not carry out a PostHoc study to correct for design effect. Furthermore, only one FGD session was held in each selected community irrespective of the participants' demography. This may not provide enabling environment for a maximum contribution of some participants in the interactions. Hence, some respondents may provide socially desirable responses different from their actual behaviours.

Declarations

Author contribution statement

Charity A. Ben-Enukora: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

Babatunde K. Adeyeye; Evaristus Adesina; Olanrewaju O. P. Ajakaiye; Adekanye Olaniyi: Analyzed and interpreted the data.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

Supplementary content related to this article has been published online at <https://doi.org/10.1016/j.heliyon.2022.e11335>.

Acknowledgements

We appreciate Landmark University Centre for Research, Innovation and Discovery (LUCRID) for funding open access publication of this research.

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