



Determinants of Lassa fever Prevalence With Regards To Attitudes and Environmental Factors in Bauchi State

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ABSTRACT

Lassa fever incidence in association with climatic factors, hygienic factors and respondent's attitudes, influencing the spread of the disease in Bauchi state. Survey research design was adopted were data collected using a structured and closed – ended questionnaire from sample and result was generalized; the hypothesis formulated was analyzed using regression technique with SPSS V 23. The population is Bauchi state which according to the population projection has a total of 645,000 people where 400 were selected using Taro Yamane formula. Six (6) local governments in the state were purposefully sampled from each senatorial district where two (2) local governments in each of the senatorial districts were sampled and simple random sampling was used to access the respondents. Findings showed that attended formal education. This shows a link in the level of awareness on LASV is attributed to ignorance and negligence. There was an association between housing condition and hygiene & sanitation. Environmental and hygienic factors have been implicated to either play a major role in determining the rate of transmission or exacerbating transmission risks. Some environmental conditions that contribute to exacerbating the incidence of Lassa fever include poor hygienic practices, attitudes (bush burning, hunting, indiscriminate wastes disposal, poor storage and food handling attitudes. Adoption of traditional and religious rulers as well as ward – heads to be included in the door – to – door sensitization campaign about the improved attitude towards the Lassa fever preventive practices. The State government in conjunction with the State Primary Health Care Development Agency should organize training, workshops and seminars of health care workers using the Standard Operating Procedures and use of well defined guidelines on preventive practices procured by NCDC.

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INTRODUCTION

Lassa Fever virus, also known as the Lassa hemorrhagic fever (LHF), is an acute viral hemorrhagic illness cause by Lassa virus (LASV) that last for 2-21 days in humans and generated recurrent outbreaks in Western Africa (Richmond & Baglolle, 2003). The virus is endemic to much of sub-Saharan West Africa with regular widespread outbreaks (Gibb et al., 2017). The LHF risk areas approximately cover 80% of Sierra Leon and Liberia, 50% of Guinea, 40% of Nigeria, 30% of Benin, Cote d'Ivoire and Togo and 10% of Ghana (Fitchet-Calvet, 2009; Akhmetzhanov et al., 2019). In

2018, an unusually large increase in LASV cases occurred in Nigeria, which led the WHO to declare it an outbreak, classified it as a grade 2 public health emergency (Katherine et al., 2018). The Nigerian Center for Disease Control (NCDC) had reported 431 laboratory-confirmed cases in patients from 21 states in 2018 alone, including 37 health care workers, with an estimated case fatality rate of 25% (Kolawole et al., 2019). In recent years 2019 and 2020, Nigeria has carried the major burden of reported disease.

Generally, LASV transmission occurs through direct contact with rat urine, faeces,



and saliva or through contact with excretion- or secretion-infected materials, the use of rodents as a food source in some areas provides a further avenue of exposure (Carey et al., 1972). Furthermore, LASV can transmit between humans via direct contact with infected bodily fluids such as blood, urine, and faeces (Akhmetzhanov et al., 2019). Epidemiological modelling studies found that 20% of hospitalized LF cases were infected by other people, with high levels of transmission due to super-spreaders (Chowell et al., 2016).

The current strategies for preventing LASV infection focus on avoiding direct and indirect contact with *Mastomys* rodent secretions, excretions and improved hygiene in health facilities (Fisher-Hock et al., 1995). However, these measures have proven challenging to implement effectively, and are unlikely to result in effective control in the foreseeable future (Hamblyon et al., 2018). Several promising studies support a LASV vaccine, although vaccine candidates have not yet undergone clinical trials (Demby et al., 2004; Saez et al., 2018).

The used of Mathematical modeling studies can help assess the potential outcomes of a LASV vaccine in LASV endemic regions, thereby optimizing the use of limited resources. Several mathematical models have been developed for LASV (Okuonghae & Okuonghae, 2008; Martins et al., 2016; Faniran, 2017; Josephine et al., 2019; Nwasuka et al., 2019; Salihu et al., 2020) however few have considered continuous or pulse vaccination. Furthermore, whilst LF disease patterns are seasonal (Asogun et al., 2012) and the absence of repeat LASV infections implies immunity (Fisher-Hock & McCormick, 2001), many existing models do not incorporate either seasonality or a recovered class. The only model incorporates human-to-human transmission, which may play an important role in transmission is that of (Akanni & Adediipo, 2018). Following the recent work in (Josephine et al., 2019) have investigated the potential outcomes of a LASV vaccine in LASV endemic regions, comparing both infant vaccination and population-wide pulse vaccination. Their findings around infant vaccination show much more sensitive to the duration of immunity than those for pulse vaccination, with considerably less benefit

achieved by infant vaccination if immunity lasts around 10–30 years.

Therefore this study will measure the association of environmental factors, hygienic factors and people's attitudes towards the LASV.

Statement of the Problem

LASV is one of the most infectious diseases in Nigeria as well as other African countries. Nigeria is the most populous country in Africa and has recently seen significant outbreaks of LASV, with 413 confirmed cases and 114 deaths from LASV reported between January 1 and April 15 of 2019. Findings have been shown that high transmission rate of the disease is as a result of late detection as well as unsupervised cure or treatment. Most of the LASV cases are undetected and this may be one of the accelerating factors to high transmission rate. Recently, (WHO, 2018) investigated the potential outcomes of a LASV vaccine in LASV endemic regions, comparing both infant vaccination and population-wide pulse vaccination. Bauchi state is one of the states affected by LASV of recent, and as such there is a need to determine the people's attitudes and other environmental and hygienic factors towards the disease. More so, from the body of literature, people's attitudes towards LASV are missing and no known study was conducted in Bauchi state with this caption, hence there is the need to bridge this gap. A gap exists in the content and acceptance of LASV risk communication information in Abakaliki, Ebonyi state.

In view of the above, it is necessary to determine the people's perceptions on LASV in association with their attitudes, environmental and hygienic factors towards LASV.

Research Objective

The main objective of the study is to determine the respondent's perception on people's attitudes, environmental and hygienic factors towards LASV in Bauchi state.

Research Hypotheses

H₀: There is no significant influence of environmental factors, hygienic factors and people's attitudes towards LASV.



LITERATURE REVIEW

Environmental and Hygienic Factors Associated with LASV

LASV is a West African phenomenon (Peterson et al., 2014) but it has received a global attention due to its horrific modes of transmission and other symptoms. LASV transmission is driven by environmental exposure (Akhmetzhanov et al., 2019). Because of its zoonotic transmission and life threatening potential to the environment, the population poses a public health challenge (Gibb et al., 2017; Mazzola & Kelly, 2019; Redding et al., 2021; Hansen et al., 2021). Response to LASV to date has been restricted to trans-disciplinary and intergovernmental coordination, public engagement and surveillance, case management and infection prevention and control, clinical management, and vector and environmental control (WHO, 2022).

In recent years, there are changes in the environmental factors due to the global climate change (Gibb et al., 2017; Ogwu, 2019). It is established that LASV is mainly found in sub-Saharan Africa, strictly West African region (Klitting et al., 2021). This could be the reason why the LASV like other arena viruses has enveloped and are sensitive to high temperatures or low humidity more than its host, which may trigger the reliance of the virus on rainfall and humidity (Clegg 2009; Klitting et al., 2021). Areas with a moderate amount of rainfall (about 1500-3000 mm) had a higher risk of occurrence (Redding et al., 2021) when compared to areas with a lower volume of rainfall (about 1200-1500 mm) had a medium risk of LASV incidence. This is in line with Fichet Calvet, (2008), Kerneis, et al., (2009); Adebimpe et al., (2020); Nchom, et al. (2021).

Temperature, humidity, rainfall and other environmental factors and seasonality are other environmental predictors of LASV transmission, Abdullahi, et al. (2020) with dry season being the peak of LASV cases in endemic areas in Nigeria and this could be as a result of the varying interaction between humans and rodents during the rainy and dry season which can impact LASV transmission. Akhmetzhanov (2019) observed that LASV shows seasonality in its incidence rate as there is more often a rise in reported cases during

the first few months of the year which exceeds that of the remaining months of the year

Good hygiene is critical for preventing the spread of infectious diseases and avoiding illness and hygienic behaviors are difficult to practice without the right knowledge and skills as well as adequate community support and the belief. Where homes, schools and health centre have dirt floors; where water for hand washing is unavailable; and even where families share spaces with domestic animals; maintaining hygiene can be a challenge. Good environmental hygiene is synonymous with good health (Izah et al., 2022) because the proliferation of vectors will decrease when the environment is devoid of waste. It leads to better health, confidence and overall growth. Good hygiene is critical for preventing the spread of infectious diseases and helping children lead long, healthy lives. It also prevents them from missing school, resulting in better learning outcomes.

Bonner, et al. (2007) in their study observed the LASV vector is a semi-domesticated scavenger pest that moves from agricultural areas, open grasslands, and human settlements. These environments where rodents have access to food and shelter are associated with the risk of infection and the presence of rat burrows and the quality of material used to build the house contributes poses a potential risk to the number of infections recorded (Izah et al., 2022).

Human Attitudes

Ikhajagbe et al., 2020, Basinski et al., 2021 and Bodo et al., 2021 in their researches found out that in terms of farm clearance, the most common method is bush burning. This method not only clears out the vegetation but also chase the wildlife (mostly pests) away to the nearby communities especially in rural areas; this has resulted in the invasion of pests (Abdullahi, et al., 2020 and Basinski, et al., 2021). The transition of forest land into arable agricultural uses is invasive and destructive to the ecosystem, and the perpetrators of this could encounter bacteria, viruses, and other organisms which could potentially cause an outbreak when introduced into a population of humans with no previous encounters with such organisms (Izah et al., 2022).



According to UNEP (2020), wildlife is being exploited and used for different purposes around the world including food, source of income (mostly among the poor in developing and low-income countries), medicine, ritual, and decorative purposes (Izah et al., 2022). According to Amoo, et al., (2021), and Duono, et al., (2021), poverty is a major factor why rodent hunting is still in practice despite the outbreaks attributed to LASV.

According to Ogwu (2019), Abdullahi, et al., (2020) and Osawaru and Ogwu (2020) in most rural settlements in West Africa, food products are sun-dried in the open along-side of the roads. This encourages contamination of food as they are exposed to environmental elements and increases the chances of rodent infestation thereby increasing the chances of LASV transmission (Izah et al., 2022). Poor storage of foods is also a major concern in the transmission of LASV; rodent-proof containers are generally not available for the storage of local farmers (Ogwu & Oladeji, 2014; Chime et al., 2016; Ikhajagbe et al., 2021) which in the long run is increasing the risk of LASV infections.

There is significant association between poor food handling practices, especially in non-airtight containers (Izah et al., 2022), and the incidence of LASV, has been reported in the literature (Aigbiremolen et al., 2017; Ilesanmi et al., 2021). Ben-Enukura, et al. (2021) reported from a study carried out in Edo state noted that high-risk practices like consuming foods infiltrated or half-eaten by rodents after washing or removing the portions that were contaminated. Poor knowledge of the risk factors associated with LASV transmission is also very poor among rural dwellers and sometimes ignorance.

Most household's wastes comprise leftovers and spoilt food items which if not

disposed of properly, these wastes become food sources for vectors, especially rats (According to Gbakeji, et al. (2016); Ogwu (2019). Maintaining a clean households, disposing of wastes to the designated wastes collection points and if possible, keeping a cat as a pet would discourage rodents from entering households (Izah et al., 2022; Gbakeji, et al., 2016; WHO, 2022).

METHODOLOGY

The research adopted survey research design. Part of the population was selected and studied whereas the result was generalized to the entire population. Inferential method was used to ascertain the extent to environmental, hygienic factors as well as attitudes is attributed with the respondent's perception towards LASV in Bauchi state. The population is Bauchi state which according to United Nations population projections, the current metro area population of Bauchi state in 2022 is 645,000 people of which 400 were sampled using Taro Yamane formula.

The sampling procedure for the research is multi-stage sampling. At the first stage, Bauchi state was clustered based on the local governments, that is, each of the local governments in Bauchi state is an independent entity and homogeneous group called cluster which gives a sum of twenty (20) clusters. The second stage of the sampling is non-probability sampling, that is, six (6) local governments in the state were purposefully sampled with special reference to senatorial districts where two (2) local governments in each of the senatorial districts were selected. The last stage is the selection of the final respondents from these six (6) local governments where 400 respondents were randomly selected.

Table 1: Sample Proportion

S/N	LOCATION/ LGA	POPULATION	SAMPLE PROPORTION
1	BAUCHI	693,700	$\frac{693,700}{2,725,500} \times 400 = 101$
2	TAFAWA BALEWA	310,900	$\frac{310,900}{2,725,500} \times 400 = 46$
3	MISAU	367,300	$\frac{367,300}{2,725,500} \times 400 = 53$
4	NINGI	542,300	$\frac{542,300}{2,725,500} \times 400 = 80$



S/N	LOCATION/ LGA	POPULATION	SAMPLE PROPORTION
5	KATAGUM	411,700	$\frac{411,700}{2,725,500} \times 400 = 61$
6	GAMAWA	399,600	$\frac{300,600}{2,725,500} \times 400 = 59$
TOTAL	6 LGA's	2,725,500	400 Respondents

Source: Author's Computation, 2022

Data was collected using the structured and close ended questionnaire designed and validated for the purpose (Cronbarch Alpha = 0.83). Simple random sampling method was used to select the

respondents. A total of 386 completed questionnaires were recovered upon which the analysis was based. Correlation and regression technique was used to analyze the recovered data using SPSS V23.

RESULT AND DISCUSSION

Table 2: Descriptive Statistics

Item	Variable	Frequency	Percentage (%)	Total
Occupation	Unemployed	43	11.1	
	Self-Employed	220	57.0	
	Civil Servant	123	31.9	100%
Marital Status	Single	90	23.3	
	Married	238	61.7	
	Divorced	58	15.0	100%
Education Level	None	81	21.0	
	Non-Formal Education	41	10.6	
	Formal Education	264	68.4	100%
Household Size	1 - 5 People	65	16.8	
	6 - 10 People	123	31.9	
	More than 10 People	198	51.3	100%

Source: Author's Computation using SPSS, 2022

From the table above, result showed that most of the respondents were self-employed (57.0%), married (61.7%), attend formal education (68.4%). In contrary, it was observed by Nwonwu et al., (2018) that a greater proportion of people live in the rural communities where poverty prevails, and standards of living are low, and the emergence of highly contagious diseases (like Lassa) fever is common. They have larger households (51.3%). This shows a link in the level of awareness on LASV disease is attributed to

married households where there may be the attitudes of housewife's negligence (as most of the respondents were formally educated) and larger families It confirmed by Oboratare et al., (2014) that housing conditions are potential sites for LASV transmission. There was an association between housing condition and hygiene & sanitation. Poor housing conditions and hygienic practices in and around the home can aggravate the transmission of LASV (Eric et al., 2021).

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.802	.643	.638	.2173603

Source: Author's Computation using SPSS, 2022



Table 4: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
1					
Regression	11.106	3	3.702	9.717	.000
Residual	145.923	383	.381		
Total	157.029	386			

Source: Author's Computation using SPSS, 2022

The coefficient of multiple correlation shows that there is strong and positive relationship between awareness of the disease and the explanatory variables, with ($R = 0.802$). $R - Squared$, the coefficient of multiple determinations is 0.643 indicating that 64.3% of the total variation is explained by the changes in the independent variables, showing that environmental factors, hygienic factors and the respondent's attitudes explained the level of awareness towards LASV diseases in Bauchi state by 64.3%.

A multiple regression analysis was carried out to assess the impact of these

variables. Study shows that when these variables (environmental factors, hygienic factors and the respondent's attitudes) were well practiced, LASV awareness will get enhanced significantly. This is justified by the measure of reliability (ANOVA) (since P value = $0.000 < 0.05$). Adjusted $R - Squared$ value of 63.8%, this also shows that there is high relationship between the dependent and independent variables indicating the actual percentage of variation explained by the set of independent variables that actually affect the dependent variable.

Table 5: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.011	14.123		-.142	.896
	Environmental Factors	.367	.033	.555	.622	.000
	Hygienic Factors	.259	.106	.751	2.434	.000
	Attitudes	.225	.250	.824	.900	.000

Source: Author's Computation using SPSS, 2022

Result from the regression analysis was carried out to ascertain the combine effect of these variables. All the predictors (environmental factors, hygienic factors and the respondent's attitudes) yielded significant beta weights with $\beta_1 = 0.367$, $\beta_2 = 0.259$, $\beta_3 = 0.225$ respectively with their varied $t -$ values which are all statistically significant as all their p - values are less than 0.05 ($P < 0.05$) in each case. This implies that there is significant effect of these proxy-variables on the disease awareness in Bauchi state. Therefore the null hypothesis is rejected in view of the positive and significant relationship being established from the statistical analysis made therefrom. The negative intercept (constant = -2.011) in the model indicated that there are other factors not captured in the study area.

CONCLUSION AND RECOMMENDATIONS

LASV transmission is driven by environmental and hygienic factors for instance the disease is sensitive to high temperatures or low humidity more than its host, which may trigger the reliance of the virus on rainfall and humidity and its life threatening potential to the environment, which is incorporated with people's attitudes in terms of bush burning, hunting, food storage, non - using protected containers, e.t.c. There is significant association between environmental factors, hygienic practices (food handling practices) and people's attitudes towards LASV disease and hence they are its influencing factors. There is need for increased efforts by Government and other stakeholders to sensitize the public about the improved attitude towards the LASV preventive practices. The State government in conjunction with the State



Primary Health Care Development Agency should organize training, workshops and seminars of health care workers using the Standard Operating Procedures and well defined guidelines on preventive practices procured by NCDC.

Adebimpe (2015) posited that it was inferred that the means and modes recorded for good knowledge of LASV infection as well as adequate prevention measures may reduce the infection rate. Therefore knowledge levels of the disease should increase so as to control possible outbreaks in the community. Adoption of traditional and religious rulers as well as ward – heads to be included in the door – to – door sensitization campaign will enhance the public awareness about the disease. Good hygiene is critical for preventing the spread of infectious diseases.

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