Social Determinants of Lassa Fever in Ondo State

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ABSTRACT

Lassa fever is a significant social health issue in West Africa, but its social and demographic determinants are not well comprehended. The paper has examined the effect of age, sex, education, occupation, and residence on the risk of Lassa fever among patients in Ondo State, Nigeria. An analytical study based on cross-sectional analysis was done on confirmed Lassa fever patients. Socio-demographic information was gathered and logistic regression analyses were conducted that determined independent predictors of infection with odds ratios (OR) and 95% confidence interval (CI). Age was an influential predictor: every year of age reduced the chance of being infected by approximately 21%(OR = 0.79; 95% CI: 0.66-0.94). Nearly 50% of the cases occurred in adults between 20 and 34 years. Males were 53% of the sample and were more than eight times as likely as females (OR = 8.12; 95% CI: 2.8023.56). The effect of educational status was more complex: people who had only primary school education were at significantly increased risk (OR = 29.17; 95% CI: 4.55186.83), whereas those with no or secondary education did not differ significantly with those who have tertiary education. Applicants, apprentices, or retirees were strongly protected against civil servants (OR = 0.07; 95% CI: 0.02–0.58). The place of residence was not determined independently but the majority of cases were concentrated in rural settings in Ondo State which was a representation of the timing of the outbreak and the level of surveillance. The risk of Lassa fever is also defined by the social and occupational determinants, and the most recent burden is concentrated among lowly educated young men working in informal or agricultural areas. The priority of the interventions should be rodent-proof housing, safe food storage, health education, and enhanced surveillance.

Key words: Infection, Disease, Demographics, Lassa & Epidemiology.

1. INTRODUCTION

Lassa fever is a major health concern in Nigeria and the West African sub region as a whole. It is a severe acute viral zoonosis caused by arenavirus (family Arenaviridae), the Lassa virus, and may cause severe haemorrhagic disease. The disease remains with significant socio-economic and public health burden and frequent seasonal epidemics, high fatality rates, and the possibility of nosocomial spread places even greater pressure on healthcare systems. Non-specific manifestations include fever, malaise, sore throat, headache, chest pain, nausea, vomiting, diarrhoea, and abdominal discomfort. In a smaller proportion of patients, it leads to more severe complications such as facial swelling, mucosal bleeding, neurological disorders, shock or death (Ahmad, 2021; WHO, 2017)

The infection is transmitted in humans primarily by contact with contaminated food or household objects containing the urine or faeces of the rodent reservoir-Mastomys natalensis, which is a widespread peridomestic multimammate rat (WHO, 2017). There is also a risk of person-to-person transmission, especially in a healthcare environment, when in contact with the bodily fluids of infected people (Capewell et al., 2016). Though about 80% of the infections are mild or asymptomatic, the rest can progress to haemorrhagic fever, which is life threatening. The incubation period is between 1 and 24 days (Vinod, 2021).
Originally named Lassa fever, the disease was first discovered in Nigeria in 1969 in Lassa village located in Borno State and since then it has become endemic in most areas, with approximately two-thirds of all states of the country having been affected (Ebenezer & Adesewa, 2023). The dry season is the typical period of the outbreaks and the fatality rate in the cases is 24-79 percent of confirmed cases over the recent years (Birindwa et al., 2018). One of the states that experience high incidence of Lassa Fever annually is Ondo State and thus the state is a priority region in control and prevention (Redding et al., 2021).

It is necessary to understand the social determinants of health in order to deal with Lassa fever. These determinants include a set of conditions under which individuals are born, grow, live, work, and age, and the distribution of resources and power on a larger scale influencing those conditions (Fofah, 2021). Exposure to Lassa virus and the capacity to react to its infection is affected by poverty, housing conditions, food preservation, sanitation, education, access to health services and the structure of community living (Iroezindu et al., 2015). Structural drivers of health inequity are frequent, such as unequal economic opportunities, social policy and governing, which are converted into disparity in risk and disease outcomes (Iton et al., 2022). It is therefore critical to have a comprehensive public health strategy that incorporates prevention, risk communication, environmental sanitation and community engagement. Health equity, social and environmental conditions in endemic regions such as Ondo State should be fortified to reduce the spread of the infection and maintain the gains against Lassa fever (IPCC, 2022). The study intends to determine social determinants of Lassa Fever in Ondo State.

2. METHODS

The analytical retrospective study based on cross-sectional analysis was applied with case extracting of medical records to measure the demographic and socioeconomic status of Lassa fever survivors (recovered) and victims (deceased) at the Federal Medical Centre, Owo, Ondo. The target population included all confirmed incidences of Lassa fever in Ondo State (N = 974) as of the epidemiological week 11 2025, FMC was used been the treatment Centre in Ondo State, while focusing on the two LGA with the Highest Lassa Fever cases in Ondo State (Akure North and Owo LGA in Ondo State) and the same number of non-Lassa cases who reported their presence in the same facilities during the study period. The sample size

was calculated by the formula of Taro Yamane (margin of error =10%). n= 90.67 approximately 91, but 10% of the sample side was added making the sample side 100, this was done to make provision should some brought in death patient medical records where selected. Equal number of non-Lassa fever patient were be sampled. Thus, the total sample size for the study was 200. Sampling was done systematically by picking every 10th case file in the medical records that were numerically arranged in both groups.

A case extraction form developed in the study was used to collect data. The tool included socio-demographic and social determinants. Patient case folders were assessed and their information entered onto the form to be analyzed. Only quantitative data was gathered. The data collected was analyzed using descriptive statistics. Descriptive statistics are numbers used to summarize and describe data collected from the survey in a more meaningful way. Descriptive statistics such as simple percentage, frequency table and other suitable statistics to calculate the case fatality (No of people reported dead due to Lassa fever over No of Lassa fever patient multiplied by 100), crosstab, and binary logistic regression analysis.

A formal approval to undertake the research was received at the Head of the Medical Records Department after handing in the introductory letter to the ethical review committee of the hospital. Due to the confidentiality and organizational concerns, access to the records library was not immediate, since some feared that the organization of the patient folders in the cabinets would be disturbed. The researcher on the other hand was introduced to the Head of the Statistics Unit and given elaborate instructions on the retrieval process. A data collection date was identified, and on the specified day, all the needed case folders were accessed and ordered, which meant that the information needed could be extracted efficiently.

3. RESULTS

Table 1 shows the socio-demographic characteristics of the respondents, it was revealed that 4.0% of the respondents fall between the age group of 0–9 years, while 1.5% fall between 10–19 years. Furthermore, 27.5% of the respondents fall within the age group of 20–29 years, and 23.0% fall between 30–39 years. In addition, 15.5% of the respondents are between 40–49 years, while 11.5% fall within the 50–59 years age group. Also, 9.0% of the respondents fall between 60–69 years, and 4.0% are within 70–79 years. Lastly, 4.0% of the respondents fall within the age group of 80–89 years.

It was revealed 53.0% (106) of the respondents are male, while 47.0% (94) of the respondents are female. 33.5% (67) of the respondents are single, while 66.5% (133) of the respondent are married. 19.0% (38) of the respondents have no formal education, 28.0% (56) of the respondents have primary school education, 38.0% (76) of the respondents have secondary school education, while 15.0% (30) of the respondents have tertiary school education. 9.0% (19) of the respondents reside in a farm settlement, 56.5% (113) of the respondents reside in the rural area, while 34.0% (68) of the respondents reside in the urban area. 81.5% (163) of the respondents are Yoruba, 15.5% (31) of the respondents are Igbo, and 3.0% (6) of the respondents are Hausa. 65.5% (131) of the respondents are residing in Akure North LGA, while 34.5% (69) of the respondents are residing in Owo LGA. 15.0% (30) of the respondents are civil servants, 16% (32) of the respondents is farmers, 28.0% (56) of the respondents are traders, 20.5% (41) of the respondents are still schooling, 14.0% (28) of the respondents are into menial jobs, and 6.5% (13) of the respondents are applicant/apprentice/retirees.

Table 1. **Socio-Demographic Characteristics of the Lassa Patients (n=200)**

Variable	**Responses**	**Frequency N=200**	**Percentage**
Age	0 – 9	8	4.0
	10 – 19	3	1.5
	20 – 29	55	27.5
	30 – 39	46	23.0
	40 – 49	31	15.5
	50 – 59	23	11.5
	60 – 69	18	9.0
	70 – 79	8	4.0
	80 – 89	8	4.0
Sex	Male	106	53.0
	Female	94	47.0
Marital status	Single	67	33.5
	Married	133	66.5
Highest level of education	No Formal Education	56	28.0
	Primary School Education	76	38.0
	Secondary School Education	30	15.0
	Tertiary School Education	56	28.0
Place of residence	Farm settlement	19	9.5
	Rural area	113	56.5
	Urban area	68	34.0
Ethnic group	Yoruba	163	81.5
	Igbo	31	15.5
	Hausa	6	3.0
LGA	Akure north LGA	131	65.5
	Owo LGA	69	34.5
Occupation	Civil Servants	30	15.0
	Farmers	32	16.0
	Trader	56	28.0
	Student	41	20.5
	Menial job	28	14.0
	Applicants/Apprentice/Retiree	13	6.5

Source: Patient's Medical Records

Table 2 shows the social determinant of determinant of Lassa Fever using crosstabulation, it was revealed that 1.0% of the respondents fall between the age group of 5 – 9 years, 3.0% of the respondents fall between the age group of 15 - 19 years, 20.0% of the respondents fall between the age group of 20 – 24 years, 12.0% of the respondents fall between the age group of 25 – 29 years, 18% of the respondents fall between the age group of 30 – 34 years, 11.0% of the respondents fall between the age group of 35 – 29 years, 12.0% of the respondents fall between the age group of 40 – 44 years, 4.0% of the respondents fall between the age group of 45 – 49 years, 7.0% of the respondents fall between the age group of 50 – 54 years, 3.0% of the respondents fall between the age group of 55 – 59 years, 5.0% of the respondents fall between the age group of 65 – 69 years, 2.0% of the respondents fall between the age group of 70 – 74 years, 1.0% of the respondents fall between the age group of 75 – 79 years, 1.0% of the respondents fall between the age group of 88 – 89 years, while 7.0% of the non-Lassa patients fall between the age group of 0 – 4 years, 11.0% of the non-Lassa patients fall between the age group of 20 – 24 years, 12.0% of

the non-Lassa patients fall between the age group of 25 – 29 years, 10% of the non-Lassa patients fall between the age group of 30 – 34 years, 7.0% of the non-Lassa patients fall between the age group of 35 – 29 years, 12.0% of the non-Lassa patients fall between the age group of 40 – 44 years, 3.0% of the non-Lassa patients fall between the age group of 45 – 49 years, 9.0% of the non-Lassa patients fall between the age group of 50 – 54 years, 4.0% of the respondents fall between the age group of 55 – 59 years, 6.0% of the non-Lassa patients fall between the age group of 60 – 64 years, 7.0% of the non-Lassa patients fall between the age group of 65 – 69 years, 3.0% of the non-Lassa patients fall between the age group of 70 – 74 years, 2.0% of the non-Lassa patients fall between the age group of 75 – 79 years, 7.0% of the non-Lassa patients fall between the age group of 80 – 84 years.

About 65.0% (65) of the respondents are male, while 35.0% (35) of the respondents are female and 41.0% (41) of the non-Lassa patients are male, while 59.0% (59) of the non-Lassa patients are female. 37.0% (37) of the respondents are single, 63.0% (63) of the respondent are married, while 30.0% (30) of the non-Lassa patients are single, while 70.0% (70) of the non-Lassa patient are married. 13.0% (13) of the respondents have no formal education, 25.0% (25) of the respondents have primary school education, 37.0% (37) of the respondents have secondary school education, 25.0% (25) of the respondents have tertiary school education while 25.0% (25) of the non-Lassa patients have no formal education, 3.0% (3) of the non-Lassa patients have primary school education, 39.0% (39) of the non-Lassa patients have secondary school education, 31.0% (31) of the non-Lassa patients have tertiary school education. 13.0% (13) of the respondents reside in a farm settlement, 47.0% (47) of the respondents reside in the rural area, 40.0% (40) of the respondents reside in the urban area while 6.0% (6) of the non-Lassa patients reside in a farm settlement, 66.0% (66) of the non-Lassa patients reside in the rural area, 28.0% (28) of the non-Lassa patients reside in the urban area. 76.0% (76) of the respondents are Yoruba, 18.0% (18) of the respondents are Igbo, 6.0% (6) of the respondents are Hausa, while 87.0% (87) of the non-Lassa patients are Yoruba, 13.0% (13) of the non-Lassa patients are Igbo.

Exactly 38.0% (38) of the respondents are residing in Akure North LGA, 62.0% (62) of the respondents are residing in Owo LGA, while 93.0% (93) of the non-Lassa patients are residing in Akure North LGA, while 7.0% (7) of the non-Lassa patients are residing in Owo LGA. 8.0% (8) of the respondents are civil servant, 19.0% (19) of the respondents are farmers, 30.0% (30) of the respondents are trader, 22.0% (22) of the respondents are student, 15.0% (15) of the respondents are into menial jobs, 6.0% (6) of the respondents are either applicant/apprentice/retiree while 22.0% (22) of the non-Lassa patients are civil servant, 13.0% (13) of the non-Lassa patients are farmers, 26.0% (26) of the non-Lassa patients are trader, 19.0% (19) of the non-Lassa patients are student, 13.0% (13) of the non-Lassa patients are into menial jobs, 7.0% (7) of the non-Lassa patients are either applicant/apprentice/retiree.

Table 2: Social determinants of Lassa Fever, crosstab with Non-Lassa Fever cases

Social determinants	Responses (in years)	Non-lassa fever	Lassa fever	Total
Age	0 – 4	7	0	7
	5 – 9	0	1	1
	10 – 14	0	0	0
	15 – 19	0	3	3
	20 – 24	11	20	31
	25 -29	12	12	24
	30 – 34	10	18	28
	35- 39	7	11	18
	40 – 44	12	12	24
	45 – 49	3	4	7
	50 – 54	9	7	16
	55 – 59	4	3	7
	60 – 64	6	0	6
	65 – 69	7	5	12
	70 – 74	3	2	5
	75 – 79	2	1	3
	80 – 84	7	0	7
	85 – 89	0	1	1
Sex	Male	41	65	106
	Female	59	35	94
Marital Status	Single	30	37	67
	Married	70	63	133
Level of Education	No Formal Education	25	13	38
	Primary School Education	5	25	30
	Secondary School Education	39	37	76
	Tertiary School Education	31	25	56
Place of Residence	Farm Settlement	6	13	19
	Rural area	66	47	113
	Urban area	28	40	68
Ethnic groups	Yoruba	87	76	163
	Igbo	13	18	31
	Hausa	0	6	6
LGA	Akure north LGA	93	38	131
	Owo LGA	7	62	69
Occupation	Civil servants	22	8	30
	Farmers	13	19	32
	Trader	26	30	56
	Student	19	22	41
	Menial job	13	15	28
	Applicants/Apprentice/Retiree	7	6	13

Findings of binary logistic regression analysis that was conducted to examine the effect of the chosen social determinants on the likelihood of the outcome are shown in Table 3. The variables considered included sex, marital status, highest level of education, place of residence, occupation and age with odds ratios (OR), 95% confidence intervals (CI)

and the p-value interpreted to describe the strength and significance of each relationship. Sex became a powerful and important predictor. Male participants were significantly more likely to have the outcome (OR = 8.12; 95% CI: 2.8023.56; p < 0.001), compared to females used as the reference group. This means that a male had more than eight times the chances of the event compared to female. Marital status, however, did not have a statistically significant impact. The odds of the outcome were lower among married respondents as compared to those who were single (OR = 0.51; 95% CI: 0.112.31), but the result was not significant (p = 0.377).

This implies that marital status might not have a significant impact on the incidence of the outcome in this sample. Education level was both negative and positive. The odds of the outcome were significantly greater in participants that had primary school education compared to tertiary education (OR = 29.17; 95% CI:4.55-186.83; p < 0.001) which indicates a strong and significant relationship. The odds were lower among respondents who were not educated (OR = 0.26; 95% CI: 0.0511.47; p = 0.127), and higher among those who were educated to secondary education (OR = 2.96; 95% CI: 0.7911.17; p = 0.109), which were not statistically significant. On the whole, primary education only was correlated with increased odds significantly.

In terms of place of residence, farm settlements and rural regions did not have a significant relationship with the outcome as compared to urban regions. Though respondents in farm settlements were found to have higher odds (OR = 4.79; 95% CI: 0.6137.93; p = 0.138), and urban dwellers had lower odds (OR = 0.65; 95% CI: 0.24181; p = 0.409), the differences were not found to be significant. An important finding was made of occupational status. The odds of the outcome were significantly lower among civil servants compared to the applicants, apprentices, or retirees (reference group) (OR = 0.07; 95% CI: 0.01-0.58; p = 0.013). Different occupational groups, including farmers, traders, students and menial job performers elicited different odds, all of which were not statistically significant. Lastly, age as a continuous variable had a significant negative relationship with the outcome. The odds reduced by about 21 percent every extra year of age (OR = 0.79; 95% CI: 0.660.94; p = 0.01 0) meaning that the younger the individual, the more likely they were to experience the event. Overall, the analysis revealed that sex, education, occupation, and age are important determinants. To be male, have primary school education, and younger age, in particular, and work as a civil servant were found to be positively correlated with the probability of the outcome, whereas aging and employment as a civil servant contributed to decreasing the odds dramatically. Other educational or occupational categories such as marital status, residence and other factors were not predictive.

Table 3: Odd Ration and statistical significance based on binary regression logistic regression analysis of social determinants of Lassa fever

Social Determinants	P>|Z|	Odd Ratio	Lower – Upper 95% Confidence Interval
SEX			
Female (RC)		1.00	
Male	0.000	8.117	2.797 - 23.555
MARITAL STATUS			
Single(RC)		1.00	
Married	0.377	0.505	0.110 - 2.305

HIGHEST LEVEL OF EDUCATION Tertiary Education (RC) Without Formal Education Primary School Education Secondary School Education	 0.127 0.000 0.109	 . 1.00 0.261 29.168 2.961	 0.046 - 1.465 4.554 - 186.831 0.785 - 11.167
PLACE OF RESIDENCE Urban Area (RC) Farm Settlement Rural Area	 0.138 0.409	 1.00 4.793 0.651	 0.606 - 37.926 0.235 - 1.806
OCCUPATION Applicants/apprentice/retiree(RC) Civil Servant Farmer Trader Student Menial Jobs	 0.013 0.260 0.195 0.379 0.162	 1.00 0 .071 3.393 0.272 0.387 0.213	 0.009 - 0.575 0.405 - 28.397 0.038 - 1.947 0.047 - 3.204 0.024 - 1.864
AGE Singular age	 0.010	 0.789	 0.660 - 0.944

4. DISCUSSIONS

This study investigated the influence of the chosen socio-demographic variables on the risk of Lassa fever in the patients. It was discovered that the age became a significant predictor. The young adults, those falling within the 20-34 years, were the most affected with almost half of the Lassa fever being recorded in this age group. The results of the regression analysis supported a strong negative relationship between age and infection (Murray et al., 2017): an increase in age by 1 year decreased the odds by about 21% (OR = 0.79; 95% CI: 0.6694).

This trend is in line with the reports that Lassa fever tends to impact the economically active people who are involved in farming, trading, or other outdoor activities and hence more in contact with rodent reservoirs (Wi et al., 2017). Another important determinant was sex. Men were 53% of the sample, and had more than eight times the probability of developing the disease than women (OR = 8.12; 95 percent CI: 2.8023.56; p = 0.001). This increased risk in males could be due to their increased participation in farming, hunting, clearing bushes or storage of farming produce, which exposes them to high exposure of Mastomys natalensis the major host of Lassa virus.

The educational status had a confounded relationship with the risk of infection. Those with the lowest qualification of primary school were significantly more likely to have the disease (OR = 29.17; 95% CI: 4.55 -186.83). In contrast, the respondents who had none or secondary education did not show a significant difference between the tertiary education.

The extreme risk among individuals who have received only primary education could be due to a lack of health literacy coupled with the involvement of these individuals in subsistence agriculture or food conservation measures that promote rodent infestation. It is not surprising that respondents who only received primary education were found to have significantly higher odds of having Lassa fever infection as earlier studies have found that lower education correlates with worse knowledge and prevention behaviors on Lassa fever (Ajayi et al., 2014). Risk perception and prevention studies also show that tertiary education provides a protective benefit in improving the knowledge of rodent-to-rodent transmission and behavioural preferences towards safer food-storage. (Nnadi et al., 2024).

The role was also occupied. The civil servants had much lower susceptibility rates compared to the applicants, apprentices, or retirees (OR = 0.07; 95% CI: 0.015-0.58). The odds of other occupational groups such as farmers, traders, students, and those involved in menial work had different odds, but they were not statistically significant. The civil servant protection effect will probably indicate improved working conditions, reduced exposure to rodent habitats, and increased access to preventative information. As of place of residence, the majority of the patients resided in rural neighbourhoods, but when other variables were held constant, the rural or the farm settlements were not much different compared with the urban centres in terms of infection risk. Although poor housing and sanitation that allows rodent intrusion may be an issue for rural residents, the statistical significance is not as significant, which could indicate that individual behaviours and professions might be more influencing than the location. Nigerian studies have indicated that civil servants and other workers in the formal sector are less likely to acquire Lassa fever infection compared to subsistence farmers, traders, or unemployed individuals, which is probably due to their occupation exposing them to fewer rodent reservoirs and their greater access to health education (Adewuyi et al., 2020). Farmers, traders, and artisans tend to be exposed to rodent-infested food storage or bushy farmlands, which puts them at risk of infection (NCDC, 2021).

Raw frequencies difference existed between marital status and ethnic group and between local government area and infection when other variables were adjusted. As an example, the proportion of Lassa cases in Owo LGA was higher than other LGA in Ondo State, although this can be attributed to time clustering of outbreaks or discrepancies in surveillance and not necessarily community risk. On the whole, these findings highlight the idea that Lassa fever is a consequence of a set of social determinants instead of biology. The strongest burden lies with young males with low levels of schooling and working in informal or agricultural sectors, but older adults and salaried workers have the relatively high level of protection. The priorities of targeted health education, enhanced hygiene in the food storage, and rodent-proofing interventions should therefore be aimed at vulnerable groups, in particular young men and households with low educational attainment in farming or trading communities. The increased prevalence of Lassa fever in young men with low education levels is also in keeping with the prior studies which have found low educational levels to be a primary risk factor of infection (Ireye, 2021; “NCDC, 2024). Likewise, applicants, farmers, or people in informal jobs had higher chances of getting infected than civil servants, which may also be due to improved housing, fewer contacts with rodents, and access to health information (NCDC, 2021). The higher percentage of cases in Owo LGA is geographically clustered and is consistent with other Nigerian studies observing no difference between LGAs due to community susceptibility but attributed to the intensity of surveillance and time-limited outbreaks (Alenoghena & Omuemu, 2021)

5. CONCLUSION

This the study revealed that a combination of demographic, educational, and occupational factors determines the burden of Lassa fever in Ondo State. Younger adults, especially males, were determined to be more at risk since they are likely to be exposed more by farming, trading, and other activities that expose them to close contact with Mastomys natalensis, the main reservoir of the virus. Low education level proved to be another significant factor, likely because of its influence on the information about disease prevention, food preservation, and overall hygiene behavior. Even though the location of residence did not have independent statistical significance, the aggregation of cases in the rural and farm-settlement regions indicates that household and environmental parameters are still of critical importance.

6. RECOMMENDATIONS

i. The households and communities play a vital role in decreasing Lassa fever spread by enhancing better rodent control, safe food storage, and good hygiene maintaining at home and in the market. Regular cleaning, proper disposal of wastes, and behaviour that result to little contact between humans and rodents should be encouraged by community leaders and market associations with special focus on young adults who are at risk of exposure through farming and trading.

ii. Government agencies including the Ministry of Health, Nigeria Centre of Disease Control, and local surveillance units should intensify routine disease surveillance systems and increase access to early diagnosis by equipping the frontline health institutions and training health workers. These agencies should also lead an integrated response to the provision of public health, which incorporates the ecological risks management alongside the knowledge of social vulnerability within affected communities.

iii. The local government councils, environmental health officers, and housing authorities should also consider environmental conditions favouring rodent infestation by instating rodent control programmes, proper waste management and sanitation. They are also expected to assist the households to renovate the building structures by closing cracks and reducing the access points that allow rodents in homes, thereby reducing the ecological factors that contribute to transmission.

iv. The development and socioeconomic stakeholders, such as NGOs, donor agencies, and community-based organisations, need to be engaged to overcome the social and economic factors that predispose people to Lassa fever. Their interventions are supposed to be geared towards promoting health literacy, supporting livelihood improvement, financing hygiene and behavioural change programmes and enhancing market and housing infrastructure. Through promoting socioeconomic growth and health programs, these actors can create long term community resilience and play a role in sustainable disease control.

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