Assessment of community risk perception on household rats (*Rattus rattus*) as a reservoir of pathogenic *leptospira* in Sokoto Metropolis, Sokoto State, North western Nigeria

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ABSTRACT

This study examines community perceptions of risk regarding household rats (Rattus rattus) as carriers of pathogenic Leptospira in the Sokoto metropolis of Northwestern Nigeria, an area facing rapid urbanization, poor sanitation, and widespread rodent infestation. Rodents are well-known reservoirs and vectors for numerous zoonotic diseases, including leptospirosis, a neglected yet significant tropical infection. Despite its public health importance, awareness and attitudes towards rodent-borne diseases in Sokoto remain insufficiently studied, hindering effective control measures. Using a cross-sectional survey, data were gathered from 212 residents across five local government areas of Sokoto metropolis. A structured, pre-validated questionnaire was employed to collect information on demographic characteristics, knowledge, attitudes, and practices related to rodents and rodent-borne diseases. The majority of respondents were male (86.8%), with a median age of 51 years; most households kept livestock and lived in modern houses. Overall, 67.9% of participants exhibited good knowledge about rodent-borne diseases, yet only 9.9% specifically linked rodents to Leptospira infections. Attitudes towards prevention were largely positive, as 98.6% supported protective actions such as proper food storage and rodent control measures. Statistical analysis showed significant associations between knowledge levels and sociodemographic factors including age, education, occupation, housing type, and sanitation facilities. Notably, higher education, especially secondary and tertiary levels was strongly associated with better knowledge (adjusted odds ratio for college/university education = 9.06, $p < 0.001$). There was also a strong positive correlation between knowledge and attitude scores ($r = 0.733$, $p < 0.01$), suggesting that more informed individuals tend to adopt more proactive preventive behaviors. Despite broad awareness of general rodent-related health risks, knowledge specific to leptospirosis was limited, and some misconceptions remained. Respondents identified government health officials as the primary agents responsible for disseminating information about rodent-borne diseases, highlighting the vital role of official health communication. Rodenticide was the most commonly favored control method, followed by maintaining cats and using traps. These findings underscore the urgent need for comprehensive, culturally appropriate health education programs aimed at vulnerable populations. Promoting integrated One Health strategies will be critical to reducing leptospirosis and other rodent-associated infections in urban Nigerian settings. This study provides essential epidemiological and behavioral insights to inform public health interventions targeting zoonotic disease risks in rapidly urbanizing areas of Nigeria.

Keywords: *Assessment, Community Risk Perception, Household Rats (Rattus Rattus), Leptospira, Nigeria, Reservoir, Sokoto Metropolis*

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INTRODUCTION

Rodents have long been recognized as important reservoirs and vectors of a wide range of infectious diseases affecting humans globally. These small mammals coexist with people across diverse environments, from rural areas to densely populated urban centers, facilitating the transmission of zoonotic pathogens that cause significant morbidity and mortality. Among the diseases transmitted by rodents, leptospirosis caused by pathogenic bacteria of the genus *Leptospira* has garnered increased attention as a neglected tropical zoonosis with substantial public health impacts (Akinbo *et al*., 2024; Friant *et al*., 2025).

Leptospira bacteria are spirochetes that can survive in moist environments such as soil, stagnant water, and mud, making transmission from rodents to humans common in settings with poor sanitation and frequent contact with contaminated water or soil. The black rat, *Rattus rattus*, is particularly important epidemiologically as a reservoir host, especially in urban and peri-urban areas of developing countries like Nigeria, where rapid urbanization and inadequate waste management exacerbate rodent infestations (Olabode *et al*., 2024; Shehata *et al*., 2025). Nigeria, with its varied ecological zones and growing population densities in urban centers including Sokoto, faces the dual challenge of emerging and re-emerging rodent-borne diseases. In addition to leptospirosis, diseases such as Lassa fever, plague, and hantavirus pulmonary syndrome continue to pose serious threats (Eneh *et al*., 2025; Udo *et al*., 2023). Notably, Lassa fever, an arenavirus infection primarily transmitted by *Mastomys* rats, has seen resurgent outbreaks in Nigeria, highlighting the intertwined risks rodents present as vectors and reservoirs of multiple pathogens (Al-Mustapha *et al*., 2024).

Despite this significant disease burden, community awareness and risk perception about rodents as pathogen reservoirs remain poorly characterized in many Nigerian cities. Studies have shown that low public knowledge and inadequate attitudes toward rodent control significantly contribute to disease persistence and transmission cycles (Adeyemi *et al*., 2025; Ekong *et al*., 2024). Timely and accurate knowledge, guiding appropriate prevention measures, is essential to disrupt these zoonotic cycles. This responsibility traditionally falls to government health agencies, community health workers, and, increasingly, local leadership. However, gaps in effective health education dissemination remain in Sokoto metropolis (Udo *et al*., 2023).

Sokoto metropolis, located in northwestern Nigeria, is a commercial and administrative center with a growing population characterized by a mix of traditional and modern lifestyles. The city grapples with challenges such as unplanned urban expansion, inconsistent waste management, inadequate sanitation infrastructure, and widespread livestock ownership within households (Nwosu *et al*., 2024). These conditions create ideal habitats for *Rattus rattus*, sustaining zoonotic pathogen reservoirs and increasing potential human exposure. Existing research on rodent ecology and pathogenic bacteria prevalence in Nigeria tends to focus on rural communities or southern urban centers, resulting in a lack of epidemiological data specific to Sokoto. This gap hampers targeted intervention efforts and limits understanding of the sociocultural and environmental factors that influence community risk perceptions and behaviors (Akinbo *et al*., 2024; Olabode *et al*., 2024).

Understanding community knowledge, attitudes, and practices (KAP) regarding rodents and leptospirosis risk is crucial for developing culturally appropriate and sustainable control strategies. High-risk groups often defined by socioeconomic status, education, and occupation may require focused educational outreach to reduce infection rates and their economic impacts (Ekong *et al*., 2024). Furthermore, environmental and climatic factors dynamically influence rodent populations and associated disease risks. Seasonal variations, urban waste patterns, and human behaviors collectively shape pathogen circulation, emphasizing the need for an integrated One Health approach that links human, animal, and environmental health surveillance (Oyeyiola *et al*., 2025; Shehata *et al*., 2025). The World Health Organization underlines the importance of robust surveillance, community education, environmental management, and rodent control as core elements of disease prevention programs (WHO, 2018). Still, localized information on risk perception and disease awareness is critical to adapt these guidelines effectively.

This study aims to investigate community risk perception of household rats (*Rattus rattus*) as reservoirs of pathogenic *Leptospira* in Sokoto metropolis. It focuses on assessing knowledge levels about rodent-borne diseases, attitudes toward prevention, and sociodemographic factors influencing these perceptions. The findings are expected to inform public health policies, enhance community engagement, and ultimately reduce the burden of leptospirosis and other rodent-associated infections in northern Nigerian urban settings.

MATERIAL AND METHODS

Study area

Sokoto State, located in the northwestern region of Nigeria, shares an international border with the Niger Republic to the north, making it a strategic hub for trans-border livestock trade and cultural exchange (Figure 1). The state lies within the Sudan-Sahel ecological zone, characterized by semi-arid savannah grassland, seasonal rivers, and sparse vegetation, ideal for pastoralism and extensive livestock rearing, especially of cattle, goats, sheep, and camels (Oladele *et al.,* 2024). These livestock

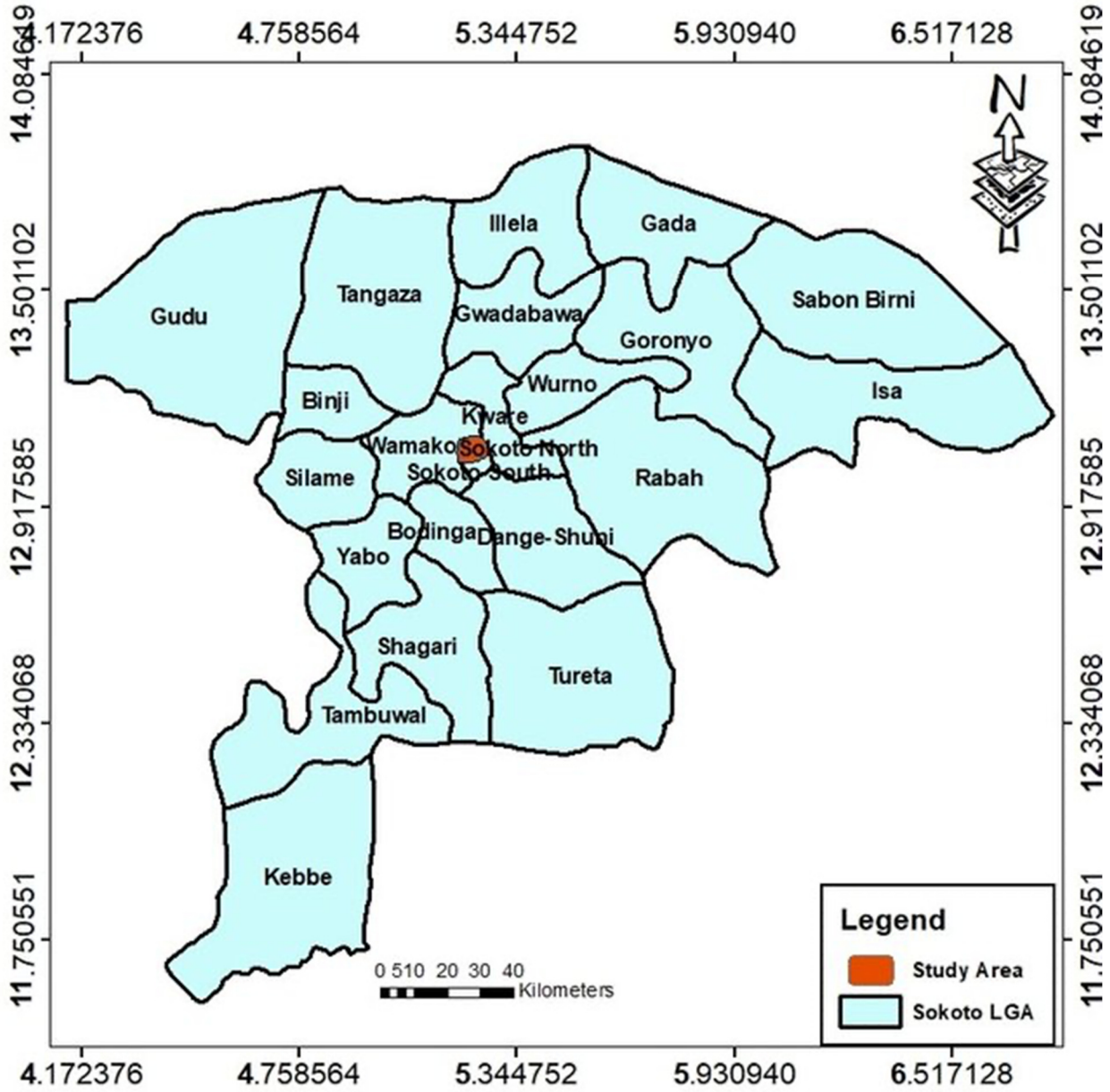

Figure 1: Map of Sokoto State showing the 23 Local Government Areas and the Study area (Fouad *et al.,* 2024).

activities form the backbone of the local economy and are vital for both domestic consumption and cross-border trade (Mamman, 2000). Sokoto city, the state capital, serves as the administrative and economic centre. It is more densely populated compared to rural parts of the state, with an estimated population exceeding 600,000 (Mamman, 2000). The city is marked by rapid urbanization, growing informal settlements, and a dense network of markets, abattoirs, and food handling areas, all of which contribute to complex interactions between humans, animals, and the environment. These conditions make Sokoto metropolis both a centre of livestock trade and a potential hotspot for zoonotic disease transmission, including Leptospirosis, especially due to poor sanitation and high rodent activity in densely populated neighbourhoods.

The study was conducted in Sokoto metropolis, which comprises Sokoto north and Sokoto South local governments, as well as parts of Wamakko, Dange-Shuni and Kware local government areas. These areas are characterized by high-density residential settlements, informal waste disposal practices, and abundant rodent populations, factors conducive to the transmission of rodent-borne zoonoses such as Leptospirosis.

Study design

This study employed a cross-sectional design to assess community risk perception on pathogenic *Leptospira* circulation among domestic rats in Sokoto Metropolis, Northwestern Nigeria. The research used a structured questionnaire survey targeting human populations to establish both behavioural and biological evidence of Leptospirosis risk.

The population of Sokoto metropolis is large, youthful, and predominantly urban poor, with a mix of civil servants, traders, artisans, and students, alongside peri-urban communities that depend on farming and livestock keeping (Dankani, 2018). The residents of Sokoto are predominantly Hausa-Fulani, and the city has densely populated neighbourhoods with limited sanitation infrastructure, irregular waste disposal, and poor drainage systems, conditions that increase contact with rodent populations and contaminated water (Nahuce *et al.,* 2022). These demographic and environmental features in addition to the high population density, informal settlements, and frequent human-rodent interactions (through food storage, open refuse dumps, and livestock markets) create an environment conducive to *Leptospira* l transmission (Neiderud, 2015). Moreover, limited awareness about zoonotic diseases, combined with reliance on untreated surface water in some areas, shapes the community's risk perception and influences exposure pathways.

Questionnaire data collection

To assess community risk perception and behavioural responses to rodent-borne diseases in Sokoto Metropolis, a structured questionnaire survey was employed to collect data across the selected local government areas using a systematic random sampling technique to ensure representativeness. Following a mapping of residential areas, trained data collectors conveniently selected the first consenting household and subsequently visited every tenth household to administer the questionnaire. Where a household refused consent or residents were absent at the time of our visit, the preceding household was chosen. Within each selected household, one adult respondent (preferably the head of household or an informed representative) was recruited to participate in the study.

Data were collected through face-to-face interviews conducted by trained field staff using a structured and pre-validated questionnaire. The tool was developed based on existing literature on rodent-borne diseases and was further refined through expert review for contextual relevance (Udechukwu *et al.,* 2024). The questionnaire was pre-tested through a pilot study involving 30 participants drawn from districts within the Sokoto metropolis that were not included in the main study. Internal consistency of the instrument was assessed using Cronbach's alpha, which yielded a value of 0.78, indicating acceptable reliability. Prior to deployment, the questionnaire was translated into Hausa and back-translated to ensure consistency and avoid loss of meaning. It was uploaded into a Google Form and administered using mobile tablets to ensure accuracy and ease of data capture.

The questionnaire consisted of four major sections, including participants' demographic and household characteristics (age, sex, education level, occupation, marital status, household size, and role within the household). Section one of the questionnaire also included structural and environmental factors, including type of housing (e.g., mud, thatched, modern), ownership of livestock or domestic animals (cattle, sheep, goats, dogs, cats, etc.), type of toilet facilities, and general household hygiene. Section two of the questionnaire assessed knowledge and perception of rodents and rodent-borne diseases to understand the level of awareness of rodents as disease vectors, understanding of Leptospirosis and other rodent-associated diseases, knowledge of disease transmission routes, and previous exposure to health education on rodents.

Similarly, attitudes of the participants toward prevention of rodent-borne diseases were measured using a series of Likert-scale statements to evaluate beliefs about rodent-related health risks, the importance of rodent control, individual responsibility in preventing infestations, and the perceived effectiveness of public health education. Finally, section four assessed the practices and control measures commonly adopted and practised, such as the use of traps, rodenticides, keeping cats, storing food in sealed containers, and regular cleaning practices. Respondents were asked to identify all applicable methods they used to mitigate rodent infestations. Each interview lasted approximately 20-30 minutes. The questionnaire responses were reviewed daily by supervisors for completeness and consistency.

Statistical analysis

Descriptive statistics were used to summarize the data. Categorical data are presented as frequencies and percentages, whereas continuous data are presented as median and interquartile range. There were no missing data points in the final dataset. The participants' knowledge and attitudes were evaluated based on their responses to the structured questionnaire. Knowledge assessment consisted of multiple true/false statements, where correct answers were scored as two and incorrect answers as 1. Using Bloom's original cut-off point, knowledge scores were dichotomised into two categories: poor knowledge (≤ 60% of the total score, corresponding to 0–6 points) and good knowledge (> 60% of the total score, corresponding to 7–11 points) (Mohamud *et al*, 2023). Attitude statements were evaluated using a 5-point Likert scale ranging from "strongly agree" (5 points) to "strongly disagree" (1 point). For reverse-coded statements, the scoring was inverted, with "strongly disagree" receiving 5 points and "strongly agree" receiving

1 point. The total attitude scores were categorised as negative (≤60% of the total score, corresponding to 11–33 points) and positive (> 60% of the total score, corresponding to 34–55 points). The relationships between the knowledge and attitude scores were analysed using Pearson correlation analysis.

RESULTS

Socio-Demographic Characteristics

Of the 212 respondents, 86.8% were male, median age 51 years (IQR 17-80). Most lived in Sokoto South (36.3%), Wammakko (26.9%), or Sokoto North (21.7%). Education levels varied: 41.5% had tertiary education, while 28.8% had Quranic/madrassa education. Business (43.9%) and government/private employment (33%) dominated occupations. Most households owned livestock (99.5%) and resided in modern houses (70.7%) (Table 1).

Knowledge levels of respondents

As shown in (Table 2), 67.9% of respondents had good knowledge of rodent-borne diseases, while 32.1% had poor knowledge. An overwhelming majority (99.1%) had observed rodents around their homes, and 61.8% recognized that rodents can transmit diseases. However, only 9.9% specifically associated rodents with Leptospira, while awareness of Lassa fever was much higher (30.7%). Most respondents (65.1%) viewed rodents as a threat to human health, and 63.2% had previously received information about rodent-borne diseases, primarily from government health officials (75%). Knowledge regarding transmission modes varied, with contaminated food/water being the most commonly recognized route (47.2%).

Attitude of Respondents

Table 3 shows that the respondents' attitudes were generally positive, with 98.6% classified as having a positive attitude regarding rodent-borne disease prevention. Most respondents strongly agreed with critical preventive statements, such as the importance of protecting food and water, controlling the rodent population, and the role of individuals and health workers in prevention. Notably, 82.5% strongly felt individual responsibility is crucial for preventing rodent infestations, and 82.1% strongly supported increased health worker education efforts.

Association between knowledge levels and participants' demographics

Table 4 explores associations between knowledge level and demographic factors. Poor knowledge was more prevalent among older adults, those with Quran/Madrassa or no education, and those in business/trading occupations. Good knowledge was significantly linked to younger age, higher educational attainment, modern housing, and government/private employment. These associations were statistically significant across several variables, notably education ($p<0.001$), indicating that knowledge is shaped by socioeconomic and educational factors.

Correlation between knowledge and attitudes of participants

With respect to the relationship between knowledge and attitude, we found a statistically significant correlation between knowledge scores and attitude scores ($r=0.733$, $p<0.01$), reinforcing that greater knowledge about rodent-borne diseases is closely linked with more positive and proactive attitudes toward prevention and control (Table 5).

Predictors of good knowledge among participants

In order to examine the relationship between a binary outcome (e.g., good knowledge and poor knowledge) and other confounding independent variables at the same time, we conducted multivariable logistic regression analysis (Table 6). The findings showed that higher levels of formal education, particularly secondary and tertiary education, were strongly predictive of good knowledge about leptospirosis and rodent-borne diseases (AOR for college/university: 9.06, $p = 0.000$). Household size also mattered as households of 6-10 and 11- 15 members had higher odds of good knowledge. Being a child, father, or uncle/aunt lowered the odds for good knowledge compared to grandparents. A majority of respondents (76%) indicated they did not know which diseases are associated with rodents. Among those who provided an answer, Lassa fever was the most frequently identified disease, followed by Plague (23%), Leptospirosis (21%) and Salmonellosis (18%). In contrast, Hanta virus and Lyme disease were the least, with 7% and 2% respectively (Table 6). Government health officials were overwhelmingly viewed as the entity responsible for educating the public about rodents, receiving by far the highest number of responses (75%). This is followed by community health officials (17.5%), while local leaders were seen as having a secondary role, with schools considered the least appropriate channel for this education by the respondents (Figures 2-4). Finally, rodenticide was considered the most effective method for controlling rodents, with a dominant majority (67%) of respondents selecting this option. Other viable rodent control options were keeping cats, as well as using traps (Figure 3).

DISCUSSION

This study provides valuable insights into community knowledge, attitudes, and risk perception regarding

Table 1: Socio-Demographic Characteristics of Participants.

Variables	Level	Frequency	Percentage
Name of district/local government:	Dange-Shuni	24	11.3
	Kware	8	3.8
	Sokoto North	46	21.7
	Sokoto South	77	36.3
	Wamakko	57	26.9
Age	<20	3	1.4
	21–30	30	14.2
	31–40	18	8.5
	41–50	51	21.4
	>50	110	51.9
	Median (IQR)	51 (17 - 80)	
Gender	Male	184	6.8
	Female	28	13.2
Level of education	Quran/Madrassa	61	28.8
	Primary School	13	6.1
	Secondary School	39	18.4
	College/University	88	41.5
	No education	11	5.2
Occupation	Business/trading	93	43.9
	Farmer	27	12.7
	Government/private employee	70	33
	Unemployed	22	10.4
Marital Status	Single	27	12.7
	Married	168	79.3
	Widowed/Divorced	17	8.0
Size of household	1–5	48	22.6
	6–10	86	40.6
	11–15	58	27.4
	>15	20	9.4
	Median (IQR)	8 (2 - 23)	
Role in household	Child	22	10.4
	Father	153	72.2
	Mother	21	9.9
	Uncle/Aunt	8	3.8
	Grandparent	8	3.8
Type of house	Mud house	54	25.5
	Thatched house	8	3.8
	Modern house	150	70.7
Ownership of animals/livestock	No	1	0.5
	Yes	211	99.5
Number of animals	1–5	68	32.1
	6–10	90	42.5
	11–15	43	20.3
	>15	11	5.2
	Median (IQR)	8 (1 - 21)	
Type of toilet	Pit latrine	83	39.2
	Water closet	105	49.5
	Open defecation	24	11.3

household rats (*Rattus rattus*) as reservoirs of pathogenic *Leptospira* in Sokoto metropolis, Nigeria. The findings reveal a moderate level of awareness about rodent-borne diseases but highlight significant gaps specifically related to leptospirosis. While 67.9% of respondents demonstrated good knowledge of rodent-

Table 2: Description of knowledge level characteristics of respondents.

Knowledge level	**Frequency n (%)**	**Median (IQR)**
Poor knowledge (≤ 60%) (0 - 6 scores)	68 (32.1)	10 (6 - 11)
Good knowledge (> 60%) (7 - 11 scores)	144 (67.9)	
Total	212 (100)	
Variable	**Level**	**Correct n (%)**
Have you seen rodents in your household or surroundings	No	2 (0.9)
	Yes	210 (99.1)
Do you know that rodents can transmit diseases to humans?	No	81 (38.1)
	Yes	131 (61.8)
Do you believe rodents are a health threat to humans?	No	74 (34.9)
	Yes	138 (65.1)
Have you received any information about rodent-borne diseases before?	No	78(36.8)
	Yes	134(63.2)
Who do you think should educate communities about rodents?	Government health officials	159 (75.0)
	Community health officials	37 (17.5)
	Local leaders	11 (5.2)
	Schools	5 (2.4)
Which of the following diseases do you associate with rodents?	Don't know	76 (35.8)
	Hanta virus	7 (3.3)
	Lassa Fever	65 (30.7)
	Leptospira	21 (9.9)
	Lyme disease	2 (0.9)
	Plague	23 (10.8)
	Salmonellosis	18 (8.5)
How do rodents transmit diseases?	I don't know	84 (39.6)
	Direct contact with rodents	28 (13.2)
	Contaminated food/water	100 (47.2)

Table 3: Description of attitude level characteristics.

Attitude level	**Frequency n (%)**				**Median (IQR)**
Negative attitude (≤ 60%) (11 - 33 scores)	**3 (1.4)**				**44 (33 - 55)**
Positive attitude (> 60%) (34 - 55 scores)	**209 (98.6)**				
Total	**212 (100)**				
Variable	**Strongly agree n (%)**	**Agree n (%)**	**Neutral n (%)**	**Disagree n (%)**	**Strongly disagree n (%)**
Rodents are a nuisance, but do not transmit diseases*	19 (9.0)	42 (19.8)	43 (20.3)	40 (18.9)	68 (32.1)
Protecting food and water from rodent contamination is important for preventing diseases	90 (42.5)	59 (27.8)	57 (26.9)	4 (1.9)	2 (0.9)
Rodents are a serious threat to human health	82 (38.7)	47 (22.2)	73 (34.4)	10 (4.7)	0 (0.0)
Diseases transmitted by rodents can cause severe illness or death	87 (41.0)	38 (17.9)	80 (37.7)	7 (3.3)	0 (0.0)
Rodents only damage property and do not pose health risks to humans*	11 (5.2)	62 (29.2)	30 (14.2)	43 (20.3)	66 (31.1)
Controlling the rodent population is essential for protecting public health	76 (35.8)	58 (27.4)	70 (33.0)	8 (3.8)	0 (0.0)
Preventing rodent infestations is more important than treating rodent-borne diseases	73 (34.4)	71 (33.5)	68 (32.1)	0 (0.0)	0 (0.0)
Individuals have a role to play in preventing rodent infestation in their homes	175 (82.5)	29 (13.7)	6 (2.8)	2 (0.9)	0 (0.0)
Health workers should provide more education on rodent-borne diseases	174 (82.1)	27 (12.7)	11 (5.2)	0 (0.0)	0 (0.0)
Storing food in sealed containers can prevent rodent contamination	145 (68.5)	55 (25.9)	9 (4.2)	3 (1.4)	0 (0.0)
Regular cleaning and proper waste disposal can reduce rodent infestations	169 (79.6)	37 (17.5)	5 (2.4)	1 (0.5)	0 (0.0)

borne diseases a promising figure, it remains suboptimal given the high-risk rodents pose in urban Nigerian settings (Udo *et al*., 2023; Adeyemi *et al*., 2025). Awareness of leptospirosis was particularly low at 9.9%, in stark contrast to the relatively higher recognition of Lassa fever (30.7%). This disparity reflects differing emphases in public health messaging and disease prioritization within local health programs (Al-Mustapha *et al*., 2024; Eneh *et al*., 2025) and underscores leptospirosis neglected status despite its documented presence in both rodents and humans in Nigeria (Price-Mouret *et al*., 2025; Olabode *et al*., 2024). Significant associations were identified between knowledge and factors such as higher education levels, younger age, and residence in modern housing, mirroring documented trends linking socioeconomic and educational status to better access to accurate health information and adoption of protective behaviors (Ekong *et al*., 2024; Udo *et al*., 2023). These associations were statistically

Table 4: Knowledge Level Association with Demographic Characteristics.

Variable	Knowledge Level		χ^2	P - Value
	Poor	Good		
Name of District/Local Government				
Dange-Shuni	24 (35.3)	0 (0.0)	62.6	< 0.001
Kware	3 (4.4)	5 (3.5)		
Sokoto North	13 (19.1)	33 (22.9)		
Hi Sokoto South	11 (16.2)	66 (45.8)		
Wamakko	17 (25.0)	40 (27.8)		
Age Group				
<20	0 (0.0)	3 (2.1)	42.4	< 0.001
21–30	3 (4.4)	27 (18.8)		
31–40	4 (5.9)	14 (9.7)		
41–50	4 (5.9)	47 (32.6)		
>50	57 (83.8)	53 (36.8)		
Gender				
Male	66 (97.1)	118 (81.9)	9.21	0.002
Female	2 (2.9)	26 (18.1)		
Level of Education				
Quran/Madrassa	44 (64.7)	17 (11.8)	102.5	< 0.001
Primary School	4 (5.9)	9 (6.3)		
Secondary School	9 (13.2)	30 (20.8)		
College/University	1 (1.5)	87 (60.4)		
No education	10 (14.7)	1 (0.7)		
Occupation				
Business/trading	50 (73.5)	43 (29.9)	67.6	< 0.001
Farmer	16 (23.5)	11 (7.6)		
Government/private employee	0 (0.0)	70 (48.6)		
Unemployed	2 (2.9)	20 (13.9)		
Marital Status				
Single	3 (4.4)	24 (16.7)	8.9	0.011
Married	56 (82.4)	112 (77.8)		
Widowed/Divorced	9 (13.2)	8 (5.6)		
Size of Household				
1–5	6 (8.8)	42 (29.2)	11.5	0.009
6–10	32 (47.1)	54 (37.5)		
11–15	21 (30.9)	37 (25.7)		
>15	9 (13.2)	11 (7.6)		
Role in Household				
Child	2 (2.9)	20 (13.9)	16.4	0.003
Father	60 (88.2)	93 (64.6)		
Mother	1 (1.5)	20 (13.9)		
Uncle/Aunt	3 (4.4)	5 (3.5)		
Grandparent	2 (2.9)	6 (4.2)		
Type of House				
Mud house	39 (57.4)	15 (10.4)	54.9	< 0.001
Thatched house	0 (0.0)	8 (5.6)		
Modern house	29 (42.6)	121 (84.0)		
Number of Animals Owned				
1–5	7 (10.3)	61 (42.4)	21.9	< 0.001
6–10	38 (55.9)	52 (36.1)		
11–15	18 (26.5)	25 (17.4)		
>15	5 (7.4)	6 (4.2)		
Type of toilet				
Pit latrine	52 (76.5)	31 (21.5)	58.5	< 0.001
Water closet	13 (19.1)	92 (63.9)		
Open defecation	3 (1.4)	21 (14.6)		

Table 5: Pearson Correlation between Knowledge Scores and Attitude Scores.

		Knowledge scores	Attitude scores
Knowledge scores	Pearson Correlation	1	.733**
	Sig. (2-tailed)		**0.000**
	N	212	212
Attitude scores	Pearson Correlation	.733**	1
	Sig. (2-tailed)	**0.000**	
	N	212	212

**Correlation is significant at the 0.01 level (2-tailed).

Table 6: Multivariate Logistic Regression Predicting Good Knowledge/Perception Level of Leptospirosis and Other Zoonoses.

	Knowledge Level			
Variable	**Poor**	**Good**	**AOR (95% CI)**	**P - value**
Gender				
Male	66 (97.1)	118 (81.9)	0.74 (0.05 - 10.91)	0.825
Female	2 (2.9)	26 (18.1)	Ref.	
Level of Education				
Quran/Madrassa	44 (64.7)	17 (11.8)	1.94 (0.50 - 3.33)	0.150
Primary School	4 (5.9)	9 (6.3)	4.31 (4.00 - 10.89)	**0.004**
Secondary School	9 (13.2)	30 (20.8)	4.59 (4.21 - 7.61)	**0.002**
College/University	1 (1.5)	87 (60.4)	9.06 (6.23 - 12.32)	**0.000**
No education	10 (14.7)	1 (0.7)	Ref.	
Size of Household				
1–5	6 (8.8)	42 (29.2)	1.49 (0.29 - 6.57)	0.287
6–10	32 (47.1)	54 (37.5)	3.11 (1.57 - 3.73)	**0.023**
11–15	21 (30.9)	37 (25.7)	3.58 (2.39 - 5.41)	**0.010**
>15	9 (13.2)	11 (7.6)	Ref.	
Role in Household				
Child	2 (2.9)	20 (13.9)	0.02 (0.00 - 0.84)	**0.041**
Father	60 (88.2)	93 (64.6)	0.01 (0.00 - 0.27)	**0.006**
Mother	1 (1.5)	20 (13.9)	0.29 (0.00 - 20.55)	0.568
Uncle/Aunt	3 (4.4)	5 (3.5)	0.03 (0.00 - 0.86)	**0.041**
Grandparent	2 (2.9)	6 (4.2)	Ref.	

Bold, indicate significance at $p < 0.05$; Ref, means reference group; AOR, adjusted odds ratio; 95% CI, 95% confidence interval. The reference category for the dependent variable (Knowledge Level) is "Poor".

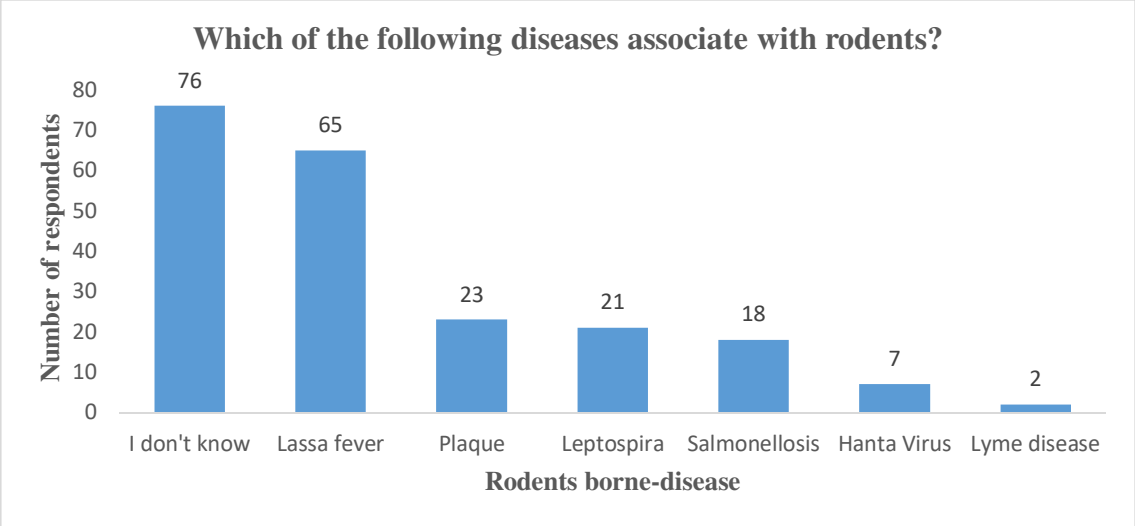

Figure 2: Respondents' knowledge about different rodent-borne diseases

significant and reinforce education as a fundamental driver in improving community understanding of zoonotic diseases. Similar conclusions were drawn by Ally *et al.* (2023) in peri-urban Tanzania, emphasizing the need for health communication strategies sensitive to literacy levels and local contexts. The overwhelmingly positive attitudes observed 98.6% agreement toward rodent control and disease prevention indicate strong community readiness to participate in preventive measures. This aligns with findings from ecological rodent management studies that stress community involvement as essential for sustainable control efforts (Friant *et al.*, 2025; Mariën *et al.*, 2024).

The strong endorsement of measures to protect food and water from contamination is particularly important given that consumption of contaminated sources remains a primary route of leptospiral transmission (WHO, 2018). Although rodenticides were the preferred control method, supported by the use of cats and traps, caution is advisable due to potential environmental and human health risks associated with chemical controls (Mariën *et al.*, 2024). Integrated pest management approaches, combining environmental hygiene with community mobilization, may offer more sustainable and safer outcomes. A strong positive correlation between knowledge and attitudes ($r=0.733$, $p<0.01$ $r=0.733$, $p<0.01$) further supports the idea that improved awareness fosters proactive attitudes and preventive behaviors (Udo *et al.*, 2023). This underscores the importance of tailored educational campaigns contextualized to local settings to enhance both knowledge and attitudes toward rodent-

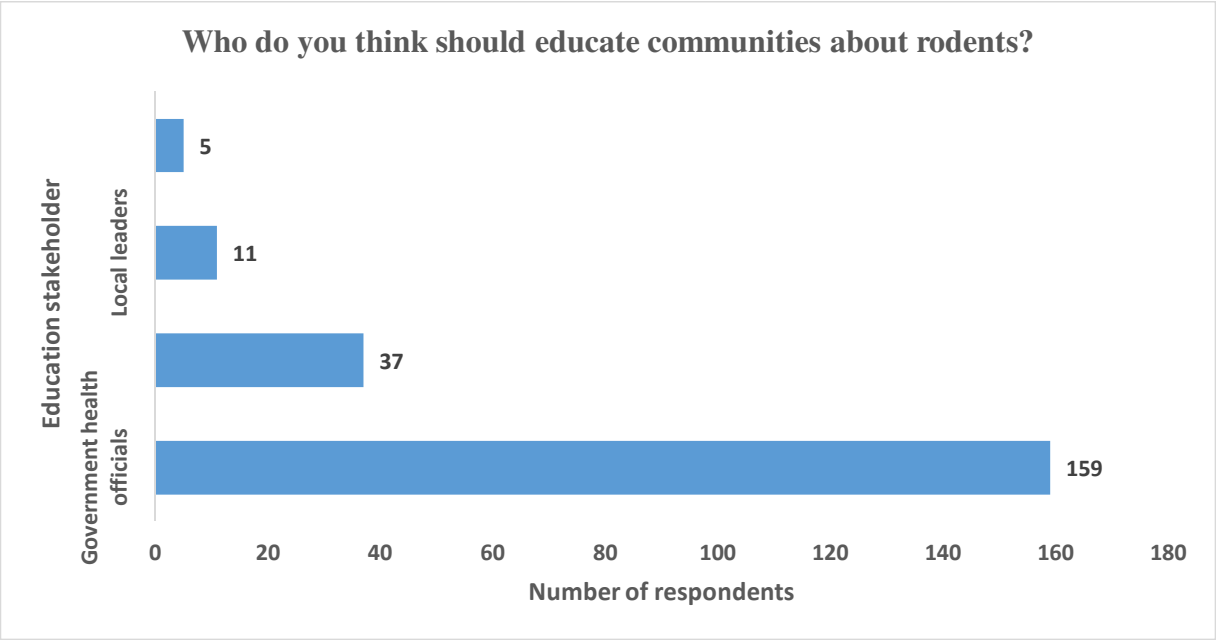

Figure 3: Respondents' Preferences for Educators Regarding Rodent Control and Health Risks

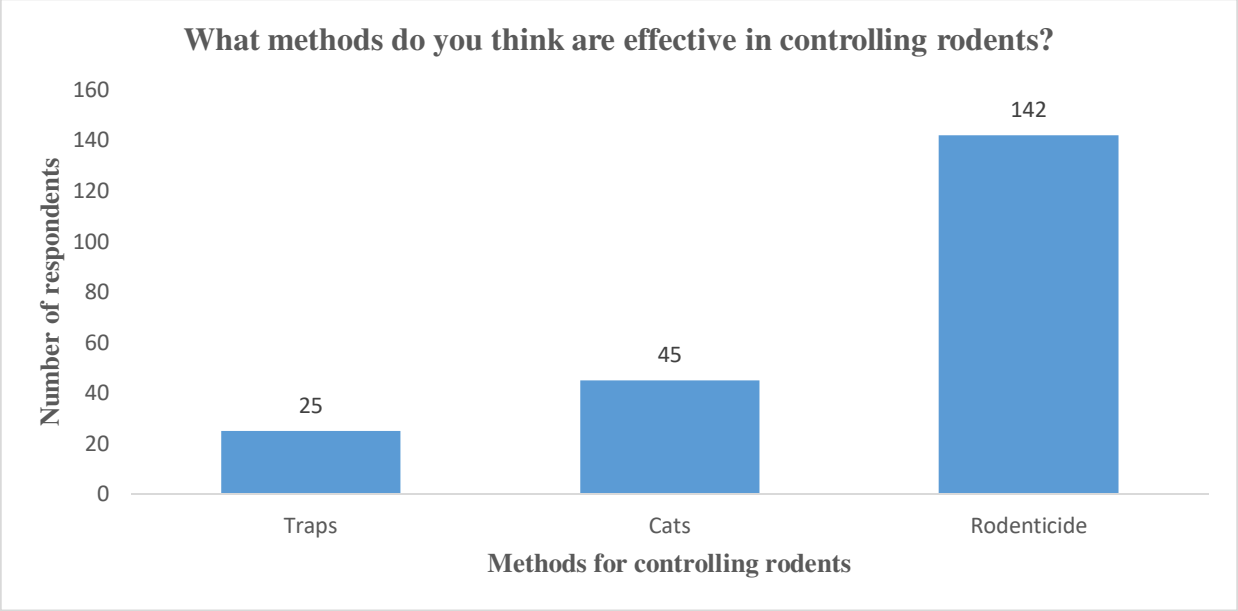

Figure 4: Community Perceptions of the Most Effective Methods for Rodent Control

borne diseases. While this study focuses on community perception, emerging molecular epidemiology in Nigeria confirms a high prevalence of pathogenic *Leptospira* in rodent populations, posing substantial risks to human health especially among certain occupational groups and residents of densely populated urban areas (Price-Mouret *et al*., 2025; Olabode *et al*., 2024). Sokoto's environmental context, marked by poor sanitation, open sewage, and overcrowding, exacerbates opportunities for human exposure to contaminated water and soil, reinforcing the zoonotic transmission cycle. Similar research in Nigerian cities such as Jos and Ibadan reiterate the high pathogenic burden in rodents and challenges linked to low community knowledge and insufficient control measures (Adeyemi *et al*., 2025; Omonona *et al*., 2022). Regional studies also highlight seasonal effects, showing increased rodent populations and disease risks during rainy seasons a factor important for scheduling targeted control initiatives (Oyeyiola *et al*., 2025). Collectively, these findings emphasize the urgent need to enhance integrated One

Health strategies that link human, animal, and environmental health sectors.

Conclusion

The study reveals that while community knowledge regarding household rats as reservoirs of pathogenic *Leptospira* in Sokoto metropolis is moderate, it remains incomplete, especially concerning leptospirosis. Positive community attitudes suggest willingness to engage in prevention, but existing educational and socioeconomic disparities influence knowledge levels. Targeted public health interventions are essential to close these knowledge gaps and strengthen integrated rodent control efforts.

Recommendations

1. Implement culturally appropriate, targeted education campaigns focusing on leptospirosis and rodent-borne disease transmission.
2. Promote integrated rodent control measures including sanitation, trapping, and safe use of rodenticides.
3. Enhance health worker training to strengthen community outreach and education.
4. Establish surveillance systems for rodent-borne pathogens to monitor trends and evaluate control efforts.
5. Encourage multidisciplinary approaches combining environmental management, social behaviour change, and public health policy.

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