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RESEARCH ARTICLE

Knowledge, Attitude and Risk Factors of Acquiring Leptospirosis and Other Rodent-Borne Diseases in Kibondo and Kakonko Districts, Kigoma, Tanzania

Clara A. Majawa[1,2], Abdul A.S. Katakweba[2,3], PB Madoshi[4*], Ginethon G. Mhamphi[2,3] and Athumani M. Lupindu[1]

[1]Department of Veterinary Medicine and Public Health, Sokoine University of Agriculture, Chuo Kikuu, Morogoro, Tanzania

[2]African Centre of Excellence for Innovative Rodent Pest Management and Biosensor Technology Development (ACE IRPM and BTD) of the Sokoine University of Agriculture, Tanzania

[3]Institute of Pest Management, Sokoine University of Agriculture, Chuo Kikuu, Morogoro, Tanzania

[4]Department of Public Health, St. Francis University College of Health and Allied Sciences, Ifakara, Tanzania

***Corresponding author:** *PB Madoshi, Department of Public Health, St. Francis University College of Health and Allied Sciences, P. O. Box 175, Ifakara, Tanzania*

Abstract

Introduction: Globally, leptospirosis is an overlooked zoonotic disease due to health illiteracy, given the high prevalence of various zoonotic diseases today, improving individual knowledge and fostering health literacy could be essential in enhancing the prevention and control of infectious diseases. This study evaluated the knowledge, attitudes, and risk factors for leptospirosis and other rodent-borne diseases.

Methodology: A cross-sectional study was conducted in Kibondo and Kakonko districts in Kigoma region. A total of 80 randomly selected respondents who were interviewed using a semi-structured questionnaire. The data were entered into MS excel and later on analysed using the IBM Statistical Package for Social Sciences (SPSS) version 25.0. The knowledge, attitude, and risk factors of the respondents were assessed using an indexed summated scale. The Chi-square test was deployed to establish the association between the variables.

Results: Majority of participants were men (72.5%), aged between 35 and 49 (46.25%). 10% had secondary school education, without higher education. 53.8% of the participants lived in brick walls and iron sheet roofed houses. 3.7% of the them from Kakonko had a high knowledge on rodent-borne diseases. Worse enough, none of them had ever heard of leptospirosis as compared to plague as a rodent-borne disease. The data analysis showed that level of education ($P = 0.003$) and type of house ($P = 0.000$) were associated with knowledge on leptospirosis. 22.5% has a positive attitude toward leptospirosis as a disease, however, they all had a positive attitude towards rodent control and their methods. It was observed that 67.5% of the participants were exposed to at least three risk factors for leptospirosis and other rodent-borne diseases, of which the most common factors were consuming food and drinking water contaminated.

Conclusion: This low level of awareness calls for more attention from health authorities to educate the communities if leptospirosis and other rodent-borne diseases are to be mitigated.

Keywords

Leptospirosis, Rodents, Knowledge, Attitude, Risk factors, Kibondo, Kakonko, Kigoma

Background Information

Leptospirosis is a global zoonosis that is widely spread in countries with humid tropical and sub-tropical climates, these environmental factors promote

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favourable conditions for the transmission of the disease [1]. It is caused by spirochetes belonging to the pathogenic species of genus Leptospira [2]. This contagious bacterium is transmitted directly through contact with urine or body fluids of infected animals, especially rodents or indirect contact with contaminated environments [3]. Rodents are thought to be the most key maintenance hosts for a variety of serovars, but a wide array of mammals including dogs, pigs, cattle and sheep can also act as hosts for human pathogenic leptospires [4]. It is a re-emerging infectious disease that affects over one million people across the globe annually, with an incidence of 0.1 to 975 cases per 100,000 people [5]. Tanzania, as well as other tropical and subtropical countries, bear the most disease burden.

Despite its rising occurrence, Leptospirosis continues to be among the neglected illness and lack of awareness, particularly among high-risk populations, contributes to its plight. The socio-economic status, economy, occupation, association with animals, rainfall and housing are meaningfully correlated with the occurrence of leptospirosis infection as they often create conditions that promote the presence of rodents and favour the maintenance of leptospirosis [1]. In rural areas, leptospirosis is reported as an occupational disease, it affects agricultural and animal workers. These are among the groups at high risk of acquiring leptospirosis because their works subject them to close contact with infected animals or urine-contaminated water and soil [6]. In Tanzania and most other African countries, the risk factors for human infection are not well categorized [7] and there is some support that the risk factors may vary from other tropical countries.

In northern Tanzania, there is evidence that leptospirosis is more common in rural areas where both livestock and rodents could be important sources of human infection [8]. Previous *Leptospira* exposure studies have identified farmers as a high-risk group for *Leptospira* seropositivity [9]. Although many studies regarding leptospirosis have been carried out in Tanzania, a few have been done to assess the level of awareness of the disease and its associated risk factors and there is a need to carry out more. The understanding of individual knowledge of the disease and health behaviour plays an important role in disease prevention and improving overall health and safety as it identifies the influence of external factors, such as socioeconomic and environmental influences on individual behaviour and attitude towards health [1,10]. It is well established that perceptions and knowledge are significant essential factors in motivating healthy behaviour [11]. To achieve this, a study to determine the knowledge, attitude and risk factors regarding leptospirosis and other rodent-borne diseases was conducted in Kigoma region. Unlike malaria, leptospirosis is still a zoonotic disease that is poorly understood; therefore, this study may offer information on knowledge, attitudes, and risk factors, particularly as they relate to rural livelihood. To minimize the spread of leptospirosis, it is crucial for the health authorities to undertake assessments, plan for surveillance, and develop efficient rodent control methods.

Materials and Methods

Study area

The study was conducted in Kibondo and Kakonko districts, Kigoma region, Tanzania. The respective populations are 362,922 and 178,419 as of the 2022 Tanzania National Census. Agriculture, livestock, and beekeeping are the main economic activities in the Kigoma region. The average daily temperature is between 20 °C and 30 °C, and there is an average of 600-1200 mm of rainfall per year, per meteorological statistics [12].

Sampling procedure

The respondents were selected using a simple random sampling technique in which each household was listed and given a number. After that, these numbers were written on paper and placed in a bag. Subsequently, they were selected at random, and the households with the selected numbers were the ones who were interviewed (Tadesse, *et al*. 2022).

Study design and population

The study employed a cross-sectional study design which was carried out from February 2022 to March 2022. The study population involved 80 randomly selected adult respondents from Kigoma region who were at least 18-years-old, with 40 respondents each from the respective districts of Kibondo and Kakonko.

Data collection

To collect the necessary data, Kiswahili-language semi-structured questionnaires were administered. Two field assistants who received training on how to administer the questionnaires were used in this study. The questionnaires asked about respondents' knowledge of leptospirosis and other rodent-borne diseases, attitude toward leptospirosis and other rodent-borne diseases, risk factors for leptospirosis and rodent-borne diseases as well as their socio-demographic factors. A 5-question index summated scale was used to evaluate participants' knowledge of leptospirosis and other rodent-borne diseases. The purpose of the scale was to ascertain whether the participants had accurate knowledge of leptospirosis and other rodent-borne diseases. A respondent received a score of 1 for each accurate response and a score of 0 for each incorrect response and “do not know”. The lowest and highest scores that could be received were 0 and 5, respectively. No knowledge was denoted by a score of 0, whereas a high knowledge score was 5. The respondents were divided into three groups based on their scores; a score of 0 indicated that the respondent had no knowledge, a score of 1 to 3 indicated low knowledge, and a score of 4 to 5 indicated high knowledge.

The respondents were also questioned on statements regarding their attitudes towards leptospirosis and other diseases that are transmitted by rodents. The response "yes", meant having a positive attitude, "no" meant having a negative attitude, and "I don't know" meant having a neutral attitude. The respondent's attitude toward rodent control was also evaluated; if they implemented any rodent control measures, this was interpreted as a high attitude; if they did not implement any rodent control measures, this was interpreted as a low attitude [1]. The respondent's risk factors for leptospirosis and other rodent-borne diseases were determined using an indexed summated-scale comprising of seven questions. A respondent received a score of 1 for each exposure to a risk factor and a score of 0 for no exposure. The lowest and highest scores that could be received were 0 and 7 respectively and scores were then converted to percentages. Using a cut-off point of 3, the scores were categorized to high and low risk, whereby, a score of 0 to 2 indicated low risk and a score of 3 to 7 indicated high risk [5].

Ethical clearance

The Institutional Review Board of the Sokoine University of Agriculture granted approval for the study (SUA/DPRTC/R/186/16) on 06/01/2022 and Regional Administrative Authorities of the Kigoma region (DA.73/274/02K/326) on 04/02/2022. Before administering the questionnaire, each respondent was informed of the study's goal, their consent was gained and information confidentiality was assured.

Data analysis

Collected data were compiled, coded using Microsoft Excel 2016, and analyzed using SPSS version 25.0 by IBM Corporation. Descriptive statistics were performed and the results were considered to be statistically significant at the 5% level of significance. Frequencies and percentages were used to describe socio-demographic data. The Chi-square test was used to determine the statistical association of variables at a significance level of $p < 0.05$. On the index summated scale, descriptive statistics were used to compute the overall scores.

Results

Socio-demographic characteristics of the respondents

Out of the 80 respondents interviewed, 72.5% and 27.5% were male and female, respectively. The results also show that there was a clear gender gap between the Kakonko and Kibondo districts. In Kakonko, 65% and 35% males and females while in Kibondo 80% and 20% were males and females. The majority (46.3%) of respondents were in the range of 35 to 49 years of age,

Table 1: The socio-demographic characteristics of the respondents.

Questionnaire variable	Kakonko		Kibondo		Total	
	N	%	N	%	N	%
Age						
18-34	19	47.5	15	37.5	34	42.5
34-49	17	42.5	20	50	37	46.25
50+	4	10	5	12.5	9	11.25
Sex						
Male	26	65	32	80	58	72.5
Female	14	35	8	20	22	27.5
Level of education						
None	5	12.5	5	12.5	10	12.5
Primary	30	75	32	80	62	77.5
Secondary	5	12.5	3	7.5	8	10
Occupation						
Farmer	37	92.5	40	100	77	96.25
Self-employed	3	7.5	0	0	3	3.75
Type of house						
Brick iron-roofed house	21	52.5	22	55	43	53.75
Brick grass-thatched house	8	20	2	5	10	12.5
Mud iron-roofed house	1	2.5	0	0	1	1.25
Mud grass-thatched house	10	25	16	40	26	32.5

while those having 50 years and beyond made up a minority (11.3%). Overall, as per study findings, only a relatively small percentage of interviewees, (10%) had completed secondary education. In contrast, 77.5% were primary school dropouts and 12.5% had never attended any type of formal schooling. On average, farming accounted for 96.3% of the participants' occupation. However, for Kibondo district farming was the main occupation to all (100%) of the participants. A considerable portion of the respondents (32%) lived in mud-grass-thatched houses, while more than half of the respondents (53.75%) resided in brick iron-roofed houses (Table 1).

Knowledge on leptospirosis and other rodent-borne diseases

The respondents were asked six questions to find out whether they had a correct knowledge of leptospirosis and other rodent-borne diseases. Results in Table 2 show that none of the participants had previously heard of leptospirosis. However, when asked if they ever heard of other rodent-borne diseases, 57.5% mentioned knowing plague while 42.5% were uncertain. All of the 34 interviewees who had heard of other rodent-borne diseases mentioned plague as a rodent-borne disease. Furthermore, a majority (17.5%) stated to have heard from village service providers whilst a minority (1.25%)

Table 2: Participants' knowledge on leptospirosis and other rodent-borne diseases.

Questionnaire variable	Kakonko		Kibondo		Total	
	N	%	N	%	N	%
Have you ever heard of leptospirosis?						
Yes	0	0	0	0	0	0
No	40	100	40	100	80	100
Have you ever heard of rodents borne diseases?						
No	11.0	23.9	35.0	76.0	46.0	57.5
Yes	29.0	85.3	5.0	15.0	34.0	42.5
If yes from where?						
At school	8.0	100.0	0.0	0.0	8.0	10.0
At school and radio	1.0	100.0	0.0	0.0	1.0	1.3
Health care workers	2.0	100.0	0.0	0.0	2.0	2.5
Not applicable	11.0	23.9	35.0	76.0	46.0	57.5
Radio	5.0	62.5	3.0	38.0	8.0	10.0
Radio and Village service providers	1.0	100.0	0.0	0.0	1.0	1.3
Village service providers	12.0	85.7	2.0	14.0	14.0	17.5
What are some of the rodent-borne diseases you know?						
I don't know	11.0	26.2	31.0	74.0	46.0	57.5
Plague	29.0	76.3	9.0	24.0	34.0	42.5
How are rodent-borne diseases spread?						
Biting	9.0	52.9	8.0	47.0	17.0	21.3
Biting and droppings	1.0	100.0	0.0	0.0	1.0	1.3
Biting and ectoparasites	1.0	100.0	0.0	0.0	1.0	1.3
Biting, Droppings, Urine, Fur	0.0	0.0	4.0	100.0	4.0	5.0
Biting, Droppings, Fur	0.0	0.0	1.0	100.0	1.0	1.3
By sharing settlements with humans	2.0	100.0	0.0	0.0	2.0	2.5
I don't know	11.0	29.0	27.0	71.0	38.0	47.5
Through their droppings	2.0	100.0	0.0	0.0	2.0	2.5
Through their ectoparasites	13.0	100.0	0.0	0.0	13.0	16.3
Through their urine	1.0	100.0	0.0	0.0	1.0	1.3
How can rodent-borne diseases be prevented?						
Civic education	35.0	46.7	40.0	53.0	75.0	93.8
Civic education and distribution of rodenticides and traps	1.0	100.0	0.0	0.0	1.0	1.3
Cleanliness	1.0	100.0	0.0	0.0	1.0	1.3
Cleanliness and Civic education	1.0	100.0	0.0	0.0	1.0	1.3
I don't know	2.0	100.0	0.0	0.0	2.0	2.5

reported to have heard from the radio. Only 52.5% of the respondents had knowledge of how rodent-borne diseases could be spread. Approximately 2.5% of the respondents knew how to prevent rodent-borne diseases, while 97.5% of the respondents did not know any preventive measure. In addition, 93.75% mentioned that in order to prevent the diseases, they need to be educated about them as civic education was key to preventing the disease.

Based on the summated scale which was used, scoring 0 denoted no knowledge, 1 to 3 meant a low level of knowledge while 4 to 5 translated to having a high level of knowledge. Results in Figure 1 show that 3.7% of the respondents had high knowledge, 51.3% had low knowledge and 45% had no knowledge. In Kakonko district, majority (65%) of the respondents had low knowledge, 7.5% had high knowledge and 27.5% had no knowledge. On the other hand, 62.5% of respondents from Kibondo districts had no knowledge while 37.5% had low knowledge. None of the interviewees from Kibondo district had high knowledge.

Association between socio-demographic variables and level of knowledge about leptospirosis and other rodent-borne diseases

A Chi-square test was carried out to show the association of each socio-demographic feature with the level of knowledge on leptospirosis and other rodent-borne diseases. The results in Table 3 show that a majority (52.8%) of respondents in the 35 to 49 age group had no knowledge compared to respondents in the 18 to 34 and 50 or more age group which had 33.30% and 13.90% respectively. In addition, a majority (51.20%) of respondents in the 18 to 34 age group had a low level of knowledge as compared to participants in the 35 to 49 and 50 or more age group which had 39% and 9.8% respectively. It was also shown that a few proportions of respondents in the 18 to 34 and 35 to 49 age group had a high level of knowledge and the association was found not to be statistically significant (x^2 = 4.960, P-value = 0.549). Also, a low level of knowledge was noted to be higher among males (75.6%) compared to females (24.4%) despite being not statistically significant (P-value = 0.377). In addition, there was an association between the participant's level of education and level of knowledge as very few proportions of them who attended both primary and secondary school education had a high level of knowledge (P = 0.003). Further, it was noted that all respondents who were illiterate had no knowledge of leptospirosis and other rodent-borne diseases. Notably, it was also shown that a high proportion (78%) of respondents living in brick iron-roofed houses and 14.6% living in mud-grass-thatched houses had low levels of knowledge compared to respondents who lived in brick grass-thatched houses who were 7.3% and the association was found to be statistically significant (P = 0.000). Furthermore, low level of knowledge was noted to be more prevalent in farmers (92.7%) compared to those who were self-employed and there was no statistical significance.

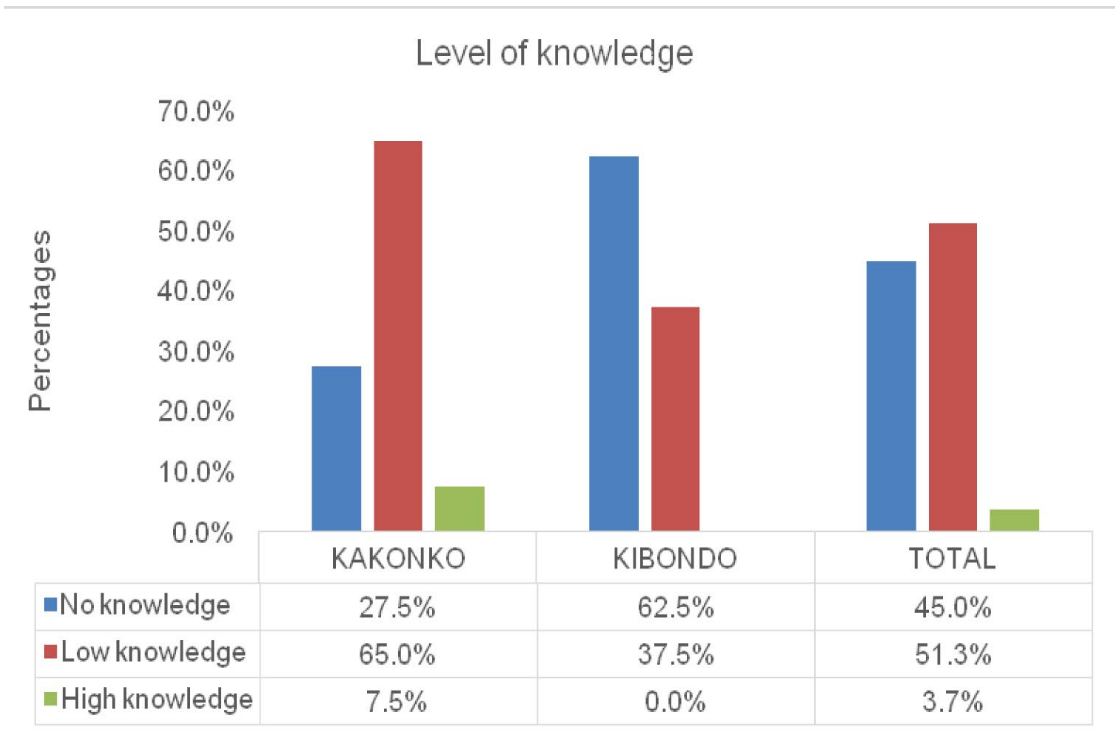

Figure 1: Proportions of respondent's level of knowledge on leptospirosis and other rodent borne diseases..

Table 3: Association between socio-demographic variables and level of knowledge about leptospirosis and other rodent-borne diseases.

Variable	Knowledge						Chi-square	P-value
	No		Low		High			
	N	%	N	%	N	%		
Age								
18-34	12	33.3	21	51.2	1	33.3	4.96	0.549
35-49	19	52.8	16	39.0	2	66.7		
50+	5	13.9	4	9.8	0	0.0		
Gender								
Female	12	33.3	10	24.4	0	0.0	1.951	0.377
Male	24	66.7	31	75.6	3	100.0		
Level of education								
None	10	27.8	0	0.0	0	0.0	15.917	0.003
Primary	24	66.7	36	87.8	2	66.7		
Secondary	2	5.6	5	12.2	1	33.3		
What type of house do you live in?								
Bricked grass thatched	4	11.0	3	7.3	3	100.0	49.582	0.000
Bricked iron-roofed	11	30.6	32	78.0	0	0.0		
Mud grass thatched	20	55.6	6	14.6	0	0.0		
Mud iron-roofed house	1	2.8	0	0.0	0	0.0		
Occupation								
Farmer	36	100.0	38	92.7	3	100.0	2.965	0.227
Self-employment	0	0.0	3	7.3	0	0.0		

Table 4: Attitudes of respondents toward leptospirosis and rodent control.

Questionnaire variable	Kakonko		Kibondo		Total	
	N	%	N	%	N	%
Do you think you are at any risk of being infected by leptospirosis and other rodent-borne diseases?						
Yes	8	20.0	10	25.0	18	22.5
No	21	52.5	18	45.0	39	48.8
I don’t know	11	27.5	12	30.0	23	28.7
What control measures do you put in place to control rodents in your home?						
Cat	7	17.5	3	7.5	10	12.5
Cat and killing traps	4	10.0	1	2.5	5	6.3
Killing traps	2	5.0	0	0.0	2	2.5
Poisonous bait	16	40.0	1	2.5	17	21.3
Poisonous bait and killing traps	6	15.0	0	0.0	6	7.5
Poisonous bait, killing traps and cats	1	2.5	20	50.0	21	26.3
Poisonous bait and a cat	4	10.0	10	25.0	14	17.5
Poisonous bait, live traps, killing traps and cats	0	0.0	5	12.5	5	6.3

Attitude towards leptospirosis and other rodent-borne diseases

The respondents were also assessed on their perception toward leptospirosis and other rodent-borne diseases and the results in Table 4 show that 48.8% of respondents had a negative attitude, 22.5% had a positive attitude, and 28.7% had a neutral attitude. However, Kibondo, had lesser respondents (45%) with negative attitude than Kakonko (52.5%). Additionally, Kakonko and Kibondo had slightly different proportions of respondents who had a neutral attitude, with 27.5% and 30%, respectively. Kibondo district outscored Kakonko by 5% in terms of the proportion of participants who had a positive attitude.

The findings about the respondents' attitude toward rodent management show that all respondents had different rodent control measures implemented in their homes, which indicates a high attitude towards rodent control. Only 2.5% of respondents used killing traps alone, whereas the majority (26.3%) combined poisonous baits, lethal traps and cats for rodent control. While the majority (50%) of respondents in Kibondo employed a combination of poisonous bait, killing traps and cats, the majority (40%) of respondents in Kakonko used poisonous baits alone as a rodent control technique.

Risk factors for leptospirosis and other rodent-borne diseases

The respondents were asked seven questions which are listed in Table 5 to find out if they are subjected to risk factors for leptospirosis and other rodent-borne diseases. Only 87.5% of the respondents said there were rodent outbreaks in their area, while the remaining percentage was unsure. Additionally, 33.8% of the respondents reported that rodents occasionally invaded their homes, whereas 66.3% said that this was the case. It was also noted that 80% and 52.5% of respondents in Kakonko and Kibondo districts respectively, had frequently experienced rodent invasion in their homes. When asked about disposal options of killed or dead rodents, 96.3% of respondents said they simply threw them away, 2.5% buried them, and the smallest percentage (1.25%) said they dumped them in pit latrines. None of the respondents admitted eating rodents as food. The findings also revealed that 41.3% of the individuals had ever encountered a rodent bite, whereas 58.75% said they had never experienced one. The percentage of people who had ever been bitten by a rodent was higher in Kibondo (45%) than in Kakonko (37.5%). Of those bitten, 33.8% did nothing after the bites, 5% cleaned the wound, and a small percentage (2%) took medication. Over half (70%) of the respondents from both districts also acknowledged consuming food and water that had been contaminated by rodents. The majority of respondents (67.5%) had a high risk for leptospirosis and other rodent-borne diseases, and 32.5% had a low risk. Kakonko district had a high proportion (72.5%) of individuals at risk for leptospirosis and other rodent-borne diseases compared to Kibondo which had 62.5%.

Discussion

This study intended to describe the knowledge, attitude, and risk factors of leptospirosis and other rodent-borne diseases in Kibondo and Kakonko districts, Kigoma region, Tanzania. To our level of knowledge, these type of researchers are rarely conducted to

Table 5: Respondents' risk factors for leptospirosis and other rodent-borne diseases.

Questionnaire variable	Kakonko		Kibondo		Total	
	N	%	N	%	N	%
Do you have rodent outbreaks in your area?						
I don't know	5	12.5	5	12.5	10	12.5
Yes	35	87.5	35	87.5	70	87.5
Do the rodents invade your home?						
At times	8	20.0	19	47.5	27	33.8
Yes	32	80.0	21	52.5	53	66.3
How do you dispose of the killed or dead rodents?						
Burying them	1	2.5	1	2.5	2	2.5
Throwing in the toilet	1	2.5	0	0.0	1	1.3
3	38	95.0	39	97.5	77	96.25
Do you consume rodents?						
No	40	100.0	40	100.0	80	100
Yes	0	0.0	0	0.0	0	0.0
Have you ever been bitten by rodents?						
No	25	62.5	22	55.0	47	58.8
Yes	15	37.5	18	45.0	33	41.3
If yes what did you do?						
Cleaned the wound	3	7.5	1	2.5	4	5
Not applicable	25	62.5	22	55.0	47	58.8
Nothing	10	25.0	17	42.5	27	33.8
Took medication	2	5.0	0	0.0	2	2.5
Do you consume or drink water that has been contaminated by rodents?						
No	12	30.0	12	30.0	24	30
Yes	28	70.0	28	70.0	56	70

Tanzania. Since none of the interviewees had ever heard of leptospirosis before, the current study revealed a leptospirosis knowledge gap and this could be one of the reasons the disease is underreported and sometimes misdiagnosed. This lack of knowledge reveals a low level of disease awareness among the Kibondo and Kakonko community and it is consistent with research conducted in Puerto Rico by Bruce, et al. [13]. Given the prevalence of leptospirosis globally and the high rates of morbidity and mortality that it causes, this was unexpected [14].

The study further revealed locally the community only understood plague to be a disease spread by rodents which shows that such people are more knowledgeable about plague than leptospirosis. This may be explained by the fact that the Tanzanian public health community has experienced recurrent outbreaks of the plague and its persistence [15], and that the local population is well informed about it. Additionally, this demonstrates how effective is health information correctly local populations to disseminate on disease dissemination. Since the study community had only knowledge on plague as a rodent-borne disease, more information about leptospirosis, among other rodent-borne diseases, is required for a better understanding of the illnesses and the development of efficient preventative measures. According to the knowledge of the modes of transmission and prevention, the majority of respondents were aware of the ways in which rodent-borne diseases may be spread and prevented, and they believed that cleanliness and civic education were the key methods. Additionally, according to Rahim, et al. [16], leptospirosis can be avoided by practicing good hygiene. Understanding a disease's causes and how to avoid them are crucial for illness prevention [17]. This is also consistent with research carried out by Arbiol, et al. [1], on zoonotic disease prevention strategies, which demonstrate that awareness of a specific disease leads to widespread adoption of preventative measures.

Furthermore, the study found a correlation between education level and knowledge of other rodent-borne diseases. This is in line with the findings of a study by Nozmi, et al. [5], which showed that people in rural communities with formal education had a 3.7 times higher likelihood of having strong knowledge than those with non-formal education. Another explanation is that people with more education are better able to gather, evaluate, and interpret data on healthy behaviours [18]. The attitude of interviewees towards rodent control was generally good as all respondents adopted various rodent control measures in their homes. However, a highly favourable attitude toward rodent control alone is insufficient to change behavioural patterns; information must be added to improve people's capacity to put prevention measures into practice. Recognition of the importance of rodent control decreases the chances of leptospirosis and other rodent-borne disease transmissions. On the other hand, their attitude towards rodent-borne disease infection was poor as a majority were uncertain of their risk of being infected since they were not aware of the disease severity. This could be attributed to the lack of knowledge of leptospirosis and other rodent-borne diseases and it could be explained by the fact that the level of education has an impact on one's perception of health issues. Recent research from Kuantan, Malaysia suggested that those with lower education levels also exhibit poorer attitude outcomes [19]. This could also be backed up by Brown, et al. [20], who also revealed that a majority of butchers who only completed primary school had negative attitudes toward infectious diseases.

The study also found variation in describing the risk factors that could increase the likelihood of contracting leptospirosis and other rodent-borne diseases. The majority of participants in this study reported seeing rodents in their neighbourhood regularly, experiencing rodent outbreaks and invasions in their homes. Due to the fact that rodents are a major reservoir of leptospirosis and other rodent-borne infections [21], rodent outbreaks and invasion put them at risk of contracting diseases from rodents. The study also found a correlation between the kind of home and a higher risk of rodent invasion. Low socioeconomic position and poverty expose individuals to inadequate infrastructures, such as mud-grass-thatched dwellings, which are thought to be a contributing cause of rodent infestations in people's homes [22]. Residents of slums were found to be at significant risk of contracting a Leptospira infection (> 3% per year) according to a study by Felzemburgh, et al. [23]. Additionally, the slums' inadequate sanitation and high rodent populations foster the environmental factors that lead to outbreaks and epidemics [24].

In the current study, it was also established that the majority engage in risky behaviours linked to leptospirosis, such as consuming rodent-contaminated food or water. Additionally, a small percentage of respondents said they had previously been bitten by rodents; the majority of these people did nothing as a result of the bites. This is dangerous because damaged skin makes it easier for Leptospira bacteria to enter the bloodstream directly and increases the number of bacteria that enter the host [25]. Furthermore, the study did not establish the link between occupation and the likelihood of developing the illness. Similar results were reported by Dias, et al. [17]. These results, however, are at odds with the literature that is currently available, which claims that leptospirosis has historically been a rare rural disease linked to occupational risk groups like subsistence farmers [26]. Further, it was determined that gender was not statistically associated with the risk for the disease, which is in contrast to a systematic literature review by Costa, et al. [27], that revealed men to be the main risk category for leptospirosis due to occupational exposures like fishing and farming.

Age was not found to be a significant predictor of respondents' knowledge of leptospirosis and other rodent-borne diseases in the current investigation. This was consistent with a KAP study [5], conducted in Malaysia, where they found that the only significant predictor of a person's knowledge level was their ethnicity. In our study, participants aged 35 to 49 years showed high levels of awareness on other diseases transmitted by rodents. This contrasts with a study conducted in Malaysia by Abdullah, et al. [28], which reported that respondents under the age of 32 were nearly three times more likely to have strong awareness of leptospirosis. The most prevalent way for humans to become infected with *Leptospira* is by contact with the environment, specifically water and soil that have been polluted by leptospires that have been shed in animal urine [29]. As a result, the cycle of transmission must be stopped in order to prevent human infection. Participants in the current study reportedly used a variety of rodent control techniques in their houses. According to research by Hagan, et al. [30], reducing rodent populations can lower the ambient pathogen load and hence lessen rodent-human transmission. In Thailand, campaigns and the deployment of intense and systematic rodent control measures were shown to reduce the incidence rate to 5.9 per 100,000 people, as reported by Hinjoy, et al. [31].

Study Limitations

It's important to note this study's shortcoming. Due to the small sample size of the study, we may not have been able to identify a crucial impact of other socio-demographic factors; however, the results of our study could not be generalized to all people of the Kigoma region. By using a large sample size and expanding the number of districts, additional research is necessary to solve this drawback. In addition, this study's respondents were only adults. Future studies should consider incorporating children, given that leptospirosis affects persons of all ages, including children.

Conclusion

Despite the fact that the current study was only carried out in a few districts, it has shown that more needs to be done to improve awareness and attitudes regarding leptospirosis and other rodent-borne diseases. This will assist relevant authorities, policymakers or healthcare professionals in developing health education programs that aim to promote good health practices, as well as reducing the incidence of leptospirosis and other rodent-borne diseases. As rodents are the primary source of infection, many stakeholders also need to invest in rodent control services. Furthermore, regular surveillance is necessary to screen for infection in humans, as well as determining the epidemiology of leptospirosis in rural settings in Tanzania.

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Conflicts of Interest

The authors declare no conflicts of interest.

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