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KNOWLEDGE AND AWARENESS OF LEPTOSPIROSIS AMONG MALAYSIAN POPULATION: A PILOT STUDY

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Abstract: Leptospirosis is a zoonotic disease that poses a significant public health concern, particularly in tropical regions. Knowledge, awareness, and preventive practices (KAP) towards leptospirosis play a crucial role in safeguarding human health and mitigating the spread of the disease. To gain insights into the knowledge gaps and behavioural patterns towards leptospirosis among the Malaysian population, an online survey was conducted and randomly distributed through social media platforms. A total of 200 respondents participated in this study, where the majority belonged to young Malay adults (58.5%), and most resided in Selangor, Kuala Lumpur, and Kelantan. Data from the survey found that 59% of the total respondents had limited specific knowledge and awareness of leptospirosis, while 44% demonstrated poor practices in preventing the transmission of leptospirosis. While this input generally reflects the knowledge and awareness of a certain age group of the respondents, there is a need to enhance their knowledge and awareness through effective strategies that will lead to a better understanding and practices towards the management and control of leptospirosis.

Keywords: Leptospirosis, survey, knowledge, awareness, infection.

Introduction

Leptospirosis is an infectious disease caused by the Gram-negative bacteria *Leptospira* sp. The disease is prevalent in tropical and subtropical regions due to the warm weather and frequent rainfall, which are favourable environmental conditions for the bacteria to thrive (Karpagam & Ganesh, 2020). Leptospirosis usually manifests as outbreaks during periods of increased rainfall associated with flooding and inadequate sanitation. On a global scale, the disease is estimated to result in approximately 1.03 million cases annually, leading to 58,900 deaths every year (Costa *et al*., 2015). Leptospirosis usually presents in a range of clinical manifestations, from mild symptoms such as fever, headache, and muscle pain to severe complications including jaundice, kidney dysfunction, and liver damage.

Leptospirosis has a wide range of animal hosts including both domestic and wild animals (Cilia *et al*., 2020). Rodents, in particular, are the primary reservoir responsible for the transmission of the disease (Boey *et al*., 2019; Hamond *et al*., 2022). Humans may contract the disease by exposure to infected animals, including direct contact with their urine or body fluids. Indirect transmission occurs when humans come into contact with water, soil, or vegetation contaminated with the urine of infected animals through activities such as swimming, canoeing, or consuming contaminated food or water. The bacteria can enter the human body through cuts or abrasions in the skin or mucous membranes (Haake & Levett, 2015).

The factors predisposing humans to leptospirosis include engagement in recreational activities and interaction with wildlife, climatic factors, poor sanitation, and lack of protective measures (Goh *et al*., 2019). Individuals in occupational settings, especially those in agriculture, face an increased risk of leptospirosis due to potential contact with infected animals or exposure to contaminated water and soil (Cook *et al*., 2017; Atil *et al*., 2020). Hence, managing

leptospirosis poses great challenges due to a wide array of transmission factors and the presence of multiple bacterial serovars causing the disease in humans.

Besides reducing contact with the animal population, preventive interventions must focus on the current knowledge and awareness of the local population, particularly those at higher risk of infection (Shafie *et al*., 2021). While surveys may have been conducted in certain regions or countries to assess knowledge, attitude and practice (KAP) levels, there is limited comprehensive global survey specifically focused on leptospirosis. It is thus important to assess the basic understanding of leptospirosis, awareness and current practices about the risk factors of leptospirosis particularly among Malaysian populations. Having adequate knowledge and awareness of the disease is essential before implementing effective preventive strategies in the future. This study thus aimed to evaluate the knowledge, awareness and preventive practices towards leptospirosis among individuals from various states in Malaysia. The findings of this study could provide valuable insights into the knowledge and practices towards leptospirosis, useful for public health interventions.

Materials and Methods

Ethics Approval

A brief consent was obtained through a statement attached to the questionnaire before taking the survey. All participants were reassured that their data privacy would be respected, participation was voluntary, and the information gathered would be utilized solely for research purposes. The approval to conduct this survey was obtained from the Ethical Review Committee Board, Universiti Malaysia Terengganu (UMT/JKEPHT/2019/30).

Sample Recruitment

Respondents to this survey included Malaysian citizens aged 18 years old and above who understood the content of the questionnaire and had agreed to participate in the study. A Google Forms link with a QR code generated for the questionnaire was randomly distributed to the Malaysian population using social media platforms including WhatsApp, Facebook, Twitter and Instagram. The survey was carried out for one month between 1st - 30th May 2021.

Questionnaire

Participants were administered a structured questionnaire designed to gauge their knowledge and awareness about leptospirosis and preventive practices adopted to reduce the risk of disease. A short introduction was mentioned on the form to describe the topic of the survey and the purpose of conducting the survey. The sociodemographic data of the respondents were recorded in the first section of the questionnaire (Section A), which included age, gender, race, educational level, and locality.

Two sets of questions about leptospirosis were generated on Google Forms, which catered for knowledge and awareness (Section B) and their preventive practices associated with the disease (Section C). Section B included 10 close-ended questions (total of 25 scores) assessing the knowledge and awareness about leptospirosis, including the causative microbial agent, main host carrier, transmission method, risk factors, disease signs, and complications. Out of 10 questions, three could be answered in a Yes/No format, two multiple choice with one correct answer, and the remaining questions had more than one correct answer option. Thus, a higher score of correct answers denotes a better knowledge of the disease. Section C contained seven close-ended questions (total seven marks) addressing practices towards preventing leptospirosis on a Yes/No basis, where a correct answer was assigned one point, and an incorrect answer was assigned zero points. This section involved assessing the protective measures, such as proper waste disposal, use of personal protective equipment, and avoidance of contact with potentially contaminated water sources or infected animals.

Data Analysis

Fully completed questionnaires were extracted from Google Forms and exported to Microsoft Excel for analysis. The level of knowledge and current practices towards leptospirosis was determined by Bloom's cut-off point (Bloom *et al.*, 1956). The data was analysed to categorise the results into three levels, which are high level (85-100%) with scores between 22-25, moderate level (60-84%) with scores between 15-21, and low level (less than 59%) with scores between 0-14. Similarly, results of the perceived practices using a Yes/No options were classified into three levels which are excellent (85-100%) with scores between 6-7, moderate level (60-84%) with scores between 4-5, and poor level (less than 59%) with scores between 0-3 (AhbiRami & Zuharah, 2020).

Results and Discussion

Socio-demographic Characteristics

A total of 200 respondents from over 13 states and two federal territories in Malaysia participated in the online survey (Figure 1). The highest number of respondents (39 individuals, 19.5%) were from Selangor, followed by Kelantan and Kuala Lumpur (both 27 individuals, 13.5%), and Terengganu (23 individuals, 11.5%). The least number of respondents came from Wilayah Persekutuan Putrajaya (2 individuals, 1%).

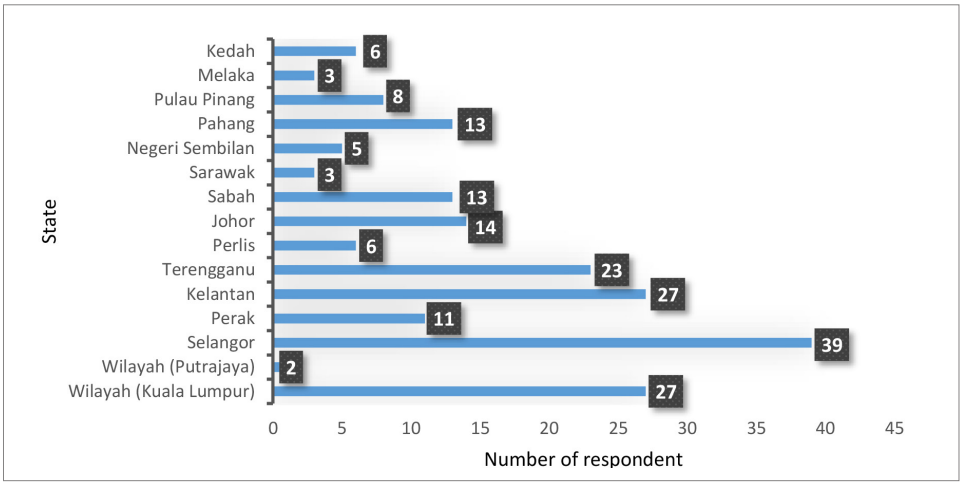

Figure 1: Number of respondents and their localities in Malaysia

To ease data analysis, the age of respondents were categorised into five groups: Age of years old 18 to 20, 21 to 30, 31 to 40, 41 to 50, and 51 years old and above. Our data showed that the number of female respondents was higher than the males, representing 138 females (69%) and 62 males (31%). The graph demonstrating the gender and age group of the Malaysian subjects is shown in Figure 2. The majority of respondents corresponded to 94 females and 39 males were between 21-30 years old, whereas 34 females and 13 males were between the age 18-20 years old. This was followed by six females and three males between the ages of 41-50 years old and three females and five males were between the ages of 31-40 years old. The last three respondents were two males and one female, who were 51 years old and above.

The race of the respondents was divided into four groups: Malay, Chinese, Indian, and others, while the education level was classified into 6 groups: Malaysian Certificate of Education (SPM), Diploma, Undergraduate, Postgraduate, Doctorate and others (Figure 3). Others represented different educational levels, including Foundation, Malaysian Higher School Certificate (STPM), Malaysian Skills Certificate

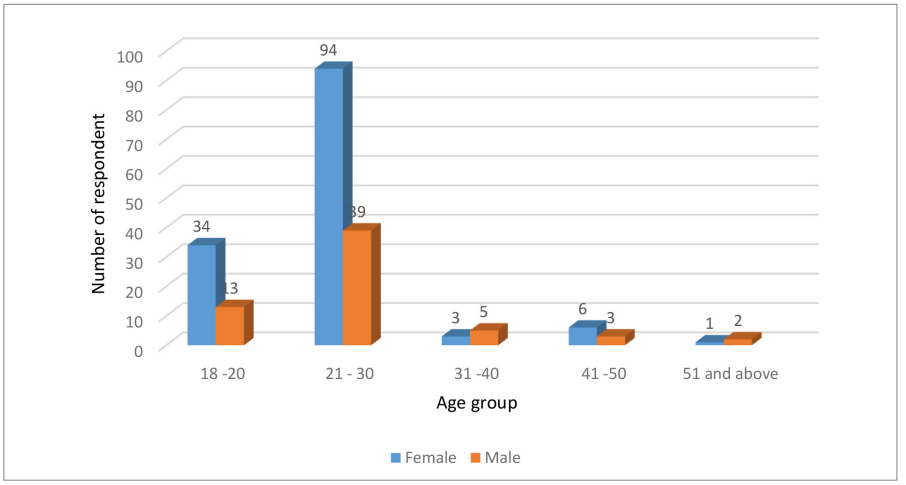

Figure 2: Gender and age groups of the respondents

(SKM) and Mara Skills Institute (IKM). Based on Figure 3, the majority of respondents were Malays (90.5%), representing 181 individuals and most of them were undergraduate students. There were at least 12 Chinese respondents (6%); where two were Diploma holders, one SPM and eight undergraduates. On the other hand, there were 6 Indian respondents (3%); where one was a Diploma holder, while five were undergraduates. Only one respondent (0.5%) came from other races (Bajau) who was an undergraduate.

Although the data was obtained through a random survey, the majority of respondents were Malays aged between 18-30 years old. Hence, the data may reflect the perspectives of this specific demographic, which potentially impacts the outcomes of the survey by limiting the findings to the broader population. There could be several factors causing the higher participation among this demographic group which includes accessibility to the survey, language preferences, individual motivation, willingness to participate, and the availability

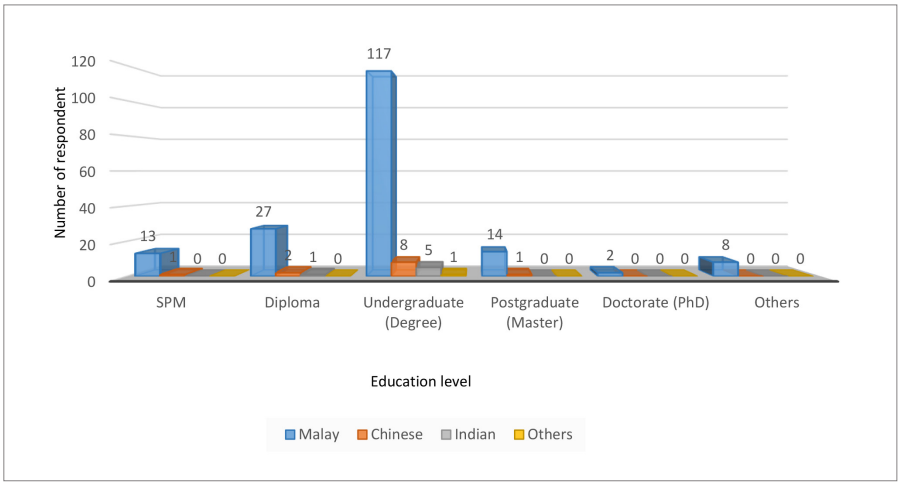

Figure 3: Educational level and races of the respondents

of time. It is also possible that the survey topic or method of recruitment specifically appealed to Malay adult females, leading to their higher representation in the responses.

Knowledge and Awareness of Leptospirosis

In our study, most respondents (97%) were unaware that leptospirosis is a zoonotic disease (Table 1). Only 36% of respondents were aware that rodents and domestic animals such as cattle, pigs, and dogs may serve as hosts for leptospirosis. Additionally, at least 73% of respondents acknowledged that flooding may contribute to the spread of the disease. Based on these responses, most respondents have limited knowledge that animals play a significant role in transmitting leptospirosis. While it is clearly established that wild animals such as rodents act as the primary host for leptospirosis, domestic animals such as goats, dogs, and pigs may serve as maintenance hosts (Cilia *et al*., 2020). Upon infection, these animals may develop chronic kidney infections and shed *Leptospira* sp. in their urine, contaminating the environment and potentially infecting other humans and animals (Garba *et al*., 2018). During periods of heavy rainfall and flooding, the urine excreted by these animals can contaminate water sources and other environmental surfaces. Further, *Leptospira* sp. has the ability to endure in stagnant water or damp environments, facilitating extended periods of transmission (Bierque *et al.*, 2020). A significant correlation between increased flooding and the rise in leptospirosis cases has been well-documented (Mohd Radi *et al.*, 2018; Chadsuthi *et al*., 2021).

Table 1: Perceived knowledge and awareness of leptospirosis among Malaysians

No.	Questions	Frequency	
		n = 200	(%)
1	Is leptospirosis (‘Penyakit Kencing Tikus’) a zoonotic disease?		
	Yes	6	3
	No	194	97
2	Do you think rodents and domestic animals such as cattle, pigs, and dogs can be the host for leptospirosis?		
	Yes	72	36
	No	128	64
3	Do you think flood is one factor that spreads leptospirosis?		
	Yes	146	73
	No	54	27
4	Which of the following microbial agent causes leptospirosis?		
	Bacteria	136	68
	Virus	55	27.5
	Fungi	9	4.5
5	Which of the following is the main animal reservoir of leptospirosis?		
	Rats	197	98.5
	Cattles	8	4
	Dogs	12	6
	Pigs	10	5
6	How is leptospirosis transmitted to humans?		
	Direct contact with urine from infected animal	145	72.5

	Contact with contaminated water	124	62
	Contact with contaminated wet soil	37	18.5
	Eating contaminated food	83	41.5
7	Which of these factors is a potential cause of leptospirosis in human?		
	Occupational exposure in agriculture	79	39.5
	Recreational activities	86	43
	Domesticated livestock	62	31
	Exposure to infected animals and rodents	136	68
8	What are the common signs of leptospirosis?		
	Fever	173	86.5
	Jaundice	44	22
	Headache	110	55
	Muscles pain	96	48
9	What are the potential complications of leptospirosis?		
	Renal problems	65	32.5
	Liver failure	85	42.5
	Respiratory distress	82	41
	Death	144	72
10	Which of the followings are effective in preventing leptospirosis?		
	Wearing boots and gloves	67	33.5
	Drinking boiled water	113	56.5
	Controlling rats in the household area	139	69.5
	Draining all potentially contaminated water	105	52.5

Data from our survey found that more than half of the respondents (68%) are knowledgeable that bacteria cause leptospirosis, while others selected virus (27.5%) or fungus (4.5%). The majority of respondents (98.5%) believed rats are the main reservoir for leptospirosis. Within the genus *Leptospira*, 10 are pathogenic mainly *Leptospira interrogans* which are responsible for causing leptospirosis, whereas seven are saprophytic that are commonly involved in environmental ecology (Marquez *et al*., 2017). Pathogenic *Leptospira* sp. has 23 serogroups and over 250 serovars, which are usually maintained in domestic and wild animal reservoirs (Garba *et al*., 2017). In Malaysia, a huge number of the pathogenic serovars were mostly isolated from rodents and only six pathogenic serovars were found in domestic animals (Bahaman *et al*., 1990). Additionally, cattle, buffalos, and pigs are all having significant prevalence rates of *Leptospira* sp. infection corresponding to 40.5%, 31%, and 16%, respectively (Garba *et al*., 2017).

In our survey, most respondents (72.5%) were aware that direct contact with the urine of an infected animal causes leptospirosis transmission to humans. In contrast, fewer individuals (18.5%) knew that transmission could also happen via contact with wet soil. Data from the survey also showed that at least 68% of the participants believed that the risk factors contributing to leptospirosis include exposure to infected animals and rodents, recreational activities (43%), occupational exposure (39.5%), and domesticated livestock (31%). It is important to note that while direct contact with infected animals poses a higher

risk of transmission, indirect contact with contaminated environments can also result in infection. Soil contaminated with rat urine contributed to the second largest risk factor for leptospirosis particularly among agricultural workers (Kamath *et al*., 2014). This could be due to outdoor work or cultivation which was performed barefoot or by hand with the assistance of animals like cows, resulting in a higher risk of injury and direct contact with contaminated soil. Thus, occupational exposure in farmers, sewer workers, and animal handlers, involving regular contact with potentially infected animals or contaminated environments increased the risk of acquiring leptospirosis (Atil *et al*., 2020).

Clinical manifestations of leptospirosis can vary widely, potentially giving rise to multiple complications. While all answer options given in the survey were correct, most respondents presumed demonstration of particular clinical signs which corresponded to fever (86.5%), headache (55%), muscle pain (48%) and jaundice (22%). The respondents were also aware that potential complications of the disease may occur including death (72%), liver failure (42.5%), respiratory distress (41%), and renal problems (32.5%). In many cases of leptospirosis, the initial stage of the disease presents as a mild febrile illness; however, as the infection progresses, more severe complications may eventually develop (Mohd Taib *et al*., 2020). Hence, prompt diagnosis and early treatment are crucial in managing the disease and preventing potential severe outcomes.

At least 69.5% of respondents expected that controlling the rat population in the household is the best way to prevent leptospirosis, followed by drinking boiled water (56.5%), draining all potentially contaminated water (52.5%), and wearing protective gloves and footwear (33.5%). To prevent leptospirosis, maintaining a clean living environment by keeping rodents out of the house and ensuring proper sanitation and waste management can help reduce the risk of leptospirosis transmission (Mohammad Aidid *et al*., 2018). This includes practicing good hygiene, such as washing hands thoroughly with soap and water after outdoor activities, especially if contact with potentially contaminated water or soil.

Perceived Practices towards Leptospirosis

Data representing the perceived practices towards preventing leptospirosis are tabulated in Table 2. Most respondents (76%) agreed that camping in recreational areas increases the risk of contracting leptospirosis, and 61% agreed that the disease can be contracted through direct and indirect contact. By avoiding swimming or wading in potentially contaminated water at the recreational area, 77.5% of responded that leptospirosis could be prevented, however, only 36% of respondents believed that by covering skin lesions using waterproof dressings could prevent exposure to leptospirosis. Globally, several outbreaks of leptospirosis have been reported during outdoor activities, including camping and water-related recreational activities, especially in areas where the disease is prevalent (Pagès *et al*., 2016; Munoz-Zanzi *et al*., 2020).

In Malaysia, the presence of pathogenic *Leptospira* sp. has been documented in environmental water samples at recreational areas and national parks (Ismail *et al*., 2014; Pui *et al*., 2015; Yap *et al*., 2021). The bacteria occurred more commonly at sites with higher anthropogenic influence, particularly those with a combination of commercial and residential activity (Blasdell *et al*., 2019). The risk is higher when there is direct contact with contaminated water or soil through activities such as swimming, rafting, or canoeing in contaminated areas (Mohd Taib *et al*., 2020).

Table 2: Perceived preventive practices among Malaysian public towards leptospirosis

No.	Practices	Frequency	
		n=200	(%)
11	Do you think camping at recreational areas can be a risk factor for leptospirosis?		
	Yes	152	76
	No	48	24
12	Do you think humans can get infected with *Leptospira* sp. through direct and indirect contact?		
	Yes	122	61
	No	78	39
13	By avoiding swimming or wading in potentially contaminated water at recreational area, could these activities prevent leptospirosis?		
	Yes	155	77.5
	No	45	22.5
14	Do you think by covering skin lesions using waterproof dressings when visiting potential exposure area could prevent leptospirosis?		
	Yes	72	36
	No	128	64
15	Do you think proper waste disposal in the household could prevent leptospirosis?		
	Yes	157	78.5
	No	43	21.5
16	Do you think by taking antibiotics could be used to treat mild cases of leptospirosis?		
	Yes	74	37
	No	126	63
17	Do you think working as paddy field worker, farmer, mine worker or abattoir worker are prone to leptospirosis?		
	Yes	104	52
	No	96	48

In relation to hygienic practice, 78.5% of respondents were aware that proper waste disposal in the household could prevent leptospirosis, whereas 21.5% disagreed. The public perceived practices on the treatment of leptospirosis were also evaluated in this study, which demonstrated that 37% of respondents believed that taking antibiotics could resolve mild leptospirosis. Additionally, 52% of respondents believed that those working in agriculture, such as farmers, miners and abattoir workers are prone to leptospirosis, whereas 48% disagreed. Improper operation of waste management has become a common factor in the rise in animal carriers, especially rodents (Abdullah *et al*., 2019a). Poor sanitation

infrastructure further exacerbates the problem by facilitating the spread of the bacteria through the urine of infected animals and contaminated surfaces.

Level of Knowledge, Awareness and Practices towards Leptospirosis

Data obtained from the survey which generally reflects the level of knowledge and awareness among respondents towards leptospirosis were categorized into different levels; low, moderate and high, following Bloom's cut-off points (Bloom *et al*., 1956). Based on the data, 59% corresponded to poor knowledge, whereas 35.5% moderate and 5.5% excellent (Figure 4). The level of perceived practices towards preventing leptospirosis is shown in Figure 5. Our data showed that 44% fall within poor practices, followed by 26% moderate and 30% excellent. Our findings indicate that most respondents generally have poor understanding and poor preventive practices towards the disease.

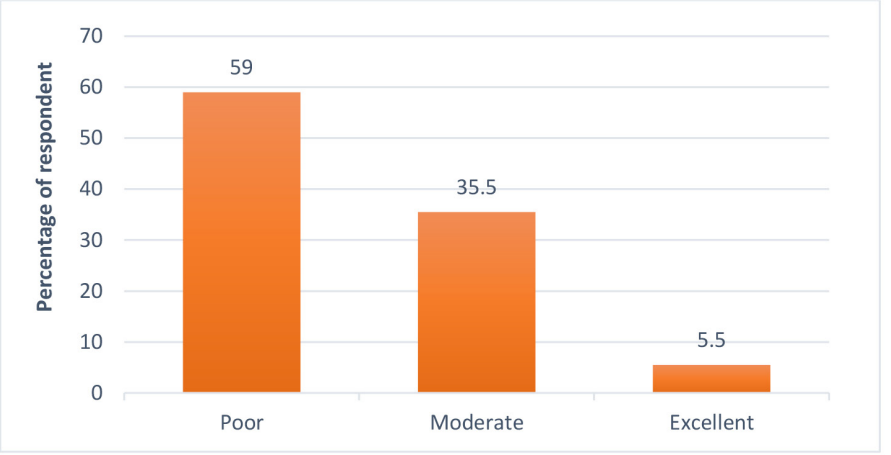

Figure 4: Knowledge and awareness levels towards leptospirosis among the respondents

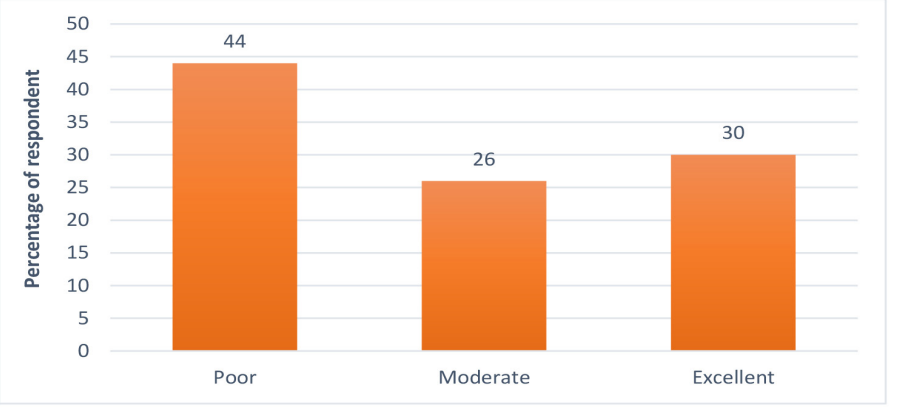

Figure 5: Level of preventive practices among respondents towards leptospirosis

Our data correlated well with a number of community surveys measuring knowledge and awareness levels towards leptospirosis in Selangor, Malaysia. Of 315 respondents from an urban community in Selangor, 80.3% demonstrated poor knowledge, and 81.3% showed unacceptable practices towards leptospirosis (Abdullah *et al*., 2019). Positive attitudes, however, were observed among the respondents regarding waste management, such as ensuring waste bins were always covered and wearing gloves while handling waste. Similar observations were observed in a rural community in Selangor, where most participants had poor knowledge (57.0%), unacceptable attitudes (90.3%) and unacceptable preventive practices (69.1%) of leptospirosis (Nozmi *et al*., 2018). Other studies include obtaining data among visitors in the Lata Belantan recreational forest to assess their KAP levels. Most respondents demonstrated a high knowledge level (63%) and good practices (68%) in disease prevention, showing a direct correlation between high knowledge and preventive practices (Shafie *et al*., 2021). The study also found that by using informative signage in recreational areas can effectively communicate essential information about leptospirosis to visitors.

In implementing hygienic practices, several studies have utilized the KAP dimensions to determine predictors within the high-risk groups such as town service workers and food handlers (Azfar *et al*., 2018; Samsudin *et al*., 2018). A study among municipal waste workers in Penang demonstrated poor basic knowledge on leptospirosis despite their good preventive practices (Rahim *et al*., 2023). Similar findings were obtained among town service workers in northeastern Malaysia, where 67% had poor knowledge, while 39.9% had satisfactory practices (Azfar *et al*., 2018). Poor knowledge may significantly expose these individuals to increasing risk of contracting leptospirosis (Atil *et al*., 2020). Controlling leptospirosis requires a comprehensive approach involving surveillance, public health education, and vector control. Hence, promoting awareness about transmission routes, emphasizing personal protective measures, and improving sanitation infrastructure are essential. Additionally, considering vaccination in high-risk populations and implementing animal control measures can further contribute to the effective control of leptospirosis.

There were few limitations to this study where the survey was conducted via an online mode. Thus, only respondents who have access to social media networks were included in this study. Secondly, since there was no interview in the survey, misunderstanding of the questions could lead to inaccurate information given by the participants. Thirdly, response bias could also happen due to the majority of participants belonging to a particular race, age group, gender, and educational level. Thus, data from this survey cannot be generalized as the Malaysian public perspective towards leptospirosis. Understanding these limiting factors can help in designing future surveys that target a more diverse range of participants to ensure greater representativeness and reduce potential biases. Furthermore, implementing comprehensive and standardized KAP studies including validated questionnaires enables the development of more effective, sustainable, and replicable health interventions for disease prevention *(Zahiruddin et al*., 2018).

Overall, this study suggests there is a need to enhance the public understanding of leptospirosis using a variety of approaches, such as continuous education programmes and health advertisements through social media or broadcasting. Improved general knowledge and awareness of the disease will lead to better attitudes and practices among Malaysians towards the management and control of leptospirosis.

Conclusion

The study findings generally indicate the poor level of knowledge and awareness among Malaysian respondents with regard to leptospirosis. By improving knowledge and promoting proactive measures to prevent leptospirosis, it is possible to minimize the incidence of the disease among the population. The findings of this study may contribute to the development of targeted interventions, public health education, and policies to mitigate the impact of leptospirosis.

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