

Original Research



Knowledge, attitude and practices of preventive measures in leptospirosis among farmers in a lower-middle income country: evidence from a divisional health area of Sri Lanka

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Abstract

Introduction: Sri Lanka continues to have a high case burden of leptospirosis despite rigorous preventive activities undertaken, with significant morbidity and mortality among economically active age groups. Hence, it is time to evaluate the knowledge, attitude and practices on preventive measures among high-risk groups to generate evidence needed to design new interventions.

Objectives: To describe the knowledge, attitude and practices of preventive measures in leptospirosis among farmers

Methods: A community-based cross-sectional study was conducted among 426 farmers in Pelmadulla Medical Officer of Health (MOH) Area. Taking one farmer community as a cluster, seven clusters were chosen using cluster sampling method out of the 28 farmer communities registered. Data were collected using a pre-tested interviewer-administered questionnaire. The knowledge, attitude and practice scores were calculated based on a scoring system prepared with expert inputs.

Results: The response rate of the study was 97%. The sample mainly consisted of 40-59 years ($n=227$; 53.2%), predominantly of males 91.1% ($n=388$) and majority (69.7%) had secondary education. It was evident that 81.9% ($n=349$) of the study sample had satisfactory knowledge with a mean of 7.88 ($SD=1.38$) while 72.8% ($n=310$) of the study sample had a good attitude with a mean of 7.54 ($SD=1.578$). Only 16.4% ($n=70$) of the study sample had good practice-scores on leptospirosis preventive measures with a mean of 12.03 ($SD=2.8$).

Conclusions & Recommendations: Knowledge and attitudes on leptospirosis prevention were satisfactory among farmers, though practices were poor. Behavioural modification-focused awareness programs for changing the practice of preventive measures need to be planned to address the identified gaps in knowledge and attitude.

Keywords: leptospirosis, farmers, preventive practices, knowledge, attitude

Introduction

Leptospirosis is a zoonotic bacterial infection caused by the pathogenic spirochete of the genus *Leptospira*. The common reservoir hosts are rats, rodents and farm animals like cattle, pigs and dogs. The infected hosts excrete spirochete with the urine causing contamination of soil and water sources. Spirochetes survive up to 14 days in the external environment (1) while some virulent forms can do so for months. This is the reason behind large outbreaks following floods due to the bacteria being released into water (2). Leptospirosis human infection can occur most commonly through the mucosal surfaces and breached skin when exposed to contaminated soil or water. Consequently, farmers, mine workers, flood victims and urban slum dwellers are at higher risk of developing leptospirosis compared to the general public (2).

The highest leptospirosis morbidity is reported in the South and Southeast Asian regions (3). In Sri Lanka, the annual leptospirosis caseload was estimated to be 10 423 with a cumulative incidence of 52.1 per 100 000 persons between the years 2008-2015 (4). Comparatively in India, it is reported to be 19.7 cases per 100 000 and in Indonesia 39.2 cases per 100 000 (3).

The key primary preventive strategies for leptospirosis include rodent control, personal hygiene, personal protective equipment (PPE) to prevent contact, and pre- and post-exposure chemoprophylaxis (5). One of the preventive strategies recommended only for well-recognized high-risk groups in Sri Lanka is the administration of doxycycline prophylaxis, which is given as a weekly dose during the paddy cultivation period for farmers as well as during flood situations for victims.

Despite the available guidelines and circulars on the prevention and management of leptospirosis, there were 8323 total notified cases in 2020, of which the highest number (1532) was reported from Ratnapura District along with 19 deaths (1). The knowledge and

attitude are important prerequisites that influence the behaviour of an individual. In order to achieve control by adhering to the preventive practices, knowledge and attitudinal deficiencies should be identified and addressed by health authorities. Documented literature is scarce on these aspects in the Sri Lankan setting. This study was done to describe the knowledge, attitude and practices of preventive measures in leptospirosis among farmers in a divisional health area in the district of Rathnapura of Sri Lanka.

Methods

A community-based cross-sectional study was done among farmers in Pelmadulla MOH Area, Sri Lanka. Sri Lanka is geographically divided into divisional level areas called MOH areas for the provision of public health services. The registered principal farmers of a farming family, who had engaged in farming for minimum of two years in Pelmadulla were taken as the study population. Farmers who were deaf or with difficulty in communication or defaulted from paddy farming during the previous two years were excluded.

The sample size was determined as 436, with a degree of precision set at 5%, 70% as the expected proportion with satisfactory knowledge level determined following literature review and expert inputs, design factor of 1.3 to overcome the cluster effect and response rate of 95%. The farmers who registered under a farmer community in agricultural research assistant divisions were taken as a cluster. The average cluster size was taken as 65 and the number of clusters needed was seven, which was selected using a random number generator on the sampling frame of 28 farmer communities.

Data collection was done in the field at convenient time periods for the farmers. A judgmentally validated interviewer-administered questionnaire was used following pretesting to collect data by trained data collectors during the month of January

2022. Knowledge was assessed using ten questions developed following a thorough literature review. Each correct answer was awarded 1 mark and each incorrect answer or 'do not know' answer 0 marks. With expert opinion and considering the mean score, those with 7-10 aggregate marks were considered as having 'satisfactory knowledge' and those with 0-6 as with 'unsatisfactory knowledge'. The cutoff values were similar for attitude score but for practice, those with 15-20 marks were considered as having 'good practice' and those <15 as with 'poor practice'.

Data analysis

Data were entered into the Epidata software and analysed using the Statistical Package for the Social Sciences (SPSS) version 21. The odds ratios were calculated with 95% confidence interval (CI) and cross tabulation of knowledge and practices was done using Chi-squared test at 0.05 level of significance.

Results

Table 1: Demographic and socio-economic characteristics of the study participants

Characteristic		No.	%
Age (completed years)	< 20	2	0.5
	20 - 39	63	14.8
	40 - 59	227	53.2
	≥ 60	134	31.5
Sex	Male	388	91.1
	Female	38	8.9
Education	Primary (Grade 1-5)	61	14.3
	Secondary (Grade 6-11)	297	69.7
	Tertiary (Grade 12-13)	63	14.8
	Above (Diploma/degree holder)	5	1.2
Occupation (Main income)	Farmer	346	81.3
	Labourer	41	9.6
	Government worker	12	2.8
	Private sector worker	27	6.3
Duration engaged in paddy cultivation (years)	< 5	59	13.8
	5 - 9	36	8.5
	10 - 14	48	11.3
	> 14	283	66.4
Approximate monthly income (LKR)	< 15 000	178	41.8
	15 000 - 29 000	150	35.2
	30 000 - 44 000	64	15.0
	≥ 45 000	34	8.0

In total, 426 subjects were recruited with a response rate of 97.7%. Their characteristics are given in Table 1.

With regards to knowledge on leptospirosis (Table 2), transmission by rats was correctly answered by 94.1%, while the majority knew that water sources can be contaminated by infected rodent urine (93.7%); a person can get the infection through damaged skin but touching the eyes, nose and mouth with contaminated hands can result in infection (94.6%); rodent control measures are useful in reducing leptospirosis transmission (87.3%); proper waste disposal is important in leptospirosis prevention (91.6%); and that taking doxycycline medication during paddy season protects them from getting the infection (89.4%). The total knowledge scores ranged from 2 to 10 with a mean of 7.88 (SD=1.38). The majority (n=349; 81.9%) had satisfactory knowledge of leptospirosis preventive measures.

With regards to attitudes towards preventive practices (Table 3), 77% believed that doxycycline chemoprophylaxis is effective against leptospirosis; 94.1% that there is a need for a proper garbage disposal system for rat control; and 85% that wearing

proper gloves and boots when working in the field is protective against the infection. Total attitude scores ranged from 2 to 10 with a mean of 7.54 (SD=1.578) and the majority (n=310; 72.8%) had good attitudes toward leptospirosis preventive measures.

Table 2: Knowledge on preventive measures in leptospirosis in the study participants

Knowledge	Yes	No	Do not know
	No. (%)	No. (%)	No. (%)
Leptospirosis is transmitted by rats.	401 (94.1)	8 (1.9)	17 (4.0)
Leptospirosis is transmitted only by rats.	203 (47.7)	116 (27.2)	107 (25.1)
Water gets contaminated by infected animal's urine.	399 (93.7)	8 (1.9)	19 (4.4)
Stagnation of water is a risk factor for the infection transmission.	392 (92.0)	12 (2.8)	22 (5.2)
A person can get the infection through damaged skin.	403 (94.6)	7 (1.6)	16 (3.8)
Touching eyes, nose and mouth with contaminated hands cannot result in leptospirosis infection.	140 (32.9)	221 (51.9)	65 (15.2)
Drinking water without boiling from natural water sources can result in infection.	281 (66.0)	103 (24.2)	42 (9.8)
Rodent control measures are useful in reducing leptospirosis transmission.	372 (87.3)	46 (10.8)	8 (1.9)
Proper waste disposal is important in leptospirosis prevention.	390 (91.6)	29 (6.8)	7 (1.6)
Taking doxycycline medication during paddy season will protect from getting infection.	381 (89.4)	19 (4.5)	26 (6.1)

With regards to preventive practices in leptospirosis (Table 4), boots and gloves were always used only by 8% and often used by 14.3%, while half of the participants always covered open wounds before working in the field. Only 55.7% always used doxycycline prophylaxis properly and 27% cooled boiled water for drinking. However, 70.7% always patched all rat holes before starting cultivation, while 89.6% had a good garbage disposal system and 85.7% always established a proper water drainage system in paddy fields to prevent water stagnation. Total practice-scores ranged from 1 to 20 with a mean of 12.03 (SD=2.8). Only 70 (16.4%) had good preventive measures.

Farmers who had good knowledge on preventive

practices had six times better compliance with such preventive practices compared to farmers who did not (19.2% versus 3.9%; OR=5.8; 95% CI=1.7, 19.1; $p<0.001$).

Discussion

This was the first documented study done on knowledge, attitude and practices on preventive measures of leptospirosis within the Ratnapura district which has the highest leptospirosis burden in Sri Lanka. The study findings show that the sample had satisfactory knowledge and attitude of leptospirosis preventive measures but deficiencies in preventive practices. It could be due to other influencing factors which act as barriers such as

educational level, perceived risk and perceived susceptibility due to past experience, and

affordability, availability and accessibility of protective facilities.

Table 3: Attitudes on preventive measures in leptospirosis in the study participants

Attitudes	Agreed	Disagreed	Undecided
	No. (%)	No. (%)	No. (%)
I think prophylaxis is effective.	328 (77.0)	22 (5.2)	76 (17.8)
I think leptospirosis needs more control and prevention than currently practised.	342 (80.3)	43 (10.1)	41 (9.6)
Living rats in and around the paddy fields help in nurturing the soil.	49 (11.5)	337 (79.1)	40 (9.4)
I think a proper garbage disposal system is essential for rat control.	401 (94.1)	11 (2.6)	14 (3.3)
I think wearing proper gloves and boots when working in the field is necessary for controlling the transmission of leptospirosis.	362 (85.0)	39 (9.2)	25 (5.8)
I think covering wounds is necessary for controlling the transmission of leptospirosis.	409 (96.0)	5 (1.2)	12 (2.8)
Drinking water is not a source of infection, so the boiling is not a must.	144 (33.8)	195 (45.8)	87 (20.4)
I should not touch my nose and eyes with contaminated hands as I can get leptospirosis.	370 (86.8)	25 (5.9)	31 (7.3)
I have already got leptospirosis once, so I am not at risk again.	56 (13.1)	246 (57.8)	124 (29.1)
I am not bothered about getting leptospirosis as I am working in paddy fields for a long duration.	95 (22.3)	222 (52.1)	109 (25.6)

The 81.9% of the sample having satisfactory knowledge of leptospirosis preventive measures was contrary to the 52% in the study done in Kurunegala district (6) and the 74% in Colombo district (7). The current evidence of high knowledge scores shown among farmers was supported by the survey (8) that suggested that the knowledge among farmers on some aspects of leptospirosis was significantly higher compared to the general public ($p=0.01$). In contrary, these differences in the knowledge level could be due to different methods of scoring and levels identified by investigators in different studies. This improvement in knowledge may be a result of continuous awareness raising programmes conducted by the ministry of health targeting high-risk populations. However, the risk of contracting the

disease through consuming contaminated drinking water without boiling and direct touching of mucosal membranes needs to be addressed further. This knowledge assessment is essential to identify these gaps in knowledge even though overall knowledge is satisfactory to plan future health awareness sessions targeting high risk groups.

Similar to the study done in Colombo district (7), 72.8% of the current study sample had a good attitude towards leptospirosis preventive measures with a mean attitude score of 7.54 ($SD=1.58$). In both studies, over 80% of participants believe leptospirosis needs more control and prevention than currently practised. The majority (more than 70%) in both studies had satisfactory attitude towards the use

of PPE during the work in paddy contrary to the 37% in Malaysian study (9). In the present study, 94.1% believed that there is a need for a proper garbage disposal system to achieve rat control which is highly satisfactory contrary to 50% in the Malaysian study (9). These differences could be due to the cultural and methodological differences of study populations. This finding is very important as it plays a main role in the health belief model. Not only knowledge affects the decisions of people, but also attitudes and beliefs. Attitudes may have cultural influences, peer influences and societal influences. Therefore, it may score was considered as good practice. The smaller sample size and methodological differences of the Colombo study (7) might have affected the result. In both studies the majority around 80% had good knowledge scores but compared to the knowledge, the practice level was not satisfactory. The current finding was further supported by different studies done in different countries (6, 10-12). This discrepancy of poor practices for leptospirosis prevention, even with good knowledge and attitude could be due to other influencing factors which act as barriers. This needs to be further evaluated to

vary from person to person and need individual level interventions such as behavioural change communication (BCC) to address any identified deficiencies.

In the current study, total scores of practices for preventive measures ranged from 1 to 20 with a mean of 12.03 (SD=2.8). Only 16.4% (n=70) of the study sample had a good practice score on leptospirosis preventive measures. On the contrary, 53% had good practice in study done in Colombo district (7) where practices were assessed using 7 questions and >60% improve the practices by addressing the factors in national level programs.

The study was limited to farmers, thus with reduced generalizability to the general population. However, as they are the high-risk population that contribute most to the disease burden, the generated evidence will be useful to plan health awareness programmes for behaviour modification programs, address the barriers to practise preventive measures, and improve health-seeking practices.

Table 4: Practice of preventive measures in leptospirosis in the study participants

Practice	Always	Often	Never	Not applicable
	No. (%)	No. (%)	No. (%)	No. (%)
I wear boots and gloves when working in the fields.	34 (8.0)	61 (14.3)	331 (77.7)	0 (0.0)
I cover open wounds before working in the field.	197 (46.3)	102 (23.9)	77 (18.1)	50 (11.7)
I take doxycycline prophylaxis properly.	237 (55.7)	95 (22.3)	90 (21.1)	4 (0.9)
I use only cooled boiled water for drinking.	115 (27.0)	147 (34.5)	163 (38.3)	1 (0.2)
I use traps and bait as a form of rodent control.	76 (17.8)	55 (12.9)	289 (67.9)	6 (1.4)
I have patched all rat holes prior to start cultivation.	301 (70.7)	55 (12.9)	64 (15)	6 (1.4)
I have good garbage disposal system.	382 (89.6)	20 (4.7)	19 (4.5)	5 (1.2)
I have established proper water drainage system in my paddy field to prevent water stagnation.	365 (85.7)	21 (4.9)	37 (8.7)	3 (0.7)
I practise soil tillage to get good exposure to sun light.	370 (86.9)	49 (11.5)	6 (1.4)	1 (0.2)
I practise beetle chewing while working without washing hands with soap and water.	204 (47.9)	67 (15.7)	150 (35.2)	5 (1.2)

Conclusions & Recommendations

The overall knowledge and attitude of farmers on preventive measures of leptospirosis was highly satisfactory. However, the knowledge on possible risk of contracting the disease through consuming and attitude. Their usage of PPE, chemoprophylaxis and rodent control measures were minimal yet had good garbage disposal practices. The factors

contaminated drinking water without boiling and direct touching of mucosal membranes needs to be addressed. The study further demonstrated poorer practice of preventive measures compared to knowledge

affecting the practices other than the knowledge must be explored preferably with analytical study designs.

Public Health Implications

- The study has demonstrated that the farmers have not practiced leptospirosis preventive measures adequately even with satisfactory level of knowledge on leptospirosis preventive measures. The ministry is putting more emphasis on awareness raising but the barriers need to be explored and addressed to improve the preventive practices and to reduce the leptospirosis disease burden in the country.

Author Declarations

Competing interests: The authors declare that they have no competing interests.

Ethics approval and consent to participate: Ethics clearance was granted by the Ethics Review Committee of the Postgraduate Institution of Medicine, University of Colombo (ERC/PGIM/2021/133). Informed written consent was obtained from each participant prior to data collection.

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Author contributions: CND participated in designing the study, data collection, analysis and writing the manuscript; and DG was the supervisor of the research.

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