



RESEARCH ARTICLE

Educational Intervention Package to Increase Knowledge on Minimizing the Delays in Seeking Treatment of Leptospirosis in a District of Sri Lanka

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Abstract

Leptospirosis is a potentially fatal zoonotic infection and often neglected due to lack of knowledge. As an occupational disease, it has become a global concern due to its disease burden in endemic countries and rural areas. The objective of the study was to assess the effectiveness of an educational intervention for knowledge on minimizing the delays in seeking treatment of leptospirosis among farmers in Monaragala District, Sri Lanka. An interventional package was developed and delivered using SMS, postcards, announcements, and education through GPs, aiming to minimize delays related to the awareness in seeking treatment for leptospirosis. The effectiveness of the intervention was measured using an interviewer-administered questionnaire among 158 farmers. The pre and post-intervention assessment revealed that awareness in seeking treatment of leptospirosis had significantly improved two months after intervention (OR = 4.59; CI = 3.9-5.2). Therefore awareness programmes through SMS, postcards, announcements, and via GPs to reduce delayed health-seeking are recommended.

Keywords

Human leptospirosis, Awareness, Interventions, Sri Lanka

Introduction

Leptospirosis is a potentially fatal zoonotic infection with significant morbidity and mortality and often neglected due to lack of knowledge. The risk of acquiring leptospirosis can be greatly reduced by

avoiding exposure to contaminated water and soil (primary prevention), which might not be possible for paddy farmers, gem miners, sewage workers, etc. Being an infectious disease, leptospirosis can be prevented by increasing awareness and promoting preventive health behaviours among high-risk occupational groups such as agricultural workers, sewage workers, military personnel, veterinarians, and people engaged in animal husbandry. According to the Epidemiology unit, the risk group's needs to be advised about the benefits of covering wounds with dressings, wearing footwear, and protective clothing while at work. The other non-intervention measures for preventing human leptospirosis include raising awareness about the disease among high-risk groups, health care providers, and the general population, in order to minimize delays related to awareness in seeking treatment for leptospirosis. Chemoprophylaxis for individuals at high risk of exposure may be useful in some settings with close monitoring by the field public health staff.

There is evidence that awareness of leptospirosis was poor among farmers even though most of them were living in endemic areas, which in turn reduces the perceived threat of the disease and thereby reduces the practice of preventive measures. Despite leptospirosis being an endemic disease with seasonal epidemics and routine non-intervention programmes at the national



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level, knowledge among the general public was poor and there is a need for more efforts awareness-raising in order to non-intervention leptospirosis in Sri Lanka [1]. But no one has studied the delays in seeking treatment for leptospirosis or conducted any intervention in order to assess the outcome.

An Indian study revealed that the awareness of a disease with timely treatment is the best option which reduces morbidity and mortality of the disease. Most people do not take seriously the fever of leptospirosis and thereby delay seeking treatment, consequently causing complications and even death. In addition, carrying out an intervention in simple, local language can better reach villagers with different educational levels [2].

Moreover, intervention programmes on leptospirosis are effective in improving awareness and preventive behaviorists among risk groups [3] and there was a significant improvement in knowledge, attitudes and practice in the targeted high-risk group for leptospirosis after an intervention for leptospirosis was noted in Malaysia [4].

Recent studies from Thailand have stressed the importance of having a higher level of knowledge on leptospirosis and improving the delay in receiving treatment among patients with leptospirosis [5].

According to a knowledge assessment survey on leptospirosis revealed that public knowledge on leptospirosis is poor, indicating a need for more awareness raising [6]. However, prompt treatment measures in rural areas are hampered by lack of identification of warning signs which need immediate hospital admissions, causing complications and deaths. Being a completely curable disease, rapid and early diagnosis is critical with specific treatment including appropriate antibiotics. Attention needs to be paid to the importance of identifying reasons for the delays in seeking treatment and addressing them through feasible interventions.

Elimination of leptospirosis in Sri Lanka is difficult since temperature, humidity, and rainfall provides an ideal conducive environment for its survival. Therefore,

minimizing the delays in seeking medical treatment through awareness rising is the best option for managing risks. This effort hopefully increases the awareness in seeking treatment of leptospirosis.

Methods

A quasi-experimental study conducted in two Medical Officer of Health (MOH areas) of Monaragala district from September 2019 to March 2020. Monaragala is a rural area in Sri Lanka where paddy farming is carried out by full time as well as part time farmers as their main income.

Development of the intervention package

The intervention was a health education intervention package on how to minimize the delays related to awareness in seeking treatment of leptospirosis. Reasons that are related to the delays in seeking treatment of leptospirosis were identified through Key Informant Interviews (KII) using a KII guide, local and international literature, expert opinion as well as principal investigator's personnel experience of discussions with the delayed presented patients with leptospirosis at DGH Monaragala. The key informants were an agricultural officer, a PHI, two representatives from Govisamithi, two patients recently recovered from leptospirosis (delayed in seeking treatment) and MOH from one of the MOH areas of Monaragala district. The findings were utilized for development of the intervention. The intervention (Table 1) was developed using the modified Delphi method with expert opinion from Epidemiology Unit, Health Promotion Bureau, Provincial Consultant Community Physician and two MOHs.

Short messages (SMS) and announcements were developed in local language (Supplementary File). A desk calendar for GPs in the intervention area was developed in English emphasizing the need for increasing awareness in seeking early treatment for leptospirosis (Supplementary File).

Implementation of the intervention package

It was implemented in three phases:

Table 1: Intervention package and modes of delivery.

Activity	Target population	Mode of delivery
Weekly Short messages (SMS) and post cards	Farmers registered at "Govisamithi" in the area	Twenty one messages related to land preparation, maintenance period and harvesting period were developed and sent weekly. It was started a week before start of "Maha" season.
Weekly Announcements at "Sathi Pola"	General population	Announcements on basic epidemiology, transmission, prevention and non-intervention of leptospirosis were delivered at "Sathi pola" where farmers regularly attend to sell their crops.
Awareness through a desk calendar	General Practitioners (GPs)	Reminding of seasonal activities related to leptospirosis and about the people involved in those activities. GP can suspect, refer to hospital and educate the clients.

Phase 1: Pre-intervention assessment with the questionnaire

Selection of the participants for the intervention and non-intervention groups

- **Inclusion criteria**

Farmers who resident of the area for at least six months before the survey.

- **Exclusion criteria**

Farmers with severe hearing impairment.

Sample size was calculated according to the Pocock 1991 formula. Final Sample size for the intervention group was 158 and non-intervention group 158. Multi-stage systematic sampling technique was used as the sampling method. Pretested interviewer administered questionnaire was used as the study instrument. Trained pre intern medical officers, who are having a research background, were involved as the data collectors.

The study instruments were interviewer-administered questionnaires; therefore the interviewer could explain and clarify contents of the questionnaires to the respondent. Non-intervention group was selected from a distant MOH area to the intervention area to avoid contamination as this is a community-based intervention. Data collectors were advised to maintain a good rapport with the participants and clear instructions were given to minimize the interpersonal variation. The contact information of the study participants was taken to give reminders of post-intervention assessment date. Same study instruments were used in pre and post-intervention assessment.

Phase II - Implementation of the intervention package: The following methods were utilized for the delivery of the educational intervention package:

- 1. Delivery of SMS**

PI created SMS group among farmers using the telephone numbers obtained at the time of recruitment, to share SMS related to leptospirosis. At the same time, postcards were distributed to their addresses as few farmers did not have mobile phones. The delivery started a week before starting Maha season, at weekly intervals throughout Maha season (20 weeks). The delivery of SMS was done by PI.

- 2. Announcements at "Sathi Pola"**

The announcements were delivered at "Sathi Pola" where most of the farmers visited to sell their crops at weekly intervals. The announcements were given by two PHIs from selected MOH area.

- 3. Desk calendar**

The desk calendar was given to 10 well established GPs in Siyambalanduwa MOH area as a tool to provide education to farmers and their family members by

giving a new message in each month. The list of GPs was taken from the relevant MOH office database.

Desk calendar was attached as ([Supplementary File](#)).

Phase 111- Evaluation of the intervention by post-intervention assessment with the questionnaire

Evaluation of the intervention groups was carried out eight weeks after the intervention using the same questionnaire. Data entry was carried by the PI and was analyzed using the SPSS version 22 software package. Before and after the intervention, health knowledge score was compared between the intervention group and the non-intervention groups. Independent t-tests and paired sample t-tests were performed to compare mean knowledge scores.

Primary outcome - Knowledge score

The questionnaire to assess the knowledge score was consisted of 26 questions. A score of '1' was assigned to correct responses and '0' for others (incorrect or no idea). The maximum possible score achieved was 26 while zero was the minimum score that can be obtained. The numbers of correct responses were converted into a percentage. The score (1/0) of each question was entered into the statistical software (SPSS, version 22) as a binary outcome for both intervention and non-intervention groups.

Results

Findings from the Key Informant Interviews ([Table 2](#)).

Summary of the findings

Out of several themes derived from the KII, only awareness related factors were selected for the development of the intervention to minimize the delays in seeking treatment for leptospirosis. Majority of the participants emphasized the need of some kind of awareness programme throughout the entire cultivation season to upgrade the level of awareness among farmers ([Table 3](#)).

The socio-demographic characteristics of the two groups were compared to see whether there is a difference between the two groups. The results are presented in [Table 4](#).

The socio-demographic factors assessed in the fourth component of the study are age, sex, highest educational level, marital status, number of years being a farmer and frequent usage of mobile phones. Distribution of socio- demographic factors among the intervention group and the non-intervention group were analyzed and there were no significant differences between the two groups at P = 0.05 level.

Effectiveness of the intervention

Primary outcome variable - Leptospirosis awareness score

Table 2: Key informant interviews - generation of themes and codes.

Themes	Subthemes	Categories	Example narrative and codes
1. Awareness related factors	Health seeking behaviour	Poor compliance	“There is a significant delay in seeking treatment of leptospirosis in the district” (MOH)
		Myths and beliefs	“Some people still believe myths related to communicable diseases such as rat bites will cause leptospirosis and it is a once in a life time disease” (PHI)
		Poor knowledge on symptoms	“Many were unaware of the signs and complications of leptospirosis as well as early medication will reduce the severity and complications of the disease” (MOH)
		Poor knowledge on high risk occupations	“Majority of the population think that the only way of getting leptospirosis was by being a paddy farmer” (Agricultural Officer)
2. Income related factors	Barriers in healthcare access	Poor financial status	“There are some people who do not want to lose their daily income as they are the bread winners of the family. So they keep on taking paracetamol without going to a hospital” (Farmer; a representative from Govesamithi)
Themes	Subthemes	Categories	Example narrative and codes
3. Health service-related factors	Health services at community level	Not satisfied with the services available for non-intervention and prevention of leptospirosis at community level	“There should be awareness programmes in regular intervals and some kind of a weekly reminding of the need of prevention of Leptospirosis throughout the paddy cultivating season” (Farmer; ICU treated recently recovered from leptospirosis, delayed presented to the hospital)
		Poor knowledge on disease non-intervention	“Awareness on wound hygiene and prophylaxis of leptospirosis was unsatisfactory among the farmers” (MOH)

Table 3: Monthly message titles of the desk calendar.

Month	Monthly Message Titles
January	The growing paddy will be protected from rodents by the farmers themselves.
February	Harvesting season begins. Farmers as well as family members engage in paddy field work. Risk of Leptospirosis is more, if there is rain during the harvesting period.
March	After the harvesting period, the paddy field left abandoned for some time. Children will play in deserted paddy fields.
April	Before the beginning of the New Year season, farmers prepare the land for the oncoming Yala cultivation season.
May	Plantation of paddy will be completed at the beginning of May with the help of family members and villagers.
June	Farmers are busy with non-interventioning weeds, insects and other plant diseases.
July	On and off water management will be done by farmers throughout this period.
August	Harvesting for "Yala" season will begin. During this period people other than farmers also will engage in harvesting.
September	Land preparation for Maha season will begin. Delivering Doxycycline will be done by the area PHI.
October	Planting of paddy will take place for Maha cultivation season. As this is the major cultivation season many people will involve including family.
November	As the paddy grows, non-intervention of weeds and insects will be done mostly by the farmers themselves.
December	North-East Monsoon begins. On and off water management will be done by the farmers.

The awareness was assessed at baseline (before the beginning of the intervention) and two months after the completion of the intervention package and the results are presented in [Table 5](#).

An independent sample t-test was conducted to compare pre and post-intervention scores for non-intervention and intervention groups.

The observed difference in the pre-intervention awareness scores between the non-intervention group and intervention group was not statistically different ($P = 0.29$). The mean difference was 0.49 (95% CI: -0.28 to 1.2). However, there was a statistically significant difference in post-intervention scores between the non-intervention group and intervention group ($P < 0.001$) with a mean difference of -4.59 (95% CI: -5.2 to -3.9).

Table 4: Comparison of socio-demographic characteristics of the intervention and non-intervention group.

Characteristic	Intervention group (N = 158)		Non-intervention group (N = 158)		Total (N = 316)		Significance χ^2 (p)
	No	%	No	%	No	%	
Age							
15 - < 45 years	58	37	61	38.5	119	37.5	$\chi^2 = 0.12$; df = 1
> 45 years	100	63	97	61.5	197	62.5	P = 0.72
Sex							
Male	137	86.5	145	91.5	282	89	$\chi^2 = 2.1$; df = 1
Female	21	13.5	13	8.5	34	11	P = 0.14
Education							
Not educated	27	17	35	22	78	19.5	$\chi^2 = 5.5$; df = 3
Grade 1-5	68	43	74	47	180	45	P = 0.13
Grade 6-11	55	35	47	29.5	129	32.2	
GCE (O/L) passed	08	05	02	1.5	13	3.3	
Characteristic	Intervention group (N = 158)		Non-intervention group (N = 158)		Total (N = 316)		Significance χ^2 (p)
	No	%	No	%	No	%	
Marital Status							
Unmarried	06	3.5	09	5.5	15	4.5	$\chi^2 = 0.63$; df = 3
Married*	152	96.5	149	94.5	301	93.5	P = 0.42
No of years being a farmer							
< 20 years	23	14.5	16	10.0	39	12.2	$\chi^2 = 1.43$; df = 1
> 20 years	135	85.5	142	90.0	277	87.8	P = 0.23
Frequent usage of mobile phones							
Using	149	94.5	152	96.0	301	95.2	$\chi^2 = 0.62$; df = 1
Not using	09	5.5	06	4.0	15	4.8	P = 0.42

*Married included Widowed/Separated/Divorced

Table 5: Between groups comparison of awareness mean scores- pre and post-intervention.

Variable	Non-intervention group		Intervention group		Mean difference (95% CI)	Significance Independent t-test
	Mean	SD	Mean	SD		
Pre-intervention awareness score	14.06	3.84	13.57	4.11	0.49 (-0.28 to 1.2)	t = 1.24 P = 0.290
Post-intervention awareness score	14.36	3.81	18.95	2.57	-4.59 (-3.9 to -5.2)	t = 14.114 P = 0.000

The awareness was assessed among the non-intervention group and the intervention group at base line (before the beginning of the intervention) and two months after the completion of the intervention package and the results are presented in [Table 6](#).

Pared sample t-test was conducted to evaluate the effectiveness of pre and post awareness on leptospirosis among the non-intervention group and intervention group. There was no statistically significant difference in pre and post awareness scores in the non-intervention group (P = 0.423) and the mean difference was 0.29 (95% CI: -0.42-1.01).

However, there was a statistically significant difference in pre and post awareness scores in the intervention group (P < 0.001) with a mean difference of 5.38 (95% CI: 4.69-6.06).

Discussion

Present intervention was conducted as a quasi-experimental study using an intervention group and non-intervention group. Equal numbers of participants were recruited for each group. The vast majority of public health interventions are non-experimental or quasi-experimental and Abramson & Abramson [6] has argued that they are more practicable than

Table 6: Pre and post comparisons of awareness mean scores among intervention and non intervention groups.

Variable	Post intervention Awareness score		Pre intervention Awareness score		Mean difference (95% CI)	Significance Independent t-test
	Mean	SD	Mean	SD		
Non-intervention group	14.36	3.81	14.06	3.84	0.29 (-0.42 - 1.01)	t = 0.803; df = 199 P = 0.423
Intervention group	18.95	2.57	13.57	4.11	5.38 (4.69 - 6.06)	t = 15.552; df = 199 P = 0.000

true experiments as they may provide beneficial and generalizable information.

The intervention group (Siyambalanduwa MOH area) and non-intervention group (Bibile MOH area) were selected more than 90 km apart to avoid contamination which dilute the effectiveness of the educational intervention package [6]. People from the intervention area and non-intervention area were rarely mixed and don not share “Sathi Pola” or GPs due to long distance between the two MOH areas. By selecting two distant MOH areas, the effect of contamination was minimized. This in turn minimized contamination bias in the present study.

In the present study, the intervention was carried out by PI with the data collection team, area PHIs and the GPs in the intervention area. As Monaragala is a rural area with a low population density and with limited resources, the villagers were highly enthusiastic about the ongoing research at Govisamithi meetings and once a week SMS was attracted the interest of the respondents which encouraged more participation in the intervention.

The Intervention package consisted of a continuous reminding of combination of different kinds of interventions specifically target to farmers and the community. Community health workers at grass-root level effectively delivered health interventions especially with simple, targeted messages. Further, the health workers are widely accepted and trusted by the community. Variations in interventions and variations in modes of delivery made the intervention package more efficient in increasing knowledge to minimize the delays in seeking treatment among farmers.

Principal investigator created the SMS group among farmers but some of them did not have the SMS facility in local language. Therefore, the PI had to go for an alternative i.e., sending once a week post cards to their addresses. The intervention started a week before starting Maha season, at weekly intervals throughout Maha season (21 weeks). This ensured reaching information directly to the relevant personnel at regular intervals. Many researches declare that the post awareness will be improved by conducting awareness raising activities frequently at regular intervals, for

higher rates of early referral due to leptospirosis [2,3]. Thus, the frequent reminding of leptospirosis related messages increased the knowledge among the target group.

The announcements on how to minimize delays related in seeking treatment of leptospirosis were delivered at Sathi Pola (weekly fair) where most of the farmers as well as the community visit, to sell and buy the home essentials at weekly intervals. The announcements were delivered by two PHIs in the relevant MOH area with further assistance of relevant MOH.

The desk calendar was given to 10 GPs in Siyambalanduwa MOH areas as a tool to provide education to farmers and their family members. The intervention was further strengthened by this component as majority of the community accept the advice given by doctors as they consider them as the most trusted in the society.

Thus, by using different types of low-cost interventions in different modes of deliveries were greatly influence the knowledge to minimize the delays in seeking treatment among farmers. Further, simple but effective interventions used by the present study which can implement even by non-healthcare personnel except the component done by GP would provide better effects for rural areas like Monaragala.

The response rate of the intervention group and the non-intervention group was 100%. Participants in both groups would have a great enthusiasm in participating such programmes due to scarcity of such activities among rural villagers.

The difference in the pre-intervention awareness scores between the non-intervention group and intervention group was not statistically different ($p = 0.29$). The mean difference was 0.49 (95% CI: -0.28 to 1.2). However, there was a statistically significant difference in post-intervention scores between the non-intervention group and intervention group ($p < 0.001$) with a mean difference of -4.59 (95% CI: -5.2 to -3.9) which clearly demonstrate the effectiveness of the intervention in increasing knowledge to minimize the delays in seeking treatment among farmers. The intervention to minimize the identified delays related

to knowledge in seeking treatment of leptospirosis is effective in improving awareness among farmers.

Paired sample t-test was conducted to evaluate the effectiveness of pre and post knowledge on leptospirosis among the non-intervention group and intervention group. There were no statistically significant differences in pre and post awareness scores in the non-intervention group ($p = 0.423$) and the mean difference was 0.29 (95% CI: -0.42-1.01). However, there was a statistically significant difference in pre and post awareness scores in the intervention group ($p < 0.001$) with a mean difference of 5.38 (95% CI: 4.69-6.06).

This can be concluded as the intervention package to increase knowledge to minimize the delays in seeking treatment of leptospirosis is effective ($p < 0.001$) in improving knowledge to minimize the delays in seeking treatment among farmers in Monaragala district.

There are no local interventions related to minimize delays in seeking treatment by patients with leptospirosis, to compare the results of the study.

A similar result was observed from an educational intervention carried out among "Navasari villagers" in India using IEC materials (poster exhibition and street play in local language), the effectiveness was measured using a questionnaire before and after the intervention on improvement of participant's knowledge of leptospirosis. The intervention consisted of a 30 minutes street play followed by a poster exhibition in local language because most of the villagers had a low educational status. It revealed that there was significant improvement of knowledge on questions asked before and after the intervention ($p < 0.001$) but there was no non-intervention group for the comparison of the study [2].

Furthermore, another interventional study revealed similar results that leptospirosis health intervention programmes delivered through lectures, video presentations, games, role-play, small group discussions and demonstrations were effective in improving awareness and preventive behaviours [knowledge ($P < 0.001$), attitude ($P < 0.001$), belief ($P < 0.001$) and practice ($P < 0.001$)] among risk groups [3] in Malaysia.

Another intervention from Malaysia revealed a similar result, by using a module called "The Leptospirosis Interactive Health Promotion Module" developed in Malaysia. It was conducted as a two day interactive and participative programme for 32 participants in the intervention group. The effectiveness was measured using a validated questionnaire which revealed that there was a statistical significance improvement in knowledge ($P < 0.001$), attitudes ($P < 0.001$) and practice ($P < 0.001$) score in the targeted high risk intervention group for leptospirosis [4].

Thus, interventional studies using simple IEC materials in local languages delivered through different modes have shown significant improvement in knowledge all over the world similar to the present study.

Conclusions

This should clearly explain the important conclusions of the work highlighting its significance, relevance and values.

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