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Effectiveness of Leptospirosis Intervention Module in Improving Knowledge, Attitude and Practice among Town Service Workers in Northeastern Malaysia



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ABSTRACT

Leptospirosis is preventable if appropriate measures are taken especially for modifiable risk factors. Intervention among the high-risk groups is one of many preventive measures that could be taken to control this disease. The purpose of this study was to determine the effectiveness of Leptospirosis Interactive Health Promotion Module (LIHPM) in improving knowledge, attitude, and practice (KAP) among town service workers in Northeastern Malaysia. It was carried out in four districts in a Northeastern State of Malaysia, which involved 71-town service workers, 34 participants were selected as intervention group and 37 participants as the control group. The LIHPM was developed based on the manual of Visualization in Participatory Programs. Data were entered and analyzed using SPSS Version 22.0. The mean knowledge score at baseline was not significantly different between intervention and control groups. However, there was a significant mean difference in knowledge score between the intervention and control groups regardless of time. Similarly, for the mean attitude and practice score, it was not significantly different between intervention and control groups at baseline but there was a significant mean difference between the intervention and control groups regardless of time. In conclusion, Leptospirosis Interactive Health Promotion Module (Knowledge, Attitude, and Practice Modules), an intensive interactive intervention program for the targeted group, was proven to be significantly effective in improving the knowledge, attitude and practice score on leptospirosis among 'high risk' town service workers in the intervention group.

INTRODUCTION

Leptospirosis, an infectious disease caused by bacteria of the genus *Leptospira* affects human and animals are considered as the most common zoonosis in the world. Leptospire is an extremely mobile bacterium that can survive in many types of wet or humid environments ranging from surface waters and moist soil to tap water^[1]. An important characteristic of this bacterium is that it may remain for a long duration of time in the kidney tubes in animals, and excreted to environments by urine for many years without the host not being sick or also known as asymptomatic carriers, thus enabling animal-to-animal or animal to human transmission^[2].

Leptospirosis is currently considered as a re-emerging zoonosis of global importance, particularly in the developing parts of the world due to certain socioeconomic or climatic conditions that favor endemicity in animal vectors and human exposure, whereas in industrialized countries, it is often reported as imported disease following international travel to endemic destinations^[3]. Additionally, most countries in South East Asia region are endemic to the disease. Despite this, leptospirosis is still under-reported due to the wide range of clinical presentations associated with acute leptospiral infection^[4; 5]. In Malaysia, the data from the Ministry of Health showed that the prevalence of leptospirosis increased dramatically from 2004 to 2009 with the case fatality rates (CFR) over the period varied from 1.8% to 7.6% with an average of 4.44%^[6; 7].

Leptospirosis is preventable if appropriate measures are taken especially for modifiable risk factors. Intervention among the high-risk groups is one of many preventive measures that could be taken to control this disease^[8]. Many kinds of literature had reported many occupational high-risk groups for leptospirosis, which includes garbage collectors, paddy planter, army and health care workers^[9; 10; 11; 12; 13; 14].

Town service workers are more likely to be exposed to the leptospiral infection resulting from their occupational activities in solid waste management in every step of the process, from the point where residents handle wastes in the home for collection or recycling, to the point of ultimate disposal^[15; 16; 17; 18; 19]. The prevalence of seropositive for leptospirosis among town cleansing laborers in Peninsular Malaysia was reported as 17.9%^[15] and study by Sulong *et al.* (2012) in 2008 reported that the seroprevalence among town service workers in the Northeastern State of Malaysia was 24.7%^[13]. An effective intervention program in this high-risk occupational group should be implemented. However, to date, there is no health education

program for these groups of workers to make them aware of their risk and the related preventive measures that can be practiced in order to reduce the risk of infection. This was an intervention study to determine the effectiveness of Leptospirosis Interactive Health Promotion Module (LIHPM) in improving knowledge, attitude, and practice (KAP) among town service workers in Northeastern Malaysia.

METHODOLOGY

Study design and population

An intervention study was carried out in four districts in a Northeastern State of Malaysia, which involved 71 town service workers from the Municipal Council (MC) and three District Councils of District A (DA), District B (DB) and District C (DC). The Municipal Council provides public services within its area of jurisdiction comprising an area of 116 km² whereas each District Councils provides public services of the operational area of about 50km². From 71 participants, 34 participants from MC were selected as intervention group and 37 participants from DA, DB and DC were selected as control group. However, two participants from the intervention group were removed from the study as one of them had the terminally ill disease and the employer terminated the other one from work.

Development of Interactive Health Promotion Module

The Leptospirosis Interactive Health Promotion Module (LIHPM) was developed based on the manual of Visualization in Participatory Programs (VIPP). VIPP is a relatively new, creative and systematically organized synthesis of applying people-centered participatory methods for conducting group events, large and small, to improving group interaction in problem-solving, decision making, planning, training or creating new visions and directions^[20].

LIHPM has three major components, which are Knowledge, Attitude and Practice Module. It was developed to emphasize on improving the knowledge, attitude, and practice on leptospirosis among town service workers. LIHPM (Knowledge Module) covers the causes, symptom, signs and complications, risk factors, treatment (including detection of the disease) and prevention (before, during and after work) of leptospirosis. Three activities in Knowledge Module that were adopted from VIPP are an expert interview, mind mapping, and role-plays. Before these three activities were conducted, there was an animation presentation on leptospirosis that was displayed to the participants to give them some general knowledge on leptospirosis with the purpose that it will attract the interest the respondents and encourage

more participation in the program.

LIHPM (Attitude Module) covers the workers attitude towards safe work practice and personal protective equipment (PPE) usage in the working environment as well as workers attitude towards general practice outside working hours. In Attitude Module, there was one activity adopted from VIPP methods, which were the Topsy Turvy session whereas the other one was modified from VIPP methods, which were Find It, Fix It session. Both this activity in Attitude Module were conducted to instill and enhance the good attitude of participants towards leptospirosis by identifying the bad attitude to avoid and recognize intensify the good attitude that the participants already had.

LIHPM (Practice Module) covers the safe work practice, PPE usage and off work general practices. In this module, there were four activities adopted and modified from VIPP methods, which were Hands-On PPE, Hand Wash, and Hand Rub session and role-play session. Practice Module was conducted to increase the understanding of the participants on the importance to PPE usage compliance, introduce and encourage the practice of correct step of hand wash with soap and hand rub using hand sanitizer and subsequently, apply and practice the new knowledge and skills obtained in the role-play session.

PROCEDURE

Ethical clearance was obtained from Research and Ethics Committee (Human), School of Medical Sciences, Health Campus, Universiti Sains Malaysia (Reference No: USMKK / PPP / JEPeM [261.3(7)]). The 32 participants in the intervention group received the LIHPM in a 2-days program that was further divided to four small groups with eight participants each to ensure the program was as interactive, interesting and participative as possible. Prior to the program, all facilitators that were involved in this program was given one-day training program to ensure the program runs as smooth as possible. Meanwhile, the participants in the control group received no intervention program. A validated KAP questionnaire was given to all participants before the intervention and six weeks after intervention completion.

STATISTICAL ANALYSIS

Data were entered and analyzed using SPSS Version 22.0 ^[21]. All continuous variables were described using mean and standard deviations (SD) whereas, for categorical variables, frequencies and percentages were presented. To determine the effect of LIHPM, repeated measures analysis of variance (RM ANOVA) was used to compare the

changes in the outcome measurement before and after intervention in the control and intervention groups.

RESULTS

Demographic characteristics

Table 1 shows the socio-demographic characteristics of participants in intervention and control group. All participants were Malay race and the majority of them were married. The mean age of participants for intervention and control group was 39.1 (9.38) and 37.7 (12.31) respectively. All participants in the intervention group were male whereas about 11% participants in the control group were female. Majority of the participants in the intervention group received upper secondary school and above level of education whereas the number of participants who received lower secondary and below and upper secondary and above level of education were nearly the same in the control group. The mean duration of employment in the intervention and control group was 9.7 (7.66) and 9.6 (8.58) respectively with the participants in the intervention group had the higher mean of monthly income.

Table 1: Socio-demographic characteristics of participants in intervention and control group

Variable	Intervention group (n=32)		Control group (n=37)	
	n (%)	Mean (SD)	n (%)	Mean (SD)
Age		39.1(9.38)		37.7 (12.31)
Gender				
Male	32 (100.0)		33 (89.2)	
Female	0(0)		4 (10.8)	
Marital status				
Married	26 (81.3)		28 (75.7)	
Single/Widower	6 (18.7)		9 (24.3)	
No. of children		3.5 (2.97)		3.4 (2.41)
Education level				
≤ lower secondary	12 (37.5)		19 (51.4)	
≥ upper secondary	20 (62.5)		18 (48.6)	
Duration of employment		9.7 (7.66)		9.6 (8.58)
Monthly income (RM)		1214 (444.33)		942 (230.36)

Knowledge Score

The mean knowledge score in intervention and control group before and after the intervention is shown Table 2. The mean knowledge score was higher among the subjects in the intervention group than the subjects in the control group were. However, the mean knowledge score at baseline was not significantly different between intervention and control groups (mean difference = -5.29, 95% CI: -18.16, 7.59; $p=0.415$).

The findings for the time effect on both groups were shown in Table 3. Mauchly's test of Sphericity for within-group changes of knowledge score based on the time indicated that the assumption of sphericity was violated. Based on the multivariate test (Wilks' Lambda $F(1,68) = 36.42, p<0.001$), there were significant effects of time on changes in knowledge score within the two groups. For the intervention group, there was the significant improvement in knowledge score before and after an intervention was done (mean difference = 34.31, 95% CI: 25.52, 43.10; $p<0.001$). However, for the control group, there was no significant improvement in knowledge score before and after intervention (mean difference=4.00, 95% CI: -0.91, 8.92; $p=0.107$).

Table 4 shows the comparison of intervention effect, based on the test of between-subjects effects, there was a significant mean difference in knowledge score between the intervention and control groups regardless of time (Wilks lambda $F(1,67)= 16.19; p<0.001$). Table 5 shows the time-intervention effect on mean knowledge score between intervention and control groups. For within-between group analysis, there was a significant difference of mean knowledge score between intervention and control groups based on time ($F=40.22, p<0.001$).

Table 2: Knowledge score in intervention and control groups before and after the intervention (n=69)

Variables	Intervention group	Control group
	Mean (SD)	Mean (SD)
Pre-intervention	54.95 (25.04)	49.67 (28.09)
Post-intervention	89.26 (4.56)	53.67 (25.80)

Table 3: Comparison of knowledge score between intervention and control groups based on time (n=69)

Comparison	Intervention		Control	
	Mean difference (95% CI)	the	Mean difference (95% CI)	the
Post-pre intervention	34.31 (25.52, 43.10)	<0.001	4.00 (-0.91, 8.92)	0.107

Repeated measures ANOVA within-group analysis were applied followed by pairwise comparison with confidence interval adjustment.

Table 4: Comparison of knowledge score between intervention and control groups regardless of time (intervention effect) (n=69)

Comparison	Repeated measures ANOVA	
	F-statistics (df)	p-value
Intervention group vs Control group	16.19 (1,67)	<0.001

Repeated measures ANOVA between groups analysis was applied. Assumption of normality, homogeneity of variances and compound symmetry were checked and fulfilled Level of significance was set at 0.05 (two-tailed).

Table 5: Comparison of mean knowledge score between groups based on time (time-intervention effect) (n=69)

Time	Group	Mean knowledge score	95% CI
Pre-intervention	Intervention	54.95	45.52, 64.38
	Control	49.67	40.90, 58.43
Post-intervention	Intervention	89.26	82.50, 96.03
	Control	53.67	47.38, 59.96

Repeated measure ANOVA between-group analysis with regard to time was applied. Assumption of normality, homogeneity of variances and compound symmetry were checked and fulfilled Level of significance was set at 0.05 (two-tailed).

Attitude Score

The mean attitude score in intervention and control group before and after the intervention is shown in Table 6. The mean attitude score was higher among the subjects in the control group than the subjects in the intervention group were. However, the mean attitude score at baseline was not significantly different between intervention and control groups (mean difference = 4.60, 95% CI:-1.37, 10.56; $p=0.129$).

The findings for the time effect on attitude score both intervention and control groups were shown in Table 7. Maunchly’s test of Sphericity for within-group changes of attitude score based on the time indicated that the assumption of sphericity was violated. Based on the multivariate test (Wilks’ Lambda $F(1,68) = 24.85, p<0.001$), there were significant effects of time on changes in attitude score within the two groups. For the intervention group, there was a significant improvement in attitude score before and after the intervention was done (mean difference = 27.34, 95% CI: 23.13, 31.55; $p<0.001$). On the contrary, for the control group, there was a significant decline in attitude score before and after intervention (mean difference= -3.43, 95% CI: -5.73, -1.14; $p=0.004$).

Table 8 shows the comparison of intervention effect, based on the test of between-subjects effects, there was a significant mean difference in attitude score between the intervention and control groups regardless of time (Wilks lambda $F(1,67)= 21.66; p<0.001$). Table 9 shows the time-intervention effect on mean attitude score between intervention and control groups. For within-between group analysis, there was a significant difference of mean attitude score between intervention and control groups based on time ($F=183.57, p<0.001$).

Table 6: Attitude score in intervention and control groups before and after the intervention (n=69)

Variables	Intervention group	Control group
	Mean (SD)	Mean (SD)
Pre-intervention	66.02 (13.10)	70.61 (11.71)
Post-intervention	93.36 (5.74)	67.18 (10.61)

Table 7: Comparison of attitude score between intervention and control groups based on time (n=69)

Comparison	Intervention		Control	
	Mean difference (95% CI)	p-value	Mean difference (95% CI)	p-value
Post-pre intervention	27.34 (23.13, 31.55)	<0.001	-3.43 (-5.73, -1.14)	0.004

Repeated measures ANOVA within-group analysis were applied followed by Pairwise comparison with confidence interval adjustment.

Table 8: Comparison of attitude score between intervention and control groups regardless of time (intervention effect) (n=69)

Comparison	Repeated measures ANOVA	
	F-statistics (df)	p-value
Intervention group vs Control group	21.66 (1,67)	<0.001

Repeated measures ANOVA between groups analysis was applied. Assumption of normality, homogeneity of variances and compound symmetry were checked and fulfilled Level of significance was set at 0.05 (two-tailed).

Table 9: Comparison of mean attitude score between groups based on time (time-intervention effect) (n=69)

Time	Group	Mean attitude score	95% CI
Pre-intervention	Intervention	66.02	61.65, 70.38
	Control	70.61	66.55, 74.67
Post-intervention	Intervention	93.36	90.29, 96.43
	Control	67.18	64.32, 70.03

Repeated measure ANOVA between-group analysis with regard to time was applied. Assumption of normality, homogeneity of variances and compound symmetry were checked and fulfilled Level of significance was set at 0.05 (two-tailed).

Practice Score

The mean practice score in intervention and control group before and after the intervention is shown in Table 10. The mean practice score was higher among the subjects in the control group than the subjects in the intervention group were. However, the mean practice score at baseline was not significantly different between intervention and control groups (mean difference=1.38, 95% CI: -4.11, 6.86; $p=0.618$).

The findings for the time effect on both groups were shown in Table 11. Maunchly’s test of Sphericity for within-group changes of practice score based on the time indicated that the assumption of sphericity was violated. Based on the multivariate test (Wilks’ Lambda $F(1,68) = 39.64, p<0.001$), there were significant effects of time on changes in practice score within the two groups. For the intervention group, there was the significant improvement in practice score before and after an intervention was done (mean difference = 26.74, 95% CI: 22.56, 30.92; $p<0.001$). However, for the control group, there was no significant improvement in practice score before and after intervention (mean difference= -0.44, 95% CI: -1.87, 0.99; $p=0.533$).

Table 12 shows the comparison of intervention effect, based on the test of between-subjects effects, there was a significant mean difference in practice score between the intervention and control groups regardless of time (Wilks lambda $F(1,67)= 32.95; p<0.001$). Table 13 shows the time-intervention effect on mean practice score between intervention and control groups. For within-between group analysis, there was a significant difference of mean practice score between intervention and control groups based on time ($F=175.75, p<0.001$).

Table 10: Practice score in intervention and control groups before and after the intervention (n=69)

Variables	Intervention group	Control group
	Mean (SD)	Mean (SD)
Pre-intervention	58.81 (12.53)	60.19 (10.30)
Post-intervention	85.55 (6.14)	59.75 (9.09)

Table 11: Comparison of practice score between intervention and control groups based on time (n=69)

Comparison	Intervention		Control	
	Mean difference (95% CI)	the	Mean difference (95% CI)	p-value
Post-pre intervention	26.74 (22.56, 30.92)	<0.001	-0.44 (-1.87, 0.99)	0.533

Repeated measures ANOVA within-group analysis were applied followed by pairwise comparison with confidence interval adjustment.

Table 12: Comparison of practice score between intervention and control groups regardless of time (intervention effect) (n=69)

Comparison	Repeated measures ANOVA	
	F-statistics (df)	p-value
Intervention group vs Control group	32.95 (1,67)	<0.001

Repeated measures ANOVA between groups analysis was applied. Assumption of normality, homogeneity of variances and compound symmetry were checked and fulfilled Level of significance was set at 0.05 (two-tailed).

Table 13: Comparison of mean practice score between groups based on time (time-intervention effect) (n=69)

Time	Group	Mean practice score	95% CI
Pre-intervention	Intervention	58.81	54.80, 62.83
	Control	60.19	56.45, 63.93
Post-intervention	Intervention	85.55	82.78, 88.33
	Control	59.75	57.17, 62.33

Repeated measure ANOVA between-group analysis with regard to time was applied. Assumption of normality, homogeneity of variances and compound symmetry were checked and fulfilled Level of significance was set at 0.05 (two-tailed).

DISCUSSION

Effectiveness of Leptospirosis Interactive Health Promotion Module (Knowledge Module)

The findings from our study showed that the LIHPM (Knowledge Module) was effective in improving the knowledge of leptospirosis in participants. When comparing the score before and six weeks after the LIHPM (Knowledge Module) between the intervention and control groups, it was found that there was a significant difference of mean knowledge score among the two groups based on time ($F=40.22, p<0.001$), where there was a significant increase in knowledge score in the intervention group and no significant changes in the control group.

Before the intervention, the mean knowledge score was not significantly different between intervention and control groups although the mean knowledge score for the intervention group was slightly higher than the control group at the baseline of the study (mean difference = -5.29, 95% CI: -18.16, 7.59; $p=0.415$). After the intervention, the mean knowledge score for intervention group significantly increased from 54.95 to 89.26 (mean difference = 34.31; 95% CI: 25.52, 43.10; $p<0.001$) whereas there was no significant change in knowledge score before and after intervention (from 49.67 to 53.57) in the control group (mean difference = 4.00; 95% CI: -0.91, 8.92; $p=0.107$).

In comparison to an intervention study by Yaacob *et al.* (2013) among army personnel in the Northeastern State of Malaysia, in which 94 participants in the intervention group completed a one-day program using Leptospirosis Health Education Module (LHEM) while another 94 participants in the control group received no intervention. LHEM consisted of a lecture on leptospirosis and its preventive measures for army personnel, printed materials (booklet, pamphlet, and poster) on leptospirosis and its preventive measures and questions and answers session ^[22]. Unlike our LHPM, LHEM had no small group activities specifically on KAP (LIHPM has Knowledge Module, Attitude Module, and Practice Module) and hands-on (practical) session on PPE usage and seven steps hand wash with soap and hand rub with hand sanitizer.

In the study by Yaacob *et al.* (2013), there was a significant difference of mean knowledge score among army personnel in the two groups (intervention camp and control camp) based on time. For the intervention camp, there was a significant improvement in knowledge score, from 97.97 before the intervention to 122.21 after the intervention (mean difference = 24.25; 95% CI: 21.93, 26.56; $p<0.001$) whereas there were no significant changes in knowledge

score before and after intervention (from 49.67 to 53.57) in the control camp (mean difference = 4.02; 95% CI: 1.55, 6.50; $p=0.200$). In comparison, our study had higher mean difference in the town service workers intervention group (mean difference = 34.31; 95% CI: 25.52, 43.10; $p<0.001$) compared to army personnel intervention camp (mean difference = 24.25; 95% CI: 21.93, 26.56; $p<0.001$) for knowledge score.

Although the study population and KAP questionnaire used was different, it could be say that generally the LIHPM (Knowledge Module) was effective in improving the knowledge of leptospirosis among town service workers and was shown to be better approach than LHEM among army personnel in terms of improvement of knowledge score as seen in higher mean difference in Knowledge score of town service workers compared to mean difference in knowledge score of army personnel.

Another intervention study using Information, Education, and Communication (IEC) materials was done among residents in Navsari district of India during the year 2005. A questionnaire was used before and after the intervention to assess the effectiveness of the intervention program in improving the respondents' knowledge of leptospirosis. However, there was no control group in this study. The intervention was given using IEC materials, which were street plays and poster exhibition in the local language. The street play lasted for 30 minutes in 10 personnel in the local language with local pronunciations performed each session. For about one month duration, the same performers repeated the same street play twice in each village at a different location. The poster exhibition was conducted right after the street play in the same place for about an hour location. The IEC materials covered the knowledge on the cause, mode of transmission, symptoms and preventive measures of leptospirosis disease. The street play was chosen as one of the health communication media used because most of the villagers were illiterate. The effectiveness of the intervention was assessed two months later using the same questionnaire used before the intervention. Analysis of the data was done using chi-square test revealed that there was the significant improvement of knowledge of respondent on leptospirosis based on the eight knowledge item asked in the questionnaire before and after the intervention ($p<0.001$)^[23].

Effectiveness of Leptospirosis Interactive Health Promotion Module (Attitude Module)

The findings from our study showed that the LIHPM (Attitude Module) was effective in improving the attitude towards leptospirosis in participants. When comparing the score before and six weeks after the LIHPM (Attitude Module) between the intervention and control

groups, it was found that there was a significant difference of mean attitude score among the two groups based on time ($F=183.57$, $p<0.001$), where there was a significant increase in attitude score in the intervention group and a significant slight decrease in the control group.

Before the intervention, the mean attitude score was not significantly different between intervention and control groups although the mean attitude score for the control group was slightly higher than the intervention group at the baseline of the study (mean difference = 4.60, 95% CI: -1.37, 10.56; $p=0.129$). After the intervention, the mean attitude score for intervention group significantly increased from 66.02 to 93.36 (mean difference = 27.34; 95% CI: 23.13, 31.55; $p<0.001$) whereas there was a significant slight decreased in attitude score before and after intervention (from 70.61 to 67.18) in the control group (mean difference = -3.43; 95% CI: -5.73, -1.14; $p=0.004$).

In comparison to an intervention study by Yaacob *et al.* (2013) among army personnel in the Northeastern State of Malaysia, there was a significant difference of mean attitude score among army personnel in the two groups (intervention camp and control camp) based on time. For the intervention camp, there was a significant improvement in attitude score, from 52.10 before the intervention to 55.91 after the intervention (mean difference = 3.82; 95% CI: 2.47, 5.17; $p<0.001$) whereas there was no significant changes in attitude score before and after intervention (from 51.86 to 52.28) in the control camp (mean difference = 0.42; 95% CI: -0.72, 1.55; $p=0.471$). In comparison, our study had higher mean difference in the town service workers intervention group (mean difference = 27.34; 95% CI: 23.13, 31.55; $p<0.001$) compared to army personnel intervention camp (mean difference = 3.82; 95% CI: 2.47, 5.17; $p<0.001$) for attitude score.

Although the study population and KAP questionnaire used was different, it could be say that generally the LIHPM (Attitude Module) was effective in improving the attitude towards leptospirosis among town service workers and was shown to be better approach than LHEM among army personnel in terms of improvement of attitude score as seen in higher mean difference in Attitude score of town service workers compared to mean difference in attitude score of army personnel.

Effectiveness of Leptospirosis Interactive Health Promotion Module (Practice Module)

The findings from our study showed that the LIHPM (Practice Module) was effective in improving the practice towards leptospirosis in participants. When comparing the score before and six weeks after the LIHPM (Practice Module) between the intervention and

control groups, it was found that there was a significant difference of mean practice score among the two groups based on time ($F=175.75$, $p<0.001$), where there was a significant increase in practice score in the intervention group and no significant changes in the control group.

Before the intervention, the mean practice score was not significantly different between intervention and control groups although the mean practice score for the control group was slightly higher than the intervention group at the baseline of the study (mean difference = 1.38, 95% CI: -4.11, 6.86; $p=0.618$). After the intervention, the mean practice score for intervention group significantly increased from 58.81 to 85.55 (mean difference = 26.74; 95% CI: 22.56, 30.92; $p<0.001$) whereas there was no significant changes in practice score before and after intervention (from 60.19 to 59.75) in the control group (mean difference = -0.44; 95% CI: -1.87, 0.99; $p=0.533$).

In comparison to an intervention study by Yaacob *et al.* (2013) among army personnel in the Northeastern State of Malaysia, there was a significant difference of mean practice score among army personnel in the two groups (intervention camp and control camp) based on time. For the intervention camp, there was a significant improvement in practice score, from 49.96 before the intervention to 53.39 after the intervention (mean difference = 3.44; 95% CI: 1.80, 5.07; $p<0.001$) whereas there was no significant changes in practice score before and after intervention (from 47.89 to 47.14) in the control camp (mean difference = 0.76; 95% CI: -1.98, 0.47; $p=0.225$). In comparison, our study had higher mean difference in the town service workers intervention group (mean difference = 26.74; 95% CI: 22.56, 30.92; $p<0.001$) compared to army personnel intervention camp for (mean difference = 3.44; 95% CI: 1.80, 5.07; $p<0.001$) practice score.

Although the study population and KAP questionnaire used was different, it could be say that generally the LIHPM (Practice Module) was effective in improving the practice towards leptospirosis among town service workers and was shown to be better approach than LHEM among army personnel in terms of improvement of practice score as seen in higher mean difference in practice score of town service workers compared to mean difference in practice score of army personnel.

Issues related to effectiveness of LIHPM (Knowledge, Attitude, and Practice Modules)

To ensure the effectiveness of our program using LIHPM, we decided to purposely select workers from the Municipal Council as the intervention group and workers from three

District Councils as the control group. This was done to avoid contamination as the geographical separation of the districts involved will prevent or minimize the contact between the subjects in the intervention and control groups. The decision was proved a crucial one as contamination problem in a Randomized Control Trial (RCT) by Ibrahim *et al.* (2012) was proved costly as the effectiveness of its intervention program was affected by cross-contamination in the control subjects despite efforts to control it. The RCT by Ibrahim *et al.* (2012) was done to evaluate the effectiveness of peer-led education on knowledge, attitude, and risk behavior practices related to HIV among students at a public university in Selangor state of Malaysia ^[24]. Although RCTs are considered by many researchers and providers to be the gold standard of health and social service effectiveness research ^[25], there was a slight positive change in HIV knowledge and attitude among subjects after three-month follow-up in the control group due to the effect of cross contamination in the control group. The reason for the positive change was possibly due to opportunities for changing of information received in the intervention program between participants in intervention and control groups within three months after intervention. The interactions happened because they were selected from the same geographical location ^[24].

Ruslan (2013) did another occupational safety and health intervention study that involved interactive and intensive intervention programs in small groups but not related to leptospirosis. Similar to the study by Ibrahim *et al.* (2012), the post-test in this study was done three months after completion of the intervention. The study was on the evaluation of health promotion program on knowledge retention and practices among automotive workers in Malaysia. There were 104 and 176 participants in the intervention and control groups respectively. All participants answered a set of the validated questionnaire at two weeks prior to and two weeks after the completion of the intervention program and later, 3 months after completion of the intervention. The participants in the intervention group were divided into small groups and were given an intervention program of 75 minutes duration whereas the control group did not receive any intervention program. The intervention program consists of an audio-visual presentation and interactive lecture with the question and answer sessions on hazard at the workplace and its effect to health, clinical manifestations to toxicity, the treatment, safety and health-seeking behavior, hazard control measures and general practices including PPE use. Post-test after three months revealed that knowledge and practice score was significantly higher in intervention group compared to control group, but no significant changes in the attitude score. Although the intervention program did not achieve the success as wanted in improvement of workers attitude, the program was considered successful in

overall as the intervention program was only for 75 minutes duration but manage to make a significant impact on workers knowledge and practice with improvement needed in the intervention program to tackle the challenges in workers attitude change ^[26].

The post-test in our study was done six weeks after completion of the intervention due to limited study period. In addition, other intervention studies evaluated their intervention six weeks after the completion of intervention, which was similar to us ^[27; 28; 22]. The study by Yaacob *et al.* (2013) was the only recent study that we could found that uses KAP questionnaire in an intervention study to evaluate the effectiveness of their intervention program six weeks after intervention completion. Other studies that uses KAP questionnaire in an intervention study to evaluate the effectiveness of their intervention program either evaluated their intervention program less than six weeks (usually four weeks or one month after intervention) ^[29; 30] or more than six weeks (usually two months or three months after intervention) which some of these studies were mentioned earlier ^[31; 32; 33; 34; 24; 26].

In conclusion, Leptospirosis Interactive Health Promotion Module (Knowledge, Attitude and Practice Modules), an intensive interactive intervention program for targeted group, was proven to be significantly effective in improving the knowledge, attitude and practice score on leptospirosis among 'high risk' town service workers in the intervention group. Therefore, local solid waste management agencies should incorporate Leptospirosis Interactive Health Promotion Module (Knowledge, Attitude and Practice Modules) in their occupational safety and health training for their workers. Over time, the adoption of Leptospirosis Interactive Health Promotion Module (Knowledge, Attitude and Practice Modules) into the organizations' human resource training policy will increase the knowledge, attitude and practice and subsequently, reduce the seroprevalence for leptospirosis among town service workers.

Conflict of interest statement

We declare that we have no conflict of interest.

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