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Journal Articles

EVALUATION OF LEPTOSPIROSIS KNOWLEDGE, ATTITUDE AND PRACTICE AMONG DOG HANDLERS

S.H. Goh[1], K.H. Khor[1]*, S.F. Lau[1], R. Ismail[2], S. Khairani-Bejo[1] and R. Radzi[1]

[1]*Faculty of Veterinary Medicine, Universiti Putra Malaysia, UPM Serdang, Selangor Darul Ehsan, Malaysia*
[2]*Faculty of Medicine, Universiti Kebangsaan Malaysia, UKM Bangi, Selangor Darul Ehsan, Malaysia.*

SUMMARY

Dogs could be reservoirs and carriers of *Leptospira* spp., hence, may play a potential role in disease transmission, exposing dog handlers to leptospirosis. This study evaluated the dog handlers' knowledge, attitude and practice (KAP) towards leptospirosis. Four working dog and four dog shelter organisations were approached. A total of 138 dog handlers were conveniently recruited and evaluated on their level of knowledge, attitude and practice towards leptospirosis using a validated structured questionnaire. Most of the dog handlers were male aged between 30 and 40 years with a wide range of working experience of 1 - 10 years and all of them have no formal training about leptospirosis. The majority of the dog handlers from the dog shelters had poor knowledge (90%, n=34/38) and attitude (100%, n=38/38) and moderate practice (53%, n=20/38) towards leptospirosis, whereas the working dog handlers had poor knowledge (58%, n=58/100) and attitude (75%, n=75/100) but a good level of practice (77%, n=77/100). The poor attitude towards leptospirosis in both groups is alarming as it may hinder implementation plans of control and preventive measures. Although there was good hand-washing practices among the dog handlers, there was a lack of personal protective equipment (PPE) practice that may therefore expose both the dogs and dog handlers to leptospirosis. Information gained from this study could be used to implement intervention programmes and to suggest prevention measures to limit the risk of leptospirosis among the dog handlers.

Keywords: knowledge, attitude, practice, dog, handler, leptospirosis

INTRODUCTION

In Malaysia, human leptospirosis was first reported in 1925 (Fletcher, 1928). Since then, 37 pathogenic serovars have been isolated locally (Bahaman *et al.*, 1987). To date, the zoonotic spirochaetal disease saw an increase in the number of reported cases locally (MOH, 2015) which indicated the endemicity of this disease locally (Garba *et al.*, 2017). The warm and humid tropical climate could be the fuelling factor behind its occurrences. However, the disease is not exclusive only to Malaysia, but also occurs in other tropical and subtropical regions such as Central America and Oceania (Torgerson *et al.*, 2015).

This infectious disease does not segregate between communities, as occupants from both urban and rural areas can be affected (Prabhakaran *et al.*, 2014). *Leptospira* spp. can be found in the environment (soil and water) and can be maintained by a wide range of mammalian species with rats being the most prominent natural reservoir (Desvars *et al.*, 2011; Bharti *et al.*, 2003). Most human infections were acquired via direct and indirect contact with the urine of reservoirs/infected animals or leptospires-contaminated environments through both occupational and recreational exposures (Haake *et al.*, 2015). In humans, the symptoms include: high fever, headache, rash, diarrhoea, abdominal pain, muscle aches, vomiting, jaundice (yellow skin and eyes), red eyes and chills. Alarmingly, some infected individuals may be asymptomatic without any overt symptoms of illness (Quina *et al.*, 2014).

In recent years, there has been a shift of leptospirosis being associated with environmental contact to being an occupational disease (Rim *et al.*, 2014; Tiwari, 2008). Occupational tasks which involved outdoor environments (unhygienic) such as forest regions (Richard *et al.*, 2015) and agricultural workers (Ridzuan *et al.*, 2016; Natarajaseenivasan *et al.*, 2002) were documented as high risk occupational groups. Besides that, leptospirosis was also reported in high numbers of cases among slaughterhouse workers (Cook *et al.*, 2017; Brown *et al.*, 2011) and dog handlers who worked closely with dogs that had a high tendency of infection either via urine shedding of leptospires contaminating the environment or direct contact (Goh *et al.*, 2019; Awosanya *et al.*, 2013).

With increased reports of local endemicity (Garba *et al.*, 2017), the spread of awareness towards leptospirosis among the general public especially those who are at risk of infection is vital. Recent local studies in dogs (shelter dogs and working dogs) have detected leptospiral seroprevalences between 3.1–7.0% with Bataviae, Icterohemorrhagiae, Canicola, Javanica, and Australis being the common serovars detected (Lau *et al.*, 2016, 2017; Khor *et al.*, 2016). This suggested that dogs as transmitters and a source of the disease are becoming a risk especially to dog handlers. This study evaluated the knowledge, attitude and preventive practices (KAP) of dog handlers towards leptospirosis. Information obtained is useful to improve, assist implementation of strategies for disease control and recommend preventive measures that could be conducted in curbing disease transmission.

MATERIALS AND METHODS

Respondents

This study was conducted for a period of 5 months. Working dog and dog shelter organisations from Johor, Kuala Lumpur, Negeri Sembilan and Selangor were approached and approval was obtained prior to

Corresponding author: Dr Khor Kuan Hua (K.H. Khor);
Phone No: +603 8609 3926; Email: khkhor@upm.edu.my

recruitment into the study. A total of eight organisations (consisting of four working dog and four dog shelter organisations) participated. The dog handlers (respondents) were conveniently recruited. The respondents were evaluated on their level of knowledge, attitude and practice towards leptospirosis using a set of validated structured questionnaire. Consent from each respondent was obtained before the distribution of the questionnaire and their confidentiality was assured as data was used only for the purposes of this study. This study obtained approval from the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKMPPI/111/8/JEP-2016-494).

Demographics

The demographical information of the recruited dog handlers such as age (years), gender (male or female), education level (non-formal, primary, secondary or tertiary), race (Malay, Chinese, Indian or others), marital status (single, married or others), job scope (manager, dog trainer, dog handler or kennelman), work status (contract, volunteer or permanent) and service duration (years) was collected (refer to Table 1).

Questionnaires

The questionnaire was developed based on information obtained from literature search and discussion with field experts. Validation of the questionnaire's items was carried out based on consensual agreement from eight veterinary experts using the method of Fuzzy Delphi technique where item acceptance was based on the Threshold value ≤0.2. The questionnaire was prepared in both the Malay and English language, to improve compliance in filling up the questionnaire. At times, some of the respondents were assisted, to clarify their understanding of the questions (item).

Each respondent was required to complete three sections, namely Section A, B and C (refer to Table 2, Table 3 and Table 4). Section A evaluated the respondent's knowledge on various aspects of leptospirosis; Section B evaluated the respondent's attitude towards disease prevention and control at the organisation, and Section C evaluated the respondent's hygiene and preventive [the use of Personal Protective Equipment (PPE)] practices.

Data Analysis

Data from both groups of respondents (dog handlers from working dog and dog shelter organisations) were tabulated and analysed descriptively using IBM® SPSS® Version 23 (IBM®, USA). Reliability testing conducted using Cronbach's alpha revealed that a measurement of more than 0.8 indicated a good internal consistency reliability. All the responses to the items in section A were dichotomous and recorded as either Know/Aware/Yes = 1 and Don't know/Not aware/No = 0. Every response to Know was given a score of 1 with a total score of 44. The subcategories for dog handlers' knowledge were further identified as poor, moderate or good based on the scores of 0 - 15, 16 - 30 and 31 - 44 respectively. As for Section B, the dichotomous responses were Yes = 1 and No = 0 with Yes being the correct response and therefore, the total scores were converted to % based on a total score of 8. As for attitude, the dog handlers were subcategorised as poor, moderate or good with scores of 0 - 3, 4 - 6 and 7 – 8, respectively. Similarly, the dichotomous responses in Section C were Yes = 1 and No = 2 with Yes being a correct response, and a 5-point Likert Scale was used for the multiple-choice questions. Every correct response for Yes was given a score of 1 and scores for Likert Scale questions were awarded based on the scale given. The respondents were also grouped into poor, moderate or good with a score range of 0 - 16, 17 - 31 and 32 – 46, respectively.

Table 1. Demographic profile of respondents (dog handlers) from the working dog (n = 100) and dog shelter (n = 38) organisations

Item(s)		Working n (%)	Shelter n (%)
Gender			
	Male	96 (96)	30 (79)
	Female	4 (4)	8 (21)
Age (Years)			
	10-20	0	1 (3)
	20-30	26 (26)	8 (21)
	30-40	48 (48)	25 (66)
	40-50	9 (9)	1 (3)
	50-60	16 (16)	2 (5)
	60-70	1 (1)	1 (3)
Education Level			
	Non-Formal	0	1 (3)
	Primary	2 (2)	0
	Secondary	77(77)	29 (76)
	Tertiary	21(21)	8 (21)
Race			
	Malay	5 (5)	0
	Chinese	5 (5)	9(24)
	Indian	41 (41)	3(8)
	Others	49 (49)	26(68)
Marital Status			
	Single	20 (20)	33 (87)
	Married	75 (75)	51 (3)
	Others	5 (5)	0
Job Scope			
	Manager	16 (16)	8 (20)
	Dog Trainer	18 (18)	0
	Dog Handler	75 (75)	0
	Kennelman	28 (28)	30 (80)
Work Status			
	Contract	0	28 (74)
	Volunteer	0	3 (8)
	Permanent	100 (100)	7 (18)
Service Duration (Years)			
	1-10	49 (49)	36 (95)
	11-20	29 (29)	2 (5)
	21-30	12 (12)	0
	31-40	9 (9)	0
	41-50	1 (1)	0

RESULTS

Dog handlers' demographic information

One hundred and thirty-eight respondents (100 working dog handlers and 38 dog shelter handlers) participated in this survey. The respondents were predominantly males [96% (n = 96) working dog handlers and 79% (n = 30) shelter dog handlers], aged 30 - 40 years old (refer Table 1) and with education background at secondary school level. Most of the working dog handlers consisted of Borneo indigenous ethnic groups 41% (n = 41) whereas the shelter dog handlers included more foreigners (68%, n = 26) [Indonesians (n = 20), Myanmarese (n = 5) and Pakistani (n = 1)]. Most of the working dog handlers were married (75%, n = 76) while the shelter dog handlers were single (87%, n = 33).

In terms of the job scopes of the dog handlers, the majority were dog handlers/trainers (75%, n = 75) at the working dog organisations whereas at the dog shelters, the dog handlers performed the task of kennelman (81%, n = 30) as they took care of the dogs. All the working dog handlers had permanent positions while the shelter dog handlers were on contract basis (74%, n = 28). The majority of the dog handlers had served for a duration of 1 - 10 years at both institutions [working dog (29%; n = 29) and dog shelter (95%; n = 36)]. The full demographical data is shown in Table 1.

Knowledge of leptospirosis

When the working dog handlers were asked whether they knew and were aware of leptospirosis, 62% (n = 62) and 57% (n = 57) of them knew and were aware respectively. Only 8% (n = 3) of the dog shelter handlers knew and were aware of leptospirosis. Eighty nine percent of working dog and 92% of the dog shelter handlers did not have any training on leptospirosis prior to the conduct of the study. Most of the working dog handlers obtained their knowledge from their veterinarians and electronic media, compared to the dog shelter handlers who relied solely on electronic media. Working dog handlers associated leptospirosis with exposure to contaminated soil and water (61%), urine from infected small mammals (55%) and dirty kennels with rat infestation (73%). However, less than 20% of dog handlers from the dog shelters could make these associations. All of them could recall that the disease was due to rat infestation but the majority of the dog handlers did not know that dogs could play a potential role in disease transmission.

Table 2: Knowledge component profiles of the dog handlers from the working dog (n=100) and dog shelter (n=38) organisations

Items	Working n (%)	Shelter n (%)
Do you know about leptospirosis?		
Know	62 (62)	3 (8)
Don't Know	38(38)	35 (92)
Are you aware of leptospirosis?		
Aware	57 (57)	3 (8)
Not Aware	43 (43)	35 (92)
History of leptospirosis training?		
Yes	11 (11)	3 (8)
No	89 (89)	35 (92)
Can dogs get leptospirosis?		
Yes	46 (46.0)	6 (16)
No	54 (54.0)	32 (84)
Source of knowledge		
Experience	17 (17.0)	1 (3.0)
Personal Reading	19 (19.0)	3 (8.0)
Electronic Media	27 (27.0)	4 (11.0)
Superior	18 (18.0)	1 (3.0)
Veterinarian	34 (34.0)	1 (3.0)
Training Session	17 (17.0)	0
Healthcare Promo	15 (15.0)	1 (3.0)
Dog infected with leptospirosis from contaminated environment (soil and water)?		
Know	61 (61)	6 (16)
Don't Know	39 (39)	32 (84)
Dog infected with leptospirosis from direct contact with infected small mammal urine?		
Know	55 (55)	6 (16)
Don't Know	45 (45)	32 (84)
Dog infected with leptospirosis from dirty kennels that attract rat infestation?		
Know	73 (73)	7 (18)
Don't Know	27 (27)	31 (82)
Potential role of dog in transmission of leptospirosis to human?		
Know	48 (48)	6 (16)
Don't Know	52 (52)	32 (84)

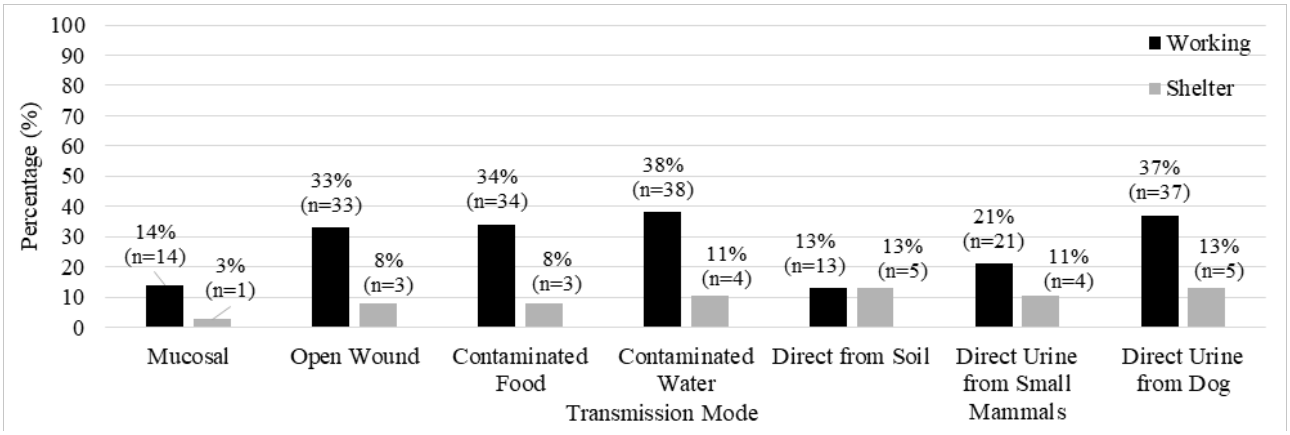

Figure 1. Respondents' knowledge on transmission modes of leptospiral infection [working dogs (n=100) and dog shelter (n=38) organisations]

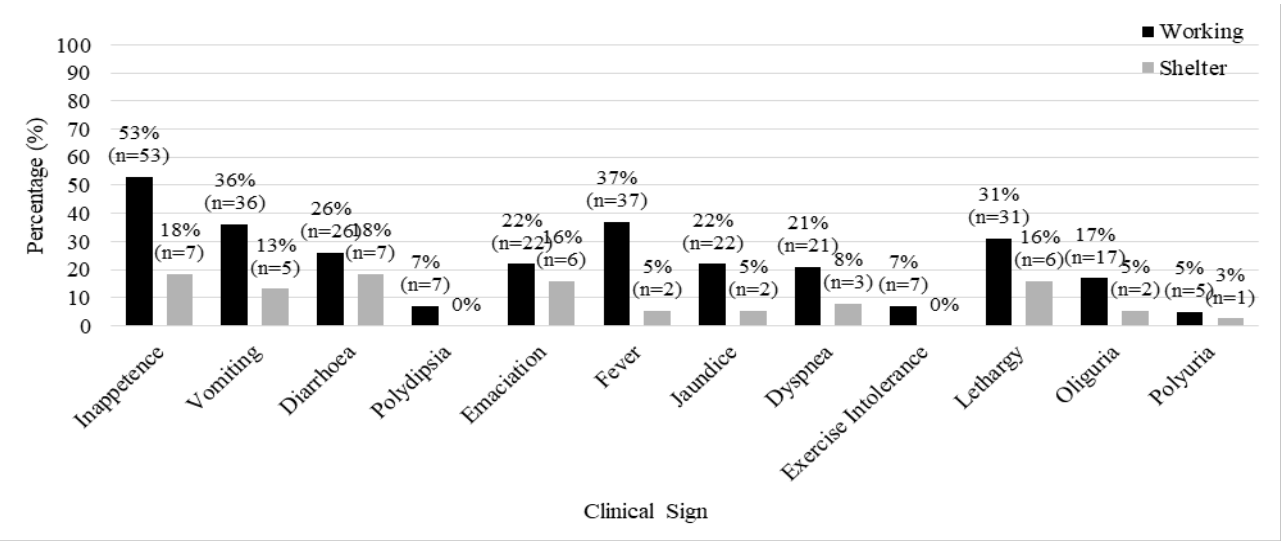

Figure 2. Respondents' ability to recognise the clinical signs of dogs with leptospiral infection [working dogs (n=100) and dog shelter (n=38) organisations]

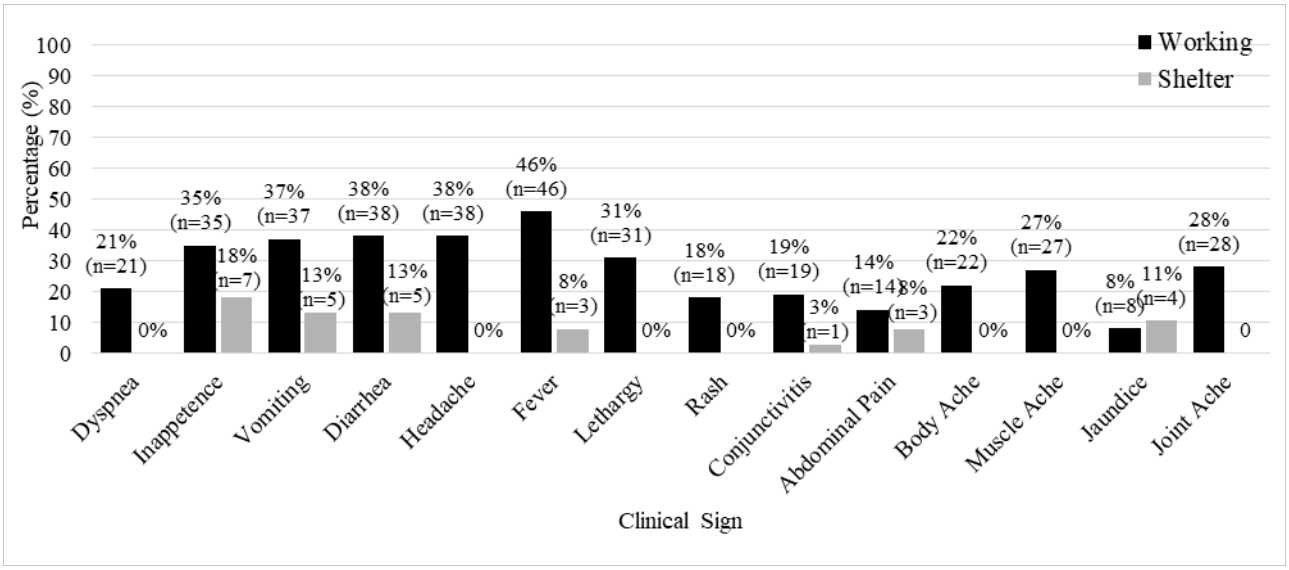

Figure 3. Respondents' ability to recognise the clinical signs of humans with leptospiral infection [working dogs (n=100) and dog shelter (n=38) organisations]

The working dog handlers were able to identify most of the transmission modes and clinical signs for both dogs and humans but the dog shelter handlers fared poorly (refer Table 2). The responses of the dog handler to the items on modes of transmission, dog clinical signs and human clinical signs were as shown in Figure 1 to 3,

respectively. Based on the evaluation, the majority of the dog handlers (58% of working dog and 90% of shelter dog handlers respectively) had poor knowledge on leptospirosis (refer to Table 5).

Attitude towards leptospirosis

The overall descriptive analysis of attitude towards leptospirosis is as shown in Table 3. Working dog handlers knew the importance of knowing the medical history of their dogs (75%) as well as providing annual vaccination (69%) for their dogs but shelter dog handlers thought otherwise. However, working dog handlers thought it was not important to routinely screen their dogs (72%) and themselves (75%) for leptospirosis; or even practice chemoprophylaxis for their dogs (79%) and themselves (86%) if there were suspected outbreaks. All shelter dog handlers responded similarly. Overall, 75% of working dog handlers and all shelter dog handlers had poor attitude when evaluated (refer to Table 5).

Practice regarding leptospirosis prevention

The overall descriptive analysis of practice towards leptospirosis is as shown in Table 4. For hand-washing practices, the majority of the handlers from all the organisations always washed their hands before and

Table 3. Attitude component profiles the dog handlers from the working dog (n = 100) and dog shelter (n = 38) organisations

Item(s)	Working n (%)	Shelter n (%)
Is it important to know your dog's medical history?		
Yes	75 (75)	16 (42)
No	25 (25)	22 (58)
Is it important to conduct routine leptospirosis screening for dogs?		
Yes	28 (28)	2 (5)
No	72 (72)	36 (95)
Is it important to vaccinate your dog?		
Yes	69 (69)	18 (47)
No	31 (31)	20 (53)
Is it important to put your dog on long term prophylaxis?		
Yes	19 (19)	0
No	81 (81)	38 (100)
If dog is positive, is it important to screen the handler for leptospirosis?		
Yes	25 (25)	0
No	75 (75)	38 (100)
If dog is positive, is it important to provide handler with prophylaxis?		
Yes	14 (14)	0
No	86 (86)	38 (100)
If dog is positive, is it important to screen other dogs for leptospirosis?		
Yes	20 (20)	0
No	80 (80)	38 (100)
If dog is positive, is it important to provide other dogs with prophylaxis?		
Yes	21 (21)	0
No	79 (79)	38 (100)

Table 4. Practice component profiles of dog handlers from the working dog (n = 100) and dog shelter (n = 38) organisations

Item(s)	Working n (%)	Shelter n (%)
Were you provided with PPE during your daily occupational work?		
Provided	62 (62)	10 (36.0)
Not Provided	38 (38)	28 (74.0)
Were you trained on the proper usage of PPE?		
Trained	58 (48)	10 (36.0)
Not Trained	42 (42)	28 (74.0)
How often do you use PPE while handling your dogs?		
Always	35 (35)	0
Often	11 (11)	0
Sometimes	30 (30)	5 (13)
Rarely	15 (15)	14 (37)
Never	9 (9)	19 (50)

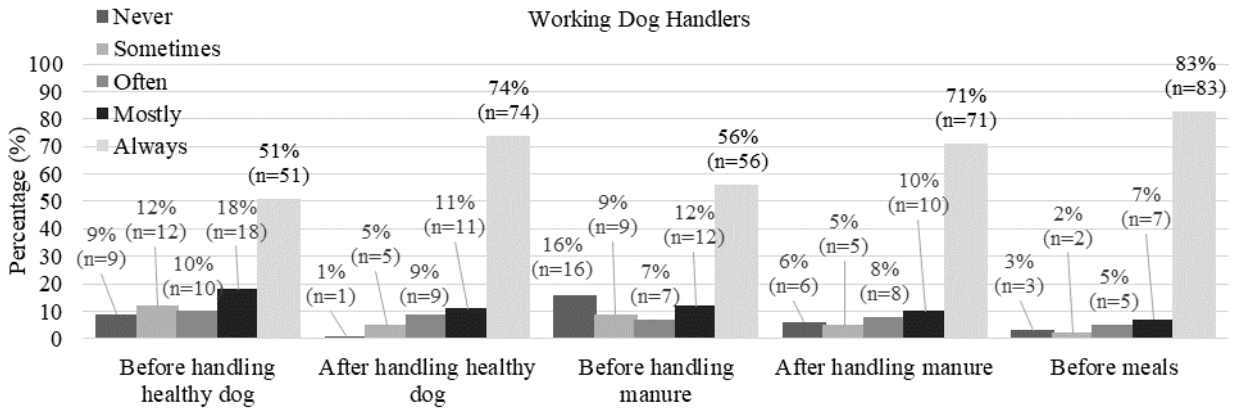

Figure 4. Hand-washing frequency among the working dog handlers (n = 100)

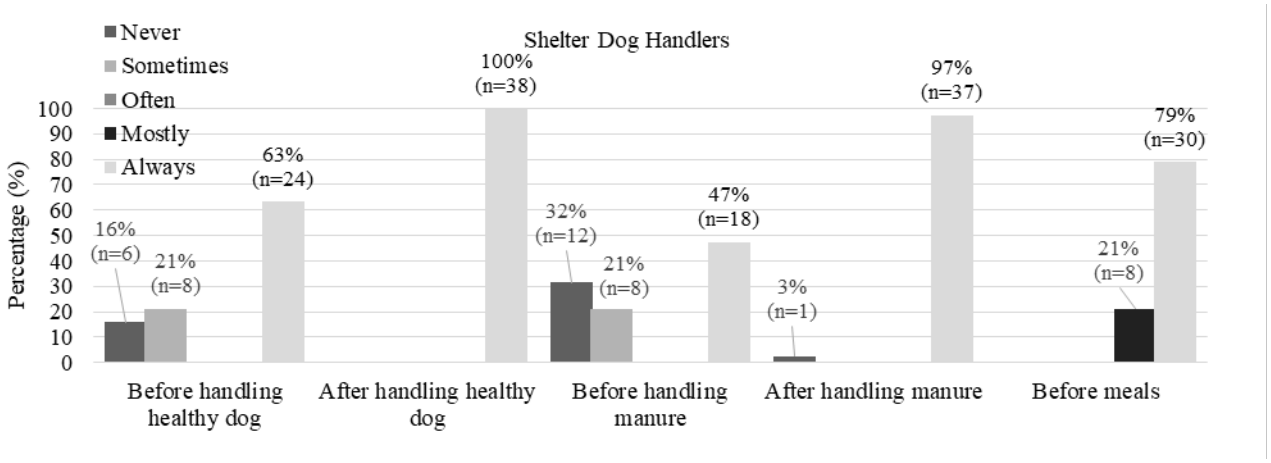

Figure 5: Hand-washing frequency of shelter dog handlers (n = 38)

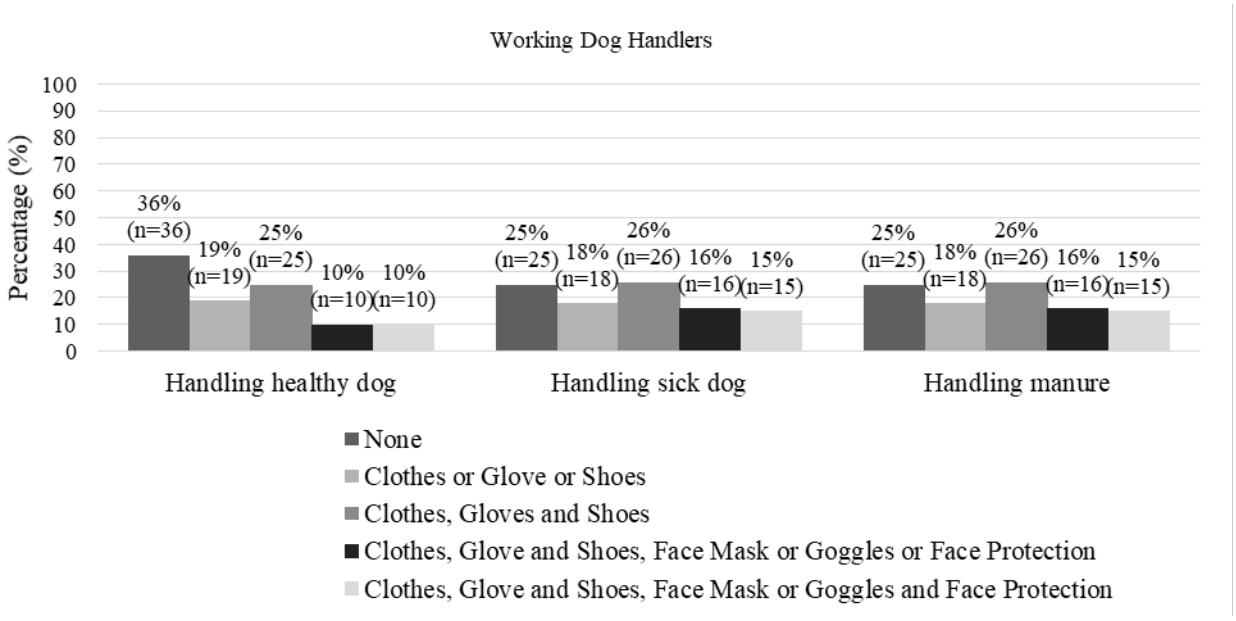

Figure 6. Level of PPE usage of working dog handlers (n = 100)

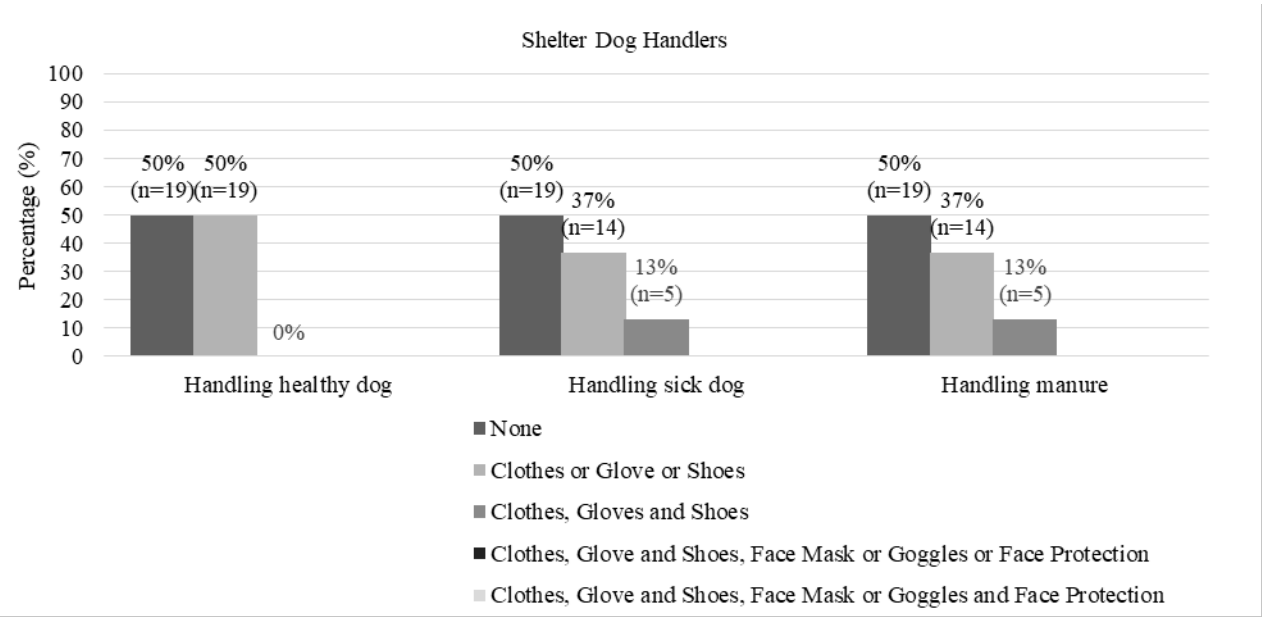

Figure 7. Different level of PPE usage of the shelter dog handlers (n = 38)

after handling dogs and manure as well as before eating (refer to Figure 4 and 5). The working dog handlers (77%) had good practice towards leptospirosis compared to only less than half of the of the dog shelter handlers 47% (n = 18) (refer to Table 5).

The majority of working dog handlers were provided with PPE (62%) and were trained (58%) on how to use them appropriately. The working dog handlers claimed that they always applied the appropriate PPE while handling their dogs. In contrast, 74.0% (n = 28) of the dog shelter handlers were neither provided or were trained on the use of PPE, therefore they rarely and/or never used them while working with dogs. When enquired further on the type of PPE and practices of each organisation, the working dog handlers were provided protective clothes (uniform), gloves and shoes while handling dogs (healthy and sick) and manure (refer to Figure 6). The scenario was different in the dog shelters, where the dog handlers had very poor PPE practice with only boots being provided while carrying out the duties of handling dogs and cleaning of the kennels (refer to Figure 7).

Table 5. The assessment of the knowledge, attitude and practice of dog handlers from the working dog (n = 100) and dog shelter (n = 38) organisations

Item	Working n (%)	Shelter n (%)
Knowledge		
Good (31 - 44)	1 (1)	0 (0)
Moderate (16 - 30)	41 (41)	4 (10)
Poor (0 - 15)	58 (58)	34 (90)
Attitude		
Good (7 - 8)	3 (3)	0 (0)
Moderate (4 - 6)	22 (22)	0 (0)
Poor (0 - 3)	75 (75)	38 (100)
Practice		
Good (32 - 46)	77 (77)	18 (47)
Moderate (17 - 31)	22 (22)	20 (53)
Poor (0 - 16)	1 (1)	0 (0)

DISCUSSION

The role of small mammals and rats has been the main source of disease transmission for a long time (Cook *et al.*, 2017; Dreyfus *et al.*, 2015; Brown *et al.*, 2011; Wright *et al.*, 2008), and recently dogs have become the focus (Jimenez-coello *et al.*, 2010). The risk of leptospirosis has been shown affecting individuals working closely with dogs (Goh *et al.*, 2019; Awosanya *et al.*, 2013). Canine serological prevalence data reported in various countries has shown a wide variation in terms of seroprevalence (7.1-71.1%) and the detected serovars of this zoonotic disease among dogs which indicates its global reach (Habus *et al.*, 2017; Ambily *et al.*, 2013; Oliveira Lavinsky *et al.*, 2012). Locally, dogs (shelter dogs and working dogs) have been shown to have a seroprevalence between 3.1–22.2% (Goh *et al.*, 2019; Lau *et al.*, 2016, 2017; Khor *et al.*, 2016) indicating that these dogs affected by the disease may potentially be involved in the transmission of leptospirosis. In Malaysia, there are groups of occupational individuals working closely with dogs such as dog handlers, veterinarians, dog groomers, dog trainers and many more who may possibly be exposed to the disease daily. Therefore, proper control and preventive measures should be practiced mitigating the risk of leptospiral infection in high risk groups of workers.

Information on knowledge and attitude as well as assessment of the preventive practices related to the risk of leptospirosis are limited based on current knowledge, especially among the working dog handlers. Knowledge, attitude and practice (KAP) questionnaires are found to be a useful tool to allow understanding of the workers' barrier to action and enabling factors that help the target population to adopt recommended preventive actions (Azfar *et al.*, 2018; Prabhu *et al.*, 2014).

In this present study, it was shown that working dog handlers overall had better knowledge and awareness about this zoonotic disease compared to the dog shelter

handlers. The majority of the dog shelter handlers neither knew nor were aware of leptospirosis. This was similar to the findings in Brazil where 90% of the residents in urban slums have not heard of leptospirosis (De Araújo *et al.*, 2013). Similarly, this result was in agreement with two other studies where the municipal workers in Tiruchirapalli, India (Prabhakaran *et al.*, 2014) and Jamaican households (Allwood *et al.*, 2014) both had poor knowledge and awareness of leptospirosis. A local study conducted in 2008 recorded that 87% of the town service workers had never heard of this disease (Rahim *et al.*, 2012).

Electronic media played an important role in providing knowledge for both groups of dog handlers. Similar findings were also noted by Azfar *et al.* (2018) and Rahim *et al.* (2012). Local efforts by the Ministry of Health Malaysia through the usage of digital healthcare promotional items that were made accessible to the general public could have been the reason for improved awareness. Public reminders through radio and television were important to reinforce the impact of this disease with reports in the local news and media. Research has shown that this method of information dissemination has proven effective in improving knowledge (Sukeri *et al.*, 2018). However, the lack of knowledge and awareness of leptospirosis among dog shelter handlers was speculated to be possibly due to the majority of these foreigners not following local news or healthcare agenda even though the electronic media was their main source of information. The level of understanding of the local news may be limited due to the differences in language becoming a barrier. Therefore the responsibility falls onto the management of the shelter to ensure that the required knowledge provided to them are received with proper understanding.

Being a notifiable disease, healthcare education plays an important role in aiding disease control and prevention (Thayaparan *et al.*, 2013). These factors might have contributed to a higher level of knowledge among the working dog handlers but not the dog shelter handlers. In our study, only 58% of working dog handlers and only 90% of dog shelter handlers had a moderate level of knowledge. Our result among dog shelter handlers was similar to findings by Prabhakaran (2014) where in that study, 81% of respondents had poor knowledge and the main reason was likely due to a lower education level (Prabhakaran *et al.*, 2014). Despite having access to information that has been made available, they could not comprehend it. The lack of exposure to digital healthcare in their country of origin also makes it difficult to assimilate this information as they are also working at these dog shelters for a limited time.

Understanding the mode of transmission and having the ability to identify clinical signs in human and dog infection is important as this knowledge indirectly instils awareness, which in turn promotes better preventive practices in curbing the risk of leptospiral infection. The working dog handlers could identify most of the items in those questions correctly but not the dog shelter handlers. Most of the working dog handlers knew that dogs could be infected from various sources such as contaminated environment, infected urine and dirty kennels. The same could not be said for the dog handlers from the dog shelters. Knowledge of clinical signs, symptoms and/or complications is important as treatment at an early stage of the disease may prevent disease progression to a severe stage that may result in poorer prognosis despite treatment. Having the ability to identify the clinical signs of the disease would allow the dog handlers to notify their superior immediately for control and preventive measures to be taken with regards to the spread of the disease within the premise of the organisation. The findings among shelter dog handlers were similarly observed among the town service workers in Kelantan, who were also unable to identify signs of disease (Rahim *et al.*, 2012).

The overall scores for attitude were generally poor in both types of institutions, but the working dog handlers fared better when compared to the dog handlers from the shelters. Similarly, a non-high risk group in Selangor found that only 6% of them had good attitude (Sakinah *et al.*, 2015). It was however different from the study which observed that town service workers had a higher level of attitude (Azfar *et al.*, 2018). The poor attitude seen among the dog handlers in our study was speculated to be likely due to the short duration of service, which could impact perception and failure to comply with certain practices. For example, a proportion of the working dog handlers may follow the instructions given by their superior staff without understanding why practices had to be carried out to protect themselves from risk of infection.

Of the two groups of dogs' handlers, 75% of working dog handlers informed that it was important to know the medical history of their dogs, compared to dog shelter handlers who were uncertain (only 42% of them agreed it was important). This could be due to the availability of veterinary care for the working dogs and the emphasis on medical care that was constantly made by their superiors as a standard operating procedure of the organisations. Healthcare provisions at the working dog organisations were a result of government funding as these organisations were government-based. The opposite scenario was observed for the dogs from the dog shelters as limited amenities for medical care were made available as required and the cost of medical care was a factor. Increased medical costs incurred to a shelter and the cost of managing overpopulated dog shelters were highly dependent on funding provided by the public as they were privately operated and do not have a fixed income.

However, despite all the services made available to dogs in working dog organisations, dog handlers thought that routinely screening their dogs for leptospirosis was not important. The ultimate reason was that the dog handlers confessed that they did not know dogs can succumb to leptospirosis. Despite not knowing that dogs can be infected with leptospirosis, they still knew the importance of vaccinating their dogs as a form of disease prevention which was encouraging. The working dog handlers when enquired also implied the unimportance of providing chemoprophylaxis therapy for both dogs and handlers in the scenario where a dog is infected with leptospirosis. The observation in the study was unlike another study, where those respondents informed that it was important to seek medical advice or veterinary

consultation if they themselves or the dogs had clinical signs (Mohan *et al.*, 2011).

With regards to the preventive practices of leptospirosis, three quarters (77%) of working dog handlers were categorised as having good practice, compared to only 47% of dog shelter handlers. The reason could be that the working dog handlers knew and were aware about human leptospirosis probably due to better understanding of the topic, as all of them had quality formal education. The dog shelter handlers were mainly immigrants from poorer developing countries where the quality of education was poorer despite having similar levels of formal education, which could have hindered their ability to perceive the benefits of a safe working environment and PPE compliance during work, where it became a risk such as seen among workers in North-western Italy (Cediel *et al.*, 2012). A similar situation is seen among male pedicab drivers in Manila, Philippines where only 21% of them had awareness (Lim *et al.*, 2015). A study reporting on the municipal workers in Tiruchirappalli, India disagreed with our study as 64% of them had lower practice scores (Prabhu *et al.*, 2014). In both of these studies, the poor practice was associated with poor knowledge. It was unlike the study on a rural community in Selangor that found that 31% of them had satisfactory practice levels (Nozmi *et al.*, 2018). Another reason for the dog handlers from the dog shelters having poor practice scores could be that they were rarely provided these personnel protective provisions. They were also not trained on the proper way of using it, hence, this may explain why most of them never used PPE while handling the dogs. Another reason for not using PPE was that they did not know the reason for using them. They did not think that the reason the PPE was provided was to prevent exposure to disease, which was also affected by the lack of knowledge among these shelter dog handlers with regards to the source of infection. These findings were almost similar to the study among town service workers (Azfar *et al.*, 2018).

In contrast, the working dog handlers were provided the equipment and were trained on how to use them. The usage of PPE for the working dog handlers were to the level of Clothes, Gloves and Shoes, Face Mask or Goggles or Face Protection, which was a good level compared to none being practiced by the shelter dog handlers. Both groups always practiced hand-washing especially when it comes to handling dogs and manure and before eating. This is evidence that they have at the least basic hygiene practice. This was important to reduce the risk of exposure to leptospirosis from their surroundings which can become a work hazard (Goh *et al.*, 2019; Ridzuan *et al.*, 2016; Rim *et al.*, 2014; Sulong *et al.*, 2011). Another important control and preventive measure that was not asked in the questionnaire was methods of decontamination, which is a basis of disease control. With funding an issue in certain organisations, older and cheap alternatives should be recommended such as quicklime as a disinfectant in these organisations (Grabow *et al.*, 1978; Hall *et al.*, 1915).

CONCLUSION

The poor level of knowledge, attitude and practice of the dog shelter handlers puts them and their dogs at increased risk of infection. The poor knowledge and attitude of working dog handlers could hinder efforts due to the lack of awareness of the importance of controlling and preventing the spread of leptospirosis. This could become a public health risk to both the dog and their handler. This evaluation of dog handlers assists medical and public health personnel in understanding the barriers to action that these individuals face, as well as the factors that govern the adoption and practice of effective preventive measures, thus enabling the development of a focused and well-targeted intervention programme through the identification of poor sections. Implementation of awareness programmes may assist efforts to control and prevent leptospirosis.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest in the present study.

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