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Awareness and control of canine leishmaniosis: A survey among Spanish and French veterinarians

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ABSTRACT

Zoonotic visceral leishmaniasis (ZVL) is a parasitic disease affecting dogs and humans, which is transmitted by female sandflies. Over the last decade, disease prevalence has increased fivefold in parts of southern Europe, where an estimated 2.5 million dogs are infected. This increase is mainly due to an expansion in sandfly distribution due to climate change and to the greater numbers of dogs travelling among European countries. To combat the spread of ZVL in Europe, international guidelines have been drawn up that describe strategies to prevent, control and monitor the disease. To investigate whether these strategies are being implemented in the field, we conducted an online survey among veterinarians in Spain (endemic for ZVL) and France (south: emerging; north: non-endemic). Of the 889 respondents, 459 veterinarians completed all questions. Although 60% of all veterinarians were aware of the current ZVL increase in Europe, 70% were not familiar with any guidelines for controlling the disease. Most of their preventive and treatment actions were, however, in line with intervention strategies recommended by the guidelines. From the veterinarians in this survey, 76% had received no reports regarding confirmed cases of canine leishmaniosis (CanL) or human visceral leishmaniasis in their region or country. The fact that 88% of confirmed cases of clinical CanL were not reported suggests inadequate disease monitoring and evaluation. We therefore recommend that an easy-to-use and accessible international online network be developed, where both veterinarians and physicians can report confirmed cases of leishmaniosis in dogs and humans. This is crucial for monitoring, controlling and preventing the further spread of ZVL in Europe at regional, national and international level.

1. Introduction

Visceral leishmaniasis is a major protozoal disease vectored by female *Phlebotomus* sand flies. In Europe, the protozoan parasite *Leishmania infantum* can cause zoonotic visceral leishmaniasis (ZVL) in both humans and animals, whereby dogs form the main reservoir of infection. (CDC, 2016; Ejov and Dagne, 2014; WHO, 2016a). Between 1998 and 2013, the number of human autochthonous ZVL cases reported each year in southern Europe was around 875 (Alvar et al., 2012; Dujardin et al., 2008). In the last decade, the *L. infantum* prevalence has increased fivefold in several parts of southern Europe, where an estimated 2.5 million dogs are infected with *L. infantum*. These dogs can have clinical disease, i.e. canine leishmaniosis (CanL), or subclinical infection (Dujardin et al., 2008; Moreno and Alvar, 2002; Palatnik-de-Sousa and Day, 2011; WHO, 2016a). CanL is endemic in southern Europe where the sandfly traditionally resides, and not only have the numbers of cases in Mediterranean countries increased over the last decade, the distribution of cases has in this time has also moved northwards into previously non-endemic regions (Arce et al., 2013; Ready, 2010; WHO, 2016b).

This northward spread of ZVL in Europe has been attributed to multiple factors, such as the expansion of sandfly territory in the same direction, which could be produced by global warming (Trájer et al., 2013). This may have led to the expansion of sandflies from the Pyrenees further into France, and from Italy towards Germany, resulting in new environments suitable for *Leishmania* transmission (Ashford, 2000; Dujardin et al., 2008; Maroli et al., 2013). A second explanation for the northward spread of the infection is the increase in the numbers of stray dogs and puppies being adopted from endemic areas and rehomed in non-endemic areas (Otranto et al., 2017). Both the expansion of sandfly territory and the increase in dog relocation have caused CanL to be introduced into non-endemic regions in Europe (Maia and Cardoso, 2015). A third possible explanation for the northward spread is the increase in numbers of dogs being infected with *L. infantum* via other

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transmission routes, i.e. through vertical transmission, sexual intercourse, blood transfusion and direct dog-to-dog transmission, as has been found in parts of northern France where the vector is not currently present (Desjeux, 2004; Maia and Cardoso, 2015; Mattin et al., 2014; Mencke, 2011). The risk of spread of *L. infantum* comes not only from clinically affected dogs recognized as having the disease; a few studies have confirmed that sand flies can also pick up the infection from apparently healthy sub-clinically infected dogs, making them a potentially persistent but invisible reservoir of infection (Laurenti et al., 2013; Ready, 2010).

Since these factors affecting the northwards spread of *L. infantum* are not expected to change in the near future, the prevention and control of infection requires active measures at the organizational level throughout the European Union (EU). Different sets of guidelines for the prevention, control and monitoring of the spread of *L. infantum* in the EU have been created or endorsed by the World Health Organization (WHO), the World Organisation for Animal Health (OIE), Leishvet, the Food and Agriculture Organization (FAO), the European Food Safety Authority (EFSA), and the European Scientific Counsel Companion Animal Parasites (ESCCAP) (Ejov and Dagne, 2014; ESCCAP, 2012; Gervelmeyer, 2015; Leishvet, 2018, OIE, 2008; Oliva et al., 2010). The responsibility for implementing these guidelines lies with veterinary practitioners in the field. Although the different guidelines differ slightly from one another, most of the recommendations focus on: 1) increasing awareness of the presence and risk of human ZVL and CanL; 2) taking preventive measures; 3) detecting and treating cases of disease; and 4) monitoring and evaluating infection. The most favourable – and possibly the only – way of restricting this zoonotic infection from spreading is thought to be through a "One Health" approach where synergism between medical physicians, veterinary practitioners, researchers, public health authorities, and politicians is central (Otranto and Dantas-Torres, 2013; Palatnik-de-Sousa and Day, 2011).

In this study, we conducted an online survey among veterinarians in an endemic (Spain), emerging (south of France), and a non-endemic region (north of France) to assess 1) the level of veterinarians' awareness of the spread of ZVL in Europe; 2) the level of their awareness of international guidelines; and 3) whether the guidelines are being used by veterinarians to control the spread of ZVL.

2. Methods

2.1. Study area and population

Spain was selected as an endemic region for this study because of Spain's long history with ZVL and because of the recent increase in the numbers of cases of ZVL in this country. The south of France was selected as an emerging endemic region, and the north of France as a non-endemic region. The south of Germany was also selected as a non-endemic region, but also as a region at risk due to the recent expansion of sandfly territory towards Germany. The target population were companion animal veterinary practitioners.

2.2. Survey development

An online survey (Supplementary File 1) was developed using LimeSurvey Professional (LimeSurvey, 2015). The survey had 24 questions and was categorized into three main parts. The first part contained general questions; the questions in the second part focused on awareness of the spread of ZVL in humans and dogs in the region and the international guidelines that are available; and the questions in the third part surveyed the protocols used when veterinarians suspected and confirmed ZVL cases. The survey was developed in English and translated into Spanish, French and German by native speakers of the target languages. Since the survey only included closed-ended questions, no translations were required to interpret the survey results.

2.3. Survey distribution

The survey was distributed between June and October 2016 among veterinarians in Spain, France and Germany through various online platforms, including mailing lists, websites, LinkedIn, Facebook groups and online newsletters.

2.4. Data processing

All data were anonymized and aggregated according to several different variables, including country, region and number of confirmed cases. To operationalize numerical variables, written values such as "20-30" were adapted to the average of 25, "approximately 100" was changed to the exact figure of 100 and "more than 50" was changed to 55. All answers that included percentages were removed from the survey if these could not be converted to actual numbers due to the lack of a denominator.

2.5. Statistical analysis

For the statistical analysis, R software (version 3.3.0) was used (R Development Core Team and R Foundation for Statistical Computing Vienna Austria, 2016). To analyse associations between variables with 95% confidence, a descriptive analysis of the data was followed by *t*-tests and chi-squared tests.

3. Results

3.1. General characteristics

Between June and October 2016, 889 individuals accessed the survey. Incomplete surveys were disregarded and all 24 questions were completed by 482 veterinarians (279 from Spain, 114 from the south of France, 66 from the north of France, and 23 from the south of Germany). Due to the low numbers of German veterinarians, only the results from Spanish and French veterinarians were included in the study. In Spain, 40 out of 50 provinces were represented; in France, 71 out of the total 96 departments (Fig. 1A). An overview of the general characteristics of the Spanish and French veterinarians is presented in Table 1.

Veterinarians in Spain confirmed an average of 27.4 CanL cases per year, compared with 6.6 in the south of France and 0.4 in the north of France, a statistically significant difference when comparing the two countries ($p < 0.01$). Fig. 1B presents the geographical distribution of the average number of cases confirmed per veterinarian per year.

Of all veterinarians, 53% worked in an animal practice that covered a mix of both rural and urban areas, while 28% had only clients from urban areas, and 19% only from rural areas. Mixed (rural and urban) animal practitioners confirmed an average of 23.9 CanL cases per year, compared with 13.5 for practices in rural areas only, and 10.8 for practices in urban areas only (no statistically significant difference between rural and urban areas, $t = 0.7627$; $p = 0.4465$). The average duration of work experience was 16.7 years, with no difference between the regions. The distribution was normal for the range 1–30 years but skewed above 30 years.

3.2. Awareness of zoonotic visceral leishmaniasis spread and international guidelines

Of the respondents, 60% indicated that human ZVL is spreading across Europe, and 62% had a similar impression regarding CanL. Veterinarians from the north of France noticed the largest increase in the number of CanL cases among their clients over the past 10 years. Awareness that CanL is involved in the spread of ZVL was significantly more prominent among Spanish (70%) than among the French veterinarians (55%) ($p < 0.01$). Nearly one third of the veterinarians who

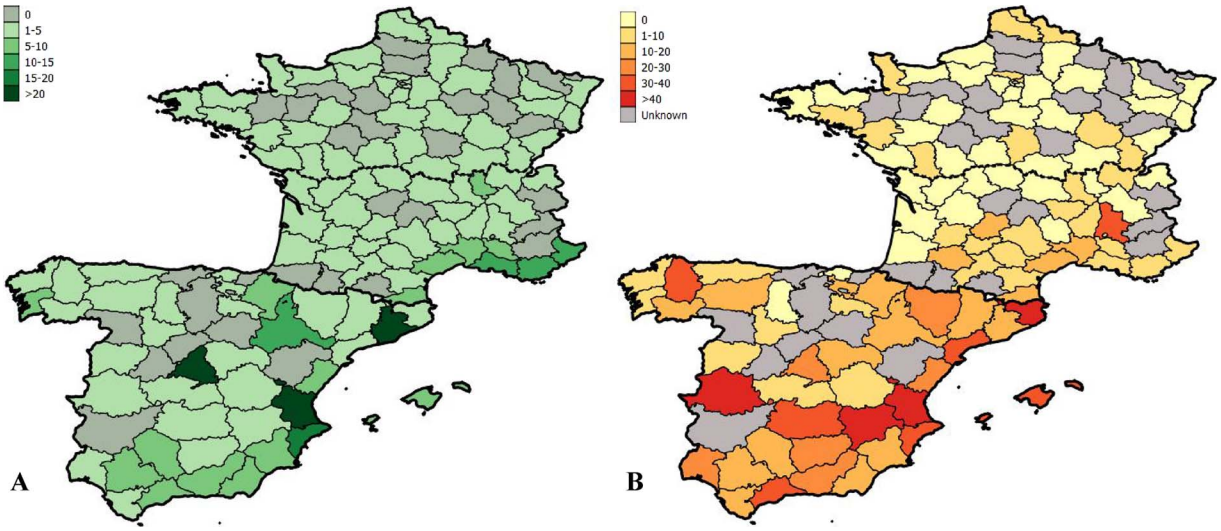

Fig. 1. A. Geographical distribution of the numbers of veterinarians who participated in the survey per province in Spain and per department in France. B. The average number of confirmed cases in the last year per veterinarian per province in Spain and per department in France.
The thicker black lines define the country borders and the dashed black line through the middle of France indicates our division between the north and south of France.

indicated seeing an increase in CanL prevalence did not indicate seeing a concomitant spread in human ZVL.

Three quarters of all veterinarians indicated that they had never received any information about CanL or ZVL cases in their region or country. In Spain, 2% of veterinarians had received reports about both CanL and ZVL, while this figure was 0% in France. The percentage of veterinarians who indicated that they had received reports about confirmed CanL cases in their region differed per region: between 9% in the north and 15% in the South of France to 28% in Spain. An average of 31% of veterinarians reported receiving most of the information about ZVL through scientific journals, conferences and their own research. An average of 75% of veterinarians reported receiving most of their information about CanL through conferences, scientific journals and their university training.

Between 62% (south of France) and 73% (Spain) of the veterinarians indicated not being aware of any guidelines for the control of ZVL in Europe at all (Fig. 2). The ESCCAP guidelines were best known in all regions, while the OIE guidelines were best known in France. There was no correlation between the level of awareness of guidelines and the number of confirmed dogs per year (chi-squared test = 5.875; p = 0.3186).

3.3. Preventive measures

All guidelines emphasize the importance of taking preventive measures to control CanL and human ZVL. Table 2 provides the survey results in terms of such preventive measures taken by veterinarians to control CanL. In Spain, 82% of the veterinarians indicated that they always recommended preventive measures to all their clients with dogs, compared with just 37% in the south of France and 0% in the north of France. However, 88% of veterinarians in the north of France indicated that they did recommend preventive measures for dogs living in an endemic region. Less than one third of the veterinarians indicated recommending preventive measures for dogs travelling to an endemic region during the high-risk season between April and November.

The types of preventive measures that respondents indicated advising the most were as follows: insecticidal repellents and insecticides that can be applied to the dog (88%); vaccination of dogs (45%); and administration of domperidone to increase dogs' immunity (27%). These preventive measures are in accordance with all mentioned international guidelines. In the endemic regions, repellents were recommended in 96% of the cases in Spain and 83% of the cases in the south of France. Domperidone was not frequently recommended in France (1.7% in the south and 1.6% in the north), while in Spain it was recommended to 44% of the dog owners. Leishmania vaccination was recommended by 55% of the Spanish veterinarians, 42% by veterinarians in the south of France, and 10% in the north of France. Reasons that veterinarians in general gave for not recommending preventive measures were that they considered the risk of CanL to be low (82%) or the costs of vaccines too high (18%).

Of the Spanish veterinarians, 64% had no objection to dogs with a confirmed *L. infantum* infection travelling from endemic to non-endemic regions, in contrast with 34% of the French veterinarians. If owners indicated wanting to travel with their dog to an endemic region during the high-risk season (April–November), 83% of all veterinarians provided information about the risks of CanL, including the risks to public health.

3.4. Diagnosing and reporting cases

Table 3 provides an overview of how veterinarians diagnosed and reported cases of CanL per region. In Spain, 93% of the veterinarians indicated having the diagnostic tools available at their practice to test for CanL, which was significantly higher than the figures in the south (71%) and the north of France (20%), a statistically significant difference between Spain and the whole of France ($p < 0.01$). In Spain and the south of France, the number of confirmed cases per year was significantly higher ($p < 0.01$) at veterinary clinics that had diagnostic tests available than at clinics that did not.

In the north of France, this difference was not significant ($t = 0.82293$; $p = 0.4203$). When the average numbers of confirmed cases in each region were compared between veterinarians who did have access to a diagnostic test and those who did not, the ratios were 29.1:3.8 (7.7:1) in Spain, 8.7:1.1 (7.9:1) in the south of France and 0.3:0.5 (0.6:1) in the north of France.

The most frequently mentioned reason for testing dogs for CanL was the presence of clinical signs. If dogs had been adopted from an endemic region to a non-endemic region, veterinarians in Spain recommended testing for CanL in 28% of cases; this figure was 7% for veterinarians in the south of France, and 21% for veterinarians in the north of France. If dogs tested positive for CanL, other dogs from the same household were tested for CanL in 30% of cases in Spain, 17% of cases in the south of France, and 23% of cases in the north of France.

When diagnosing a dog with CanL, an average of 89% of the

Table 1
General characteristics of the surveyed veterinarians, their awareness of the spread of human zoonotic visceral leishmaniasis (ZVL), canine leishmaniosis (CanL), and the guidelines. Results are based on the 459 veterinarians who completed the survey, aggregated at regional level.

	Spain	South of France	North of France	Total
Location of veterinarian	279 (61%)	114 (25%)	66 (14%)	459 (100%)
Average number of dogs suspected with CanL in the past 12 months per veterinarian	45.1	23.6	1.7	33.5
Average number of dogs confirmed with CanL in the past 12 months per veterinarian	27.4	6.6	0.4	18.3
Type of region				
Rural	37 (13%)	33 (29%)	16 (24%)	86 (19%)
Urban	83 (30%)	22 (19%)	23 (35%)	128 (28%)
Mixed	159 (57%)	59 (52%)	27 (41%)	245 (53%)
Average duration of work experience (years)	17.2	16.2	15.2	16.7
Awareness of spread of ZVL in Europe				
Yes	177 (63%)	67 (59%)	33 (50%)	277 (60%)
No	102 (37%)	47 (41%)	33 (50%)	182 (40%)
CanL plays a role in the spread ZVL				
Yes	195 (70%)	61 (54%)	36 (55%)	292 (64%)
No	84 (30%)	53 (46%)	30 (45%)	167 (36%)
CanL cases among clients in the last 10 years				
Increased	155 (56%)	58 (50%)	39 (60%)	252 (55%)
Decreased	41 (15%)	18 (16%)	0 (0%)	59 (13%)
Remained the same	83 (30%)	38 (33%)	27 (40%)	148 (32%)
Awareness of confirmed CanL and/or human ZVL cases				
No	194 (70%)	97 (85%)	60 (91%)	351 (76%)
Only CanL cases	77 (28%)	17 (15%)	6 (9%)	100 (22%)
Only ZVL cases	1 (0%)	0 (0%)	0 (0%)	1 (0%)
About both CanL and ZVL cases	7 (2%)	0 (0%)	0 (0%)	7 (2%)
Information sources CanL and or ZVL (CanL/ZVL)[a]				
Never heard of	(3%/4%)	(4%/24%)	(5%/38%)	(3%/14%)
Other veterinarians	(69%/20%)	(61%/5%)	(52%/11%)	(64%:15%)
Physicians	(8%/28%)	(2%/7%)	(2%/5%)	(6%/19%)
Own research	(69%/37%)	(20%/15%)	(52%/9%)	(61%/28%)
Study	(74%:/29%)	(59%/18%)	(58%/14%)	(68%/24%)
WHO[b]	(19%/28%)	(4%/6%)	(2%/5%)	(13%/19%)
EFSA[b]	(3%/4%)	(0%/0%)	(0%/0%)	(2%/2%)
ESCCAP[b]	(29%/7%)	(22%/4%)	(26%/2%)	(27%/5%)
OIE[b]	(19%/10%)	(16%/2%)	(9%/0%)	(17%/7%)
Media (television, newspaper etc)	(27%/25%)	(10%/9%)	(9%/6%)	(20%/19%)
Mentioned during conferences	(73%/40%)	(67%/23%)	(65%/21%)	(71% 33%)
Mentioned during regular meetings	(51%/14%)	(31%/8%)	(9%/3%)	(40%/11%)
Mentioned in journals	(81%/37%)	(90%/27%)	(90%/30%)	(85%/33%)
Awareness of guidelines[a]				
Not aware of any	205 (73%)	71 (62%)	44 (67%)	320 (70%)
WHO	28 (10%)	24 (21%)	9 (14%)	61 (13%)
EFSA	4 (1%)	2 (2%)	1 (2%)	7 (2%)
ESCCAP	48 (17%)	15 (13%)	14 (21%)	77 (17%)
FAO	5 (2%)	10 (9%)	3 (5%)	18 (4%)
EU	14 (5%)	4 (4%)	3 (5%)	21 (5%)
OIE	15 (5%)	27 (24%)	12 (18%)	54 (12%)
Other	7 (3%)	1 (1%)	1 (2%)	9 (2%)

[a] Percentages do not add up to 100%, because respondents could select multiple options.
[b] WHO: World Health Organization; EFSA: European Food Safety Authority; ESCCAP: European Scientific Counsel Companion Animal Parasites; OIE: World Organization for Animal Health.

veterinarians informed the dog owner that CanL is a zoonosis. The proportion of veterinarians who passed on this information was significantly higher ($p < 0.01$) in Spain (94%) than in France (81% in the south and 82% in the north).

After confirming a case with CanL, 18% of the veterinarians in Spain indicated communicating this to other veterinarians–mostly to colleagues within their own clinic–compared with 4% of veterinarians in the south of France and 0% of veterinarians in the north of France. On average, 88% of the veterinarians indicated not reporting any confirmed CanL case.

4. Discussion

The results of our survey indicate that the majority of veterinarians are not aware of international guidelines on how to control CanL. However, most veterinarians are aware of the spread of the infection in Europe and they appear to be implementing measures similar to those recommended by the guidelines.

The distribution of the numbers of confirmed CanL cases per veterinarian per year indicated by the results of this survey is consistent with the currently recognized distribution of CanL in Europe, with Spain having the highest burden of disease, followed by the south and the north of France, among these countries (WHO, 2016b). The interventions of veterinarians focused largely on preventive measures, such as insect repellents and vaccination. However, if the guidelines change in the future, such changes would likely reach less than 30% of the target population. Also, 76% of all veterinarians indicated that they had never received any reports regarding confirmed CanL and human ZVL cases in their region or country, and 88% indicated they had never reported a CanL case that had been confirmed by them, which implies a distinct lack in the of monitoring and evaluation, which are the key areas covered by the guidelines. There is a significant gap between the data on ZVL and CanL that are publicly available and the actual numbers of cases that are being confirmed by veterinarians.

While equal efforts were put into reaching veterinarians in the three countries included in this study, the response rate from German

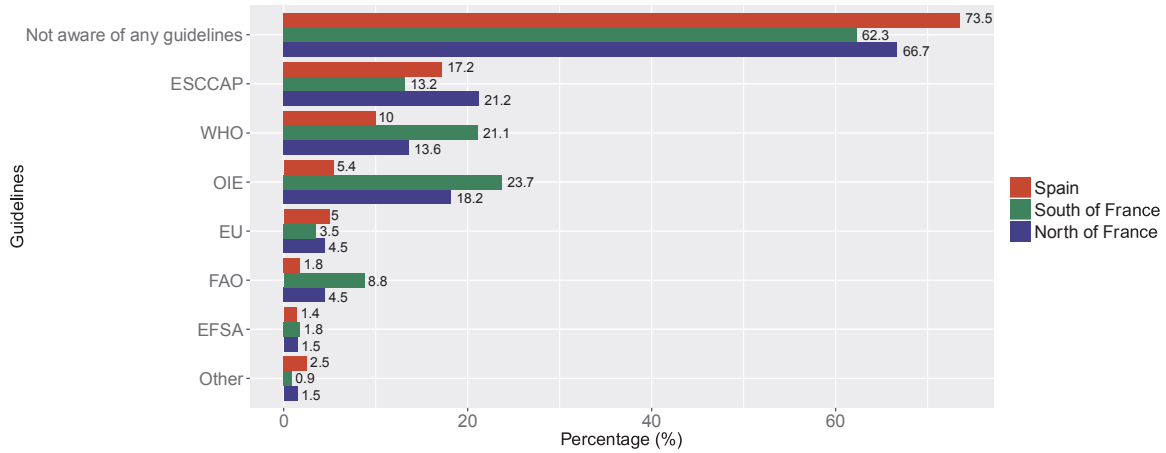

Fig. 2. Percentage of veterinarians that was aware of the different guidelines per country.
Legend: ESCCAP: European Scientific Counsel Companion Animal Parasites; WHO: World Health Organization; OIE: World Organization for Animal Health; EU: European Union; FAO: Food and Agriculture Organization; EFSA: European Food Safety Authority.

veterinarians was extremely low, which suggests that these veterinarians do currently not consider CanL and ZVL a priority. Due to the low number of responses from France, we decided to include their input, but the outcomes may be better considered as a pilot study. The number of CanL cases in France is very low compared with countries like Spain, and most of these cases will be seen in referral practices.

If information about guidelines and cases is reaching only 30% of the veterinarians in Europe based on our study, and these veterinarians are confirming an average of 18.3 CanL cases in the last year, such information will most likely reach even fewer veterinarians in regions where fewer cases are confirmed. The increasing presence of the sandfly in the south of Germany makes it therefore imperative that German veterinarians are made aware of the risk factors and that they are given advice on preventive measures (Mencke, 2011; Naucke et al., 2008). Such provision of information is also needed because of the possibility of dogs with confirmed *L. infantum* infection being imported into non-endemic regions, one of the major risk factors for the spread of infection into northern Europe.

Three similar survey-based studies have previously been carried out on this topic. The aim of the most recent study was to assess the management strategies of CanL by veterinarians in southwestern Europe (Bourdeau et al., 2014); another study assessed the management strategies of CanL-infected dogs in the highly endemic region of Madrid (Gálvez et al., 2011); and the third provided a detailed picture of diagnostics and control practices in the southeast of Spain (Ruiz de Ybáñez et al., 2009). The use of preventive measures was a topic common to all three surveys and the results of our study are comparable with the outcomes of the above-mentioned studies, in that they all concluded that veterinarians in endemic regions are recommending preventive measures to most of their clients. Furthermore, our findings

Table 2
Preventive measures. Results are based on the responses of 459 veterinarians who completed the survey, aggregated at regional level.

	Spain	South of France	North of France	Total
When do you recommend using preventive measures against CanL?[a]				
Never	2 (1%)	2 (2%)	0 (0%)	4 (1%)
If dogs are living in an endemic region	78 (28%)	63 (55%)	58 (88%)	199 (43%)
If dogs travel to an endemic region during high-risk season	70 (25%)	45 (39%)	27 (41%)	142 (31%)
If dogs travel from endemic regions to non-endemic regions	34 (12%)	12 (11%)	5 (76%)	51 (11%)
If dogs move to an endemic region for a longer period	63 (23%)	40 (35%)	32 (48%)	135 (29%)
If dogs have already been diagnosed with CanL	52 (19%)	34 (30%)	20 (30%)	106 (23%)
Always	228 (82%)	42 (37%)	0 (0%)	270 (59%)
Other	3 (1%)	2 (2%)	0 (0%)	5 (1%)
Which measures do you recommend to your clients to prevent sandfly biting and *Leishmania* infection? Please indicate with a percentage.				
Repellents or insecticides applied to the dog	96%	83%	67%	88%
Vaccination	55%	42%	10%	45%
Domperidone	44%	1.7%	1.6%	27%
If you do not recommend any preventive measures it is because:[a]				
You think they are ineffective	3 (8%)	0 (0%)	0 (0%)	3 (5%)
They are too expensive	4 (11%)	3 (21%)	2 (18%)	9 (15%)
You do not know where to get them	0 (0%)	1 (7%)	0 (0%)	1 (2%)
You think the risk of CanL is low	8 (22%)	7 (50%)	9 (82%)	24 (40%)
Other	21 (58%)	3 (21%)	0 (0%)	24 (40%)
Confirmed CanL cases should not be imported from endemic regions into non-endemic regions because of the public health risk.				
Agree	100 (36%)	70 (61%)	43 (65%)	213 (46%)
Disagree	179 (64%)	44 (39%)	23 (35%)	246 (54%)
Do you give information about the public health risk of CanL if the dog owner plans to travel to an endemic region with their dog during high-risk season (April–November)?				
Yes	223 (80%)	94 (82%)	59 (89%)	376 (83%)
No	56 (20%)	20 (18%)	7 (11%)	83 (18%)

[a] Percentages do not add up to 100%, because respondents could select multiple options.

Table 3
Overview of the diagnosis and the reporting of canine leishmaniasis cases. Results are based on the 459 veterinarians who completed the survey, aggregated at regional level.

	Spain	South of France	North of France	Total
Do you have CanL diagnostics available at your clinic?				
Yes	260 (93%)	83 (73%)	13 (20%)	356 (78%)
No	19 (7%)	31 (27%)	53 (80%)	103 (22%)
When do you test dogs for CanL?[a]				
If they have symptoms associated with CanL	247 (89%)	102 (89%)	57 (86%)	406 (88%)
If dogs have been imported from endemic regions to non-endemic regions	78 (28%)	8 (7%)	14 (21%)	100 (22%)
If dogs are being exported to non-endemic regions	34 (12%)	3 (3%)	0 (0%)	37 (8%)
If owners travelled with their dog(s) to an endemic region for a longer period during high-risk season	83 (30%)	19 (17%)	15 (23%)	117 (25%)
If another dog in the household has already tested positive	109 (39%)	53 (47%)	17 (36%)	179 (39%)
Other	100 (36%)	23 (20%)	0 (0%)	123 (29%)
When you diagnose a patient with CanL, do you inform the dog owner that it is a zoonosis?				
Yes	261 (94%)	92 (81%)	54 (82%)	407 (89%)
No	18 (6%)	22 (19%)	12 (18%)	52 (11%)
Do you report a confirmed case of CanL?				
Yes	51 (18%)	4 (4%)	0 (0%)	55 (12%)
No	228 (82%)	110 (96%)	66 (100%)	404 (88%)

[a] Percentages do not add up to 100%, because respondents could select multiple options.

are in line with the findings of Bourdeau et al. (2014), that veterinarians in Spain (98%) and France (89%) are making dog owners aware of the public health risks of CanL and that 80% of the Spanish veterinarians, 82% of the veterinarians in the south of France and 90% in the north of France reported informing dog owners about these risks. The other surveys did not address the veterinarians' awareness of guidelines, whether veterinarians received information from governmental or official organizations about cases in their region, or if veterinarians reported confirmed cases.

While the veterinarians who participated in the current survey cannot be considered as representative of all veterinarians in Spain and France due to voluntary response bias, they are likely to be more aware of ZVL in general. We are therefore almost certainly presenting an overestimation of the awareness of guidelines, of the information that veterinarians receive about cases, and of the percentage of veterinarians who are informing others about confirmed cases. Nevertheless, the relatively large number of respondents, combined with their wide geographical distribution and wide range in annually confirmed cases, allowed us to interpret the data and compare variables between the regions. We emphasize, however, that our numbers still represent a very small percentage (approximately 1%) of all registered veterinarians in both countries (EBVS, 2017a, 2017b).

Since dogs are the main reservoir of ZVL in Europe, this study focused on the awareness and implementation of guidelines by veterinarians. Future studies could build on this by assessing the awareness and implementation of guidelines by general practitioners in the same regions. Further explorations could focus on the implementation of a One Health approach since such collaboration between the two professions has been suggested to be a crucial aspect for controlling ZVL in both humans and animals.

5. Conclusion

The creation of an easy-to-use online network where both veterinarians and physicians can report the presence of confirmed ZVL cases may be recommended. An example of such an online network that is successfully being used in the USA is PetWare. Such a network in Europe is crucial for monitoring, controlling and preventing the further spread of zoonotic visceral leishmaniasis at the regional, national and international level.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.vetpar.2018.01.013.

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