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Basic knowledge about visceral leishmaniasis before and after educational intervention among primary health care professionals in Midwestern Brazil

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ABSTRACT

Health education and training of primary health care (PHC) professionals are highly recommended to reduce the occurrence and lethality of visceral leishmaniasis (VL). This study assessed the impact of an educational intervention on the basic knowledge about visceral leishmaniasis (VL) among PHC professionals from the Brazilian municipality of Rondonopolis, an important endemic area for VL. Responses provided by physicians, nurses, nursing technicians and community health agents from 12 PHC facilities were recorded through the application of self-completed and semi-structured questionnaires before (n=92) and after (n=64) an in-person health training course covering various aspects of VL. Closed- and open-ended responses were compared by the chi-square test and analyses of word clouds, respectively. The proportion of professionals aware of the correct etiological agent (p<0.001) and transmission route (p<0.001) of VL increased post-intervention. In addition, they increased their ability to recognize fever (p<0.001), weakness (p<0.001), weight loss (p<0.001), pallor (p<0.001) and abdominal distention (p=0.013) as clinical manifestations of human VL, and weakness (p<0.001), alopecia (p<0.001) and weight loss (p=0.019) as signs of canine VL. Analyses of word clouds suggested that the participants became more aware of the role of dogs in VL transmission and the role of environmental management in the prevention of VL. In conclusion, the intervention positively impacted the baseline knowledge concerning VL among the professionals. This can support the planning of educational activities for the PHC team regarding early case detection, prevention and control of VL in endemic areas.

KEYWORDS: Kala Azar. Awareness. Health education. Primary health care. Family health strategy. Visceral leishmaniasis.

In Brazil, visceral leishmaniasis (VL) is a severe and complex zoonotic disease, whose control is guided by the VL Surveillance and Control Program (VLSCP). In brief, the VLSCP recommends the identification and treatment of human cases, vector monitoring and control, and screening and euthanasia of infected dogs. These measures should be performed by integrating all levels of the national public health care system[1]. Primary health care (PHC) centers at the community level play a crucial role in the screening and referral of clinically suspected cases, identification of transmission sites and promotion of community engagement on preventive and control activities, among other tasks[2].

Nonetheless, according to Romero[3], some Brazilian PHC professionals are unable to promptly recognize the clinical syndrome of VL. In addition, some

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investigations conducted nationwide among these individuals have demonstrated conceptual gaps regarding VL[4] and unawareness regarding flows and protocols to attend patients[5]. This lack of knowledge seems to contribute to the current worrisome situation of VL in the country. Approximately 3,500 new human cases are annually reported nationwide, and 8.1% of these patients die from the disease[6]. Health education and training of local PHC professionals on various aspects of VL have been recommended by the World Health Organization (WHO) as useful tools to reduce the occurrence and lethality of VL[2]. However, studies addressing this topic are limited in Brazil.

The municipality of Rondonópolis, located in Mato Grosso State, Midwestern Brazil, emerged as an important endemic area for both, human and canine VL in the 2000s. From 2001 to 2016, the municipality reported 212 autochthonous cases of human VL, representing almost 50% of the total cases observed within the State[7]. Recently, our research team has identified high lethality rates of human VL[8] and a long period of time between the onset of VL symptoms and the diagnosis of the disease in Rondonopolis[9]. Moreover, the local seroprevalence of canine VL was estimated at 19.2%[10] and dog owners have demonstrated limited knowledge, attitudes and practices concerning the disease[11]. Therefore, this study aimed (i) to assess the basic knowledge of PHC professionals about elementary clinical and epidemiological concepts of VL in the municipality of Rondonopolis, and (ii) to evaluate the impact of a health training course on this knowledge.

In 2018, Rondonopolis comprised 222,316 inhabitants. The local PHC at the community level had 37 basic care units, most of which were based on the Family Health Strategy (Estrategia de Saude da Familia - ESF). The ESF is a national program focused on prevention, promotion and person-centred health care. Within the ESF, health assistance is provided at both PHC facilities and at the patient's home through integrated efforts of a multidisciplinary team that includes a physician, a nurse, nursing technicians and community health agents[12].

We performed a quasi-experimental study (i.e., one group evaluated pre- and post-intervention) between August 2017 and February 2018 among professionals of the ESF team in Rondonopolis. The participants were recruited from 12 PHC facilities located in different neighbourhoods covered by the ESF. Ten of these neighbourhoods were chosen based on the occurrence of human VL cases in the five years prior to the study (2012-2016). All professionals of the ESF team who provided written consent and attended at least the first study recruitment were included.

We based our investigation on basic concepts of VL, given the diversity of educational levels within the ESF team. The knowledge of the professionals was first assessed using an anonymous, self-completed, and semi-structured questionnaire (pre-intervention). This questionnaire was developed using simple language, easily understandable terms and the following basic concepts of the disease: etiological agent, transmission route, clinical manifestations of human and canine VL, role of dogs in the transmission of VL and preventive measures. The latter two questions were open-ended, whereas the remaining were closed-ended with multiple choice.

After administering the questionnaires, a four-hour standardized health training course was designed based on the WHO's recommendations[2], covering the following topics of VL: history; epidemiology at the national and local levels; vector transmission; early clinical manifestations; VL/HIV coinfection; diagnosis, treatment and management/flows in the PHC; canine VL; control and prevention. The course was given by the research team approximately three months after the application of the pre-intervention questionnaire. We used lectures, slides projection, group discussion, examination of insect specimens, and educational quizzes during the educational course. Immediately after the intervention, we asked the participants to complete the same questionnaire once again (post-intervention).

Data were doubly entered and checked in Microsoft Office Excel 2013 (Microsoft Corp., Santa Rosa, CA, USA). We determined the absolute and relative frequencies of the answers provided to closed-ended questions. Answers to open-ended questions were organized in distinct word clouds using the IRAMUTEQ software, version 0.7 (LERASS, Universite de Toulouse, Toulouse, France). The word clouds were translated into English. Our main hypothesis was that PHC professionals were not fully aware of basic concepts about VL and that a health training intervention would fill these gaps. Thus, we employed the chi-square test or the Fisher's exact test to compare the proportions of answers pre- and post-intervention. Differences with p-values < 0.05 were considered significant. In addition, the patterns of open-ended responses provided pre- and post-intervention were compared considering the frequency of terms between word clouds. Statistical analyses were performed using the BioEstat software, version 5.3 (Instituto Mamiraua, Tefe, Brazil).

Ethical approval was obtained from the Ethical Committee for Human Research of the Federal University of Rondonopolis (CAAE Nº 72615417.0.0000.8088). Informed consent was obtained from all participants.

Ninety-two and 64 individuals were enrolled in the pre- and post-intervention stages, respectively. Both groups were statistically similar in terms of the participant's role in

the ESF team, time spent working at the PHC facility and previous contact with human patients with VL. There was a predominance of community health agents, individuals working at the facility for >60 months, and professionals with previous contact with VL patients (Table 1).

Although we detected a high proportion of professionals unaware of the correct etiological agent and transmission route of VL in the pre-intervention phase, most of them reported that VL is caused by a protozoan (56.6%) and is transmitted through the bite of sand flies (66.3%) (Table 1). Most of the participants have also reported knowing the clinical manifestations of human (91.3%) and of canine (92.4%) VL. The signs of human VL were named at lower frequencies than the signs of canine VL. Abdominal distension (68.5%), prolonged fever (53.3%) and weakness (50.0%) were the most cited clinical features of human VL. Skin lesions, a presentation of cutaneous leishmaniasis, were also named by more than a third of the participants (37.0%) as a sign of human VL (Figure 1A). For the canine disease, onychogryphosis (84.8%), weight loss (80.4%) and skin lesions (71.7%) were more frequently cited as clinical manifestations (Figure 1B).

A majority (75.0%) of the PHC professionals reported knowing the role of dogs in the transmission of human VL before the intervention (data not shown). Among the answers provided, the terms "mosquito" and "host" were mentioned with high frequency (Figure 2A). Regarding preventive measures against VL, 80.4% of the participants mentioned at least one measure (data not shown). The words "backyard", "mosquito", "leave", "cleanliness" and "garbage" prevailed among the answers. Few and sparse mentions on the management of canine reservoirs were recorded (Figure 2B).

After the intervention, we observed a significant increase in the proportion of participants that were aware of the correct etiological agent ($p<0.001$) and transmission route ($p<0.001$) of VL (Table 1). In addition, they were significantly better able to recognize early

Table 1 - Distribution of primary health care (PHC) professionals pre- and post-intervention according to the overall characteristics and the knowledge about the etiological agent and the transmission route of visceral leishmaniasis (VL). Rondonopolis, Mato Grosso State, Brazil (2017-2018).

Variable	Pre-intervention (n=92)		Post-intervention (n=64)		*p*-value
	n	%	n	%	
Role in the PHC facility					
Community health agent	59	64.1	45	70.3	0.296
Nursing technician	18	19.6	14	21.9	
Nurse/ physician[a]	15	16.3	5	7.8	
Time spent working at the PHC facility (months)					
< 12	15	18.5	7	11.3	0.488
12 – 60	14	17.3	11	17.7	
> 60	52	64.2	44	71.0	
Did not answer	11	-	2	-	
Previous contact with human patients with VL					
Yes	47	52.2	37	57.8	0.492
No	43	47.8	27	42.2	
Did not answer	2	-	0	-	
Etiological agent					
Protozoan	47	56.6	64	100.0	< 0.001*
Viruses / Bacteria / Not known	36	43.4	0	0.0	
Did not answer	9	-	0	-	
Transmission route					
Bite of sand flies	57	66.3	62	100.0	< 0.001*
Bite of *Aedes aegypti* / Direct contact with dogs	29	33.7	0	0.0	
Did not answer	6	-	2	-	

[a]Four and one physicians were enrolled in the pre- and post-intervention phases, respectively; *Significant differences when *p*-value < 0.05.

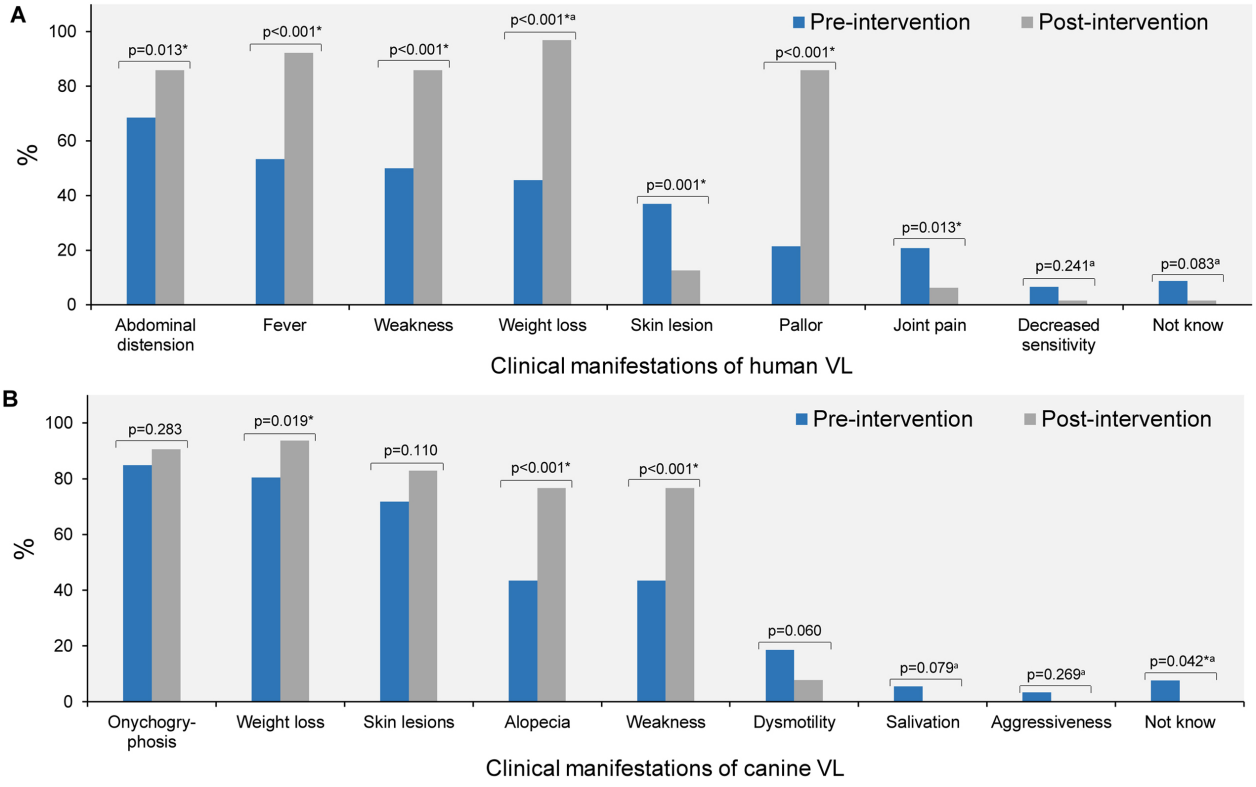

Figure 1 - Grouped barplots showing the percentual distribution of responses provided pre- and post-intervention by primary health care professionals for questions related to the clinical manifestations of human (A) and canine (B) visceral leishmaniasis (VL). Rondonopolis, Mato Grosso State, Brazil (2017-2018). ªFisher exact test; *Significant differences when *p*-value < 0.05.

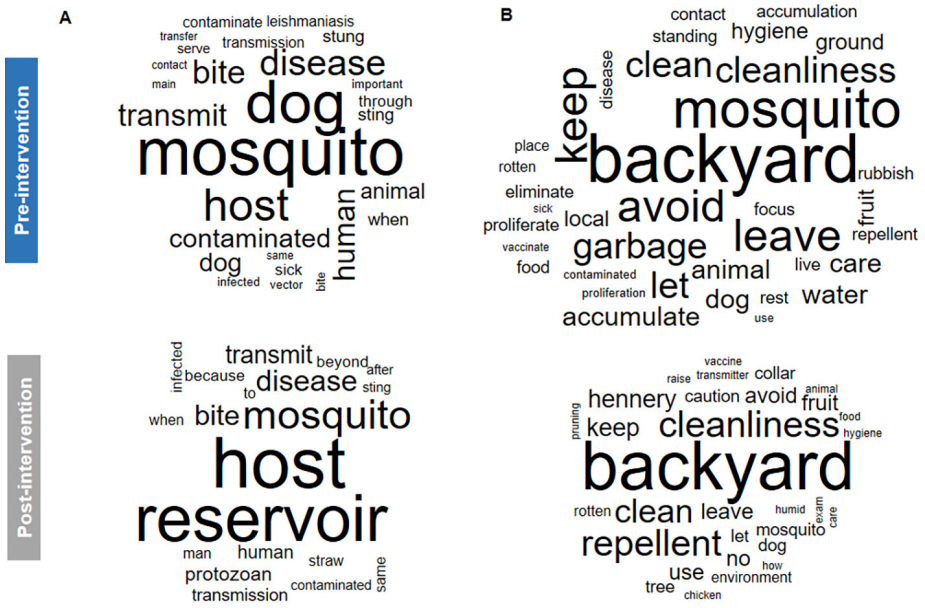

Figure 2 - Word clouds elaborated from the provided open-ended responses pre- and post-intervention by primary health care professionals for questions related to the role of dogs in the transmission of visceral leishmaniasis (A) and to the control and preventive measures for the disease (B). Rondonopolis, Mato Grosso State, Brazil (2017-2018).

signs of human VL, such as fever (p<0.001), weakness (p<0.001), weight loss (p<0.001) and pallor (p<0.001). There was also a significant decrease in the proportion of individuals reporting atypical manifestations of the classic VL syndrome, such as skin lesions (p=0.001) and joint pain (p=0.013) (Figure 1A). We observed an increase in the proportion of professionals that were aware of the manifestations of canine VL (p=0.042). They were better

able to recognise weight loss (p=0.019), alopecia (p<0.001) and weakness (p<0.001) as clinical sings of the canine disease (Figure 1B).

The comparison of the word clouds from pre- and post-intervention stages demonstrated the emergence of the term "reservoir" in the responses regarding the role of dogs in VL transmission, as well as the maintenance of the terms "host" and "mosquito". The use of the technical term "sand fly" in reference to the vector was missing in both stages (Figure 2A). Given the VL prevention, in addition to the permanence of some terms previously mentioned with high frequencies ("backyard", "mosquito", "leave", "cleanliness"), the substantial increase in references to the word "repellent" and the emergence of "hennery" and "collar" (Figure 2B) are noteworthy.

This study identified misconceptions regarding basic clinical and epidemiological topics on VL among PHC professionals from the municipality of Rondonopolis, which was consistent with previous investigations conducted in Brazil[4] and abroad[13]. In contrast with other studies, we performed a health training intervention, which has positively influenced the basic knowledge on VL.

The identified conceptual gaps in the previous knowledge regarding VL may be related to the heterogeneity of the ESF team, which includes professionals with a wide range of educational levels, from elementary education (community health agents) to college (at least, nurses and physicians). In addition, other diseases that require PHC support are highly endemic in the area, such as dengue, leprosy and cutaneous leishmaniasis[14,15]. Although not desirable, these other diseases are likely to be conceptually confused with VL[16]. It should also be considered that Rondonopolis has experienced a decreasing incidence of human VL from 2012 onwards[8], which has consequently limited the frequent exposure to the disease during routine work at the PHC facilities; this has also led to a decrease in the training programs focused on the disease.

We considered the proportion of professionals that were previously aware of the actual early clinical manifestations of human VL to be relatively low. Abdominal distension was the most mentioned sign, but this is a late sign of the disease[8]. Despite the initial VL being classically notable by a prolonged febrile syndrome[1], fever was less mentioned than abdominal distension. This was probably because the latter is extensively used to illustrate the clinical picture of the disease in educational materials. These findings indicate a major concern, as they suggest that the local PHC may be unable to suspect the disease promptly. Indeed, it was already reported that VL patients in Rondonopolis mainly sought PHC facilities at the onset of symptoms, but they had to visit additional health services until the diagnosis was confirmed[9].

On the other hand, a high proportion of participants was able to recognize the clinical signs of canine VL. This was expected given the large contingent of infected dogs within the municipality[10] with apparent signs of the disease[17]. Although Rondonopolis is highly burdened by canine VL, the concept of dogs as reservoirs in the VL transmission cycle did not seem to be entirely clear to the participants. Most of them considered dogs as hosts only. This response pattern can be explained by the complexity underlying the urban cycles of zoonotic VL, where dogs are both, reservoirs and hosts[2]. Nonetheless, we are not sure whether the meanings of the terms "reservoirs" and "hosts" were previously clear to the participants.

Control and preventive measures focused on canine reservoirs were reported at very low frequencies by the professionals enrolled in the pre-intervention phase. Despite representing the main pillar of the VLSCP, the screening and euthanasia of infected dogs have low public acceptance and questionable effectiveness[18], possibly justifying the low number of responses mentioning it. The participants mainly pointed out preventive measures focused on environmental management, which is of paramount relevance to reduce sand fly populations[1]. This is highly desirable in Rondonopolis, since previous studies have suggested the association of both human[19] and canine[17] VL with precarious environmental conditions.

The positive impact of health training on the basic knowledge of PHC professionals on VL was already demonstrated in India[13]. In our study, the individuals became more aware of the early more frequent clinical signs of human VL. Thus, it is expected that they could work better toward the reduction of VL lethality rates by actively detecting cases within the community, and promptly recognizing the disease among patients with suspected disease who attended the PHC facility[2]. We also noticed an enhancement on the knowledge of VL transmission. After the training, participants apparently recognized VL as a vector-borne disease that has dogs as reservoirs and hosts. According to Carmo *et al.*[16], the awareness of health professionals regarding the VL transmission chain is important, so that they can act in the territory in a more effective and sustainable way. Indeed, more preventive measures focused on dogs and vectors were more frequently provided after the intervention. This improvement may impact the occurrence of VL through the dissemination of correct preventive knowledge, better engagement of the population and integration of the ESF team with the control activities performed by endemic disease control agents within the community.

This study has some limitations. Firstly, data were analyzed without considering the dependence between

observations or pairing, as data collection was anonymous. Secondly, unbalanced groups were compared because some professionals enrolled in the pre-intervention phase were on vacation when the health training was performed. In addition, few physicians consented to participate in the study, which may have biased the results towards a low previous knowledge in the pre-intervention phase. Thus, further studies are recommended to fill these gaps and confirm the results. They can explore in more detail the impact of educational interventions within and between different professions that make up the ESF team. In addition, different outcomes for assessing the impact of the intervention could be considered, such as attitudes and practices regarding the disease and operational indicators (number of suspected cases detected, number of dogs screened for canine VL in the community, among others).

Despite these limitations, we demonstrated an increase in the knowledge and empowerment of the ESF team regarding VL in the studied area. This may be useful for the planning of policies focused on continuous educational activities for PHC professionals regarding early case detection, prevention and control of the disease in endemic areas nationwide. In addition to preventing VL, it is expected that health training will indirectly support the reduction of the occurrence of other diseases that share a similar epidemiological context, such as dengue and leptospirosis[16]. Although the Brazilian Ministry of Health has offered a free online course aimed at VL for PHC professionals[20], we strongly encourage local public health managers to provide additional ongoing face-to-face training, which has already proved to be more effective[21]. Given the role of education in controlling the disease[2], it should be one of the priorities in order to achieve an efficient control of VL.

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AUTHORS' CONTRIBUTIONS

AGC and JGGL conceived the study; AGC and JGGL designed the study protocol; AGC, IA, LMB, LBS, LSC, and JGGL carried out the data collection; AGC, IA, LMB, and JGGL analyzed the data; AGC drafted the manuscript; IA, LMB, LSC, and JGGL critically revised the manuscript for intellectual content. All authors read and approved the final manuscript.

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