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https://doi.org/10.22239/2317-269x.01090

Revista Visa em debate
sociedade, ciência & tecnologia

Domestic response to intervention based on health recommendations on the environment and dogs in a locality with transmission of visceral leishmaniosis (Pto. Iguazú, Argentina, 2014-2016)

Respuesta doméstica a las recomendaciones sanitarias de intervención sobre ambiente y perros en una localidad con transmisión de leishmaniasis visceral (Pto. Iguazú, Argentina, 2014-2016)

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Received: Nov 24, 2017
Approved: Jun 29, 2018

ABSTRACT

Introduction: Visceral leishmaniasis (VL) is an emerging parasitic disease in Argentina. In Puerto Iguazú, border with Brazil and Paraguay, vector and canine cases were registered in 2010; and in 2014 and 2015 there were two human cases. **Objective:** The objective of this article is to analyze changes at the micro-scale level after informing the cohabitants of the diagnosis of canine LV (CVL), letting them know the environmental management strategies to reduce contact with the vector. **Method:** It is a descriptive research, which investigated in two moments (2014 and 2016) a non-probabilistic sample distributed based on the criterion of the best scenario for the presence of the vector (n = 55). Sampling points with the presence of vectors and at least one dog with CVL (n = 6/55) were selected, after a first entomological and veterinary diagnosis raking. **Results:** A single household implemented the suggested modifications. The changes were not enough to control the transmission. The hypothesis is that the control measures require intervention at a meso-scale (the neighborhood instead of the home), taking into account the real radius of vector dispersion. **Conclusions:** The risk of human infection due to VL is related to the way of life, inclDUing interspecies relationships. The human-dog relationships combine speciesism and post-humanism, which limits the effectiveness of "responsible ownership" as model of a healthy bond.

KEYWORDS: Leishmaniasis; Interdisciplinary Research; Health Evaluation

RESUMO

Introducción: La leishmaniasis visceral (LV) es una enfermedad parasitaria emergente en Argentina. En Puerto Iguazú, frontera con Brasil y Paraguay, en 2010 se registró presencia del vector y casos caninos; y en 2014-2015 dos casos humanos. **Objetivo:** Este artículo tiene como objetivo analizar los cambios en el nivel micro escala después de dar a conocer a los convivientes el diagnóstico de LV canina (CVL), informándoles estrategias de manejo ambiental para reducir el contacto con el vector. **Método:** Es una investigación descriptiva, que indagó en dos momentos (2014 y 2016) una muestra no probabilística distribuida en base al criterio de mejor escenario para la presencia del vector (n = 55) en la que se seleccionaron, luego de un primer rastrillaje entomológico y de diagnóstico veterinario, puntos de muestreo con presencia de vectores y al menos un perro con CVL (n = 6/55). **Resultados:** Un único hogar implementó las modificaciones sugeridas. Esos cambios no resultaron suficientes para controlar la transmisión. La hipótesis es que las medidas de control requieren intervención a meso escala (el vecindario y no el domicilio), atendiendo al radio real de dispersión de vectores. **Conclusiones:** El riesgo de infección humana por LV se relaciona con el modo de vida, incluyendo las relaciones interespecie. Las relaciones humano-perro combinan especismo y poshumanismo, acotando la efectividad de la "tenencia responsable" como modelo de vínculo salDUable.

PALAVRAS-CHAVE: Leishmaniasis; Investigación Interdisciplinaria; Evaluación en SalDU

INTRODUCTION

Visceral leishmaniasis is a parasitic disease caused by Leishmania infantum, with approximately 200,000 to 400,000 new human cases per year in the world[1]. In humans, with clinical manifestations, represents a lethality greater than 90% if it is not treated and in America, even with treatment, the average lethality is 7.7[2]. In its American transmission cycle, a *phlebotominae* insect, *Lutzomyia longipalpis*, intervene as the most frequent vector, and in an animal reservoir, which in the urban environment is the dog, can present clinically symptomatic or unapparent infections. En Argentina, el vector urbanizado se registró por primera vez en 2004, y el primer caso humano en 2006[3]. En la localidad de Puerto Iguazú (82.849 habitantes INDEC 2010), fronteriza con Brasil (a 16 km de Foz do Iguaçú) y Paraguay (a 28 km de Ciudad del Este) el vector y los primeros casos caninos se registran en el año 2010[4,5], hasta la fecha se notificaron dos casos humanos en 2014 y 2015[2]. In Argentina, the urbanized vector was registered for the first time in 2004, and the first human case in 2006[3]. In the town of Puerto Iguazú (82.849 inhabitants INDEC 2010), border with Brazil (16 km from Foz do Iguaçú) and Paraguay (28 km from Ciudad del Este) the vector and the first canine cases are recorded in 2010[4,5], to date two human cases were reported in 2014 and 2015[2].

The objective of this article is to analyze in a micro spatial scale the changes in the human-dog relationship, after sixteen months of continuous evaluation of the risk of visceral leishmaniasis transmission, to inform the cohabitants of the positive diagnosis of Canine Visceral Leishmaniasis (CVL), and also to inform about environmental management strategies in order to reduce the risk of transmission to human and non-human cohabitants, with practices that affect potential breeding environments of the vector and about the reservoir-vector contact.

Within the framework of this research, a definition of the environment[6] was applied as a natural space of interactions between species, where the variables and socio-environmental actors involved in the emergence and dispersion are differentiated according to the scale of analysis, whether this micro scale (the domestic unit for the social researcher and point of sampling of vectors and reservoirs in biological samples), mesoscale (the neighborhood for the social researcher and the surface unit of 400 x 400 m in entomological samples), or macro scale (the city or the regional circulation in the province and on the international border with Brazil and Paraguay).

The research presented in this article is part of the IDRC project #107577- 001, interdisciplinary study of the emergence and dispersion of Visceral Leishmaniasis (VL) and Cutaneous Leishmaniasis (CL) in the triple border of Argentina, Brazil and Paraguay. In the context of this project, the authors conducted a retrospective review of the eco-epidemiology of leishmaniasis in the study area[7] and described the human-dog relationship in terms of multinaturalism and social distance generated by domestication and domesticity[8]. In the study, a continuum of three types of human-dog bond was determined: speciesism (breeders), post-humanism (protectors) and the human relationships with a non-social being (Mbyá villages)[9]. In this article will be discussed how the variables that define the ideal types of this interspecies *continuum* are articulated in sampling points with high abundance of vectors and at least one LV + dog in the town of Puerto Iguazú, Iguazú Department, Misiones Province, Argentina. This characterization is oriented to situate the recommendations of environmental intervention of the sanitary surveillance in the local ways of life and in the suitable scale.

METHOD

The object of study was defined from an eco-epidemiological perspective[10] in order to add the results of the entomological, veterinary and social research fields in a sequence of feedback and interpretation (hermeneutical loops). A descriptive investigation was carried out, investigating in two moments (November 2014 and March 2016) a non-probabilistic sample of intentional selection distributed spatially in the city based on the criterion of best scenario for the presence of the vector (n = 55).

First sampling: determination of the universe of best transmission scenarios

In each of these DU, in November 2014, with prior informed consent, capture of vector was carried out simultaneously (with REDILA[12] light traps), environmental survey (where biotic, meteorological and housing variables were recorded), sampling of blood of dogs (up to 5 dogs in each home) for serological diagnosis using the fast immunochromatographic test strips of rK39 *Kalazar Detect* (InBIOS) recombinant antigen pawed according to manufacturer's specifications, which reports a greater sensitivity and effectiveness greater than 90%. For the purposes of this paper it is assumed that a canine diagnosis result rK39 + is a result of CVL.

After the surveys and diagnosis, the positive results for CVL (rK39 positive) were communicated to the DU, who was identified as "dog owner". In the dialogue was informed about the disease in humans, the dog condition as reservoir and host and the environmental and sanitary modifications that the National Leishmaniasis Program recommends (reduction of litter and chicken coops, recommendation of euthanasia of dogs with CVL, mosquito nets in doors and windows, repellent in dogs and humans, not to remain outdoors at dawn and dusk, to move animal breeding sites away from those where humans sleep).

Among the results of this first survey, sampling points were selected with the presence of the vector *Lutzomyia longipalpis*, in a number equal to or greater than 30 specimens and at least one positive dog for a CVL diagnostic test Rk39 (n = 6/55).

Second sampling: determination of environmental changes and in the human-dog relationship CVL after the health intervention

In a second field survey in 2016, changes in practices and speeches were recorded at the 6 selected DUs. A social

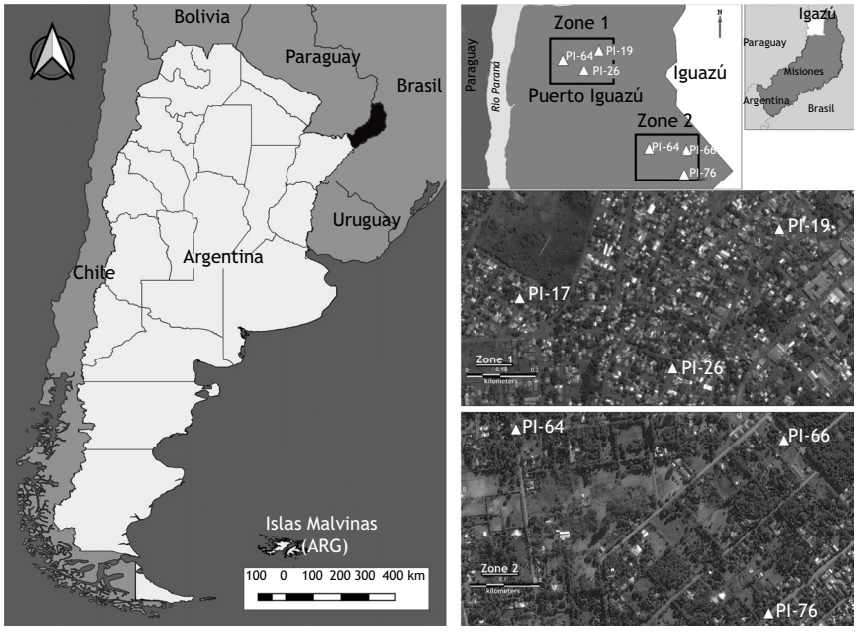
anthropologist conducted a semi-structured interview to the cohabitants with the infected dog, investigating the interspecific social relationships between vectors, dogs and humans in the domestic and public spaces. It was asked if any human intervenes in controlling the reproduction of the animals diagnosed[13] and on the circulation of puppies as a gift and/or merchandise. The circulation with dogs was investigated in the national and international spaces and the knowledge of the sanitary control measures prescribed by the national states that make up the triple border (Argentina, Brazil, and Paraguay). About the human-dog coexistence was questioned regarding the places of sleep, recreation and veterinary care, including the use of repellents and vaccines, whether existed before diagnosis or their frequency once CVL was diagnosed. The environmental, bond or social distance[14] changes between dogs and humans were recorded from the diagnosis of CVL. Also was inquired about the sources of information legitimized by the health actor on risk of infection and prevention in humans. The domestic environment was considered to be the space modeled by the agencies of human and non-human animals[15], focusing on the observation of vector relationships, reservoir, host of leishmaniasis. The method to register these interactions was photographs and sketches of the DU plant.

Ethics

The project received an opinion from the independent Ethics Committee in Carlos A. Barclay Clinical Research. For the taking of interviews, their recording in audio and photographs, such as samples of dogs and entomological capture informed consent was taken, remembering to protect the anonymity of the people.

RESULTS

Figure 1 shows the location of the 6 sampling points in the city studied (Table 1). The 6 DUs are grouped into two sectors of the urban area of Puerto Iguazú: the zone 1 shows a neighborhood with greater density of human occupation and with a greater proportion of bare ground (courtyard and dirt roads in neighborhoods as Villa Alta, Obrero, Santa María del Iguazú); while zone



Source: Self-development based on field data.

Figure 1. Location in the urban level of the DU with vectors ≥30 specimens and at least one positive dog for LkC Rk39 diagnostic test.

Table 1. Location and surface synthesis points high abundance of vector and CVL dog.

DU	District	Surface DU (m^2)	Average surface DU per area sampling (m2)
PI 17	Obrero	380	
PI 19	Santa María del Iguazú	280	370
PI 26	Villa Alta	450	
PI 64	Zona de Granjas y Quintas	2.750	
PI 66	Zona de Granjas y Quintas	625	2.791
PI 76	Zona de Granjas y Quintas	5.000	

Source: Self-development based on field data.

2 has more density remaining of primary-secondary vegetation (area of farms) with lots that on average have 7.5 times more area than those of zone 1.

Next are presented the results of the 2016 survey, including floor plans of the DUs that made substantive modifications after the diagnosis in 2014.

Case PI 17

1. Interspecific social relationships between vectors,dogs and humans

In this DU, despite the positive diagnosis of one of their two dogs in 2014, both dogs slept inside a house with cement floor and roof floor on which humans do not spend the night. No changes in distribution of space or care of the courtyard and garden were registered.

2. Changes in the relationship or the environment after the CVL diagnosis

In 2014, after the diagnosis of CVL, the owner of the house decided to take the children away from the contact with the pets and placed a repellent necklace on both dogs. The dog with a positive diagnosis died during 2015, with the symptoms described by "the nurse": she lost her hair and lost her appetite. At the time of the interview in 2016, there survived a male medium adult dog that in 2014 had a positive diagnosis of CVL, without symptoms.

To prevent ectoparasites infections was instructed to add coarse salt to a solution of creoline (low-cost germicide based on phenol, Fluid Manchester®) in the bath water every two or three months. Between the diagnosis and the death, the positive female dog used repellent necklace. The live dog has a repellent necklace that is changed every 6 months. In the regular operations of the municipality, even before the diagnosis of VL in 2014, both dogs received the rabies vaccination. None of the dogs was vaccinated against leishmaniasis.

3. Legitimated sources of health information

A nurse of primary health care attention.

4. Circulation of puppies as merchandise or gift

The female dog with CVL, killed in 2015, was a gift received from the husband's employer when she was a puppy. That gentleman brought two similar dogs from the provincial capital (Posadas, 326 km away) in a private vehicle, when one of his granddaughters was small. He gave it to her as a "toy and then became a guardian." The surviving male dog in 2016 is the offspring of a neighboring dog.

5. International circulation with dogs and knowledge of sanitary control measures

Even when the family buys domestic supplies in Brazil (Puerto Miera) or Paraguay (Puerto Presidente Franco) they do not travel with dogs. It was not found if there are any controls or certificates necessary to present when traveling outside the country.

6. Reproductive control

None of the dogs had their reproduction regulated.

Caso PI 19

1. Interspecific social relationships between vector, dogs and humans

The dogs belong to the brother of the interviewee who is considered to be "only a friend of dogs, not dealing with humans" and therefore not only refused the personal interview but also prevented from taking photographs. The sister is the one who deals with the care of the elderly mother, of the house and who cooks for the dogs. She is a registered nurse and is unemployed.

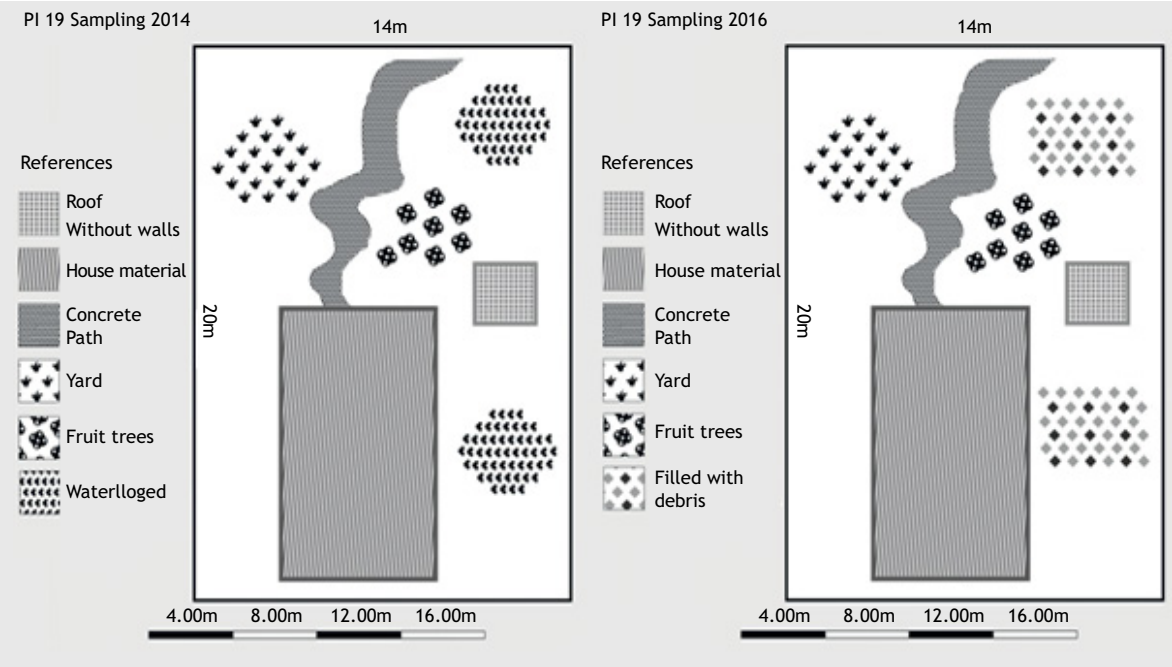
In the DU are two male dogs, one large and one small, both adults. The little one was diagnosed with CVL. The dogs receive rabies vaccination in municipal sanitary truck operations, use a pipette as a repellent and visit the vet every 6 months. Although they know the recommendation of euthanasia for infected dogs do not consider it necessary, because the dog has a healthy clinic. She knows that his brother gives him remedies to treat leishmaniasis, but she does not know which ones or who indicated. The dogs live and spend the night in the lot with loose chickens that sleep in a partially roofed side of the house, inside wooden boxes.

2. Changes in the relationship or the environment after the CVL diagnosis

Although they received the result of CVL in 2014, the changes in the environment of the lot were due to the dengue infection of the three members of the family (mother with 87 years, daughter with 50 years and son with 52 years) in January 2016. As shown in the Figure 2 because the uneven terrain, the lot had two large areas flooded that were covered with debris to drain them. The lot has fruit plants and requires periodic maintenance work: pruning and collecting fallen fruits and leaves. They have planned to remove all the fruit plants during the year 2016. The municipal fumigations for dengue are in the path, inside the house they place spiral (pyrethrin) and spray repellents (DEET). Do not sit in the gallery or patio when the sun rises or dawns to avoid being bitten by mosquitoes.

3. Legitimated information sources

In order to make the changes, they did not accept advice from the researchers or consult the municipality: it was the family's decision and they did it with their own work, without the entry of people or expenditures.



Source: Self-development based on field data.

Figure 2. Floor plan PI19.

4. Circulation of puppies as merchandise or gift

The dogs of the house were donated by a sister of the owner. One of them came from the family of a local politician to be taken care of but never was withdrawn.

5. International circulation with dogs and knowledge of sanitary control measures

They do not travel or take them for a walk, but the dogs leave by their own means and spend the day on the sidewalk.

6. Reproductive control

Do not perform.

Case PI 26

1. Interspecific social relationships between vectors, dogs and humans

In this DU three dogs were found, two large adult females and one small male, all are mongrel and sleep outside without a box. The male was diagnosed positive for CVL during the study; the owners coexisted with him 7 years ago. None of the dogs were vaccinated, received treatment, visited a veterinarian or were repellent, before or after diagnosis. Sometimes when the male with CVL is discouraged, the owner medicates him with over-the-counter antiparasites that she buys at an agricultural products store.

The lady interviewed, sexagenarian, is "the owner of the dogs". She says that had dogs all life because likes them as a company and as a night keeper. Difference barks in the face of problems or if someone is trying to enter the lot. The dogs go out to the street loose because find the door open or because cross the perimeter fence. Do not let leave voluntarily, because there is a neighbor who battles them with stones. They are dogs "well trained, not like others who eat diapers" or "get into bed when enter the house." None of the dogs in this house are left to bathe.

2. Changes in the relationship or the environment after the CVL diagnosis

The family did not make any changes in the peridomestic environment related to the prevention of the transmission of VL to humans. However, due to "fear of dengue", was pruned the fruit tree (hose) and swept and burned leaf litter, turning bottles and containers that may have water inside (cans, toys).

3. Legitimated sources of health information

The owner of the dogs does not believe in diagnosis of CVL because they have no symptoms. Considers that at 65 she "already knows what has to do, it does not depend on what is taught to her".

4. Circulation of puppies as merchandise or gift

The dogs were a gift from their son because "when there are creatures it's nice to have puppies". The dogs that are in the house were brought from another neighborhood (Ribera del Paraná) of Puerto Iguazú and have not left the town. She had other dogs that were lost in the locality and did not recover them. Her neighbor wanted a dog of breed and gave it to her, she takes care of it a lot and that sleeps with air conditioning.

5. International circulation with dogs and knowledge of sanitary control measures

Once bought a puppy of breed in Brazil, the dog entered a private car and did not have sanitary controls at the international border.

6. Reproductive control

She controls the reproduction, "to avoid the trouble of the puppies" by placing injectable contraceptives in the females. It happened to inject them to a female pregnant and all the brood was born dead.

Case PI 64

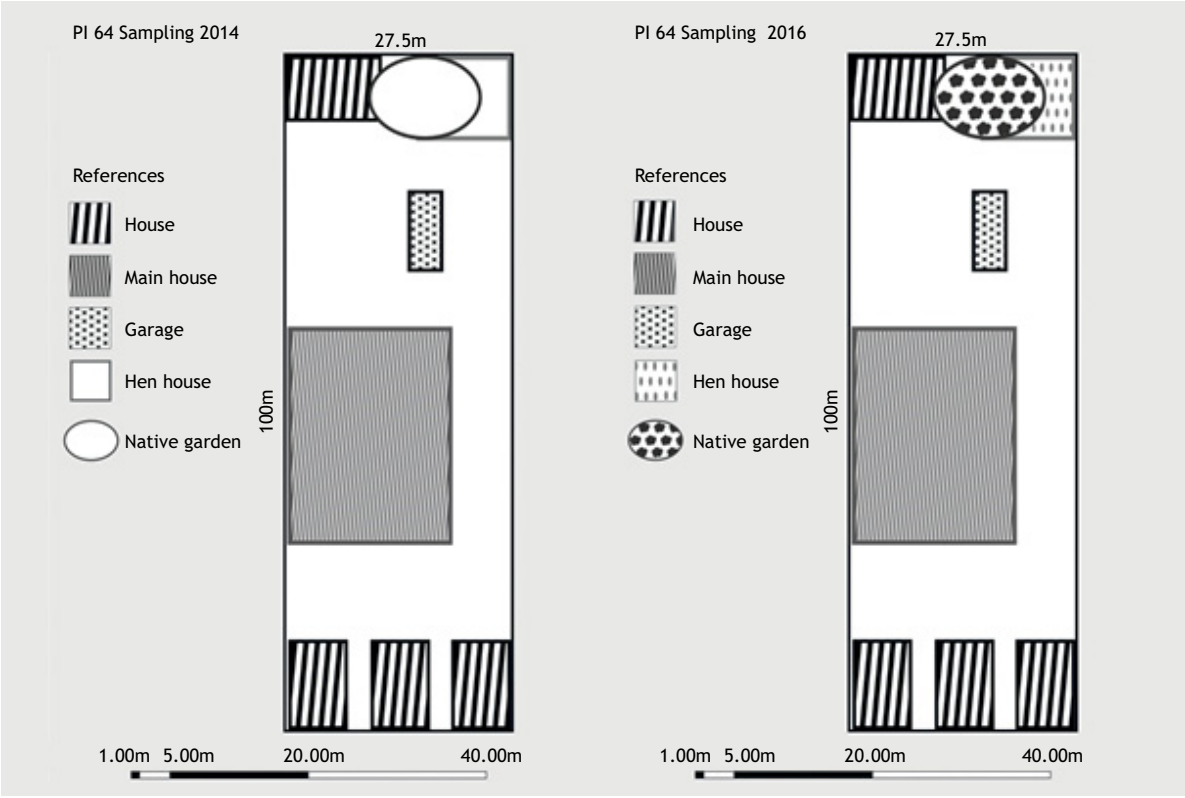
1. Interspecific social relationships between vectors, dogs and humans

This DU was a weekend house until 2010, when it began to be occupied permanently. In 2014, seven dogs and three human adults lived together at this sampling point. In the project diagnosis, two dogs were positive for CVL and were slaughtered. A third died of natural causes (old). In the 2016 sample, there were four large mongrel dogs, two males and two females. One elderly and another adult, all four had been diagnosed with CVL in private exams, after sampling this investigation. To the owner of the dogs it is especially traumatic to continue taking the decision to give dignified death to infected dogs, especially because he misses the dogs he sacrificed, he feels guilty and has not managed to control the transmission on his property with this measure.

The lot is large and they define themselves as "a kennel family". Feel gratitude towards the dogs for the job of caring for the family when the man of the house works at night. This man is the "owner of the dogs" and the woman "cleans and orders". All the dogs sleep outside, receive semi-annual veterinary care (contraceptives and repellent pipette) and rabies vaccination at the municipal campaigns. They do not have a vaccine or receive treatment for leishmaniasis. After knowing that the 4 dogs living in the house tested positive for CVL started considering buying a repellent necklace to protect the family. However, it is not an easy decision, because it results in a fixed cost relevant to the domestic budget.

2. Changes in the relationship or environment after diagnosis

At the beginning of the study, the residents accepted the sanitary recommendations of euthanasia of the dogs with CVL and the changes in the domestic environment (elimination of the henhouse, reduction of the reserve area and shade garden). Could not waterproof the access surface and the garage because it is a very large area and very expensive, also limited the pruning to reduce the shaded area because it greatly increases the temperature inside the house (Figure 3).



Source: Self-development based on field data.

Figure 3. Plan floor PI64.

3. Legitimated sources of health information

The source of information accepted for the control of vector transmission between dogs and humans was the field technicians of this research project.

4. Circulation of puppies as merchandise or gift

All the dogs that family had and have are donated in Puerto Iguazú. One of them appeared one night escaping the fireworks. They have lived in the center and then moved with the dogs to this new location. None of the family dogs that stayed there is positive for CVL. The property of the district of Farms and Quintas is closed with a perimeter wall and the dogs cannot leave the boundary.

5. International circulation with dogs and knowledge of sanitary control measures

Do not take the dogs with them on the trip.

6. Reproductive control

Reproductive control is not associated with transmission control of CVL. They apply contraceptive injections to the females every 6 months.

Case PI 66

1. Interspecific social relationships among sandflies, dogs and humans

This DU is located in front of a place where dogs are abandoned. The two dogs diagnosed with CVL were not owned by that DU, they were there for eat or drink water. The place is a store that serves lunch at noon, so the guests invite live leftovers to abandoned dogs in the vicinity. In the house there is a single small mongrel female dog that was not positive to the diagnosis for CVL. The other dogs were taken care of by a daughter of the current owner who moved, after the two dogs diagnosed in 2014 with CVL died. The dog that currently lives was given to the owner who always has it inside the house, in a way that she does not fight with abandoned stray dogs. This dog sleeps outside the rooms in an interior courtyard of the house, without communication with the street or sidewalk. The owner takes her to the veterinary clinic once a year, does not use repellents, has an anti-rabies vaccination and bathes her with phenol dissolved in water (idem PI17) periodically. She did not apply or know of the existence of a vaccine against leishmaniasis.

The dogs that appear in the neighborhood are because others come to throw them there: “Sometimes they throw puppies, other young or sick adults, other times dogs that no longer want to have in the house”.

2. Changes in the relationship or environment after CVL diagnosis

The diagnosis of CVL in two dogs of the residence changed the relationship with his daughter who rescued abandoned dogs. After discussing for the coexistence and two dogs died, the daughter left the house.

3. Sources of information legitimized by the actors on risk of infection and prevention in humans

It does not recognize sources of information on risk of infection and prevention in humans.

4. Circulation of puppies as merchandise or gift

The dogs that prowl the store are in the condition of abandoned. The storekeeper does not feel responsible for those who come to eat from the diners. For more than two years she has lived in the place with a dog that was given to her in another district of Puerto Iguazú.

5. International circulation

The owner knows about the circulation of dogs between neighborhoods of Iguazú. It has no information over transborder circulation and does not travel with dogs.

6. Reproductive control

Not done.

Case PI 76

1. Interspecific social relationships among sandflies, dogs and humans

In the 2014 sample, there were three medium-mongrel male dogs one was infected with LV. In 2016 a male poodle without diagnosis was added, bought from a friend as a gift to his granddaughter. All the dogs that reside in this DU enter the ontological category of thing (that if it is “mestizo” it is given by hierarchical networks of reciprocity as a gift and if it is “of race” it is bought as merchandise). In this case in the human-dog bond there is a differentiated speciation: the “mestizos” are considered “keepers” even when they are medium in size, while the poodle is considered “company of a girl”. The guard generates gratitude in the owner, who considers that the dogs, when competing among themselves for the authority of the owner, express affection. The guard dogs go out into the street, the companion of the girl remains inside the lot.

The internal domestic space of the house, the care of the plants and the feeding of humans and non-humans are marked for the female gender. The dogs that entered to the house by donation were chosen by the male humans.

In another location different from the DU studied, a family member has a pit bull to raise puppies. They bought it because have demand of this breed as guardianship. The dog produces between eight and ten puppies per litter in two pregnancies per year. Each puppy is sells for $5.000 (US$ 330), which is estimated to yield between $80.000 a $100.000 per year (US$5.000- $6.000 a year). All the dogs sleep outside of human dwellings, in boxes of wood. The dog bought, who is “of race”, is the only one that visits monthly the veterinarian. “Stray dogs -mestizos- do not need veterinary, they are harder”.

All the dogs use repellent pipette, they have rabies vaccination from the municipal campaign and do not have a vaccine against leishmaniasis.

2. Changes in the relationship or environment after the CVL diagnosis

There are family members who do not assume the diagnosis of CVL as a risk to their health. Others who argue that they cannot be sick because have no symptoms and because "God does not want anything bad for his own creation." The homeowner, evangelical Christian believer, says:

> "I know a superior plan for the men: the goodness of Almighty God and his promises of beatitudes. He keeps and protects. There is 31 years ago that I visited the hospital to accompany the sick and I was never hospitalized or got sick. My son had malaria and was healed: Christ saves and heals. "

This man, older adult, besides the confidence that "the Lord takes care of his life", applies fumigation in light doses with his own sprinkler, with "remedies" inside bought in Brazil. Do as a service that also lends to clients in the neighborhood. Spray with Galgotrin® (Cypermethrin) "1/100 liters". When his neighbors hire him he reviews the spray again at 30 days after. At home he sprays once a month during all the months of the year. About the fumigations of Public Health in the neighborhood, consider that:

> "They are a help, but do not have the magic wand. They cannot spray the branches, the piles of wood, the piles of bricks from all the yards, which is the reason they hire me for. It is fine Public Health do, but it is not enough".

Even when they knew the CVL diagnosis in one of their dogs, did not think about abandoning or sacrificing:

> "It is like I have you, we play, we eat, you take care of the house and when I find out you're sick I leave you to be killed. Cannot be like this. You have to take care of the animal, because they feel. That is love for love. "

3. Legitimated sources of health information

In this DU, "God and the divine order" are the legitimated sources of information to prevent the transmission of VL.

4. Circulation of puppies as merchandise or gift

Crossbreed dogs were given to them by people of affective reference, political or emotional hierarchy in other neighborhoods. The dog "of race" was bought in another district and brought as a gift.

5. International circulation

They do not travel with dogs either inside or outside the city.

6. Reproductive control

It is not done (all the dogs are males).

Summary of results

Half (3/6, PI 19, PI 26 and PI 64) of the six DUs that compose the sample made environmental changes between the 2014 and 2016 sampling, but only one of them (PI 64) did so to reduce the risk of human infection of VL. In the other cases it was due to recommendations for control of the dengue vector.

Only one of the DUs (PI 64) agreed to the humane death of the infected dogs as a measure to control the transmission based in recommendation oriented by the investigators of the project, however the DU informs that it will not do it again with the new infected dogs in their lot. On the other hand, only one of the DUs incorporated the repellent necklace after the diagnosis (PI 17). It is necessary to consider that all the DU of the sample has reference of application of chemical control (pyrethroids) in ultra-light sprayings (associated with control campaigns of dengue transmission or particular fumigations) and repellents with DEET.

The diagnosis of CVL is independent of reproductive control, which is generally done on female dogs with injectable medication.

Both the adoption of mongrel dogs and the purchase of breeds are made on the basis of previous social relations (asymmetric as "the chief and a politician" or symmetrical as "a friend of the family") (Table 2).

Table 2. Summary of results.

ID	Relations human-dog	Nº dogs rK+/total dogs sampling 2014	Nº dogs rK+/total dogs sampling 2016	Euthanasia in dogs CVL	Control reproductivo	Circulation P - Provincial Na - National I - International N - Not	Home environment changes by CVL diagnosis	Source legitimized health information
PI 17	gift-guardian	1/2	0/1	no	no	P	no	health mobile
PI 19	gift-companionship	1/2	1/2	no	no	P	no	family
PI 26	commodity-gift-companionship	1/3	1/3	no	yes	P-I	no	family
PI 64	gift-guardian-work	2/7	4/4	yes	yes	N	yes	project IDRC
PI 66	gift- abandon thing-companionship	2/3	0/1	no	no	P	no	not recognized
PI 76	gift - commodity -companionship	1/3	1/3	no	no	P	no	God

Source: Self-development based on field data.

DISCUSSION

The objective of the eco-epidemiological research that gave rise to this study was to identify the socio-environmental variables associated with the distribution and dispersion of leishmaniasis, in order to determine the viability[16] of the surveillance and control strategies suggested by the National Program that is consider, not only isolated factors of risk, but also determine the ways of life[17] of the endemic area.

The recommendations made, in view of results considered to be at greater risk of exposure in micro scale/ domestic unit (an abundance of insect vectors and dogs with offers of parasites for the vectors), were made by social commitment with the study subjects, and according to the programmatic indications previous, those that could be modified from the conclusions of the investigation. Therefore, the need for the present focal evaluation was considered, which will contribute to substantiate the general recommendations and local adjustments of the health strategies in relation to leishmaniasis, with the participation of social actors of the supra-domestic level (municipality, neighborhood associations).

The variation in the average size of the sample lots implies special considerations in the intervention recommendations. It is necessary to bear in mind that the greater average surface of the lots implies higher labor and machinery costs for the environmental modifications suggested by the sanitary control, which conditions the implementation of micro scale changes[18]. This way, at the focal level, among which general environmental recommendations should validate those with the greatest impact on vectors according the specific environment, the actual exposure of humans and dogs according to the practices of the inhabitants (time and places) and the capacity of agency to make the modifications.

In the present study, just a single household complied with the environmental modifications suggested by the researchers. These changes were not enough to control the transmission, which allows supposing the existence of a vector source outside of the DU sampled. In this sense, it has been postulated that although the micro-scale environmental variables are those that define the presence and abundance of the vectors in the DU - critical site - the risk of transmission is modulated by environmental variables beyond the limits of the DU - critical area[18]. This situation contributes for validation of the hypothesis that the control measures require intervention at the neighborhood level and not only at the DU, taking into account the real radius of vector dispersion. That is, it is necessary to determine an equivalent to the concept of "healthy apple" in the urban environment that was proposed for dengue, considering the differential models of breeding sites of the leishmaniasis vector[19]. In this sense, the interventions require a structure and community agency that makes possible the synergy between actions in the domestic, the municipal level and the interjurisdictional circulation (provincial, federal, international).

The international traffic of dogs is delimited and is done in private vehicles in a way that it eludes regular sanitary controls of the border. The free movement of people and goods in a state of law and countries with border integration agreements in a frontier of highly porous traffic[20], suggest that, together with the formal effective control system based on well-founded health risk considerations, they should to add recommendations in a level micro scale, to achieve greater effectiveness, requiring intervention in interspecies social aggregates of intermediate scale (breeders of breed dogs, societies of protection, veterinary clinics).

The interspecific human-dog relationship in the cases of the analyzed sample accounts for the combination of humanist ontologies of speciesism that consider the dog as a commodity or gift, with post-humanist sayings and practices that consider it as a sentient being or companion species. In the context of the human-dog interspecies relationship, the condition of sentient being or thing is not stable, but varies within the same human-dog bond, giving rise to social, moral and religious arguments. It is based on these circumstantial expressions that the social distance with the dog is defined in the coexistence that can range from "love for love" understanding obedience as gratitude, to humanitarian sacrifice with the intention of limiting their suffering[9]. These variables limit the exercise of responsible ownership by dog owners, as well by veterinary professionals and technical health personnel, and also are inserted as contradictions of health surveillance and control discourses, delegitimizing the actors with the that are in conflict, where the results and recommendations become articles of faith, whether or not the diagnosis is believed, effectiveness of an intervention, in the infection, especially when it is asymptomatic[3].

With regard to the effectiveness of health information as a prevention and surveillance tool, two reflections can be made. As previously mentioned, in the first instance, there is the necessity to validate in the field the recommendations for the local population under study. Secondly, the results obtained make it possible to complicate the sender-receiver relationship[21] in health communication. The various ways of understanding the relations between society and nature involve placing information in an intercultural dialogue[22], considering interspecies domestic relations as social relations that define moral values and our own human condition[9]. In this regard, other studies evaluating the feasibility of health surveillance[23], in indigenous peoples of South America indicate greater efficacy in the epidemiological analysis of possible sites of infection, vector and reservoirs for collaboration in social activities with health agents and local residents.

CONCLUSIONS

The risk of human infection due to VL is related to the mode of life[17] of DU and interspecies relationships. Although the micro-scale environmental variables define the critical sites - DU - of the presence of the vector, the risk of transmission appears modulated by environmental variables of the critical area -barrio, urban sector -18. Therefore, the control measures must meet the actual radius of dispersion of the vector to be effective. The interventions require validation and synergy between domestic and public space, as well as interjurisdictional coordination (municipality, provincial, federal, international) on the circulation of dogs. Human-dog relationships combine speciesism and post-humanism, which, in addition to the need to intervene in

public space, limits the effectiveness of "responsible ownership" as the only model of link. Environmental actions focused on DU considered critical or behavioral site on responsible ownership as an exclusive strategy are not enough. It should also intervene on the critical area and the interspecies groups (breeders of breed dogs, protective societies, veterinary clinics).

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Acknowledgment

The research was funded with grants of International Development Research Cluster #107577 and Agencia Nacional de Ciencia y Tecnología de Argentina (PICT 2354/2012). The data collection was organized by Mariela Martínez, Daniela Lamattina, Juan Arrabal, Sebastián Costa, Mariana Manteca Acosta, Pablo Berrozpe, and Jose Direni. The edition of maps and figure was made by Melina de Cobo.

Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.