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The path of canine visceral leishmaniasis versus the path of Center for Zoonoses Control: contributions of spatial analysis to health

O caminho da leishmaniose visceral canina *versus* o caminho do Centro de Controle de Zoonoses: contribuições da análise espacial para a saúde

La trayectoria de la leishmaniasis visceral canina *versus* la trayectoria del Centro para el Control de Zoonoses: contribuciones del análisis espacial a la salud

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Abstract

Visceral leishmaniasis (VL) is a public health problem in Brazilian municipalities. As much as there is a planning of public policies regards VL in São Paulo State, new cases have been reported and spread. This paper aims to discuss how the Center for Zoonoses Control conducts its actions spatially in endemic city of Presidente Prudente, São Paulo State. Data are from the Municipal Health Department of Presidente Prudente, Adolfo Lutz Institute, and Brazilian Institute of Geography and Statistics. We spatially estimated the dog population per census tract and used geoprocessing tools to perform choropleth maps, spatial trends, and spatial autocorrelation. We found a spatial pattern of higher prevalence in the city's outskirt and a positive statistically significant spatial autocorrelation ($I = 0.2$, p-value < 0.000) with clusters of high-high relationships in the Northwest part of the city. Moreover, we identified a different direction in the path of the conducted serosurveys versus the canine VL trend, which stresses the fragility of the Center for Zoonoses Control actions to control the disease. The Center for Zoonoses Control always seems to chase the disease. The spatial analysis may be useful for rethinking how the service works and helps in public policies.

Visceral Leishmaniasis; Decision-Making; Epidemiologic Surveillances

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Introduction

Visceral leishmaniasis (VL) is a vector-borne disease that affects people and animals worldwide [1]. This disease is caused by protozoans of the *Leishmania* genus, transmitted by sandflies via bitting during blood feeding. Many species are found in the *Leishmania* group, but in Brazil, *L.* (*L.*) *infantum chagasi* has been diagnosed, and the main vector is *Lutzomyia longipalpis* species [2,3,4].

VL is endemic in 98 countries and territories. The World Health Organization (WHO) reported 17,000 cases of this disease in 2018, out of which almost 90% of them occurred in India, Brazil, Sudan, South Sudan, Ethiopia, and Kenya. Brazil presented the second highest frequency of cases, totalizing 3,460 cases [1]. In the Americas, VL is endemic in 12 countries, where 63,331 new cases were reported from 2001 to 2018, and 61,048 (96.4%) occurred in Brazil [5].

Currently, all regions of Brazil registered autochthones cases, except in the states of Acre, Amazonas, and Rondônia, in the North Region [6]. In the State of São Paulo, the first confirmed autochthonous canine and human case occurred in 1998 and 1999, respectively, in Araçatuba, Northwest Region of the State [7]. In West São Paulo, Presidente Prudente is a central municipality to the region and discovered autochthonous canine cases in early 2010. No human cases were reported until 2013 [8,9]. Nowadays, the disease affects dogs and people, being a public health problem.

In Brazil, the domestic dog is the main reservoir. Most of them are euthanized when positive in serology diagnoses as a recommendation of the Brazilian Visceral Leishmaniasis Surveillance and Control Program (VLSCP)/Brazilian Ministry of Health [4]. The canine treatment became possible via regulation at the end of 2016 [10,11]. However, this treatment is expensive, and its high-efficacy is still unproven. In humans, if VL is not diagnosed and treated, it can lead to death [1].

VLSCP suggests that municipalities should follow its guidelines to prevent and to control the disease. Nonetheless, different measures against VL can be found, depending on the actions taken at the local level, represented by the vector control, epidemiological surveillance, and Center for Zoonoses Control. In Presidente Prudente, the last performs serosurveys regularly. Thus, this paper aims twofold: (i) to analyze spatial patterns of canine visceral leishmaniasis (CVL) in an endemic city of the State of São Paulo, and (ii) to analyze how the Center for Zoonoses Control conducts its actions spatially in the city. We used geoprocessing tools to estimate the canine population and to identify the disease cases and serosurveys paths. We also applied statistical functions to find disease clusters.

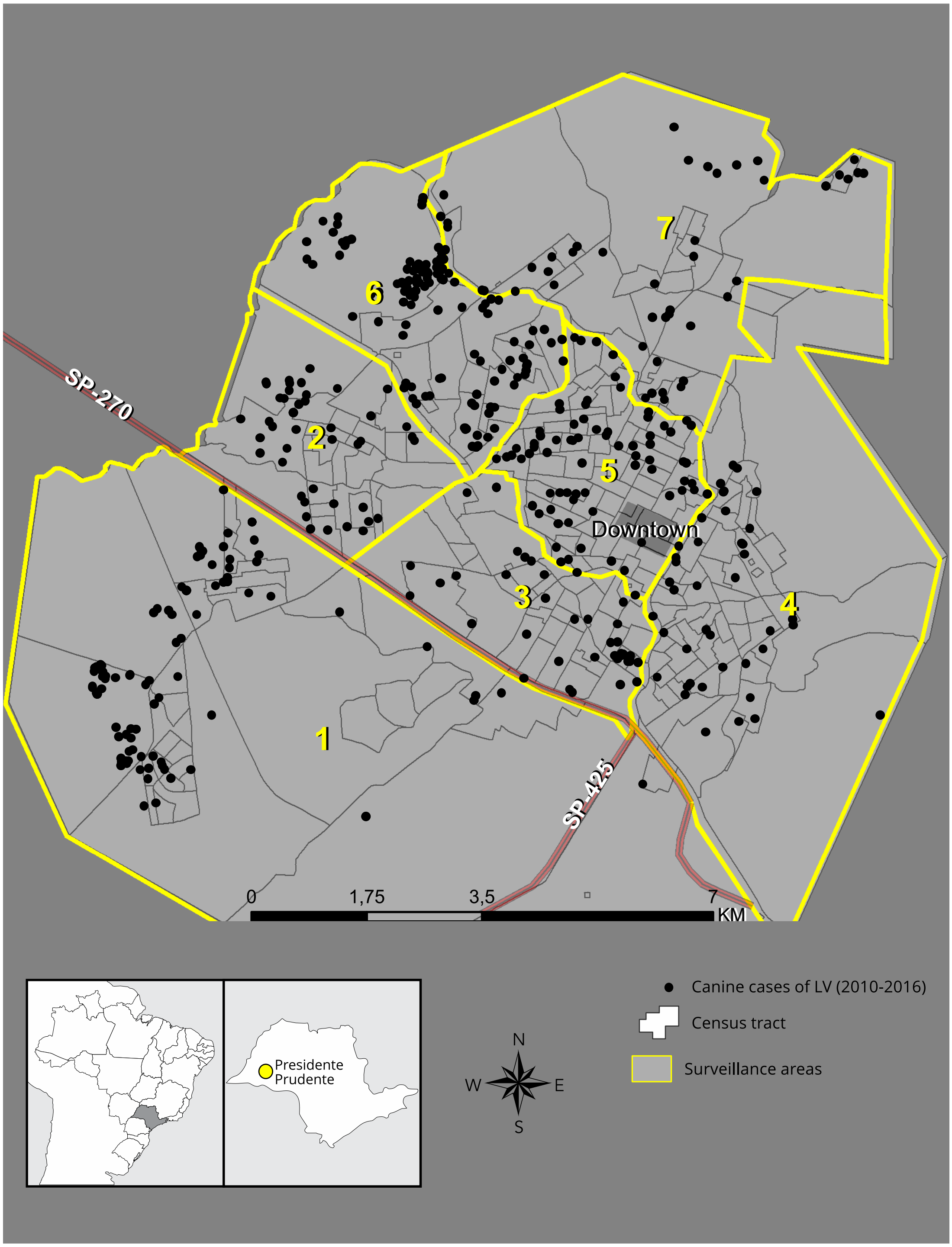
Many papers have discussed leishmaniasis via spatial analysis, using geoprocessing tools or statistical models [7,12,13,14,15,16,17,18,19,20,21,22,23,24,25]. By analyzing the city of Presidente Prudente spatially, we found that disease cases have a particular behavior. VL cases advance, even if the prevalence is kept low. The Center for Zoonoses Control is always chasing the disease. Serosurveys have been conducted in areas of reported humans or canine cases, which has not been efficient in controlling the disease. Even though a guideline with recommendations focused on vectors, hosts, and human cases is available, the actions seem to be disconnected. Similar situation may be found in other endemic medium cities of Brazil .

Methods

Our study area is in Brazil's Southeastern Region, on the west side of São Paulo State (Figure 1). Presidente Prudente (coordinates 22º07'33" S and 51º23'20" W) is an administrative municipality, that is, it concentrates industries, education, commerce, and health services in the region. The city's population was estimated at 230,371 inhabitants in 2020, and the demographic density at 408.4 per km^2 [26]. Two main highways traverse Presidente Prudente: the SP-270 and SP-425, giving access to the capital of the state (city of São Paulo) and Paraná State (at the Southern Brazil). There are 301 census tracts in the urban area of Presidente Prudente and seven surveillance areas used for municipal management and planning.

Figure 1

Location of the city of Presidente Prudente, São Paulo State, Brazil.



Diagnosis data

Data from Municipal Health Department of Presidente Prudente was used. Our period of study was from 2010 to 2016. Until 2012, diagnoses were tested by ELISA (Enzyme-Linked Immunosorbent Assay, BioManguinhos, Rio de Janeiro, Brazil) and confirmed by IFI (indirect fluorescent immunoassay, BioManguinhos, Rio de Janeiro, Brazil). Parasitological diagnoses were the minority. In 2012, a chromatographic immunoassay based on Dual Path Platform technology (DPP rapid test, BioManguinhos, Rio de Janeiro, Brazil) became the screening test and ELISA the confirmatory one [27]. According to both screening tests and confirmed diagnoses, our records consider all the diagnoses mentioned.

Estimation of the canine population

The canine population of Presidente Prudente was estimated based on the study of Alves et al. [28], considering the number of inhabitants and the São Paulo Index of Social Responsibility (IPRS [29]) in the estimative. In this study, for the municipalities of the state of São Paulo, they calculated an average of 1:4 dogs/people ratio, approximately 0.25 dogs per person. Then, the canine population in Presidente Prudente weas estimated at 57,592 dogs [26]. The number of dogs was also estimated in each census tract using the 2010 census, as follows in Equation 1:

$$\Delta \mathrm{d} = \Delta \mathrm{p} \times 0.25 \qquad (1)$$

Where: Δd is the estimation of the canine population; Δp is the human population in the census tract. Then, Equation 1 was used to calculate the disease prevalence (Equation 2), defined as:

$$f(\Delta \mathrm{c}, \Delta \mathrm{d}, \kappa) = \frac{\Delta \mathrm{c}}{\Delta \mathrm{d}} \times \kappa \qquad (2)$$

Where: κ is an arbitrary constant; Δc is the number of canine cases of VL.

Geoprocessing and spatial analysis

CVL data were available by address. The ArcGIS 10.2.2 (http://www.esri.com/software/arcgis/index.html) geocoding tool was used to generate the coordinates of latitude and longitude of each address. Then, points were created as shapefiles. Points were transformed into areas using the spatial join tool, which allowed mapping the prevalence of census tracts. The serosurvey data were also mapped by address and transformed into areas using the Geographic Information System.

A collection of Choropleth maps was created for spatial analysis, showing the prevalence of CVL throughout the seven years (2010-2016). Furthermore, a collection of trend maps was created to show the movement of the disease cases versus the percentage of screening coverage, a layer that shows the ratio of the number of examined dogs, and the dogs estimative in each census tract.

Finally, Local Moran's I (Equation 3) was used, providing measure for each census tract in the region, correlated with values in nearby areas:

$$l_i = \mathrm{z}_i \Sigma_j w_{ij} z_j \qquad (3)$$

Where: z_i and are standardized scores of attribute values for unit i and j; l_j is among the identified neighbors of , conforming to the weights matrix w_{ij}.

We defined the conceptualization of contiguity edges corners for polygons and Euclidean distance as our mapping parameters, with 5% significance level. The local spatial autocorrelation is based on LISA (Local Indicators of Spatial Autocorrelation). A measure of spatial association is estimated for each location, in which +1 indicates strong positive spatial autocorrelation, and -1 indicates strong negative spatial autocorrelation, and 0 (zero) indicates random spatial ordering [30]. Spatial autocorrelation defines a neighborhood around each geographic unit and explores the spatial dependence of deviation in attribute values from the second-order properties [31].

In the Moran Scatter Plot, the four quadrants of a graph provide a classification of the spatial autocorrelation: high-high (upper right), low-low (lower left), for positive spatial autocorrelation. On the other hand, high-low (lower right) and low-high (upper left), for negative spatial autocorrelation. For LISA map interpretation, the hotspots theory was introduced, where a cluster is characterized by a census tract with positive autocorrelation with neighborhoods in the same situation (high-high or low-low relationship). When a census tract is positive, and other is negative, this is a high-low or a low-high relationship, entitled outliers. Hotspots neighbors that have at least one side touching the other present first-order contiguity between them [32].

Results

Our study analyzed a seven-year window from 2010 to 2016. According to Table 1, a large number of dogs were evaluated, and most of the diagnoses were non-reagent. However, CVL cases increased progressively since the first reported case, with a peak in 2015.

Figure 2 presents a three-year moving average of CVL. From 2010-2012 to 2012-2014, CVL cases were stable, and then, there was an increase of 164% and 82% in the 2013-2015 and 2014-2016 triennium, respectively.

We observed a change in the disease spread pattern by analyzing the city's space (Figure 3). The first canine case was reported in 2010. From 2010 to 2014, CVL cases and prevalence were mostly in the central areas. In 2015, the spatial pattern of higher prevalence and number of cases changed to the outskirts. A growth in the Northwest (Area 6) can be noted, with neighboring areas with medium or high prevalence. In the Southeast, besides the higher prevalence, the number of cases (absolute variable – proportional circles) is smaller. In all seven-years (2010-2016), both higher prevalence and number of cases occurred in the city's outskirts.

Figure 4 represents the movement of the trend of CVL. From 2010 to 2011, the trend comes from the Northeast to the Southwest. In 2012, the higher trend moved to the extreme North (Areas 6 and 7) and, in 2014, to the Southeast (Area 4). Then, the Northwest Region, since 2014, have been presenting a higher trend. Overall, this is the direction of all the period (2010-2016).

Figure 4 shows the conducted serosurvey regarding the number of dogs per census tract. We observed a higher trend in Area 6 in 2011, when dogs were examined primarily in Areas 1, 2, and 3. In

Table 1

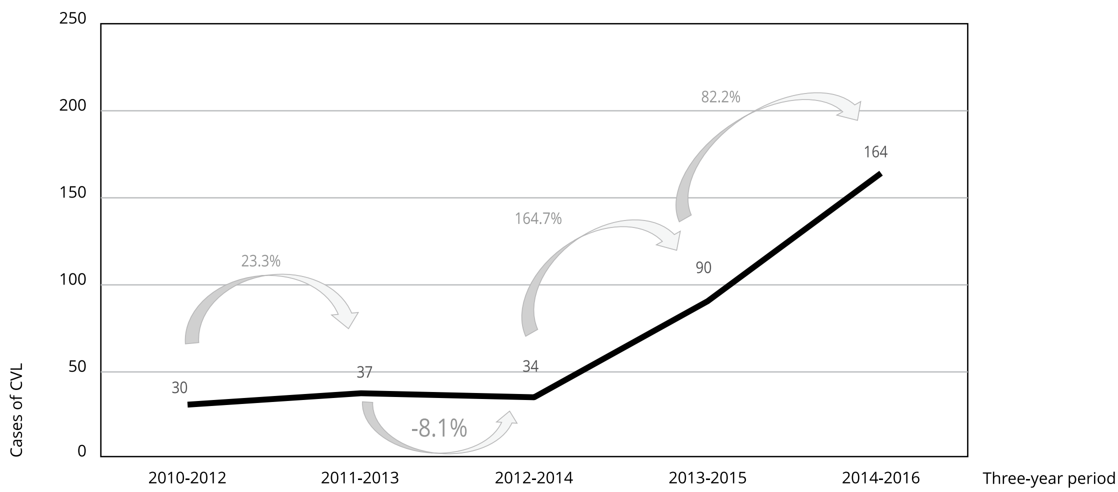
Number of cases of canine visceral leishmaniasis and serosurvey conducted in the city of Presidente Prudente, São Paulo State, Brazil, 2010-2016.

Year	Serosurvey (number of samples tested)	Positive canine cases *	Negative canine cases or inconclusive/Not found	Prevalence (%)
2010	7,167	14	-	0.19
2011	4,263	46	-	1.07
2012 **	8,413	30	8,116	0.35
2013	8,980	34	8,566	0.37
2014	8,530	39	7,894	0.45
2015	3,570	196	3,146	5.49
2016	16,357	256	15,339	1.56
Total * **	57,280	615	43,061	1.07

Source: Municipal Health Department of Presidente Prudente and Adolfo Lutz Institute.
* Screened and confirmed test, according to the Brazilian Ministry of Health's recommendations;
** The serosurvey time series were firstly organized in 2012;
*** The difference between positive or negative/inconclusive/not found and the number of samples refers to retested diagnoses.

Figure 2

Three-year moving average of cases of canine visceral leishmaniasis (CVL), city of Presidente Prudente, São Paulo State, Brazil, 2010-2016.



2012 the higher trend corresponded to higher coverage areas in Areas 5, 6, and 7. However, in 2013, low coverage (< 25%) was found in all areas, but the high tendency is in Area 4, where a higher coverage in the next year (2014) was observed between Areas 3 and 4.

We emphasize that since 2014, Area 6 presented a higher number of cases in all historical series, with the maximum value in this area in 2015, expanding to Area 7 (Figure 3). In 2016, Area 6 showed a decrease, but it was a significant area, considering the number of cases. Overall, the Northwest has a higher number of cases, prevalence (Figure 3), and the trend (Figure 4), historically a critical area regarding CVL. Moreover, most census tracts were covered in more than 50% in all period (2010-2016), that is, seven years.

Finally, Moran's index (Figure 5; Table 2) demonstrates a positive and very weak spatial autocorrelation annually, with statistical significance for 2011, 2013, 2015, and 2016. From 2010 to 2016, the spatial autocorrelation is stronger and statistically significant (I = 0.2021, p-value < 0,000). In 2011, we observed clustered areas of high-high relationship in the city's geographical center and the Northwest outskirt while outliers are nearby main streets and the SP-270. In 2013, nearby one of the high-low outliers, there are clustered areas in the Southeast. Finally, in 2015 and 2016, clustered areas changed to the Northwest of the city, with an outlier in the North area. The overall period has clustered census tracts in the Northwest of the city. The higher prevalence and trend from 2010 to 2016 (Figures 3 and 4) is broadly consistent with this cluster.

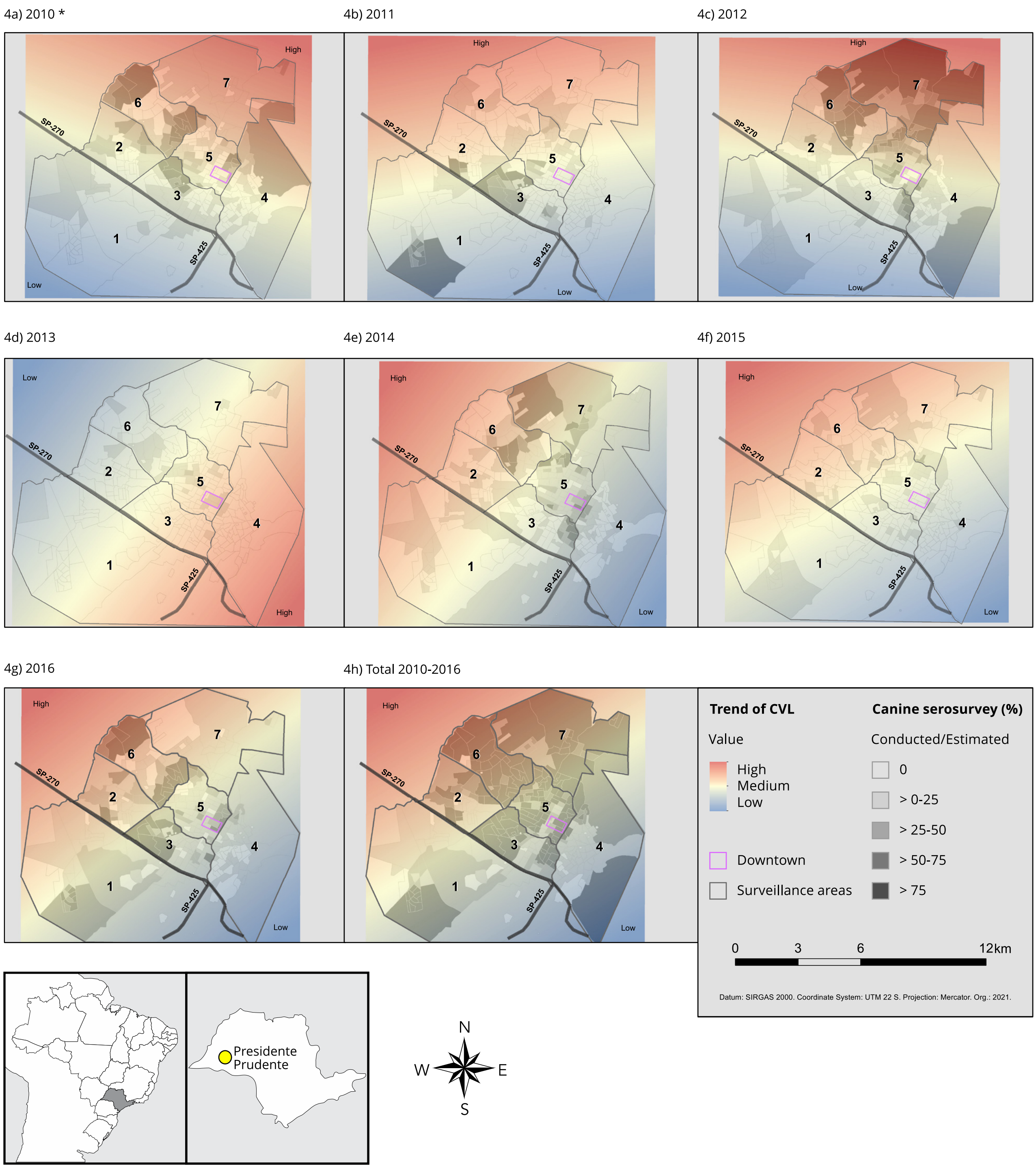
Figure 3

Prevalence and cases of canine visceral leishmaniasis in the city of Presidente Prudente, São Paulo State, Brazil, 2010-2016.

Source: Center for Zoonoses Control of Presidente Prudente and Adolfo Lutz Institute.
* 2010 and before.

Figure 4

Trend of canine visceral leishmaniasis (CVL) and the canine serosurvey (conducted/estimated) in the city of Presidente Prudente, São Paulo State, Brazil, 2010-2016.

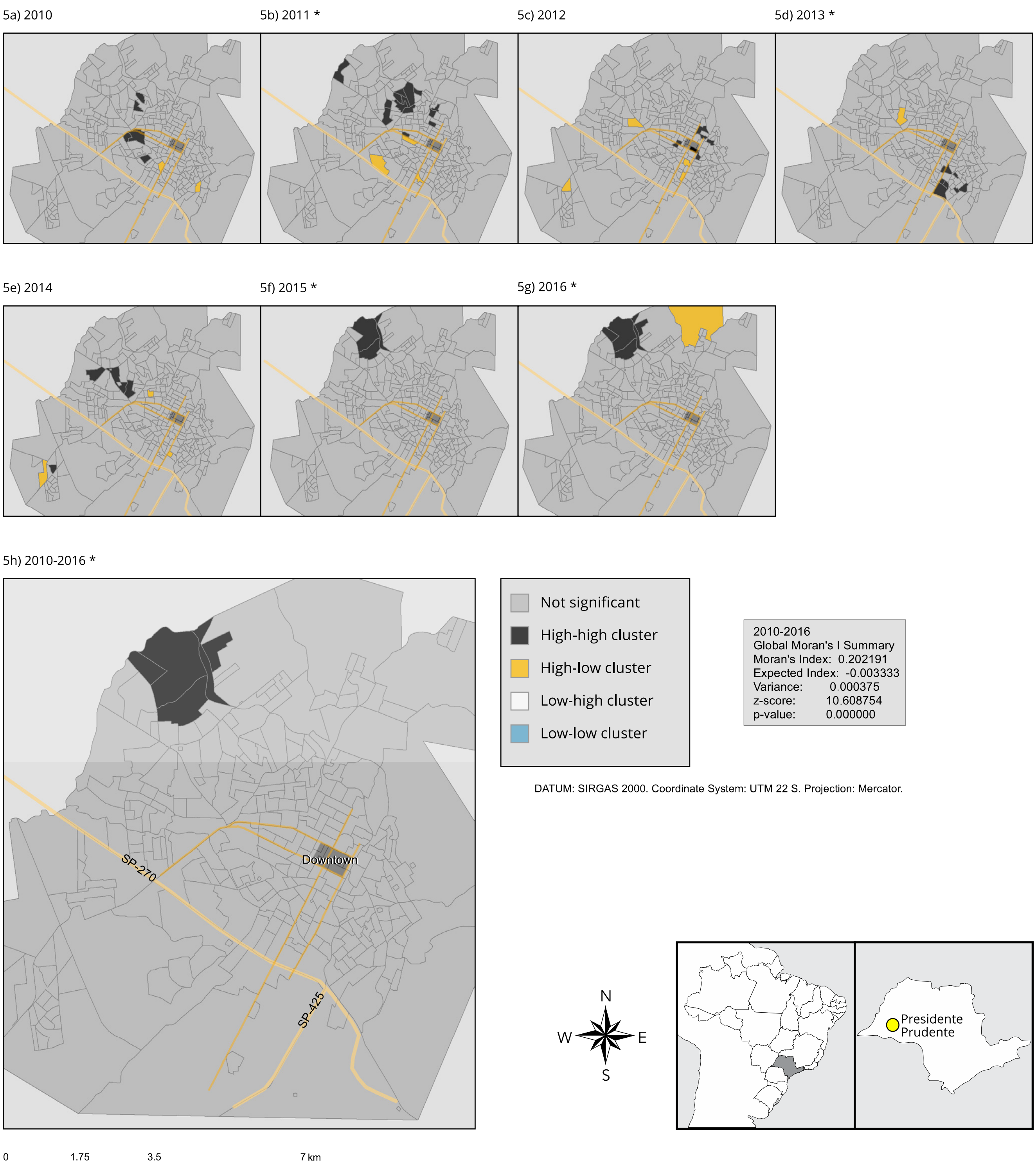


Source: Center for Zoonoses Control of Presidente Prudente.

* 2010 and before.

Figure 5

Spatial autocorrelation for canine visceral leishmaniasis (CVL) in the city of Presidente Prudente, São Paulo State, Brazil, 2010-2016.



Source: Center for Zoonoses Control of Presidente Prudente.

* Statistical significance (p-value < 0.05).

Table 2

Spatial pattern of canine visceral leishmaniasis in the city of Presidente Prudente, São Paulo State, Brazil, 2010-2016.

Year	Pattern	Z-score	Moran's index	p-value
2010	Random	1.636198	0.041773	0.101798
2011	Clustered	3.002109	0.089547	0.002681 *
2012	Random	-0.110850	-0.006933	0.911735
2013	Clustered	2.072096	0.057103	0.038257 *
2014	Random	-0.653906	-0.020319	0.513172
2015	Clustered	11.057344	0.204386	0.000000 *
2016	Clustered	5.345896	0.107989	0.000000 *
2010-2016	Clustered	10.608754	0.202191	0.000000 *

* Statistical significance, p-value < 0.05.

Discussion

The discontinuity of control activities, resistance to euthanasia of dogs, and low coverage of chemicals against vectors are the main problems faced by local managers regarding VL [33]. We could add reduced budgets and the pressure of other diseases or health issues, such as dengue fever, the presence of scorpions, or other synanthropic animals. Brazilian Centers for Zoonoses Control work with a lack of human, equipment, and financial resources. Therefore, they do not monitor the canine population, neither conclude a serosurvey recovering all the canine population, nor even an annual sampling, planning the actions concerning the diagnoses prevision. Data on the population of dogs are hardly updated.

The canine population constantly changes in households, approximately 50% in six months [34]. With this in mind, the human population seems to be an alternative to estimate the number of dogs once they are domestic animals. Literature has a variety of estimative proportions of dogs per inhabitant, ranging from 1:2 to 1:5 [35,36,37,38]. We used a ratio of 1:4 [28], consistent with a medium-sized city of the state of São Paulo. We observed a low coverage of serological surveys in Brazilian cities [39,40], which have also been one of the most precise statistics for canines in Brazil. While canine monitoring is still insufficient, our methodology – estimating the number of dogs per census tract – offers a possibility to precisely investigate disease patterns. It can cover a lack of data in an area or lost temporal information.

In the city of Presidente Prudente, a massive difference in the number of examined dogs in 2014, 2015, and 2016 was detected. Besides, the shortage of DPP in 2015, affecting the municipalities of the state of São Paulo [41] was also observed. In this year, a high prevalence can be observed once the schedule for monitoring reservoirs was interrupted. Diagnostic tests were used in spontaneous demand, that is, dogs referred to the Center for Zoonoses Control with clinical symptoms and probably were positive, affecting prevalence rates. When CVL increased, the diagnostic kits were insufficient to perform planned canine serosurveys, emphasizing that monitor CVL in Brazilian cities is very difficult. Although the DPP shortage was normalized in 2016 – doubling the samples (Table 1) – the number of cases increased roughly 82%, which stresses that only the serosurvey and culling dog may not be enough to control VL. The failure of both strategies may be due to the low coverage of the serosurveys [39].

This study found that the spatial prevalence in the city of Presidente Prudente remained low until 2014 (< 2.5%). Nevertheless, dogs can be asymptomatic and a source of infection [42,43], including asymptomatic seronegative individuals [44], allowing VL to spread. In 2015, the prevalence had a spatial pattern of low values in the center and high values in the outskirts. Two reasons might have contributed to this pattern: the municipality borders have a higher number of dogs, and those are the boundaries between urban and rural areas. Vegetation creates a suitable habitat for vectors and may be related to infected dogs [25,45,46,47]. For the global prevalence (Table 1), we observed low rates (< 1.1%) from 2012 to 2014 and then a rapid increase in 2015 (5.4%). The global prevalence was low

(1%) compared to another Brazilian state, e.g., 54% in Mato Grosso [46], or even in an endemic city of São Paulo State with 8% [48].

In urban areas, VL control is complex: (i) canine diagnoses are a challenge due to the operationalization of thousands of samples in the serosurveys [49]; (ii) euthanasia is a social problem due to the relationship of the families with their dogs, increasingly adapted to humans; (iii) a long period of time between diagnosis and canine treatment or euthanasia may occur; (iv) there is a cultural habit of fast replacement of culled dogs or the introduction of new animals in the households [23,50,51], contributing to areas remaining endemic, and finally; (v) the Center for Zoonoses Control has planned its actions mainly focused on the location of human cases. However, it seeks to reach the disease. Considering Aristoteles' theory of Act (*energeia*, *entelecheia*) and Potency (*dynamis*) to Center for Zoonoses Control, we may rethink the path of VL between human or canine cases and their movement: who is and could turn out to be infected. The Center for Zoonoses Control needs to act faster, drawing up plans to prevent disease cases.

The higher trends and the location of the examined dogs follow different directions. The trends move in the city throughout the years. In many areas, no significant number of disease notifications occurred and then became visible. The movement starts with a single notification from any place in the city. Strategically, a couple of actions are performed in the area (or should be), such as serosurvey, environmental management, vectors control, and euthanasia, in accordance with Brazilian protocols [4]. A break in the VL cycle is observed, but other epidemiological factors are still present. One clear example is the "bimodal pattern", that is, the decrease in canine positive results in a given year usually preceded by a higher positive rate in the previous year [39]. In other words, when control activities are executed, the number of cases decreases momentarily. Nonetheless, epidemiological aspects may not disappear due to favorable conditions to vector colonization, maintenance of infected dogs at households, or the replacement of euthanized ones. Additionally, neighboring households could have vectors and (asymptomatic) dogs.

The spatial trend (Figure 4) and the increasing number of cases (Figure 2) represent the Center for Zoonoses Control's reduced capacity in controlling CVL. We observed that, in 2015, when the maximum number of cases was registered in the Northwest Region (Figure 3, area 6), only a few samples were examined (Table 1; Figure 4). An increase in testing capacity was detected only in 2016, demonstrating a delay in case appearance and serosurvey. Additionally, the Northwest area, indicated with a high prevalence in 2015, had a lower prevalence in 2016, but neighboring areas still had medium prevalence, emphasizing that the Center for Zoonoses Control is trying to control disease cases, but not sufficiently. The spatial pattern of the difference in the trend and higher screening coverage is due to, most likely, the inquiries focused on human cases areas. The annual screening coverage never surpassed more than 50% in at least half of the municipality. These results corroborate the findings of a yearly screening coverage of below 50% from 2012 to 2017 in another endemic Brazilian city [39]. Conversely, the serosurvey conducted in all the historical period (2010-2016) demonstrated a high coverage (> 75%) in most areas of the city (57,000 pieces of data), which corresponds to the estimated canine population (57,592). However, this was concluded in seven years, too long for the rapid response that the Center for Zoonoses Control and public health urge. This scenario is not only faced by the city of Presidente Prudente but by the Brazilian cities that have been trying to control VL for decades unsuccessfully.

VL surveillance and control actions must be taken as a priority by different public management levels. The measures are recommended by the National PCLV but executed by the local governments, which suffer the pressure of the dog's guardians and animal protection organizations, affecting the local elections and politicians' popularity. Even in the scientific community, euthanasia has been deeply discussed [41,51,52,53,54]. The debate concerning the possibility of introduction of new control strategies regarding CVL – treatment, vaccines, selected euthanasia of symptomatic dogs, and the use of insecticides [52,53] – based on scientific evidence that considers the participation of the society in a horizontal construction of a health system increasingly participatory, plural, and effective [49]. Therefore, socioeconomic, cultural, political, and environmental conditions play an essential role in the directions that cases may be following in a city.

The positive spatial autocorrelation of CVL per year highlights the relationship that the value at a location and its neighbor regions are influence by each other. In 2011, the spatial pattern showed the existence of clusters of high-high relationships and outliers in different areas of the city (Figure 5). Then, the areas near the high-low outliers have clustered areas of high-high relationship in 2013 (Figure 5). Outliers are clues to investigate which areas can turn into clustered areas. Overall, from 2010 to 2016, the spatial autocorrelation was positive (I = 0.2, p-value < 0.000) and statistically significant (Figure 5), allowing us to better comprehend the spatial disease pattern. We indicated one big cluster of high-high relationships in the Northwest, broadly consistent with the trend. The lower prevalence is consistent with polygons of no statistical significance and spatial autocorrelation. Our results corroborate the finds in Argentina in 2014, where the higher prevalence areas are overlapped in the high-high cluster or high-low outliers [55].

Furthermore, it has been suggested that the human VL clusters can emerge after the CVL clusters, with a temporal association between the two outcomes [56]. The high-high clusters and the high-low outliers are priority areas to intervene and to monitor. Then, the Centers for Zoonoses Control can arrive first, with preventive measures. The non-significant polygons describe random risk areas, that is, all areas will be at risk and represent a lower priority for intervention than the area presented as a high-high cluster. Our recommendation is to monitor all areas, but mainly those highlighted as a priority.

Geography knowledge, with spatial analysis, can provide clues of priority areas thinking of an integrated approach. Spatial analysis is a way to minimize the distance between the path of Centers for Zoonoses Control and disease spread. This informations could help predict where VL will be and what pattern it will take. Spatial analysis studies help us to understand the behavior of the disease and its background. Nevertheless, the Centers for Zoonoses Control seem to be far from absorbing these technologies. These tools need to be used by public policies to plan VL control once the disease is an issue of particular concern to local health authorities. We emphasize that the Centers for Zoonoses Control represent one of the practices of public health. The success of control measures will depend on integrated actions from three public health practices against VL: the vectors control, epidemiologic surveillance, and Center for Zoonoses Control, using geographical knowledge to support decision-making.

Finally, this study had limitations that should be acknowledged. The canine estimation assumed that all percentage of dogs calculated by a city, in this case Presidente Prudente, is parallel to the human population. We recognize that neighborhoods can be different and that the proportion of dogs per inhabitant could change inside the city. Yet, when no recorded database of dogs is available, the estimation can help calculate the local prevalence. We used different data in our analysis, such as the real number of examined dogs and the estimative, aware of the need to change data when necessary.

Conclusion

We applied statistical techniques and generated thematic cartography maps. Our methodology allowed analyzing canine visceral leishmaniasis in the space, identifying priority intervention areas. As the patterns are constantly changing, the Center for Zoonoses Control needs to be prepared to face VL. We emphasize using spatial analysis to support decision-making, drawing up strategies to make health services react faster than disease spreading.

Contributors

P. S. S. Matsumoto contributed to the conceptualization of the study, methodology, data curation, formal analysis, writing, reviewing and editing the text. E. F. Flores contributed to the methodology, formal analysis, writing, review and editing the text. J. S. Barbosa contributed to the methodology, writing, reviewing and editing the text. U. C. Pessoto and J. E. Tolezano contributed to the writing, revision and editing of the text. R. M. Hiramoto and H. H. Taniguchi contributed to the data curation, writing, revision and editing the text. R. B. Guimarães contributed to the conceptualization of the study, writing, reviewing and editing the text. All authors have approved the final version for publication.

Additional informations

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Conflict of interests

The authors declare no conflict of interest.

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Resumo

A leishmaniose visceral (LV) é um problema de saúde pública nas cidades brasileiras. Por mais que haja um planejamento de políticas públicas para LV no Estado de São Paulo, Brasil, novos casos têm sido notificados e se disseminado. O artigo objetiva discutir como o Centro de Controle de Zoonoses realiza suas atividades espacialmente em uma cidade endêmica, Presidente Prudente, no Estado de São Paulo. Os dados são da Secretaria Municipal de Saúde de Presidente Prudente, Instituto Adolfo Lutz e Instituto Brasileiro de Geografia e Estatística. Estimamos espacialmente a população canina por setor censitário e utilizamos ferramentas de geoprocessamento para produzir mapas coropléticos, tendências espaciais e autocorrelação espacial. Encontramos um padrão espacial de maior prevalência na periferia da cidade e uma autocorrelação espacial positiva estatisticamente significativa (I = 0,2; p < 0,000) com clusters *de relação alta-alta no noroeste da cidade. Além disso, identificamos uma direção diferente no caminho dos inquéritos sorológicos realizados* versus *a tendência na LV canina, o que enfatiza a fragilidade das medidas de controle do Centro de Controle de Zoonoses para controlar casos da doença. O Centro de Controle de Zoonoses parece estar sempre correndo atrás da doença. A análise espacial pode ser útil para repensar o funcionamento do serviço e auxiliar as políticas públicas.*

Leishmaniose Visceral; Tomada de Decisões; Vigilância Epidemiológica

Resumen

La leishmaniasis visceral (LV) es un problema de salud pública en las ciudades brasileñas. Aunque hay políticas públicas de planificación relacionadas con la LV en el estado de São Paulo, Brasil, se han informado de nuevos casos, además de su propagación. El objetivo de este trabajo es discutir cómo el Centro de Control de Zoonosis dirige sus acciones espacialmente en una ciudad endémica del estado de São Paulo, Presidente Prudente. Los datos proceden de la Secretaría Municipal de Salud de Presidente Prudente, del Instituto Adolfo Lutz, y del Instituto Brasileño de Geografía y Estadística. Estimamos espacialmente la población de perros por sector censal y utilizamos herramientas de geoprocesamiento para elaborar mapas de coropletas, tendencias espaciales, y autocorrelación espacial. Encontramos un patrón espacial de más alta prevalencia en la periferia de la ciudad, además de una autocorrelación espacial positiva y estadísticamente significativa (I = 0,2; valor de p < 0,000) con clústeres de relaciones alto-alto en la parte noroccidental de la ciudad. Además, identificamos una dirección diferente en la trayectoria de las encuestas serológicas llevadas a cabo, frente a la tendencia de LV canina, que enfatiza la debilidad de acciones del Centro de Control de Zoonosis para controlar casos de la enfermedad. El Centro de Control de Zoonosis parece siempre estar tras la enfermedad. El análisis espacial podría ser útil para repensar cómo está funcionando el servicio, además de ayudar a políticas públicas.

Leishmaniasis Visceral; Toma de Decisiones; Vigilancia Epidemiológica

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