Economic impact of hospitalizations due to leishmaniasis in southern Brazil

Impacto econômico das internações hospitalares por leishmaniose no sul do Brasil

Impacto económico de la hospitalización por leishmaniasis en el sur de Brasil

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Abstract
Objectives: To investigate the hospital morbidity related to leishmaniasis in a state of Southern Brazil and to analyse the management of the financial resources regarding hospital expenses. Methods: This is a cross-sectional study. The cases of hospital admissions due to leishmaniasis recorded in the state of Paraná between 2008-2018 were obtained by consulting the IT Department of the Unified Health System (DATASUS), Brazil. The profile of the hospitalized patients, the character of medical care and expenses with hospital service were investigated. The data were statistically analysed on Epi Info™ version 3.5.4. Results: The study recorded 3,927 confirmed cases and 61 hospital admissions caused by cutaneous leishmaniasis (31.77%), 42 mucocutaneous (21.88%), 18 visceral (9.37%) and 71 unspecified clinical form (36.98%). Most patients were male (79.17%, 152), of white race (68.75%, 132) and older than 30 (81.77%, 157). The higher number of hospital admissions was due to urgency service (85.41%, 164). The total amount spent on hospitalizations varied in these ten years, with a minimum value of US$1,205.43 and a maximum of US$5,073.94. Joinpoint regression program 4.6.0. was used for the trend analysis. Conclusions: The expenditures with tertiary care for the treatment of patients with leishmaniasis reflect the need to strengthen basic health care. We believe that the development of health education activities with the population to prevent the leishmaniasis

transmission reduces the number of new cases, while the early diagnosis of the disease can avoid medical complications and consequently decrease the costs of hospitalizations.

Keywords: Leishmaniasis; Hospitalization; Epidemiological monitoring; Health expenditures.

Resumo

Objetivos: Investigar a morbidade hospitalar relacionada à leishmaniose em um estado do Sul do Brasil e analisar o manejo dos recursos financeiros referentes às despesas hospitalares. Metodologia: Trata-se de um estudo transversal. Os casos de internações por leishmaniose registrados no estado do Paraná entre 2008-2018 foram obtidos por consulta ao Departamento de Informática do Sistema Único de Saúde (DATASUS), Brasil. Investigou-se o perfil dos pacientes internados, o caráter do atendimento médico e os gastos com atendimento hospitalar. Os dados foram analisados estatisticamente no Epi Info™ versão 3.5.4. Resultados: O estudo registrou 3.927 casos confirmados e 61 internações por leishmaniose cutânea (31,77%), 42 mucocutânea (21,88%), 18 visceral (9,37%) e 71 de forma clínica não especificada (36,98%). A maioria dos pacientes era do sexo masculino (79,17%; 152), da raça branca (68,75%; 132) e com mais de 30 anos (81,77%; 157). O maior número de internações foi devido ao serviço de urgência (85,41%; 164). O valor total gasto com as internações variou nesses dez anos, com valor mínimo de US$ 1.205,43 e máximo de US$ 5.073,94. O programa de regressão Joinpoint 4.6.0. foi usado para a análise de tendências. Conclusões: Os gastos com a atenção terciária para o tratamento de pacientes com leishmaniose refletem a necessidade de fortalecer a atenção básica. Acreditamos que o desenvolvimento de ações de educação em saúde com a população para prevenir a transmissão da leishmaniose reduz o número de novos casos, enquanto o diagnóstico precoce da doença pode evitar complicações médicas e consequentemente diminuir os custos com internações.

Palavras-chave: Leishmaniose; Hospitalização; Monitoramento epidemiológico; Gastos em saúde.

Resumen

Objetivos: Investigar la morbilidad hospitalaria relacionada con la leishmaniasis en un estado del sur de Brasil y analizar la gestión de los recursos financieros en relación con los gastos hospitalarios. Métodos: Se trata de una investigación transversal. Los casos de ingresos hospitalarios por leishmaniasis registrados en el estado de Paraná entre 2008 y 2018 se obtuvieron mediante consulta al Departamento de TI del Sistema Único de Salud (DATASUS), Brasil. Se investigó el perfil de los pacientes hospitalizados, el carácter de la atención médica y los gastos con atención del servicio hospitalario. Los datos fueron analizados estadísticamente en Epi Info™ versión 3.5.4. Resultados: El estudio registró 3.927 casos confirmados y 61 ingresos hospitalarios por leishmaniasis cutánea (31,77%), 42 mucocutánea (21,88%), 18 visceral (9,37%) y 71 de forma clínica no especificada (36,98%). La mayoría de los pacientes eran del sexo masculino (79,17%, 152), de raza blanca (68,75%, 132) y mayores de 30 años (81,77%, 157). El mayor número de ingresos hospitalarios se debió al servicio de urgencias (85,41%, 164). El monto total gastado en hospitalizaciones varió en estos diez años, con un valor mínimo de US$ 1.205,43 y un máximo de US$ 5.073,94. Programa de regresión Joinpoint 4.6.0. se utilizó para el análisis de tendencias. Conclusiones: Los gastos con atención terciaria para el tratamiento de pacientes con leishmaniasis reflejan la necesidad de fortalecer la atención básica de salud.

Palabras clave: Leishmaniasis; Hospitalización; Monitoreo epidemiológico; Gastos en salud.

1. Introduction

Leishmaniasis are infectious-parasitic diseases caused by different protozoan species of the *Leishmania* genus, being among the six most important infectious diseases nowadays (Ministry of Health of Brazil, 2017b). They are classified as cutaneous, mucocutaneous and visceral leishmaniasis according to the clinical manifestations presented by the patients (Ferreira & Moraes, 2015).

The World Health Organization (WHO) estimates that 350 million people are exposed to the risk of contracting leishmaniasis around the world, with an estimated two million new cases of different clinical forms per year (Ministry of Health of Brazil, 2017b). In the countries of Americas, Brazil is the one with the highest prevalence of visceral leishmaniasis (about 96% of cases), as well as cutaneous and mucocutaneous leishmaniasis (Pan American Health Organization, 2018). In Brazil, leishmaniasis is one of the neglected tropical infectious diseases with the highest impact on public health (Reis *et al*., 2016), standing out for its prevalence and high potential for morbidity (Ministry of Health of Brazil, 2017b). Precarious socioeconomic conditions stimulate the multiplication of the vector and reduce the immunological resistance of hosts, being a significant factor in the manifestation of the disease (Donato et al., 2013).

Among the different damages caused by infection are: eruption of wounds, nodules, development of exudate by associated secondary infection, progressive destruction of cartilages with mutilation of the face, harm to the viscera and other sequelae, including the possibility of death. Therapeutic failure may occur because the patient abandons the treatment or due to the high toxicity and adverse effects of the drugs. Moreover, there are cases of drug resistance (Mcgwire & Satoskar, 2014; Blanco & Nascimento-Júnior, 2017; Okwor & Uzonna, 2016; Ready, 2014). When these factors are associated with some other pathology, the clinical manifestations can become atypical and harder to treat (Okwor & Uzonna, 2016; Zijlstra, 2014; Rossi & Fasel, 2017), making the individual susceptible to complications and hospitalization as a result of these health problems.

The Brazilian Ministry of Health has proposed surveillance actions as one of the main objectives for controlling leishmaniasis in the country, which include collecting and analysing data on human cases and risk factors. These analyses support the decision-making regarding leishmaniasis prevention and control recommendations, to optimize available resources and increase their effectiveness (Ministry of Health of Brazil, 2017b).

In this study, we investigated the hospital morbidity caused by leishmaniasis between 2008-2018 in the state of Paraná, southern Brazil, and analysed the management of the financial resources by the public health system regarding the hospital expenses.

2. Methodology

This cross-sectional study was conducted by consulting DATASUS, a database of public domain information provided by the IT Department of the Unified Health System, Brazil. Public and private hospitals send the information through the Authorization of Hospital Admission, and the data are managed in DATASUS as anonymous information of patients. The total number of cases of leishmaniasis in the state of Paraná was investigated by consulting the Information System for Notifiable Diseases (SINAN) (Figure 1). This is a database fed by the notifications and investigations of cases which are included in the national list of compulsory notification diseases. The study followed the initiative named Strengthening the Reporting of Observational Studies in Epidemiology (STROBE), that developed a checklist containing recommendations to complete description of observational studies (Elm *et al.*, 2008).

The data of hospitalizations due to leishmaniasis were obtained by consulting DATASUS from April to November of 2018, following the steps described in Figure 1. We analysed the cases of hospital admissions caused by leishmaniasis recorded in the state of Paraná between January/2008 and August/2018. The hospital morbidity by leishmaniasis in all its clinical forms were evaluated according to the variables: gender, age, colour/ethnic group of patients, medical care (urgency and elective), average length of stay, number of deaths, average cost of hospitalization, total expenses with hospital service and mesoregion of the state where the cases of hospitalization were recorded.

The values of hospitalization expenses provided by the database are in Brazilian Real. These amounts were converted to US dollars according to the commercial value of the currency each year (Ipea, 2018). The state of Paraná was divided into mesoregions according to the classification of The Brazilian Institute of Geography and Statistics (IBGE, 1990) to analyse the distribution of the disease cases in the state. The maps were designed through Qgis version 7.4.2, an Open Source Geographic Information System to generate the shapes of the state of Paraná, which was obtained from IBGE data and analysed on GeoDa™ software for spatial analysis research.

The data obtained were organized in spreadsheets and statistically analysed on Microsoft Excel® software and Epi Info™ version 3.5.4. Joinpoint regression program 4.6.0. was used for the trend analysis.

Figure 1. Flowchart of the data search of hospitalizations related to leishmaniasis in the state of Paraná from 2008 to 2018 at SINAN and DATASUS.
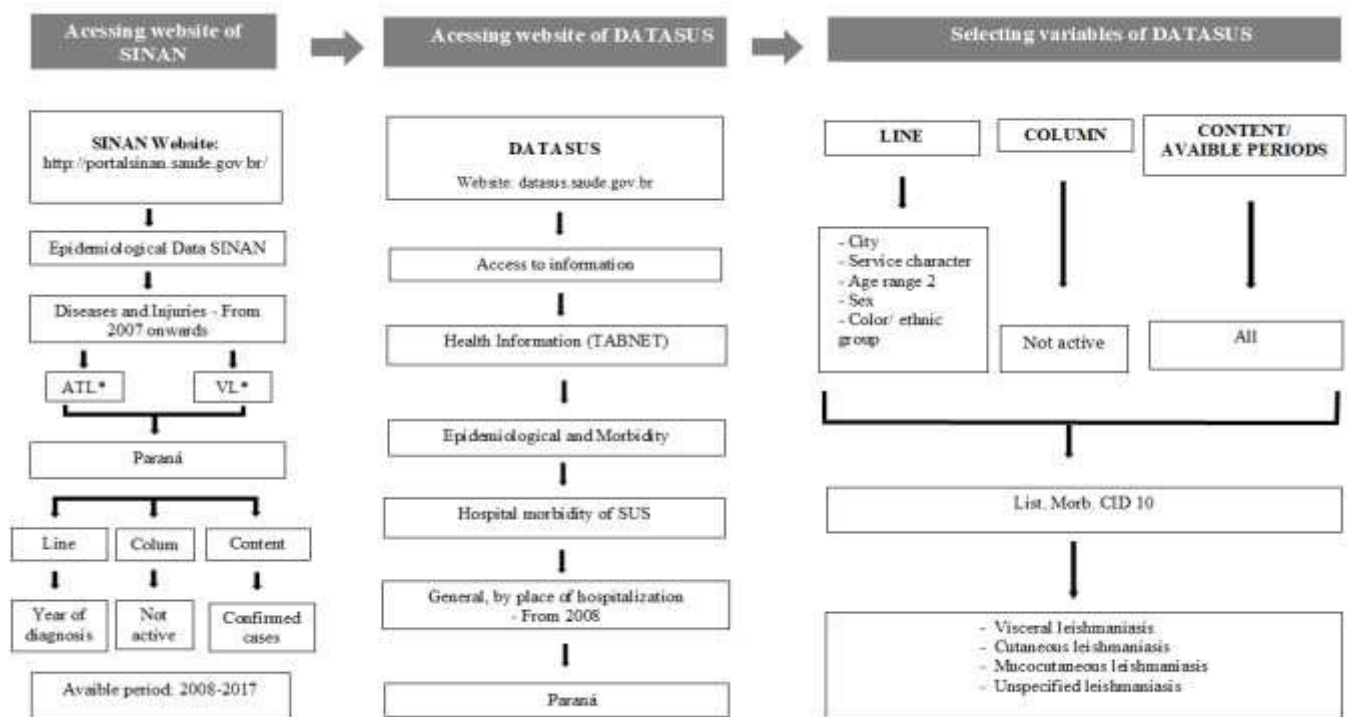
Source: Authors (2019).

3. Results

We recorded 3,927 confirmed cases and 192 hospitalizations caused by leishmaniasis in the state of Paraná during the period of the study (Table 1). Half of the hospital admissions were of individuals with the cutaneous and mucocutaneous forms of the disease (53.65%, 103). The type of leishmaniasis was unspecified in a little more than a third of the registered hospitalizations (36.98%, 71). Most of the patients were male (79.17%, 152), white (68.75 132) and older than 30 (81.77%, 157). The length of stay was higher among patients hospitalized for mucocutaneous leishmaniasis when compared to other clinical forms. The number of deaths (3.64%, 7) was low when compared to the total number of hospitalizations (Table 1).

Table 1. Profile of hospital admissions for leishmaniasis in all its clinical forms, state of Paraná, Brazil, 2008-2018.

	Cutaneous		Mucocutaneous		Visceral		Unspecified		Total	
	n	%	n	%	n	%	n	%	n	%
Number of hospitalizations	61	31.77	42	21.88	18	9.37	71	36.98	192	100.00
Sex										
Female	14	22.95	5	11.90	4	22.22	17	23.94	40	20.83
Male	47	77.05	37	88.10	14	77.78	54	76.06	152	79.17
Age										
0-14	6	9.84	1	2.38	1	5.56	6	8.45	14	7.29
15-29	6	9.84	1	2.38	4	22.22	10	14.08	21	10.94
30-59	30	49.18	17	40.48	9	50.00	27	38.03	83	43.23
60 or more	19	31.14	23	54.76	4	22.22	28	39.44	74	38.54
Color/Ethnic group										
White	36	59.02	36	85.72	14	77.78	46	64.79	132	68.75
Black	5	8.20	-	-	-	-	-	-	5	2.61
Brown	4	6.56	2	4.76	3	16.67	7	9.86	16	8.33
Yellow	-	-	-	-	-	-	-	-	-	-
Indigenous	-	-	-	-	-	-	-	-	-	-
No related	16	26.22	4	9.52	1	5.55	18	25.35	39	20.31
Lenght of stay (days)	12		18		14		11		13	
Number of deaths	2	3.27	-	-	2	11.11	3	4.22	7	3.64
Average value spent by hospitalization (US$)	164.77		176.83		374.14		179.93		192.64	
Expenses with medical care service (US$)										
Elective	696.00	6.92	1,840.80	24.79	146.04	2.17	2,156.77	16.88	4,839.60	13.08
Urgency	9,354.65	93.08	5,585.88	75.21	6,588.55	97.83	10,617.99	83.12	32,147.08	86.92
Total expenses (US$)	10,050.65	27.17	7,426.68	20.08	6,734.59	18.21	12,774.76	34.54	36,986.68	100.00

Source: Authors (2019).

The total expenses with hospital admission by leishmaniasis over the ten years were equivalent to US$36,986.68, with an average hospitalization value of US$192.64 per patient (Table 1). The total costs on hospitalizations were similar among the different clinical forms of leishmaniasis, but the average costs with patients hospitalized for visceral leishmaniasis was higher than the ones of other clinical manifestations. The most expressive number of hospital admission was due to urgency service (Figure 2), accounting for 86.92% of hospitalization expenses (US$32,147.08) (Table 1).

Figure 2. Absolute frequency of elective and urgency hospitalizations from all clinical forms of leishmaniasis, state of Paraná, Brazil, 2008-2018.
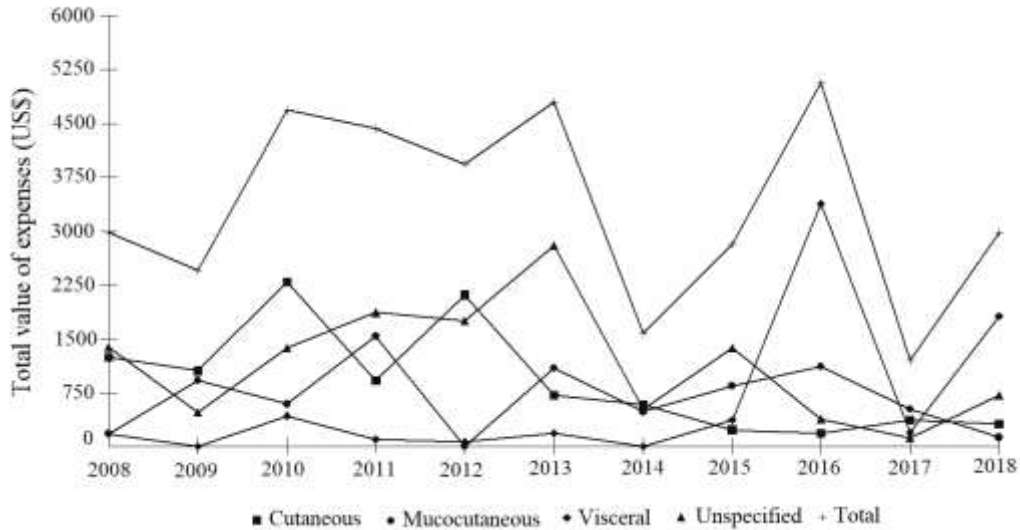
Source: Authors (2019).

The total amount spent with hospitalizations by leishmaniasis showed fluctuations in the ten years analysed (Figure 3), with a minimum value of US\$1,205.43 and a maximum of US\$5,073.94 (Table 2). There was an expressive increase in costs in 2016 compared to other years, mainly due to visceral and mucocutaneous leishmaniasis. It is worth pointing out that in 2018 it had already been spent, until August, more than half the amount spent in 2016 (Table 2). The trend analysis of hospitalizations by leishmaniasis in all its clinical forms was not statistically significant (p= 0.4).

Figure 3. Time series - Total value of expenses with hospital admissions related to leishmaniasis in the state of Paraná, Brazil, 2008-2018.
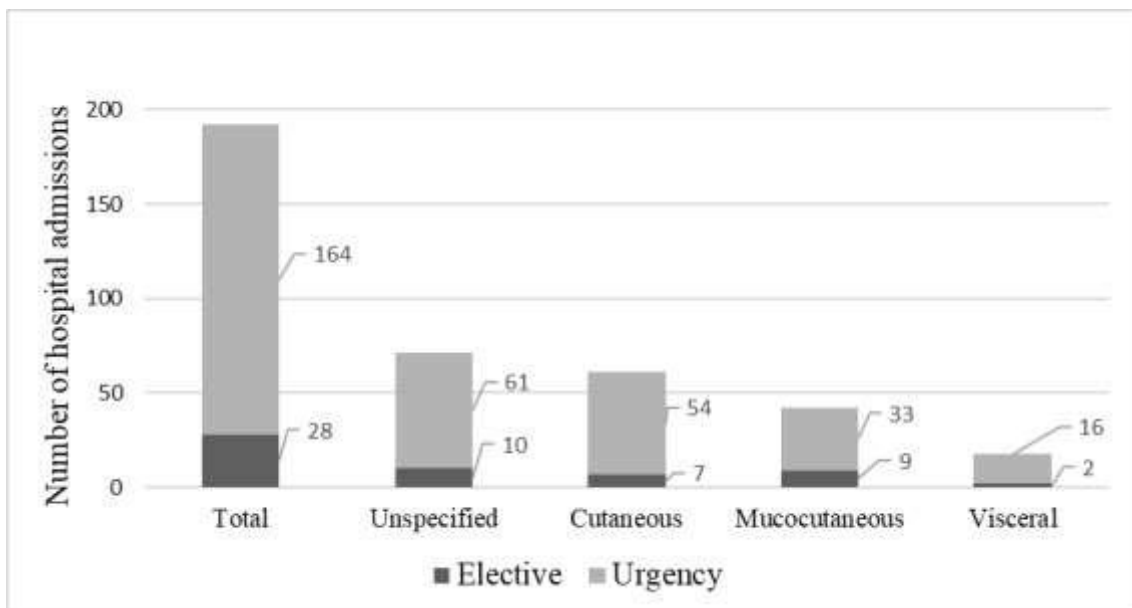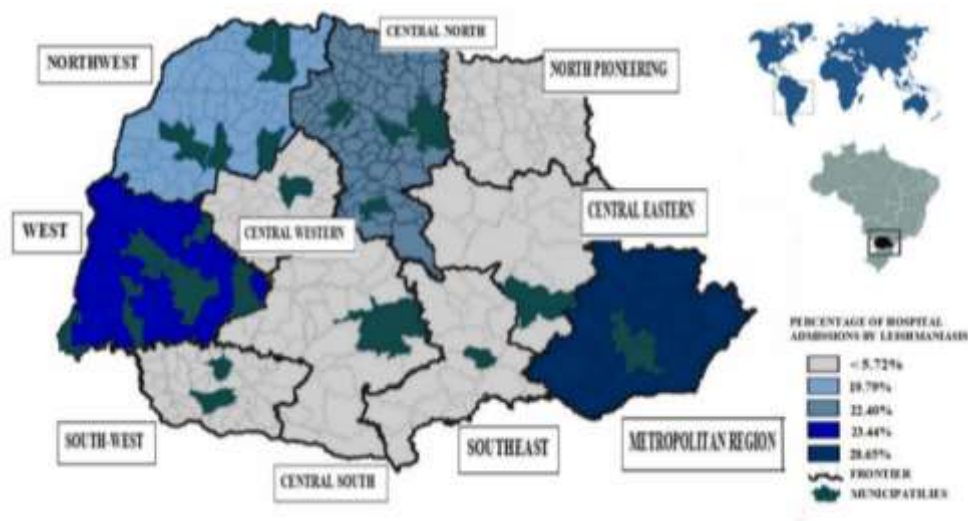

Source: Authors (2019).

Table 2. Expenses due to hospital admissions caused by leishmaniasis per year in all its clinical forms in the state of Paraná, Brazil, 2008-2018 (US$).

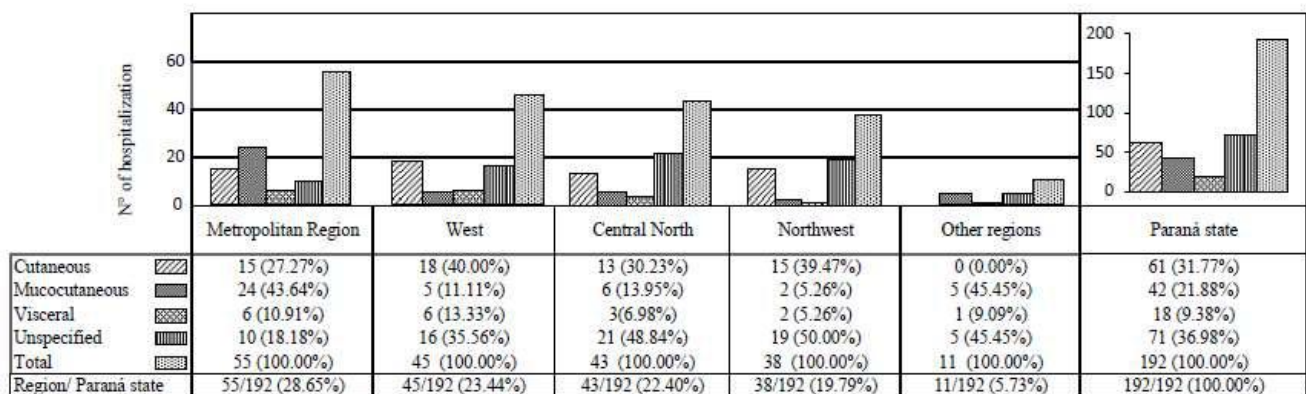| Year	Cutaneous	Mucocutaneous	Visceral	Unspecified	Total
2008	1,244.08	180.98	175.91	1,387.58	2,988.55
2009	1,057.35	920.40	0.00	481.33	2,459.08
2010	2,297.29	593.57	427.39	1,371.61	4,689.86
2011	924.17	1,540.46	102.24	1,868.20	4,435.07
2012	2,113.74	0.00	71.15	1,754.26	3,939.15
2013	717.76	1,097.33	189.42	2,801.68	4,806.19
2014	581.93	483.29	0.00	517.63	1,582.85
2015	233.87	843.77	371.56	1,372.83	2,822.03
2016	189.41	1,117.99	3,382.34	384.20	5,073.94
2017	372.09	520.78	193.37	119.19	1,205.43
2018	318.96	128.11	1,821.21	716.25	2,984.53
Total	10,050.65	7,426.68	6,734.59	12,774.76	36,986.68

Source: Authors (2019).

The higher number of cases of hospitalizations caused by leishmaniasis was registered in the metropolitan region of Curitiba (28.65%, 55), followed by the west (23.44%, 45), central north (22.40%, 43) and northwest region (19.79%, 38) of the state of Paraná (Figure 4). The metropolitan region of Curitiba had a higher number of hospitalizations by mucocutaneous leishmaniasis (43.64%, 24/55), while the west region had a higher number of cases for cutaneous form (40.00%, 18/45) (Figure 5). In the central north and northwest regions, a higher number of records of unspecified leishmaniasis was observed (48.84%, 21/43 and 50.00%, 19/38, respectively), followed by cases of cutaneous leishmaniasis (30.23%, 13/43 and 39.47%, 15/38, respectively) (Figure 5).

Figure 4. Leishmaniasis hospitalizations in the state of Paraná, Brazil, 2008-2018. In shades of blue, four of ten regions with the principal percentage rates calculated of leishmaniasis hospitalizations in the state of Paraná. 27 municipalities of these regions registered hospital admissions.

Source: Authors (2019).

Figure 5. Absolute and relative frequency of hospital admissions due to leishmaniasis in the state of Paraná in all its clinical forms, Brazil, 2008-2018.

		Metropolitan Region	West	Central North	Northwest	Other regions	Paraná state
Cutaneous		15 (27.27%)	18 (40.00%)	13 (30.23%)	15 (39.47%)	0 (0.00%)	61 (31.77%)
Mucocutaneous		24 (43.64%)	5 (11.11%)	6 (13.95%)	2 (5.26%)	5 (45.45%)	42 (21.88%)
Visceral		6 (10.91%)	6 (13.33%)	3 (6.98%)	2 (5.26%)	1 (9.09%)	18 (9.38%)
Unspecified		10 (18.18%)	16 (35.56%)	21 (48.84%)	19 (50.00%)	5 (45.45%)	71 (36.98%)
Total		55 (100.00%)	45 (100.00%)	43 (100.00%)	38 (100.00%)	11 (100.00%)	192 (100.00%)
Region/ Paraná state		55/192 (28.65%)	45/192 (23.44%)	43/192 (22.40%)	38/192 (19.79%)	11/192 (5.73%)	192/192 (100.00%)

Source: Authors (2019).

4. Discussion

The average hospitalization cost per patient in 2018 represents about 90% of the national minimum wage of the respective year (US$254.40) (Decree no. 9.255, 2017). Thus, a large part of the population would be unable to pay more than one day of treatment if there was no assistance from the Brazilian Unified Health System. Even the inhabitants of the state of Paraná, which has one of the highest Human Development Indexes (HDI) in the country (Ipardes, 2013), cannot afford all the expenses. The medical expenses include exams, medicines, supplies, hospital care, payroll of employees, life-saving emergency care and other services (Datasus, 2018).

Most patients with leishmaniasis are classified as economically active population: they are in a productive phase, contribute to family income and generate wealth for the country (Ministry of Health of Brazil, 2017b; IBGE, 2010b). Because of the adverse effects of the medicines, some patients may need to be hospitalized (Ministry of Health of Brazil, 2017b), and their withdrawal from work becomes necessary, affecting the finances of their families and the local economy. The abandonment of treatment by the patients and therapeutic failure can then occur, leading to cases of relapse and complications of the disease (Singh et al., 2016; Ministry of Health of Brazil, 2017b).

The frequency of male infected by leishmaniasis was the majority in this study, probably due to the habits developed by the patients. This result corroborates with previous observations in the literature, indicating that factors such as men´s professional occupation, their leisure activities and ecotourism practice can contribute to the higher number of cases among them (Tonelli *et al.*, 2017; Okwor & Uzonna, 2016). In this study, patients older than 30 were the most frequently hospitalized. Iddawela et al., (2018) showed that the most affected age group with cutaneous leishmaniasis was the 40-49 years old, corroborating with our results, maybe because great part of the population living in Paraná belongs to that age group (IBGE, 2010b). This study also showed that most of the patients hospitalized by leishmaniasis were white people. In Brazil, with the exception of the southern region, black people is at higher risk of contracting leishmaniasis than white people (Ministry of Health, 2017a). However, according to IBGE, the white race is predominant in the state of Paraná (IBGE, 2010a), what would justify the higher number of cases among these individuals.

American tegumentary leishmaniasis (ATL) covers cutaneous and mucocutaneous forms of the disease, presenting a high potential of morbidity but low rates of mortality. This profile is well established by the literature (Silva, 2003) and observed in this study. The treatment for cutaneous leishmaniasis is likely to cause side effects that may eventually lead to hospital admission, such as cardiac, hepatic, pancreatic or renal changes (Ministry of Health of Brazil, 2017b). ATL is widely

distributed in all states and regions of Brazil and is considered the most prevalent type of leishmaniasis in the entire national territory (Figueirêdo et al., 2020; Pelissari et al., 2011). It may be the reason why the number of hospitalizations caused by this clinical form is higher in Paraná than the one caused by visceral leishmaniasis.

About 1 to 10% of patients with cutaneous leishmaniasis develop the mucocutaneous form, which is the most debilitating form and a highly disfiguring condition, destroying oral mucosa and cartilage (Sakib et al., 2018). The highest average length of stay, related to patients hospitalized for the mucocutaneous form of leishmaniasis, can be justified by the fact that destructive lesions may cause health complications, requiring immediate hospitalization. Secondary infections in nasal mucosa ulcers can lead to bronchopneumonia; lesions in the mouth and pharynx hinders swallowing and lead to malnutrition; advanced lesions in the larynx can obstruct the passage of air; and conjunctival lesions can lead to distortion of the ocular cleft (Ministry of Health of Brazil, 2017b).

In the state of Paraná, the first autochthonous case reported of visceral leishmaniasis was described only in 2016 by Trench *et al.* (2016). Therefore, it is believed that the cases of hospitalizations reported by DATASUS are of patients from other regions of Brazil referred for treatment in the state of Paraná, or they are cases from residents of this state who went to other regions of the country where there are cases of visceral leishmaniasis. The highest average value spent with patients hospitalized by visceral leishmaniasis occurs because this disease presents clinical characteristics of severe evolution (Ministry of Health of Brazil, 2014; Oliveira & Moreira, 2021); it is potentially fatal (Pan American Health Organization, 2018) and requires higher financial resources. Diagnosis of patients with advanced visceral leishmaniasis is common and can be attributed to patients' delay in seeking health services and the low capacity to detect the cases by professionals in the basic health care (Ministry of Health of Brazil, 2014). Depending on the severity with which the patient with visceral leishmaniasis was hospitalized, death may occur in a short period of time (Ministry of Health of Brazil, 2014). That would explain the shorter length of stay of patients hospitalized by visceral leishmaniasis than by mucosal leishmaniasis. If adequate treatment does not start in time, the disease can progress to death in 90% of the cases (Pan American Health Organization, 2017).

The present study used secondary data, and it may show limitations in consequence of sub-notifications and diagnostic errors, which could justify the large number of leishmaniasis classified as unspecified by DATASUS. The database also does not provide information about other possible diseases presented by the patient at the time of hospital admission, but leishmaniasis was considered the cause of hospitalization and death of the patient in the data analysed by this study.

To treat severe cases of leishmaniasis, it is recommended that the patient receive the treatment in a hospital environment, under the supervision of a health staff (Ministry of Health of Brazil, 2017b; Ministry of Health of Brazil, 2014). The high number of urgent care cases suggests possible late diagnosis or relapse of the disease, with patient health complications that lead to more severe clinical conditions (Ministry of Health of Brazil, 2017b; Trench *et al.*, 2016) and require emergency hospitalization. Our analysis of the expenditures over the ten years reflects the cyclical profile of the ATL: there are peak rates of transmission of the disease (Ministry of Health of Brazil, 2017b), showed through the fluctuation in the hospitalization expenses caused by this disease and confirmed by a not significative trend analysis.

The urban areas, which have the highest number of cases, are surrounded by the Ivaí, Iguaçu, Tibagi and Pirapó rivers and associated with remnants of forest, consonant to the literature findings (Melo et al., 2017). We believe these areas have the highest rates of endemicity and admissions in hospitals due to favourable circumstances for the vectors such as: remaining forest, high secondary forests and the anthropogenic impact related to agriculture. The migration of the rural population to urban areas, driven by the demand for a better quality of life, leads them to occupy peripheral regions of large cities. This part of the population starts to live in precarious conditions, without basic sanitation and dividing restricted spaces with domestic animals, thus concentrating the ecological space of the disease (Silva, 2003).

The Plan of Action of Leishmaniasis in the Americas 2017-2022 intends to reduce morbidity and mortality in endemic regions through the strengthening of diagnosis, treatment, rehabilitation, prevention, surveillance and control of the different epidemiological scenarios of the endemic countries (Pan American Health Organization, 2018). We believe that the development of health education activities with the population can prevent the possibility of leishmaniasis transmission and reduce the number of new cases. In addition, the early diagnosis of the disease may avoid medical complications and consequently cut down the costs of hospitalizations.

It is opportune that measures are implemented aiming at the epidemiological education of health professionals in relation to leishmaniasis. They can detect the early occurrence of the disease and, through the notification of cases, enable the implementation of sanitary measures to mitigate the consequences of the disease (Dias *et al*., 2022). Interventions involving several sectors of society to integrate information would raise awareness about prevention, decreasing the risks of leishmaniasis transmission and its costly aggravation. That would surely reduce unnecessary expenses in the different health sectors, as well as avoid the death of those affected by the disease.

5. Conclusion

In Paraná, one of the states with the lowest incidence rate of leishmaniasis in Brazil (Ministry of Health of Brazil, 2017b), hospital admissions generated a cost of approximately US$37,000.00 for the public health system between 2008-2018. It suggests that in regions of the country with higher incidence rates the expenses were even higher. Leishmaniasis remains as a neglected disease; however, the reflexes in the social sphere and the expenses associated with the treatment of this disease cannot be ignored.

New researches should be developed to broaden our understanding about the profile of hospital admissions for leishmaniasis in all regions of Brazil, mapping risk areas for the disease in the country. In addition, it is important to investigate primary and secondary care expenditures on the prevention and treatment of leishmaniasis to assist health authorities in managing financial resources.

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