

# Characterization of Reported American Tegumentary Leishmaniasis Cases in Mato Grosso 2011-2020

Caracterização dos Casos de Leishmaniose Tegumentar Americana Notificados em Mato Grosso 2011-2020  
Caracterización de Casos de Leishmaniasis Tegumentaria Americana Notificados em Mato Grosso 2011-2020

## RESUMO

A leishmaniose tegumentar americana é uma doença zoonótica negligenciada de relevância em saúde pública no Brasil. **Objetivo:** Analisar o perfil demográfico, clínico, geográfico e temporal dos casos notificados em Mato Grosso entre 2011 e 2020. **Método:** Estudo epidemiológico descritivo com dados do Sistema de Informação de Agravos de Notificação. Foram avaliadas variáveis demográficas, clínicas, taxas de incidência anual e padrões de distribuição espacial. **Resultados:** Foram notificados 23.471 casos, com predominância no sexo masculino, indivíduos em idade produtiva, raça parda e baixa escolaridade. A forma cutânea foi a mais frequente. A distribuição apresentou padrão estável ao longo do período, com maiores taxas nas mesorregiões norte e nordeste. **Conclusão:** O perfil epidemiológico manteve-se estável no período analisado, caracterizado por predominância no sexo masculino, forma cutânea e concentração espacial nas mesorregiões norte e nordeste do estado.

**DESCRIPTORIOS:** Leishmaniose Cutânea; Leishmaniose Mucocutânea; Incidência; Epidemiologia; Análise Espacial.

## ABSTRACT

American tegumentary leishmaniasis is a neglected zoonotic disease of public health relevance in Brazil. **Objective:** To analyze the demographic, clinical, geographic and temporal profile of reported cases in Mato Grosso from 2011 to 2020. **Method:** Descriptive epidemiological study using data from the Notifiable Diseases Information System. Demographic and clinical variables, annual incidence rates and spatial distribution patterns were analyzed. **Results:** A total of 23,471 cases were reported, predominantly among males of working age, brown race and low educational level. The cutaneous form was the most frequent. The distribution remained stable over time, with higher rates in the northern and northeastern mesoregions. **Conclusion:** The epidemiological profile remained stable, characterized by predominance in males, cutaneous form and spatial concentration in northern and northeastern regions.

**DESCRIPTORS:** Cutaneous Leishmaniasis; Mucocutaneous Leishmaniasis; Incidence; Epidemiology; Spatial Analysis.

## RESUMEN

La leishmaniasis tegumentaria americana es una enfermedad zoonótica desatendida de relevancia en salud pública en Brasil. **Objetivo:** Analizar el perfil demográfico, clínico, geográfico y temporal de los casos notificados en Mato Grosso entre 2011 y 2020. **Método:** Estudio epidemiológico descriptivo con datos del Sistema de Información de Enfermedades de Notificación. Se analizaron variables demográficas y clínicas, tasas de incidencia anual y distribución espacial. **Resultados:** Se notificaron 23.471 casos, predominando el sexo masculino, personas en edad productiva, raza parda y bajo nivel educativo. La forma cutánea fue la más frecuente. La distribución se mantuvo estable en el tiempo, con mayores tasas en las mesorregiones norte y nordeste. **Conclusión:** El perfil epidemiológico permaneció estable, caracterizado por predominio en el sexo masculino, forma cutánea y concentración espacial en las regiones norte y nordeste.

**DESCRIPTORIOS:** Leishmaniasis Cutánea; Leishmaniasis Mucocutánea; Incidencia; Epidemiología; Análisis Espacial.

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## INTRODUCTION

American tegumentary leishmaniasis is a zoonosis caused by protozoa of the genus *Leishmania*, transmitted by sandfly bites. The disease presents three main forms: cutaneous, mucocutaneous, and diffuse cutaneous. The cutaneous form is the most common, causing skin ulcers that can result in permanent scarring and stigmatization. Leishmaniasis is endemic in tropical and subtropical regions, primarily affecting vulnerable populations living in poor housing conditions, suffering from malnutrition, and lacking financial resources<sup>(1)</sup>. It is estimated that between 600,000 and 1 million cases are reported annually, with Brazil being the country with the highest burden of the cutaneous form of the disease<sup>(1)</sup>.

In Brazil, cutaneous leishmaniasis remains a public health problem, especially in the North and Central-West regions. Between 2007 and 2017, more than 230,000 cases were reported, with a prevalence of 118.39 cases per 100,000 inhabitants<sup>(2)</sup>. Factors such as deforestation and agricultural expansion favor the transmission of the

disease, especially in states like Amazonas<sup>(3)</sup>, with the municipalities of Presidente Figueiredo and Rio Preto da Eva having the highest risk rates<sup>(4)</sup>.

In the state of Mato Grosso, the disease has a high prevalence, with the highest concentration of cases in the northern region, which has seen the greatest agricultural expansion. Environmental changes, associated with the coexistence of the Amazon, Cerrado, and Pantanal biomes, favor transmission<sup>(5)</sup>. However, the scarcity of integrated analyses on the demographic and clinical profile and the spatial and temporal distribution of cases hinders the development of effective surveillance and control strategies<sup>(6)</sup>.

This study is based on the hypothesis that cutaneous leishmaniasis in Mato Grosso exhibits spatial heterogeneity, with a higher concentration in the northern part of the state and a predominance among men of working age<sup>(3)</sup>.

The objective of this study was to analyze the demographic, clinical, geographic, and temporal profile of cases of American tegumentary leishmaniasis reported in Mato Grosso from 2011 to 2020, identifying spatial patterns and

temporal trends that could improve disease surveillance and control strategies.

## METHOD

**Study design:** A population-based, epidemiological, observational, descriptive, and retrospective study conducted in the state of Mato Grosso, comprising 141 municipalities.

**Study location:** The study was conducted in the state of Mato Grosso, which is characterized by the Amazon, Cerrado, and Pantanal biomes, where environmental diversity influences the dynamics of disease transmission.

**Data collection period:** Data collection took place in 2023, with records extracted of confirmed cases of American tegumentary leishmaniasis reported between January 1, 2011, and December 31, 2020, in the Notifiable Diseases Information System.

**Population and sample:** The population included all individuals with a confirmed diagnosis of American tegumentary leishmaniasis residing in the state during the analyzed period. The sample consisted of all confirmed cases recorded in the official system, constituting an epidemiological census. After

consistency checks and exclusion of inadequate records, 23,471 cases were included in the final analysis.

#### Inclusion and exclusion criteria:

Cases confirmed by laboratory and/or clinical methods, with essential variables recorded, were included. Cases with duplicate, inconsistent, or missing essential information were excluded.

**Variables analyzed:** Demographic variables (sex, race/ethnicity, age group, education level, and residential area), clinical variables (clinical presentation and case classification), temporal variables (year and month of notification), and spatial variables (municipality, mesoregion, and microregion, according to the Brazilian Institute of Geography and Statistics) were evaluated.

**Procedures:** The data were organized into spreadsheets and underwent consistency checks and standardization prior to statistical analysis.

**Statistical analysis:** Descriptive

analysis was performed using absolute and relative frequencies. Annual incidence rates were calculated per 100,000 inhabitants, using population estimates from the Brazilian Institute of Geography and Statistics. For the spatiotemporal analysis, municipal rates were aggregated into two-year periods and smoothed using the Local Empirical Bayesian method, employing a neighborhood matrix in GeoDa software version 1.2. Areas of highest risk were identified using Kulldorff's spatial scan statistics, with a discrete Poisson probability model and Monte Carlo simulation to assess statistical significance, using SaTScan software version 10.1. The thematic maps were created using ArcGIS software version 10.5.

**Ethical considerations:** The study was approved by the Research Ethics Committee under opinion No. 311/2021, in accordance with current national regulations for research using

secondary data.

## RESULTS

### Demographic profile

From 2011 to 2020, 23,471 confirmed cases of American cutaneous leishmaniasis were reported in the state of Mato Grosso. A predominance was observed among males (79.38%), while females accounted for 20.60% of cases. The most affected age group was 30–39 years (20.93%), followed by 40–49 years (19.12%). Regarding race/ethnicity, the mixed-race population predominated (48.63%), followed by white (32.85%) and Black (7.77%). Regarding education level, the highest prevalence was observed among individuals who had not completed grades 5 through 8 of elementary school (18.74%).

Detailed data on demographic and clinical characteristics are presented in **Table 1**.

**Table 1 - Distribution of demographic and clinical characteristics of cases of American tegumentary leishmaniasis in Mato Grosso, Brazil, 2011–2020.**

Characteristics	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Reported Cases
	n =	n =	n =	n =	n =	n =	n =	n =	n =	n =	n =
	2016	2825	2609	2768	2460	1922	2354	2160	2199	2158	23471
	%	%	%	%	%	%	%	%	%	%	%Total
<b>Gender</b>											
Male	78,77	81,91	79,72	77,82	79,23	81,32	77,66	78,70	80,13	78,50	79,38
Women	21,23	17,98	20,28	22,18	20,77	18,68	22,34	21,30	19,87	21,50	20,60
Ignored	—	0,11	—	—	—	—	—	—	—	—	0,01
<b>Race</b>											
White	36,46	35,08	34,69	32,41	34,15	33,51	31,69	28,10	30,60	31,14	32,85
Black	8,53	9,31	8,55	8,71	8,29	6,19	6,67	6,71	6,78	6,95	7,77
Yellow	1,34	1,35	1,23	1,01	0,98	0,73	0,89	0,56	0,41	0,93	0,96
Brown	46,78	45,27	46,26	48,12	47,03	49,53	48,98	52,27	52,84	50,97	48,63
Indigenous	5,16	6,80	6,98	6,54	7,40	7,75	10,11	10,42	7,46	7,23	7,55
Ignored	0,74	1,24	1,19	2,28	1,59	1,82	1,27	1,20	1,41	2,41	1,52
N/A	0,99	0,96	1,11	0,94	0,57	0,47	0,38	0,74	0,50	0,37	0,72
<b>Age Group</b>											
< 10	0,55	0,81	1,61	1,88	2,76	2,76	3,82	3,84	4,23	4,26	2,59
10–19	4,41	4,67	4,98	6,68	6,50	4,73	7,43	9,07	8,59	8,71	6,54
20–29	12,90	14,62	16,44	15,14	16,18	18,78	17,25	17,22	15,96	16,77	16,07

30-39	20,24	21,17	20,81	21,17	19,72	20,81	20,09	23,19	21,28	20,85	20,93
40-49	20,59	19,47	20,01	19,33	19,02	19,88	19,54	17,27	18,51	17,38	19,12
50-59	16,72	16,92	15,10	14,60	16,26	15,35	16,02	13,89	15,14	16,13	15,62
60-69	11,81	12,57	10,43	10,91	10,20	10,30	9,60	8,84	9,64	9,64	10,45
70-79	7,14	5,42	5,98	6,25	5,85	4,16	3,82	4,12	3,96	4,45	5,16
80-89	3,32	2,55	2,57	1,99	2,07	2,03	1,57	1,02	1,55	0,93	1,98
90-99	1,09	0,74	0,50	0,76	0,57	0,26	0,25	0,51	0,14	0,19	0,51
100-109	0,10	—	0,11	0,11	0,12	0,05	—	—	—	—	0,05
110-119	—	—	0,04	0,04	0,04	—	—	—	0,05	—	0,02
N.I	1,14	1,06	1,42	1,16	0,69	0,88	0,59	1,02	0,95	0,70	0,97
Zone											
Urban	56,3	53,5	53,2	53,8	53,0	56,8	50,9	54,0	52,0	53,8	53,7
Rural	39,9	42,9	43,8	42,8	44,3	40,6	46,6	42,6	44,9	44,0	43,2
Suburban	1,2	1,3	1,1	0,9	0,6	0,6	0,8	0,9	0,7	0,6	0,9
Not specified	0,1	—	0,2	—	—	0,1	0,1	0,2	—	0,1	0,1
N.I	2,5	2,4	1,7	2,5	2,1	1,9	1,6	2,3	2,4	1,6	2,1
Education											
Illiterate	5,75	4,81	4,25	4,15	4,07	2,97	3,36	3,10	3,55	2,83	3,92
Incomplete grades 1-4 of elementary school	20,54	19,33	19,32	19,76	17,28	13,94	14,83	14,63	13,73	12,88	16,83
Completed 4th grade of elementary school	9,42	8,32	8,85	6,11	8,09	6,09	7,31	6,99	8,14	7,14	7,66
Incomplete 5th through 8th grade of elementary school	20,44	22,27	21,39	19,40	18,98	16,65	18,35	17,50	15,78	14,78	18,74
Completed elementary school	7,79	8,57	7,93	7,62	7,60	7,86	7,43	7,87	8,09	8,57	7,94
Incomplete high school education	6,65	7,68	8,47	8,45	9,19	10,98	10,45	10,83	9,91	10,70	9,25
High school graduate	9,82	10,83	10,54	12,43	11,22	14,67	14,36	13,70	14,78	14,41	12,57
Incomplete higher education	1,64	0,99	1,30	1,16	1,50	1,98	1,36	1,25	1,68	1,11	1,37
Completed higher education	2,28	1,98	2,53	2,06	3,33	3,49	2,85	2,55	4,41	3,43	2,84
Not specified	4,66	5,81	6,36	8,24	9,07	13,74	10,07	11,39	11,23	16,64	9,49
Not applicable	3,37	3,22	3,56	3,79	4,02	3,49	4,29	4,07	4,23	3,61	3,76
N/A	7,64	6,19	5,48	6,83	5,65	4,16	5,35	6,11	4,46	3,89	5,62
Clinical Presentation											
Presence of Skin Lesion	91,27	93,81	94,90	94,65	93,90	91,88	95,79	95,60	95,54	96,43	94,38
Presence of Mucosal Lesion	9,92	7,01	6,82	6,65	8,54	7,86	5,44	5,97	5,73	5,51	6,94

**Source:** Prepared by the authors based on data from the Notifiable Diseases Information System.

Among the municipalities with the highest absolute number of cases during the study period were Cuiabá (6.16%), Sinop (4.88%), and Barra do Garças (4.51%).

### Clinical aspects

The cutaneous clinical form was predominant, accounting for 94.38% of cases, while the mucosal form accounted for 6.94%. Complete information regarding the clinical form is also described in **Table 1**.

### Geographic and temporal distribution

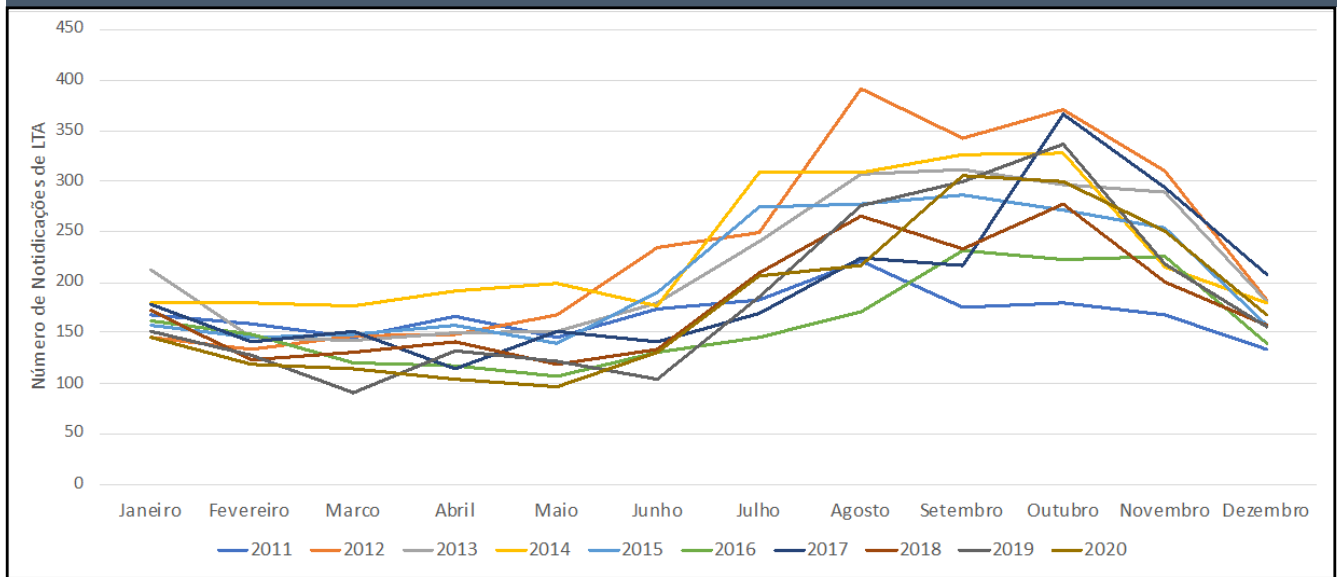
Analysis of the area of residence showed a similar distribution between urban (53.63%) and rural (43.32%) areas.

The monthly distribution of notifications showed a higher concentration in the second half of each year, accounting for 62.17% of cases in the analyzed period, as shown in **Figure 1**.

# Original Article

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 Characterization of Reported American Tegumentary Leishmaniasis Cases in Mato Grosso 2011–2020

**Figure 1—Distribution of the number of reported cases of American tegumentary leishmaniasis by month of notification in Mato Grosso, Brazil, 2011–2020.**



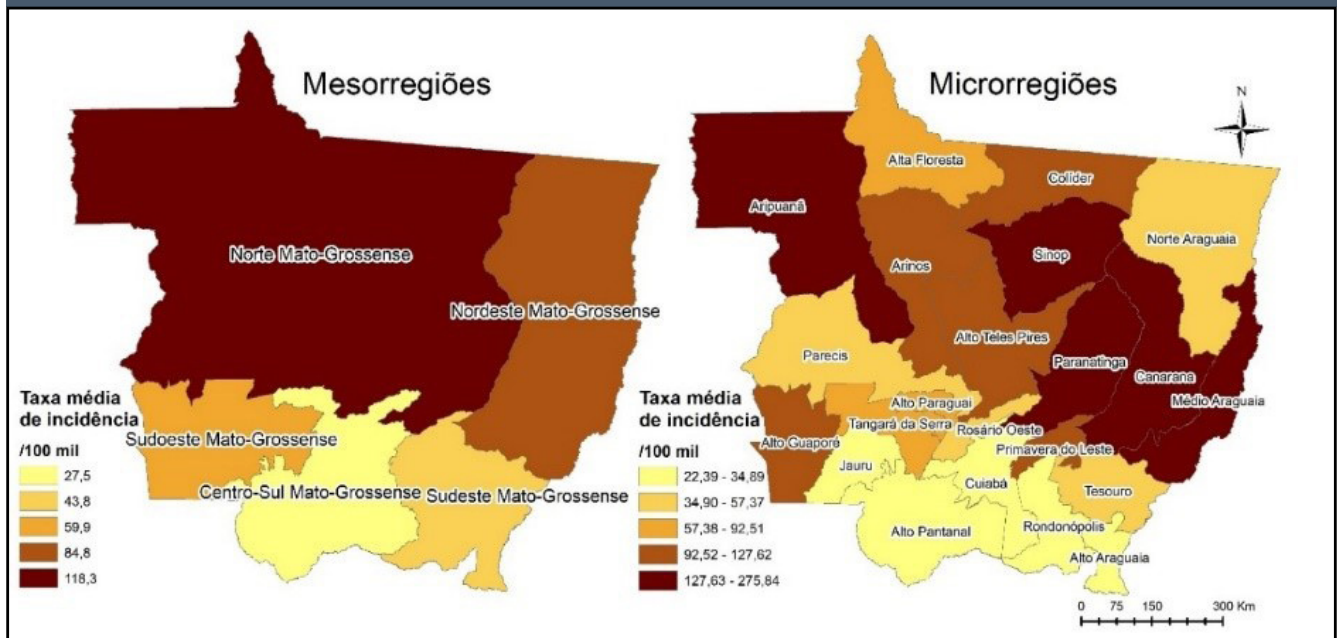
**Source:** Prepared by the authors based on data from the Notifiable Diseases Information System.

The average incidence rate by mesoregion was highest in the North me-

soregion (118.3 cases per 100,000 inhabitants), followed by the Northeast mesoregion (84.8 cases per 100,000 inhabitants). The micro-regions of Aripuanã, Sinop, and Paranatinga had

the highest average incidence rates. The detailed distribution is illustrated in **Figure 2**.

**Figure 2 – Distribution of the average incidence rate of American cutaneous leishmaniasis in the mesoregions and microregions of Mato Grosso, Brazil, 2011–2020.**

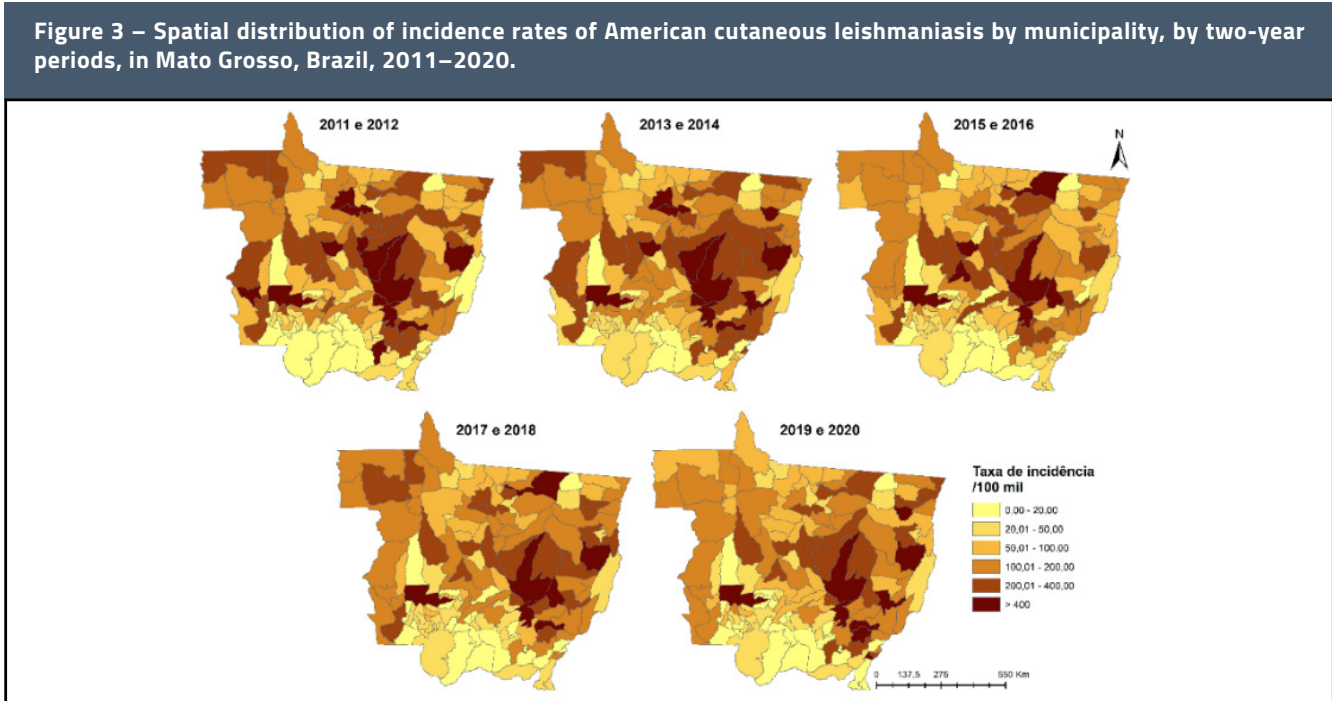


**Source:** Prepared by the authors based on data from the Notifiable Diseases Information System and the Brazilian Institute of Geography and Statistics.

The spatial distribution of rates smoothed using the Local Empirical Bayesian method showed a relatively stable pattern throughout the

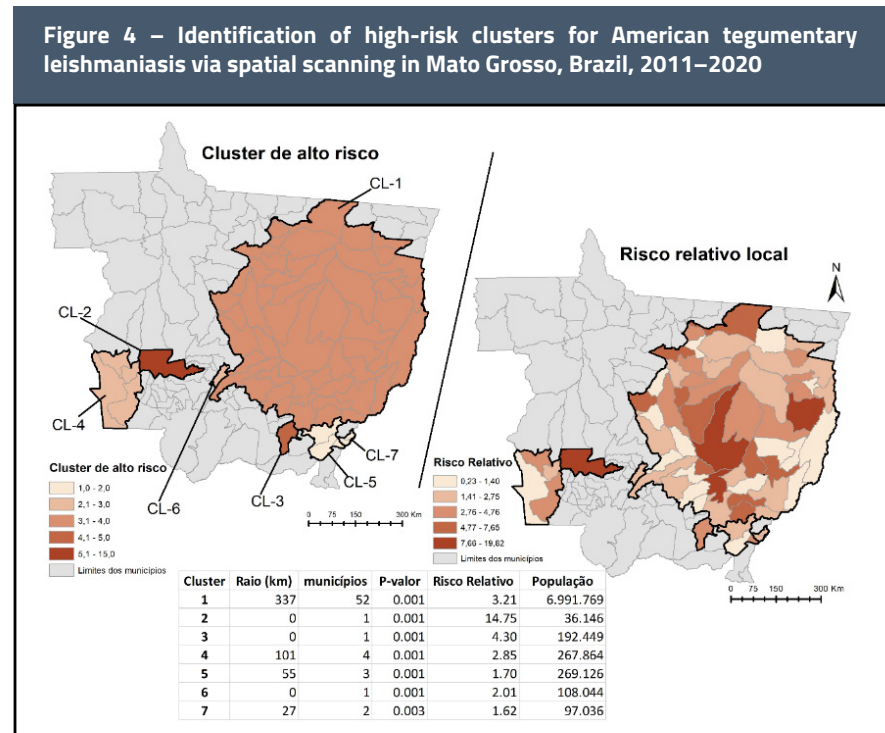
analyzed two-year periods, with the highest concentration in the North, Northeast, and part of the Southwest mesoregions of the state. The munic-

ipality of Tangará da Serra reported rates exceeding 400 cases per 100,000 inhabitants during the analyzed period, as shown in **Figure 3**.



Source: Prepared by the authors based on data from the Notifiable Diseases Information System.

The spatial scan analysis identified seven statistically significant clusters ( $p < 0.05$ ), with a relative risk ranging from 1.6 to 14.7 times higher compared to the other areas of the state. The clusters included 64 of the 141 municipalities, with the primary cluster located predominantly in the North and Northeast mesoregions, covering 52 municipalities, as shown in **Figure 4**.



Source: Prepared by the authors based on data from the Notifiable Diseases Information System.

## DISCUSSION

The present study demonstrated that the epidemiological profile of American cutaneous leishmaniasis in Mato Grosso follows a pattern similar to that described in other endemic regions of Brazil, with a predominance among males and individuals of working age<sup>(7)</sup>. This finding has been widely reported in the national literature and is attributed mainly to the greater occupational exposure of adult men to agricultural, extractive, and forestry activities, which favor contact with the vector<sup>(8,9)</sup>.

The higher prevalence among individuals with lower levels of education suggests social vulnerability associated with the risk of infection. Previous studies indicate that unfavorable socioeconomic conditions, substandard housing, and limited access to information contribute to increased exposure and delayed diagnosis<sup>(10,11)</sup>. In this context, the state's productive structure, heavily based on agribusiness, may act as a determining factor in sustaining transmission<sup>(12)</sup>.

With regard to race/skin color, a predominance of individuals who self-identified as mixed-race was observed, a finding similar to that described in previous studies conducted in the same state. On the , however, this variable should be interpreted with caution, given the regional demographic distribution and the heterogeneity of self-identification within the population.

The predominance of the cutaneous form confirms the most common clinical pattern of the disease in Brazil. However, the occurrence of cases of mucosal leishmaniasis reinforces the need for early diagnosis and appropriate treatment, since this presentation is associated with higher morbidity and functional impact. Studies conducted in the Northern region also demonstrate a similar clinical pattern<sup>(13)</sup>.

The relatively similar distribution

between urban and rural areas suggests a process of urbanization of transmission. Historically associated with forested areas, the disease has been increasingly reported in urban settings, a phenomenon attributed to unplanned expansion, deforestation, population migration, and the vector's adaptation to peri-urban areas<sup>(9)</sup>. This shift in the epidemiological pattern reinforces the need for surveillance strategies that go beyond an exclusively rural focus.

Spatial analysis demonstrated a concentration of higher rates in the state's Northern and Northeastern mesoregions, areas characterized by intense agricultural activity and high biodiversity. The interaction between economic expansion, environmental changes, and the movement of wild reservoirs favors the maintenance of the zoonotic cycle. Previous entomological studies in the region have already indicated high vector density in municipalities within these mesoregions<sup>(14)</sup>, which may explain the persistence of high-risk areas.

The identification of high-risk spatial clusters confirms the existence of priority areas for intervention. The formation of these clusters suggests that environmental, socioeconomic, and occupational factors act in combination to sustain transmission. Identifying these areas can support targeted actions for vector control, health education, and active surveillance.

A seasonal pattern was also observed, with a higher concentration of reported cases in the second half of the year. Although studies conducted in other regions have demonstrated an association with rainy periods<sup>(15,16)</sup>, seasonal patterns may vary according to local climatic characteristics. This information is relevant for planning preventive measures and intensifying control actions during periods of higher risk.

Among the study's limitations, the use of secondary data from a notification system stands out, as such data are

subject to underreporting, inconsistencies, and potential delays in data entry. Furthermore, it was not possible to assess individual environmental and occupational variables that could contribute to a more in-depth analysis of the disease's determinants. Despite these limitations, the study covers the entire state and provides a detailed spatio-temporal analysis, contributing to the understanding of the epidemiological dynamics of the disease in the region.

## CONCLUSION

The study demonstrated that American tegumentary leishmaniasis in Mato Grosso presented a stable epidemiological profile from 2011 to 2020, with a predominance among males of working age and with lower levels of education. The cutaneous clinical form was the most frequent, and the spatial distribution showed a concentration of higher risk in the northern and northeastern mesoregions of the state, with the identification of statistically significant clusters. A seasonal pattern was also observed, with a higher number of cases reported in the second half of the year.

The findings reinforce the influence of environmental, occupational, and socioeconomic factors on the maintenance of transmission, indicating the need for targeted surveillance and control strategies in priority areas.

Limitations include reliance on secondary data subject to underreporting and inconsistencies. Gaps remain regarding the influence of specific environmental, occupational, and entomological variables, suggesting the need for future studies that integrate ecological, climatic, and socioeconomic analyses to better understand the disease dynamics in the state.

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