

# CUIDADO É FUNDAMENTAL

Escola de Enfermagem Alfredo Pinto – UNIRIO

RESEARCH

DOI: 10.9789/2175-5361.rpcfo.v14.10086

## SPATIAL ANALYSIS OF AMERICAN CUTANEOUS LEISHMANIASIS BETWEEN 2007 AND 2017

*Análise espacial da leishmaniose tegumentar americana entre 2007 e 2017**Análisis espacial de la leishmaniosis tegumentaria americana entre 2007 y 2017***Sergio Vital da Silva Junior**<sup>1</sup> **Caliandra Maria Bezerra Luna Lima**<sup>1</sup> **Rebeca Rocha Carneiro**<sup>1</sup> **Elismar Pedroza Bezerra**<sup>1</sup> **Maria Aparecida Cavalcanti Catão**<sup>1</sup> **Maria Eliane Moreira Freire**<sup>1</sup> 

### ABSTRACT

**Objective:** to analyze the epidemiological profile of american cutaneous leishmaniasis between 2007 and 2017 in Paraíba, Northeast Brazil. **Method:** ecological study of cases of american cutaneous leishmaniasis registered in the Notifiable Diseases Information System. Relative Risk, Spatial Scan Method and Local Empirical Bayesian Method were used for the analysis of conglomerates.

**Results:** 671 cases of american cutaneous leishmaniasis were registered in Paraíba between 2007 and 2017, with the highest occurrence in 2009 and 2010, with 121 and 91 notifications, respectively and among males (341). Most presented the clinical cutaneous form and lived in the rural area. Significant spatial conglomerates of american cutaneous leishmaniasis were identified in Paraíba, on the North Coast, the Agreste micro-region and in the municipality of Poço Dantas in Alto Sertão.

**Conclusions:** the spatial conglomerates at risk for infection demonstrate the importance of immediate health education actions to prevent the disease.

**DESCRIPTORS:** Descriptive epidemiology; Health information systems; American cutaneous leishmaniasis; Space-time conglomerates.

<sup>1</sup>Universidade Federal da Paraíba, João Pessoa, PB, Brasil.

Received: 06/01/2020; Accepted: 01/04/2021; Published online: 02/03/2022

**Corresponding Author:** Sergio Vital da Silva Junior, Email: sergioenfe1@gmail.com

**How cited:** Silva Junior SV, Lima CMBL, Carneiro RR, Bezerra EP, Catão MAC, Freire MEM. Spatial analysis of american cutaneous leishmaniasis between 2007 and 2017. *R Pesq Cuid Fundam* [Internet]. 2022 [cited year month day];14:e10086. Available from: <https://doi.org/10.9789/2175-5361.rpcfo.v14.10086>



## RESUMO

**Objetivo:** analisar o perfil epidemiológico da leishmaniose tegumentar americana entre 2007 e 2017 na Paraíba, Nordeste Brasileiro. **Método:** estudo ecológico dos casos de leishmaniose tegumentar americana registrados no Sistema de Informação de Agravos de Notificação. Utilizou-se o Risco Relativo, Método Scan Espacial e Método Bayesiano Empírico Local para a análise dos conglomerados. **Resultados:** foram registrados 671 casos de leishmaniose tegumentar americana na Paraíba entre 2007 e 2017 com maior ocorrência em 2009 e 2010, com 121 e 91 notificações, respectivamente e no sexo masculino (341). A maioria apresentou a forma clínica cutânea e residia na zona rural. Identificaram-se conglomerados espaciais significativos da leishmaniose tegumentar americana na Paraíba, no Litoral Norte, microrregião do Agreste e no município de Poço Dantas no Alto Sertão. **Conclusões:** os conglomerados espaciais de risco para a infecção demonstram a importância de ações imediatas de educação em saúde para prevenção do agravo.

**DESCRITORES:** Epidemiologia descritiva; Sistemas de informação em saúde; Leishmaniose tegumentar americana; Conglomerados espaço-temporais.

## RESUMEN

**Objetivo:** analizar el perfil epidemiológico de la leishmaniosis cutánea entre 2007 y 2017 en Paraíba, noreste de Brasil.

**Método:** estudio ecológico de casos de leishmaniosis cutánea registrados en el Sistema de Información de Enfermedades Notificables. El riesgo relativo, el método de exploración espacial y el método bayesiano empírico local se utilizaron para el análisis de conglomerados. **Resultados:** se registraron 671 casos de leishmaniosis cutánea en Paraíba entre 2007 y 2017, con mayor incidencia en 2009 y 2010, con 121 y 91 notificaciones, respectivamente, y entre hombres (341). La mayoría presentaba la forma clínica cutánea y vivía en el área rural. Se identificaron importantes conglomerados espaciales de leishmaniosis cutánea en Paraíba, en la costa norte, en la microrregión de Agreste y en el municipio de Poço Dantas en Alto Sertão.

**Conclusiones:** los conglomerados espaciales en riesgo de infección demuestran la importancia de las acciones inmediatas de educación sanitaria para prevenir la enfermedad.

**DESCRIPTORES:** Epidemiología descriptiva; Sistemas de información de salud; Leishmaniosis cutánea americana; Conglomerados espacio-temporales.

## INTRODUCTION

Neglected diseases occur in the tropics, presenting themselves in locations with inefficient sanitary, housing and food structures, in addition to social inequities and difficult access to health care devices.<sup>1</sup>

The scope of neglected diseases includes leishmaniasis, which, according to the World Health Organization (WHO), is an anthroponosis of great importance in the world's public health and presents itself as a complex of broad clinical and epidemiological spectrum, with 350 million people exposed to risk and the appearance of approximately two million new cases every year for the two clinical forms: tegumentar and visceral.<sup>2</sup>

Leishmaniasis is a disease caused by protozoans of the genus *Leishmania*, presenting as visceral leishmaniasis (VL) or American tegumental leishmaniasis (ATL). Female phlebotominoïds of the genus *Lutzomyia* participate in the transmission cycle and present themselves as vectors, with the dog, fox and marsupials as main reservoirs.<sup>3-4</sup>

The ATL occurs in 85 countries, with distribution in the Americas, Europe, Africa and Asia, with 0.7 to 1.3 million new cases per year. The World Health Organization (WHO) considers ATL to be one of the six most important infectious diseases, due to the high detection coefficient and the capacity to produce deformities.<sup>2</sup>

In America, the incidence of forms of leishmaniasis is also high, with Brazil being responsible for the largest number of new cases on the continent, which are distributed and reported in all national regions. This characteristic is possibly explained by the lack of basic sanitation (common in developing countries), as well as by deforestation, human habitation in endemic sites, and the tourist exploitation of forests and woodlands.<sup>5-6</sup>

This being said, the investigation of the detection of ATL in the Brazilian territory is of vital importance, in order to know the epidemiological dynamics of the bill of review, which affects countless individuals in several regions of the country: especially in the Northeast (NE) Brazil. Therefore, the present study aims to analyze the epidemiological profile of American tegumental leishmaniasis between 2007 and 2017 in Paraíba, Northeast Brazil.

## METHOD

Ecological, observational and descriptive study, with quantitative approach, with secondary data from the Sistema de Informação Nacional de Agravos e Notificação (SINAN) of the Ministry of Health. The data used for geoprocessing correspond to all cases of ATL registered in Paraíba confirmed between 2007 and 2017 and collected in July 2019.

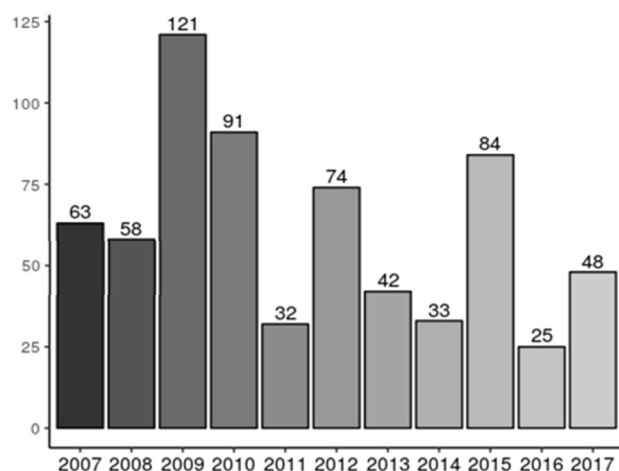
The State of Paraíba is located in the NE with a humid climate in the coastal region and dry in the interior. It has an estimated

population of 3,996,496 inhabitants, living predominantly in urbanized areas, with a Human Development Index (HDI) of 0.658 in its 56,467,239 km<sup>2</sup> of territorial area.<sup>7</sup>

Initially, the SINAN databases were verified in order to fill out the data collection instrument through the Microsoft Excel spreadsheet editor. This instrument sought to recover the following variables: number of registered cases, gender, age range, notification by type of entry, clinical form, diagnosis method, zone of residence and detection coefficient. The temporal cutout of this investigation considered the year of start-up of SINAN (Sinan NET 4.0/patch 4.2), which occurred in 2007, and the latest data presented online by DATASUS and corresponding to 2017.

They were processed by R-Project, version 3.5.1, which is a free software environment for statistical and graphical computing. For analysis, descriptive statistics were used by means of frequencies, mean and median of notifications, and inferential statistics, using the Relative Risk calculation, the Spatial Scan Method and the Local Empirical Bayesian Method. The areas are considered high risk when the relative risk of the municipality is higher than the relative risk of the state.

To obtain the relative risk of each municipality, the local incidence coefficient (of the municipality) and the total incidence coefficient for the period under study were calculated. The local incidence coefficient was obtained through the proportion between the number of cases registered in each municipality and its population in the respective period. To calculate the incidence, the geometric method was used to project the population per city from 2007 to 2017 through the Pesquisa Nacional por Amostra de Domicílios (PNAD) of 2007 and the census of the Brazilian Institute of Geography and Statistics (IBGE) of 2010.<sup>9</sup>



**Figure 1** – Frequency of the number of cases of American tegumental leishmaniasis, 2007 to 2017 (n=671). João Pessoa, Paraíba, Brazil, 2020  
Source: SINAN/DATASUS (2020).

By the Local Empirical Bayesian Method, the expected number of cases for the period was calculated in each municipality. Taking the number of cases actually observed from each of these areas and the expected number, a vector of differences (observed – estimated) was produced, which was used in the construction of the maps.

It is emphasized that the present study, under CAAE: 11309619.9.0000.5183, obtained the approval of the Committee of Ethics in Research, according to Opinion n° 3.362.887 on June 2nd, 2019, attending the prerogatives of Resolution 466/2012, of the National Health Council.

## RESULTS

The data from this research shows that, in the State of Paraíba, between 2007 and 2017, 671 (100%) cases of ATL were confirmed and, for this purpose, the municipality of residence of the individuals was used for tabulation. Analyzing Figure 1, it can be seen that the highest number occurred in the years 2009 and 2010, with 121 (18%) and 91 (14%) notifications, respectively. On the other hand, the year 2016 presented the lowest number of cases, with 25 (4%) notifications.

Regarding the clinical form of patients affected by ATL according to age, Table 1 shows that the highest number of confirmed cases had the clinical skin form in 623 (93%) patients. When analyzing the age range, the highest numbers recorded occurred in patients aged 20 to 40 years, with 163 (26%) recorded for the cutaneous form. In the age range between 40 and 60 years, 17 (35%) records for the mucosa form were computed.

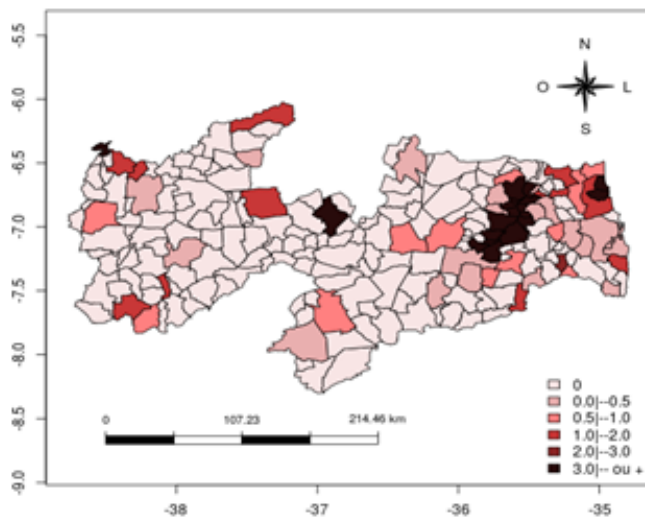
**Table 1** – Clinical forms of patients with American tegumental leishmaniasis, according to age group between 2007 and 2017 (n=671). João Pessoa, Paraíba, Brazil, 2020

Age range	Cutaneous	Mucous	Total
< 1 year	23	2	25
1  – 5 years	25	0	25
5  – 10 years	50	1	51
10  – 15 years	65	1	66
15  – 20 years	69	6	75
20  – 40 years	163	10	173
40  – 60 years	140	17	157
60  – 65 years	22	4	26
65  – 70 years	15	2	17
70  – 80 years	29	4	33
> 80	22	1	23
Total	623	48	671

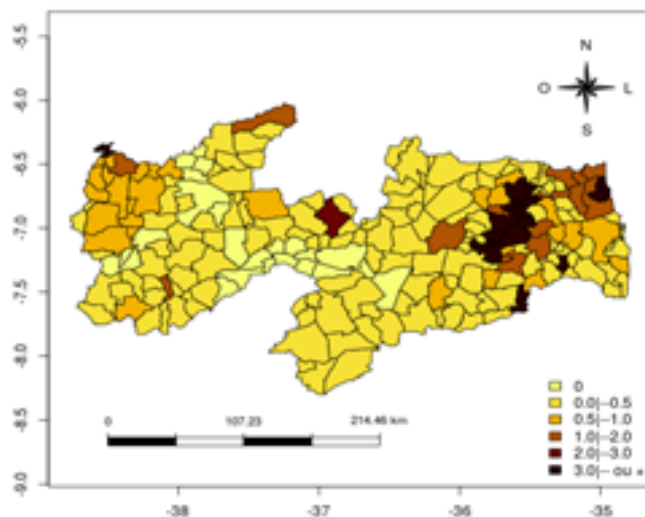
Source: SINAN/DATASUS (2020)

According to SINAN, in its data dictionary version 5.0, 2010, as well as in the Notification/Research Form of the ATL of the Ministry of Health, the forms of entry in the system for registration of the ATL are described as: new case, relapse, transfer and ignored.

Regarding the types of entry into the system for notification of ATL patients per year of notification, between 2007 and 2017 the highest number of confirmed was entered into the system as “new case”, corresponding to 341 (56%) registrations for males and 270 (44%) notifications for females. In this period, the years 2009 and 2015 stand out because they correspond to the highest number of new case registrations, while the lowest number of this type of registration was observed in 2011.



**Figure 2** – Relative risk for incidence of American tegumental leishmaniasis in the state. João Pessoa, Paraíba, Brazil, 2020  
Source: SINAN/DATASUS (2020)



**Figure 3** – Local Bayesian Empirical Method for the incidence of American tegumental leishmaniasis in the state. João Pessoa, Paraíba, Brazil, 2020  
Source: SINAN/DATASUS (2020)

When considering the total number of cases, 30 (04%) of them were notified while relapsing, being 23 (76%) male and seven (24%) female. Regarding the Epidemiological Classification, it is observed that 670 of the confirmed cases belong to the “imported” class and only one case classified as “autochthonous”. Regarding the clinical form according to the area of residence, the largest records of ATL occurred in patients who had the clinical form cutaneous, living in rural areas.

The map of relative risk for ATL in Paraíba, presented in Figure 2, illustrates the areas of risk for ATL, which are highlighted in darker tones, referring to the higher risks, and lighter tones when presenting lower risks.

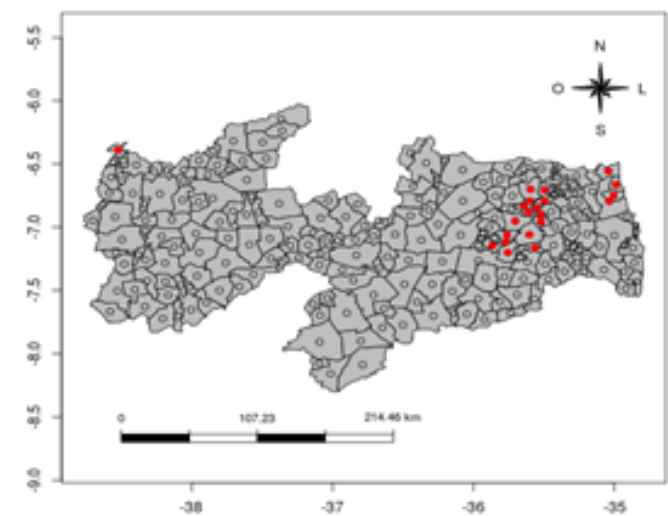
By comparing the relative risk map (Figure 2) with the maps of the Local Empirical Bayesian Method (Figure 3) and the Spatial Scan Method (Figure 4), significant spatial conglomerates of the LTA are identified (in red) in the following Paraíba areas: in the Northern Coast, in the Agreste micro-region and in the municipality of Poço Dantas, located in the High Sertão.

A comparison between the maps shows that these areas, detected by the Scan Method, are at high risk for ATL.

## DISCUSSION

It is observed that there are a high number of notifications of ATL during the period in evidence, with a higher number of new cases in males. Regarding the clinical form, the present research indicates that the cutaneous form was the most reported in people between twenty and forty years of age.

Thus, it is observed that there are spatial conglomerates of ATL in the North Coast of the State, in the micro-region of Agreste paraibano and in the municipality of Poço Dantas, located in the Alto Sertão da Paraíba, demonstrating the importance of



**Figure 4** – Spatial Scan Method for incidence of American tegumentary leishmaniasis in the state. João Pessoa, Paraíba, Brazil, 2020  
Source: SINAN/DATASUS (2020)

the epidemiological knowledge of this neglected disease in the referred state, which can refer to actions of surveillance, prevention and early diagnosis of this disease.

Currently, in the Brazilian territory there are seven species of *Leishmania* involved in the appearance of the cases of ATL, being the most important: *Leishmania (Leishmania) amazonensis*, *L. (Viannia) guyanensis* and *L. (V.) braziliensis*.<sup>4</sup>

ATL has had medical importance in Brazil, due to the epidemiological changes presented in recent years, occurring endemically in the states. This fact can be explained by the insertion of man in rural areas and the adaptation of the vector to urban changes that have occurred in recent decades.<sup>3,6</sup>

In Brazil, from 1980 to 2013, 789,278 cases of ATL were recorded, demonstrating the high incidence of this bill of review in the national territory,<sup>10</sup> thus corroborating the findings of the annual incidence of this investigation.

The Ministry of Health has a notification system with high national utility, since it allows the planning, execution of public health policies and evaluation of measures implemented in the national territory. The systems enable the analysis of several localities in the country, with the help of professionals working in the three government spheres, which provides greater accuracy to the information collected in this technological resource.<sup>11</sup>

There have been significant epidemiological changes over the last few years, concerning the standard of transferability of ATL, being its occurrence in regions of deforestation and located near urban centers. This process suffers interference related to parasites, vectors, the environment where they are inserted and the existing form of territorial use.<sup>12</sup>

This research points out that the ATL in the State of Paraíba has greater notification in males, corroborating other findings in Brazil, as in a study carried out in Belo Horizonte and published in 2013.<sup>13</sup> It is also observed in a study developed in India, with people with ATL, in the year 2017, where 56.5% of the participants were males.<sup>14</sup>

However, a different result was found in a research whose objective was to evaluate the quality of life of people with ATL, carried out in Brasilia, DF, Brazil, in the year 2013, and which presented the majority of participants (n=24; 54.5%) being female.<sup>5</sup> In a research developed in Iran in the year 2018, the participants corresponded equally to both sexes, demonstrating that the involvement of individuals depends on factors other than sex.<sup>15</sup>

ATL is described as an occupational disease, due to the fact that it affects individuals who, for the most part, develop economic activities in wooded areas and/or with a predominance of reservoirs and/or vectors. It is still observed that the disease is affecting males, which may be related to the fact that, socially, man remains the main financial provider,<sup>16</sup> especially in rural areas (due to social and cultural factors), which may hinder self-care and immediate and resolute care for the treatment of infection in the male public.

The findings of the present investigation demonstrate that the clinical cutaneous form of ATL in the state of Paraíba has a higher incidence in SINAN notifications. Because it is an insidious

clinical presentation, with a long period between the appearance and diagnosis of the lesion,<sup>17</sup> probably the greatest involvement of people in the age group, which includes adults in their active phase (from 20 to 40 years of age) may be related to the exposure of these people to the vector. These are presentations of ATL: the cutaneous form, which may affect the individual as a localized, disseminated or diffuse lesion, and the mucous form, which may be late, of undetermined origin, concomitant, contiguous or primary.<sup>18</sup>

In cutaneous ATL, the localized lesion is caused by species of *Leishmania (L.) amazonensis*, with diffuse allergic lesions in individuals with innate immune deficiency, with transmission associated with wild rodents and marsupials.<sup>19</sup> In the disseminated form, the appearance of several acneiform lesions is characterized, which are distant from the site of protozoan inoculation by the vector, related to the propagation by hematogens or lymphatics of the parasite. It is related to two species: *Leishmania (V.) braziliensis* and *Leishmania (L.) amazonensis*.<sup>20</sup>

In the case of ATL in its mucous form, a secondary lesion is observed, with involvement of the oropharynx and nearby region. In its late presentation, which is the most common form, new mucosal lesions appear after healing of an anterior tegumental lesion, which may be associated with several lesions or with longer duration, besides spontaneous cures or interruption of drug therapy.<sup>18</sup>

ATL does not present imminent risk of death, but it is responsible for negatively interfering with the physical appearance of the affected individual, generating social exclusion and psychological suffering. The characteristic wounds of the disease occur from the vector sting, which generates papules and later ulcerated lesions, being also possible the lymphatic spread of the parasite, causing new ulcerations.<sup>21</sup>

The high incidence of notification of cases of imported ATL in the state of Paraíba can be explained by the fact that the treatment occurs in distinct localities of the zone of residence of the patient. This demonstrates that, despite the advances that have occurred in recent years, which pervade the historicity of social struggles for improvements in the health of the population, there is still complexity in the access to health services by the most socially vulnerable and needy individuals.<sup>22</sup>

Through this study, it is observed that the ATL has a wide distribution in Paraíba, with concentrations of the notifications in the Coastal, Agreste and Alto Sertão regions of the State, demonstrating, with this, the maximum importance in the development of surveillance actions, reduction of the vectors and prevention of human infection by ATL: especially, in the cited areas. Thus, the diversity of localities found by this investigation in the State may be related to the characteristics of the vectors. The adult phlebotomoids have wide variability in their habitat, according to (species), seasonality and characteristics of relative air humidity. Therefore, they are preferably sheltered in places with higher humidity, abundance of organic decomposition and decreased incidence of light, in order to protect themselves from intense climate changes.<sup>23</sup>



Since the beginning of the European colonization in Brazil, intense degradation of the fauna and flora occurs, with important alterations in the existing biomes in the national territory.<sup>24</sup> This exploration of the regions of the forest, either with the cutting of trees or, in a sustainable way, with the development of the ecotourism, that is common practice also in Paraíba,<sup>25</sup> which can be related to the findings of the present study, which reveals elevated incidence of ATL in the state, in specific localities and with intense tourist activity.

It is important to emphasize that, for the transmission of leishmaniasis to occur, the vector must be circulating in the locality of increase of infection; a factor that has been suffering a change in the epidemiological profile and transmissibility in the last years in Brazil. Previously, this disease was only considered a zoonosis that occurred accidentally in humans when they entered forest regions, which is different from today's, because now there is also the appearance of this disease in territories that have had intense deforestation and urbanization, demonstrating a possible environmental adaptation of the vector.<sup>26</sup> ATL has been presented with a double epidemiological profile: either by the maintenance of existing cases or by the increase of new cases resulting from exposure activities favorable to the emergence of the disease.<sup>4</sup>

The findings of the present investigation are relevant because they describe the epidemiological situation in Paraíba regarding the records of cases of ATL, highlighting the spatial conglomerates of risk for infection and transmission of parasites by the vectors in Paraíba.

The knowledge about the epidemiological geoprocessing of the infection may subsidize actions of health professionals, referring to the improvement of the control of the vectors that participate in the transmission cycle, and that, allied to other structuring actions, may interfere in the decline of anthroponosis incidence. From this, the understanding of the epidemiological determinants of ATL will be given, consolidating improvements in management actions and surveillance of incident cases.

Since this is a study derived from public data made available by the Ministry of Health, the limitations of the present epidemiological investigation resulting from possible failures in the feeding process of these systems should be considered. This may be related to the underreporting of the bill of review, besides the impossibility of individual evaluation of the participants, generating, only, information related to the population average of exposed individuals.<sup>12</sup>

Based on the epidemiological method used in this research, it was possible to proceed to the identification of significant spatial conglomerates of ATL in the state of Paraíba: the North Coast, the micro-region of Agreste and the municipality of Poço Dantas, located in the High Sertão of Paraíba.

## CONCLUSIONS

The information presented in this study regarding the epidemiological data of ATL in Paraíba points out practices to effect the integral attention of the population affected by this

condition. Therefore, immediate actions such as home visits by health professionals in order to promote individual and collective educational actions become necessary in order to mitigate the impact of this disease on the quality of life of human beings through the prevention of this infection.

The Public Power, through trained health professionals, can subsidize the propagation of information through TV and radio mass communication channels, in addition to delivering repellents against the ATL vector and screens to prevent infection.

Furthermore, actions of continued education should be encouraged to health professionals, especially those who work in the Family Health Strategy, regarding the early diagnosis of this bill of review with high medical importance and neglected today.

## REFERENCES

1. Reis ACSM, Borges DPL, D'Ávila VGFC, Barbosa MS, Ternes YMF, Santiago SB, *et al.* O cenário de políticas públicas do Brasil diante do quadro das doenças negligenciadas. *Saúde & Ciência em Ação*. [Internet]. 2016 [acesso em 04 de setembro 2019]; 3(1). Disponível em: <http://revistas.unifan.edu.br/index.php/RevistaICS/article/view/237>.
2. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Manual de vigilância da leishmaniose tegumentar [Internet]. Brasília: Ministério da Saúde, 189p; 2017 [acesso em 04 de setembro 2019]. Disponível em: [http://bvsmms.saude.gov.br/bvs/publicacoes/manual\\_vigilancia\\_leishmaniose\\_tegument.ppd](http://bvsmms.saude.gov.br/bvs/publicacoes/manual_vigilancia_leishmaniose_tegument.ppd).
3. Batista FMA, Machado FFOA, Silva JMO, Mittmann J, Barja PR, Simioni AR. Leishmaniose: perfil epidemiológico dos casos notificados no estado do Piauí entre 2007 e 2011. *Revista UniVap*. [Internet]. 2013 [acesso em 11 de agosto 2019]; 20(35). Disponível em: <http://dx.doi.org/10.18066/revunivap.v20i35.180>.
4. Ministério da Saúde (BR). Guia de vigilância em saúde. 2ed; [internet] Brasília: Ministério da Saúde; 2017 [acesso em 11 de agosto 2019]. Disponível em: <http://portalarquivos.saude.gov.br/images/pdf/2017/outubro/06/Volume-Unico-2017.pdf>.
5. Honório IM, Cossul UM, Bampi LNS, Baraldi S. Quality of life in people with cutaneous leishmaniasis. *Rev. bras. promoç. Saúde*. [Internet]. 2016 [cited 2019 mai 31]; 29(3). Available from: <http://dx.doi.org/10.5020/18061230.2016.p342>.
6. Rocha TJM, Barbosa ACA, Santana EPC, Calheiros CML. Aspectos epidemiológicos dos casos humanos confirmados de leishmaniose tegumentar americana no estado de Alagoas, Brasil. *Rev. Pan-Amaz. Saúde*. [Internet]. 2015 [acesso em 31 de maio 2019]; 6(4). Disponível em: <http://dx.doi.org/10.5123/S2176-62232015000400007>.

7. Brasil. Instituto Brasileiro de Geografia e Estatística [homepage na internet] 2019. [acesso em 31 de maio 2019]; Disponível em : <https://cidades.ibge.gov.br/brasil/pb/joao-pessoa/panorama>.
8. Ministério do Planejamento, Orçamento e Gestão (BR). Instituto Brasileiro de Geografia e Estatística – IBGE. Pesquisa nacional por amostra de domicílios: aspectos complementares da educação de jovens e adultos e educação profissional 2007; [Internet] Brasília: MPOG; 2009 [acesso em 02 de novembro 2019]; 186p. Disponível em: [http://portal.mec.gov.br/dmdocuments/pnad\\_eja.pdf](http://portal.mec.gov.br/dmdocuments/pnad_eja.pdf).
9. Ministério do Planejamento, Orçamento e Gestão (BR). Instituto Brasileiro de Geografia e Estatística – IBGE. Censo Demográfico 2010; [Internet] Brasília: MPOG; 2011 [acesso em 02 de novembro 2019]; 270p. Disponível em: [https://biblioteca.ibge.gov.br/visualizacao/periodicos/93/cd\\_2010\\_caracteristicas\\_populacao\\_domicilios.pdf](https://biblioteca.ibge.gov.br/visualizacao/periodicos/93/cd_2010_caracteristicas_populacao_domicilios.pdf).
10. Oliveira RZ, Oliveira LZ, Lima MVN, Lima AP, Lima RB, Silva DG. Leishmaniose tegumentar americana no município de Jussara, estado do Paraná, Brasil: série histórica de 21 anos. *Revista de Saúde Pública do Paraná*. [Internet]. 2016 [acesso em 11 de julho 2019]; 17(2). Disponível em: <http://dx.doi.org/10.22421/1517-7130.2016v17n2p59>.
11. Bittar OJNV, Biczuk M, Serinolli MI, Novaretti MCZ, Moura MMN. Sistemas de informação em saúde e sua complexidade. *Rev. Adm. Saúde*. [Internet]. 2018 [acesso em 02 de novembro 2019]; 18(70). Disponível em: <http://dx.doi.org/10.23973/ras.70.77>.
12. Temponi AOD, Brito MG, Ferraz ML, Diniz SA, Cunha TN, Silva MX. Ocorrência de casos de leishmaniose tegumentar americana: uma análise multivariada dos circuitos espaciais de produção, Minas Gerais, Brasil, 2007 a 2011. *Cad. Saúde Pública (Online)*. [Internet]. 2018 [acesso em 21 de julho 2019]; 34(2): e00165716. Disponível em: <http://dx.doi.org/10.1590/0102-311X00165716>.
13. Toledo Jr ACC, Silva RE, Carmo RF, Amaral TA, Luz ZMP, Rabello A. Assessment of the quality of life of patients with cutaneous leishmaniasis in Belo Horizonte, Brazil, 2009–2010. A pilot study. *Trans. R. Soc. Trop. Med. Hyg.* [Internet]. 2013 [cited 2019 mai 04]; 107(5). Available from: <http://dx.doi.org/10.1093/trstmh/trt021>.
14. Pal B, Murti K, Siddiqui NA, Das P, Lal CS, Babu R, et al. Assessment of quality of life in patients with post kalaazar dermal leishmaniasis. *Health qual. life outomes*. [Internet]. 2017 [cited 2019 jul 23]; 15:148. Available from: <http://dx.doi.org/10.1186/s12955-017-0720-y>.
15. Khatami A, Emmelin M, Talaee R, Mohammadi AM, Aghazadeh N, Firooz A. et al. Lived experiences of patients suffering from acute Old World cutaneous leishmaniasis: A qualitative content analysis study from Iran. *Iranian Journal of Arthropod-Borne Diseases*. [Internet]. 2018 [cited 2019 jul 23]; 12(2). Available from: <http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1238933&dswid=-6929>.
16. Cortez MB, Machado NM, Trindade ZA, Souza LGS. Profissionais de saúde e o (não) atendimento ao homem-pai: análise em representações sociais. *Psicol. Estud.* (Online). [Internet]. 2016 [acesso em 24 de julho 2019]; 21(1). Disponível em: <http://dx.doi.org/10.4025/psicoestud.v21i1.28323>.
17. Vasconcelos JM, Gomes CG, Sousa A, Teixeira AB, Lima JM. Leishmaniose tegumentar americana: perfil epidemiológico, diagnóstico e tratamento. *Rev. bras. anal. clin.* [Internet]. 2018 [acesso em 10 de setembro 2019]; 50(3). Disponível em: <http://dx.doi.org/10.21877/2448-3877.201800722>.
18. Makowiecky ME, Mattos MS, Tormem SH, Gatti RR, Biz DM, Pereira R. Vigilância da leishmaniose tegumentar americana: Guia de orientação. 5ª ed. Secretaria de Estado da Saúde/SC. [Internet]. 2016 [acesso em 10 de setembro 2019]. Disponível em: [http://www.dive.sc.gov.br/conteudos/zoonoses/publicacoes/Manual\\_de\\_OrientOri\\_de\\_LLT\\_revisado.pdf](http://www.dive.sc.gov.br/conteudos/zoonoses/publicacoes/Manual_de_OrientOri_de_LLT_revisado.pdf).
19. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Atlas de leishmaniose tegumentar americana: diagnósticos clínico e diferencial [Internet]. Brasília: Ministério da Saúde; 2006 [acesso em 10 de setembro 2019]; 136p. Disponível em: [http://bvsm.s.saude.gov.br/bvs/publicacoes/atlas\\_lta.pdf](http://bvsm.s.saude.gov.br/bvs/publicacoes/atlas_lta.pdf).
20. Bentes AA, Rodrigues DE, Carvalho E, Carvalho AL, Campos FA, Romanelli RMC. Leishmaniose tegumentar americana: um desafio diagnóstico na prática pediátrica. *Rev. méd. Minas Gerais*. [Internet]. 2015 [acesso em 10 de setembro 2019]; 25 (Supl6). Disponível em: <http://dx.doi.org/10.5935/2238-3182.20150100>.
21. Thomaidou E, Horev L, Jotkowitz D, Zamir M, Ingber A, Enk CD, et al. Lymphatic Dissemination in Cutaneous Leishmaniasis Following Local Treatment. *Am. J. Trop. Med. Hyg.* [Internet]. 2015 [cited 2019 aug 07]; 93. Available from: <https://doi.org/10.4269/ajtmh.14-0787>.
22. Silva CR, Carvalho BG, Cordoní Júnior L, Nunes EFPA. Difficulties in accessing services that are of medium complexity in small municipalities: a case study. *Ciênc. Saúde Colet.* [Internet]. 2017 [cited 2019 nov 02]; 22(4). Available from: <https://doi.org/10.1590/1413-81232017224.27002016>.
23. Silva PES, Freitas RA, Silva DF, Alencar RB. Fauna de flebotomíneos (*Diptera: Psychodidae*) de uma reserva de campina no Estado do Amazonas, e sua importância epidemiológica. *Rev. Soc. Bras. Med. Trop.* [Internet]. 2010 [cited 2019 sep 07]; 43(1). Available from: <http://dx.doi.org/10.1590/S0037-86822010000100017>.

24. Silvério Neto R, Bento MC, Menezes SJMC, Almeida FS. Caracterização da cobertura florestal de unidades de conservação da Mata Atlântica. *Floresta e Ambiente*. [Internet]. 2015 [acesso em 07 de setembro 2019]; 22(1). Disponível em: <http://dx.doi.org/10.1590/2179-8087.058013>.
25. Pereira TF, Campos JO, Pereira MRS, Lima VRP. Ecoturismo e os impactos ambientais no Parque Estadual Mata do Pau-Ferro, Areia, Paraíba. *GEO Temas* [Internet]. 2019 [citado 2019 sep. 07]; 9(1): 128-143. Acessado em: <http://periodicos.uern.br/index.php/geotemas/article/view/3382/1969>.
26. Vasconcelos PP, Araújo NJ, Rocha FJS. Ocorrência e comportamento sociodemográfico de pacientes com leishmaniose tegumentar americana em Vicência, Pernambuco, no período de 2007 a 2014. *Semina cienc. biol. saude*. [Internet]. 2017 [acesso em 23 de julho 2019]; 38(1). Disponível em: <http://dx.doi.org/10.5433/1679-0367.2017v38n1p105>.