Alarming information on human leprosy cases in the Zona da Mata Rondoniense region, Western Amazon, Brazil

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ABSTRACT

The Zona da Mata Rondoniense region has become one of the territories with the highest human leprosy cases in Brazil and the worst situation in the Amazon region. In an attempt to control the disease, it is necessary to encourage the policy of decentralization of primary health care and the implementation of control actions. Therefore, the aimed of study was to evaluate prevalence of human leprosy in rural area of the Rondônia state, specifically in the Zona da Mata Rondoniense region, between years 2016 and 2018, a period in which the highest number of cases of the disease were reported. Data regarding human leprosy in the aforementioned region were collected through SINAN-NET software and information on cases in course of treatment (CCT) in year 2018 through the epidemiology sector of health secretariats of the municipalities. Spatial distribution of CCTs was performed using ArcGis 10.5 software, and application of the Kernel density estimator. We identified 104 rural residents undergoing treatment for leprosy. The prevalence rate (PR) indicated for the Rondônia state TP $\cong$ 18.60 patients per 10,000 inhabitants. However, the Zona da Mata Rondoniense region TP $\cong$ 135 per 10,000 inhabitants, therefore it is the most endemic region in Rondônia state, Brazil. In view of annual PR in Brazil 10.0 to 19.9 per 10,000 inhabitants, surveyed by Ministry of Health, of PR for leprosy in the Zona da Mata Rondoniense region is much higher than the Brazilian national average, and therefore it can considered an alarming value because it is very high. It is concluded that there is a situation of high prevalence of leprosy.

Keywords: Amazon; *Mycobacterium leprae*. Public health. Rolim de Moura.

Informações alarmantes sobre casos de hanseníase humana na região da Zona da Mata Rondoniense, Amazônia Ocidental, Brasil

RESUMO

A região da Zona da Mata Rondoniense tornou-se um dos territórios com maior número de casos de hanseníase humana no Brasil e a pior situação da região Amazônica. Na tentativa de controle da doença, é necessário estimular a política de descentralização da atenção primária à saúde e a implementação de ações de controle. Portanto, o objetivo do estudo foi avaliar a prevalência da hanseníase humana na zona rural do estado de Rondônia, especificamente na região da Zona da Mata Rondoniense, entre 2016 e 2018, período em que o maior número de casos da doença foi relatado. Os dados referentes à hanseníase na referida região, foram coletados por meio do *software* SINAN-NET e informações sobre casos em tratamento (CCT) em

2018 por meio do setor de epidemiologia das secretarias de saúde dos municípios. A distribuição espacial dos CCTs foi realizada utilizando o *software* ArcGis 10.5, e aplicação do estimador de densidade Kernel. Foram identificados 104 moradores rurais em tratamento para hanseníase. A taxa de prevalência (RP) indicada para o TP do estado de Rondônia ≅ 18,60 pacientes por 10.000 habitantes. No entanto, a região da Zona da Mata Rondoniense apresentou TP ≅ 135 por 10.000 habitantes, portanto, é a região mais endêmica do estado de Rondônia. Tendo em vista a RP anual no Brasil de 10,0 a 19,9 por 10.000 habitantes, pesquisada pelo Ministério da Saúde, a RP para hanseníase na região da Zona da Mata Rondoniense é muito superior à média nacional brasileira e, portanto, pode ser considerada um valor alarmante, porque é muito alto. Conclui-se que existe uma situação de alta prevalência de hanseníase.

Palavras-chave: Amazônia. *Mycobacterium leprae*. Rolim de Moura. Saúde Pública.

INTRODUCION

Leprosy is a cosmopolitan, infectious, slowly evolving disease caused by *Mycobacterium leprae* (Mycobacteriaceae), a weakly gram-positive, alcohol-acid resistant bacillus that infects peripheral nerves and, more specifically, Schwann cells (SILVA et al., 2021). The transmission of this pathology, from one person to another, occurs only if the carrier is not undergoing treatment, through droplets eliminated in aerosol during coughing, sneezing or speaking, making it possible for the bacillus to enter the non-carrier's airways (DENNISON et al., 2021). Most people who come into contact with the bacillus do not get sick. However, in individuals who become ill, the incubation period has an average of five years, and their symptoms may manifest within shorter periods, such as one year or also in longer periods, such as 20 years or more, characterizing presence of bacilli in the nerves and on the skin (SILVA et al., 2012). In cases of leprosy not being treated, or even treated late, disabilities and/or deformities in the eyes, nerves, limbs and skin may occur (FERNANDES et al., 2017).

For the study of leprosy, one must talk about geoprocessing, which acts as an ally, being a set of techniques that aim to manipulate such information spatially. When applied to Public Health, it is possible to map diseases, assess risks and plan efficient health actions (RIBEIRO et al., 2017). In the study carried out by Vieira et al. (2014), in years 2001-2012, an average 1,304 cases of human leprosy were recorded in the Rondônia state, totaling 15,648 cases in this period. Also in Rondônia state, Campos et al. (2015) reported in the Monte Negro municipality, between years 2009 and 2013, 40 confirmed cases of human leprosy were registered, and between years 2013 and 2014, through a self-image form followed by tests necessary for diagnosis of the disease, seven cases were detected in Monte Negro, in addition to another 13 records, provided secondarily by Basic Health Unit of Monte Negro, positive for leprosy, totaling 60 cases between years 2009 and 2014. The Cacoal municipality, considered hyperendemic for leprosy, recorded in 2013 an

average case detection rate of 45.42 cases per 100,000 inhabitants; between 2001 and 2012, there were 908 positive cases for leprosy (ROMANHOLO et al., 2018). During their research, in a short period of time (April to October 2014), Romanholo et al. (2018) also recorded 313 more positive cases in Cacoal, reported in the Notifiable Diseases Information System (SINAN), totaling 1,221 cases between 2001 and 2014.

In an attempt to control the disease, it is necessary to encourage the policy of decentralization for primary care, and the implementation of leprosy control actions, through the Programa Saúde da Família (PSF). An alternative leprosy control program is essential, as it is an endemic area, in addition to a guiding study to justify training and qualification of health professionals. Preventive, promotional and curative actions are important for epidemiological profile of the region. This commitment is a search for improvements in the clinical and epidemiological perspective.

Based on the assumptions, the study aimed to carry out a retrospective survey of human leprosy cases undergoing treatment, reported to municipal health network in the Zona da Mata Rondoniense region, Western Amazon, Brazil. In this way, identifying hyperendemic areas for the disease between the years 2016 to 2018.

MATERIAL AND METHODS

Study area characterization

According to data from Ministry of Agrarian Development (MDA of Brazil), reports in mid year 2010, the study area belongs to Zona da Mata Rondoniense region, Western Amazon, Brazil. And, it is located between the meridians 63°0'W and 61°30'W and the parallels 12°40'S and 11.20°0'S, being composed of seven municipalities: Alta Floresta D'Oeste, Alto Alegre dos Parecis, Castanheiras, Nova Brasilândia D'Oeste, Novo Horizonte D'Oeste, Rolim de Moura and Santa Luzia D'Oeste, comprising a total area of 17,120.29 km², and has a population of 130,431 inhabitants, of which 55,901 (42.8%) reside in rural áreas (BRASIL, 2010; IBGE, 2010).

Data collection in SINAN-NET database

To obtain the data, the database of Information System of Notifications Diseases (SINAN-NET) was consulted, covering the years 2016 and 2018, encompassing notifications of ongoing cases and new data on the occurrence of leprosy. Anonymous quantitative data, available in the medical records of patients undergoing treatment with

a multidrug therapy (MDT) regimen, were also requested from epidemiology sector of the seven municipalities in the Zona da Mata Rondoniense region. The variable observed in this study is unique and refers to cases undergoing treatment (CCT), which were submitted in year 2018.

Bioestatistical analysis performed

Data were submitted to chi-square test (χ^2) to verify difference (α= 0.05) between the occurrence of the disease between the years 2016 to 2018. Data analysis was performed in Bioestat software (version 5.3) (AYRES et al., 2007), in the 95% confidence interval (CI= 95%), considering the statistical significance was set at *p* <0.05 (CORREA et al., 2012). Therefore, the information was also entered in the Geographic Information Systems (GIS) and modeled in a pattern of distribution of leprosy cases in points, using the Kernel density estimator (EDK), present in the Spatial Analyst extension of the ArcGis software 10.5 (MATSUMURA et al., 2018).

The addresses of collected CCTs were made anonymous and entered into Bioestat software, with each case being transformed into a point. This type of operation is performed by fitting a two-dimensional function to events considered, where this function performs a count of all points within an area of influence (SANTOS et al., 2017). In other studies, EDK draws the radius of influence in a circular shape around each sampling point, and then sets values from 1 (one), for the position of the point, to 0 (zero), for the limit of the area, with each value overlapping summed and the result is divided by area of the search radius (LIMA NETO et al., 2020). In view of the implementation of this tool, it is possible to obtain a thematic map with the estimation of the density of punctual events (SILVA et al., 2020).

About the database, data obtained were stored and organized in Epi info™ software, version 3.5.3 - 2011 (OS: MS-Windows, Programming language C Sharp).

RESULTS AND DISCUSSION

According to data collected, on the basis of SINAN-NET, between years 2016 and 2018. They were 480 new cases detected throughout the Zona da Mata Rondoniense region. The municipalities Alto Alegre dos Parecis and Rolim de Moura showed a significant increase in the general coefficient of detection of new cases of human leprosy, with *p*= 0.04 and *p*= 0.002, respectively, considering *p* <0.05 (Figure 1).

Figure 1 - Overall detection coefficient (prevalence rate) of new cases of human leprosy in years 2016-2018 in the Zona da Mata Rondoniense region, Western Amazon, Brazil.
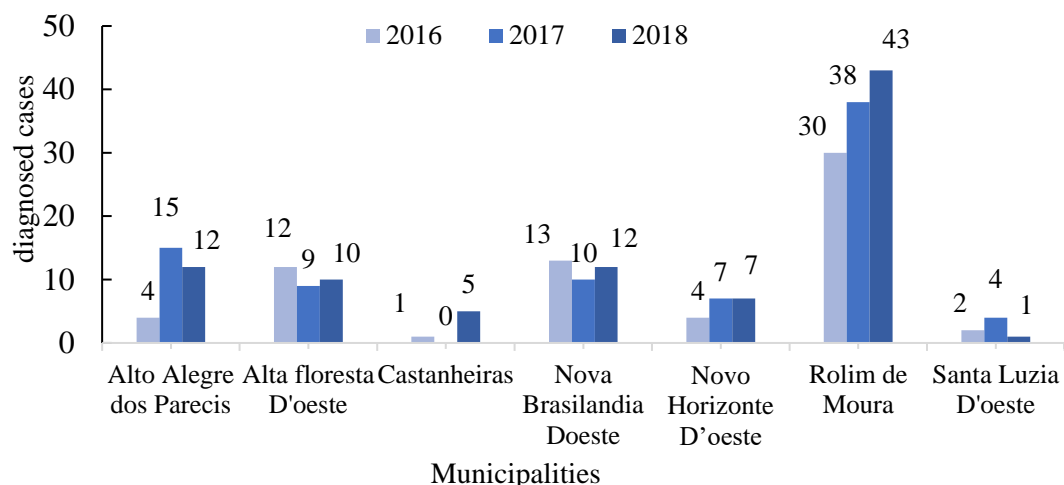
Source: Research data with information extracted from SINAN-NET.

In the entire perimeter of the Zona da Mata Rondoniense region, in year 2018, according to data collected through epidemiology sectors, in seven municipalities in the region, among the 55,901 residents of the rural area, there were 104 cases undergoing treatment (CCT). Rolim de Moura municipality, containing an area of 1,457.89 km² and comprising a total population of 50,648 inhabitants, of which 9,219 live in rural areas (IBGE, 2010), in year 2018, had an incidence rate in the total population 8.48 per 10,000 inhabitants (SINAN-NET), and stood out as the municipality in the Zona da Mata region with the highest occurrence of human leprosy in rural residents, with 55 cases undergoing treatment in a multidrug therapy (recommended by the WHO). Which represents 52.8% of overlapping cases in the region (Figure 2).

Figure 2 - Occurrence (CCT) in the rural area of the municipalities of Zona da Mata Rondoniense in the year 2018.
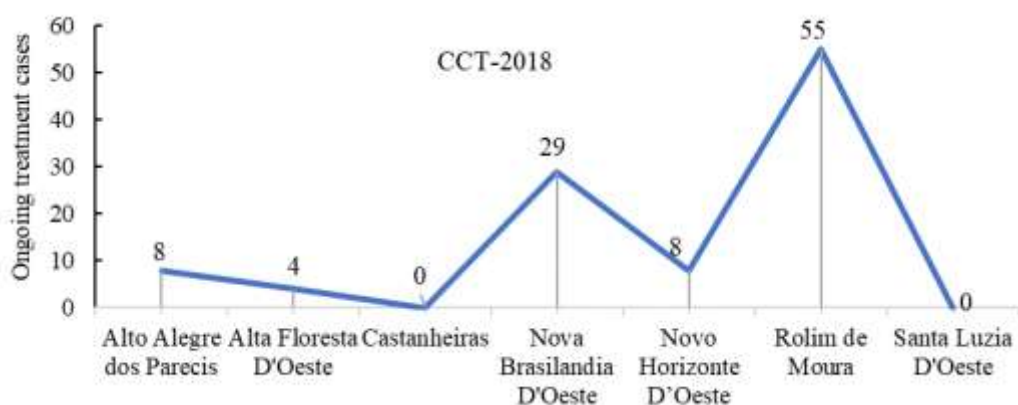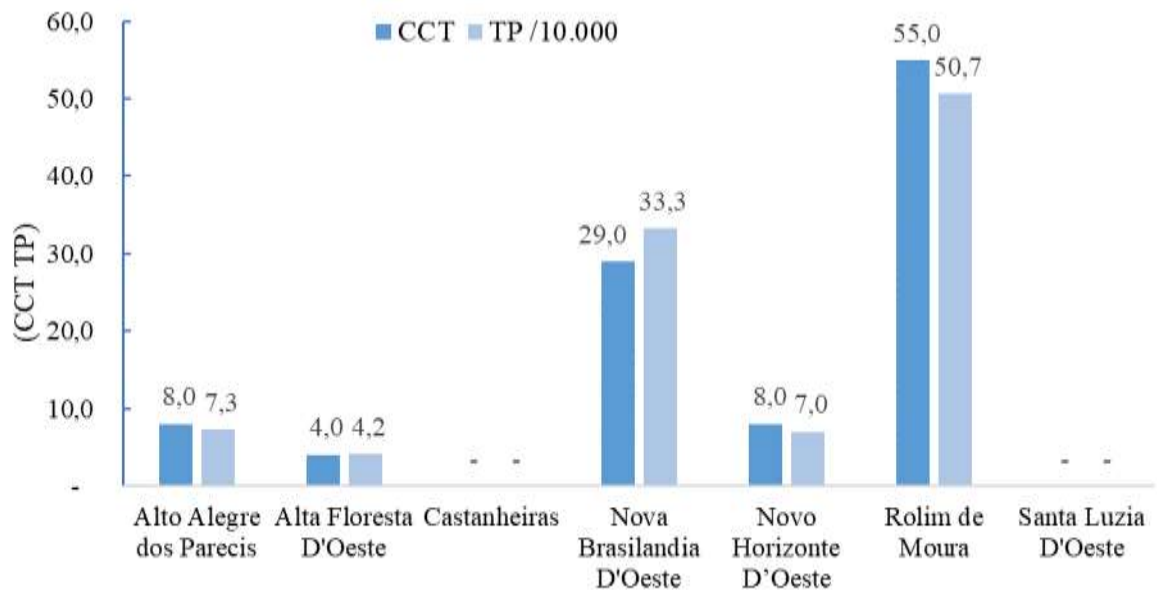

Source: authors' data.

The highest prevalence rate was 55.0 per 10,000 inhabitants in Rolim de Moura municipality in year 2018 (Figure 3). The most endemic microregion for human leprosy, in the Zona da Mata Rondoniense region, located in Rolim de Moura, corresponds to an area of approximately 120 km^2. According to Primary Care and Family Health sector of the municipality, this rural microregion has an estimated population of 1,843 inhabitants, directly assisted by Community Agents of Endemic and Social Action, among which 25 people have cases undergoing treatment (BORBA et al., 2021). This population represents 19.9% of the rural inhabitants of the endemic municipality, while the 25 CCTs correspond to 45.4% of the total cases in Rolim de Moura municipality.

Therefore, the prevalence of disease in the period was equivalent to 135 cases per 10,000 inhabitants, thus constituting a very high density according to the Kernel density estimator of ArcGis 10.5 software (Figure 4).

Figure 3 - Prevalence rate of cases undergoing treatment for human leprosy, in the rural area of the municipalities of Zona da Mata Rondoniense in year 2018.

Source: authors' data.

Figure 4 - Hyperendemic areas for human leprosy in the Zona da Mata Rondoniense region, Western Amazon, Brazil.
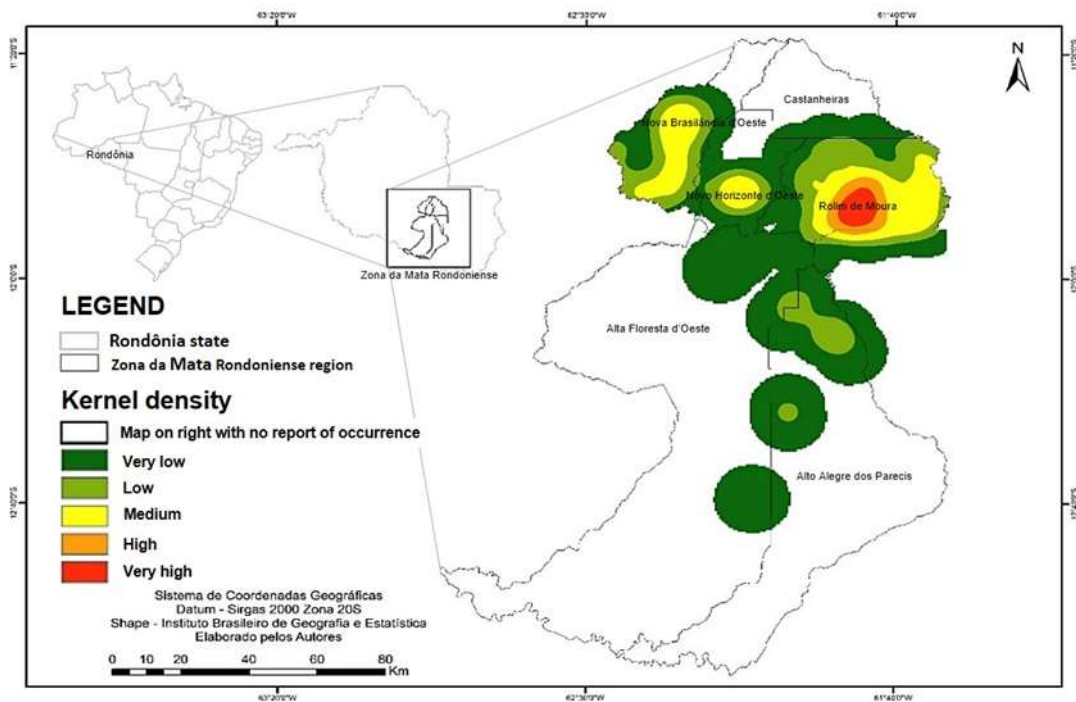
Source: authors' data.

From the years 2011 to 2015, there was a commitment proposed by Ministry of Health (MS of Brazil) to eradicate human leprosy as a public health problem, aiming to achieve a prevalence rate of one case per 10,000 inhabitants. Based on this study, it is possible to observe that in the Rondônia state, one of the priority states in terms of disease control, due to its high concentration of cases, it continues to present a high number of new cases. In this sense, the eradication objective is far from being achieved.

The history of occupation of the Zona da Mata Rondoniense region was marked by developmental public policies and territorial occupation based on removal of native forest and obtained a deforestation rate 400% between years 2002 and 2011 in ratio to total deforested until 2001 (PIONTEKOWSKI et al., 2014). In year 2005, for example, Rondônia state had approximately 29% of its municipalities with an average of between 75 and 95% of deforested area (SILVA JUNIOR et al., 2021). The areas where there was a high rate of detection of leprosy were located in the region where there was an intensity of deforestation, which can be suggested as a stimulator of the emergence of new cases of human leprosy, since it becomes possible to have greater contact with wild fauna where they can carriers of Mycobacterium leprae (SILVA et al., 2020), the bacterium

responsible for leprosy. An example of wild animals already diagnosed with leprosy in Brazil are the armadillos (Dasipodidae family), animals easily found in Brazilian biomes. There are records in the literature that demonstrated the existence of direct contact with these animals, which is related to increase in the incidence of human leprosy. Deps et al. (2008) showed that 68% of the cases recorded in their study were individuals who had been directly exposed to wild armadillos.

Nery et al., (2019) reported in their study that several factors may increase the chances of infection by bacillus M. leprae; people in poverty, for example, are 40% more at risk of contracting the disease. In this regard, worrying data are found in Brazil, half of the population in the North and Northeast regions earns up to half a minimum wage per person, while in other regions of the country, between 15.6 and 21.5% of individuals survive with that same income. Still in the North region, 76% of people residing in private households maintain a minimum wage (per capita) (MONTEIRO et al., 2017). It is known that in year 2010, in the Rolim de Moura municipality 34.1% of households had a monthly income of up to half a minimum wage per person (IBGE, 2010).

In addition to economic aspects, social factors can contribute to spread of leprosy. Living at home with current carriers of the disease can increase the risk of transmission by approximately three times (TEIXEIRA et al., 2020). However, when living with old carriers, the same risk increases to five times. The authors also suggest that a person who is currently positive for Hansen's disease probably transmitted the disease to family members and to other people with whom he/she was in direct contact, before there was a clinical diagnosis, due to long incubation period of the bacillus, which, associated with the lack of symptoms, leads to a delay in diagnosis and greater chances of transmission in the social niche (PEREIRA et al., 2019).

From a prophylactic point of view, there are professionals in favor of the use of the bacillus Calmette-Guérin (BCG) vaccine, primarily used in the health area as a preventive measure against tuberculosis, in cases of contact with leprosy. This means the application of a second dose of the vaccine in those who have a typical BCG scar and have contact with leprosy patients. BCG vaccine can offer 20 to 90% protection (LOBATO et al., 2016). However, further studies are needed to effectively prove its effectiveness against the M. leprae bacillus. Currently, there is a plan to eliminate leprosy in the world, followed by Ministry of Health (MS of Brazil), and other countries that

make up WHO. This plan aims to eliminate the disease through early diagnosis and rapid initiation of treatment (FUJISHIMA et al., 2020).

For this goal to achieved, it is extremely important that the population creates the habit of performing routine exams in order to diagnose the disease at beginning. However, Arruda et al., (2018) described the search for health care by rural residents only after signs of illness. Vinente-Neto et al. (2021), in their research carried out in eight municipalities in the Pará state, noticed that of a total of 1,592 students evaluated dermatologically, approximately 90% tested positive for leprosy. Also, in the Pará state, in a survey carried out with 146 residents of two villages in the Belterra municipality, seven positive people were identified, among these, four were registered as new cases and three had already been diagnosed before the study (SILVA et al., 2018).

The Rondonópolis municipality, Mato Grosso state, this is a considered municipality hyperendemic, an epidemiological survey showed that between years 2000 and 2010 there were 2,087 cases of human leprosy, of which 102 affected people from rural areas (MARCIANO et al., 2018). In a survey of new leprosy cases in rural communities along Lake Mamiá, in the Coari municipality, Amazonas state, Stefani et al. (2019) were able to observe that among the 176 volunteers who were screened during the study, six were infected, in the year 2015.

In a rural microregion in the Rolim de Moura municipality, the largest number of CCTs in the Western Amazon occurs, a context that has been configured by WHO parameters as a hyperendemic leprosy. As the most endemic microregion, Rolim de Moura indicated TP $\cong$ 135 per 10,000 inhabitants. What, in view of the annual PT 10.0 to 19.9 per 10,000 inhabitants, raised by Ministry of Health, can seen as a very high value (FREITAS et al., 2017). Therefore, it is possible to say that there is a situation of high prevalence of leprosy in the Zona da Mata Rondoniense region, Brazil. CCTs can refer to patients who were diagnosed in previous years, or those who discontinued treatment, and resumed within the period of the aforementioned study (PARAGUASSÚ-CHAVES et al., 2018).

Considering history of territorial occupation of the Rondônia state, and given the high prevalence rate of human leprosy according to data demonstrated in this study, it is possible to suggest that the anthropization of ecosystems is contributing to other ways of maintaining M. leprae in the environment, in addition to conventional reservoirs (VIANA et al., 2016; PARAGUASSÚ-CHAVES et al., 2018; REIS et al., 2019).

CONCLUSIONS

In a rural microregion in the Rolim de Moura municipality, in the Zona da Mata Rondoniense region, the largest number of CCTs in the Western Amazon occurs, a context that has been configured by WHO parameters as a hyperendemic human leprosy. As the most endemic microregion, Rolim de Moura indicated TP $\cong$ 135 per 10,000 inhabitants. Which, in view of the annual TP 10.0 to 19.9 per 10,000 inhabitants, raised by Ministry of Health (MS of Brazil), can be seen as a very high rate. Therefore, it is reasonable to say that there is a serious situation, with a high prevalence of human leprosy in the Zona da Mata Rondoniense region. CCTs may refer to patients who were diagnosed in previous years, or those who discontinued treatment, and resumed during the study period.

Considering the history of territorial occupation of the Rondônia state, and given the high prevalence rate of human leprosy, according to data demonstrated in this study, it is possible to suggest that the anthropization of ecosystems is contributing to other ways of maintaining Mycobacterium leprae in the environment, in addition to conventional reservoirs.

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