EPIDEMIOLOGICAL AND SPATIAL ANALYSIS OF LEPROSY IN THE MUNICIPALITY OF RIO BRANCO / ACRE / BRAZIL (2006-2016). SPATIAL ANALYSIS OF LEPROSY IN RIO BRANCO / ACRE / BRAZIL

https://doi.org/10.56238/sevened2024.030-015

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ABSTRACT

In this work, the epidemiological and spatial analysis of leprosy was performed along the borders of the Amazon in the municipality of Rio Branco, in the state of Acre, based on secondary data obtained from national public databases. The number of registered contacts, examined contacts and new confirmed cases of the disease identified between 2006-2016, based on information from the National Surveillance System (SINAN), were used. The calculated detection rate and prevalence rate were classified according to recommendations by the Ministry of Health. To spatial evaluation, due to the low number of cases per district/year, triennial aggregation (2006-2008, 2010-2012 and 2014-2016) was used to evaluate the number of new cases of the disease and the mean detection rate. The cumulative prevalence rate was assessed in the period from 2006 to 2016. Spatial exploration of the distribution of new cases of leprosy by district using the Local Empirical Bayesian Model was applied, which smoothed the effects of random fluctuation of disease rates resulting from the calculation of small areas. The data showed high detection rates (1.62/10,000 inhabitants) in the year 2016, while the prevalence rate accumulated throughout the 2006-2016 period (29.76/10,000 inhabitants) was considered hyperendemic. Spatial analysis revealed that there was a reduction in the number of new cases from 2014 to 2016, the same for the mean detection rate in the period. Spatial analysis identified many hyperendemic leprosy areas in the municipality requiring specific public policies geared towards an active search for new cases of the disease.

Keywords: Leprosy. Epidemiology. Spatial analysis. Rio Branco. Acre.

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INTRODUCTION

Leprosy is a chronic infectious disease presenting clinical forms that affect 200,000 individuals every year in the world. Both *M. leprae* or *M. lepromatosis* have been reported to be associated with the disease. Mycobacteria infect either macrophages in the skin or Schwann cells of the peripheral nerves, which can lead to irreversible neurological damage. Epidemiological evidence suggests that the main form of transmission of the disease is direct contact between untreated multibacillary patients and their household contacts[1,2].

Leprosy is a neglected tropical disease that continues to reach the poorest groups in low- and middle-income countries, demanding great efforts from health services[3]. The introduction of multidrug therapy (MDT) for the disease in 1981 lead to a reduction in the overall prevalence of leprosy with millions cured since the 1980s. Nevertheless, there have been 200,000 new leprosy cases steadily detected every year over the past 10 years[4,5]. Contact tracing together with chemoprophylaxis, immunoprophylaxis and new tools for early diagnosis can interrupt the chain of transmission of the disease, in order to reduce these numbers[6-9].

The geographic distribution of the disease in Brazil shows the highest incidence of leprosy in poorest regions, clusterized into 10 areas (around 44%) of new cases in the states of Mato Grosso, Pará, Maranhão, Tocantins, Goiás, Rondônia and Bahia[10]. Although the incidence rate of leprosy is slightly decreasing in the country, the detection in the states of the North, Central-West and Northeast regions is still high when compared to the states of the Southeast and South regions.

Leprosy settled in the state of Acre in the beginning of the 20th century with the migratory currents of the rubber cycle[11]. At present, the detection rate of leprosy in the state of Acre is lower than the average of the states in the North region, but still higher than the national average. The spatial distribution of the disease shows that most of the municipalities of Acre have high endemicity (very high or hyperendemic) for leprosy. The capital of Acre, Rio Branco, presented a detection rate of 34.78 cases/100,000 inhabitants in 2010, a very high level of endemicity. However, in the last years these numbers are decreasing, like the observed reduction in 2019 year to 9.08 cases/100,000 inhabitants. The analysis of the coefficients of leprosy detection in children under 15 years of age in the state of Acre in 2010 showed that several municipalities have high rates of cases (12.54 cases/100,000 inhabitants), among them the municipality of Rio Branco (very high). More recently, a reduction in this rate of detection of the disease in children under 15 years of age has been observed throughout the country, being more pronounced in the north region[12].

Several studies have used spatial analysis for the study of neglected tropical diseases, such as malaria[13], leishmaniasis[14], schistosomiasis[15], tuberculosis[16] and leprosy[17-18]. Geolocation is an important tool for the analysis of neglected tropical diseases, especially leprosy, where it can contribute to the improvement of policies for tracing new cases, essential for the containment of the disease. Here, we evaluated spatial distribution in city of Rio Branco, Acre State from 2006 to 2016 and found high detection rates (1.62/10,000 inhabitants) in 2016. The accumulated prevalence rate throughout the 2006-2016 period (29.76/10,000 inhabitants) was considered hyperendemic, despite a reduction in the number of new cases from 2014 to 2016. Geolocation could provide strategies to locate new cases, and when combined with chemoprophylaxis, could reduce the prevalence faster.

Thus, this research aimed to carry out the spatial analysis of leprosy in Rio Branco/Acre/Brazil, focusing on contact tracing and identifying the population at greatest risk, contributing to the interruption of the disease transmission chain and to public policies that lead to early diagnosis of new cases.

MATERIAL AND METHODS

CHARACTERIZATION OF THE STUDY AREA

Acre is located in the north region of Brazil (see Supplemental Material 1). It has international borders with Peru (W) and Bolivia (S) and by Brazilian states of Amazonas (N) and Rondônia (E). The state has low socioeconomic indicators, and most municipalities have poor infrastructure and basic sanitation (65.41% have piped water distribution systems, 14.78% have sewage systems and 74.29% have garbage collection). The state has poor education (57.6% of the young population has only partial or no access to education) and high illiteracy rates[19].

EPIDEMIOLOGICAL EVALUATION OF LEPROSY IN THE MUNICIPALITY OF RIO BRANCO / AC

For the epidemiological evaluation of leprosy in the municipality of Rio Branco/AC, data included the number of registered contacts, examined contacts and new confirmed cases of the disease identified between 2006-2016, as well as the operational classification (multibacillary or paucibacillary) of these cases obtained from the Municipal Epidemiological Surveillance Secretary, based on information from the National Surveillance System (SINAN). Population data was obtained from the 2000 and 2010 Census, in addition to population estimates made by the Brazilian Institute of Statistics and Geography (IBGE) in

the intercensorial period. From these data, the yearly detection rate of the municipality (2006 to 2016) was calculated, in addition to the prevalence rate accumulated over the period studied. The calculated detection rate and prevalence rate were classified according to recommendations by the Ministry of Health[20].

SPATIAL ANALYSIS OF LEPROSY IN THE MUNICIPALITY OF RIO BRANCO/AC

For the spatial analysis of leprosy in the municipality of Rio Branco/AC, a population-based descriptive study was carried out based on the quantitative method for the manipulation of secondary data on the disease, in the period from 2006 to 2016. For that, the number of new confirmed leprosy cases per district in the period between 2006 and 2016, obtained from the Municipal Epidemiological Surveillance Secretary, based on information from SINAN, were used. Population data by district were derived from estimates made from the number of consumer units registered by Eletrobrás/Acre in the period, considering the average of three residents per household, as determined by IBGE in the 2010 Census.

The municipality of Rio Branco/AC has 143 districts, divided into 11 regionals (see Supplemental Material 2). Of these, eight districts did not present the relevant information and were, thus, disregarded in this study. In addition, population and socio-demographic data are available by municipality and not by district, making more detailed analysis impossible.

Due to the low number of cases per district/year, triennial aggregation (2006-2008, 2010-2012 and 2014-2016) was used to evaluate the number of new cases of the disease and the mean detection rate. The cumulative prevalence rate was assessed in the period from 2006 to 2016 [21]. According Ministry of Health[20], data were stratified (divided into classes) as follows: New cases (0, 1-5, 6-10, 11-15 or 16-20); Mean detection rate per 10.000 inhabitants (low (< 0.2), medium (0.2 to 0.9), high (1.0 to 1.9), very high (2.0 to 3.9) or hyperendemic (≥ 4.0)); Cumulative prevalence rate per 10.000 inhabitants (low (<1.0), medium (1.0 to 4.0), high (5.0 to 9.0), very high (10 to 19) or hyperendemic (≥20).

Spatial exploration of the distribution of new cases of leprosy by district using the Local Empirical Bayesian Model was applied, which smoothed the effects of random fluctuation of disease rates resulting from the calculation of small areas[21]. However, districts that did not have any information (number of new cases and/or population) were considered zero for calculation purposes. This procedure consisted of the estimation of spatial means, having as neighborhood criterion the proximity condition between the districts. The fourth order neighborhood (four nearest districts) was considered. These analyzes were

performed in Software R for Linux (version 3.4.2)[22], using the function packs ("spdep", "rgdal" and "Tidyverse").

The updated cartographic base, in digital format, was made available by the Municipal Government of Rio Branco (Datum 32719 WGS 84 UTM zone 18S). Subsequently, maps were developed using open-source data spatialization software (QGIS 2.18.14). Data tabulation was performed with Microsoft Excel Software (Microsoft Office 365).

ETHICS APPROVAL

This project was approved by the Ethics Committee (CEP-UFAC: Opinion no. 750,553; CEP- Fiocruz: Opinion no. 775,694; CEP- HC/Acre: Opinion No. 910,309).

RESULTS

EPIDEMIOLOGY OF LEPROSY IN THE MUNICIPALITY OF RIO BRANCO/AC

From 2006 to 2016, it was possible to verify that there were 4,098 registered contacts, 2,603 examined contacts and 1,122 new cases of leprosy in the municipality of Rio Branco/AC (mean of 102 cases/year). In addition, it was possible to observe a fluctuation in the number of registered contacts and examined contacts over the period, with a tendency of improving the number of contacts in recent years, mainly from the year 2013. Among the 1,122 new cases of leprosy between 2006 to 2016, 457 patients were classified as paucibacillary (PB) and 665 as multibacillary (MB). It was also possible to observe a reduction in the number of new cases of the disease in the period studied (from 195 new cases in 2006 to 61 new cases in 2016), with an apparent stability in recent years.

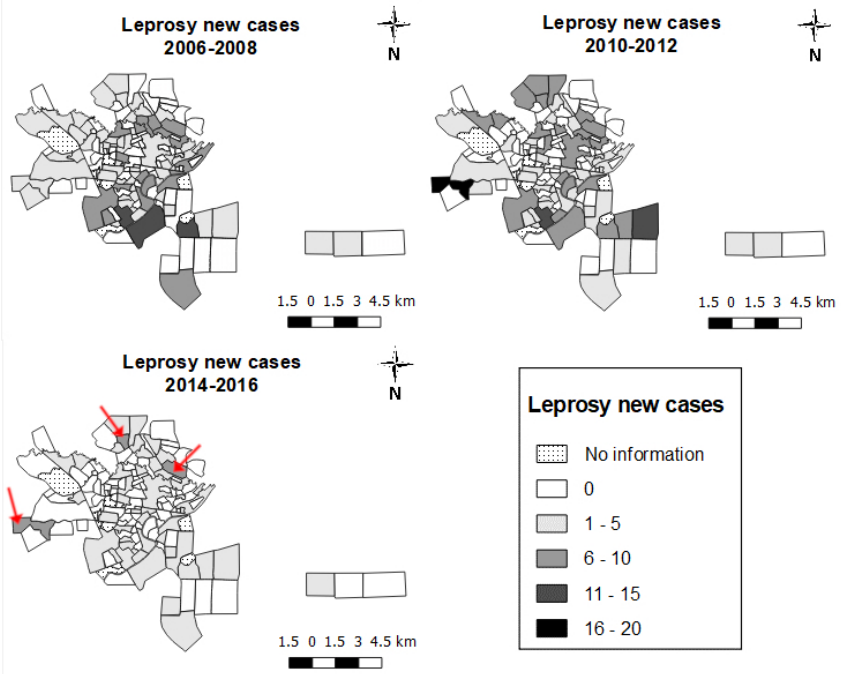
In addition, it was possible to calculate the detection rate per year and the prevalence rate in the period. The detection rate showed a decrease in the period studied but was still high in the year 2016 (1.62/10.000 inhabitants). The accumulated prevalence rate in the period between 2006 and 2016 (29.76/10,000 inhabitants) was even more critical, being classified as hyperendemic.

SPATIAL ANALYSIS OF LEPROSY IN THE MUNICIPALITY OF RIO BRANCO/AC

Spatial analysis of the number of new cases of leprosy showed that most of the districts of the municipality of Rio Branco/AC presented cases of the disease in the period evaluated, with a prevalence of 1 to 5 cases of the disease (Figure 1). In addition, it was possible to observe that there was a reduction in the number of new cases of leprosy and the number of districts with new cases of the disease from 2014 to 2016, when compared to

2006 to 2008 or 2010 to 2012. However, some districts indicated on the map (Calafate, Tancredo Neves and Vitória) presented a higher number of new cases, (6 to 10 new cases) over the last period (2014-2016). It is important to highlight that these districts house predominantly low-income populations with poor sanitation[23].

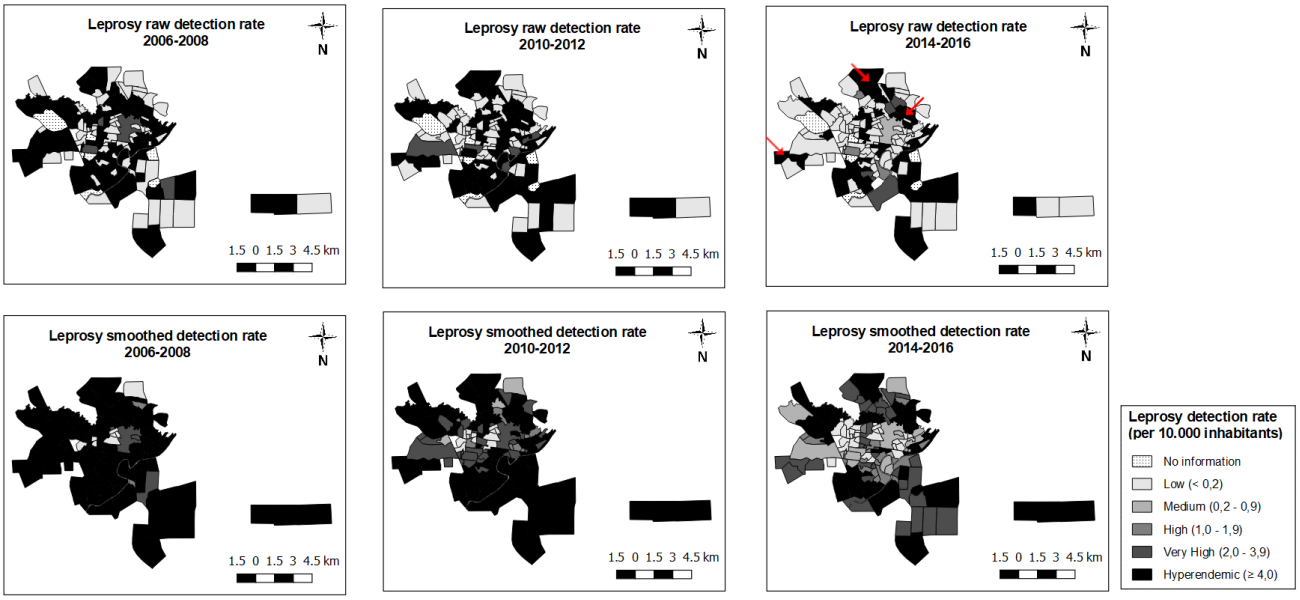
Figure 1: New cases of leprosy by districts in the municipality of Rio Branco/AC in triennia 2006-2008, 2010-2012 and 2014-2016.



Data source: Municipal Epidemiological Surveillance Secretary (SINAN). Maps: Elaborated with QGIS Software (2.18.14).

Spatial analysis of the mean leprosy detection rate showed that there was a reduction in the 2014-2016 period. However, many districts were still classified as hyperendemic for the disease. This was observed both in the raw mean detection rate (Figure 2 - top) and in the smoothed mean detection rate, by the Local Empirical Bayesian Method (Figure 2 - bottom). It is important to highlight that the same districts identified previously as having a higher number of new cases (Calafate, Tancredo Neves and Vitória – Figure 1), were also shown to have a high raw mean detection rate of leprosy (Figure 2 - top).

Figure 2: Leprosy detection rate (per 10.000 inhabitants) by districts in the municipality of Rio Branco/AC in triennia 2006-2008, 2010-2012 and 2014-2016. Top: Raw detection rate. Bottom: Smoothed detection rate by Bayesian Local Empirical Method.



Data source: Municipal Epidemiological Surveillance Secretary (SINAN). Maps: Elaborated with QGIS Software (2.18.14).

From Table 1, it is possible to observe that the raw mean detection rate in the 2006-2008 period was hyperendemic in more than half of the districts (51.85%). In the 2010-2012 period there was a reduction in this situation, but still almost half of the districts presented a very high or hyperendemic endemicity (3.70% and 43.71%, respectively). Only in the 2014-2016 period, was a considerable reduction in the endemicity of the disease observed. However, many districts (27.41%) were still hyperendemic for leprosy. When analyzing the smoothed mean detection rate by the Local Bayesian Empirical Method, it was possible to observe that the values were even more expressive when calculating the detection rate of the district.

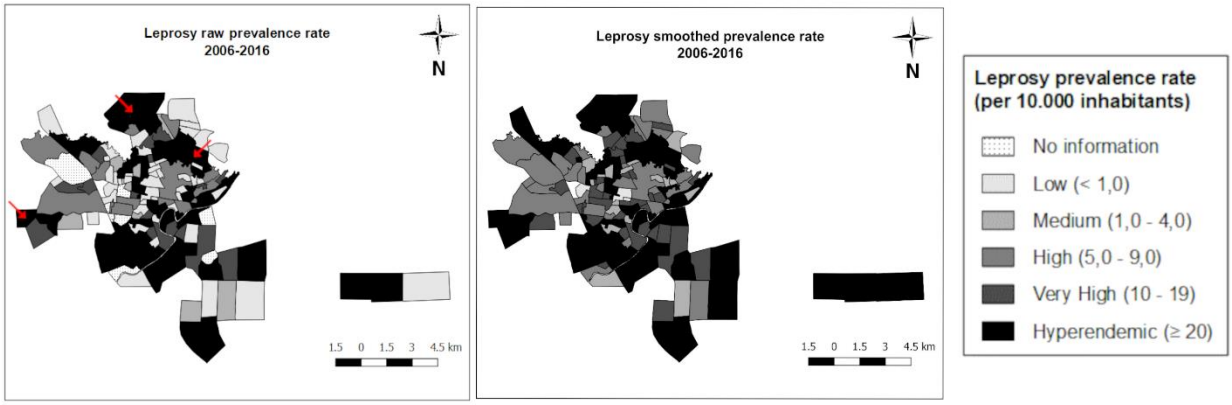
Table 01: Classification of raw and smoothed mean detection rate of leprosy by districts in the municipality of Rio Branco/AC.

Classification of leprosy raw mean detection rate (districts (%))				
Low	**Medium**	**High**	**Very High**	**Hyperendemic**
2006-2008 Triennium				
61 (45,19)	0 (0)	0 (0)	4 (2,96)	70 (51,85)
2010-2012 Triennium				
71 (52,59)	0 (0)	0 (0)	5 (3,70)	59 (43,71)
2014-2016 Triennium				
88 (65,19)	0 (0)	5 (3,70)	5 (3,70)	37 (27,41)
Classification of leprosy smoothed mean detection rate (districts (%))				
Low	**Medium**	**High**	**Very High**	**Hyperendemic**
2006-2008 Triennium				
8 (5,93)	0 (0)	2 (1,48)	4 (2,96)	121 (89,63)
2010-2012 Triennium				
13 (9,63)	3 (2,22)	7 (5,19)	28 (20,74)	84 (62,22)
2014-2016 Triennium				
30 (22,22)	15 (11,11)	18 (13,33)	29 (21,48)	43 (31,86)

Data source: Municipal Epidemiological Surveillance Secretary (SINAN).

Spatial analysis of the accumulated prevalence rate of leprosy in the districts of the city of Rio Branco/AC in the period between 2006 and 2016 presented most of the districts as hyperendemic, very high or high endemicity for the disease. This was observed in the raw prevalence (Figure 3 - top) and intensified in the smoothed prevalence by the Local Empirical Bayesian Method (Figure 3 - bottom). It should be noted once again that the districts of Calafate, Tancredo Neves and Vitória (indicated on the map) presented hyperendemicity for the disease (Figure 3 - top).

Figure 3: Leprosy prevalence rate (per 10.000 inhabitants) by districts in the municipality of Rio Branco/AC in the period from 2006 to 2016. Top: Raw prevalence rate. Bottom: Smoothed prevalence rate by Bayesian Local Empirical Method.



Data source: Municipal Epidemiological Surveillance Secretary (SINAN). Maps: Elaborated with QGIS Software (2.18.14).

From Table 2, it was possible to observe that the raw cumulative prevalence rate in the period (2006-2016) was classified as high (12.59%), very high (12.59%) or hyperendemic (37.05%). When analyzing the smoothed cumulative prevalence rate by the Local Bayesian Empirical Method, it was possible to observe once again a high (22.96%), very high (24.44%) or hyperendemic (39.26%) endemicity.

Table 2: Classification of raw and smoothed prevalence rate of leprosy by districts in the municipality of Rio Branco/AC.

Classification of leprosy raw prevalence rate (districts (%))				
Low	**Medium**	**High**	**Very High**	**Hyperendemic**
46 (34,07)	5 (3,70)	17 (12,59)	17 (12,59)	50 (37,05)
Classification of leprosy smoothed prevalence rate (districts (%))				
Low	**Medium**	**High**	**Very High**	**Hyperendemic**
3 (2,22)	15 (11,11)	31 (22,96)	33 (24,44)	53 (39,26)

Data source: Municipal Epidemiological Surveillance Secretary (SINAN).

DISCUSSION

Although the reduction in the prevalence of the disease has been observed in recent years, it has not been proportionally monitored by the fall in the rate of detection of new cases. This demonstrates that prevalence alone is not a good indicator to accompany the control of leprosy. The elimination strategy is not being effective in blocking the transmission of the disease, which contributes to the continuance of endemicity in Brazil[11]. Thus, incidence and prevalence records, as well as evaluation of disabilities, cure percentage and

contact examination seem to show weaknesses, which may represent an underestimated number of cases, also suggesting the occurrence of problems in data feeding in information systems[24]. Therefore, as approached by some authors[5,7,25-27], contact surveillance of leprosy patients, that represent a population of high-risk for the maintenance of the endemic, is crucial in contributing to early diagnosis, treatment and interruption of the disease transmission chain. The spatial analysis performed in this work is important because, although most of the endemic areas for leprosy are in the north and central-west regions, almost a third of the studies on the disease are carried out in the Southeast region[28].

From the data obtained from the Municipal Epidemiological Surveillance, it was possible to observe higher number of multibacillary patients, which also deserves attention. This may suggest that due to the lack of effective diagnostic methods for the disease and proper training of health services, the number of paucibacillary patients may be underreported. In addition, the lack of accurate clinical diagnosis by health professionals outside reference centers for the disease leads erroneously to the treatment of paucibacillary patients as multibacillary, which increases the numbers of people classified in this group. Therefore, since the evolution of the disease is slow (months to years), a question that must be asked is whether the number of new cases of the disease recorded per year is not underestimated, as discussed in the literature[29], considering the absence of an early diagnosis methodology and the strategy adopted for contact surveillance.

According to ILEP[30], the coefficients of detection can be analyzed from two points of view: the first, reflects the active transmission of leprosy, which generates new cases in the area; the second, the possible existence of hidden prevalence, which identifies more cases through strategies and plans for disease control. In this sense, the decreasing trend in the mean detection rate in the municipality should not lead to a decrease in efforts by local authorities and health professionals, since the data suggest the endemic persistence, as pointed out in the literature[31].

Some papers in the literature related to the spatial analysis of leprosy performed in Bayeux/PB[32], Duque de Caxias/RJ[33], Vitória/ES[34], Juazeiro/BA[35] and Bahia[36] have demonstrated that this tool allows the evaluation of the relationship between socioeconomic factors and the incidence of the disease. As shown in other regions of Brazil[37,38], the distribution of leprosy in the districts of Rio Branco/AC was characterized as heterogeneous and did not seem to respect regional boundaries or any other geographic/environmental factor. However, detection and prevalence rates were higher in districts with lower infrastructure and with a lower income population, suggesting a strong influence of

unfavorable living conditions with the disease (hygienic conditions, sanitation, poverty, and malnutrition), as indicated by some authors[23,39-40].

We could not retrieve the operational classification according to the districts, but the collected data (see Supplemental Material 3) showed that the municipality of Rio Branco registered about 60% of multibacillary cases in the past 10 years (2006-2016). Thus, the frequency of MB patients indicate that late diagnosis and active transmission is common in Rio Branco.

Although our data were informative, it is worth mentioning that other relevant information for districts was not available, such as income and schooling. Also, the sewage system does not follow the limits of districts or census evaluations. This disconnection and outdated information made it difficult to associate data collected from social and environmental factors. Therefore, in this study it was not possible to establish a relationship between different factors with the disease since it requires a more in-depth analysis of the data.

CONCLUSIONS

The spatial analysis of leprosy provided information that would not be visualized merely with tabular data. This identification provides clear and accurate data on the areas in which the disease is effectively installed, presenting a greater risk for transmission, evidencing the districts that deserve greater attention. This study may serve as a contribution to the planning of public health policies for the disease in the municipality of Rio Branco and the state of Acre, highlighting the areas of greater vulnerability to leprosy. Thus, it would be possible to perform an active search for the disease in the most endemic districts, through the conduction of dermatological clinical evaluations by a multidisciplinary team, as well as the collection of samples from the population. The use of this strategy is very important and should be prioritized by the competent agencies, especially in the state of Acre, where this analysis had not yet been carried out. In addition, it is also suggested that a health education campaign be carried out with the population, aiming to avoid the spread of the disease.

FUNDING

The research was supported by IFAC and IOC/Fiocruz.

AUTHORS ’CONTRIBUTIONS

RSP, OGC and MOM contributed to the conception, design, analysis and interpretation of the research data, as well as to the writing, critical review and approval of the article. CSF contributed to the analysis and interpretation of the research data, as well as to the writing, review and approval of the article.

ACKNOWLEDGEMENTS

We thank the Municipal Epidemiological Surveillance Secretariat and the Eletrobrás (Acre) for providing the research data.

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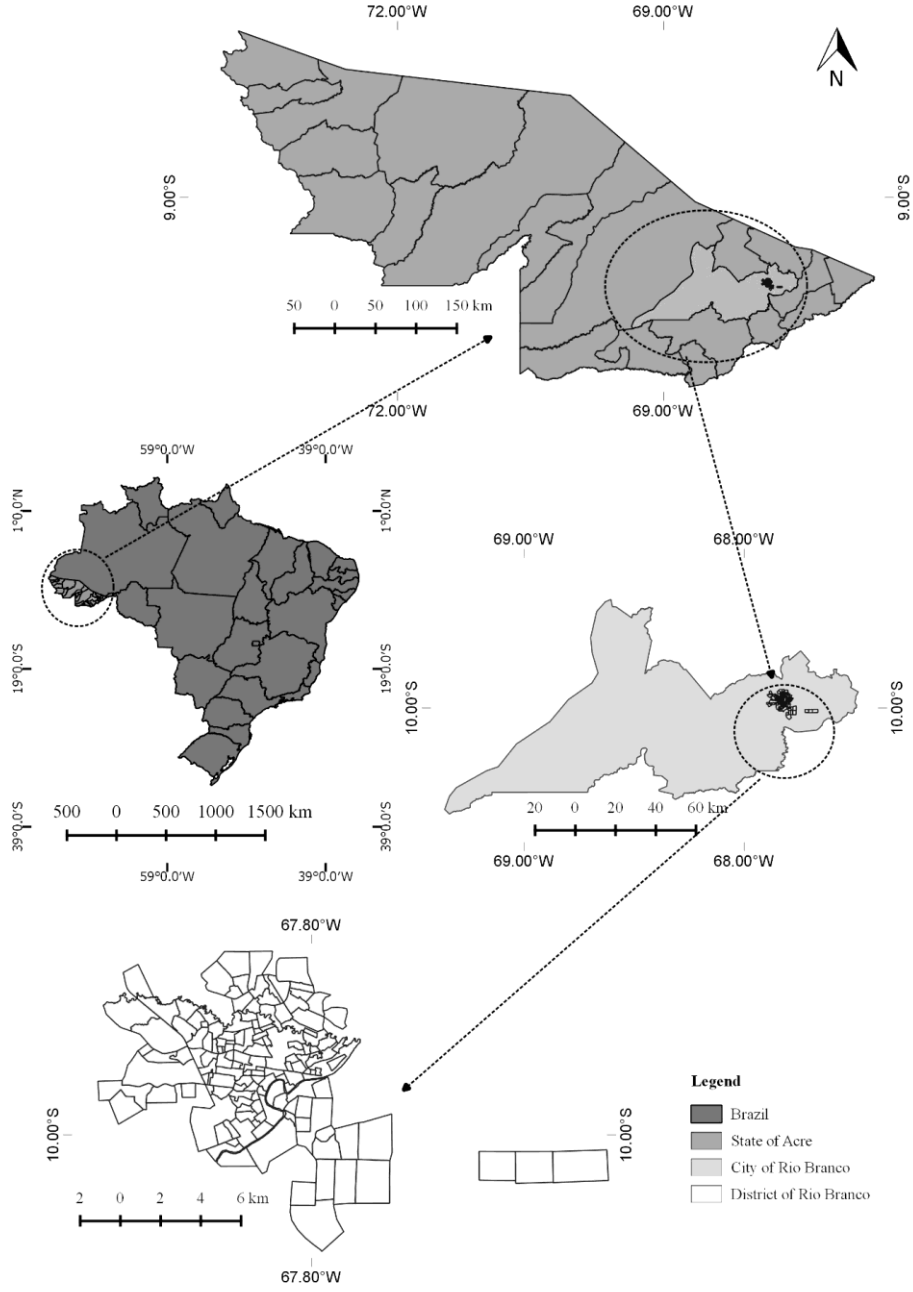
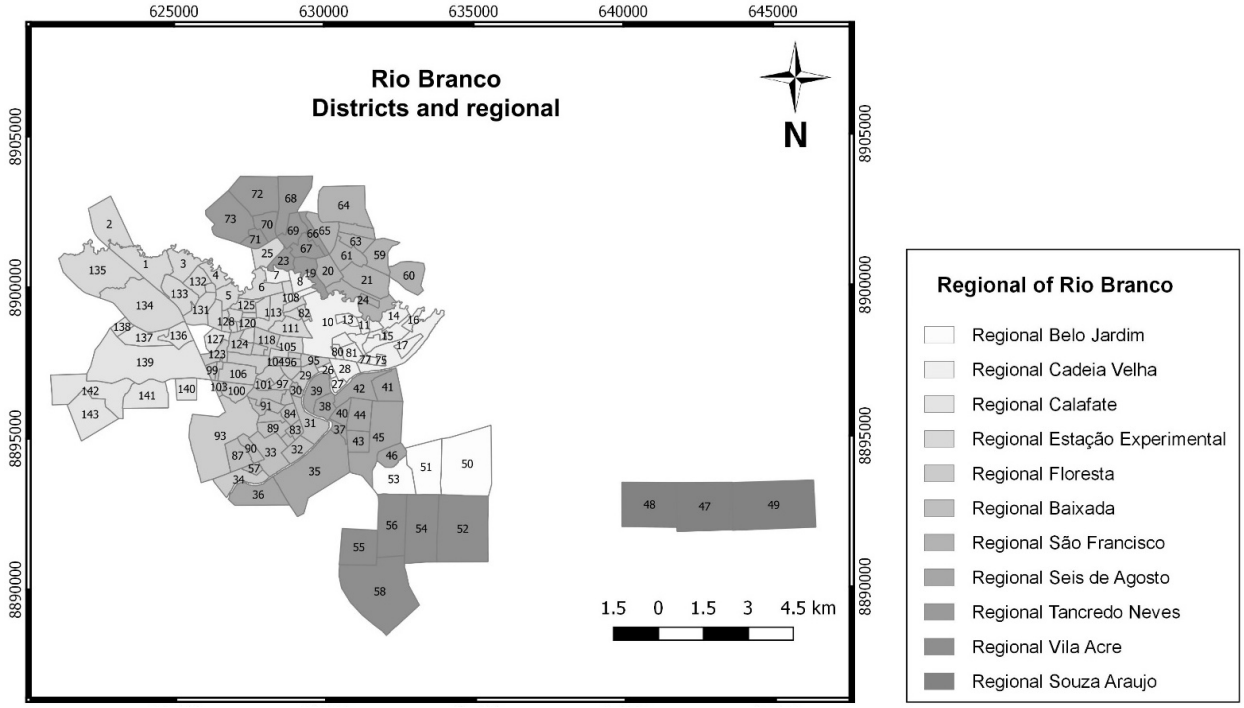
Supplemental Material 1: Map of location of the municipality of Rio Branco, in the state of Acre, Brazil.



Source: Prepared by Cleilton Sampaio de Farias (IFAC Professor) (2018).

Supplemental Material 2: Division of the districts of Rio Branco/AC municipality by regional.



Data source: Secretaria de Vigilância Epidemiológica Municipal (SINAN NET). Maps: Elaborated with QGIS software (2.18.14). Legend of districts: 1- Distrito Industrial, 2- Loteamento Vila Maria, 3- Mocinha Magalhães, 4- Loteamento Joafra, 5- Paz, 6- Conquista, 7- Horto Florestal, 8- Vila Ivonete/PROCOM/SOLAR, 9- Loteamento São José, 10- Bosque, 11- Baixa da Colina, 12- Casa Nova, 13- Conjunto Guiomard Santos, 14- Conjunto Jardim Tropical, 15- Morada do Sol, 16- Adalberto Aragão, 17- Cadeia Velha, 18- Baixa da Cadeia Velha, 19- Raimundo Melo, 20- Placas, 21- Vitória, 22- Conjunto Oscar Passos, 23- Vila Nova, 24- São Francisco, 25- Loteamento Novo Horizonte, 26- Papoco, 27- Base, 28- Centro, 29- Preventório, 30- Volta Seca, 31- Aeroporto Velho, 32- Ayrton Senna, 33- Sobral, 34- Invasão da Sanacre, 35- Taquari, 36- Loteamento Praia do Amapá, 37- Triângulo Novo, 38- Quinze, 39- Cidade Nova, 40- Triângulo Velho, 41- Santa Terezinha, 42- Seis de Agosto, 43- Comara, 44- Vila do DNER, 45- Areial, 46- Maurí Sérgio, 47- Vila Alberto Sampaio, 48- Vila Santa Cecília, 49- Dom Moacir, 50- Belo Jardim II, 51- Belo Jardim I, 52- Residencial Rosa Linda, 53- Santa Inês, 54- Loteamento Santo Afonso, 55- Vila da Amizade, 56- Loteamento Santa Helena, 57- Boa Vista, 58- Vila Acre, 59- Eldorado, 60- Loteamento Jardim São Francisco, 61- Chico Mendes, 62- Loteamento Jaguar, 63- Conjunto Ouricuri, 64- Loteamento Santa Luzia, 65- Parque dos Sabiás, 66- Conjunto Xavier Maia, 67- Wanderley Dantas, 68- Alto Alegre, 69- Conjunto Adalberto Sena, 70- Tancredo Neves, 71- Defesa Civil, 72- Montanhês, 73- Jorge Lavocat, 74- Conjunto São Francisco, 75- Baixa da Habitasa, 76- Habitasa, 77- Cerâmica, 78- José Augusto, 79- Aviário, 80- Ipase, 81- Capoeira, 82- V.W. Maciel, 83- Glória, 84- Pista, 85- Boa União, 86- Palheral, 87- Plácido de Castro, 88- Bahia Velha, 89- Bahia Nova, 90- João Paulo II, 91- João Eduardo II, 92- João Eduardo I, 93- Floresta Sul, 94- Jardim Nazle, 95- Dom Giocondo, 96- Abraão Alab, 97- Conjunto Castelo Branco, 98- Ivete Vargas, 99- Nova Esperança (fragmento), 100- Mauro Bittar - LBA - Vila Betel, 101- Novo Horizonte, 102- Conjunto Habitar Brasil, 103- Residencial José Furtado, 104- Mascarenhas de Morais, 105- 7º BEC, 106- Nova Esperança, 107- Conjunto Bela Vista, 108- Jardim América, 109- Jardim Manoel Julião, 110- Boa Esperança, 111- Isaura Parente, 112- Santa Quitéria, 113- Nova Estação, 114- Conjunto Manoel Julião, 115- Residencial Iolanda, 116- Conjunto Esperança, 117- Doca Furtado, 118- Estação Experimental, 119- Conjunto Tangará, 120- Loteamento Isaura Parente, 121- Loteamento dos Engenheiros, 122- Conjunto Paulo C. de Oliveira, 123- Jardim Europa, 124- Flor de Maio, 125- Geraldo Fleming, 126- Parque das Palmeiras, 127- Jardim de Alah, 128- Residencial Petrópolis, 129- Conjunto Mariana, 130- Jardim Brasil, 131- Jardim Primavera, 132- Conjunto Rui Lino, 133- Conjunto Tucumã, 134- Campus da Universidade Federal do Acre, 135- Conjunto Universitário, 136- Pedro Roseno, 137- Chácara Ipê, 138- Conjunto Jardim Universitário, 139- Portal da Amazônia, 140- Village Tiradentes, 141- Waldemar Maciel, 142- Calafate, 143- Conjunto Laélia Alcântara.

Supplemental Material 3: General data on leprosy in period 2006-2016 in Rio Branco/Acre/Brazil.

Year	Registered Contacts	Contacts Examined	New cases	MB	PB	Population	Detection Rate	Prevalence Rate
2006	743	40	195	92	103	314.127	6,21	
2007	471	394	129	63	66	290.639	4,44	
2008	514	456	123	68	55	301.398	4,08	
2009	388	201	104	65	39	305.954	3,40	
2010	470	305	126	71	55	336.038	3,75	
2011	384	295	116	69	47	342.299	3,39	
2012	339	257	92	61	31	348.354	2,64	
2013	193	170	67	47	20	357.194	1,88	
2014	146	126	50	40	10	363.928	1,37	
2015	217	185	59	42	17	370.550	1,59	
2016	233	174	61	47	14	377.057	1,62	
Total	**4098**	**2603**	**1122**	**665**	**457**	**-**	**-**	**29,76**

Data source: Municipal Epidemiological Surveillance Secretary (SINAN).